111th Congress, 1st Session – – – – – – – – – – – – House Document 111–33

THE DALLAS FLOODWAY EXTENSION

COMMUNICATION

FROM

THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS), THE DEPARTMENT OF THE ARMY

TRANSMITTING

THE ENVIRONMENTAL IMPACT STATEMENT FOR THE DALLAS FLOODWAY EXTENSION IN TEXAS

PART 1 OF 2

APRIL 23, 2009.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

THE DALLAS FLOODWAY EXTENSION
PART 1 OF 2

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

APR 22 2009

Honorable Nancy Pelosi
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

HOUSE DOCUMENT NUMBER 111-33

Dear Madam Speaker:

Per the request of the Chairman, Committee on Transportation and Infrastructure, I am resubmitting, herewith the following three Executive Communications: EC 10240 (South River, Raritan River Basin, New Jersey) and EC 10241 (General Reevaluation Report (GRR) to determine whether an extension of the Dallas Floodway, Trinity River project would be warranted) and EC 10242 (a feasibility report to document the development of a project for the Illinois River between Henry and Naples with particular reference to the non-Federal Peoria River Front Development project). I am enclosing all documents that were transmitted with the original correspondence.

Very truly yours,

John Paul Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)

Enclosures

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

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DEC 09 2008

Honorable Nancy Pelosi
Speaker of the House
of Representatives
U.S. Capitol Building, Room H-232
Washington, D.C. 20515-0001

Dear Madam Speaker:

I am submitting my report on the General Reevaluation Report (GRR) undertaken by the Army Corps of Engineers to determine whether an extension of the Dallas Floodway, Trinity River project would be warranted. The results of the GRR are documented in the report of the Chief of Engineers, dated December 7, 1999. The Congress authorized this project as the Dallas Floodway Extension, Trinity River, Dallas Texas, in Section 301 of the Rivers and Harbors Act of 1965, as modified by Section 351 of the Water Resources Development Act (WRDA) of 1996 and Section 356 of WRDA 1999. While the primary project purpose is flood damage reduction, environmental restoration and recreation are also authorized project purposes.

The flood damage reduction features as recommended by the Corps of Engineers in the GRR would restore the standard project flood level of protection to the existing Dallas Floodway Project and would also provide flood damage reduction benefits to downstream areas. The flood damage reduction features consist of the Lamar Street Levee, an earthen structure about 3.1 miles long with an average height of about 17.5 feet, and the Cadillac Heights Levee, an earthen structure about 2.2 miles long, with an average height of about 15 feet. Portions of two existing levees, the Rochester Park Levee and the Central Wastewater Treatment Plant Levee, which were constructed previously by the non-Federal sponsor have been incorporated into the project. Also included as a flood damage reduction feature is a "chain of wetlands," which consists of a side channel or bypass channel located in the right overbank area. Environmental restoration features include about 123 acres of emergent wetlands habitat with 4 constructed wetlands cells in the upper swale, and 3 constructed wetlands cells in the lower swale.

Environmental mitigation for the construction, and operation and maintenance of the modified project would involve the acquisition of 1,179 acres of additional lands, including the acquisition, improvement and management of about 926 acres of bottomland hardwood forest, and acquisition of about 253 acres of mixed grasses and forbs, of which 223 acres would be converted to bottomland hardwood forest and 30 acres would be managed as grasslands.

Recreation features include about 31.5 miles of recreation trails (about 18 miles of concrete hike and bike trails, 8.5 miles of naturally surfaced equestrian trails, and 5 miles of naturally surfaced nature trails), 6 access sites including parking, and other related recreation facilities would also be provided. At October 2007 price levels, the Corps estimates the construction cost of the project at $190,783,000, including about $173,205,000 for flood damage reduction measures, about $8,361,000 for ecosystem restoration measures, about $7,940,000 for recreation measures, and about $1,277,000 for cultural resources preservation measures. Following the cost sharing provisions of WRDA 1986, as amended by Section 210 of WRDA 1996, the Federal share of project costs would be about $125,706,000, and the non-Federal share would be about $65,077,000. As the non-Federal sponsor, the city of Dallas would operate and maintain all elements of the completed project, and would also develop and adopt a comprehensive flood plain management plan for the project area.

The report prepared by the District office recommended that a portion of the Rochester Park Levee and the Central Wastewater Treatment Plant Levee, both constructed by non-Federal interests, should be included in the Dallas Floodway Extension Project. Non-Federal interests constructed these levees following the floods of 1989 and 1990, at a total cost of about $26,958,000. The creditable cost of the levees at the time this work was considered to be potentially eligible for credit, was about $23,120,000. The Secretary of the Army determined on January 28, 2000 that those portions of the levees incorporated into the plan developed by the Corps are compatible with, and required for, construction of the project, in accordance with Section 351 of WRDA 1996. The cost sharing noted above reflects this non-Federal credit.

The Administration completed its review of the GRR on October 3, 2001 and recently confirmed its previous conclusion that it does not support funding to construct this project.

The Office of Management and Budget (OMB) advises that there is no objection to the submission of this report to Congress. I am providing a copy of this report and the OMB letters to the House Subcommittees on Energy and Water Development, and Water Resources and Environment.

Very truly yours,

John Paul Woodley, Jr.

John Paul Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)

Enclosures

5 Enclosures

1. Report of the Chief of Engineers, Dec 7, 1999
2. OMB Letter, Oct 3, 2001
3. OMB Letter May 5, 2008
4. NEPA Record of Decision, Aug 13, 2003
5. Dallas Floodway Extension General Reevaluation Report, February 1999 and Supplement No. 1 Environmental Impact Statement, April 2003

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

07 DEC 1999

CECW-PC (10-1-7a)

SUBJECT: Dallas Floodway Extension, Trinity River Basin, Texas

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on flood damage reduction, environmental restoration and recreation in the area of the Trinity River Basin, Dallas, Texas. It is accompanied by the report of the district and division engineers. These reports address modification of the Dallas Floodway Extension project that was authorized by Section 301 of the 1965 Rivers and Harbors Act (Public Law 89-298). Section 356 of the Water Resources Development Act (WRDA) 1999 (Public Law 106-53) authorized environmental restoration and recreation as project purposes. Preconstruction engineering and design activities for the modified project will be continued under the above authorities.

2. The reporting officers recommend construction of the Federally Supportable Plan (FSP) that is eligible for Federal cost sharing of all elements. The Recommended FSP would restore the Standard Project Flood (SPF) level of protection to the existing Dallas Floodway and would provide protection for the SPF to portions of the city of Dallas downstream of the existing Dallas Floodway that are currently unprotected. Major flood control features include a chain of wetlands consisting of an upper swale about 1.5 miles long with an average bottom width of 400 feet and a lower swale about 2.2 miles long with an average bottom width of 600 feet; the Lamar Levee on the left bank about 3.1 miles long with an average height of 17.6 feet; the Cadillac Heights Levee on the right bank about 2.2 miles long with an average height of 14.9 feet; appropriate drainage facilities for each levee; portions of two levees constructed by the non-Federal sponsor, Rochester Park Levee on the left bank and Central Wastewater Treatment Plant (CWWTP) Levee on the right bank that are integral to the Federal project as authorized. Recreation features would consist of 31.5 miles of recreation trails (18 miles hike and bike, 8.5 miles equestrian, and 5 miles nature trails) and related facilities. Environmental restoration would provide 123 acres of emergent wetlands habitat with four constructed wetlands cells in the upper swale and three constructed wetlands cells in the lower swale. Environmental mitigation

Encl 1

for the flood control features involves acquisition of 1,179 acres of additional project lands (acquisition, improvement and management of 926 acres of bottomland hardwood forest; and acquisition of 253 acres of mixed grassland and forblands, of which 223 acres would be converted to bottomland hardwood forest and 30 acres would be managed as grassland).

3. The total first cost of the Recommended FSP based on October 1998 price levels is estimated at $127,154,300, of which $83,557,600 would be Federal and $43,596,700 would be non-Federal. The total first costs of the project allocated by purpose are as follows: flood damage reduction, $113,958,300; environmental restoration, $5,638,600; and recreation, $6,757,400. In addition, total project cost includes $800,000 (Federal) for cultural resources preservation. Based on an interest rate of 6 7/8 percent, amortized over 50 years and including annual operation, maintenance, repair, replacement, and rehabilitation, average annual flood control costs are $8,685,000. Average annual benefits attributed to the flood damage reduction plan are estimated at $13,285,100, and the flood control benefit-cost ratio is 1.5 to 1. Average annual recreation costs are $571,300 and average annual recreation benefits are $5,777,200, for a recreation benefit-cost ratio of 10.1 to 1. The net annual flood control and recreation benefits for this plan are $9,806,000. The environmental restoration features will provide 184 average annual habitat units.

4. The Recommended FSP is not the plan originally authorized by Section 301 of the 1965 Rivers and Harbors Act, nor is it the National Economic Development (NED) plan that would produce the greatest net economic benefits for flood damage reduction. The originally authorized plan consisted of levees and channels, some of which are no longer economically justified under current conditions. In regard to the channel conveyance system, a fully mitigated 1,200 foot wide swale plan would produce the greatest net economic benefits, but this plan would also require the removal of a large portion of the existing bottomland hardwood forested area below the existing Dallas Floodway System. The portion of the Recommended FSP for flood control purposes includes a chain of wetlands rather than the 1200-foot swale. In comparison to the Swale Plan, the Chain of Wetlands Plan provides for a narrower conveyance system that is aligned in a fashion to greatly reduce impacts on the forested area, it is economically justified, represents a reduction in scale and cost, and is fully supported by the sponsor, state of Texas, and Federal agencies. As such, the chain of wetlands was selected as the recommended conveyance system for the reduction of flood damages. In accordance with 33 U.S.C 701(m), this smaller plan can be fully cost shared. In addition to the chain of wetlands, the Recommended FSP would include SPF levees for the Lamar Street area and the Cadillac Heights Community. The levee that would produce the greatest NED benefits for the Cadillac Heights Community would protect against what is commonly referred to as the 100-year flood; in terms of risk, this levee would protect against the flood that would have a 1.0 percent annual

chance of exceedance. However, it was found that this levee would not meet Federal Emergency Management Agency standards for protecting the area from the 1.0 percent annual chance of exceedance flood; it would not provide an acceptable level of reliability, particularly when compared with other project elements; and it would expose the Cadillac Heights Community to increased flooding due to construction of other project levees. As a result, the Assistant Secretary of the Army (Civil Works) concurred in the recommendation to provide SPF protection for the entire Dallas Floodway Extension project. This is consistent with the level of protection provided by the originally authorized project. The Recommended FSP is fully supported by the non-Federal sponsor, the state of Texas and other Federal agencies. All project features of the Recommended FSP are either specifically authorized by Congress, or can be implemented within the discretionary authority of the Chief of Engineers [33 U.S.C. 701(m)] and no additional project authorization is needed.

5. The report of the district and division engineers, which contains an integrated Environmental Impact Statement (EIS), is hereby submitted to Congress to satisfy the requirements of Section 404(r) of the Clean Water Act [33 U.S.C. 1344(r)]. Section 404(r) waives the requirement to obtain the state water quality certification and requires that the project EIS be submitted to Congress prior to appropriation of funds for project construction.

6. As provided in Section 351 of WRDA 1996, the reporting officers recommend that the non-Federal sponsor receive credit for work carried out which is integral with the project as authorized and as currently recommended. The city of Dallas constructed the Rochester Park and CWWTP Levees at a total cost of $26,958,000. Only a portion of the Rochester Park Levee was found to be an integral part of the Federal project, therefore the total cost of creditable non-Federal work was estimated at $23,120,000. This total includes construction for $22,174,000, and lands, easements, rights of way, relocations, and disposal areas (LERRD) for $946,000; LERRD is a non-Federal responsibility by law. Both the Section 351 construction credit of $22,174,000 and related LERRD credit are reflected in the Federal/non-Federal cost sharing shown above for the Recommended FSP. The amount of construction credit will be the lesser of the actual cost of the work incurred by the sponsor, or the cost had the Federal Government constructed the same portion of the project at the time the work was done.

7. I concur in the findings, conclusions and recommendations of the reporting officers. Accordingly, I recommend implementation of improvements for flood damage reduction, environmental restoration, and recreation as described for the Dallas Floodway Extension, Trinity River Basin, Texas. Cost sharing for the previously authorized flood control will be a non-Federal share of at least 25 percent and a Federal share of no more than 75 percent, as required by WRDA 1986. The environmental restoration and recreation features will be subject

to cost sharing as required by WRDA 1986, as amended by Section 210 of WRDA 1996. Further, the non-Federal sponsor would be responsible for 100 percent of the operation, maintenance, repair, replacement, and rehabilitation for the entire project. This recommendation is also subject to the non-Federal sponsor agreeing to comply with all applicable Federal laws and policies. I further recommend that the non-Federal sponsor receive credit under Section 351 of WRDA 1996, subject to an audit of the sponsor's actual expenditures. The amount of credit will be the lesser of the actual cost of the work incurred by the sponsor or the cost had the Federal Government constructed the same portion of the project at the time the work was done. My recommendation is subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including the following requirements:

a. Provide a minimum of 25 percent, but not to exceed 50 percent, of total project costs allocated to structural flood control, 50 percent of total project costs allocated to recreation, and 35 percent of total project costs allocated to environmental restoration, as further specified below:

(1) Provide, during construction, a cash contribution equal to 5 percent of total project structural flood control costs;

(2) Provide all lands, easements, rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(3) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project;

(4) Provide, during construction, any additional costs as necessary to make its total contribution equal to 25 percent of the separable project costs allocated to structural flood control costs, 50 percent of the total project recreation costs, and 35 percent of the total project environmental restoration costs; and

b. In addition, credit for work performed by the non-Federal sponsor and approved by the Assistant Secretary of the Army (Civil Works) will be applied toward the contributions of additional cash and lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas (LERRD) for flood control. The amount of credit will be the lesser of the cost that the Government would have incurred for the work or the actual cost subject to audit for reasonableness, allowableness, and allocability. However, in no instance will the credit applied exceed the value of additional cash and LERRD contributions or 45 percent of total project costs for flood control, whichever is the lesser.

c. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government.

d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local 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.

e. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

f. Comply with Section 221 of the Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

g. Hold and save the Government free from all damages arising for the construction, 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.

h. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

i. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for the construction, operation, and maintenance of the project, except that the non-Federal sponsor shall not perform such investigations on lands, easements, or right-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

j. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

k. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR, part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of floodplain management plans.

n. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to structural flood control, recreation, and environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for the project.

o. Participate in and comply with applicable Federal floodplain management and flood insurance programs.

p. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder operation and maintenance of the project.

q. Not less than once each year, inform affected interests of the extent of the protection afforded by the project.

r. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

s. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

JOE N. BALLARD
Lieutenant General, U.S. Army
Chief of Engineers

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

THE DIRECTOR

October 3, 2001

The Honorable Thomas E. White
Secretary of the Army
104 Army Pentagon
Washington, DC 20301-0104

Dear Secretary White:

As required by Executive Order 12322, the Office of Management and Budget (OMB) has reviewed a September 1999, Army Corps of Engineers (Corps) General Reevaluation Report (report) that recommends construction of a $127 million Federal multipurpose water project in Dallas, Texas, whose primary purpose is flood control. We also have reviewed a supplementary paper on "Dallas Floodway System Phasing," dated August 3, 2001, and other information prepared by the Corps.

Under the applicable Federal principles and guidelines, the Corps must evaluate all reasonable alternatives and their impacts, and must identify the option with the greatest net economic benefits consistent with protecting the Nation's environment. Based on our review, the Corps has not done so in this case, and a renewed effort that may well lead to a fundamentally different project appears to be in order. The Administration believes that the Corps should not enter into a Project Cooperation Agreement or begin any physical construction work on the authorized project at this time.

OMB has serious concerns about the way the Corps formulated this project. The economic justification presented in the report rests largely on the level of protection that the project would provide to downtown Dallas in the event of a very large flood. Downtown Dallas is located immediately upstream of the area in which the Corps has proposed to build this project. Without the protection that the project provides to downtown, both the total cost of the project and the cost of each of its major flood control features would exceed the benefits. Given this, the report should have explored a range of options for reducing this flood risk together with those that would address downstream flooding concerns. Actions taken (or not taken) in adjacent reaches of the river affect each other.

There is some evidence that the Corps reviewed options directly addressing the downtown flood risk during the initial stages of formulating this project. Since at least 1993, the Corps has understood that raising the existing Federal levee on the east side of the Dallas Floodway (east levee) and replacing the floodwall that connects it to high ground, perhaps in combination with other justified measures, could provide a low-cost, yet highly effective way to

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reduce the existing flood risk to downtown Dallas. By 1994, the Corps had developed preliminary estimates of the costs and benefits for these upstream measures and had considered combining them in an integrated project with both upstream and downstream features. Those data suggested that the net economic benefits of a project that included raising the east levee could be high. However, the Corps elected not to evaluate this potentially promising approach in the report. In effect, this decision removed from consideration an entire set of reasonable options -- those that include a basic upgrade to the existing flood control infrastructure that defends downtown.

The Corps' recent supplementary paper (dated August 3, 2001) confirms the need to develop one or more such alternatives prior to reaching a decision on whether to proceed with the proposed project. In this supplementary paper, the Corps estimates that the benefits of upgrading the existing levee system could be over four times the costs of doing so on an annual basis. Because this represents a return on investment that far exceeds every flood damage reduction option examined in the report, these upstream improvements probably should have been the central feature of a leading alternative. In excluding this alternative, the Corps presented an incomplete picture of the available choices and their impacts, and prevented an informed public discussion of the merits of the proposed project.

The omission of an option based on the upstream improvements also led to an overstatement of the extent to which the benefits identified in the report should be attributed to this project. According to the Corps' supplemental paper, the benefit-to-cost ratio for the flood control plan recommended in the report would drop to about 1.14, once the raising of the east levee to protect downtown Dallas is considered. However, this is a composite ratio for all of the project's flood control features and, as such, gives a false sense of the plan's economic justification. The 1.14 ratio does not suggest that the Corps has sized or placed each of the features appropriately, nor does it demonstrate that they are justified incrementally. Indeed, the "chain of wetlands" may be the only feature whose flood damage reduction benefits would continue to exceed the costs. Thus, the Corps has not identified the option with the greatest net economic benefits consistent with protecting the Nation's environment, as required under the applicable Federal principles and guidelines.

In addition, OMB has the following two concerns:

- According to the report, the proposed Cadillac Heights levee would yield a net negative economic return, by increasing the overall flood damage in the city from a very large storm. Before recommending this levee, the Corps should have considered a broader range of alternatives, such as the option of purchasing, on a willing seller basis, only the homes that flood and offering relocation assistance to the people who live there.

We disagree with the report's recommendation to award the city a $23 million credit for past work on two local levees. Incorporating these levees into the Federal project would significantly reduce its net flood damage reduction benefits. While the decision of the city to build the Rochester Park levee and to upgrade the wastewater treatment plant levee is understandable, these levees are not integral to the Federal project, nor are they required for its construction.

Thank you for your assistance during our review. We would be happy to discuss these issues further with you and look forward to working with you to resolve these concerns.

Sincerely,

Mitch Daniels

Mitchell E. Daniels, Jr.
Director

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

May 5, 2008

RECEIVED
MAY 14 2008
Office of the ASA (CW)
Washington, DC

The Honorable John Paul Woodley, Jr.
Assistant Secretary of the Army (Civil Works)
108 Army Pentagon
Washington D.C. 20310-0108

Dear Mr. Woodley:

I am writing to clarify the status of the Dallas Floodway Extension project with respect to the Office of Management and Budget's (OMB) process for reviewing proposed Federal water resources projects under Executive Order 12322.

OMB reviewed the feasibility report for this project in 2001. Our review identified serious concerns about the way the Corps formulated this project. On October 3, 2001, OMB Director Daniels sent a letter to Secretary of the Army White detailing these concerns. Since that time, the Administration has never proposed funding for this project in the President's Budget.

This project is not under review at OMB at this time. Your office twice asked OMB to reconsider its position on this project – in letters dated October 26, 2001, and August 18, 2004. These requests, however, did not respond to the concerns that OMB had raised. For these reasons, OMB considers its review of this project to have been completed on October 3, 2001.

If you have any further questions, please let me know.

Sincerely,

Richard A. Mertens
Deputy Associate Director
Energy, Science, and Water

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RECORD OF DECISION
SUPPLEMENT No. 1 TO ENVIRONMENTAL IMPACT STATEMENT
DALLAS FLOODWAY EXTENSION
TRINITY RIVER, TEXAS

1. SYNOPSIS

A Final Supplement Number 1 to the Environmental Impact Statement (Final SEIS #1) for the Dallas Floodway Extension (DFE) Project was prepared to provide additional cumulative impact analysis and evaluation beyond information presented in the General Reevaluation Report and Integrated Environmental Impact Statement (GRR/EIS) for the Dallas Floodway Extension (DFE), dated February 1999. The Final SEIS #1 was filed with the U.S. Environmental Protection Agency and the 30-day comment period ended on June 9, 2003.

The Deputy Commander for Civil Works signed the Record of Decision for the GRR/EIS on 1 December 1999. In May 2000, a motion to prevent commencement of construction of authorized project features was filed. On April 10, 2002, the U.S. District Court for the Northern District of Texas ruled in favor of the U.S. Army Corps of Engineers (Corps) on three of four counts in the lawsuit. On one count the Court ruled in favor of the plaintiffs and remanded the matter to the Corps "for further consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project."

The purpose of the SEIS #1 was to provide more detailed information on cumulative impacts of alternatives considered in the GRR/EIS relative to similar reasonably foreseeable actions within the geographic area, which may occur and may have a bearing on selection of a plan for the DFE. The authorized DFE project is located along the Trinity River in the Southeast quadrant of Dallas, Texas, downstream of the existing Dallas Floodway, and consists of an off-channel flood damage reduction feature that incorporates environmental restoration in the form of a Chain of Wetlands, levees on both sides of the river, linear recreation facilities, and acquisition and management of open space lands in the floodplain for mitigation of habitat losses.

A Scoping Meeting for the SEIS #1 was held on July 16, 2002, and letters were sent to all known agencies and organizations that might be involved in related activities, including various cities, Dallas County, state and Federal highway departments, airports, resource agencies, and others. Potential activities of other entities are grouped into the categories of Transportation, Flood Damage Reduction, Recreation, Ecosystem Restoration and Preservation, and a broad category of Fills, Permits, Utilities, and Other Activities. Many of these reasonably foreseeable activities were previously addressed in the Programmatic Environmental Impact Statement for the Upper Trinity River Basin Feasibility Study, dated June 2000, but additional potential activities were identified as well.

The Notice of Availability of the Draft SEIS #1 for the DFE appeared in the Federal Register on December 6, 2002. A Public Meeting on the draft SEIS #1 was held on January 8, 2003, and written comments were accepted through February 4, 2003. The SEIS #1 for the DFE incorporates both the GRR/EIS for the DFE and the Upper Trinity Programmatic EIS (PEIS)

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largely by reference but selected information from those documents was carried forward into the Final SEIS #1.

The majority of the reasonably foreseeable projects proposed by the Corps or other entities within the DFE geographical area have not been developed in sufficient detail to predict which alternative(s) may be ultimately selected and, consequently, specific cumulative impacts of the final selected plans cannot be predicted with a great deal of certainty. Therefore, the SEIS #1 evaluated the potential cumulative effects of each of the known alternatives of these potential projects. The Final SEIS #1 indicates that with implementation of the DFE in conjunction with other reasonable foreseeable projects, no significant adverse cumulative effects would occur to any study area resources of concern and nothing in the analysis indicates the Recommended Plan for the DFE should be modified.

2. AUTHORITY

Authority for construction of water resource development features described in the Comprehensive Survey Report on Trinity River and Tributaries, Texas (reprinted as House Document 276/89/1), including the Dallas Floodway Extension, is contained in Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). The authority is commonly known as the Trinity River and Tributaries Basinwide Study Authority. All studies conducted under this authority serve as an interim response to the basinwide authority, and do not close out the granting authority.

The DFE Project is one of five local flood protection projects authorized for construction in 1965 as part of the basinwide plan of improvement for the Trinity River and Tributaries, Texas. The authorized plan of improvement for the DFE consisted of a combination flood control channel and floodway levees, which would provide a Standard Project Flood (SPF) level of protection. The plan consisted of a 22-mile levee and floodway system with a 9.1-mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek.

Following the severe flood event of 1989, a general reevaluation study was undertaken in response to a request by the city of Dallas in 1990, to reactivate the authorized DFE Project. The GRR/EIS was completed in 1999, and subsequently, the Record of Decision was signed in December 1999. Authorization for the Dallas Floodway Extension Project was modified by the Water Resources Development Act of 1996 to include credit to the city of Dallas for previously constructed levees, and again by the Water Resources Development Act of 1999 to include ecosystem restoration and recreation as project purposes.

3. SUMMARY OF PROPOSED ACTIONS CONSIDERED IN THE SEIS #1

The SEIS #1 for the DFE focused on the cumulative impacts of reasonably foreseeable similar proposed actions in the same geographical area as the DFE Project in response to the April 10, 2002, order of the U.S. District Court for Northern District of Texas in Fort Worth. An analysis of cumulative impacts of various past, present, and reasonably foreseeable future Corps projects and projects of others was conducted in combination with the plan for the DFE Project as recommended and approved in the GRR/EIS, along with the final array of alternatives in that document.

3.a. DFE Alternatives

The final array of alternatives evaluated in the GRR/EIS for the DFE consisted of the following:

The No Action Plan for the DFE would involve no additional Corps flood damage reduction, ecosystem restoration or recreational development within the DFE area. The Rochester Heights Levee as constructed and the Central Wastewater Treatment Plant levee modifications by the city of Dallas would remain in place

The National Economic Development (NED) Plan would consist of a series of two 1,200-foot bottom width swales that would extend an overall distance from upstream at the end of the existing Dallas Floodway downstream to approximately 2,000 feet below Loop 12, with the upper and lower swales separated at Interstate Highway 45 (I-45). The length of the upper swale would be about 7,800 feet, or 1.5 miles, and would extend from the confluence of Cedar Creek, at the upstream end, to the river crossing of I-45. The lower swale would extend a total length of 17,300 feet, or 3.3 miles, downstream from I-45. The NED Plan would include 3,200 acres of environmental mitigation.

The Chain of Wetlands Plus Levees Plan was identified as the Locally Preferred Plan (LPP), and was formally adopted by the Dallas City Council in March 1997. This plan would include Standard Project Flood (SPF) levees protecting the Lamar and Cadillac Heights areas and a Chain of Wetlands feature, thereby providing flood protection to the neighborhoods within the study area comparable to the protection provided to the Central Business District by the existing Dallas Floodway. The Lamar Levee would include an earthen levee to provide SPF protection for the Lamar Street area. This levee would extend from East Levee of the existing Dallas Floodway for a distance of 2.9 miles to the Rochester Park Levee, previously constructed by the city of Dallas. The Cadillac Heights Levee would include an earthen levee to provide SPF protection for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), would raise a portion of the northwest corner of the CWWTP Levee, and would extend to high ground near the intersection of Kiest Boulevard and McGowan Avenue for a total distance of approximately 2.2 miles. The Chain of Wetlands would consist of an upper chain of four wetland cells and lower chain of three wetland cells, each of various lengths and shapes and totaling about 123 acres. The upper chain would have an average width of 400 feet and would extend from Cedar Creek to the oxbow lake at I-45, a distance of about 1.5 miles. The lower chain would have an average width of 600 feet, would extend between I-45 and Loop 12, a distance of about 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course to minimize impacts to forested areas and nearby residential areas. Total length of the wetland cells, therefore, would be about 3.8 miles with average width of about 500 feet, average depth of about 1.5 feet, and maximum depth of 7 feet. Environmental restoration features associated with the Chain of Wetlands include 123 acres of emergent wetland creation. The recreation component of the Locally Preferred Plan would include construction of 18 miles of hike/bike trail, 8.5 miles of natural surface equestrian trail, 5 miles of natural surface nature trail, picnic areas, and a rest stop area. The environmental mitigation plan for the Locally Preferred Plan includes acquisition of 1,179 acres of additional lands within the "Great Trinity Forest", and consists of conversion of grassland to bottomland hardwood areas, habitat improvement on existing bottomland hardwood areas, and grassland preservation.

The Combination Non-structural / Structural Plan investigated for the final array of DFE alternatives would involve the acquisition and removal of homes in the Cadillac Heights area in lieu of the construction of a Cadillac Heights Levee, as the last-added increment of an overall plan also including the construction of the Chain of Wetlands and the SPF Lamar Levee. This buyout was analyzed for the 2-, 5-, 10-, 25-, 50-, and 100-year flood zones.

The Tentative Federally Supportable Plan (TFSP) would consist of the Chain of Wetlands, SPF Lamar Levee, 100-year Cadillac Heights Levee, the previously constructed non-Federal levees, a channel realignment at I-45, and recreation amenities compatible with the regional recreation master plan, including hike/bike trails, equestrian trails, canoe launches, and pavilions. In addition to the levees described above, the TFSP would include the costs and benefits of the portions of the previously constructed non-Federal levees.

The Recommended Plan provides for the Chain of Wetlands, an SPF levee at Lamar Street, a SPF levee in the Cadillac Heights area, channel realignment at I-45, recreation features, and habitat mitigation. While meeting the primary goal of providing SPF protection in the immediate area of the DFE Project, the Recommended Plan would result in additional protection within the existing Dallas Floodway.

3b. Other Reasonably Foreseeable Projects / Proposals

A total of thirty-four different proposals, projects, or activities by the Corps or other entities, along with multiple alternatives for each, were identified that could potentially have cumulative effects relative to the recommended DFE Project and/or its alternatives. These proposed or potential projects include eleven on-going or potential Corps studies within the vicinity of the DFE Project, along with alternatives to the extent that have been developed. Activities by other entities also identified and discussed in the SEIS #1 are: two regional policies affecting future floodplain development, three comprehensive Master Plans or Land Use plans proposed for the Trinity River Corridor by the city of Dallas, fourteen proposed or potential transportation plans and their alternatives, four railway transportation proposals, three local flood damage reduction proposals, nine recreation proposals, two major ecosystem restoration proposals, and four pending major permit actions. All of these proposals and their alternatives are discussed in the SEIS #1 in relation to their potential cumulative effect in combination with the final array of alternative plans for the DFE. Summary descriptions of the more significant proposals, which could be considered as reasonably foreseeable are presented in sections 3.b.1 and 3.b.2.

3.b.1. Reasonably Foreseeable Corps Projects

There are two ongoing Corps studies within the Dallas area that are being conducted under specific Congressional authorization as part of the Upper Trinity Basin Feasibility Study. They are the study of the Stemmons North Industrial District along the Elm Fork of the Trinity River in the northwest Dallas area, and the study of the existing Dallas Floodway Project area. Both areas are being investigated for flood damage reduction, ecosystem restoration, and recreation under the 1988 Senate Resolution, which authorizes the Upper Trinity Basin Feasibility Study. Investigations to date of Stemmons North Industrial District do not indicate that there is a Federal interest in Corps involvement in a project in that area. Further, there are no projects formally approved by the City Council or proposed by the city of Dallas for the Elm Fork that can be considered as reasonably foreseeable, and no related activities have been identified that would have significant cumulative effect on DFE study area resources.

Alternatives being considered by the Corps and the city of Dallas in the existing Dallas Floodway area include a plan that would optimize flood damage reduction and protection to the Central Business District and West Dallas, and an Environmental Quality Plan. A Flood Damage Reduction Plan for the existing Dallas Floodway would seek to optimize flood protection for the central business district of Dallas, with the ability to include ecosystem restoration and recreation features. The Environmental Quality Plan would have beneficial impact in terms of forested resources, floodplain recreation, natural floodplain values, and aesthetic outputs, but without appropriate hydraulic mitigation could have the effect of increasing the flood risk for floodplain areas upstream of the existing Dallas Floodway levees. Investigations under the Interim Feasibility Study of the Dallas Floodway are currently being held in abeyance by the Corps, awaiting selection of a preferred alignment for the Trinity Parkway by the Federal Highway Administration, Texas Department of Transportation, North Texas Tollway Authority, and the city of Dallas. Depending on the parkway or tollway alignment ultimately selected, it is very possible that a multi-objective plan could be formulated within the existing Dallas Floodway area, which would include flood damage reduction, ecosystem restoration, and recreation measures which would ultimately provide a net positive contribution to cumulative effects with the DFE on forested resources and recreation with essentially neutral effects on hydraulics and water quality.

In addition, the Corps, along with the city of Dallas and Dallas County, are currently conducting studies for two small ecosystem restoration projects under the Corps Continuing Authority Program. These studies are the Old Trinity River Project adjacent to the existing West Levee of the Dallas Floodway and the Joppa Preserve Project adjacent to Lemmon Lake, downstream of the DFE. It is anticipated that both will proceed to implementation within the reasonably foreseeable future. If implemented, these projects will contribute positively to cumulative effects on bottomland hardwoods, wetlands, water quality, aesthetics, and recreation within the immediate study area for the DFE.

3.b.2. Reasonably Foreseeable Projects of Others

Reasonably foreseeable projects proposed by other entities have been included in the SEIS #1 analyses. The major foreseeable action potentially effecting the DFE study area environment would be the proposed Trinity Parkway, which could impact resources within the area of the existing Dallas Floodway, as well as the DFE area. The Federal Highway Administration, with support of the North Texas Tollway Authority, and the city of Dallas, issued a Notice of Intent to prepare an Environmental Impact Statement on the Trinity Parkway on June 17, 1999. The EIS will address five alternative alignments for the Trinity Parkway which include: 1) combined riverside parkway constructed on the east levee of the Dallas Floodway, 2) split parkway constructed on the riverside slopes of the Dallas Floodway east and west levees, 3) split parkway constructed on the landside slopes of the Dallas Floodway east and west levees, 4) modifying or reconstructing the existing Industrial Boulevard at grade, or 5) above grade to accommodate increased traffic load. The EIS for the Trinity Parkway is currently in working draft with public release of the Draft EIS scheduled later in 2003 and a Final EIS to follow in 2004.

Although only developed at a conceptual stage, the city of Dallas' Trinity River Corridor Master Implementation Plan proposes changes to resources and features in the DFE geographic area. The Master Plan provides for a series of lakes, a split river channel, constructed wetlands, recreation trails, parklands, grasslands, and pedestrian bridges. The plan also proposes upgrading of several bridges that cross the Dallas Floodway slated for replacement to attain "signature" or renowned architectural status.

4. SUMMARY OF CUMULATIVE ENVIRONMENTAL EFFECTS

In the Final SEIS #1, each of the identified reasonably foreseeable proposals is considered and discussed relative to the DFE Project and cumulative effects on water and related land resources within the DFE geographic area. The environmental resources and human use categories of significance that are analyzed include water quality, air quality, aquatic resources, wetlands, forested resources, floodplain recreation, natural floodplain values (EO 11988), public services, environmental justice, hydraulics and hydrology, flood damages, aesthetics, and historic and cultural resources.

Moderate adverse cumulative effects on forested resources would result if the Trinity Parkway Combined Riverside and Split Riverside alternatives were implemented in combination with the DFE NED Plan alternative without environmental mitigation. Other plans or alternatives would provide no cumulative or only slight adverse effects to forested resources. It was also determined that ecosystem restoration proposals associated with the potential Corps projects for Joppa Preserve, Old Trinity, and the Dallas Floodway Environmental Quality alternative would provide moderate cumulative beneficial effects to forested resources.

Moderate adverse cumulative effects to upstream hydrology and hydraulics would result from implementation of the environmental restoration proposed in the Dallas Floodway Environmental Quality alternative, because impedance to flood flows from the reforestation that would occur with that plan.

It is anticipated that all of the Trinity Parkway alternatives would have varying degrees of cumulative impact in association with the DFE Project, depending on the resource considered. Alternative alignments of the Trinity Parkway outside the existing Dallas Floodway levee system would have minimal cumulative impact on hydraulics and biotic resources. All of the Trinity Parkway alternatives with appropriate mitigation would have slightly negative effects (with substantial plantings) on forested resources, moderately negative to no effects on environmental justice issues and community structure, and an essentially neutral effect on hydraulics. Alignments inside the existing Dallas Floodway levees would require special consideration to assure minimal negative impact to hydraulics, water quality, recreation, noise, and aesthetics. If a Trinity Parkway alternative is ultimately selected or constructed in the vicinity of the DFE Project, it is anticipated that cumulative effects on air quality related to the DFE would be minimal since impacts of the DFE Project on air quality would be of short duration. Any alternative associated with the existing levees would require the excavation of "borrow" material from between the levees for use as fill to raise the Trinity Parkway to an elevation at least above the 100-year flood elevation. That excavated area between the levees would create an opportunity for a lake or lakes, consistent with the city of Dallas' Trinity River Corridor Master Implementation Plan.

Of the proposals in the Trinity River Corridor Master Implementation Plan, the upgrading of bridges to renowned architectural status was not evaluated in the DFE SEIS #1 because their designs have not been sufficiently developed for evaluation. A "Lakes Only" Plan located within the existing Dallas Floodway area, if implemented by the city of Dallas, would have a slight negative cumulative effect on forested resources of the geographic area of the DFE Project, or minimal effect with substantial plantings. It is anticipated that a "Lakes Only" plan would be beneficial in terms of recreation and aesthetics.

The Programmatic EIS (PEIS) for the Upper Trinity River Basin Feasibility Study, completed in June 2000, addressed the cumulative impacts of all reasonably foreseeable activities of the Corps and others, including the DFE Project, within the entire upper Trinity River watershed that were known as of June 2000. Data and other information contained in that document are incorporated by reference throughout the Final SEIS #1. Every effort was made in preparation of the Final SEIS #1 to analyze the cumulative effects of potential actions of the Corps and others that have been proposed since finalization of the Upper Trinity PEIS and signing of the Record of Decision for that document.

5. AREAS OF CONTROVERSY

Throughout the planning and NEPA process for the DFE Project, concerns have been raised regarding the number and scope of potential projects (both by Corps and by others), being proposed for implementation within the Trinity River corridor. The potential for resultant adverse impacts created the need to address the environmental consequences of the reasonably foreseeable proposed actions. The cumulative effects of numerous and various projects on flood damages and natural floodplain functions are considered to be controversial. Structural measures implemented to reduce flood damages often adversely impact natural floodplain values and some members of the public have expressed concerns that use of floodplains for purposes contrary to their natural function is controversial. These areas of concern, collectively, provided additional impetus for preparation of the June 2000 PEIS addressing the Upper Trinity River Basin Feasibility Study.

Issues identified early in the public involvement process for the DFE Project as controversial have remained so to some extent throughout the review of the Draft and Final GRR/EIS and in scoping and review of both the Draft and Final SEIS #1.

The primary objectives of the evaluations in the DFE SEIS #1 have focused on identifying and summarizing the cumulative impacts of reasonably foreseeable projects of the Corps and others within the study area with emphasis on hydraulic and floodplain environmental features. A further objective was to disclose cumulative impacts of those actions relative to the DFE Project. Foremost among controversial issues is the proposal by transportation interests and the city of Dallas to place transportation features laterally within the floodplain of the existing Dallas Floodway and the perception that the Dallas Floodway Extension project was being constructed in order to accommodate roadways between the existing levees. Other issues identified as controversial in the plaintiff's motion to stop construction of the DFE Project concern the hydraulic modeling analysis, the level of protection of the existing Dallas Floodway afforded to the Central Business District, and the relationship of various projects to one another.

In March 2003, Dallas City Council members were briefed on another conceptual Trinity River Master Plan proposal for the existing Dallas Floodway area, which was developed by a team of private urban designers and landscape architects for the Dallas Plan. While this new proposal contains many of the features presently proposed in prior plans, it does deviate, however, in that more emphasis is placed on recreation and ecosystem amenities and less on transportation features. Because detailed information has not been developed on the proposal, more detailed engineering design, cost estimates, and feasibility analyses are planned in future months. Council member approval would be required prior to adoption of any of the latest proposals.

6. PUBLIC INVOLVEMENT

A Notice of Intent (NOI) to prepare SEIS #1 for the Dallas Floodway Extension Project was published in the *Federal Register* on June 28, 2002. The NOI provided background information related to the DFE Project, the Summary Judgment ruling of the Northern District, status of ongoing studies, and the rationale for preparing the SEIS #1. Notice of a Public Scoping Meeting was published in the *Federal Register* and also mailed to all known interested parties on July 3, 2002. A notice was also placed in the Dallas Morning News on July 14, 2002, providing the location, date, and time of the scoping meeting. A public scoping meeting was held on July 16, 2002, in Dallas, Texas. The meeting was held at the Ramada Plaza Hotel with approximately 45 individuals in attendance.

Scoping meeting participants were afforded an opportunity to review a variety of displays documenting the location of known proposed projects in the geographic area. The public was also encouraged to provide comments and information on these projects, other projects known to them that they believed should be considered, and the types of impacts and resources that should be considered in the SEIS #1. Notebooks were also available at each display for the public to list other projects or items that should be considered. A Court Reporter present at the scoping meeting recorded oral statements. Written statements were accepted at the meeting and afterward. The scoping period remained open until August 31, 2002.

A Notice of Availability for the Draft SEIS #1 for the Dallas Floodway Extension was published in the *Federal Register* December 6, 2002. A public meeting was held January 8, 2003, and the comment period was extended until February 4, 2003, following public request. All comments received on the Draft SEIS #1, written and oral, are presented and responded to, in an appendix to the Final SEIS #1.

A public review period starting on May 9, 2003, and ending on June 9, 2003, was provided for interested parties to examine the Final SEIS #1. A total of four comment letters were received on the Final SEIS #1. No new issues were raised and the Fort Worth District Engineer sent individual letter responses to each.

7. CONCLUSIONS AND RECOMMENDATIONS

Based upon analyses and findings developed as a result of preparation of the Final SEIS #1 for the Dallas Floodway Extension project, there are no significant adverse effects identified on study area resources, either individually or cumulatively, by the DFE Project and other reasonably foreseeable activities in the study area that warrant selection of an alternate plan for the DFE.

When all relevant environmental, economic, and technical factors are evaluated and balanced, all practicable means to avoid and minimize adverse affects to the human environment have been incorporated in the selected alternative for the DFE. The plan for the DFE as recommended in the GRR/EIS avoids and minimizes impacts to the maximum extent practicable. The recommended and authorized plan for the DFE includes mitigation for unavoidable losses of significant habitat resources in the form of acquisition and management of about 1,180 acres of mitigation lands, which will be monitored yearly for a minimum of ten years, or longer if needed, to document that the system has developed sufficiently to assure the effectiveness in mitigating primarily bottomland hardwood habitats.

In summary, regardless of which set of reasonably foreseeable future actions by the Corps or others may occur in the geographic area of the proposed DFE Project, the cumulative effects assessment in the Final SEIS #1 does not indicate significant adverse cumulative effects to any of the resources considered. Nothing in the analyses contained in the Final SEIS #1 indicate the Recommended Plan should be changed from the plan addressed in the December 1999 Record of Decision for the DFE Project.

8. DECISION

Based on the information and analyses presented in the Final General Reevaluation Report and Integrated Environmental Impact Statement, dated February 1999, and the Final Supplement No. 1 to the Environmental Impact Statement, dated April 2003, for the Dallas Floodway Extension Project, I have determined that regardless of which set of reasonably foreseeable future actions by the Corps and others are assumed for the geographic area of the proposed DFE Project, the DFE Project will not contribute significantly to the cumulative adverse effects on the resources considered. I have decided since cumulative adverse effects are not significant, and based on other relevant environmental, economic and technical factors, that the alternative described and recommended in the Record of Decision for the Dallas Floodway Extension Project, dated December 1, 1999, is still the recommended plan.

Robert H. Griffin
Major General, U.S. Army
Acting Director of Civil Works

Date: 13 Aug 03

NOTICE

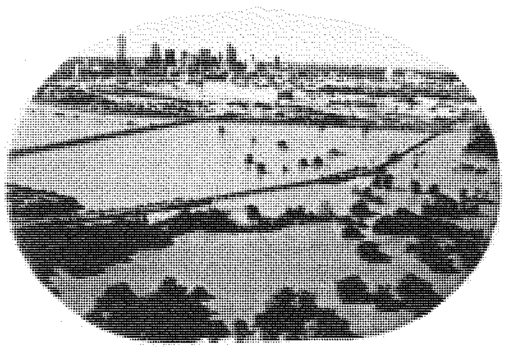
Dallas Floodway Extension, Texas
General Reevaluation Report

Since Congress has authorized the project, the Army Corps of Engineers does not request that the report be printed. If there are any questions about this, please call Ms. Andrea Walker at Corps Headquarters. You can reach Ms. Walker at (202) 761-5696.

US Army Corps
of Engineers
Fort Worth District

GENERAL REEVALUATION REPORT AND INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

DALLAS FLOODWAY EXTENSION



TRINITY RIVER BASIN, TEXAS

VOLUME I

FEBRUARY 1999

(1)

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

01 DEC 1999

RECORD OF DECISION
ENVIRONMENTAL IMPACT STATEMENT
DALLAS FLOODWAY EXTENSION, TEXAS

SYNOPSIS

In February 1999, the Final General Reevaluation Report and Integrated Environmental Impact Statement, which documented the results of a comprehensive reevaluation of the authorized Dallas Floodway Extension Project located in the Trinity River Basin, Texas, was filed with the U.S. Environmental Protection Agency. The review period was extended an additional 30 days in response to local interest requests. This Record of Decision completes the approval process for flood damage reduction, environmental (ecosystem) restoration, and recreation measures for the Dallas Floodway Extension, Texas, as described in the referenced report.

AUTHORITY

Authority for construction of water resource development features described in the Comprehensive Survey Report on Trinity River and Tributaries, Texas (reprinted as House Document 276/89/1), including the Dallas Floodway Extension, is contained in Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). The authority is commonly known as the Trinity River and Tributaries Basinwide Study Authority. All studies conducted under this authority serve as an interim response to the basin wide authority, and do not close out the granting authority. Section 351 of the Water Resources Development Act (WRDA) of 1996 (Public Law 104 303) and Section 356 of WRDA 1999 (Public Law 106-53) authorized several project modifications.

The Dallas Floodway Extension is one of five local flood protection projects authorized for construction in 1965 as part of the basin wide plan of improvement for the Trinity River and Tributaries, Texas. The authorized plan of improvement consisted of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection. The plan consisted of a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek.

A General Design Memorandum (GDM), which assessed the Dallas Floodway Extension in greater detail, was completed in 1981. In 1985, however, work on the project was suspended following a failed city of Dallas bond election. Final approval of the 1981 GDM was subsequently discontinued, resulting in the retention of the 1965 plan as the authorized plan.

The current General Reevaluation Study was the result of a request by the city of Dallas to reactivate the authorized Dallas Floodway Extension Project, following the severe flood event of 1989. The project was reactivated in 1990 under the provision that a general reevaluation be conducted prior to construction.

DECISION

It is my decision that the Recommended Federally Supported Plan (FSP) for the Dallas Floodway Extension Project should be implemented as soon as practicable as a means to alleviate potential flood damages, restore the natural environment, and provide recreation facilities within the Dallas, Texas, area. Authority to implement the project is partially provided by Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). In addition, Section 351 of WRDA 1996 (Public Law 104-303) authorized that the sponsor built Rochester Park Levee and CWTP Levee be included in the project and that the sponsor receive credit for work carried out which is integral with the project as authorized and as currently recommended. Section 356 of WRDA 1999 (Public Law 106-53) authorized environmental restoration and recreation as project purposes. All project features of the Recommended FSP are either specifically authorized by Congress, or can be implemented within the discretionary authority of the Chief of Engineers [33 U.S.C. 701(m)] and no additional project authorization is needed.

FINDINGS OF THE FINAL GENERAL REEVALUATION REPORT AND INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

Implementation of the Recommended FSP, as presented in the Final General Reevaluation Report and Integrated Environmental Impact Statement, dated February 1999 (revised September 1999), would provide completion of a significant portion of the Authorized Plan for the Dallas Floodway Extension. The Recommended FSP, as described in summary below, is located within the authorized site, and includes smaller scale features of the authorized flood damage reduction plan. Future work efforts to more fully fulfill the scope of the authorized plan would not be adversely affected by the Recommended FSP.

COMPARISON OF ALTERNATIVE PLANS

Subsequent to the evaluation and assessment of potential water resources management measures in the Dallas area and formulation of those measures into plan components, various comprehensive plans were investigated. Evaluation of those plans in light of specified planning objectives and public involvement produced the array of alternative plans as detailed below.

The 1965 Authorized Plan consists of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection (approximately 800-year or 0.125 percent Annual Chance of Exceedence (ACE). The plan would include a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek. This plan would no longer be economically justified, with current flood control first costs of $199.2 million (January 1997 prices), annual flood control costs of $17.1 million (7.375 percent interest, 50-year period of analysis), negative annual net flood control benefits of $4.1 million, and a benefit-to-cost ratio (BCR) of 0.76.

The National Economic Development (NED) Plan consists of clearing the vegetation along an upper and a lower overbank swale. The upper overbank swale would be about 1,200 feet wide and would extend from the confluence of Cedar Creek, at the upstream end of the project, to the river crossing of IH-45 for a length of about 7,800 feet, or 1.5 miles. The lower overbank swale would be about 1,200 feet wide extending from Hwy. 310, beginning at least 100' from the edge of the east bank, downstream to about 2,000 feet below Loop 12, for a total length of 17,300 feet, or 3.3 miles. Fragmentation of habitat would be unavoidable and would require extensive mitigation. Acquisition and management of approximately 3,200 acres of land would be required to offset the adverse environmental impacts associated with the project's implementation. This plan would have estimated flood damage reduction first costs of $50 million (January 1887 prices), annual flood control costs of $5.5 million (7.375 percent interest, 50-year period of analysis), annual net flood control benefits of $8.1 million, and a BCR of 2.46.

The Combination Non-structural / Structural Plan (which is the environmentally preferable alternative) consists of a chain of wetlands, a Standard Project Flood (SPF) levee protecting the Lamar neighborhood, and a 10-year buyout of the Cadillac Heights area (seven structures). The buyout of seven structures would leave 158 structures within the 100-year floodplain in Cadillac Heights. This plan would have estimated flood damage reduction first costs of $67.0 million (January 1997 prices), annual flood control first costs of $7.6 million (7.375 percent interest, 50-year period of analysis), annual net flood control benefits of $5.3 million, and a BCR of 1.70.

The Recommended FSP is a multi-objective project consisting of a swale for reducing flood damages, with an incorporated chain of wetlands for environmental restoration purposes, SPF levees protecting the Lamar and Cadillac Heights neighborhoods, environmental mitigation, and recreation facilities compatible with a larger, regional recreation master plan. Also included in this plan would be a proposed realignment of the existing river channel at the IH-45 bridge to prevent catastrophic failure of this designated national defense route, and to reduce significant annual maintenance costs due to debris accumulations at the bridge. This plan is also the locally preferred plan. This plan will provide an approximate 800-year or 0.125 percent ACE level of protection to the areas adjacent to and upstream of the project area. This plan would have an estimated first cost of $127.2 million (October 1998 prices), annual costs of $9.3 million

(6.875 percent interest, 50-year period of analysis), annual benefits of $19.1 million, and a BCR of 2.06.

PLAN SELECTION CONSIDERATIONS

Plan selection considerations involved a comparison of the cost effectiveness, environmental – social – economic balance, broad social acceptability, and adverse environmental impacts of the final plans. Plans formulated were evaluated based on their contribution to the National Economic Development account, and they are consistent with protection and restoration of the Nation's environment. In addition to these National objectives, additional planning objectives evolved from meetings with area residents, from contact with the local sponsor, State and Federal agencies, and from observations made in the area. Specific needs, desires, and goals of the community were identified. The plan selection considerations for the Dallas Floodway Extension project were as follows:

* Reduce flood damages, provide better health and safety measures, reduce emergency services, reduce potential for loss of life due to high velocity flows, reduce isolations caused by flood waters, reduce overtopping of bridges and roads along the Trinity River, and reduce the loss of jobs and/or wages caused by flooding from the Trinity River within the city of Dallas.

* Preserve and protect existing environmental and aesthetically pleasing areas and maintain, as much as possible, the existing vegetation and wildlife habitat along the Trinity. The channel portion of the Trinity River is possibly the largest remaining natural channel within Dallas.

* Preserve and/or protect historically and culturally significant areas.

In summary, a comparison of the alternatives reveals the <u>1965 Authorized Plan</u>, which did not include mitigation, is no longer the best plan nor is it cost effective or environmentally or socially acceptable; the <u>NED Plan</u> would not provide the maximum protection to the project area and would require significant mitigation, with approximately 3,200 acres of land being required to offset the adverse environmental impacts; the <u>Combination Non-structural / Structural Plan</u> (environmentally preferable alternative) was not selected because it would leave 158 structures within the 100-year floodplain in Cadillac Heights without flood protection and would provide disproportionate flood protection within the project area, while requiring 1,027 acres of mitigation; and the <u>Recommended FSP</u> which provides the maximum protection to the project area, while requiring 1,179 acres of mitigation, best satisfies cost-effectiveness, social, and environmental acceptability criteria and is the locally preferred plan.

ENVIRONMENTAL CONSIDERATIONS IN THE FINAL GENERAL REEVALUATION REPORT AND INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

Compliance with applicable environmental review and consultation requirements has been accomplished through coordination of the Final General Reevaluation Report and Integrated Environmental Impact Statement. In addition to satisfying the Fish and Wildlife Service Coordination Act, full compliance has been accomplished with the Clean Water Act, including the preparation of a Section 404(b)(1) analysis, Clean Air Act, Comprehensive Environmental Resource Compensation and Liability Act, Resource Conservation and Recovery Act, Endangered Species Act, National Historic Preservation Act, Floodplain Management (Executive Order 11988), Section 9 (33 U.SC. 401) and Section 10 (33 U.S.C. 403) of the Rivers and Harbors Act of 1899, and Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (Executive Order 12898). The General Reevaluation Report and Integrated Environmental Impact Statement are being submitted to Congress to satisfy the requirements of Subsection 404(r) of the Clean Water Act [33 U.S.C. 1344(r)]. Subsection 404(r) waives the requirement to obtain the state water quality certification and requires that the project EIS be submitted to Congress prior to appropriation of funds for the project. The integrated project EIS provides information regarding the effects of the discharge of dredged or fill material, related to project construction of the Recommended FSP.

A signed Programmatic Agreement with the Advisory Council on Historic Preservation, Texas Historic Preservation Office, and other interested parties has been developed to address cultural resources with due diligence.

All practicable means to avoid or minimize environmental impacts have been adopted and were incorporated in the development of the Recommended FSP. The Final Fish and Wildlife Coordination Act Report, dated February 3, 1999, has been coordinated with Texas Parks and Wildlife Department. The conclusion was that if the Recommended FSP is implemented, the project should include the acquisition and intensive management of a minimum of 1,179 acres of terrestrial habitat, including 926 acres of bottomland hardwoods and reforestation of 253 acres of mixed grass-forb lands. Once the environmental restoration and mitigation features have been turned over to the non-Federal sponsor for long term operation and maintenance, a program to monitor the success of the environmental restoration and mitigation features of the project will be initiated. The U.S. Army Corps of Engineers, Fort Worth District, will conduct annual inspections of the environmental restoration and mitigation areas and any deficiencies would be documented. Enforcement procedures to rectify any deficiencies in the environmental restoration or mitigation features will be adopted and jointly implemented by the non-Federal sponsor and the U.S. Army Corps of Engineers. The non-Federal sponsor will be responsible for all Operation, Maintenance, Repair, Rehabilitation, and Replacement requirements of the environmental restoration and mitigation features.

CONCLUSIONS

I have reviewed and evaluated all documents concerning the Fort Worth District Engineer's recommendation, including the views of other interested agencies and the general public, and have considered prevailing administrative policies and procedures. Based on these factors, I find the Recommended FSP as contained in the Final General Reevaluation Report and Integrated Environmental Impact Statement, dated February 1999 (Revised September 1999), suitable for use as a plan for implementation of flood damage reduction, environmental restoration, and recreation at Dallas, Texas. I further conclude that the Dallas Floodway Extension project should be implemented as soon as practicable.

Based on the conditions set forth in the Fort Worth District Engineer's findings and the conditions set forth herein, I conclude that the public interest is best served by the decisions as set forth herein.

H.V.W.

HANS A. VAN WINKLE
Major General, U.S. Army
Deputy Commander for
Civil Works

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DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PC (10-1-7a)

07 DEC 1999

SUBJECT: Dallas Floodway Extension, Trinity River Basin, Texas

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on flood damage reduction, environmental restoration and recreation in the area of the Trinity River Basin, Dallas, Texas. It is accompanied by the report of the district and division engineers. These reports address modification of the Dallas Floodway Extension project that was authorized by Section 301 of the 1965 Rivers and Harbors Act (Public Law 89-298). Section 356 of the Water Resources Development Act (WRDA) 1999 (Public Law 106-53) authorized environmental restoration and recreation as project purposes. Preconstruction engineering and design activities for the modified project will be continued under the above authorities.

2. The reporting officers recommend construction of the Federally Supportable Plan (FSP) that is eligible for Federal cost sharing of all elements. The Recommended FSP would restore the Standard Project Flood (SPF) level of protection to the existing Dallas Floodway and would provide protection for the SPF to portions of the city of Dallas downstream of the existing Dallas Floodway that are currently unprotected. Major flood control features include a chain of wetlands consisting of an upper swale about 1.5 miles long with an average bottom width of 400 feet and a lower swale about 2.2 miles long with an average bottom width of 600 feet; the Lamar Levee on the left bank about 3.1 miles long with an average height of 17.6 feet; the Cadillac Heights Levee on the right bank about 2.2 miles long with an average height of 14.9 feet; appropriate drainage facilities for each levee; portions of two levees constructed by the non-Federal sponsor, Rochester Park Levee on the left bank and Central Wastewater Treatment Plant (CWWTP) Levee on the right bank that are integral to the Federal project as authorized. Recreation features would consist of 31.5 miles of recreation trails (18 miles hike and bike, 8.5 miles equestrian, and 5 miles nature trails) and related facilities. Environmental restoration would provide 123 acres of emergent wetlands habitat with four constructed wetlands cells in the upper swale and three constructed wetlands cells in the lower swale. Environmental mitigation

for the flood control features involves acquisition of 1,179 acres of additional project lands (acquisition, improvement and management of 926 acres of bottomland hardwood forest; and acquisition of 253 acres of mixed grassland and forblands, of which 223 acres would be converted to bottomland hardwood forest and 30 acres would be managed as grassland).

3. The total first cost of the Recommended FSP based on October 1998 price levels is estimated at $127,154,300, of which $83,557,600 would be Federal and $43,596,700 would be non-Federal. The total first costs of the project allocated by purpose are as follows: flood damage reduction, $113,958,300; environmental restoration, $5,638,600; and recreation, $6,757,400. In addition, total project cost includes $800,000 (Federal) for cultural resources preservation. Based on an interest rate of 6 7/8 percent, amortized over 50 years and including annual operation, maintenance, repair, replacement, and rehabilitation, average annual flood control costs are $8,685,000. Average annual benefits attributed to the flood damage reduction plan are estimated at $13,285,100, and the flood control benefit-cost ratio is 1.5 to 1. Average annual recreation costs are $571,300 and average annual recreation benefits are $5,777,200, for a recreation benefit-cost ratio of 10.1 to 1. The net annual flood control and recreation benefits for this plan are $9,806,000. The environmental restoration features will provide 184 average annual habitat units.

4. The Recommended FSP is not the plan originally authorized by Section 301 of the 1965 Rivers and Harbors Act, nor is it the National Economic Development (NED) plan that would produce the greatest net economic benefits for flood damage reduction. The originally authorized plan consisted of levees and channels, some of which are no longer economically justified under current conditions. In regard to the channel conveyance system, a fully mitigated 1,200 foot wide swale plan would produce the greatest net economic benefits, but this plan would also require the removal of a large portion of the existing bottomland hardwood forested area below the existing Dallas Floodway System. The portion of the Recommended FSP for flood control purposes includes a chain of wetlands rather than the 1200-foot swale. In comparison to the Swale Plan, the Chain of Wetlands Plan provides for a narrower conveyance system that is aligned in a fashion to greatly reduce impacts on the forested area, it is economically justified, represents a reduction in scale and cost, and is fully supported by the sponsor, state of Texas, and Federal agencies. As such, the chain of wetlands was selected as the recommended conveyance system for the reduction of flood damages. In accordance with 33 U.S.C 701(m), this smaller plan can be fully cost shared. In addition to the chain of wetlands, the Recommended FSP would include SPF levees for the Lamar Street area and the Cadillac Heights Community. The levee that would produce the greatest NED benefits for the Cadillac Heights Community would protect against what is commonly referred to as the 100-year flood; in terms of risk, this levee would protect against the flood that would have a 1.0 percent annual

chance of exceedance. However, it was found that this levee would not meet Federal Emergency Management Agency standards for protecting the area from the 1.0 percent annual chance of exceedance flood; it would not provide an acceptable level of reliability, particularly when compared with other project elements; and it would expose the Cadillac Heights Community to increased flooding due to construction of other project levees. As a result, the Assistant Secretary of the Army (Civil Works) concurred in the recommendation to provide SPF protection for the entire Dallas Floodway Extension project. This is consistent with the level of protection provided by the originally authorized project. The Recommended FSP is fully supported by the non-Federal sponsor, the state of Texas and other Federal agencies. All project features of the Recommended FSP are either specifically authorized by Congress, or can be implemented within the discretionary authority of the Chief of Engineers [33 U.S.C. 701(m)] and no additional project authorization is needed.

5. The report of the district and division engineers, which contains an integrated Environmental Impact Statement (EIS), is hereby submitted to Congress to satisfy the requirements of Section 404(r) of the Clean Water Act [33 U.S.C. 1344(r)]. Section 404(r) waives the requirement to obtain the state water quality certification and requires that the project EIS be submitted to Congress prior to appropriation of funds for project construction.

6. As provided in Section 351 of WRDA 1996, the reporting officers recommend that the non-Federal sponsor receive credit for work carried out which is integral with the project as authorized and as currently recommended. The city of Dallas constructed the Rochester Park and CWWTP Levees at a total cost of $26,958,000. Only a portion of the Rochester Park Levee was found to be an integral part of the Federal project, therefore the total cost of creditable non-Federal work was estimated at $23,120,000. This total includes construction for $22,174,000, and lands, easements, rights of way, relocations, and disposal areas (LERRD) for $946,000; LERRD is a non-Federal responsibility by law. Both the Section 351 construction credit of $22,174,000 and related LERRD credit are reflected in the Federal/non-Federal cost sharing shown above for the Recommended FSP. The amount of construction credit will be the lesser of the actual cost of the work incurred by the sponsor, or the cost had the Federal Government constructed the same portion of the project at the time the work was done.

7. I concur in the findings, conclusions and recommendations of the reporting officers. Accordingly, I recommend implementation of improvements for flood damage reduction, environmental restoration, and recreation as described for the Dallas Floodway Extension, Trinity River Basin, Texas. Cost sharing for the previously authorized flood control will be a non-Federal share of at least 25 percent and a Federal share of no more than 75 percent, as required by WRDA 1986. The environmental restoration and recreation features will be subject

to cost sharing as required by WRDA 1986, as amended by Section 210 of WRDA 1996. Further, the non-Federal sponsor would be responsible for 100 percent of the operation, maintenance, repair, replacement, and rehabilitation for the entire project. This recommendation is also subject to the non-Federal sponsor agreeing to comply with all applicable Federal laws and policies. I further recommend that the non-Federal sponsor receive credit under Section 351 of WRDA 1996, subject to an audit of the sponsor's actual expenditures. The amount of credit will be the lesser of the actual cost of the work incurred by the sponsor or the cost had the Federal Government constructed the same portion of the project at the time the work was done. My recommendation is subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including the following requirements:

a. Provide a minimum of 25 percent, but not to exceed 50 percent, of total project costs allocated to structural flood control, 50 percent of total project costs allocated to recreation, and 35 percent of total project costs allocated to environmental restoration, as further specified below:

(1) Provide, during construction, a cash contribution equal to 5 percent of total project structural flood control costs;

(2) Provide all lands, easements, rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(3) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project;

(4) Provide, during construction, any additional costs as necessary to make its total contribution equal to 25 percent of the separable project costs allocated to structural flood control costs, 50 percent of the total project recreation costs, and 35 percent of the total project environmental restoration costs; and

b. In addition, credit for work performed by the non-Federal sponsor and approved by the Assistant Secretary of the Army (Civil Works) will be applied toward the contributions of additional cash and lands, easements, rights-of-way, relocations, and borrow and dredged or excavated material disposal areas (LERRD) for flood control. The amount of credit will be the lesser of the cost that the Government would have incurred for the work or the actual cost subject to audit for reasonableness, allowableness, and allocability. However, in no instance will the credit applied exceed the value of additional cash and LERRD contributions or 45 percent of total project costs for flood control, whichever is the lesser.

c. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government.

d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local 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.

e. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

f. Comply with Section 221 of the Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

g. Hold and save the Government free from all damages arising for the construction, 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.

h. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

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SUBJECT: Dallas Floodway Extension, Trinity River Basin, Texas

i. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way necessary for the construction, operation, and maintenance of the project, except that the non-Federal sponsor shall not perform such investigations on lands, easements, or right-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

j. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

k. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR, part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as 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 Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), requiring non-Federal preparation and implementation of floodplain management plans.

n. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to structural flood control, recreation, and environmental restoration that are in excess of 1 percent of the total amount authorized to be appropriated for the project.

o. Participate in and comply with applicable Federal floodplain management and flood insurance programs.

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SUBJECT: Dallas Floodway Extension, Trinity River Basin, Texas

p. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder operation and maintenance of the project.

q. Not less than once each year, inform affected interests of the extent of the protection afforded by the project.

r. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in preventing unwise future development in the floodplain and in adopting such regulations as may be necessary to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

s. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

JOE N. BALLARD
Lieutenant General, U.S. Army
Chief of Engineers

FINAL

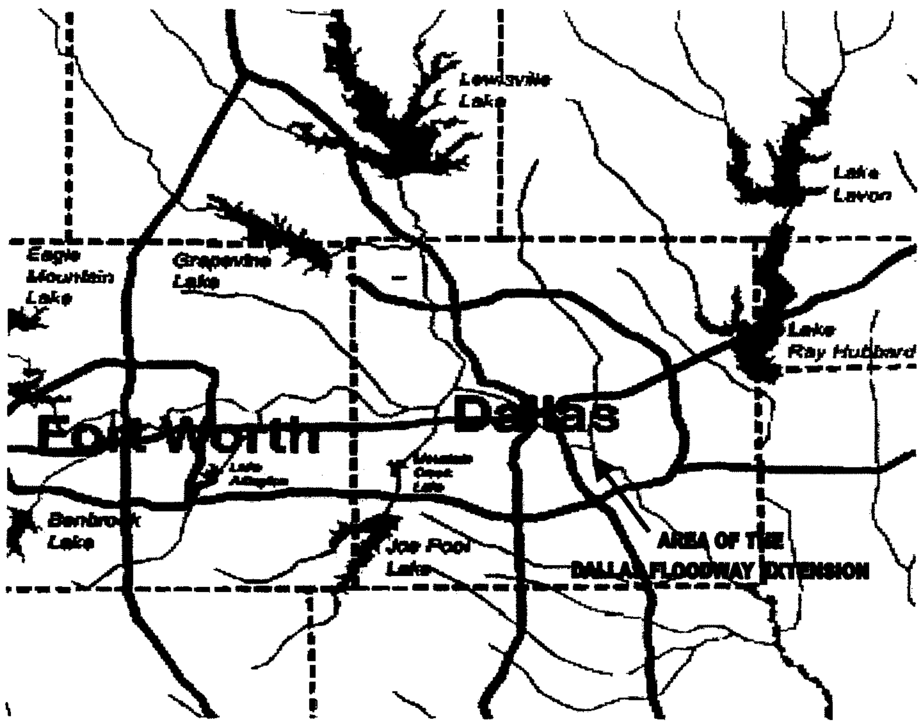
Supplement No. 1

to the

Environmental Impact Statement

for the

Dallas Floodway Extension
Trinity River, Texas



US Army Corps
of Engineers
Fort Worth District

April 2003

FINAL
SUPPLEMENT I to the ENVIRONMENTAL IMPACT STATEMENT DALLAS FLOODWAY EXTENSION, TRINITY RIVER BASIN, TEXAS

COVER SHEET

Lead Agency:	U.S. Army Corps of Engineers, Fort Worth District
Cooperating Agencies:	N/A
Title of Proposed Action:	Supplement 1 to the Environmental Impact Statement
Affected Jurisdiction:	Upper Trinity River Basin, Trinity River, Texas

ABSTRACT: This document supplements the information presented in the General Reevaluation Report and Integrated Environmental Impact Statement (GRR/EIS) for the Dallas Floodway Extension (DFE) dated February 1999. The Deputy Commander for Civil Works signed the Record of Decision for that document on 1 December 1999. In May 2000, various groups opposed to the DFE project filed a motion to prevent construction. On April 10, 2002, the U.S. District Court for the Northern District of Texas ruled in favor of the Corps of Engineers on three of four counts in the lawsuit. On the fourth count the Court ruled in favor of the plaintiffs and remanded the matter to the Corps of Engineers "for further consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project." The purpose of this Supplement to the EIS is to comply with that court order. This document, therefore, addresses the cumulative impacts of the final array of alternatives considered in the GRR/EIS including the authorized plan for the DFE along with all similar and reasonably foreseeable actions of the Corps and others that may occur within the geographic area of the DFE. The authorized DFE project is located along the Trinity River in the Southeast quadrant of Dallas, Texas, and consists of an off-channel flood damage reduction feature incorporating environmental restoration in the form of a chain of wetlands, levees on both sides of the river, recreation facilities, and acquisition and management of open space lands in the floodplain for mitigation of habitat losses. In order to determine activities of others that could be identified as "reasonably foreseeable", a Scoping Meeting for this Supplement was held on July 16, 2002 and letters were sent to all known agencies and organizations that might be involved in related activities, including various cities, Dallas County, State and Federal Highway departments, airports, resource agencies, and others. Potential activities of other entities are grouped into the categories of Transportation, Flood Damage Reduction, Recreation, Ecosystem Restoration and Preservation, and a broad category of Fills, Permits, Utilities, and Other Activities. Many of these reasonably foreseeable activities were previously addressed in the Programmatic Environmental Impact Statement for the Upper Trinity River Basin dated June 2000, but additional potential activities were identified as well. The Notice of Availability of the Draft Supplement to the EIS for the DFE appeared in the Federal Register on December 6, 2002. A Public Meeting on the draft Supplement was held on January 8, 2003, and written comments were accepted through February 4, 2003. This Supplement to the EIS for the DFE incorporates both the GRR/EIS and 2000 Programmatic EIS (PEIS) largely by reference but some specific information from those documents has been brought forward into the Final SEIS.

The review period extends for 30 days after publication of the Notice of Availability in the Federal Register. If you would like further information about this document, please contact:

U.S. Army Corps of Engineers
Fort Worth District
ATTN: CESWF-PM-C (Mr. Gene T. Rice, Jr.)
P.O. Box 17300
Fort Worth, Texas 76102-0300

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FINAL
SUPPLEMENT I to the ENVIRONMENTAL IMPACT STATEMENT

DALLAS FLOODWAY EXTENSION
TRINITY RIVER BASIN, TEXAS

SUMMARY

( ) Draft (X) Final

U.S. Army Corps of Engineers
Fort Worth District
ATTN: CESWF-PM-C (Mr. Gene T. Rice, Jr.)
P.O. Box 17300
Fort Worth, Texas 76102-0300

Type of Action: (X) Administrative
( ) Legislative

Project Description: A detailed description of the Dallas Floodway Extension (DFE) project is contained in the General Reevaluation Report and Integrated Environmental Impact Statement (GRR/EIS) dated February1999. That document may be referenced for additional information not presented herein. In summary, the DFE project is located within the Standard Project Flood (SPF) floodplain of the Trinity River in Southeast Dallas and consists of five pertinent project features depicted on Figure S-1. Those project features are a "Chain of Wetlands" for flood damage reduction and ecosystem restoration, levees along Lamar Street and in the Cadillac Heights neighborhood for flood damage reduction, acquisition and management of lands in the "Great Trinity Forest" for mitigation of habitat losses, recreational (trail) facilities, and realignment at Interstate Highway 45 (IH 45) to prevent damage to the overpass. Features of the Recommended and Authorized DFE project are summarized as follows:

The chain of wetlands feature of the DFE project consists of an upper wetland chain, with four separate wetland cells, and a lower wetland chain, with three separate cells, each of various lengths and shapes. During flooding, the upper and lower chains would act as flood conveyance to outfalls. The total length of the wetland cells would be about 3.8 miles with average width of about 500 feet, average depth of about 1.5 feet, and maximum depth of 7 feet. The chain of wetlands will be located in the floodplain as far west of the river as practical to avoid the most pristine bottomland hardwood areas closer to the river and includes 123 acres of emergent wetland vegetative plantings as environmental restoration. The Dallas City Council formally adopted the Chain of Wetlands on August 28, 1996, with the caveat that the addition of levees to the plan would be further investigated.

Two earthen levees are to be constructed as part of the Recommended DFE project. The Lamar Levee would have total length of 16,419 feet. The average height of the levee would be 17.6 feet, with a maximum height of 31.0 feet and a 20-foot crown width. The Cadillac Heights Levee would have a total length of 11,891 feet, with an average height of 14.9 feet, a maximum height of 25.75 feet, and crown width of 20 feet. Both levees are designed to provide SPF level of protection (estimated at about 800-year frequency of occurrence) to the adjacent neighborhoods. The existing Dallas Floodway upstream of the DFE currently provides an estimated 300-year frequency level of protection to the Central Business District. Implementation of the Recommended DFE would restore SPF level of protection to the Central Business District. The Dallas City Council formally supported the Chain of Wetlands plus the SPF levees on March 26, 1997.

In order to protect the integrity of the IH-45 overpass, the channel alignment of the Trinity River will be realigned to be centered between the nearest 320-foot span of the IH-45 bridge, resulting in the channel being moved laterally a distance of about 350 feet. The existing channel would be filled to prevent further collection of debris. A portion of the old channel downstream of the IH-45 bridge would remain unfilled to provide a slack water area for use as a possible river access point, and to provide some habitat diversity near the river.

An environmental mitigation plan for the approved DFE project provides for acquisition of 1,179 acres in additional project lands within what is referred to as the "Great Trinity Forest". The mitigation plan includes acquisition, improvement and management of 926 acres of bottomland hardwood, and acquisition of 253 acres of mixed grassland/forbland, of which 223 acres would be converted (planted and managed) to bottomland hardwood forest. The remaining 30 acres would be managed as grassland. The mitigation plan also provides for compatible low-density recreation.

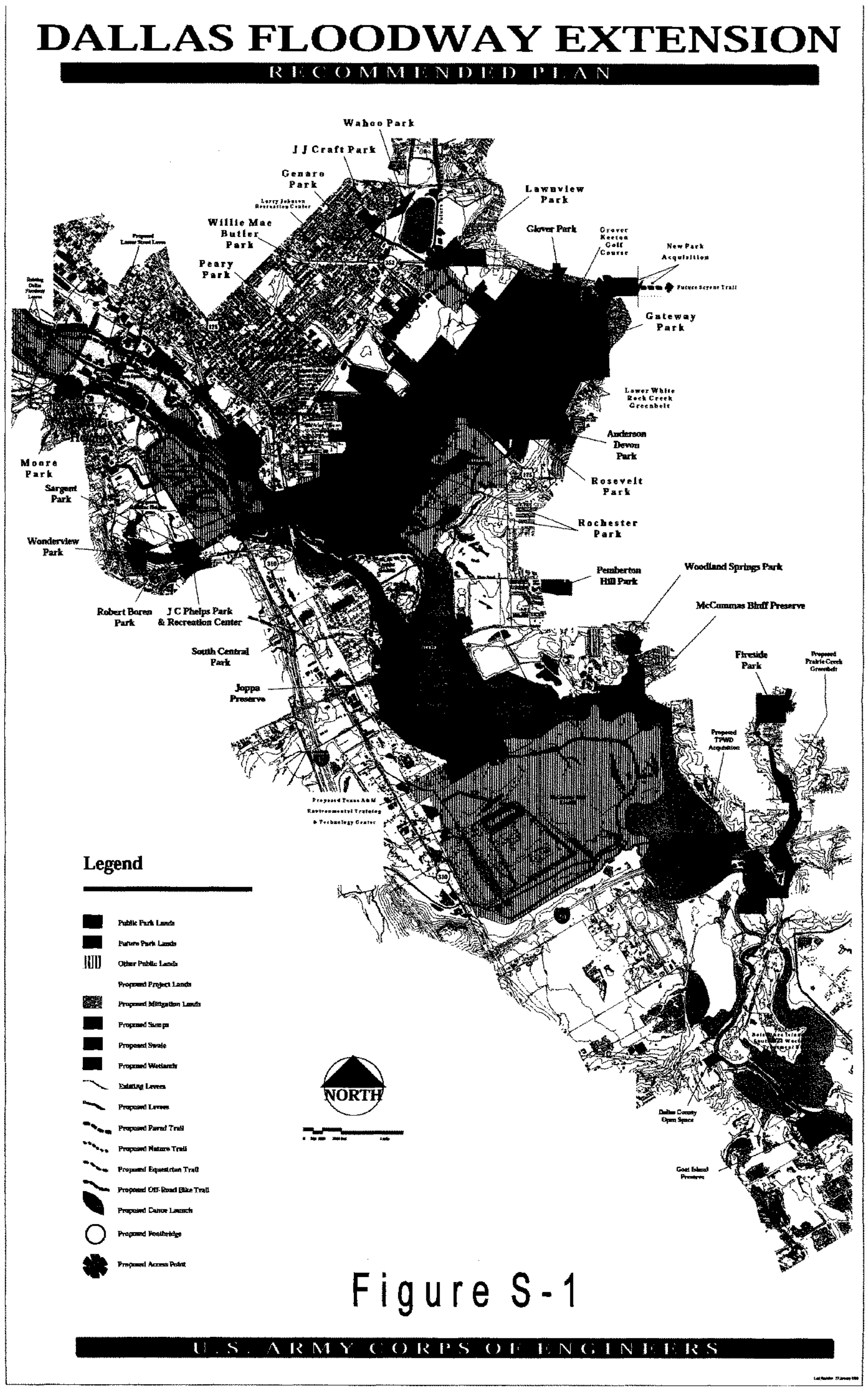
The recreation plan for the DFE would create linkages between existing recreational areas and public open space areas and would include 18 miles of 10-foot wide concrete trail, 8.5 miles of natural surface equestrian trails, and 5 miles of natural surface nature trails. A total of seven access areas are planned.

Summary of Major Environmental Effects: This Supplement to the EIS for the DFE project focuses on the cumulative impacts of reasonably foreseeable similar proposed actions in the same geographical area as the DFE project in response to the April 10, 2002, order of the U.S. District Court for Northern District of Texas in Fort Worth. An analysis of cumulative impacts of various past, present, and reasonably foreseeable future Corps of Engineers projects and projects of other entities was conducted in combination with the plan for the DFE project as recommended and approved in the GRR/EIS, along with the final array of alternatives in that document.

There are two studies of potential future Corps of Engineers projects in the Dallas study area that are currently being conducted under specific Congressional authorization as part of the Upper Trinity Basin Feasibility Study. They are the Stemmons North Industrial District along the Elm Fork of the Trinity River in northwest Dallas and the existing Dallas Floodway. Both areas are being investigated for flood damage reduction, ecosystem restoration, and recreation needs and opportunities. Based on studies of Stemmons North Industrial District to date, it does not appear that there is a Federal interest in Corps of Engineers involvement in a project in that area. There are no projects formally approved by the City Council or proposed by the City of Dallas for the Elm Fork that can be considered as reasonable foreseeable, and no related activities have been identified that would have significant cumulative effect on study area resources.

Alternatives being considered by the Corps of Engineers and the City of Dallas in the area of the existing Dallas Floodway include a plan that would optimize food damage reduction protection to the Central Business District and West Dallas, and an Environmental Quality or "EQ" plan. The "EQ" plan would have beneficial cumulative impact, along with the DFE project, in terms of forested resources, floodplain recreation, natural floodplain values, and aesthetic outputs, but without appropriate hydraulic mitigation would have the effect of increasing the flood risk for upstream floodplain areas not protected by the Dallas Floodway levees. The plan that would seek to optimize flood damage reduction would be essentially neutral in terms of impacts on other resources, unless significant ecosystem restoration and recreation features were to be included. At the current time, investigations under the Interim Feasibility Study of the Dallas Floodway being held in abeyance awaiting selection of a preferred alignment for the Trinity Parkway by the Federal Highway Administration, North Texas Tollway Authority, and the City of Dallas. Depending on the parkway or tollway alignment ultimately selected, it is very possible that a multi-objective plan could be formulated for the existing Dallas Floodway which would include flood damage reduction, ecosystem restoration, and recreation measures which would have a net positive contribution to cumulative effects with the DFE on forested resources and recreation with essentially neutral effects on hydraulics and water quality.

In addition to the above activities, the Corps of Engineers, along with the City of Dallas and Dallas County, are currently conducting two small ecosystem restoration studies under the Corps of Engineers Continuing Authority Program.


DALLAS FLOODWAY EXTENSION
RECOMMENDED PLAN
Wahoo Park
J J Craft Park
Genaro Park
Lawnview Park
Willie Mae Butler Park
Glover Park
Peary Park
Grover Keeton Golf Course
New Park Acquisition
Gateway Park
Lower White Rock Creek Greenbelt
Anderson Devon Park
Moore Park
Sargent Park
Rosevelt Park
Rochester Park
Wonderview Park
Pemberton Hill Park
Woodland Springs Park
Robert Boren Park
J C Phelps Park & Recreation Center
McCommas Bluff Preserve
South Central Park
Fireside Park
Joppa Preserve
Dallas County Open Space
Goat Island Preserve
Legend
Public Park Lands
Future Park Lands
Other Public Lands
Proposed Project Lands
Proposed Mitigation Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Proposed Paved Trail
Proposed Nature Trail
Proposed Equestrian Trail
Proposed Off-Road Bike Trail
Proposed Canoe Launch
Proposed Footbridge
Proposed Access Point
NORTH
U.S. ARMY CORPS OF ENGINEERS
Figure S-1

Those projects are the Old Trinity River project adjacent to the existing West Levee of the Dallas Floodway and the Joppa Preserve adjacent to Lemmon Lake, downstream of the DFE project. It is anticipated that both will proceed to implementation within the reasonably foreseeable future. If implemented, these projects will contribute positively to cumulative effects on bottomland hardwoods, wetlands, water quality, aesthetics, and recreation within the immediate study area for the DFE.

Reasonably foreseeable projects proposed by other entities have been included in these analyses. The major potential action potentially effecting the study area environment would be the proposed Trinity Parkway, which could impact resources within the area of the existing Dallas Floodway. The Federal Highway Administration with support of the North Texas Tollway Authority, and the City of Dallas issued a Notice of Intent to prepare an Environmental Impact Statement on the Trinity Parkway on June 17, 1999. The EIS is to address five alternative alignments for the Trinity Parkway which include: 1) combined parkway constructed on the East levee of the Dallas Floodway, 2) split parkway constructed on the riverside slopes of the Dallas Floodway East and West Levees, 3) split parkway constructed on the landside slopes of the Dallas Floodway East and West Levees, 4) modifying or reconstructing the existing Industrial Boulevard at grade, or 5) above grade to accommodate increased traffic load. The EIS for the Trinity Parkway is currently in working draft with public release of the Draft EIS scheduled later in 2003 and a Final EIS to follow in 2004. It is anticipated that all of the Trinity Parkway alternatives would have varying degrees of cumulative impact associated with the DFE project, depending on the resource considered. Alternative alignments outside the existing Dallas Floodway levee system would have minimal cumulative impact on hydraulics and biotic resources. All of the Parkway alternatives would have slightly negative to no effect (with substantial plantings) on forested resources, slightly negative effects on environmental justice issues and community structure, with an essentially neutral effect on hydraulics. Alignments inside the existing Dallas Floodway levees would require special consideration to assure minimal negative impact to hydraulics, water quality, recreation, noise, and aesthetics. Any alternative associated with the existing levees would require the "borrow" or excavation of material from between the levees to raise the Parkway to an elevation at least above the 100-year flood elevation. That excavated area between the levees would create an opportunity for a lake or lakes, consistent with the City of Dallas' Trinity River Corridor Master Implementation Plan.

The City of Dallas' Trinity River Corridor Master Implementation Plan provides for a series of lakes, a split river channel, constructed wetlands, recreation trails, parklands, grasslands, and pedestrian bridges. The Trinity River Corridor Master Implementation Plan also proposes upgrading of several bridges that cross the Dallas Floodway slated for replacement to attain "signature" or renowned architectural status. These bridges were not evaluated in this Supplement to the DFE EIS because their designs have not been sufficiently developed for evaluation. A "Lakes Only" Plan in the existing Dallas Floodway, if implemented by the City of Dallas, would have a slight negative cumulative effect on forested resources of the geographic area of the DFE project, or minimal effect with substantial plantings. It is anticipated that a "Lakes Only" plan would be beneficial in terms of recreation and aesthetics.

A Programmatic EIS for the Upper Trinity River Basin, completed in June 2000, addressed the cumulative impacts of all reasonably foreseeable activities of the Corps of Engineers and others, along the DFE project, within the entire upper Trinity River watershed that were known as of June 2000. Data and other information contained in that document have been incorporated by reference throughout this Supplement to the DFE EIS. Every effort was also made in preparation of this Supplement to analyze the cumulative effects of potential actions of the Corps of Engineers and others that have been proposed since finalization of the PEIS and its Record of Decision.

Areas of Controversy: Throughout the planning and NEPA process for the DFE project, concerns have been raised regarding the number and scope of potential projects (both by Corps of Engineers and by others), being proposed for implementation. The potential for resultant adverse impacts created the need to address the environmental consequences of the reasonably foreseeable proposed actions. The cumulative effects of numerous and various projects on flood damages and natural floodplain functions are considered to be controversial. Structural measures implemented to reduce flood damages often adversely impact natural flood plain values. Thus, selected interests have expressed concerns the use of flood plains for purposes contrary to their natural function to be controversial. These areas of concern, collectively, provided additional impetus for preparation of the June 2000 PEIS addressing the Upper Trinity River Basin Feasibility Study.

Issues identified early in the public involvement process for the DFE project as controversial have continued so throughout the review of the Draft and Final GRR/EIS and in scoping for this Supplement to the EIS. The primary objectives of the evaluations in this Supplement to the DFE EIS has focused on identifying and summarizing the cumulative impacts of reasonably foreseeable projects of the Corps of Engineers and others within the study area with emphasis on hydraulic and floodplain environmental features. A further purpose has been to disclose cumulative impacts of those actions relative to the DFE project. Foremost among controversial issues is the proposal to place transportation features laterally within the floodplain of the existing Dallas Floodway and the perception that the Dallas Floodway Extension project was being constructed in order to accommodate roadways between the existing levees. Other issues identified as controversial in the plaintiff's motion to stop construction of the DFE project concerned the hydraulic modeling analysis, the level of protection of the existing Dallas Floodway afforded to the Central Business District, and the relationship of various projects to one another. Determination of reasonably foreseeable future actions within the Dallas Floodway has not been clarified during the development of this Final Supplement.

In March 2003, City of Dallas Council members were briefed on another conceptual proposal for the existing Dallas Floodway, which was developed by a team of private urban designers and landscape architects for the Dallas Plan. While this new proposal contains many of the features presently proposed in prior plans, it deviates in that more emphasis is placed on recreation and ecosystem amenities and less on transportation features. Preliminary evaluations of the impacts associated with this new proposal are described herein in a very general manner. More detailed engineering design, cost estimates, and feasibility analyses are planned in future months. Council member approval would be required prior to adoption of any of the latest proposals.

Public Involvement: A Notice of Intent (NOI) to prepare Supplement 1 to the EIS for the Dallas Floodway Extension project was published in the *Federal Register* on June 28, 2002. The NOI provided background information related to the DFE project, the Summary Judgment ruling of the Northern District, status of ongoing studies and the rationale for preparing the Supplement to the EIS. Notice of a Public Scoping Meeting was published in the *Federal Register* notice and also mailed to all known interested parties on July 3, 2002. A notice was also placed in the Dallas Morning News on July 14, 2002 providing the location, date, and time of the scoping meeting. A public scoping meeting was held on July 16, 2002 in Dallas, Texas. The meeting was held at the Ramada Plaza Hotel with approximately 45 individuals in attendance.

Scoping meeting participants were afforded an opportunity to review a variety of displays documenting the location of known proposed projects in the geographic area. The public was also encouraged to provide comments and information on these projects, other projects known to them that they believed should be considered, and the types of impacts and resources that should be considered in the supplemental EIS. Notebooks were available at each display for the public to list other projects or items that should be considered. A Court Reporter present at the scoping meeting recorded oral statements. Written statements were accepted at the meeting and afterward,. The scoping period remaining open until August 31, 2002.

A Notice of Availability for the Draft Supplement 1 to the EIS for the Dallas Floodway Extension was published in the Federal Register on December 6, 2002. A Public meeting was held on January 8, 2003, and the comment period was extended until February 4, 2003, following public request. A public review period of at least 30 days will be provided for interested parties to examine this Final Supplement 1 to the EIS.

Conclusions and Recommendations: Based upon analyses and findings developed as a result of preparation of this Supplement 1 to the EIS for the Dallas Floodway Extension project, it is believed that any of the projects being considered by the Corps of Engineers and other entities could be implemented with varying degrees of appropriate mitigative measures. Higher Corps of Engineers authorities will continue to review the various proposals as they progress and will have final policy approval of any proposed Corps of Engineers projects or permit actions. The cumulative impacts of any or all of the projects identified as reasonably foreseeable in this Supplement would need to be carefully planned and designed to avoid, minimize, and mitigate identified adverse environmental effects.

Other than the Dallas Floodway Extension project, none of the projects addressed in this Supplement, Federal or otherwise, have been developed in sufficient detail that this document could represent a final decision document under the National Environmental Policy Act (NEPA). Further, any project in the study area that is carried forward will need to be reviewed under a Corridor Development Certificate process, adopted by local area study participants, and will likely require individual permitting and public interest review under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. In the event that a new suite of potential projects emerges and/or that have not been foreseen during the preparation of this Supplement to the GRR/EIS or the PEIS for the Upper Trinity River Basin, there will likely be a need to supplement the PEIS in the future to undertake another programmatic review at that time.

FINAL
SUPPLEMENT I to the ENVIRONMENTAL IMPACT STATEMENT
DALLAS FLOODWAY EXTENSION,
TRINITY RIVER BASIN, TEXAS

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LIST OF ACRONYMS

AAHU	Average Annual Habitat Units
ACE	Annual Chance of Exceedance
AQCR	Air Quality Control Region
CDC	Corridor Development Certificate
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
COE	Corps of Engineers
CWWTP	Central Wastewater Treatment Plant
DART	Dallas Area Rapid Transit
DFE	Dallas Floodway Extension
EA	Environmental Assessment
EIS	Environmental Impact Statement
ENRAC	Environmental and Recreation Assistance Committee
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
FCSA	Federal Cost Sharing Agreement
FDR	Flood Damage Reduction
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FONSI	Finding of No Significant Impact
FPMP	Floodplain Management Plan
GDM	General Design Memorandum
GI	General Investigation
GRR/EIS	General Reevaluation Report & Integrated Environmental Impact Statement
IET	Interagency Executive Team
LPP	Locally Preferred Plan
MIS	Major Investment Study
MTIS	Major Transportation Investment Study
NA	No Action
NCTCOG	North Central Texas Council of Governments
NED	National Economic Development (Plan)
NEPA	National Environmental Policy Act
NRHP	National Register or Historic Places
NTTA	North Texas Tollroad Authority
PEIS	Programmatic Environmental Impact Statement
ROD	Record of Decision
SHPO	State Historic Preservation Office
SPF	Standard Project Flood
SPOT	
SWD	Southwest Division of Corps of Engineers
SWF	Fort Worth District of Corps of Engineers
TNRCC	Texas Natural Resources Conservation Commission
TORP	Texas Outdoor Recreation Plan
TPWD	Texas Parks and Wildlife Department
TRCCC	Trinity River Corridor Citizens Committee
TREIS	Trinity Regional Environmental Impact Statement
TSWQS	Texas Surface Water Quality Standards
TxDOT	Texas Department of Transportation
UFORE	Urban Forest Effects
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service

FINAL
SUPPLEMENT I to the ENVIRONMENTAL IMPACT STATEMENT

DALLAS FLOODWAY EXTENSION
TRINITY RIVER BASIN, TEXAS

CHAPTER 1 – AUTHORITY AND PURPOSE

PROJECT AUTHORITY

Authority for construction of water resource development features described in the Comprehensive Survey Report on Trinity River and Tributaries, Texas (reprinted as House Document 276/89/1), including the Dallas Floodway Extension (DFE) project, is contained in Section 301 of the Rivers and Harbors Act, approved 27 October 1965 (Public Law 89-298). Authorization of the DFE was modified by Section 351 of the Water Resources Development Act of 1996, which authorized inclusion of non-Federal levees. Section 356 of the Water Resources Development Act of 1999 (Public Law 106-53) further modified the DFE Authorization to add environmental restoration and recreation as project purposes.

PURPOSE AND NEED

Following the severe flood event of 1989, the City of Dallas requested reactivation of the authorized Dallas Floodway Extension project, which had been inactive due to lack of local sponsor funding support since the mid 1980's. The project was reactivated in 1990 under the provision that a general reevaluation be conducted prior to construction. This reevaluation was required to address updated environmental and economic criteria, as well as significant land use changes within the study area. A product of the reevaluation was the General Reevaluation Report and Integrated Environmental Impact Statement (GRR/EIS) dated February 12, 1999. The Record of Decision (ROD) was signed December 1, 1999. Advanced design work has been completed on the lower chain of wetlands and has been initiated for the upper chain of wetlands. Construction initiation was funded by Congress for the DFE project at $2M in Fiscal Year (FY) 2001 and $10M in FY 2002.

In May 2000, shortly after the ROD was signed, various groups opposed to the DFE project sought an injunction (*Texas Committee on Natural Resources et al v. Major General Hans Van Winkle et al,)* to prevent construction. Two lawsuits were filed; the first (USDC, Northern District, Texas, Fort Worth Division) sought a permanent injunction against DFE project, the second, (USDC, Southern District, Texas, Houston Division) sought enforcement of the 1973 Trinity River Project injunction. On February 26, 2001, the U.S. District Court for the Southern District of Texas denied Plaintiff's motion, finding that the United States Court of Appeals for the Fifth Circuit had vacated the 1973 injunction in "Sierra Club v Froehlke 816 F.2d 205" (5th Cir. 1987). On April 10, 2002, The U.S. District Court for the Northern District ruled in favor of the Corps of Engineers on three of four counts. On the fourth count, the plaintiffs argued that the DFE-EIS did not address the cumulative impacts of reasonably foreseeable proposed actions. The Court ruled in favor of the plaintiffs on that count and remanded the matter to the Corps of Engineers *"for further consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project."* The Order also directed that the Corps of Engineers stop work on any further action related to the construction of the DFE project.

The Corps of Engineers prepared this Supplement to the DFE EIS In response to the Court Order. Also in response to the Court, the Corps of Engineers suspended construction of the first wetland cell for the project. The City of Dallas is proceeding with land acquisition for mitigation and other project purposes. The City of Dallas recently purchased of 170 acres of the Great Trinity Forest (the first of many tracts) as part of the mitigation for the DFE project. This is the first step in the process to place the forest in permanent protection from what might otherwise be subject to destruction and/or future development. Consistent with the Court Order, this Supplement to the EIS addresses the cumulative impacts of other known or reasonably foreseeable future projects. Again consistent with the Court Order, this Supplement does not re-evaluate the authorized features of the DFE project including levees, chain of wetlands, trails, and environmental restoration, nor does it re-evaluate alternatives to the project.

PRIOR STUDIES AND REPORTS

Numerous studies have been conducted regarding water resource development, flooding and emergency streambank erosion, and water quality within the Trinity River watershed. Pertinent information on previous studies and reports prepared by the Corps of Engineers and other Federal and State agencies was summarized in the GRR/EIS for the Dallas Floodway Extension project dated February 12, 1999. Table 1.1 provides a list of the studies and reports discussed in the GRR/EIS with addition of several reports prepared since completion of that document.

Table 1-1 Studies and Reports Relevant to Supplement 1 to the DFE EIS

Document Name	Agency	Date
Comprehensive Survey Report on Trinity River and Tributaries, Texas	Corps of Engineers	June 1962
The Texas Water Plan	Texas Water Development Board	November 1968
Trinity River Project, Texas, Phase 1 General Design Memorandum	Corps of Engineers	August 1974
Flood Insurance Study, Dallas County, Texas	FEMA	1977 - 1978
Water Resources Development in Texas	Corps of Engineers	1971, 1981, 1988, 1989, 1991,1995
Trinity River Project, Texas, Phase I General Design Memorandum	Corps of Engineers	October 1981
Trinity River Project, Texas, Habitat Mitigation Report	Corps of Engineers	December 1981
Water for Texas	Department for Water Resources	August 1987
Trinity Regional Environmental Impact Statement	Corps of Engineers	1988
Upper Trinity River Basin, Reconnaissance Report	Corps of Engineers	March 1989
Report on Flooding Dallas Floodway	Corps of Engineers	May – June 1989
Reconnaissance Report	Corps of Engineers	February 1989
Report on Flooding	Corps of Engineers	April – May 1990
The Texas Statewide Inventory of Flood Protection Needs		May 1990
Water for Texas, Today and Tomorrow	Texas Water Development Board	December 1990
Trinity River Basin Study	Texas Water Commission	September 1992
Water Resources Development in Texas	Corps of Engineers	1995
GRR/EIS for the Dallas Floodway Extension	Corps of Engineers	February 12, 1999
Programmatic EIS, Upper Trinity River Basin (PEIS)	Corps of Engineers	June 2000
Water for Texas - 2002	Texas Water Development Board	January 2002

NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS

The National Environmental Policy Act of 1969 (NEPA), as amended, is the nation's charter for environmental protection. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Section 102 (2) of the Act includes a provision to prepare a detailed Environmental Impact Statement (EIS) on the effects of a proposed Federal action. The Federal regulations for implementing the procedural provisions of NEPA were published by the Council on Environmental Quality (CEQ) in the Code of Federal Regulations (CFR) as 40 CFR Parts 1500-1508 (43 Federal Register 55978-56007, November 29, 1978). The Corps of Engineers' Engineer Regulation (ER 200-2-2), Procedures for Implementing NEPA, dated March 1988, provides the Corps of Engineers procedure for preparing and processing an EIS or Supplement to an EIS.

STUDY OBJECTIVES

The Record of Decision on the DFE project as recommended in the GRR/EIS was signed by the Corps of Engineers' Deputy Commander for Civil Works on December 1, 1999, and the GRR/EIS was made available to Congress shortly thereafter. Groups seeking an injunction to prevent construction of the DFE project filed two separate lawsuits in May 2000 (*Texas Committee on Natural Resources et al v. Major General Hans Van Winkle et al,)*. The first suit, filed with the U.S. District Court for Northern District of Texas in Fort Worth, sought a permanent injunction against DFE project. The second suit, filed with the U.S. District Court for the Southern District of Texas in Houston, sought enforcement of the 1973 injunction on the Trinity River Project. On February 26, 2001, the U.S. District Court for the Southern District of Texas denied Plaintiff's motion to enforce the 1973 injunction, finding that the injunction had been vacated by the United States Court of Appeals for the Fifth Circuit.

The Motion for Summary Judgment filed with the Northern District included four counts:

Count 1: APA Review of Corps' Determination of Flood Levels
A. Factual Discussion – The Seven-Foot Rise is False
B. Legal Standard for Arbitrary and Capricious

Counts 2 and 3: The NEPA Counts
A. Count 2: Failure to Fully Disclose Environmental Impacts
Count 2(A) – Cumulative Impact of the DFE Project and Past Actions on Water Surface Elevations
Count 2(B) – Failure to Disclose Extent of Downtown Flooding and to Fully Disclose Economic Analysis of Benefits
Count 2(C) – Analysis of Reasonable Alternatives

B. Count 3: Failure to Fully Assess Cumulative and Connected Impacts
Count 3(B) – Cumulative Impacts of Reasonably Foreseeable Future Actions
Count 3(A) – Connected Actions

Count 4: Failure to Follow 1988 Record of Decision

On April 10, 2002, the US District Court for the Northern District of Texas ruled in favor of the Corps of Engineers on all but one of the counts and sub counts. On Count 3(B) of the motion, the Court ruled in favor of the plaintiffs argument that the GRR/EIS did not address the cumulative impacts of reasonably foreseeable future actions and remanded the matter to the Corps of Engineers "*for further consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project.*" The objective of this Supplement to the DFE EIS is, therefore, to address the U.S. Court for the Northern District of Texas' instruction by further examining the cumulative impacts of the DFE project and determining if any other projects are in fact "proposed actions that must be considered in a single EIS"

CHAPTER 2 – ALTERNATIVES

This chapter briefly summarizes the formulation process that led to the Recommended and Authorized Dallas Floodway Extension (DFE) project. The General Reevaluation Report and Integrated Environmental Impact Statement for the Dallas Floodway Extension Trinity River Basin, Texas (GRR/EIS), dated February 1999, can be referenced for more detailed discussion.

BACKGROUND

The DFE project is one of five local flood damage reduction projects authorized for construction in 1965 as part of the basinwide plan of improvement for the Trinity River and Tributaries, Texas. Authority for construction is contained in Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). The originally authorized plan for the Dallas Floodway Extension consisted of a combination flood control channel and floodway levee that would provide a Standard Project Flood (SPF) level of protection with a design flow capacity of 270,000 cubic feet per second. The plan consisted of a 22-mile levee and floodway system with a 9.1-mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek.

A General Design Memorandum (GDM), which assessed the DFE project in greater detail, was completed in 1981. Work on the project was suspended in 1985, however, following the failure of a bond election by the City of Dallas. Final approval of the 1981 GDM was subsequently discontinued, resulting in the retention of the 1965 plan as the authorized plan. In 1990, following a severe flood event in 1989, a general reevaluation the authorized Dallas Floodway Extension Project was initiated at the request of the City of Dallas. An integrated General Reevaluation Report and draft Environmental Impact Statement was released for public review in May 1998. The report was finalized and made available to the public as a Final GRR/EIS for review in February 1999. The Deputy Commander for Civil Works signed the Record of Decision (ROD) for the DFE Impact Statement for the Corps of Engineers on December 1, 1999. A copy of that ROD is included in Appendix A to this Supplement.

FORMULATION

The plan formulation process for the Dallas Floodway Extension was performed in three phases, each predicated by changes deemed significant enough to necessitate reevaluation and revision of existing conditions hydrology, hydraulic, and/or economic models. These changes included, but were not limited to, the availability of more current technical data, the addition of risk-based flood damage reduction analysis requirements, and the passage of legislation providing for inclusion of previous non-federal levee construction in the Federal plan. Two of these phases were completed during the development of the National Economic Development (NED) Plan, while the third was initiated during selection of the Locally Preferred Plan (LPP).

Initially, a wide range of structural and non-structural flood damage reduction measures evolved from the analysis of available economic, environmental, engineering, and social data during the course of the study. Non-structural alternatives for flood damage reduction included flood proofing, relocation, and permanent evacuation. Structural alternatives analyzed during the preliminary screening included channelization, clearing and grubbing, detention dams, swales, levees, and combination plans. Additionally, several variations of the final concept were analyzed to insure that the solution was properly located and sized to provide the highest net annual benefits.

During the formulation process the NED Plan was identified as a 1,200 -foot wide swale in the overbank area adjacent to the Trinity River. Public opposition to environmental impacts of this plan on forested areas along the Trinity prompted the investigation of less environmentally detrimental alternatives, including the concept of a Chain of Wetlands. Floodplain residents of the DFE project area sought additional flood protection in the immediate study area, beyond what the Chain of Wetlands would provide, and comparable to the level of protection to that afforded by the existing Dallas Floodway levees to the Central Business District. Their actions prompted the City to request investigation of additional levee alternatives aimed at removing more residents and businesses from flood risk within the immediate vicinity of the Dallas Floodway Extension. Alternatives analyzed in the final array are presented in detail in the DFE GRR/EIS and are summarized below.

NO ACTION

The no action plan for the DFE would involve no additional Corps of Engineers flood damage reduction, ecosystem restoration or recreational development within the DFE area. The Rochester Heights Levee as constructed and the Central Wastewater Treatment Plant levee modifications by the City of Dallas would remain in place. These flood damage reduction features provide important protection at those isolated locations, however, the City would lose the ability to utilize their previous construction expenditures for these two levees in the cost sharing of a complete flood damage reduction project for the entire DFE area. The No Action plan would do nothing more to provide equity of flood damage reduction between residents of the DFE area to that afforded the central business district.

NATIONAL ECONOMIC DEVELOPMENT (NED) PLAN

An alternative plan consisting of two 1,200-foot bottom width swales in series was determined to produce the greatest net economic benefits. This plan, identified as the NED Plan, would extend from upstream at the end of the existing Dallas Floodway downstream to approximately 2,000 feet below Loop 12, and would be separated at Interstate Highway (IH) 45. The length of the upper swale would be about 7,800 feet, or 1.5 miles, and would extend from the confluence of Cedar Creek, at the upstream end, to the river crossing of IH-45. The lower swale would extend a total length of 17,300 feet, or 3.3 miles. Based on applicable criteria, the 1,200-foot swale would produce the greatest net benefits and was designated as the NED plan. The NED plan is currently estimated to have a first cost of $103.6 million (Benefit/Cost = 2.46) based on January 2003 price levels.

From an environmental standpoint, the NED Plan would require acquisition of approximately 3,200 acres for mitigation. Because of these adverse impacts a "chain of wetlands" plan was formulated which would require only 650 acres of mitigation. A comparative analysis between the NED Swale Plan and the Chain of Wetlands Plan showed that the chain of wetlands would provide fewer net economic benefits than the NED Plan, but would also have a lower first cost.

LOCALLY PREFERRED PLAN (LPP)

The "Chain of Wetlands" would consist of an upper chain of four wetland cells and lower chain of three wetland cells, each of various lengths and shapes and totaling about 123 acres. The upper chain would have an average width of 400 feet and would extend from Cedar Creek to the oxbow lake at I-45, a distance of about 1.5 miles. The lower chain would have an average width of 600 feet, would extend between I-45 and Loop 12, a distance of about 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course to minimize impacts to forested areas and nearby residential areas. Total length of the wetland cells, therefore, would be about 3.8 miles with average width of about 500 feet, average depth of about 1.5 feet, and maximum depth of 7 feet. Environmental restoration features associated with the chain of wetlands include 123 acres of emergent wetland creation. The LPP is currently estimated to have a first cost of $154.4 million (Benefit/Cost = 2.06) based on January 2003 price levels.

The Chain of Wetlands Plan was initially identified as the Locally Preferred Plan (LPP), and was formally adopted by the Dallas City Council on August 28, 1996, with the caveat that the addition of levees to the plan would be further investigated. The Chain of Wetlands Plus Levees Plan, which would include SPF levees protecting the Lamar and Cadillac Heights areas, in addition to the Chain of Wetlands feature, was determined to meet the needs of the local sponsor, by providing flood protection to the neighborhoods within the study area comparable to the protection provided to the Central Business District by the existing Dallas Floodway. The Lamar Levee would include an earthen levee to provide SPF protection for the Lamar Street area. This levee would extend from East Levee of the existing Dallas Floodway for a distance of 2.9 miles to the Rochester Park Levee, previously constructed by the City of Dallas. The Cadillac Heights Levee would include an earthen levee to provide SPF protection for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), would raise a portion of the northwest corner of the CWWTP Levee, and would extend to high ground near the intersection of Kiest Boulevard and McGowan Avenue for a total distance of approximately 2.2 miles.

The recreation component of the Locally Preferred Plan would include construction of 18 miles of hike/bike trail, 8.5 miles of natural surface equestrian trail, 5 miles of natural surface nature trail, picnic areas and rest stop area. Seven access areas are proposed, one of which would require no modifications. Three of the remaining six would be located at existing parks or areas with adequate parking facilities and would require minimal modifications. Three other access areas are also proposed.

The environmental mitigation plan for the Locally Preferred Plan includes acquisition of 1,179 acres of additional lands within the "Great Trinity Forest", and consists of conversion of grassland to bottomland hardwood areas, habitat improvement on existing bottomland hardwood areas, and grassland preservation.

On March 26, 1997, the Dallas City Council formally adopted the Chain of Wetlands and Levees plan along with recreation facilities and habitat mitigation included as components of the plan as the Locally Preferred Plan. The Chain of Wetlands alone would result in a lowering of the water surface profile of the SPF event at the end of the existing Dallas Floodway of 3.50 feet. Consequently, the locally supported plan, which includes the Lamar and Cadillac Heights SPF levees, would still result in a lowering of SPF water surface elevation by 1.40 feet at that point.

COMBINATION STRUCTURAL / NON-STRUCTURAL PLAN

The combination non-structural / structural plan investigated for the final array of Dallas Floodway Extension alternatives would involve the acquisition and removal of homes in the Cadillac Heights area in lieu of the construction of a Cadillac Heights Levee, as the last-added increment of an overall plan also including the construction of the chain of wetlands and the SPF Lamar Levee. This buyout was analyzed for the 2-, 5-, 10-, 25-, 50-, and 100-year flood zones. The economic analysis of this non-structural increment of the overall combination structural / non-structural plan was shown in Table 4-21 of the DFE/GRR EIS. Economic feasibility is not demonstrated for any buyout beyond the 25-year flood zone, leaving highly significant residual damages at the 50-, 100-, and SPF-flood frequencies. For comparative analysis, also included in Table 4-21 are the incremental costs and benefits of constructing a last-added 100-year levee in the Cadillac Heights area. The combination plan 10-year buyout of Cadillac Heights is currently estimated to have a first cost of $135 million (Benefit/Cost = 1.7), based on January 2003 price levels.

TENTATIVE FEDERALLY SUPPORTABLE PLAN (TFSP)

After adoption of the LPP by the City of Dallas, a channel realignment at I-45 was requested and supported by the Texas Department of Transportation, to allow the river to flow through a wider span of the I-45 Bridge, which was designed to more efficiently accommodate river flows. This realignment would reduce the risk of catastrophic failure of this bridge, and would significantly reduce current annual maintenance costs associated with debris removal around the bridge columns. The identified

TFSP would consist of the Chain of Wetlands, SPF Lamar Levee, 100-year Cadillac Heights Levee, the previously constructed non-Federal levees, and selected recreation features.

The TFSP would include an earthen levee providing SPF protection for the Lamar Street area, which would extend from the existing Dallas Floodway East levee to the previously constructed Rochester Park Levee, a distance of 2.9 miles. The plan would also include a levee / floodwall system providing 100-year protection for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), a distance of 1.1 miles. In addition to the levees described above, the Tentative Federally Supportable Plan would also include the costs and benefits of the portions of the previously constructed non-Federal levees. The total cost for the compatible portions of these levees was estimated at $23.1 million ($14.2 million for the CWWTP Levee upgrade and $8.9 million for the compatible portion of the Rochester Park Levee). The TFSP would include recreation amenities compatible with the regional recreation master plan, including hike/bike trails, equestrian trails, canoe launches, and pavilions. The TFSP is currently estimated to have a first cost of $135.4 million (Benefit/Cost = 1.82) based on January 2003 price levels.

THE RECOMMENDED PLAN

The LPP, along with the realignment of the river channel at the Interstate Highway 45 (I-45) Bridge, was adopted as the Recommended Plan for the Dallas Floodway Extension. It provides for the "Chain of Wetlands", an SPF levee at Lamar Street, a SPF levee in the Cadillac Heights area, recreation features, and habitat mitigation. While meeting the primary goal of providing SPF protection in the immediate area of the Dallas Floodway Extension, the Recommended Plan would result in additional protection within the existing Dallas Floodway. Section 351 of the Water Resources Development Act of 1996 authorized inclusion of the previously constructed non-Federal levees at Rochester Park and the CWWTP as part of the DFE project. Section 356 of the Water Resources Development Act of 1999 (Public Law 106-53) further modified the DFE Authorization to add environmental restoration and recreation as project purposes. The current cost estimate for the Recommended DFE project is $154,400,000 2.06) based on January 2003 price levels, which includes the cost of the levees previously constructed by the City of Dallas.

Since completion of the GRR/EIS in 1999, a number of follow-on proposals have been discussed by various Dallas city officials and reported in the media for alternate uses of the area to be protected by the Cadillac Heights Levee once the levees are in place. Among these ideas are the buy-out and/or partial buy-out of residences in that neighborhood. One potential use suggested in the area is to build a police academy and/or other similar public facilities. To date the City Council has not taken any official action to support any changes other than those included in the LPP. A Project Cost Sharing Agreement has been signed by the City of Dallas, fully committing the City's support of the Recommended Plan. Until formal notification is made by the City of Dallas regarding their support of a plan that is different from that for which they have formally provided an endorsement, alternate plans discussed by individuals or the media cannot be considered as reasonably foreseeable. The plan recommended in the 1999 GRR/EIS, therefore, remains the Recommended Plan for analysis in this Supplement to the DFE EIS.

CHAPTER 3 – AFFECTED ENVIRONMENT

STUDY AREA

This section describes the study area within the geographic vicinity of the DFE project. Detailed discussion of the climatology, geology, physiography, soils, hydrology and hydraulics, vegetative cover, terrestrial resources, aquatic resources, water quality, air quality, cultural resources, socioeconomics, environmental justice, and recreation and open space may be found in the GRR/EIS dated February 1999 and in the PEIS for the Upper Trinity River Basin, dated June 2000. In accordance with CEQ regulations for implementing NEPA (40 CFR Part 1508), information from those documents is incorporated herein by reference.

From a water resource related perspective, the physical boundaries of the general study area correspond to the Standard Project Floodplain (SPF) of the Upper Trinity River and its major tributaries. The hydrologic study area can be considered to be the watershed of the Upper Trinity River. The hydraulic study area is most easily defined by the downstream and upstream limits of the major river reaches. The downstream limit was taken as River Mile (RM) 473.9. This point generally coincides with the Malloy Road Bridge crossing of the Trinity River in southeast Dallas County. The upstream limits of the study area can generally be defined as the first major impoundment on each of the major branches and tributaries of the Trinity River and all the adjacent land and all of the watercourses contained within the boundaries of the floodplain for the Standard Project Flood. The major river segments include: Denton Creek from Grapevine Lake Dam to its confluence with the Elm Fork, Elm Fork from Lewisville Lake Dam to its confluence with the West Fork, the Clear Fork from Benbrook Lake Dam to its confluence with the West Fork, Mountain Creek from Mountain Creek Dam to its confluence with the West Fork, and Village Creek from Lake Arlington Dam to its confluence with the West Fork, two segments of the West Fork - one beginning at the Lake Worth Dam to the confluence with Village Creek, and the second from the Village Creek confluence to the West Fork's confluence with the Elm Fork, and finally, the mainstem of the Trinity from the confluence of the Elm Fork and West Fork downstream to the Malloy Road Bridge crossing. This hydrologic and hydraulic study area is defined and described in detail in the PEIS dated June 2000.

DETAILED STUDY AREA

Instructions from the Court to address cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project (emphasis added) led to a focus on potential future developmental activities that would be water related or would occur in or near the floodplain of the Trinity River, with special emphasis on Dallas, Dallas County, and the general vicinity. The SPF floodplain within the study area is depicted in Figure 3-1. The study area for evaluating cumulative impacts within this Supplement to the GRR/EIS is defined based upon Standard Project Flood (800-year frequency) hydrology as it is anticipated to be in the year 2050. While accounting for past, present, and potential future actions of the Corps of Engineers and other entities that could occur within the general study area of the Upper Trinity River Basin, this document focuses on addressing the cumulative impacts of other projects in the floodplain of the Trinity River in Dallas, Dallas County, and the general vicinity of the authorized DFE project.

PAST ACTIONS AFFECTING THE STUDY AREA

This section presents past, present, and reasonably foreseeable future projects that have been or would be conducted in the study area. Focus of this section is on Corps of Engineers projects and projects of others as they relate to potential cumulative impacts associated with the DFE project. The PEIS, dated June 2000, may also be referenced for activities within the watershed that are more remote from the general vicinity of the DFE project.

CORPS OF ENGINEERS PROJECTS

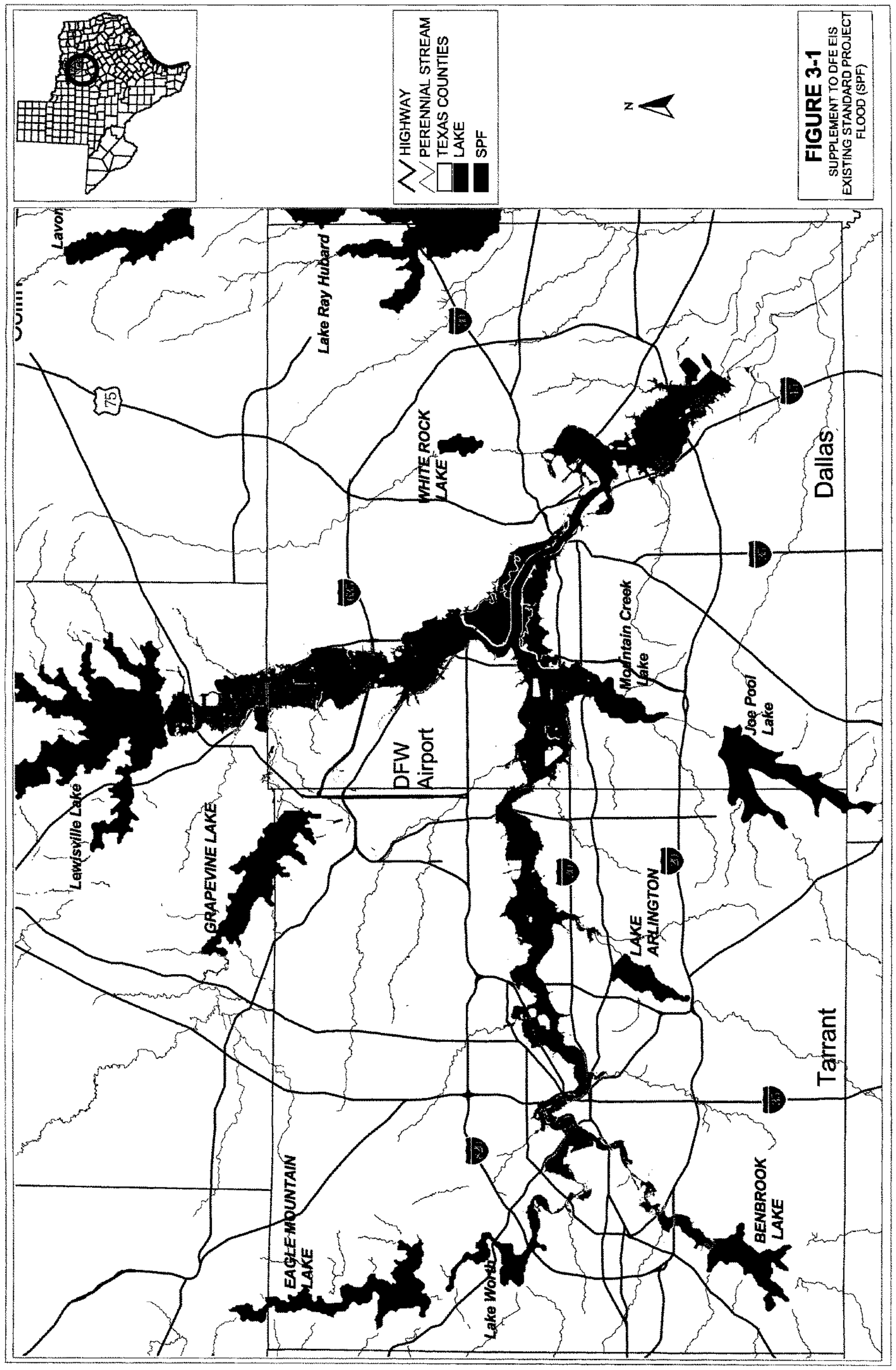
Completed Section 205 Projects
Section 205 of the Flood Control Act of 1948 provides the authority to the Corps of Engineers for planning, design, and construction of water resources projects related to flood damage reduction. The federal expenditure limit on Section 205 projects is $7,000,000. Section 205 projects conducted within the general vicinity of the DFE project are discussed below. Discussion of additional Section 205 projects constructed in the Upper Trinity River Basin may be found in the June 2000 PEIS.

Ten Mile Creek – Lancaster:
Ten Mile Creek is located in the central portion of the City of Lancaster in southern Dallas County, approximately 14 miles south of Dallas. The creek begins on the east side of Joe Pool Lake, flows generally from west to east and joins the mainstem of the Trinity River in far southeast Dallas County. This nonstructural project completed in 1995 is a flood warning system consisting of six stream and rainfall gauges throughout the Ten Mile Creek Watershed.

Ten Mile Creek – Desoto:
Ten Mile Creek is a tributary of the mainstem Trinity River. It flows generally from west to east through the City of Desoto in south Dallas County. The project consisted of one-sided channel modification on the north bank of Ten Mile Creek approximately 4,200 feet in length. The project begins 700 feet east of Hampton Road and proceeds upstream to a point approximately 4,000 feet southeast of Westmoreland Road. The channel is grass-lined and features the excavation of a 50-foot wide terrace on the north bank, approximately 5 feet above the invert of the creek, which transitioned into a side slope. The right bank and the creek bottom were allowed to remain in their natural state. The project provides a minimum 25-year level of flood protection to the lowest structure within the project reach. Completed in 1997, the project resulted in adverse impacts to approximately 11 acres of mature riparian forest. Mitigation for the project included reforestation of a 22-acre site adjacent to the creek with hard- and soft-mast producing woody species, and revegetation of all disturbed areas with native plant species.

Johnson Creek - Grand Prairie:
Johnson Creek is a tributary of the West Fork Trinity River. The creek flows from southwest to northeast through Arlington in Tarrant County and Grand Prairie in Dallas County. The project called for 4,950 feet of gabion-lined channel to provide 100-year flood protection for residents between Duncan Perry Road and Carrier Parkway. Completed in 1998, the project resulted in adverse impacts to approximately 22 acres of riparian hardwoods. Mitigation for the project included the preservation of 5.3 acres of existing riparian hardwoods, the establishment of a 2.5-acre wetland and 1.0 acres of native grassland/herbaceous plant, and planting of 635 hard-mast producing trees and the same number of soft-mast producing shrubs on 12.8 acres adjacent to the creek.

Dry Branch -- Grand Prairie:
Dry Branch originates in west central Irving and flows southward through the cities of Grand Prairie and Irving to its confluence with Bear Creek, which is a tributary of the West Fork Trinity River. The plan for Dry Branch consisted of replacement of the Shady Grove Road Bridge and channelization. The project was divided into two channel reaches. The downstream reach consisted of a grass-lined channel that extended approximately 175 feet upstream and downstream of the Shady Grove Road Bridge. The upstream reach had a concrete-lined trapezoidal channel 2,850 feet in length and a trapezoidal drop structure at the upstream end. The project resulted in adverse impacts to approximately 100 predominately hard- and soft-mast producing trees with diameters greater than 10 inches. Mitigation for the project was completed in 1997, and included planting approximately 250 hard-mast producing trees and 250 soft-mast producing shrubs on 6.3 acres of land near Johnson Creek in Grand Prairie.


HIGHWAY
PERENNIAL STREAM
TEXAS COUNTIES
LAKE
SPF
N
FIGURE 3-1
SUPPLEMENT TO DFE EIS
EXISTING STANDARD PROJECT
FLOOD (SPF)
Lavon
Lake Ray Hubard
75
WHITE ROCK LAKE
Dallas
Mountain Creek Lake
Joe Pool Lake
DFW Airport
Lewisville Lake
GRAPEVINE LAKE
LAKE ARLINGTON
Tarrant
EAGLE MOUNTAIN LAKE
Lake Worth
BENBROOK LAKE

Delaware Creek -- Irving:
Delaware Creek originates in northwestern Irving and flows generally southeastward 7 miles to the West Fork Trinity River. The project consisted of constructing approximately 3,600 feet of grass-lined channel beginning at Oakdale Road and continuing southeast. A box culvert was constructed upstream of the Shady Mobile Home Park to allow low flows to continue along the original creek channel while high flows would be diverted to the southeast into the West Fork floodplain by a levee and a grass-lined diversion channel. The project was subsequently modified by the addition of 1000 feet of grass-lined diversion channel. The project adversely impacted 19.4 acres of riparian corridor and 11.3 acres of old field habitat. Environmental mitigation for impacts of the project was completed in 1997 and consisted of planting approximately 20 acres of hard- and soft-mast producing trees and shrubs downstream of Loop 12 within the floodplains of Delaware Creek and West Fork Trinity River on the Twin Wells Golf Course.

Specifically Authorized Flood Damage Reduction Projects
Certain projects are specifically authorized by Congress to meet a specific purpose(s), which may include flood damage reduction, water supply and conservation, and/or other benefits. While the existing Dallas Floodway is the most significant Congressionally authorized flood damage reduction project relative to the DFE project, both the Fort Worth Floodway and the Big Fossil Creek Floodway have also been constructed in the Upper Trinity River Basin and are described in the June 2000 PEIS for the Upper Trinity River Basin.

Dallas Floodway:
The project is located along the mainstem of the Trinity River just downstream of the confluence of the West and Elm Forks in west Dallas. Completed in 1960, the project consisted of strengthening approximately 23 miles of existing levees that were constructed by local interests between 1928 and 1932 on both sides of the river, clearing the floodway channel, and improving the capabilities of the interior floodway drainage facilities. The urban area protected by the existing Dallas Floodway levees consists of about 9,000 acres with about 1500 acres of open space between the levees. The Dallas Floodway was designed to provide SPF protection to the central business district of Dallas and the area to the west. This existing project is immediately upstream of the Recommended Dallas Floodway Extension Project.

Corps of Engineers Reservoir Projects
Five reservoirs have been constructed by the Corps of Engineers within the Upper Trinity River basin. One reservoir has been authorized and constructed within the Dallas County portion of the study Upper Trinity study area. Each of these multi-purpose Corps of Engineers reservoirs provides flood damage reduction, water conservation and storage, recreation, and other benefits. These Corps of Engineers reservoirs within the hydrologic study area, which are addressed in the June 2000 PEIS, are Benbrook, Grapevine, Lewisville, Ray Roberts, Joe Pool, and the Lewisville pool raise and associated recreation area (Green Belt). Of these lakes, Grapevine on Denton Creek and Lewisville and Ray Roberts on the Elm Fork of the Trinity River, north of Dallas County, have the greatest effect on the hydrology of the study area of the DFE, and those effects are incorporated into the hydrologic and hydraulic models for the study area.

PAST PROJECTS OF OTHERS IN THE STUDY AREA

Within the Upper Trinity River Basin in the general vicinity of the study area are a number of reservoir projects built by entities other than the Corps of Engineers. Among these is Mountain Creek Lake on its namesake tributary, which is just downstream of Joe Pool Lake and feeds into the mainstem Trinity River from the south. The lake is operated by a local entity for power plant cooling. Within the Dallas-Fort Worth Metroplex, other reservoir projects have been constructed over the years for various purposes including urban recreation and cooling for utility generation.

There are numerous projects that have been implemented within the study area in the last 20 to 30 years, which have resulted in significant adverse impacts to the environment. Environmental impacts resulting from these projects are impossible to estimate. However, sources of information do exist regarding impacts to natural resources that are located within waters of the United States, including wetlands, around water bodies. Under the direction of Congress, using the authorities stated in Section 10 of the Rivers and harbors Act of 1899 and Section 404 of the Clean Water act, the Regulatory Branch of the Army Corps of Engineers regulates all work or structures in, or affecting the course, condition or capacity of navigable waters of the United States and the discharge of dredged and fill material into all waters of the United States including wetlands. Consequently, applicants are required to submit information to the Corps of Engineers for approval of many construction projects that are conducted in floodplain areas.

Regulatory documents reviewed in preparation of the PEIS indicate that over the period from 1985 to 1998 there were a total of 193 general permit verifications, letters of permission, or individual permit actions within the Upper Trinity study area. The location of these actions is illustrated in Figure 2-1 of the PEIS. Out of the 193 actions during that time period, adverse impacts occurred to approximately 630 acres of bottomland hardwood forests and wetlands occurred. Mitigation for impacted natural resources amounted to 261 acres for bottomland hardwoods and wetlands. It should be noted, however, that much of the adverse impacts occurred prior to the 1988 Record of Decision for the Trinity Regional Environmental Impact Statement (TREIS), with avoidance, minimization, and mitigation improving considerably after that time. More detail on recent trends is included in the Fills, Permits, Utilities, and Other Activities section of this chapter. Permit actions being considered since 1999 are shown on Figure 3.2 of the Supplement.

REASONABLY FORESEEABLE FUTURE CORPS OF ENGINEERS ACTIONS

As evidenced above, floodplain lands within the study area have undergone extensive alterations in the past 50 years due to the construction of flood control and water supply lakes, major channelization/levee projects, and numerous smaller projects, which may have affected the physical characteristics of the Upper Trinity River watershed and the general vicinity of the DFE project.

UPPER TRINITY RIVER FEASIBILITY STUDY

General Investigation (GI) studies are investigations that have been specifically authorized by Congress to address water resource related problems and opportunities within a given study area. Feasibility Studies for the Upper Trinity River Basin have been and are being conducted under the GI program in response to the authority contained in the following United States Senate Committee on Environment and Public Works Resolution dated April 22, 1988, as quoted below:

> *Resolved by the Committee on Environment and Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Trinity River and Tributaries, Texas, House Document No. 276, Eighty-Ninth Congress, and other pertinent reports, with a view to determining the advisability of modifying the recommendations contained therein, with particular reference to providing improvements in the interest of flood protection, environmental enhancement, water quality, recreation, and other allied purposes in the Upper Trinity River Basin with specific attention on the Dallas-Fort Worth Metroplex.*

Initial investigations during the Upper Trinity Feasibility Studies, as compiled and distributed for public review in 1995 as part of the "Information Paper for the Upper Trinity River Basin, Texas", focused on determining if continued Federal participation in more detailed studies was warranted in order to provide flood damage reduction, environmental enhancement opportunities, water quality, and recreational facilities in the Upper Trinity River Basin. The intent of the Information Paper was to identify for the public, those project proposals that appeared to have merit for further study. Detailed

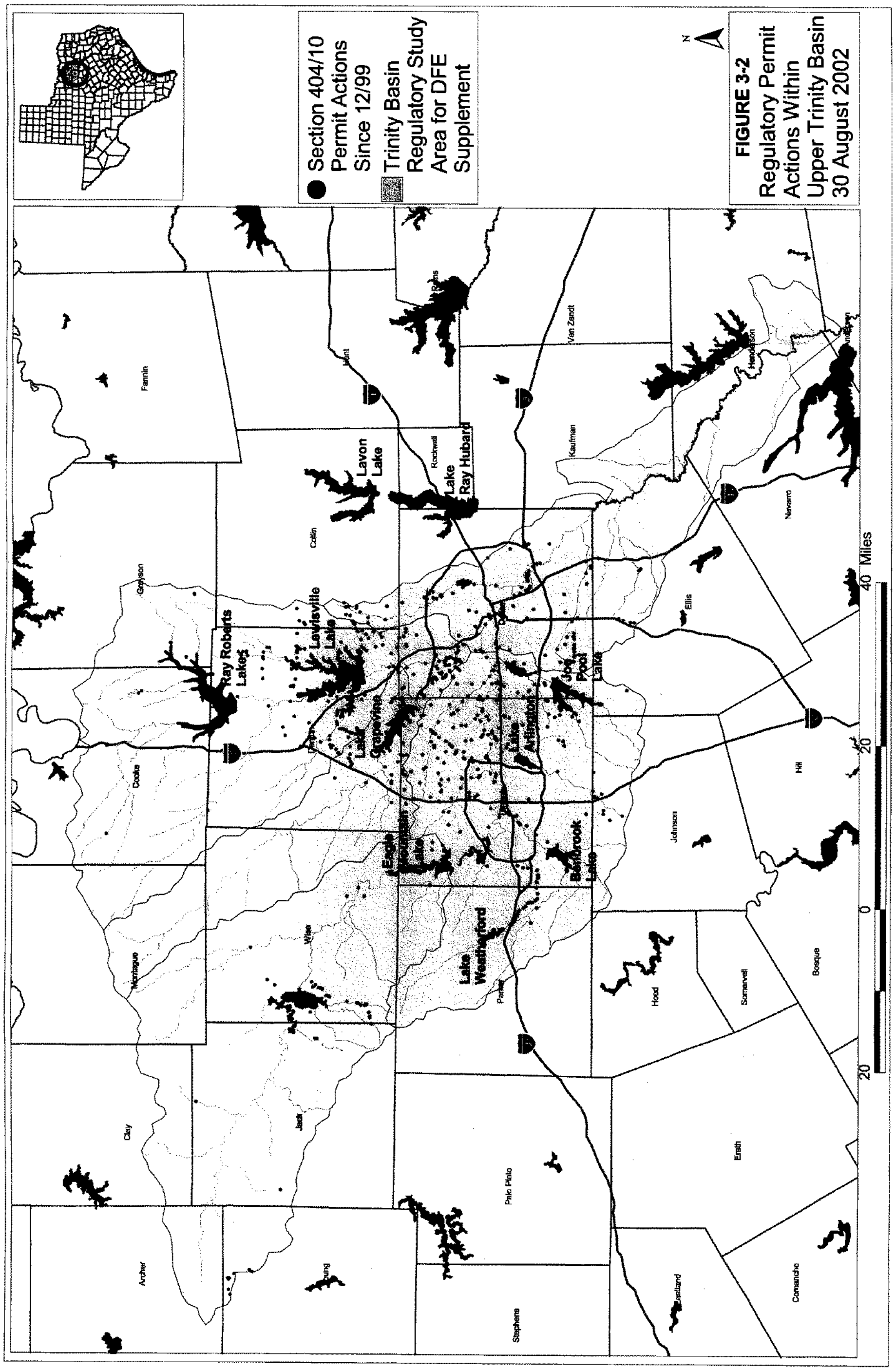


FIGURE 3-2
Regulatory Permit Actions Within Upper Trinity Basin
30 August 2002

TABLE 3-1, STATUS OF SPONSORED STUDIES BY THE CORPS OF ENGINEERS AS PART OF THE UPPER TRINITY RIVER FEASIBILITY STUDY

Sponsor	Study	Proposal
Currently Active Studies		
City of Arlington	Johnson Creek (Study complete – project is under construction)	Non-structural flood damage reduction and ecosystem restoration project authorized by Water Resources Development Act of 1999. Project under construction.
City of Dallas	Stemmons North Industrial District	National Economic Development (NED) plan for Flood Damage Reduction has been investigated
	Dallas Floodway	NED Plan, Environmental Quality (EQ) Plan, City of Dallas' Trinity River Corridor Master Plan have been developed
*Tarrant Regional Water District	West Fork to Lake Worth and Clear Fork to Benbrook Lake	Study of flood damage reduction, ecosystem restoration, recreation and water quality improvements at numerous sites in and adjacent to floodway and tributaries to main channels
*Cities of Fort Worth, North Richland Hills Haltom City and others	Big Fossil Creek	Study to provide sponsors with updated baseline H&H models, FEMA, floodplain and detailed topographic maps and baseline environmental information, and to identify water related needs within the watershed
Tarrant Regional Water District	Watershed upstream of Lake Worth	Lake Worth Ecosystem restoration and watershed management
Studies Expected To Move Forward To Cost-Sharing Negotiations		
Grand Prairie	Mountain Creek Watershed	Multi-objective flood damage reduction, ecosystem restoration, and recreation
Cities of Fort Worth, Grand Prairie, Arlington, and Dallas County	West Fork at Hwy 360	Ecosystem restoration and recreation
Viable Projects, Not Expected To Be Sponsored		
Tarrant County	Village Creek	Basin-wide multi-objective study
City of Arlington	Quads at Hwy 157	Environmental restoration and recreation
City of Coppell	Denton Creek	Multi-objective, erosion control, flood damage reduction, ecosystem restoration
Cities of Dallas and Fort Worth	West Fork/Mainstem	Construction of emergent and forested wetlands to provide ecosystem restoration and water quality improvements. Would utilize effluent from existing waste water treatment plants.

•Cost-sharing agreements and initiation of studies were imminent at time of final PEIS, and studies are now active.

descriptions of these nearly 90 measures are contained in the referenced Information Paper and the measures are listed and summarized in Chapter 2 of the June 2000 PEIS for the Upper Trinity River Basin.

In order to continue work into the detailed feasibility phase on any of the potential measures, a non-Federal sponsor must agree to cost-share (50/50) in the feasibility investigations. Potential sponsors have been identified for 11 interim feasibility studies. Table 3-1 lists the studies that are 1) currently active, 2) likely to go forward to cost-sharing agreements, and 3) proposed, but currently lack sufficient support for a reasonable expectation that they will be initiated within the near future. This table has changed somewhat from a similar table that was presented in the June 2000 PEIS for the Upper Trinity River Basin. Note that two of those active studies in the immediate vicinity of the DFE project are the Dallas Floodway and the Stemmons North Industrial District. Following is a discussion of those currently active studies under the Upper Trinity River Feasibility Study.

Clear Fork/West Fork Studies

Riverside Oxbow:
The study area is located just east of downtown Fort Worth on the West Fork of the Trinity River and includes the old West Fork channel, which formed an oxbow when the channel was realigned. Ecosystem restoration features include reestablishing low flows through the old oxbow; creation of 21 acres of emergent wetlands; creation and/or enhancement of 18 acres of open water habitat; restore 29 acres of forested pond vegetation; habitat improvement of 133 acres of existing forested tracts, including establishment of a 150 foot wide riparian buffer along the West Fork from Riverside Drive to East 1st Street; restoration of 43 acres of native grassland buffer along the old oxbow; establishment of native grasses and forbs mixed with tree mottes or, habitat islands, on approximately 229 acres of land; and reforestation of roughly 73 acres of open space using a variety of native hard and soft mast trees and shrubs. The project lands, which encompass approximately 600 acres of land, are adjacent to roughly 400 acres of city-owned park and open space. Together these lands would provide 1000 acres of fish and wildlife and open space habitat and outdoor education and recreation opportunities for local citizens within a rapidly growing and developing urban area. Approximate cost of the project is $17,000,000 based on January 2003 price levels. The feasibility study on this section was initiated in November 2001. Draft Interim Feasibility Report and Integrated Environmental Assessment is scheduled for release for public review in spring 2003.

Central City:
The study area is located just north of downtown Fort Worth, Texas on the Clear Fork and West Fork of the Trinity River. Study limits are Interstate Highway 30 on the Clear Fork, Sumps #7 and #8 in the Rockwood Park area on the upstream end of the West Fork, NE 28th Street on the upstream end of Marine Creek, a tributary of the West Fork, and Riverside Drive on the downstream end of the West Fork. The Central City study area as defined by these boundaries encompasses approximately 4 square miles. The study is intended to be a comprehensive investigation of flood damage reduction, ecosystem restoration, recreation, economic development, and other allied purposes resulting in an integrated feasibility report and environmental impact statement. One of the preliminary concepts to be investigated consists of creating six to eight miles of urban waterfront along the Clear Fork and West Fork between 7th Street and Samuels Avenue. A higher and more constant water level would be impounded by a hydraulic dam near the Samuels Avenue bridge downstream from the junction of Marine Creek and the West Fork of the Trinity River. This would create a constant urban lake and river that link the Stockyards and near north neighborhoods with Downtown, the Cultural District area and Rockwood Park area. A bypass channel would generally follow the current path of the Fort Worth and Western Railroad. The bypass channel combined with the historic Oakwood Cemetery would transition between proposed urban developments and the historic near north neighborhoods. The preliminary cost estimates for this concept is approximately $400 million. The feasibility study on this section was initiated in August 2002. The study is currently in the existing conditions phase.

Stemmons North Industrial District (Interim Feasibility Study)
The study area for the Stemmons North Industrial District is approximately 1,034 acres in size. In the study area, there are about 14.4 acres of open water, 855 acres of grasslands, 154.3 acres of riparian forest, and 10.5 acres of wetlands. Detailed cost-shared feasibility investigations under the Upper Trinity River Feasibility Study are currently being held in abeyance. The City of Dallas is the local project sponsor. The study area is located on the left descending bank of the Elm Fork and is generally bounded by the Elm Fork to the west and south, Loop 635 to the north, and the Standard Project Floodplain boundary to the east. Present development of the area includes extensive commercial and industrial development with some multi-family and high-density residential areas.

No Action:
The "no action plan" or "Future Without Project" is an alternative plan that does not include implementation of any Federal activities within the Stemmons North Industrial District study area. This is the alternative to which other alternatives are compared.

Structural Plan:
A Levee alternative along Mañana Street was preliminarily identified as feasible, however, it has subsequently been determined not to be feasible. The plan would consist of an earthen levee beginning at Interstate 35 (Stemmons Freeway) on the north side of Mañana Drive and extending west to Wesco Creek. An intermittent earthen levee / concrete floodwall system would then be utilized, continuing south and west along the creek to the Burlington Northern Railroad track, then south along the railroad track to Northwest Highway. An earthen levee would then resume, extending south and east, and eventually tying in to the embankment of Loop 12. The levee alignment would cross various roads and streets. In lieu of ramping all of these transportation facilities over the levee, gate closure structures are proposed in some areas. The Mañana Street Levee alternative would provide 500-year flood protection to approximately 1000 acres within the area near Mañana Street. This alternative would remove about 180 acres from the current Federal Emergency Management Agency (FEMA) 100-year floodplain. The footprint of the levee and floodwall would directly impact approximately 31 acres. This plan has been determined not to be economically or environmentally feasible.

Non-Structural Plan:
The details and conditions of a non-structural plan for the Stemmons North Industrial District are under preparation and entail evaluation of the possible buy-out and removal of structures within various flood zones. Currently, the structures eligible for buyout and removal within the 2-year, 5-year, 10-year, and 25-year zones in the Stemmons North Industrial District are 0, 21, 27, and 37 structures, respectively. Based on preliminary evaluations completed to date, a non-structural alternative for this area does not appear justified. The area has been delineated into several reaches and an economic analysis was conducted on Reach 1, the area between the railroad and the Elm Fork, which appeared to be the only reach that had even the slightest chance of economic feasibility for federal participation in a buy-out plan. The results of the preliminary analysis indicate the damages begin at the 5-year flood event and effecting 21 structures with a benefit to cost ratio well below unity. At the 25-year flood event only 37 structures would be impacted, also resulting in a benefit to cost ratio below 1.0.

Status of the Stemmons North Industrial District Interim Feasibility Study:
Due to insufficient benefits to justify the potential costs and subsequent lack of Federal interest, it is likely that this study will be terminated.

Dallas Floodway (Interim Feasibility Study)
The potential exists for a multi-objective project located entirely within the existing floodway in Dallas County, Texas. The Floodway extends along the Trinity River upstream from the AT&SF Railroad Bridge at Trinity River Mile 497.37, to the confluence of the West and Elm Forks at River Mile 505.50, then upstream along the West Fork for approximately 2.2 miles and upstream along the Elm Fork approximately 4 miles. There are approximately 1,422 acres in the study area. Of that amount, 14

acres consists of open surface water, 1,159 acres are grasslands, 51 acres are emergent wetlands, and 198 acres are classified from SPOT satellite data as forest.

No Action:
The "no action" or "Future Without Project" is an alternative plan which would assume no Federal (Corps of Engineers) activities within the Dallas Floodway study area. For Feasibility Study purposes, the Future Without Project Alternative considers the effects of the Dallas Floodway Extension project, which includes the Lamar Street and Cadillac Heights Levees and the Chain of Wetlands measures as recommended in the GRR/EIS, as part of the baseline conditions.

Flood Damage Reduction Plan:
This alternative for the Dallas Floodway seeks to maximize the flood damage reduction outputs. Although an NED Plan has not been determined, preliminary investigations identified a plan that would consist of raising the existing Dallas East and West Levees to a crest height 2 feet above the SPF water surface elevation resulting from implementation of the Dallas Floodway Extension project, which is 1.4 feet lower than the existing elevation at the ATSF Bridge. The levee raise would involve placement of impervious fill up to the design crest height and the addition of fill on the riverside of the levees to a 4 horizontal to 1 vertical slope. This action would result in an increased levee height of approximately 2.5 feet near the Houston Street Bridge. No additional fill would be placed on the city side of the levees. The design would include removal of the existing road base material at the crest of the existing levees prior to the placement of the impervious fill. An additional 18 inches of road base material would be placed on top of the impervious fill to accommodate vehicular traffic for maintenance and inspections. The proposed crest width of the levees would be 16 feet. Excavated fill for the levees would be obtained from the floodplain near the toe of the levees. Levee fill would be excavated from the floodplain from a broad, shallow cut to minimize disruption of the uniformity of the floodplain. These borrow areas would be designed with an average width of 300 feet and have an average depth of 2.5 feet. The improvements to the East Levee would extend approximately 58,400 linear feet and include approximately 1,468,400 cubic yards of embankment. Approximately 54,600 linear feet of the West Levee would be raised and include placement of 1,388,400 cubic yards of embankment. These improvements would extend upstream the full length of the existing levees. The approximate cost for this project is currently estimated at $62.9 million (Benefit/Cost = 1.1) based on January 2003 prices.

No excavation of fill material would occur beneath any of the bridges. Floodwall-type structures would be constructed beneath and between the bridge beams to provide the needed protection at the bridges. All of the existing bridges over the levees provide adequate levee design crest height with the exception of the West Levee crossing of the Houston Street Bridge. Many of the bridges crossing the Trinity River in the study area are being considered as potential historic properties; however, detailed information regarding the status of these bridges and proposed modifications for their protection or restoration is not presently available.

Implementation of this alternative would result in a loss of 11.9 acres of riparian forest. Approximately 787.5 acres of grasslands would also be adversely impacted from implementation of this plan. Replacement of herbaceous vegetation would result in a net gain of 49 acres of grasslands. Mitigation for riparian forest losses would be 35.7 acres.

Environmental Quality Plan:
This alternative for the Dallas Floodway was investigated primarily to improve the environmental character of the study area. This Environmental Quality alternative would provide benefits to fish and wildlife habitat, water quality and aesthetic properties while minimizing adverse impacts to existing cultural resources and flood damage reduction benefits. The Environmental Quality alternative for the Dallas Floodway would consist of: excavating a new meandering low flow channel between the levees; establishing forested areas and additional wetlands; and raising the levees to provide a flood damage risk comparable to the "Future Without Project" alternative condition as compensation for additional roughness attributable to increased forested areas.

The meandering channel would be designed to mimic the original natural Trinity River channel with respect to sinuosity, side slope, and capacity. The meandering channel alignment would diverge from the existing channel alignment upstream of the Dallas Area Rapid Transit (DART) Bridge at the downstream end, and from the existing channel near the confluence of the Elm Fork and the West Fork at the upstream end. The preliminary design for the meandering channel would have a variable bank slope and bottom width but would have an average side slope of 3 horizontal to 1 vertical and an average bottom width of 70 feet. Raised overbank areas reminiscent of natural sediment depositional zones would be incorporated as part of the construction to allow the establishment of trees and shrubs normally found in high quality riparian habitat areas. The existing channel would be filled with excavation from the meandering channel up to an elevation approximately 2 to 4 feet below the existing top of bank except for the bridge crossings where the existing channel would be retained. Portions of the old channel would be partially filled and the old banks would be graded to provide gradual slopes that would lead to the development of shallow wetlands. Additional segments of the original channel would be left unfilled to provide sources of permanent water at several locations within the overbank areas. Woody vegetation, including cottonwood and willow, which has reestablished adjacent to the constructed channel over the last couple of decades, would remain. The new meandering channel would traverse the entire available floodplain width between the levees at several locations but would utilize the existing channel crossings at bridges. This would reduce costs by preventing the need to modify bridges to accommodate different channel crossings. The length of the meandering channel would be longer than the existing channel by approximately 8,500 feet. The average bottom slope of the meandering channel would be 0.025 percent.

The meandering channel would have rock outer-bank and streambed protection at the bends. The rock bank protection would be designed to prevent channel migration due to streambank erosion and provide grade control. Placement of rock in the channel and at key areas along the channel curves would promote areas of turbulence in the river flow that would improve aeration and simulate the natural riffles and pools found in the Upper Trinity River. The rock outer bank protection would extend from the toe of the slope approximately halfway up the bank slope or approximately 15 feet in height. The upstream and downstream limits of the rock slope protection would extend from the upstream curvature of the bend to approximately 200 feet downstream of the bend. The rock bed protection would be strategically placed to form riffles and pools and extend across the entire channel bottom from the downstream limit of the rock slope protection, to approximately 500 feet upstream.

Trees would be planted along the top of the bank of the meandering channel on one side at a minimum width of 100 feet. This riparian corridor is intended to ultimately provide overstory shading for the river and would be planted alternately on either side of the channel only on the outer bends of the meandering channel. One- to 5-acre forested areas would be established in random locations within the floodplain between the toes of the levees. A minimum tree spacing of 15 to 20 feet would be required to facilitate occasional underbrush mowing and floating debris collection; however, the perimeter of the forested area would be marked to ensure that mowing does not occur at the same frequency as the remaining areas between the levees and the levee slopes.

Existing depressions in the floodplain would be preserved or enhanced to provide seasonal wetland functions and to support wetland vegetation. No structures to provide water management of individual wetland sites are proposed. Wetland sites would also be periodically mowed to control woody vegetation but would not necessarily be required on the same frequency as the grassland areas of the floodplain. Implementation of the Environmental Quality alternative would result in an increase of 224 acres of surface water, 184 acres of forest, and 84 acres of wetlands. The Environmental Quality alternative would result in a loss of 492 acres of grasslands.

Status of the Dallas Floodway Interim Feasibility Study:

This study is suspended pending selection of an alignment for the Trinity Parkway proposed by the North Texas Tollway Authority and the City of Dallas. Alternatives being considered for the Trinity Parkway are described later in this chapter. Once the issue of an alignment for the Trinity Parkway is resolved, and if the City of Dallas still desires to proceed with the Corps of Engineers on formulation of a plan for flood damage reduction, ecosystem restoration, and recreation, studies will be resumed.

Any plan for the Dallas Floodway involving Corps of Engineers participation will be subject to additional appropriate NEPA requirements, including tiering from the June 2000 PEIS.

Studies Expected To Move Forward To Cost-Sharing Negotiations
Two potential interim feasibility studies have been identified under the Upper Trinity River Basin Study, which have a reasonable likelihood of sponsorship by local interests, and which are in the general vicinity of the DFE project. Those studies are shown on Table 3-1 as the Mountain Creek Watershed Study and the West Fork at Hwy 360 Study. Grand Prairie has expressed an interest in evaluating opportunities for multi-objective flood damage reduction, ecosystem restoration, and recreation in the Mountain Creek watershed. The Cities of Fort Worth, Grand Prairie, Arlington, and Dallas County have expressed an interest in cost sharing in the feasibility study of ecosystem restoration and recreation along the West Fork of the Trinity River near Hwy 360. Since no studies have currently been initiated it is not possible at this time to define what any potential projects might entail.

West Fork at State Hwy 360
A feasibility study is being considered to evaluate the Federal interest (Corps of Engineers) to participate in a project to provide ecosystem restoration and recreational development. The preliminary identified study area extends from FM157 on the west to Roy Orr Boulevard on the east in Grand Prairie. The area includes floodplain lands between these two areas. Degradation of forested resources has occurred from transportation crossings, uncontrolled offroad vehicle use, and local floodplain fill activities for developments. Aquatic and terrestrial restoration and preservation and linear recreation appear to be project features most likely to have a federal interest. The linear recreation could provide linkage between existing the Arlington trail system immediately to the west and a proposed recreational trail in the city of Grand Prairie. Access needed for operation and maintenance of the ecosystem restoration and recreation could incorporate potential linkage to TRE Centerport rail station. Additionally, the project could incorporate an abandoned railroad bridge, built around 1900 into the system for maintenance access. The existing regional recreational trail system typically utilizes a 12-foot wide concrete trail. This type of trail would be investigated along with other alternative sizes and surfaces along with differing alignments for incorporation into this plan. While the actual study area has not been finalized, it is currently estimated that 800 acres could be included in a project. This study could be initiated by Fall 2003. Potential cost sharing sponsors with the Corps of Engineers for this study include Grand Prairie, Arlington, and city of Fort Worth and Dallas County in cooperation with NCTCOG.

CONTINUING AUTHORITY PROGRAM STUDIES

The Corps of Engineers Continuing Authorities Program (CAP) consists of several authorities delegated by Congress to the Chief of Engineers for study and implementation of projects if determined to be in the Federal interest. All CAP authorities have limitations on Federal expenditures, most at about $5M to $7M per project, and all have requirements for cost sharing by a local sponsor. Among those Continuing Authorities are: Section 205 for local flood damage reduction; Section 206 for aquatic habitat restoration; Section 1135 for habitat restoration of damages caused by Corps of Engineers projects; and others. Descriptions of all on-going CAP studies in the Upper Trinity River Basin are contained in the PEIS for the Upper Trinity River. The only CAP studies that are currently underway that are closely related geographically to the DFE project are being conducted under the Section 1135 authority.

Section 1135 Projects
Section 1135(b) of the Water Resources Development Act of 1986, as amended, authorizes the modification of structures and operations of water resources projects constructed by Corps of Engineers, or restoration of areas affected by Corps of Engineers projects, for the purpose of improving the quality of the environment in the public interest. The Federal expenditure limit on Section 1135 projects is $5,000,000. Section 1135 studies being conducted in the study area are discussed below.

Ecosystem Restoration Project, Old Trinity River, Dallas:
This project will restore riparian and wetland vegetation along the remnant West Fork of the Trinity River channel adjacent to the south levee of the existing Dallas Floodway in west Dallas. This area along with interconnected small-excavated areas serves as the interior drainage system for the Dallas Floodway. The specific objective of the restoration would be to re-establish the bottomland hardwoods, riparian forest and emergent wetlands that originally existed in the project area. This would be accomplished through modification of the Bickers Street Sump, construction of a water surface elevation control structure at the Westmoreland Road crossing, restoration of the lower Shadrack Creek channel by construction of an overbank wetland, planting of trees and shrubs along the Old Trinity Channel that are conducive to enhancing wildlife values, and regeneration of the littoral zones along the developed and modified wetlands to provide additional wildlife and fisheries values. The project would restore approximately 29.93 acres of emergent wetlands, improve the quality of habitat on 28.42 acres of riparian forest and result in the restoration of 53.48 acres of grassland. The Draft Report and Environmental Assessment for this project are currently under review by the project sponsor (City of Dallas) and the Corps of Engineers' Southwestern Division office prior to release for public comment.

Ecosystem Restoration Project, Joppa Preserve, Dallas County:
At the request of the Dallas County, and under the authority of Engineers Section 1135 of the Water Resources Development Act of 1986, as amended (33 USC 2201), the Fort Worth District Corps of Engineers conducted an ecosystem restoration study to identify the environmental degradation caused by the construction and operation of the Dallas Floodway project and subsequent development activities, evaluate measures to improve the functional stability and integrity of important ecological resources, identify opportunities that would improve the quality of these important ecological resources, and recommend a cost effective ecosystem restoration project, if applicable. The study area consisted of approximately 390 acres of lands within the 100-year floodplain of the Trinity River located southeast of Interstate Highway 45 and Loop 12 in southeast Dallas, Dallas County, Texas. The majority of the area, approximately 315 acres, is currently owned by Dallas County and operated and maintained by the city of Dallas. This property, known as the Joppa Preserve, consists of Lemmon Lake, Little Lemmon Lake, and some surrounding area and is located immediately adjacent to the main stem of the Trinity River about 9 miles downstream of the Dallas Floodway project.

Proposed project features include the reconstruction of the levee embankment separating Lemmon Lake from the Trinity River in two places where severe erosion and bank sloughing have occurred; the removal and replacement of the existing water inlet structure in Lemmon Lake from an unnamed tributary of Five Mile Creek, diversion of water from the same tributary into Little Lemmon Lake; repair of an existing water outlet structure in Little Lemmon Lake; relocation of the water control structure in Lemmon Lake to the southern bank of the lake, removal of the old structure, and repair of the breach in the levee at the location of the old structure; and dredging portions of Little Lemmon Lake to provide water depth gradients and use the dredge material to create a nesting island. In addition, the proposed project would restore or create approximately 123 acres of emergent wetlands, improve the quality of the habitat on 68 acres of bottomland hardwood and mixed deciduous forest stands, reforest 53 acres of open space to bottomland hardwoods, and restore 60 acres of native grass and forb lands, in addition to protecting 20 acres of maintained park lands, and 73 acres of open water. The remaining acres of existing habitat within the study area would become more valuable by reducing the fragmented nature of the existing habitat and restoring a contiguous corridor for migration of avian and wildlife species through the area. The recommended plan would significantly increase the habitat value of the study area over the future without project alternative.

A final component of the plan, recreation access, includes approximately 8,800 linear feet of equestrian trail that will be 10 foot wide, stabilized dirt covered with wood mulch, 550 linear feet of shared equestrian and pedestrian trail that will be 8 foot wide grass pavers suitable for pedestrians (approved by the Americans with Disabilities Act) and horses, and 3,900 linear feet of pedestrian trail the is 5 foot wide reinforce concrete. In addition, recreation access features include a roughly 900 square yard parking lot located in the southwestern corner of the study area, which can be reached from Simpson-Stuart Road.

The recommended plan would impact waters of the United States and is subject to provisions of Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. The restoration activities recommended would meet the conditions of Nationwide Permit 27, Wetland and Riparian Restoration and Creation Activities. The State of Texas has issued a water quality certificate for Nationwide Permit 27 and therefore no further coordination is required under Section 404. The proposed project is located within the flood plain of the Trinity River. The project, as proposed, requires siting within the flood plain to meet its intended purpose and further, the project would not induce or increase flood damages within the area, therefore, the proposed project is in compliance with Executive Order 11988, Floodplain Management. The proposed project would neither adversely impact nor result in any loss of wetland areas so the project is in compliance with Executive Order 11990.

Public involvement for this project has been conducted, the Finding of No Significant Impact (FONSI) has been signed, and higher Corps of Engineers authority has approved the planning report. The project is currently waiting funding for preparation of Plans and Specifications for construction.

REASONABLY FORESEEABLE ACTIONS OF OTHERS

There are a number of potential projects of other entities, including the private sector as well as local, state, and Federal agencies. There are relatively few, however, that have the potential for significant cumulative effect on water and related land resources of the Upper Trinity River Basin study area with the possible exception of the proposed Trinity Parkway.

FLOODPLAIN POLICIES AFFECTING FUTURE DEVELOPMENT

There have been two major regional policies developed since the mid-1980s that are specifically intended to reduce cumulative impacts to hydrology and hydraulics of development activities within the floodplain of the Upper Trinity River Basin. The first is the Trinity Regional Environmental Impact Statement (TREIS) and its Record of Decision of 1988. The second is The Corridor Development Certificate (CDC) program, which is a joint effort of the North Central Texas Council of Governments (NCTCOG), the Corps of Engineers, Fort Worth District, and member NCTCOG cities with jurisdiction over the Trinity River floodplain.

1988 Record of Decision for the Trinity Regional EIS

The TREIS was prepared by the Corps of Engineers in the mid-1980s to address extensive floodplain development that was occurring along the Trinity River within the region. The TREIS focused on actions requiring permits under Section 10 of the River and Harbors Act of 1899 and Section 404 of the Clean Water Act of 1972, as amended, with emphasis on addressing cumulative impacts of granting multiple permits. The Record of Decision (ROD) for the TREIS was signed in 1988. The ROD applies to all project actions requiring a permit under either Section 10 or Section 404 within the Standard Project Flood (SPF) floodplain. In general, the criteria developed to reduce hydraulic impacts include the provision for no increase in the 100-year or SPF elevation from dredging and/or fill activities along the mainstem, West Fork, and Elm Fork and tributaries. The criteria also require a maximum loss in storage capacity for the 100-year and SPF discharges of 0 percent and 5 percent, respectively. For projects proposed on tributaries with drainage areas of 100 square miles or less, criteria allow for up to 15 percent reduction of valley storage within the 100-year floodplain and up to 20 percent reduction of the SPF floodplain valley storage. Further, requested projects on tributaries that would increase water surface elevations to a point of inducing additional flooding or damage to others are not to be permitted. The ROD also established guidelines for mitigation of environmental habitat losses caused by projects in floodplain areas covered by the TREIS.

The criteria of the TREIS ROD apply only to navigable waters of the United States under Section 10 and waters of the United States including wetlands under Section 404. It does not apply to projects for which the Corps of Engineers has no regulatory authority. The TREIS raised awareness that a large area of floodplain lands within the Upper Trinity River Basin could be developed outside the jurisdiction of the Corps of Engineers and that if developed following only Federal Emergency Management Agency (FEMA) requirements, significant increases in flooding frequency and extent would continue to occur in adjacent and downstream areas. Subsequently, the Corridor Development Certificate process was established as a means to address those floodplain actions that were not within the jurisdictional areas administered by the Corps of Engineers.

Corridor Development Certificate Process
The purpose of the CDC Process is to affirm local government authority over for local floodplain management while establishing a common set of permit criteria and procedures for development within the Trinity River Corridor. The CDC process ensures that a proposed development's effect on future flooding will be considered in floodplain permitting decisions. Member cities, counties, and the NCTCOG administer the CDC program with technical advise by the USACE. The program, as part of the Trinity River Common Vision, relies on member cities within the area to require developers to submit plans showing the impact of their proposed projects on floodplain hydraulic values. Emphasis is placed on preservation of valley storage; however, participating cities may approve projects with valley storage losses when shown to be in the best overall public interest. After a review by all other cities within the CDC, the proponent city decides on whether to allow the floodplain alteration. The CDC criteria centers on stabilizing flood risk by not allowing new development to cumulatively worsen hydrologic and hydraulic impacts. The member cities participating in the CDC program include Arlington, Carrollton, Coppell, Dallas, Farmers Branch, Fort Worth, Grand Prairie, Irving, and Lewisville, and the counties of Dallas and Tarrant.

DALLAS TRINITY RIVER CORRIDOR MASTER IMPLEMENTATION PLAN

The City of Dallas, on 25 August 1999, preliminarily approved a Trinity River Corridor Master Implementation Plan for the Dallas Floodway and Dallas Floodway Extension area. In the footprint of the Dallas Floodway, this alternative, subsequently called the "Lakes Only" alternative, would consist of a series of lakes, a split river channel, promenades, constructed wetlands, recreation trails, parklands, grasslands, and pedestrian bridges. The lakes and split river channel would result in excavation of one large lake approximately 135 to 235 acres in size and numerous other smaller lakes within the existing Dallas Floodway. The main river channel would be divided with channels running parallel to the levee on either side of the floodway. The lake(s) would be located in the central section of the floodway between the channels, and source water for the lake would be a combination of groundwater and Central Wastewater Treatment Plant effluent polished by the upper three wetlands of the Dallas Floodway Extension's "Chain of Wetlands." The split river channel and raised promenade would provide 2-year flood protection to the lake.

The City of Dallas' Trinity River Corridor Master Implementation Plan provides for the inclusion of water-related or recreational features. However, there are a number of possible variations, depending upon the ultimate alignment selected for the proposed Trinity Parkway route (discussed below). The Trinity River Corridor Master Implementation Plan utilizing the "Lakes Only" plan or the "Lakes Only" plan in conjunction with the Industrial Boulevard option for the Trinity Parkway would result in adverse impacts to 492 acres of grasslands and 191 acres of riparian forest while creating approximately 513 acres of open surface water and 147 acres of wetlands. Implementation of this alternative with a Parkway between the levees would affect essentially the same acreage except that it would also create 260 acres of hard surface roads between the levees.

TRINITY RIVER CORRIDOR COMPREHENSIVE LAND USE PLAN (CLUP)

In June 2000, the City of Dallas contracted with a consulting group, the HTNB Team, to develop a comprehensive land use plan for the Trinity River Corridor. Currently, the project is in its fourth phase and the consultant team is developing a comparative analysis of the Trinity Parkway options that considers economic, land use and urban design factors. The purpose of the Trinity River Corridor Comprehensive Land Use Plan is to review and clarify the goals and objectives for the Trinity River Corridor in order to develop and provide information to the Dallas City Council and the Citizens of Dallas related to the costs and benefits of the Trinity River Project and its specific components. The objectives of the costs and benefits study are as follows:

- To identify the site specific, and spin-off costs and benefits of each of the Trinity River Project components as currently planned, including the Dallas Floodway Extension (DFE), the Elm Fork Levee, the Trinity Corridor Transportation Improvements, the Great Trinity Forest, and the Chain of Lakes,
- To provide analysis needed to assist the City in identifying a preferred alternative for the Trinity Parkway and associated improvements, and,
- To re-evaluate the phasing of the proposed improvements based upon the costs and benefits of each.

The purpose of the study is to develop a long-range plan, implementation strategies and economic analyses for the Trinity River Corridor. The plan will also provide analysis needed to assist the City in identifying a preferred alignment for the Trinity Tollway.

Study Area
In the first phase of the study, the consultant reviewed existing plans and policies, existing physical conditions, existing infrastructure, and proposed Trinity River Corridor Projects in order to identify potential boundaries for both primary and secondary areas of study. Twenty-two (22) sub-areas of the corridor were identified as primary study areas. The consultant will prepare very detailed land use plans and urban design strategies for these sites. These areas were selected based upon the following criteria: a) proximity to the Trinity River; b) proximity to one or more of the proposed Trinity Parkway options; c) proximity to existing or future DART rail; d) existing residential uses with housing issues; and e) existing under-utilized commercial and industrial areas. The secondary study area or overall project study area is roughly 1 to 1 ½ miles on either side of the Trinity River from Royal Lane on the north to IH 635 on the south. The consultant team will prepare a recommended land use plan and planning policies for this area.

Figure 3-3 provides an overview of the study area for the CLUP, along with the locations of the 22 sub-areas of the primary study area. From the 22 primary study areas, the consultant will identify 10 prototype sites. The development types in the prototype plans can occur in other places along the corridor with similar characteristics.

Expected Outcomes
The expected outcomes of the CLUP study include a comprehensive land use plan, including urban design strategies, for the Trinity River Corridor study area. Economic analyses from the study will include: cost/benefit analysis of the Trinity Parkway options; market analysis of the recreational amenities associated with the Trinity Project; market analysis of the Trinity River Corridor; and cluster/target industry analysis for corridor. The team will also conduct a study to determine the financial approaches that will capture the economic potential and benefits generated by the Trinity River Project. An implementation strategy will be developed which will include identification of budget strategies, financing program for improvements, identification of State and Federal funding opportunities, identification of regulatory tools and changes, identification of regulatory guidelines, identification of catalyst projects, and preparation of a phasing plan for development. In the last phase of the study, the consultant will identify the ordinances and policies that will need to be changed to implement the recommended plan. The team will also identify design guidelines that

would need to be incorporated in zoning and subdivision regulations and incorporated in property disposition agreements to achieve the desired results of the recommended plan.

Current Status
The consultant is tentatively scheduled to brief the City Council by Midyear 2003. This study is now expected to be completed by the end of 2003. The development of the comprehensive land use plan (last phase of the project) is scheduled after the City Council selects the locally preferred alignment for the Trinity Tollway. Until this plan is developed, presented to, and adopted by the Dallas City Council, it is not possible to predict the individual impacts of the plan or cumulative impacts associated with the DFE project.

TRANSPORTATION – VEHICULAR

The Texas Department of Transportation (TXDOT), Dallas District is responsible for planning to meet much of the transportation needs in the study area. Parts of Dallas, Denton, Collin and Ellis Counties are within the Dallas District portion of the Upper Trinity Basin. TXDOT provided data to the Corps of Engineers for inclusion in the Supplement to the EIS for the DFE project. The information was provided in the form of a spreadsheet that enabled the Corps of Engineers to conduct a further analysis to isolate the projects that actually were proposed to cross tributaries to or on the Main Stem, Elm Fork, and West Fork of the Trinity River. Data available at this time precludes determination of actual footprint that would be affected by most of the proposed activities; however, the width of the crossing including approach construction is available. Table 3-2 provides a summary of that information by county.

Most of the construction that would be conducted by TXDOT summarized in Table 3-2 would be replacement or in some cases widening of existing structures. Further most of these activities are on crossings of small tributaries on existing rights of way, and would likely be authorized by Nationwide permit under the Section 404 process. A few of these projects however have a potential to cause.

TABLE 3-2, DALLAS DISTRICT TXDOT REASONABLY FORESEEABLE PROJECTS
Bridge and Abutment Replacements and New Trail Construction
Within Upper Trinity River Basin

County	Number of Activities	Linear Feet	Proposed Construction Initiation Dates	Estimated Cost
Bridges				
Collin	6	1,900	Jan 2003 to Mar 2007	$7,276,000
Dallas	94	92,200	Mar 2001 to Jan 2010	$189,968,000
Denton	73	38,100	Jan 2000 to Apr 2012	$44,544,230
Ellis	3	1,600	Sep 2003 to Jan 2008	$1,905,657
	176	133,800		$243,693,887
Trails				
Dallas	6	34,500	May 2005 to Jun 2012	$15,660,521
	6	34,500		$15,660,521
Totals	182	168,300		$259,354,408

cumulative impacts to some resources, particularly, waters of the United States, including wetlands, riparian forests, hydrology and hydraulics or other floodplain values. These transportation projects as well as those that might be constructed under other local government authorities or initiatives, including the City of Dallas' proposal for bridge crossings of the Trinity River mainstem are described in the following paragraphs.

Trinity Parkway/Tollway
By far the proposed action within the general geographic area of the DFE with the greatest potential for cumulative effects is the proposed Trinity Parkway or Tollway. Feasibility studies are currently underway to determine whether the project may be economically and environmentally feasible. The Programmatic EIS for the Upper Trinity River Basin (PEIS) dated June 2000 addresses the status of the proposed Tollway, as it was understood at that time. Below is a brief background description of the proposal along with descriptions of the alternatives that are being evaluated by the NTTA and their estimated costs as of the date of this Supplement to the EIS for the DFE project.

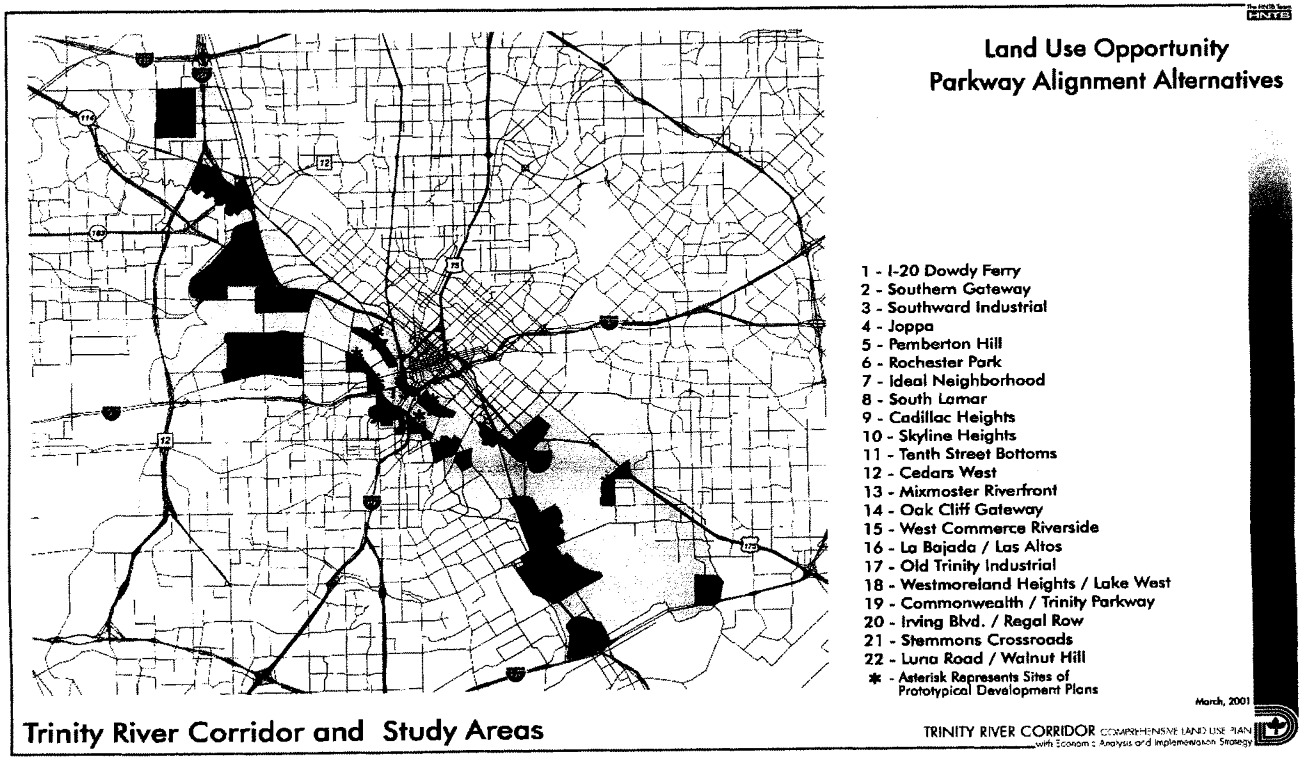
In 1998, TXDOT completed a Major Transportation Investment Study (MTIS). The study focused on transportation needs in the IH-35E/IH-30 interchange on the west side of downtown Dallas (the Mixmaster) and the depressed portion of IH-30 south of downtown (the canyon). The MTIS plan of action consists of seven elements including constructing a reliever route along the Trinity River. Based upon support from the City of Dallas and the North Texas Tollway Authority (NTTA), the Federal Highway Administration, on June 17, 1999, issued Notice of Intent to prepare an Environmental Impact Statement on the Trinity Tollway. The EIS will address five alternative alignments for the Trinity Tollway. Additionally, a design option for access to IH-35E (South R.L. Thornton Freeway) will be addressed for each of the five alternatives. The alternatives include: 1) reconstructing Irving/Industrial Boulevard to be installed as a double-deck structure, 2) modification of the existing Irving/Industrial Boulevard to accommodate increased traffic load, 3) combined Tollway constructed on the riverside of the East Levee of the Dallas Floodway, 4) split Tollway constructed on the riverside slopes of the Dallas Floodway East and West Levees, 5) split Tollway constructed on the landside slopes of the Dallas Floodway East and West Levees. All alternatives use the US-175 interchange with S.M. Wright Freeway (SH-310) as the southern terminus, and the Stemmons Freeway (IH-35E) interchange with John W. Carpenter Freeway (SH-183) will serve as the northern terminus. Structural alternatives being evaluated by NTTA are described below:

Irving/Industrial Boulevard – Elevated:
This alternative would entail development of a reliever route by modifying the entire Irving/Industrial segment to be installed as a double-deck structure above the existing city street. Traffic along the proposed route would be bi-directional. The elevated Irving/Industrial Boulevard option would be approximately 8.83 miles in length and would vary from four to three lanes in each direction. The construction cost of this alternative is approximately $1.2 billion and would require approximately 280 acres of right-of-way. This alternative would essentially avoid impact to the Dallas Floodway.

Irving/Industrial Boulevard – At Grade:
This alternative is similar to the elevated alternative; however, the road is installed primarily at-grade. Traffic would be bi-directional with four to three lanes in each direction. The route for this alternative would be approximately 8.83 miles in length and would require approximately 370 acres of right-of-way. The construction costs would be approximately $923 million to construct. This alternative would essentially avoid impact to the Dallas Floodway.

Combined Tollway – Riverside:
This alternative would have four to three lanes in each direction along the riverside of the Dallas Floodway East Levee. The route would have a design speed of 60 mph with a posted speed of 55 mph and be approximately 8.67 miles in length. The roadway would generally follow the riverside face of the Trinity Floodway East levee to the DART light rail bridge (5.6 miles) before crossing the levee to proceed on the landside of the proposed DFE East Levee extension (Lamar Levee). Placement of the roadway would be approximately two feet above the 100-year flood event, and

FIGURE 3-3, TRINITY RIVER CORRIDOR LAND USE PLAN (CLUP)



where the road underpasses existing bridge structures, protection from a 100-year flood event would be provided by a riverside floodwall. The tollway would have a width of approximately 332 feet in the floodway segment. The Combined Tollway – Riverside alternative would require 396 acres of right-of-way and cost approximately $620 million to construct.

Split Tollway – Riverside:
This alternative would be constructed on the riverside slopes of the Dallas Floodway East and West Levees with four to three lanes in each direction. The roadway would split west of Hampton/Inwood Road with the southbound lanes crossing the Trinity River to the West Levee. The southbound and northbound lanes would travel along the riverside face of the west and East Levee, respectively. The split would continue for approximately 4.2 miles before the southbound lanes would cross to the east levee via a bridge structure and rejoin the northbound lanes near Corinth Street. The roadway would be placed upon earthen embankments set approximately two feet above the 100-year flood level, and where the road underpasses existing bridge structures, protection from a 100-year flood event would be provided by a riverside floodwall. The roadway width would be 246 feet within the floodway segment, and a 20-foot drainage swale would be located on the levee side of the roadway. The entire Split Tollway – Riverside alternative is approximately 8.84 miles in length and would require 498 acres of right-of-way. The construction cost for this alternative is approximately $670 million.

Split Tollway – Landside:
The landside alternative is identical to the Split Tollway – Riverside alternate, except the roadway would be located on the landside of the levees and underpass existing arterial roadways. The normal drainage conditions of the levee-protected areas would be incorporated into the design of the roadway. As with the riverside alternative, the southbound lanes would cross from the west levee via a bridge to the east levee and rejoin the northbound lanes near Corinth Street. This alternative is approximately 8.90 miles in length and would require an estimated 402 acres of right-of-way. Construction costs would be approximately $865 million.

Status of the Proposed Trinity Tollway:
The Federal Highway Administration filed a Notice of Intent (NOI) to prepare an EIS for the Trinity Tollway on June 17,1999. A second NOI was published, which included analysis of potential lakes between the existing Dallas Floodway levees as part of the scope of the Trinity Tollway EIS. As of the date of this draft Supplement to the EIS for the DFE project, the Federal Highway Administration has a scheduled release of a draft EIS for the Trinity Tollway sometime in 2003 and the final EIS is due out sometime in 2004. The Federal Highway Administration's EIS for the Tollway will contain detailed discussions of the direct and indirect effects of each of the alternatives to the Trinity Tollway. After public input on the draft, the Final EIS for the Tollway will include the Federal Highway Administration's recommended alignment and a proposed implementation schedule.

Southwest Parkway
This potential project is not in the immediate vicinity of the DFE project, but because it was not identified in the PEIS, it is discussed here. The Southwest Parkway is a potential 32-mile commuter route from the southwest edge of downtown Fort Worth to Cleburne. The initial project will proceed in a southwesterly direction from downtown to an intersection at Alta Mesa Boulevard, a distance of approximately eight miles. This is a cooperative project between NTTA, the City of Fort Worth, and the Texas Department of Transportation. TXDOT plans to assist in the design and construction of the interchanges at IH 30 and IH 20. In addition, TXDOT plans to extend the initial phase of Southwest Parkway to FM 1187. Feasibility and environmental impact studies are on-going. Final design and right-of-way acquisition could take two years, with construction anticipated to begin in 2004.

Dallas North Tollway (DNT) System
The DNT is a 21-mile, six-lane, main street of the Metroplex connecting downtown Dallas to cities in northern Dallas and southern Collin and Denton Counties, passing through or along the cities of Dallas, Highland Park, University Park, Addison, Farmer's Branch, and Plano. Service roads have already been built north of SH 121 in cooperation with Collin County and Frisco in anticipation of an extension of the tollway. An environmental assessment was performed on the proposed extension from its current

terminus north of Legacy Drive in Plano to US 380 north of Frisco. From Legacy Drive to Gaylord Parkway, the DNT is currently under construction. This includes the interchange at SH 121. The NTTA periodically evaluates the financial feasibility of continued extensions of the DNT to points north of SH 121. Frontage roads currently exist from Legacy Drive just south of SH 121 to FM 2934. Collin County is currently constructing one frontage road from FM 2934 to US 380. Future work on this system falls outside of the study area.

Project Pegasus

Project Pegasus focuses on the IH 30/IH 35E interchange on the western edge of downtown Dallas, locally known as the 'Mixmaster'; the depressed portion of IH 30 south of downtown, locally known as the 'Canyon'; and the portion of IH 35E from the Mixmaster to SH 183, also referred to as 'Lower Stemmons'. Project Pegasus is intended to transform the two major Interstate Highways directly serving Downtown Dallas, by totally redesigning IH 30 from Sylvan Avenue to IH 45, and IH 35E from Eighth Street to Empire Central Drive (north of SH183).

Bridge Crossings of the Trinity River

The bridge crossings of the Trinity River are proposed to be completely reconstructed at both IH 30 and IH35. The City has determined that both bridge replacements should be done as a Signature Bridges. $12 million has been raised by the City of Dallas, Dallas County and from an anonymous donor for the design phase of I-30 Bridge. Phase 1 of preliminary design is expected later this year; design must be completed by 2005 to meet TXDOT anticipated construction schedules. Other proposed bridge replacements for the Trinity River in the vicinity of the DFE project are as follows:

Woodall Rodgers Extension and Bridge:

The extension across the Dallas Floodway would be constructed with funding coming from FHWA, TXDOT, and the City of Dallas. Environmental studies have been initiated and documents are in internal review. Although detailed design will not begin until the Trinity Parkway/tollroad alignment is selected, it has been determined that this bridge should be designed with aesthetic considerations. Award of design contract to Santiago Calatrava, S.A. was made in January 2002. The current estimated time for TXDOT to initiate construction of this bridge is mid-2005. The Woodall Rodgers Extension Bridge is potentially the first major signature bridge to be constructed across the Trinity River Corridor. Located between the Continental Avenue and Union Pacific Railroad Bridges, the Woodall Rodgers Extension Bridge would unite the West End and downtown Dallas to West Dallas and Oak Cliff. One suggested design for the bridge would be for a six to eight lane bridge consisting of two separate inclined arches connected at the top. The Continental Avenue Bridge could be totally converted to a pedestrian bridge.

Beckley Avenue Enhancement:

The studies to provide technical information for eventual design of Beckley Avenue improvements were initiated in Summer 2001. The segment currently being evaluated has boundaries of the Union Pacific Railroad and just south of Commerce Street. The intent of the upgrade is to improve Beckley to a six-lane expanded roadway. While studies have been initiated, the detail design is dependent on the Woodall Rodgers extension design. It is estimated that construction would be complete by 2008. The footprint of the Beckley Avenue improvement would be located entirely on the landside of the West Levee.

Corinth Street Bridge (new):

Proposed by TxDOT and the City of Dallas, it was originally anticipated that this bridge would be completely demolished and reconstructed. However, to retain the architectural significance of this structure it has now been planned as a separate additional bridge.

Hampton Road Bridge (replacement):

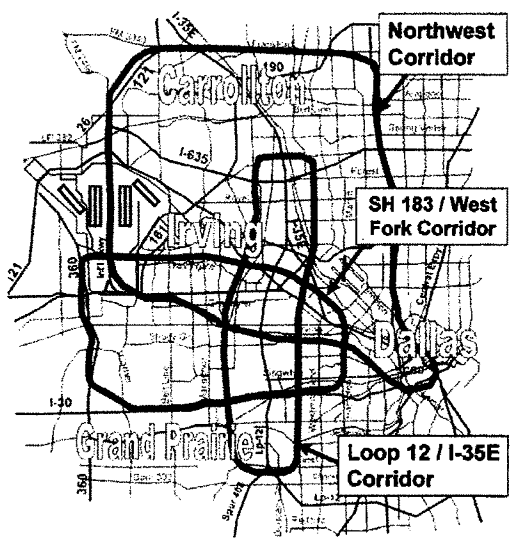
Based on information received, the Hampton Bridge replacement will provide for a widening of the existing lanes to provide for better traffic flow. Some of the design has been completed but construction funds are not foreseeable for this project at this time.

<u>Sylvan Street Bridge (replacement):</u>
The surface of this bridge and its approaches are entirely within the Dallas Floodway floodplain. Because of its location, the crossing is required to be closed on a frequent basis as rising waters inundate the floodway. An initial design has been done for this Dallas County Bridge, but construction funds have not been appropriated. No detailed information has been made available to the Corps of Engineers for this proposal.

<u>SH 183 Bridge at Elm Fork (Replacement):</u>
The SH 183 Bridge at the Elm Fork is a bridge widening enhancement project, with some lane widening and possible new lanes. The Major Investment Study (MIS) is underway by the highway department, which should provide more general information about capacity needed but will not provide details for impact assessment.

<u>Loop 12 Bridge Replacement at Elm Fork and West Fork:</u>
Consideration for improving this crossing is incorporated into a larger MIS, which should provide more general information about capacity needed. Currently, however, details are insufficient to determine size, timing, and exact location of the structures or other transportation features that might be implemented in the Loop 12 study area. Figure 3–4 provides an overview of the Loop 12 study area.

FIGURE 3-4, Transportation Corridors



President George Bush Turnpike (Segment IV)
The proposed project is approximately 5.5 miles in length and involves the construction of a new 6-lane north-south controlled-access tollway in Dallas County specifically within the Cities of Irving, Carrollton and Farmers Branch. The purpose of the proposed project is to create a direct link between IH 35E and IH 635, which would complete the northern and western sections of the President George Bush Turnpike. A Section 404 permit (199700020) was issued on May 24, 2002, authorizing placement of fill into 133 acres of waters of the United States. The project will result in permanent adverse impacts to 58.61 acres of waters of the United States including 26.22 acres of wetlands and temporary adverse impacts to 74.12 acres of waters of the United States including 11.54 acres of wetlands. To compensate for adverse

impacts to the aquatic environment, the project also includes a mitigation plan that must be implemented as part of the project. The plan includes restoration and /or enhancement of approximately 12, 251 linear feet, which would total 66.0 acres of Elm Fork Trinity River adjacent to the proposed roadway, development of 22.4 acres of emergent wetland and 18.5 acres of open water habitat within the 100-year floodplain of the Elm Fork. The entire 106.9 acres in the mitigation plan would be protected in perpetuity through management as mitigation and natural areas. Authorization for completing the work by Section 404 ends on December 31, 2006.

West Fork Corridor
The Texas Department of Transportation is performing a Major Investment Study (MIS) on improvements to SH 183 (the "Airport Freeway") and the construction of a companion transportation facility referred to as the West Fork Corridor. The general study area is also indicated on Figure 3-4 and basically covers east-west transportation needs in the north central region of the DFW Metroplex. Generally, the study area includes, west Dallas, central Irving, north Grand Prairie, and the southern area of DFW International Airport. Also covered are areas generally north of the West Fork of the Trinity River. The SH 183/West Fork Corridor covers existing SH 183 (Airport Freeway) through Dallas and Irving from the interchange of I-35E and SH 183 westward to SH 360 and is about 10 miles.

The West Fork Corridor connects to the west end of the "Trinity Parkway Corridor." Ultimately, this facility would connect the Central Business Districts of Dallas and Fort Worth. The corridor extends almost to I-30, covering some portions of Grand Prairie, Arlington, and Fort Worth. The MIS for the West Fork Corridor will cover a large variety of potentials to address transportation needs in this area and will consider travel modes such as:

- Rail and bus transit
- High Occupancy Vehicle (HOV) lanes
- Express lanes
- Bicycle and pedestrian facilities
- Toll facilities
- Non-construction measures such as Travel Demand Management (TDM)
- Transportation Systems Management (TSM)
- Intelligent Transportation Systems (ITS)
- Additional all purpose travel lanes

At this point in time, no specific alignments or features have been chosen or designed such that cumulative impacts can be quantified. However, it can generally be stated that hydrology and hydraulics and environmental preservation issues are of concern in the West Fork and its floodplain. Social and economic impacts will be of greater concern for alignments of project features near the existing Hwy 183 area, or for that matter along most areas not within the 100-year floodplain, which has been or will be subject to competing developmental pressures

TRANSPORTATION – RAIL

Trinity Railway Express (TRE) parallel bridge and repair of existing bridge on Elm Fork
The bridge crossing is actually owned and operated by Burlington Northern Santa Fe Railway, but is shared for use by the TRE. A parallel bridge at the Elm Fork crossing of the Trinity River within the existing Dallas Floodway will be added to allow better scheduling of the commuter train. The addition is part of an overall plan to improve the crossing of the river in this area. According to the Dallas Morning News, August 8, 2002, the Elm Fork bridge project would take about 18 months to complete.

The new bridge construction was authorized by Nationwide Permit 14 (199900397) and renovation / replacement of the existing bridge was authorized by Nationwide Permit 3 (20000935). Evaluation of information submitted for Corps of Engineers permit review, and also to the Federal Emergency Management Agency, indicates the combined actions would result in a impact of 0.11 acres of waters of the United States and an additional 0.04 acres of wetlands. The project was reviewed and determined to meet the hydrologic and hydraulic criteria of the CDC review process discussed earlier in this chapter and also meets the aforementioned for new construction in a Federal floodway.

Northwest Corridor Crossing at Elm Fork

Dallas Area Rapid Transit (DART) initiated a Northwest Corridor Major Investment Study (MIS) beginning in Spring 1998. In December 1999, the Project Team completed the detailed evaluation of alternatives including costs, operating plans and ridership. The DART Board approved the Locally Preferred Investment Strategy (LPIS) on February 22, 2000. The rail portion of the strategy included two routes one of which detailed a crossing of the Elm Fork of the Trinity within the existing Dallas Floodway. The University of Dallas/Texas Stadium alignment diverges from the Union Pacific Railroad just south of Northwest Highway. The alignment turns southwest toward Texas Stadium and University of Dallas, paralleling Story Lane, and continues along the south side of SH 114 before turning north toward the Las Colinas Urban Center. At the North Urban Center Station, the alignment turns west and generally parallels SH 114 to its ultimate terminus at the north end of DFW Airport. Most of this alignment would be on a new corridor. Detailed design studies of this alignment will begin in Fall 2002. The crossing of the Elm Fork near Story Lane should have similar impacts to waters of the United States as those described for the TRE Elm Fork crossing.

Southeast Corridor Crossing at White Rock Creek

The US Department of Transportation, along with Federal Transit Administration and DART, has conducted studies to evaluate potential alternatives to provide light rail project to improve transit opportunities within the Southeast Corridor. The study area generally includes the area along and between IH-30 and IH-45 extending from Dallas CBD to IH- 635. Several alternatives were evaluated in a draft EIS dated February 2002. The "build" alternative discussed in the summary of the draft EIS indicates that eight streams or tributaries would be crossed with bridge structures. Four areas within the 100-year floodplain would be crossed. Approximately 70 acres of vegetation would be impacted, of which 30 acres are currently forested primarily within the White Rock Creek to the June Road segment.

Other Railroad Modifications

Representatives of the Union Pacific Railroad and others have met with Corps of Engineers and City of Dallas personnel to address a potential rail siding expansion within an area adjacent to the proposed DFE. The existing rail yard is located East of Highway 310 and is intersected by Linfield Street. In this area, the only direction that the yard could be expanded would be toward the Trinity River, which would require fill within the floodplain to accomplish. This expansion, if it should occur, would likely extend onto a 25-acre tract of land that was identified in the DFE GRR/EIS to be partially used to meet environmental mitigation requirements. Additional discussions indicate that should the UPRR decide to further consider expansion in this area, there would be a need to evaluate means to mitigate hydrologic, hydraulic and environmental impacts. One idea under consideration to accomplish the hydrologic and hydraulic impacts would be to develop valley storage on the east side of the Trinity River directly across from the existing rail yard. Material removed to provide the valley storage could be used for the rail yard expansion and additional material could be used on the more upland areas adjacent to the borrow site to raise that area above the 100 year flood plain for residential development.

The 25-acre tract represents about two percent of the required mitigation area, and should it not be available as planned for in the DFE/EIS then additional land, most likely within the White Rock Creek drainage, would need to be evaluated for its ability to offset this change.

AIR TRAVEL / AIRPORT PROJECTS

There are no known air travel or airport expansion projects or potential future developments that might affect hydraulics and hydrology of the DFE study area.

FLOOD DAMAGE REDUCTION

Cadillac Heights Buyout Plan
As a result of a recent settlement in the Miller lawsuit, the City of Dallas agreed to purchase six homes in Cadillac Heights. The six owners and the addresses of their homes are as follows; F. Crawford at 2511 Chrysler, C. Miller at 2723 Roberta, M. Cooper at 2503 Chrysler, M. Hayden at 2423 Chrysler, J. Adams at 2527 Chrysler, and D. Thomas at 2414 Chrysler. All of these six homes lie outside the 100-year floodplain.

There have been discussions by City officials and staff and in the media regarding a plan to buyout the remainder or a substantial number of homes in the Cadillac Heights residential area and then convert it to some other use after the area is protected by the levee system proposed in the DFE project. The most recent proposal is the buyout of a number of homes and vacant property above the 100-year floodplain and subsequent construction of a police training facility. In April 2002, City of Dallas staff presented a concept to City Council to replace the residential footprint of the Cadillac Heights neighborhood with a City services footprint that could serve the Police Department, Dallas Water Utilities, and Code Enforcement. This idea is currently unapproved and not funded. If such a concept is eventually adopted by City Council, it is envisioned that such a plan would take about ten years or longer to implement. Any schedule is totally dependent on the City's success in securing the necessary funds. A second idea for transforming the Cadillac Heights residential footprint to a light industrial, private development footprint was also presented by City staff to City Council.

During the scoping meeting for this Supplement to the DFE EIS, one attendee stated an indication that the City has a specific plan to either participate in a buyout, or to encourage others to convert the land use of the area, could be found by examining recent zoning changes in the Cadillac Heights area. From information provided to the Corps of Engineers subsequent to the Scoping meeting, no zoning changes have been recently implemented by the City of Dallas for the Cadillac Heights vicinity. In fact, no zoning category (residential verses industrial) changes have occurred since 1965. The only zoning changes since 1965 are the result of changes in zoning definitions (type of residential zoning or type of industrial zoning). Also, no specific proposal for a Cadillac Heights categorical zoning change is currently being prepared for City Council approval.

The City has contracted a study to produce economic development scenarios that may result from the full implementation of Trinity River Corridor Project Bond Program. This Comprehensive Land Use Plan (CLUP) has been ongoing since June 2000 and is expected to be completed by the end of 2003. It is conceivable that the CLUP may recommend some land use changes in the floodway and adjacent areas. Some rezoning might be required should the city choose to implement the CLUP. However, at this time no results are available that provide definitive information to the Corps of Engineers that there is any reasonably foreseeable project or plan to buy out houses within the Cadillac Heights area other than the six homes required by the previously discussed "Miller" lawsuit settlement.

Removal/Replacement of ATSF Bridge
Studies have been conducted to determine the historic status of this bridge, as well as, the possibility to use this alignment for a recreational trail crossing of the river. In addition, the existing configuration of the support piers and abutments cause substantial impacts to hydraulic conditions of the Dallas Floodway. It has been proposed to remove the wooden, concrete, and earthen approaches, preserve the historic center span, and reconstruct the approaches to blend with the preserved center span, thus potentially providing hydraulic relief while maintaining possible trail access. An interlocal agreement is required with TXDOT to use this bridge as a recreational trail. The City of Dallas' schedule calls for selection of a consultant to begin design in early 2003. TXDOT has agreed to assist in review and assist with design criteria. Figure 3–5 is a picture of the ATSF Bridge.

FIGURE 3-5, ATSF Bridge, Dallas Floodway

Elm Fork Area
The City of Dallas has initiated an Elm Fork Floodplain Management Study to develop a storm water management plan for the Elm Fork Corridor. The goals are to identify flooding problems and recommend solutions, identify open space ecosystem restoration and recreational opportunities, incorporate proposed transportation initiatives and produce a floodplain management plan. The study area also includes the floodplain area between the Elm Fork and IH 35 and between Royal Lane and Hwy 183; included in the area are the Richards Branch, Wesco Channel, and Daniels Branch watershed. Flood damage reduction alternatives being considered include a Luna Road levee and channel, buyout of areas to construct a mega-park with limited flood damage reduction capacity, and ring levees to protect all or portions of the study area. Other levee alternatives for the Daniels area, channel improvements for Richards Branch and culvert replacements and buyout of floodprone areas to convert to park and open space in the Wesco area are being considered for flood damage reduction potential. Several road modifications to locate the road surface above the 100-year floodplain are being considered. Other features considered in the plan include evaluation of proposed Dart light rail projects and recreational access between Bachman Lake and Irving. The plan included these and other transportation initiatives that cannot be considered as potential projects at this time. No transportation projects would be funded by the Trinity Bond Funds within the Elm Fork area. Twelve recreational priorities were identified in the plan. Recreational features proposed include conversion of disturbed open space to soccer fields, establishment of a primary trail from Luna Road south to Wildwood and another primary trail from Wildwood to Bachman Lake, secondary trail linkages, canoe access at Frazier Dam and California crossing, fishing enhancements, and a white water course. Ecosystem restoration features were incorporated into flood damage reduction and recreational proposal and not specifically identified by location or cost. The primary restoration being proposed is through preservation of existing riparian areas and some development of buffers to benefit existing wildlife habitat.

Las Colinas Levee Raise
Studies have been initiated by Dallas County Utility and Reclamation District (DCURD) to evaluate the need to modify the existing Las Colinas Levee protecting the Urban Center. This 17,700 foot-long levee was designed and constructed by DCURD to provide Standard Project Flood protection. However, DCURD studies indicate that based upon current hydraulic models, only 500-year protection plus freeboard currently exists for this intensively developed area. The DCURD has also indicated that preservation of freeboard designed for the areas being developed north of Royal Lane and east of O'Connor Boulevard is of interest to protect significant existing and future development. DCURD has indicated that they envision that projects to protect or restore flood damage reduction previously provided at these two areas would be conducted in the immediate future.

RECREATION

Trinity Lakes or "Chain of Lakes"(230 and 120 acre) – City of Dallas
The City of Dallas' Master Implementation Plan for the Trinity River Corridor provides for a "Chain of Lakes" between the existing levees of the Dallas Floodway to enhance recreation opportunities of the area. The plan calls for a complex of two lakes created from excavation of material, which would be used to raise the proposed Trinity Tollway to an elevation above the 100-year flood frequency elevation. Dallas' plan also calls for a split river channel that would carry normal flows on either side of the man-made lakes for water quality purposes. The need for the material, the evacuation of which would create the "lakes", is dependant upon which Tollway alignment might be ultimately selected. The City of Dallas is also considering a "Lakes Only" plan that would not require selection of a Tollway alternative that would involve excavation. Ostensibly, Dallas could also pursue the "Lakes Only" plan without Corps of Engineers participation in a multiobjective project between the existing Dallas Floodway levees. Until a Trinity Tollway alignment is selected it cannot be determined with any degree of certainty what configuration, if any, the Trinity Lakes might take.

Equestrian Center and Trinity Interpretive Center (Loop 12 at Main Stem)
A feasibility study and master plan for the Interpretive Center, Equestrian Center and other associated components is being conducted by contract. Brown Reynolds Watford Architectural team initiated the studies in August 2002 and design should be completed by March 2004. The Interpretive Center is estimated to cost $15 million. The Equestrian Center is estimated at this time to cost about $1.7 million. Included are additional funding for trails and design and feasibility studies including site, archeological, economic, conceptual design, programming, construction, feasibility and public participation.

ISTEA Trails
Three ISTEA-T21 grants have been awarded to the City of Dallas for two projects. Two of the grants are being applied to the Santa Fe Trestle Trails, which is described in its own section. The other grant was issued in the mid-1990s for the Trinity Trails, which is a trail project that is planned to extend 14 miles in length between Westmoreland and Corinth within the Dallas Floodway. The Trinity Trails project is pending the further development of the Urban Design Study and the concurrent Lakes Study for the Dallas Floodway.

Hike and Bike Trail Connection at West Fork and SH 360
See description of this potential project under Ecosystem Restoration projects.

Sylvan Avenue Boat Launch
This boat launch was constructed utilizing funds from the City of Dallas and Texas Parks and Wildlife Department. It is located adjacent to Sylvan Avenue and provides access to the Main Stem of the Trinity River within the Dallas Floodway. Construction was completed in February 2002. The original construction contract was for $250,849 of which Texas Parks and Wildlife Department provided $200,000. Figure 3-6 is a view of the Sylvan Avenue boat launch area.

FIGURE 3–6, Sylvan Avenue Boat Launch

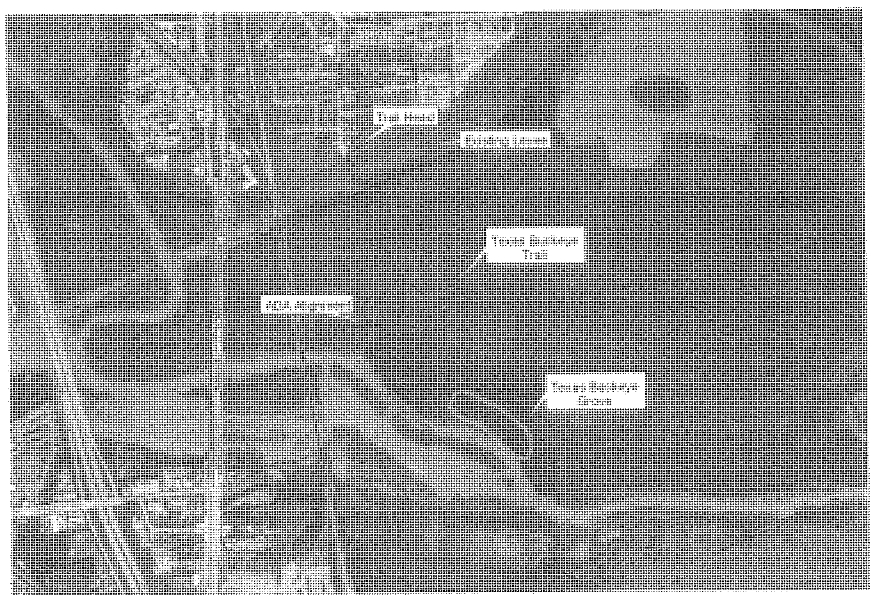
Old Trinity Meanders Trail
This trail is proposed to be placed in west central Dallas adjacent to the cutoff Trinity River bed between Trinity River Park Trail and Katy Trail (near the American Airlines arena). Preliminary consideration is for the trail to cross I35 on the old rail corridor north of Continental, and ideally it would follow the old meander close to Medical City area. The trail is proposed to be a pedestrian "Woonerf" which is wide enough for a car, but designed to be used predominantly by pedestrians and is planned to go on the high banks along the southern side of the meander (at present). This will be part of a New Urbanism development approach with portions similar to White Rock Creek Trail and other area similar to the San Antonio Riverwalk. In addition, links to White Rock Lake, White Rock Creek Park Chain, the Dallas Zoo and a northern extension ultimately to the Collins County Line and a branch to UT Dallas would be considered. Nodes of development are planned along the way including the Trinity River/Stemmons Corridor. The project is being approached by City of Dallas and the Trinity Commons Foundation and will involve predominantly all private land. The City is hoping to get donations of land, but may approach funding in a future bond issue.

South Loop 12 Boat Ramp
Design is completed for this site and City Attorneys and City Council have approved a multi-use agreement with TxDOT. The agreement was necessary because of the proposed location of the ramp on the right-of-way for Loop 12. The project would be located on the west bank of the main stem of the Trinity River. The final design has been completed, and the current schedule calls for construction initiation by mid-2003.

Texas Buckeye Trail
The Texas Buckeye Trail would provide access to a unique botanical site in the White Rock Creek floodplain adjacent to the main stem of the Trinity River within Rochester Park. The project includes one soft surface trail (4300 ft) and one ADA accessible trail approximately one-half mile in length. The plan includes development of information kiosks and trail signage. The trailhead would be adjacent to a

parking area at the southern end of Bexar Street. The trail would require access over the Rochester levee which will be raised slightly higher than present as part of the tie in with the Lamar Street levee as included in the Dallas Floodway Extension Recommended Plan. The two trails would also cross wetlands or other waters of the United States. Preliminary trail layout was mapped by City staff and documented through use of GPS. Environmental analysis of the proposal would include a wetlands and waters of the United States delineation. Section 404 and Section 10 analysis is scheduled to begin in the Fall of 2002 and construction is expected to begin in early 2003. Construction time is estimated to be 3 months. All of the trail except the portion going over the Rochester Levee would lie within the White Rock Creek area, which is heavily forested with an early successional stage of bottomland hardwood forest. Previous studies indicate that approximately 50 percent of that area is wetland. The area is frequently flooded by overbank flooding events from both White Rock Creek and the Trinity River. The soft surface trail would require minimal clearing of understory vegetation, but the ADA trail would likely require more clearing to allow construction of a hard surface path. In addition, culverts or other methods would have to be used to allow access across many small drainages and depressional areas in the path of the trails. It is estimated that about 2400 linear feet, or less that one acre, of clearing would be required for placement of the ADA trail alignment. Figure 3–7 depicts the layout of the Texas Buckeye Trail.

FIGURE 3–7, Texas Buckeye Trail

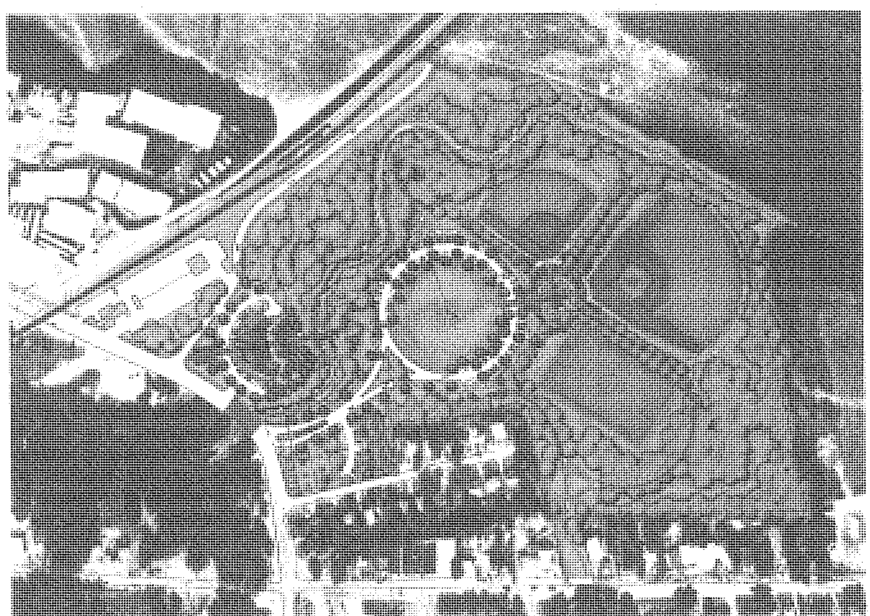


Moore Park modification

The City of Dallas proposes several modifications to Moore Park, adjacent to the Dallas Floodway Extension area on the south side of the river. Figure 3–8 provides a representation of the modifications to Moore Park. Detailed design should be completed during 2003 and construction completed during 2004. The estimated cost of the first phase is $1 million. Initial features proposed during Phase 1 include:

- Pedestrian Promenade
- Trinity Welcome Center (Large Open air pavilion with ability for future expansion to include concessionaire spaces.)
- Park Entry and Signage (at this point limited to signage only)
- Pedestrian Bridge (access from motel property across Little Cedar Creek to existing Moore Park)
- Concrete Trail (access to Santa Fe Trestle trail and Trinity Trails
- Playground (Temporary location of playground near welcome center.)
- Canoe Launch, access road and parking on Trinity River (access from the maintenance road on the west side of DART line).

FIGURE 3-8, Moore Park Modification



ECOSYSTEM RESTORATION/PRESERVATION

Elm Fork Area

The ecosystem restoration component identified in the Elm Fork Floodplain Management Study primarily consists of preservation of existing riparian woodlands within the Stemmons area. Additional description of other features of the study is presented in the previous section on Flood Damage Reduction.

Great Trinity Forest

Dallas County Open Space Plan:
An open space plan was initially developed by Dallas County in 1980. This plan identified two major landscape features as the basic components of the recommended Open Space Program. The Trinity River and its various tributaries, lakes and floodplains is one of those components. In 1991, Dallas County approved a new plan that recommended acquisition of 60,000 to 65,000 acres of diverse open space resources including additional landscape features. The 1991 Plan identified 39 potential tracts for acquisition and management. Four of those Open Space components were located in creeks or corridors within tributaries to the West Fork of the Trinity River in Dallas County. Seventeen components of the plan are in areas that drain into a part of the Main Stem Trinity River and three components were recommended that lie in the Elm Fork segment. All of these components are substantially located in the floodplain and have ecological important water or forested related resources. Twenty-one total components have been acquired into the Dallas County Open Space, fifteen of which are within the drainage area to the West Fork, Elm Fork or Mainstem reaches of the study area. Since December 1, 1999, no new lands have been acquired but Dallas County has participated in studies to improve the quality of existing properties. One of these proposed restoration projects is the Joppa Preserve project proposal discussed in the Corps of Engineers Ecosystem Restoration projects.

Texas Parks and Wildlife Department (TPWD) Master Plan:
This study was funded by TPWD to provide a plan to guide the development of a large urban park utilizing two of Dallas' major natural assets, the large tract of bottomland hardwood forest and the Trinity River itself. The area for which the plan was developed is located along the banks of the Main Stem Trinity River in the corridor between the Santa Fe railroad trestle near the lower end of the existing Dallas Floodway and downstream to IH-20. The purpose of the Master Plan is to suggest boundaries for the park, recommend conceptual locations for recreational facilities that are placed in the park and provide a framework for implementation by recommending development phases, identification of alternative funding sources and management structures for the park. The plan suggests that 3,000 to 6,000 acres should be acquired for inclusion in the Great Trinity Forest, development of a Trinity Center, 30 to 40 miles of bicycle trails, 15 to 20 miles of equestrian trails and 50 or more miles of nature trails.

As indicated, this study produced a Master Plan to provide guidance for ultimate development. Any or all of the features suggested will be possible only as funds become available. For example, TPWD has provided funds to acquire one tract of land near 1H-20. Other features of the master plan would likely come about over a long period of time. The Dallas Bond issue had funds approved for acquisition of parts of the Great Trinity Forest. Other acquisitions could come about as a result of implementation of environmental mitigation plans for projects such as the DFE. Still other tracts are already in public ownership, such as those in the Rochester Park.

FILLS, PERMITS, UTILITIES AND OTHER ACTIVITIES

Corps of Engineers Regulatory Program
The Corps of Engineers regulates discharge of dredged and fill materials into all waters of the United States including wetlands under Section 404 of the Clean Water Act and regulates all work or structures in or affecting the course, condition, or capacity of navigable waters of the United States under Section 10 of the Rivers and Harbors Act of 1899. The Fort Worth District regulatory program includes maintenance of a database to track projects reviewed by the District. While not all activities that might occur in waters of the United States require reporting to the Fort Worth District Engineer, those that do not generally are of a nature that has been determined from a national, state and regional level to result in only minimal impacts on regulated resources. Description of proposed activities submitted to the District for processing under either of the two mentioned authorities is added to the database upon submission. Queries were conducted of the regulatory database to determine all of the permit requests that were received in the sixteen counties that contribute to the Upper Trinity River Basin. Data was retrieved for Archer, Clay, Collin, Cooke, Dallas, Denton, Ellis, Grayson, Hood, Jack, Johnson, Montague, Parker, Tarrant, Wise, and Young Counties. These data were further refined to only include those cases that we evaluated from

December 1, 1999 to the September 1, 2002 and screened by use of a GIS program to determine which of the projects were actually located in the Upper Trinity River Basin (Figure 3-2).

The resulting data indicate that 770 projects were authorized in the Upper Trinity River Basin within the study period. Of those, 55 were letters of permission or individual permits, and 570 were Nationwide General permits. The Nationwide permit authorizations resulted in 93.85 acres of impacts to water of the United States and 198.66 acres of compensatory environmental mitigation were provided to offset those impacts.

The Fort Worth District is considering another 127 pending project authorizations at this time. These projects are currently under review and could range from no permit action required to individual permits with substantial impacts. Specific activities regulated by Section 404 or Section 10 that were identified in the geographic area as reasonably foreseeable projects, which appear to have the potential to cause cumulative impacts in relation to Dallas Floodway Extension, were identified. These regulated activities include the McCommas Bluff Landfill modification located downstream of the DFE on the Trinity River floodplain, the Frasier Dam modification on the Elm Fork, the Basic Capital Management proposal for a commercial development near IH 635 and Luna Road in Farmers Branch on the Elm Fork and a proposal to construct a parking lot for a Park and Ride facility on a 12-acre tract within the 100 year floodplain of West Fork of the Trinity River in Grand Prairie. Several other projects regulated under Section 404 or Section 10 such as the bridge modifications associated with the TRE crossing of the Elm Fork, the new rail crossing proposed for the Northwest Corridor and the President George Bush Tumpike (Segment IV) are described in the Transportation Section in this chapter.

McCommas Bluff Landfill Extension. (Application Number 199900319):
The proposed project modification includes the extension of the existing landfill levee to allow an additional 425 acre expansion of the existing landfill, excavation of a swale to compensate for reduction in flood storage due to the landfill encroachment into the 100-year floodplain, relocation of existing high-pressure gas main and a 54 to 60-inch water main and implementation of an onsite mitigation plan to offset adverse impacts to waters of the United States. The construction of the project features (excluding mitigation) would permanently impact a total of 158.7 acres of waters of the United States and temporarily impact an additional 1.6 acres. The permanent impacts would occur to 92.6 acres of emergent wetland, 45 acres of open water and 21.1 acres of shrub-scrub wetlands. These would be temporary impacts to 1.6 acres of emergent wetland. As identified in the project description, features have been incorporated to mitigate hydraulic and hydrology impacts and to mitigate losses to waters of the United States. The environmental mitigation plan would provide for protecting, developing and managing a total of 254.5 acres of land in the vicinity of the landfill. The mitigation plan would provide for ultimate development and long-term preservation of 119.7 acres of emergent wetlands, 41.2 acres of forest, 8.9 acres of open water, 9 acres of stream channel, and 75.7 acres of vegetated buffer areas. Project final design is expected to be completed during 2003.

Frasier Dam Modification. (Application Number 200100031):
As demand for domestic water increases, the City of Dallas Water Utilities has had increasing difficulty in providing sufficient water supply at the time of demand. Water supply releases from Lake Lewisville and Lake Grapevine require 12 hours to flow down the Elm Fork to the pump station. Frasier Dam on the Elm Fork provides the storage volume to meet supply needs during peak demand periods. Recently, peak demands have surpassed the supply that can be stored behind the Frasier dam; therefore, the City has requested authorization to increase the available supply for peak demands by increasing the height of the existing dam. As proposed, the modification would provide the additional volume and operating range of the pumps for draw down. The modification would increase the water surface elevation within Elm Fork by two feet at the dam location. The two feet increase in at the dam would gradually diminish upstream but would have an effect over an approximate four-mile reach. A loss of valley storage would result from the proposed plan, however to compensate for this expected loss within the CDC area and the TREIS record of decision area, the applicant proposes linking an adjacent flood plain lake and using a water control structure to transfer flows to the Bachman Creek Drainage. It is anticipated that the increased water surface elevation within the Elm Fork Channel would also result in some minor changes to the vegetation on the vertical surface of the channel bank as well as a short distance horizontally from the channel.

Basic Capital Management (Application number 200100023).
This proposed commercial development would be located on a 138-acre tract of land near IH 635 and Luna Road in Farmers Branch on the Elm Fork of the Trinity River. The proposed project would result in discharge of dredged and fill material totaling 173,000 cubic yards into 12.2 acres of open water, 1,142 linear feet of Farmers Branch Creek, 1508 linear feet of ephemeral streams, and 0.18 acre of an ephemeral pond. The project would result in an adverse impact to a total of 14.3 acres of water of the United States. The project would also result in the fill of approximately 39 acres of the 100-year floodplain, resulting in an unspecified quantity (by the public notice for this project) of valley storage loss. This area lies within the CDC area requiring that valley storage losses be mitigated. In addition, the applicant proposed to mitigate environmental losses. The environmental mitigation proposed by the applicant included onsite and an offsite, 230-acre mitigation area within the floodplain of the Elm Fork approximately 2.15 miles northwest of the project site. Valley storage mitigation was proposed by development of two lakes.

Park and Ride facility, Grand Prairie (Application Number 199800690):
This facility is proposed to be located on a 12-acre tract to the west of MacArthur Boulevard and immediately north of IH-30 in Grand Prairie, Dallas County. The tract is within the 100-year floodplain of the West Fork of the Trinity River. As proposed the project would require placing fill on 7.8 acres. The project would result in permanent adverse impacts to 0.9 acres of open water and 0.7 acres of palustrine forested wetland. The applicant has proposed environmental mitigation at an offsite location approximately 1.1 miles northwest of the proposed fill site adjacent to Bear Creek. The applicant proposes to develop 1.8 acres of emergent wetland and 1.2 acres of forest for the environmental mitigation. No plan has been specified to mitigate valley storage losses in the 100-year floodplain

Other Dallas Floodway Projects or Activities

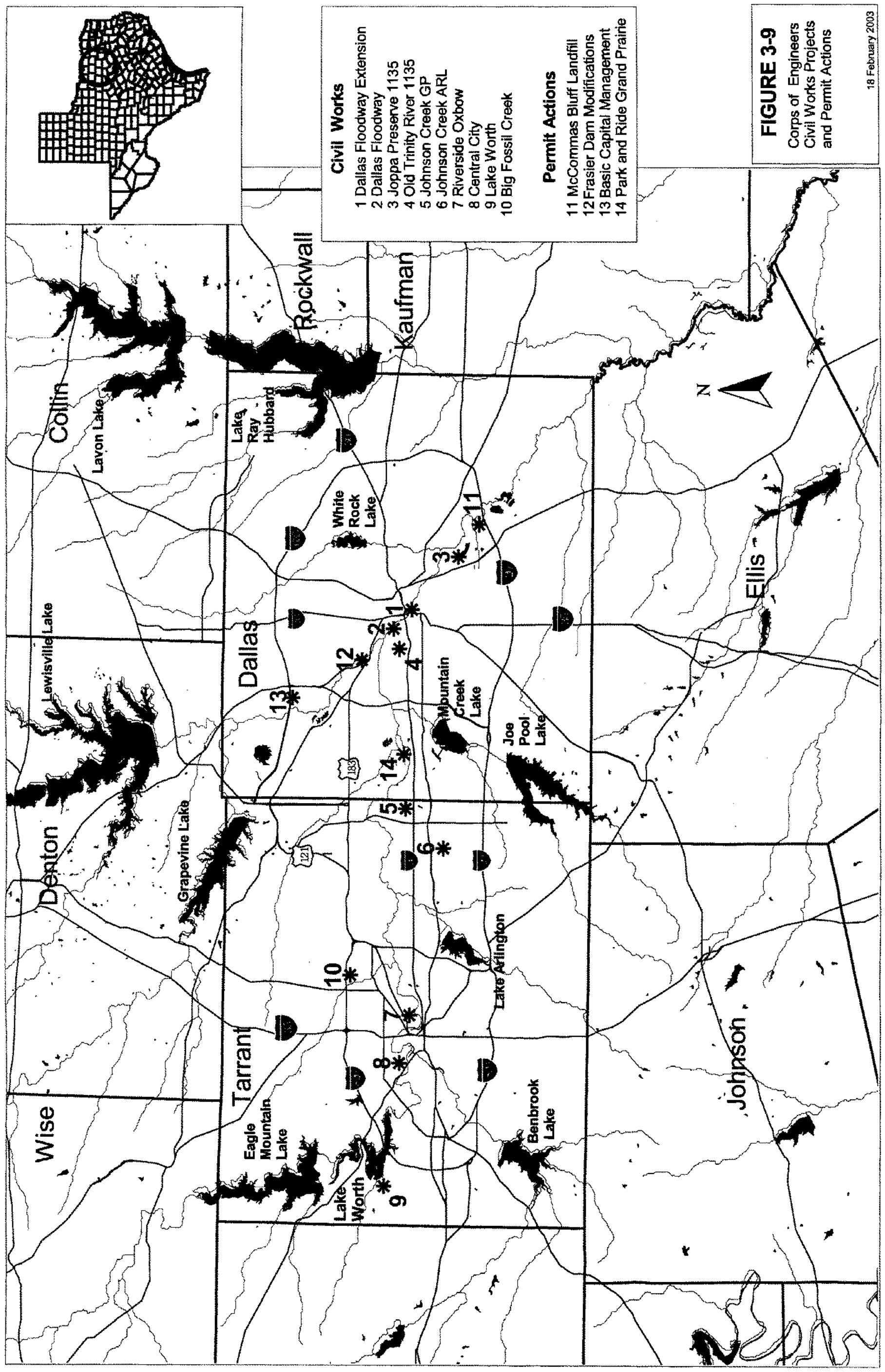
Urban Design Study:
The Urban Design Study is managed by the "Dallas Plan", which is not a City department. The study assesses the overall Trinity River Corridor Project program and its current vision for the Dallas Floodway and the Great Trinity Forest vicinity. The Trinity River Corridor Urban Design and Transportation Study is totally funded with private donations and is steered by Mayor Laura Miller and Judge Lee Jackson. Chan Krieger, a Cambridge Massachusetts consultant, initiated the study fall of 2002. A presentation of study results (www.thedallasplan.com) to date was presented to the Dallas City Council on March 5, 2003. With respect to the Dallas Floodway, the study produced an assessment and recommendations for several changes to the current Master Implementation Plan, the Trinity Parkway, the Corps of Engineers' / City's Dallas Floodway Study, or other Trinity River Corridor Project initiatives.

The concepts presented to the Council included a proposed sequential and integrated development of flood control, transportation, economic development and recreation. The transportation element varies from that previously thought to be the most compelling when considered for its ability to meet relief needs for the I-35/I-45 corridor. While it is not possible to call any of these concepts "plans", the idea expressed was to develop a less intrusive system that calls for a roadbed atop the East Levee as the reliever route, roadways to the outside of the east and west levees to serve residents and business development along the levees and a parkway within the floodway to provide recreational access. The suggested recreational areas would include many of the same features previously considered as reasonably foreseeable actions within the floodway, but differ in their design and functionality. The Study's Phase 1 Project Groups recommends proceeding with the Lamar and Cadillac Levee Extensions and the development of the Chain of Wetlands, in addition to development of flood damage reduction and environmental features (lakes and wetlands) within the existing Dallas Floodway. At this point in time, the Study would require the City to consider more modification to the Dallas Floodway alternatives, primarily the tollroad features. Those modifications, if acceptable to the decision makers for those projects, could result in slightly different cumulative impacts than determined for this project. However, the anticipated impacts would likely be less significant because of the emphasis on open space and quality of life issues. The concept has the potential to adversely impact the integrity of the existing levee system, due to the fact that the reliever route proposed would lie directly on top of the levee. This concept has not been evaluated by the Corps of Engineers for its impact to long-term stability of the levee. Other transportation design issues that would have to be addressed would include the at-grade intersection with several major bridges crossing the Floodway.

Additionally, the City of Dallas has contracted with Camp, Dresser and McKee on a Lakes Study for the Dallas Floodway. The first objective of the study is to review previous work and recommend the best approach for lake configuration. This will involve a determination of whether an on-channel or off channel lake design is better, including functionality and operability issues. The resultant Lakes Study would provide technical guidance and input to the Urban Design Study consultant. This work is anticipated to be completed by the end of 2003.

New Utility Corridors:
The only specific information that has been made available was found in the review of Section 404 and Section 10 permit activities that were initiated or finalized after December 1, 2002. Generally underground utilities cause only temporary impacts to surface resources. Overhead utilities such as power lines cause longer-term impacts due to the necessity for operation and maintenance. Wooded vegetation generally is not allowed to mature in the corridors, and grasslands are frequently mowed or otherwise treated to reduce the introduction of woody growth.

Other Developments:
Construction of the International Environmental Training and Technology Center was scheduled to be completed by February 2003. The activity is located south of Loop 12 adjacent to McCommas Landfill and to the Joppa Preserve. Landfill operations will occupy a small portion of the facility and manage classes and the facility. Other recycling manufacturers are considering development of office/business sites at the park.


Civil Works
1 Dallas Floodway Extension
2 Dallas Floodway
3 Joppa Preserve 1135
4 Old Trinity River 1135
5 Johnson Creek GP
6 Johnson Creek ARL
7 Riverside Oxbow
8 Central City
9 Lake Worth
10 Big Fossil Creek
Permit Actions
11 McCommas Bluff Landfill
12 Frasier Dam Modifications
13 Basic Capital Management
14 Park and Ride Grand Prairie
FIGURE 3-9
Corps of Engineers
Civil Works Projects
and Permit Actions
18 February 2003
Collin
Lavon Lake
Rockwall
Kaufman
Lake Ray Hubbard
White Rock Lake
Dallas
Lewisville Lake
Denton
Grapevine Lake
Mountain Creek Lake
Joe Pool Lake
Ellis
Tarrant
Lake Arlington
Wise
Eagle Mountain Lake
Lake Worth
Benbrook Lake
Johnson
N

CHAPTER 4 – ENVIRONMENTAL CONSEQUENCES

This chapter presents the recommended Dallas Floodway Extension project in the context of current and future trends in the designated study area. The purpose is to assess the cumulative impacts of the proposed action to the study area when combined with other known actions in the vicinity of the Dallas Floodway Extension area as described in Chapter 3 "Past and Future Actions". The Final General Reevaluation Report for Dallas Floodway Extension (February 1999) and the Final Programmatic Environmental Impact Statement for the Upper Trinity Basin (June 2000) contain discussions with regard to cumulative impacts. These discussions are incorporated herein by reference as allowed by the CEQ regulations for implementing NEPA (40 CFR Part 1508).

CUMULATIVE IMPACTS

In 1997, the Council on Environmental Quality (CEQ) developed a handbook addressing cumulative effects in analyses prepared under the National Environmental Policy Act. CEQ has defined cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions". Clearly within the Upper Trinity River basin, potential for cumulative impacts is high. Establishing the significance of cumulative impacts on the other hand is much more difficult to accomplish. A significant cumulative effect on the environment means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the projects that results from the compounded or incremental individual environmental effects.

To date, there remains no universally accepted approach to the preparation of cumulative effects analyses. CEQ guidance indicates that it is not practical to analyze cumulative impacts for other than those truly meaningful environmental effects. In addition, the determination of the level of effects that produces the threshold beyond which cumulative effects significantly degrade an ecosystem or other resources is difficult. For a cumulative effects analysis to be worthwhile it must be limited through scoping to the effects that can be evaluated meaningfully. Accordingly, the scope of this cumulative impact analyses has been limited to the projects and resources discussed below.

Flood damage reduction projects typical of past Corps of Engineer's activities have the potential to impact an array of natural resources, induce downstream floodplain impacts and cause general land use changes within the newly protected areas. Continued reclamation of floodplain lands for residential and industrial uses also have potential to cause other cumulative effects. In recent years, a number of new authorities and administrative procedures have been implemented including mitigation banking. Administrative priorities promoting nonstructural flood damage projects including buy-outs and environmental protection alternatives are becoming more prevalent. Restoration of important ecosystem components is being conducted to mitigate and reverse some of the adverse impacts associated with past structural flood damage reduction measures. These philosophical changes affect cumulative impact analysis. Public scoping was utilized to ascertain the major issues of concern to general public and other agencies. Issues discerned from the public meetings held at the initiation of the NEPA process as well as those issues which have been made known through other public forums were considered.

FLOOD DAMAGE REDUCTION PROJECTS

The reasonably foreseeable flood damage reduction projects that were identified within the Upper Trinity Study area include the Dallas Floodway modifications by the Corps of Engineers and the modification of the Las Colinas existing levee by Dallas County Utility and Reclamation District. Studies underway by the City of Dallas indicate a potential for future actions to protect existing investments in the Stemmons Industrial area may eventually evolve, however, nothing has been specifically elevated to the point that any specific project could be considered as reasonably foreseeable.

TRANSPORTATION PROJECTS

A number of transportation projects were identified in the Upper Trinity area that are likely foreseeable. The majority of these individual projects are small, replacements of existing structures and located considerable distance from the Dallas Floodway Extension. Transportation projects that have a potential to cause cumulative impacts to the study area include the proposed modifications to I-30, I-35, Hwy 183, Woodall Rodgers, and the Trinity Parkway/Tollroad (should alignment fall on parts of Dallas Floodway or Dallas Floodway Extension project boundaries). Additional modifications in the Dallas Floodway that could induce cumulative impacts were identified for the Corinth and Hampton Road, Sylvan and Loop 12 bridges. In addition, the President George Bush Tollroad, Segment IV, largely falls on new alignment within the Elm Fork Corridor, and therefore, direct and cumulative impacts must be considered. The DART railroad study for the Southeast Corridor also indicates the potential for cumulative impacts to riparian forest associated with the White Rock Creek area.

ECOSYSTEM RESTORATION

The ecosystem restoration projects that have a potential for cumulative impacts include the Joppa, Old Trinity River, and various proposals for modification of the existing Dallas Floodway. While each of these three projects would provide positive direct and cumulative impacts for riparian vegetation and associated fish and wildlife resources, the potential for negative cumulative impacts to hydraulic conditions as a result of increased roughness associated with providing additional reforestation must be considered.

RECREATION

Recreational trail development generally results in minor direct and indirect impacts to environmental resources. The trails are generally designed to take advantage of the natural quality of the area they cross. They are intended for casual use and minor adjustments in alignment are common to avoid important resources. The potential to cause minor impacts to bottomland hardwoods and regulatory wetlands associated with the Texas Buckeye Trail and the Equestrian Center and Trinity Interpretive Center indicate that these two recreational projects should be considered for cumulative impacts.

FILLS, PERMITS, UTILITIES & OTHER ACTIVITIES

The reasonably foreseeable fill activities that could have cumulative impacts on resources in the study area include the McCommas Bluff Landfill extension on the main stem Trinity River, the Frasier Dam modification and the Basic Capital Management floodplain reclamation projects on the lower Elm Fork and the Park and Ride facility on the West Fork of the Trinity River.

CUMULATIVE IMPACT IDENTIFICATION

Identification of reasonably foreseeable projects was ascertained through a scoping process, including written requests for information from agencies that have information on proposed activities that would occur in the study area and through participation in meetings with regional organizations, literature and newspaper reviews and through active browsing of internet sites hosted by many agencies and organizations that have proposed projects or have interests in them. The most significant problem, however, comes not from identifying the reasonably foreseeable projects but in identifying the direct and indirect impacts that the projects might have on environmental resources. The term "reasonably foreseeable" implies that the project may only have a general public knowledge or acceptance at a point in time and that details of design and project specific impacts are yet to be developed or disclosed by the project proponent. That has been found to be the case during assembly of information for this Supplement. There is a general knowledge of various plans with components, any of which if implemented, would result in substantial changes in the existing Dallas Floodway. These plans could intensify transportation, recreation, environmental restoration and/or flood damage reduction benefits depending upon the ultimate selection of possible plans or plan components for any specific purposes. The fill activities identified during preparation of this Supplement are relatively more certain, as evidenced by the greater level of information that has been developed by proponents or applicants for fill activities. Since it is still unclear which components proposed for the Dallas Floodway may ultimately be selected, this chapter evaluates an array of reasonably foreseeable alternative development scenarios for the Floodway and discloses cumulative impacts of those scenarios along with other reasonably foreseeable projects in the geographic vicinity of the Dallas Floodway Extension. In addition, cumulative impacts of these aforementioned activities are discussed and analyzed in relation to the final array of alternatives from the DFE GRR/EIS.

A summary of estimated impacts to important environmental floodplain vegetation resources that can be attributable to projects or their alternatives is shown in Table 4-1. All scenarios for Cumulative Impact in Table 4.1 include DFE acreages, and all scenarios include lakes between the existing levees except the Dallas Floodway EQ Plan.

Tables 4-2 through 4-6 summarize the cumulative changes to important resources based upon the impacts associated with reasonably foreseeable alternatives displayed in Table 4-1. If mitigation has been proposed or recommended with a plan, the acreages associated with that mitigation has been included in the summaries. The DFE array of alternatives are considered stepwise through the Tables. Table 4-2 discloses the cumulative impacts of other reasonably foreseeable alternatives in relation to the No Action alternative in the DFE project area. This table provides a baseline for comparing other DFE alternatives.

To address cumulative impacts of multiple reasonably foreseeable projects in this Supplement to the DFE EIS, input from Corps of Engineers environmental specialists was utilized. A matrix was developed to indicate the potential cumulative impact for reasonably foreseeable projects on a series of environmental, social and community resources. Table 4-2 displays an assessment of the magnitude of the potential impacts in relation to the recommended DFE plan and alternatives based upon information available at this time.

Several of the projects identified as reasonably foreseeable have not been sufficiently formulated and designed to date to offer detailed analysis. In other cases, the information may have been developed but has not been made available to the Corps of Engineers. For those instances, a preliminary estimate of potential cumulative impact has been made based upon the general types and magnitude of impacts those projects typically induce.

As noted earlier, there likely will not be a project proposed by the Corps of Engineers for the North Stemmons Industrial area as part of the Upper Trinity Feasibility Study due to unfavorable economic benefits for flood damage reduction. Dallas has continued evaluation of the Stemmons area and has developed a Floodplain Management Study for the Elm Fork in that area. The plan documents strategies for providing flood damage reduction as well as integrating environmental protection and extending recreational opportunities. The City's study documents a recommendation to allow previously permitted ongoing fill activities (26 issued from 1972 to 1999) to be extended through the end of 2004, ultimately requiring a variance from CDC guidelines for these activities. New fill requests would be reviewed under the CDC criteria. If adopted as included in the study, an additional 473 acres would ultimately be removed from the flood plain. Although none of the proposals discussed in the Management Study can be considered as reasonably foreseeable at this time, the action of developing the plan indicates that impacts could be significant relative to CDC criteria.

Insufficient information is available to ascertain the significance of any proposed modification of the existing Las Colinas Levee system. However, from a generic point of view, levee or other floodplain fills impact valley storage and have the potential to cause direct and cumulative impacts to hydrology and hydraulics. The project proposal would likely be a modification to an existing flood damage reduction project, and therefore, there would be less adverse impacts to forest and wetland resources, since most of the site would have been previously impacted. Cultural resources, however, could potentially be impacted. DCRUD has expressed concern that activities of others have produced cumulative impacts to

TABLE 4-1. ESTIMATED PROJECT IMPACTS (ACRES) TO FLOODPLAIN RESOURCES BY REASONABLY FORESEEABLE PROJECTS IN STUDY AREA

	Waters of United States	Open Water	Wetland	Forest Improvement	Forest Conversion	Grassland/ Buffer
Flood Damage Reduction						
Dallas Floodway Levee raise			-36.7		-11.9	
(Mitigation)			+36.7		+35.7	-35.7
Stemmons Area	U	U	U	U	U	U
Las Colinas Levee raise	U	U	U	U	U	U
ATSF Bridge Modification	0	0	0	0	0	
Ecosystem Restoration						
Old Trinity			+29.3	+28.42	+53.48	-82.8
Joppa Preserve		+73	+123	+53		
Dallas Floodway		+224	+84		+184	-492
Transportation						
Trinity Parkway						
Irving/Industrial						
Elevated	0	0	0	0	0	
At Grade		-2	-1		-7	
Combined Riverside		-22	-133		-7	-121
Split Riverside		-21	-132		-7	-220
Split Landside		-5	-1		-7	
George Bush (IV)	-58.6		-26.2			
(mitigation)	+18.5		+22.4	+66		
Trinity Railroad Express	-0.11		-0.04			
DART SE Corridor					-70	
Other Floodway Bridges	-9	-9	-9	0	-9	

TABLE 4-1 (concluded)
Estimated Project Impacts (acres) to Floodplain Resources by Reasonably Foreseeable Projects in Study Area

	Waters of United States	Open Water	Wetland	Forest Improvement	Forest Conversion	Grassland/ Buffer
Fill Activities						
McCommas Bluff Landfill		-45	-113.7			
(Mitigation)	+9	+8.9	+119.7	+41.2		+75.7
Frasier Dam Modification	-72	-72				
Basic Capital Management	-1.92	-12.2	-0.18			
(Mitigation)				+230		
Park and Ride, Grand Prairie		-0.9			-0.7	
(Mitigation)			+1.8		+1.2	
Recreation						
Floodway Lake(s)		+370	+147			-500
Texas Buckeye Trail			<-1.0			
Equestrian /Interpretive Center	U	U	U	U	U	U
Dallas Floodway Extension						
No Action	0	0	0	0	0	0
NED		-24.3	0	-99	-504	+504
(Mitigation)				+2514	+605	+81
LPP / Recommended Plan		+2	+123.3		-162	-109.7
(Mitigation)				+926	+223	+30
Comb. Structural/Non-Structural		+3	+123.3		-143	-68
(Mitigation)				+806	+195	+26
TFSP		+3	+123.3		-155	-78.6
(Mitigation)				+890	+217	+28

Parkway data from NTTA. All estimated impacts other than for DFE alternatives are preliminary and subject to change as plan formulation on these projects continues. + = gain - =loss U = Unknown

TABLE 4-2. CUMULATIVE CHANGES TO RESOURCES (ACRES) DUE TO REASONABLY FORESEEABLE ACTIONS IN DALLAS FLOODWAY, WITH "NO ACTION" AS THE DFE PROJECT

Resource	No Action	FDR	Combined Pkwy Riverside	Lakes/Split Pkwy	Lakes only	EQ
Waters of US	-114.13	-114.13	-114.13	-114.13	-114.13	-114.13
Open Water	-49.2	311.8	309.8	290.8	311.8	535.8
Wetland	154.28	292.28	291.28	160.28	292.28	376.28
Forest Improvement	418.62	418.62	418.62	418.62	418.62	418.62
Forest Conversion	-16.02	-1.22	-32.02	-32.02	-25.02	158.98
Grassland	-7.1	-542.8	-507.1	-727.1	-507.1	-999.1

TABLE 4-3. CUMULATIVE CHANGES TO RESOURCES (ACRES) DUE TO REASONABLY FORESEEABLE ACTIONS IN DALLAS FLOODWAY, WITH "NED" AS THE DFE PROJECT

Resource	No Action	FDR	Combined Pkwy Riverside	Lakes/Split Pkwy	Lakes only	EQ
Waters of US	-114.13	-114.13	-114.13	-114.13	-114.13	-114.13
Open Water	-73.5	287.5	265.5	266.5	287.5	511.5
Wetland	154.28	305.12	172.12	173.12	305.12	389.12
Forest Improvement	2833.62	2767.62	2767.62	2767.62	2767.62	2767.62
Forest Conversion	84.98	178.78	147.98	147.98	154.98	3398.98
Grassland	577.9	42.2	-43.1	-142.1	77.9	-414.1

No Federal Action in DFE area means that the Corps would not construct either alternative assessed in the final array of DFE/GRR EIS.
No Action in the Dallas Floodway means that no Corps activities, Tollroad alternatives, or Lakes being considered by others would be constructed in the existing Dallas Floodway. O&M as currently required to maintain the existing Dallas Levees, Sumps and Floodway would continue.
FDR= Corps studied Levee Raise Alternative in Dallas Floodway
EQ= Corps studied Environmental Quality Alternative in Dallas Floodway

TABLE 4-4. CUMULATIVE CHANGES TO RESOURCES (ACRES) DUE TO REASONABLY FORESEEABLE ACTIONS IN DALLAS FLOODWAY, WITH "LPP" (RECOMMENDED PLAN) AS THE DFE PROJECT

Resource	No Action	FDR	Combined Pkwy Riverside	Lakes/Split Pkwy	Lakes only	EQ
Waters of US	-114.13	-114.13	-114.13	-114.13	-114.13	-114.13
Open Water	-47.2	313.8	291.8	292.8	313.8	537.8
Wetland	277.58	415.58	282.58	283.58	415.58	499.58
Forest Improvement	1344.62	1344.62	1344.62	1344.62	1344.62	1344.62
Forest Conversion	44.98	59.78	28.98	28.98	35.98	219.98
Grassland	-86.8	-622.5	-707.8	-806.8	-586.8	-1078.8

TABLE 4-5. CUMULATIVE CHANGES TO RESOURCES (ACRES) DUE TO REASONABLY FORESEEABLE ACTIONS IN DALLAS FLOODWAY, WITH "COMBINATION STRUCTURAL/NON-STRUCTURAL PLAN" AS THE DFE PROJECT

Resource	No Action	FDR	Combined Pkwy Riverside	Lakes/Split Pkwy	Lakes only	EQ
Waters of US	-114.13	-114.13	-114.13	-114.13	-114.13	-114.13
Open Water	-46.2	314.8	292.8	312.8	314.8	538.8
Wetland	277.58	415.58	282.58	414.58	415.58	499.58
Forest Improvement	1224.62	1224.62	1224.62	1224.62	1224.62	1224.62
Forest Conversion	105.98	50.78	19.98	19.98	26.98	210.98
Grassland	-49.1	-584.8	-670.1	-549.1	-549.1	-1041.1

No Action in the Dallas Floodway means that no Corps Activities, Tollroad alternatives, or Lakes being considered by others would be constructed in the existing Dallas Floodway. O&M as currently required to maintain the existing Dallas Levees, Sumps and Floodway would continue.
FDR= Corps studied Levee Raise Alternative in Dallas Floodway
EQ= Corps studied Environmental Quality Alternative in Dallas Floodway

TABLE 4-6. CUMULATIVE CHANGES TO RESOURCES (ACRES) DUE TO REASONABLY FORESEEABLE ACTIONS IN DALLAS FLOODWAY, WITH "TFSP" AS THE DFE PROJECT

Resource	No Action	FDR	Combined Pkwy Riverside	Lakes/Split Pkwy	Lakes only	EQ
Waters of US	-114.13	-114.13	-114.13	-114.13	-114.13	-114.13
Open Water	-49.2	311.8	289.8	290.8	311.8	535.8
Wetland	154.28	292.28	159.28	160.28	292.28	376.28
Forest Improvement	418.62	418.62	418.62	418.62	418.62	418.62
Forest Conversion	-16.02	-1.22	-32.02	-32.02	-25.02	158.98
Grassland	-7.1	-542.8	-628.1	-727.1	-507.1	-999.1

No Action in the Dallas Floodway means that no Corps Activities, Tollroad alternatives, or Lakes being considered by others would be constructed in the existing Dallas Floodway. O&M as currently required to maintain the existing Dallas Levees, Sumps and Floodway would continue.
FDR= Corps studied Levee Raise Alternative in Dallas Floodway
EQ= Corps studied Environmental Quality Alternative in Dallas Floodway

The hydrology and hydraulics that have lowered the level of protection that the levee was originally designed to provide. It should be considered possible that the reduction of protection afforded by the Las Colinas Levee is more a reflection of the improved modeling capabilities developed after the levee was designed and constructed rather than a cumulative impact of other projects in the area.

WATER QUALITY

Implementation of any combination of the alternatives for the reasonably foreseeable future actions is not expected to result in any long-term adverse impacts to water quality. Short-term impacts might occur as a result of construction of major projects such as the toll roads, or as intermittent effects from runoff from any project area. Given recent trends in wastewater treatment and temporary retention of storm water runoff, overall water quality in the Trinity River should continue to experience moderate improvement. Implementation of the Environmental Quality plan within the Dallas Floodway as well as the Old Trinity and Joppa Preserve areas would produce slight beneficial cumulative impacts. The EQ plan for the Dallas Floodway would restore functional wetlands and restoration of stream sinuosity along with placement of rock at multiple locations along the channel bottom and banks near bends should provide aeration to produce more rapid clean up of nutrient enriched waters characteristic of the Trinity. The restoration of riparian forest along the new channel would also provide shading that should help with moderation of summer water temperatures. The chain of wetlands within the Dallas Floodway Extension would provide some water quality benefits as well as produce fish and wildlife resource benefits. Use of treated effluent for makeup water for the City of Dallas' proposed off-channel lakes within the Dallas Floodway could slightly reduce the predicted minor water quality improvements within those impoundments. Implementation of the Old Trinity and Joppa Preserve ecosystem restoration projects would add wetlands and improve existing wetlands in the cumulative study area that should produce minor incremental water quality benefits.

AQUATIC RESOURCES

Cumulative impacts to aquatic habitat, fish and aquatic invertebrates that would be associated with any combination of reasonably forseeable projects in the Upper Trinity River Watershed would be minimal. Beneficial cumulative impacts to aquatic habitat, fish, and aquatic invertebrates would occur if the Environmental Quality alternative for the Dallas Floodway were to be implemented, along with implementation of the ecosystem restoration projects at the Joppa Preserve and the Old Trinity sites. Implementation of this scenario would not generate as many acres of surface waters as plans consisting of lakes between the Dallas Floodway levees, but the quality of the aquatic habitat created would be much higher. The higher quality aquatic habitat afforded by this scenario would promote the development of a healthy ecosystem and facilitate a more rapid return to environmental conditions characterized by a high species diversity of aquatic organisms.

WETLANDS

It appears that during the 1984 to 1996 period, acreage of emergent wetlands has increased in the study area (Table 3-4 of the PEIS). Table 4-1 of this Supplement shows the known direct gains or losses in acres of wetlands resulting from implementation of the slate of reasonably foreseeable projects. Most of the flood damage reduction projects identified have only a minor potential to cause direct impacts to wetlands. While the Dallas Floodway levee raise, primarily resulting from excavation of suitable fill from within the floodway, could impact low quality emergent wetlands, a proposal exists to mitigate these impacts. All the transportation projects, including the Trinity Tollway, new and modified railroad bridge crossings, and the proposed modification of several bridges crossing the Trinity could have direct adverse impacts on wetlands; however, due to the nature of the types, small size of the bridge corridor footprints and overall low quality of the existing wetlands these impacts would only be minor from a cumulative standpoint. The Dallas Master Implementation Plan scenario proposes creation of large acreage of wetlands. At this point, that plan is not well defined as to when or by which agency these wetlands would be developed. Some wetlands might ultimately be constructed as mitigation for Trinity Tollway impacts.

Interaction with high-density recreation and proposed nearby parkway traffic could reduce the vitality and function of those wetlands for other than water quality improvements. Other wetlands might be constructed as part of the EQ plan for the Dallas Floodway resulting from the Corps of Engineers Feasibility Study. The Environmental Quality plan would increase emergent wetland acreage and, in light of trends observed, the direct individual benefits would be significant but cumulatively would still be minor from a regional perspective. The two Corps of Engineers proposed ecosystem restoration projects under Section 1135 also include wetland development. The fill activities evaluated appear to have potential to induce cumulative losses of wetlands. Of the four individual permit applications evaluated, only two indicate that mitigation for wetland losses would be required. Overall, without mitigation, there would be a cumulative loss to wetlands, resulting from the all projects identified. Based upon the trends evaluated in the PEIS, however, and review of past Corps of Engineer permit actions, mitigation for the wetland losses will be required. If that occurs, cumulative impacts would be minor, primarily resulting from the relocation of these resources at a different site from where they occurred.

FLOODPLAIN FOREST RESOURCES

The trend analysis conducted as part of the PEIS (see Table 3-4 of the PEIS) clearly shows that forest resources within the 100-year and SPF floodplain of the Upper Trinity study area have been adversely impacted as the result of many independent actions. The impacts that would cumulatively result from implementation of alternatives considered during evaluation of the PEIS are shown in Figure 4-1 of the PEIS.

Additional cumulative positive benefits to bottomland hardwoods would result should the ecosystem restoration studies considered in this Supplement to the DFE EIS be implemented. In particular, the reasonably foreseeable ecosystem restoration projects at the Old Trinity River and Joppa Preserve would provide protection to riparian forest, not necessarily reversing the trend for loss of forested resources but at a minimum slowing the rate of decrease. The Dallas Floodway EQ plan would also provide moderate beneficial cumulative impacts. The other Floodway plans would each result in minor cumulative adverse impacts to forest resources. The quality of the woodlands within the floodway are low from most resource agency standards, however, their presence is highly beneficial to a number of other resources including fish and wildlife, aesthetics, water quality, and noise filtering. Forests are particularly valuable because of the long period of time required to develop to maturity, even under the best management scenarios. Wildlife usage of riparian forests has been quite well documented. In addition, there is extensive amount of research indicating the cumulative values of both larger contiguous forest size and linear forests without breaks. The Trinity Tollway alternatives with footprints falling on the existing Dallas Floodway would each extend downstream along or near the recommended alignment for the Lamar Levee identified for the DFE project. Each of these alternatives would remove 7 acres of bottomland forest. The DART SE corridor alignment could also result in the loss of 70 acres of forest, the majority of which has been identified within the White Rock Creek corridor. At this point in time, no specific mitigation plan has been identified for either of these two projects. Therefore, any losses or even these relatively low quality woodlands would increase patchiness and decrease size of forested areas, constituting a significant cumulative impact that would require mitigation.

The most significant resource within the proposed project area has been identified as the bottomland hardwood forest ecosystem located in an area referred to as the "Great Trinity Forest". While the proposed DFE project would impact only a small area of the forest, the proposed environmental mitigation plan would provide a catalyst to ultimate acquisition and management of 1,179 acres of the area which is either currently forested, or could be converted to bottomland hardwood forest through intensive management. In addition, the recommended environmental restoration project feature, which includes the development of emergent wetlands, would help reverse the trend to losses to this important resource, by restoring 123 acres.

Urbanization has greatly influenced land use patterns within the Dallas area. As additional runoff from upstream areas has increased the frequency of flooding within the study area, and as adjacent urbanization has continued, floodplain land use has shifted away from agriculture, except for a few areas of pastureland. The large floodplain areas adjacent to the river are zoned for industrial development, but with or without project, it is unlikely that substantial new development will occur in flood-prone areas due to extensive flooding and regulatory prohibitions that are currently in place. Past programs for voluntary removal of some residences and other structures in the more frequently flooded areas have also influenced floodplain land uses. Most abandoned floodplain areas have re-vegetated with grasses, followed by young forests. The proposed DFE project would significantly reduce remaining flood damages that occur within the project area. Most of the areas that would be impacted by the proposed project features are currently in private ownership and would be shifted to public open space with the project. Physical features of the project would directly impact some forestlands that have developed during the past 30 to 40 years; however, these losses would be mitigated, resulting in a larger area of preserved and reestablished floodplain forests.

All lands acquired as features of the DFE project, including the area between the proposed levees, the footprint of the project features, and the mitigation areas, would no longer be available for uses such as agricultural production or industrial use. These lands would remain in the floodplain as open space and would be available for public uses compatible with the project. The project would result in increased use of the floodplain lands for recreation. Recreation trails and flood compatible day use facilities would be developed through project lands and the habitat mitigation area. The City of Dallas plans more intensive recreation facilities certain areas within the lands required for the project, including athletic fields and a community center. Direct land use changes caused by the proposed DFE project would be compatible with floodplain functions and should have no negative effects on floodplain uses compared to conditions without the project.

The DFE project would provide reduction in damages to areas in both the Lamar Street and Cadillac Heights areas that are currently susceptible to flooding. The economic stimulus associated with the project, combined with the reduction in frequency and intensity of flood damages, would result in a higher order of economic use of the affected lands which would be afforded protection or which are adjacent to the project. Redevelopment would not be expected to occur all at once, but over a period of years. The most obvious changes would likely be in the form of redevelopment and reuse rather than direct change from one land use to another. Liability concerns for environmental contamination must be addressed prior to any major redevelopment. This would be largely the responsibility of the land developer(s) and would need to comply with both Environmental Protection Agency and Texas Commission on Environmental Quality requirements, as well as consistency with such programs as the "Brownfields" initiatives administered by those agencies. Although no specific proposals have been identified with any certainty, it is probable that any industrial redevelopment that may be induced will be "cleaner" than former industrial development in the study area.

With participation in the DFE project, or any Corps of Engineers project currently in the Feasibility Study phase that might go on to implementation, the City of Dallas would be required to prepare a comprehensive floodplain management plan which should address watershed land uses adjacent to and upstream of the project. A primary purpose of this comprehensive plan is to assure that future developments do not increase potential future flood damages. The floodplain management plan must address conditions of the project as assumed to be in-place, along with any other proposals, such as highways or commercial, residential, or industrial development. Any potential zoning changes proposed by the City of Dallas in preparing this comprehensive floodplain management plan should provide opportunity for public input.

TABLE 4-7. CUMULATIVE IMPACT ANALYSIS FOR ALTERNATIVES TO DALLAS FLOODWAY EXTENSION

Potentially Impacted Area or Resource	Flood Damage Reduction				Ecosystem Restoration			Transportation								Fill Activities				Recreation		
	Floodway Levee Raise (1) (9)	Stemmons Area (2)	Las Colinas levee Raise (3)	ATSF Bridge Modification (4)	Old Trinity (1)	Joppa Preserve (1)	Dallas Floodway (1)	Industrial (5)	Combined Riverside (5)	Split Riverside (5)	Split landside (5)	George Bush Seg. 4 (9)	TRE Bridge (6)	DART Southeast Corridor (6)	Other Floodway Bridges (7)	McCommas Bluff Landfill Extension (9)	Frasier Dam Modification	Basic Capitol Management (9)	Park / Ride Grand Prairie	Floodway Lake (10)	Texas Buckeye Trail (11)	Equestrian Center/Interpretive Center (11)
Water Quality	○	○	○	○	▲	▲	▲	○	○	▼	▼	○	○	○	○	○	○	▼	▼	○	○	○
Air Quality	○	○	○	○	○	○	▲	○	○	○	○	○	○	○	○	○	○	○	▲	○	○	○
Aquatic Resources	○	▲	○	○	▲	▲	▲	○	○	▼	▼	▼	▼	▼	○	○	▼	▼	▼	○	○	○
Wetlands	○	○	○	○	▲	▲	▲	○	▼	▼	▼	▼	○	○	▼	○	▲	▼	▼	○	▼	▼
Forested Resources	○	▲	○	○	▲▲	▲	▲▲	▼	▼	▼	▼	▲	▼	▼	▼	○	▼	▼	▼	▼	○	▼
Forested Resources (NED Plan)	○	○	○	○	○	▲	▲	▼	▼▼	▼▼	▼	○	▼	▼	▼	○	▼	▼	▼	▼	○	▼
Floodplain Recreation	▲	▲	○	▲	▲	▲	▲▲	○	○	○	○	○	○	○	○	○	○	○	○	▲▲	▲	▲
Natural Floodplain (EO 11988)	▲	▲	○	○	▲	▲	▲▲	○	▼	▼	▼	▼	○	▼	○	▼	▼	○	▼	▲	○	○
Public Services	○	▲	▲	▲	○	○	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲▲	▲	○	▲	▲	▲	▲
Environmental Justice	○	○	○	○	▲	▲	▲	○	○	▼	▼▼	○	○	▲	▲	○	○	○	▲	○	▲	▲
Upstream H & H	▼	▼	▼	▲	○	○	▼▼	○	▼	▼	○	▼	○	▼	▼	○	▼	▼	▼	▲▲	○	○
Downstream H & H	▲	▼	▼	▼	○	○	▲	○	▼	▼	○	○	○	▼	▲	○	○	▼	▼	▼	○	○
Flood Damages	▲▲	○	▲	▲	○	○	▼	○	○	○	○	▼	○	▼	▼	○	○	▼	▼	▲	○	▼
Aesthetics	○	▲	○	○	▲	▲	▲▲	○	▼	▼	▼	○	○	▼	▲	▼	○	○	▼	▲▲	▲	▼
Historic andCultural Resources	○	▼	▼	○	○	○	▼	▼	▼	▼	▼	○	○	○	○	○	▼	○	○	▼	○	○

Legend: ▼▼ Moderate Adverse Effects ▼ Slight Adverse Effects ○ No Affect ▲ Slight Beneficial Effects ▲▲ Moderate Beneficial Effects

Note: Applies to all alternatives in the Final Array of the DFE GRR/EIS, except differences as noted in table.
(1) Corps of Engineers Studies
(2) Elm Fork Floodplain Management Study / Dallas
(3) Dallas County Utility and Reclamation District
(4) Lower end of existing floodway
(5) Roadway footprint and excavation of borrow material
(6) Passenger / Light Rail
(7) Project Pegasus (I-30 and I-35), Sylvan, Commerce, Woodall Rodgers, Loop 12, Hampton, 183, Corinth
(8) Section 404 / 10 Authorities
(9) Including proposed mitigation
(10) Reasonably foreseeable, however, could be constructed in phases by different entities (e.g., Corps / City complete)
(11) NED Plan would impact the design and possibly location of these recreational plans, however the cumulative impact of these features to the area are mostly the same for all DFE and Floodway action alternatives

TABLE 4 - 7
CUMULATIVE IMPACT ANALYSIS

Redevelopment of adjacent neighborhoods and commercial and industrial areas would be cumulatively influenced by the Trinity Tollway project proposed to extend from Hwy 175 to the existing Dallas Floodway along the Lamar Street Levee alignment of the proposed DFE project. The number and location of access ramps, as well as aesthetic treatment and noise reduction measures that would be included with the Trinity Tollway will affect the type and extent of adjacent land use changes. The Federal Highway Administration, Texas Department of Transportation, and the North Texas Tollway Authority will address those effects as those agencies move forward with compliance under the National Environmental Policy Act. One certain effect of the proposed roadway project on land use in the project vicinity would be an economic stimulus resulting from construction. The economic effect of a roadway project on land use within the study area would occur even in the absence of the DFE project or any other proposed flood damage reduction project. The DFE project and a Trinity Tollway project together, however, would have a combined or cumulative effect on land use. The nature, location, and extent of land use changes or economic redevelopment that would occur cannot be predicted with certainty at this time. Economic development within the project study area will be greatly influenced by the City of Dallas' comprehensive floodplain management plan, by the City's Trinity River Corridor Comprehensive Land Use Plan (CLUP), and by features of the proposal for the Trinity Parkway as they move along in the planning and public involvement process.

PUBLIC SERVICES

The cumulative impacts of the reasonably foreseeable projects on public services considered changes in the need or ability of local governments to effectively provide for the safety and welfare of citizens and visitors to the immediate area of the Dallas Floodway and the Dallas Floodway Extension. Reduction in injury and life threatening events would be considered beneficial. Benefits would accrue if emergency services could be provided with minimal delay. Other public service benefits would accrue from protection of wastewater treatment plants and sanitary landfill facilities. Potential adverse cumulative impacts to public services would occur from public gatherings at events with insufficient facilities to accommodate health and safety needs.

ENVIRONMENTAL JUSTICE/COMMUNITY STRUCTURE

Cumulative effects on social, economic, and community well being within proposed project areas are difficult to measure because it requires a delineation of cause-and-effect between the multiple actions and the human communities of concern. Until sufficient scoping of all the project proposals and coordination with affected communities can be completed, only a preliminary discussion of cumulative effect is possible. Both structural and nonstructural alternatives need to consider existing directly affected socioeconomic resources within potential project areas, especially with regard to issues of environmental justice and potential adverse cumulative impacts to communities.

The project area of the Stemmons North Industrial District, now being studied under the Elm Fork Floodplain Management Study, is unlikely to produce any negative, long-term, cumulative impacts to socioeconomic conditions from implementation of the recommendations reviewed. The reduction of flood damages within this portion of the study area would encourage the development of additional businesses and industries in this area. Job growth is already high in this area and could potentially increase even more as additional work opportunities become available.

The consequences to socioeconomic conditions within the area of Feasibility Study for the Dallas Floodway would be generally beneficial to the region at large. Reduction of flooding events, environmental restoration, and development of public use facilities, would generally result in stabilized and slightly increased property values and reduced public and private emergency expenditures. The incorporation of recreational components into any of these projects would provide even greater benefit. Some potentially negative consequences to low-income and minority communities caused by relocations and buy-outs is possible, especially within the area of the Dallas Floodway if the proposed Trinity

Parkway were constructed. The environmental restoration component of the Dallas Floodway (EQ Plan) alone, without the parkway component, is unlikely to have these direct negative impacts. Cumulatively, with other possible projects proposed for the broad study area, the DFE project would result in an enhancement of the area through reductions in flood damages or the threat of flood damage and/or ecosystem restoration and would produce positive benefits for the future.

HYDROLOGY AND HYDRAULICS

Generally, any alternative within the study area that results in alteration of the flood carrying capacity causes direct, indirect and cumulative impacts to some other locations within the floodplain. The hydrology and hydraulic analysis evaluation conducted for the PEIS presented the results of new studies. That study took into consideration the known new construction within the floodplain and considered the recommended plan for Dallas Floodway Extension, including environmental mitigation and recreational development to be in place.

The hydrologic and hydraulic models used for this SEIS follow the same development rationale and the HEC-1 hydrologic models used for the SEIS are the same as the models used for both the DFE GRR/EIS and the PEIS. See Appendix A of this SEIS for explanation of models used. The HEC-2 models developed for the original DFE GRR/EIS alternatives were converted to the HEC-RAS model format and combined with the Upper Trinity CDC HEC-RAS model. This was done in the same manner that the Recommended Plan for the DFE project was combined with the various alternatives for the Dallas Floodway as described on Page A-9 under Dallas Floodway alternatives in the PEIS. Additionally, the same "future conditions" year 2050 hydrologic land use conditions were used to compute the data within this Supplement to the DFE GRR/EIS in order to maintain consistency with the data presented in the PEIS.

Data from several tables in Appendix A of this report and from Appendix A of the PEIS are presented in this section. Tables 4-8 through 4-12 present the hydraulic conditions and impacts (change in water surface elevations) from reasonably foreseeable projects in the Dallas Floodway compared to the final array of alternatives of the DFE GRR/EIS. Table 4-8 provides hydraulic conditions that were predicted based upon there being no Federal Action in the DFE project area for the 100-year and Standard Project Flood conditions. The "No Action" column in this table thus provides the baseline for evaluation of individual and cumulative impacts displayed in this and subsequent H&H tables. .

It was found in the PEIS that subtle differences exist between the various "Lakes" alternatives. For example, the parkways would be protected to the 100-year level, and therefore, they would have less reduction in the water surface than the lakes alone during the 100-year event. However, during the SPF event, the parkways would act as concrete lined channels and allow/cause the water to flow faster and therefore lower the water surface more than just the stand-alone lakes. Regardless, the "Lakes" alternatives are sufficiently similar from a hydraulic perspective so that they can be grouped together. This being the case, and taking into account the magnitude of the reductions in water surface elevations, for the 100-year event, the cumulative impact upstream of the Dallas Floodway would be less than the sum of the DFE and "Lakes" evaluated separately.

Changes to the water surface elevations for the Flood Damage Reduction Alternative are sufficiently small that the change will converge to zero within a relative short distance upstream of the Elm Fork/West Fork confluence. This alternative, when combined with the DFE project would have essentially no impact to the area upstream of the existing Dallas Floodway. Thus, the cumulative hydraulic impacts of the two projects would be similar to the sum.

The EQ plan, because of the additional forest and overbank resistance to flows, causes a significant rise to water surface elevations at the upstream end of the Dallas Floodway. The City's Elm Fork

TABLE 4-8 HYDRAULIC IMPACTS FOR DALLAS FLOODWAY REASONABLY FORESEEABLE ACTIONS, AT SELECTED TRINITY RIVER LOCATIONS, WITH "NO ACTION" AS THE DFE PROJECT (2050 HYDROLOGY)

100-year Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	424.12	423.96	-0.16	423.57	-0.55	423.61	-0.51	423.49	-0.63	425.30	1.18
Hampton	421.87	421.72	-0.15	421.37	-0.50	421.42	-0.45	421.24	-0.63	422.99	1.12
Commerce	419.40	419.29	-0.11	418.91	-0.49	418.92	-0.48	418.94	-0.46	420.42	1.02
DART Rail	417.61	417.56	-0.05	417.49	-0.12	417.49	-0.12	417.50	-0.11	417.59	-0.02
SH 310	410.80	410.8	0.00	410.83	0.03	410.83	0.03	410.82	0.02	410.74	-0.06
S Loop 12	403.14	403.15	0.01	403.19	0.05	403.19	0.05	403.17	0.03	403.07	-0.07

SPF Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	436.14	436.09	-0.05	435.10	-1.04	435.11	-1.03	435.17	-0.97	437.89	1.75
Hampton	434.00	433.92	-0.08	432.98	-1.02	432.98	-1.02	433.06	-0.94	435.75	1.75
Commerce	430.72	430.63	-0.09	429.84	-0.88	429.82	-0.90	429.96	-0.76	432.39	1.67
DART Rail	427.55	427.14	-0.41	427.27	-0.28	427.27	-0.28	427.26	-0.29	427.41	-0.14
SH 310	421.98	421.95	-0.03	422.09	0.11	422.09	0.11	422.09	0.11	421.85	-0.13
S Loop 12	411.78	411.75	-0.03	411.92	0.14	411.92	0.14	411.91	0.13	411.63	-0.15

Change reflects the differences in water surface elevations from the No Action water surface at the referenced location. A negative change represents a decrease in water surface elevation.

No Action Column provides water surface elevations related to No alternatives being implemented in Dallas Floodway area

TABLE 4-9 HYDRAULIC IMPACTS FOR DALLAS FLOODWAY REASONABLY FORESEEABLE ACTIONS, AT SELECTED TRINITY RIVER LOCATIONS, WITH "NED PLAN" AS THE DFE PROJECT (2050 HYDROLOGY)

100-year Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	422.87	422.62	-0.25	422.35	-0.52	422.37	-0.50	422.23	-0.64	424.18	1.31
Hampton	419.74	419.46	-0.28	419.19	-0.55	419.25	-0.49	418.95	-0.79	421.16	1.42
Commerce	415.80	415.57	-0.23	415.17	-0.63	415.17	-0.63	415.10	-0.70	417.47	1.67
DART Rail	412.26	412.21	-0.05	412.16	-0.05	412.16	-0.10	412.13	-0.13	412.24	-0.02
SH 310	407.17	407.17	0.00	407.19	0.02	407.20	0.03	407.19	0.02	407.10	-0.07
S Loop 12	403.36	403.36	0.00	403.39	0.03	403.39	0.03	403.38	0.02	403.28	-0.08

SPF Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	434.20	434.09	-0.11	433.07	-1.13	433.12	-1.08	433.09	-1.11	435.97	1.77
Hampton	431.37	431.23	-0.14	430.21	-1.16	430.27	-1.10	430.22	-0.15	433.20	1.83
Commerce	426.78	426.64	-0.14	425.58	-1.23	425.58	-1.20	425.72	-1.06	428.83	2.05
DART Rail	421.83	421.69	-0.14	421.60	-0.23	421.60	-0.23	421.60	-0.23	421.67	-0.16
SH 310	417.24	417.21	-0.03	417.34	0.10	417.35	0.11	417.35	0.11	417.10	-0.14
S Loop 12	412.24	412.21	-0.03	412.34	0.10	412.34	0.10	412.34	0.10	412.09	-0.15

TABLE 4-10. HYDRAULIC IMPACTS FOR DALLAS FLOODWAY REASONABLY FORESEEABLE ACTIONS, AT SELECTED TRINITY RIVER LOCATIONS, WITH "LPP" (RECOMMENDED PLAN) AS THE DFE PROJECT (2050 HYDROLOGY)

100-year Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	423.39	423.23	-0.16	422.86	-0.53	422.89	-0.50	422.75	-0.64	424.66	1.27
Hampton	420.70	420.51	-0.15	420.19	-0.51	420.24	-0.46	419.98	-0.72	421.99	1.28
Commerce	417.56	417.51	-0.05	417.05	-0.51	417.06	-0.50	417.01	-0.55	418.87	1.31
DART Rail	415.12	415.12	0.00	415.02	-0.10	415.02	-0.10	415.01	-0.11	415.10	-0.02
SH 310	407.62	407.62	0.00	407.64	0.02	407.64	0.02	407.63	0.01	407.54	-0.08
S Loop 12	403.35	403.35	0.00	403.39	0.04	403.39	0.04	403.38	0.03	403.26	-0.09

SPF Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	435.56	435.71	0.15	434.43	-1.13	434.47	-1.09	434.50	-1.06	437.32	1.76
Hampton	433.24	433.43	0.19	432.10	-1.14	432.14	-1.10	432.18	-1.06	435.01	1.77
Commerce	429.66	429.94	0.28	428.63	-1.03	428.65	-1.01	428.78	-0.88	431.42	1.76
DART Rail	426.24	426.19	-0.05	425.89	-0.35	425.89	-0.35	425.88	-0.36	426.07	-0.17
SH 310	418.08	418.04	-0.04	418.16	0.08	418.17	0.09	418.16	0.08	417.93	-0.15
S Loop 12	412.30	412.27	-0.03	412.40	0.10	412.40	0.10	412.40	0.10	412.16	-0.14

TABLE 4-11 HYDRAULIC IMPACTS FOR DALLAS FLOODWAY REASONABLY FORESEEABLE ACTIONS, AT SELECTED TRINITY RIVER LOCATIONS, WITH NON-STRUCTURAL/STRUCTURAL PLAN AS THE DFE PROJECT (2050 HYDROLOGY)

100-year Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	423.26	423.04	-0.22	422.73	-0.53	422.75	-0.51	422.61	-0.65	424.54	1.28
Hampton	420.46	420.24	-0.22	419.94	-0.52	419.99	-0.47	419.72	-0.74	421.78	1.32
Commerce	417.15	416.98	-0.17	416.62	-0.53	416.62	-0.53	416.57	-0.58	418.54	1.39
DART Rail	414.51	414.45	-0.06	414.42	-0.09	414.42	-0.09	414.40	-0.11	414.49	-0.02
SH 310	407.61	407.62	0.01	407.65	0.04	407.65	0.04	407.64	0.03	407.55	-0.06
S Loop 12	403.35	403.35	0.00	403.39	0.04	403.39	0.04	403.38	0.03	403.27	-0.08

SPF Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	434.93	434.79	-0.14	433.79	-1.14	433.82	-1.11	433.83	-1.10	436.64	1.71
Hampton	432.40	432.20	-0.20	431.23	-1.17	431.26	-1.14	431.27	-1.13	434.12	1.72
Commerce	428.43	428.20	-0.23	427.31	-1.12	427.30	-0.13	427.43	-1.00	430.20	1.77
DART Rail	424.47	424.18	-0.29	424.15	-0.32	424.15	-0.32	424.15	-0.32	424.32	-0.15
SH 310	418.05	418.02	-0.03	418.16	0.11	418.17	0.12	418.16	0.11	417.91	-0.14
S Loop 12	412.30	412.27	-0.03	412.40	0.10	412.40	0.10	412.40	0.10	412.16	-0.14

TABLE 4-12 HYDRAULIC IMPACTS FOR DALLAS FLOODWAY REASONABLY FORESEEABLE ACTIONS, AT SELECTED TRINITY RIVER LOCATIONS, WITH "TFSP" AS THE DFE PROJECT (2050 HYDROLOGY)

100-year Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	423.44	423.24	-0.20	422.92	-0.52	422.94	-0.50	422.80	-0.64	424.70	1.26
Hampton	420.78	420.58	-0.20	420.28	-0.50	420.33	-0.45	420.08	-0.70	422.05	1.27
Commerce	417.70	417.55	-0.15	417.21	-0.49	417.21	-0.49	417.16	-0.54	418.99	1.29
DART Rail	415.32	415.27	-0.05	415.23	-0.09	415.23	-0.09	415.22	-0.10	415.30	-0.02
SH 310	407.61	407.62	0.01	407.65	0.02	407.65	0.04	407.64	0.03	407.55	-0.06
S Loop 12	403.35	403.35	0.00	403.39	0.03	403.39	0.04	403.38	0.03	403.27	-0.08

SPF Water Surface Elevations (ft.)

Location	No Action	FDR	Change	Pkwy 1side	Change	Lakes/Split Pkwy	Change	Lakes only	Change	EQ	Change
Confluence	434.93	434.79	-0.14	433.79	-1.14	433.82	-1.11	433.83	-1.10	436.64	1.71
Hampton	432.40	432.20	-0.20	431.23	-1.17	431.26	-1.14	431.27	-1.13	434.12	1.72
Commerce	428.43	428.20	-0.23	427.31	-1.12	427.30	-0.13	427.43	-1.00	430.20	1.77
DART Rail	424.47	424.18	-0.29	424.15	-0.32	424.15	-0.32	424.15	-0.32	424.32	-0.15
SH 310	418.05	418.02	-0.03	418.16	0.11	418.17	0.12	418.16	0.11	417.91	-0.14
S Loop 12	412.30	412.27	-0.03	412.40	0.10	412.40	0.10	412.40	0.10	412.16	-0.14

proposals could then further increase the 100-year water surface elevation, and thus, the cumulative impacts may slightly exceed the sum of the two projects when evaluated separately. A project scenario such as this would most definitely require other hydraulic mitigation measures, which have yet to be determined.

As indicated by the hydrologic and hydraulic analysis for the Recommended Plan for the DFE, valley storage changes in the project reach would result from both the reduction of peak water surface elevation and the function of levees blocking floodwater access to the areas of the floodplain that would be protected by the levees. The analysis indicates that a reduction in the valley storage in the project reach would result in an increase in the peak discharges. This increase has been computed and is expressed in terms of an increase in the peak water surface profile downstream of the project. The water surface profile elevations would be increased an average of 0.15 feet for the 1 percent chance flood (100-year) and 0.3 feet for the SPF. Based on the small increases downstream of the DFE and the very limited potential for flood damages downstream of the project, a variance from the criteria requiring mitigation for reduction of valley storage based upon the Trinity River Environmental Impact Statement Record of Decision (ROD) has been considered and approved by the District Engineer for the Recommended Plan for the DFE project.

The cumulative effects of the various Dallas Floodway alternatives combined with alternatives downstream in the DFE study area and the results of the hydrologic and hydraulic analysis are discussed in the PEIS. These results are presented in terms of the individual project's impacts to the water surface profiles and flow velocities both upstream and downstream. In general, the data presented indicates that a project which raises the water surface profile upstream of the project results in lowering the water surface profile downstream of the project and vice versa due to the valley storage losses or gains resulting from implementation of the project. These phenomena are also observable in the additional data presented herein and the reasons are essentially the same as those discussed in the PEIS and will not be repeated here. Reference the PEIS for discussion of the valley storage effects of the various Dallas Floodway alternatives. However, one important conclusion can be drawn from the additional data presented in this Supplement. The relative scale of the effects both upstream and downstream for each of the Dallas Floodway alternatives when compared to the No Action Plan for the Dallas Floodway and combined with the final array of alternatives for DFE is very similar to those observed in the PEIS. In fact, the results show that all of the alternatives of the Dallas Floodway cause relatively insignificant impacts downstream. For example, the 100-year water surface (WS) elevation difference for the Recommended Plan DFE/FDR Plan combination in the PEIS is -0.16 ft. and the 100-year WS elevation difference for the No Action DFE/FDR Plan combination is –0.16 ft at the West Fork / Elm Fork confluence. The same comparison for the SPF WS elevation is 0.15 ft. for the Recommended Plan DFE/FDR Plan and is –0.05 ft. for the No Action DFE/FDR Plan. One should keep in mind that all of the data presented in the PEIS includes the Recommended Plan for DFE.

The data also indicates that the difference in the scale of the upstream water surface elevation impacts compared to the downstream impacts of the Dallas Floodway alternatives is quite high. This difference is observed in some cases higher than a 10:1 ratio upstream to downstream which means that an alternative that raises the water surface elevation upstream from the project of about 1.0 foot will generally result in lowering the water surface downstream of about 0.1 feet or less. This same hydrologic and hydraulic phenomenon is observed in the DFE alternatives and works to a distinct advantage for the DFE Recommended Plan which results in lowering the water surface elevation upstream in the Dallas Floodway reach significantly where extremely high flood damage values are located and raises flood levels downstream an insignificant amount where very low flood damage values exist.

Cumulative impacts can also be observed in the data when comparing the same plan for Dallas Floodway with various alternatives for the DFE. For example, the SPF water surface (WS) elevation comparison upstream of the EQ Plan at the West Fork/Elm Fork Confluence for the EQ Plan/No Action DFE combination with the EQ Plan/Recommended Plan in DFE combination equals –0.57 (437.32 - 437.89) and the same comparison downstream at Loop 12 would equal 0.53 (411.63 – 412.16). This comparison yields the results of adding the Recommended Plan for DFE if the EQ Plan were implemented first.

Almost identical results are obtained comparing the No Action in Dallas Floodway/No Action DFE combination and the No Action in Dallas Floodway/Recommended Plan for DFE combination.

Another way of using the data in a cumulative way would be to compare the implementation of two plans simultaneously in both the Dallas Floodway and the DFE area with the No Action Plan for both areas (Existing Conditions). Using the data in the previous example would yield an upstream elevation change for the SPF water surface at the West Fork/Elm Confluence of +1.18 (437.32 – 436.14) and a downstream change at Loop 12 of +0.38 (412.16- 411.78). This example yields the impacts of implementation of the EQ Plan and the Recommended Plan for DFE compared with existing conditions.

Based upon the evaluations conducted for the DFE GRR/EIS and PEIS, it appears that based upon all known reasonably foreseeable projects there would be potential for cumulative impacts to flood elevations both upstream of the Dallas Floodway and downstream of the Floodway Extension. All project proposals currently under investigation, including the Dallas Floodway Feasibility Study and the Trinity Tollway EIS, must take those potential cumulative effects into account. Plan formulation, selection, and design of all reasonably foreseeable projects must account for and must mitigate any determined adverse hydrologic and hydraulic effects.

Since it is would be impossible to combine plan features occupying the same space or that otherwise may have conflicting purposes, it is also not possible to view the hydrologic and hydraulic impacts of these preliminary individual plans developed for the Dallas Floodway as additive. For example, if it was found that one plan raised the water surface one foot at a point and another plan lowered the water surface at the same point the same amount then it might be construed that if the plans were combined the net effect would be approximately no change. This would be invalid because combining plans in most cases would require significant modification to either plan. However, the data provides indications to the overall effects of these types of projects and is valuable in the planning process for ultimately developing multiple purpose recommendations or plans that may individually provide several types of benefits and provide the most efficient means of satisfying the needs of the region both economically and environmentally. It is therefore likely, based on the findings of this data, that a combination of the various features of the reasonably foreseeable actions could be developed to produce an overall plan which results in very insignificant hydraulic impacts both upstream and downstream while providing many of the desired benefits. Some specifics of this process would be that since levee raises impact the design of a riverside Parkway reliever route, the Parkway could be located closer to the river to allow for riverside levee fill required to raise the levees. Also for example, floodplain recreational lakes that tend to lower water surface elevations could be used in some locations while forested areas as in the EQ Plan, that tend to raise water surface elevations could be used in other areas to compensate.

AESTHETICS

The Dallas Floodway alternatives, which would include a Parkway in association with the levees, would have moderate adverse impact on aesthetics as these hard-surface engineered features detract from remnant natural floodplain features. From a natural perspective, positive cumulative aesthetic impacts would result from implementation of the EQ and Lakes only alternative within the Dallas Floodway and from the Lakes alternative with the Parkway located at an alternate site such as the Industrial Boulevard alignment.

CULTURAL RESOURCES

Cumulative effects on cultural resources can be generally considered as limited with regard to individual Federal actions because of the nature of the resources and the actions. Properties that are eligible or listed in the National Register of Historic Places are accounted for and preservation actions would be taken on each property as the effects are identified. However, multiple actions by several agencies over time, and sometimes-separate State or privately sponsored activities within the same areas, have the potential for cumulative negative effects on the broad range of cultural resources. There is a potential for cumulative impacts within the Dallas Floodway project area associated with any of the alternatives being considered. Any of the alternatives likely would encourage development adjacent to the floodway area. Resources which could be impacted in this project area are the archeological resources which may be present in areas where no survey effort has been completed or is required, buildings and structures which may or may not have been identified as significant, and properties of traditional importance to Native American Indian tribes or other traditional groups.

Construction in the Stemmons North Industrial District could produce adverse cultural resources impacts similar to those associated with the Dallas Floodway project area. Providing additional flood protection within the Stemmons area would encourage development in the protected area. Resources which could be impacted in this project area are the archeological resources which may be present in areas where no survey effort has been completed or is required, buildings and structures which may or may not have been identified as significant, and possibly properties of traditional importance to Native American Indian tribes or other traditional groups. Cumulatively, projects in the Dallas Floodway, Stemmons North Industrial District, and the Trinity Parkway routes, have potential to directly impact built architectural and engineering properties. Mitigation of cultural resources that would be impacted by any aspect of the Federal projects would be required. A programmatic agreement to address types of studies needed and actions necessary to mitigate cultural resource losses has been developed by the Corps of Engineers agreed upon by the SHPO to address Corps of Engineers actions.

Any impacts to cultural and historical resources would be mitigated, according to provisions of the National Historic Preservation Act. Therefore, the proposed federal actions would make no contributions to cumulative impacts of the area.

NOISE

All noise impacts directly attributable to the DFE project would be temporary in nature. Levees would tend to interfere with the distribution of some noises. Roadway traffic noise associated with proposed tollway alignments, bridge upgrades or replacements, and other transportation proposals in the study area must be evaluated by the Federal Highway Administration, TXDOT, NTTA, or other entities as appropriate. The recommended DFE project would not contribute to cumulative noise impacts.

ENVIRONMENTAL COMPLIANCE

The President's Council on Environmental Quality's Regulations for Implementing the Procedural Provisions of the National Environmental Act require that Environmental Impact Statements list all Federal permits, licenses, and other entitlements which must be obtained in order to implement a proposal. If it is uncertain whether or not any permits, licenses, or other entitlements are required, the EIS must state that as well. The GRR/EIS for the DFE lists those requirements for the DFE project. This section addresses the requirements, to the extent that they are known, for other reasonably foreseeable projects in the study area.

ENDANGERED SPECIES

Several federally protected species may occasionally migrate through the proposed project area. It is known that the Black-capped vireo nests in southwestern Dallas County within the juniper forested area associated with that area. In addition, least tern has been documented nesting within the Southside Wastewater Treatment facility grounds several miles southeast of the Dallas within the mainstem Trinity River floodplain. Preliminary evaluation of the reasonably foreseeable proposals in the study area indicates that none would affect federally listed threatened or endangered species or their critical habitat. Each would have to be evaluated on a case-by-case and site-specific basis as planning progresses.

EXECUTIVE ORDER 11988

Executive Order 11988 was considered in preparation of this Supplement. The objective of the EO is to avoid, to the extent possible, long and short-term adverse impacts associated with occupancy and modification of the base floodplain. Further objectives are the avoidance of direct and indirect support of development in the base floodplain wherever there is a practicable alternative and protection and restoration of natural floodplain functions. Feasible alternatives may remain that need to be further evaluated prior to final determination of whether activities proposed within the 100-year floodplain of the Trinity River are compliant with the Executive Order. Corps of Engineers regulations for implementing EO11988 (ER 1165-2-26) defines the base floodplain as the one percent chance, or 100- year floodplain. For the most part, lakes and wetland features and flood damage reduction measures are required to be located within the floodplain to provide their intended function. Parkways, recreational features and associated support do not need to be located within the floodplain to fulfill their basic purposes. Additional analysis will be required of the Corps of Engineers and other Federal decision agencies prior to final determination of compliance of various project alternatives with this Executive Order. Review of policy issues associated with the various project proposals being investigated will continue to assure compliance with Executive Order 11988 directives.

SECTION 202(C) OF THE WATER RESOURCES DEVELOPMENT ACT OF 1996

This guidance requires the preparation of a comprehensive Floodplain Management Plan (FPMP) by the local sponsor for any projects that are cost shared with the Corps of Engineers. This requirement will have future floodplain impacts within the study area. The project sponsor of Corps of Engineers projects is required to develop a FPMP within one after the signing of the Project Cooperation Agreement, and then implement the plan within one year after completion of construction of the project. Thus, the City of Dallas, as cost sharing sponsor for the Dallas Floodway Extension, is required to complete a FPMP for that project prior to the development of any additional Corps of Engineers projects within their area of jurisdiction.

SECTION 176(C) CLEAN AIR ACT

Federal agencies are required by this Act to review all air emissions resulting from Federal funded projects or permits to insure conformity with the State Implementation Plans in non-attainment areas. The Dallas/Fort Worth Metropolitan Area is a non-attainment area.

SECTION 404 CLEAN WATER ACT

Congress under Section 404 of the Clean Water Act (33 USC 1344) has directed the Corps of Engineers to regulate the discharge of dredge and fill material into all waters of the United States including adjacent wetlands. The intent of Section 404 is to protect the nation's waters from indiscriminate discharge of material capable of causing pollution, and to restore and maintain the chemical, physical and biological integrity of these areas. Although the Corps of Engineers does not issue itself permits for proposed activities that would affect waters of the United States, the Corps of Engineers must meet the legal requirements of the Act.

Each of the potential projects of others in this Supplement to the DFE EIS must be evaluated on its own merits as alternatives are selected and plans are developed. At this point, it is presumed that any of the Dallas Floodway project alternatives would impact jurisdictional areas, including wetlands, and would result in a requirement for the Corps of Engineers to conduct and incorporate Section 404(b)(1) analyses into subsequent NEPA and agency decision documents.

SECTIONS 9 AND 10 RIVERS AND HARBORS ACT

Section 9 (33 USC 401) and Section 10 (33 USC 403) of the Rivers and Harbors Act of 1899 direct the Corps of Engineers to regulate all work or structures in or affecting the course, condition, or capacity of navigable water of the United States. Since no alternative evaluated considers construction of a dam across a navigable waterway, Section 9 need not be considered further. The mainstem Trinity River at Dallas is navigable, as is the West Fork upstream to Riverside Drive; however, no commercial navigation occurs on the Upper Trinity. The Elm Fork is also not navigable and provided activities within the

Stemmons area do not induce direct or cumulative impacts downstream on the mainstem, then the activities at Stemmons would be in compliance with Section10.

Project proposals within the Dallas Floodway would have minimal affect on navigation. The footprint of most features would lie within the floodplain adjacent to the mainstem. The construction of a split channel around the lakes and recreational features would cause some impacts to the recreational navigation that occurs on the mainstem. Most of these impacts would be temporary in nature occurring during the construction. Further evaluation of all mainstem alternatives would be required to determine compliance with Section 10.

EXECUTIVE ORDER 11990 - PROTECTION OF WETLANDS

In addition to Section 404 and Executive Order 11988, Executive Order 11990 for Protection of Wetlands was considered during the evaluation of proposed projects. The purpose of this Executive Order is to assure that Federal Agencies in the process of carrying out their missions, take all reasonable action to preserve and protect the functional values of wetlands. Further evaluation will be necessary for proposals within the existing Dallas Floodway as the proposals evaluated in this Supplement would clearly impact jurisdictional areas including wetlands.

SECTION 106 OF THE NATIONAL HISTORIC PRESERVATION ACT

Assessment, avoidance, and potentially, mitigation, of resources identified during future studies that would be impacted by any aspect of the federal projects would be required. For purposes of Section 106 of the National Historic Preservation Act, a programmatic agreement to address types of studies needed and actions necessary to mitigate cultural resource losses is being pursued with the Texas SHPO and Advisory Council on Historic Preservation. Other groups are being consulted with regarding potential properties of traditional significance.

FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act requires the Corps of Engineers to coordinate with the U.S. Fish and Wildlife Service on water resources related projects to obtain their views toward preservation of fish and wildlife resource values and mitigation of unavoidable impacts. The Fish and Wildlife Service has provided information that was utilized during the planning of the DFE project and has assisted in the early planning process for other projects being studied by the Corps of Engineers. Subsequent detailed studies, including development of appropriate fish and wildlife resources mitigation plans, will be conducted with the U. S. Fish and Wildlife Service prior to recommendation of any specific project alternatives for construction authorization.

CORPS OF ENGINEERS HABITAT MITIGATION PROCESS

The Corps of Engineers has established a goal of no net loss of resource value for bottomland hardwoods as a part of the planning process. This goal is similar to the mitigation objectives established by the Fish and Wildlife Service as part of its mitigation policy. In light of the cumulative impacts to forested resources in the study area, particularly within the 100-year floodplain, the Corps of Engineers will continue within its planning process to minimize impacts to bottomland hardwoods and to fully mitigate unavoidable losses. The Corps of Engineers will continue to pursue projects such as, wetland restoration associated with the Dallas Floodway Extension, and ongoing ecosystem restoration activities under the Continuing Authorities Program, including Section 1135. Coordination will continue with resource agencies to determine the most efficient use of program resources to maximize forested resource benefits. In particular, efforts will be pursued to minimize fragmentation of forests and to restore linear corridors of sufficient width to be utilized by migratory songbirds and local wildlife.

Recent trends indicate that emergent wetland resources are being conserved or compensatory mitigation has been appropriately required within the study area. Similar to the Corps of Engineers' mitigation policy for bottomland hardwoods, forested wetlands, and riparian corridors, Corps of Engineers policy specifies no net loss of wetlands. Resource values of emergent wetlands will be considered during the Corps of Engineers planning process. Wetland restoration in addition to mitigation of unavoidable losses will continue to be supported as project features for Corps of Engineers projects. Environmental mitigation under Department of the Army permitting for Section 404 and Section 10 activities within the study follow mitigation guidelines established in the Record of Decision (ROD) for the TREIS.

HYDROLOGY AND HYDRAULICS MITIGATION

The ROD for the Trinity Regional EIS applies to all project actions requiring a permit under Section 10 or Section 404 within the Standard Project Flood (SPF) floodplain of the study area. The ROD established criteria for minimizing cumulative impacts to hydrology and hydraulics.

The TREIS raised awareness that a large area of floodplain lands within the Upper Trinity River could be developed outside the jurisdiction of the Corps of Engineers and that if developed following only FEMA requirements, significant increases in flooding frequency and extent would continue to occur in adjacent and downstream areas. Subsequently, the Corridor Development Certificate (CDC) process was developed as a means to address those floodplain actions that were not within the jurisdictional areas administered by the Corps of Engineers.

CHAPTER 5 – PUBLIC INVOLVEMENT/COORDINATION

The Final General Reevaluation Report for Dallas Floodway Extension (February 1999) and the Final Programmatic Environmental Impact Statement for the Upper Trinity Basin (June 2000) contain extensive discussions of public involvement associated with the investigations for those documents. Incorporated herein by reference as allowed by the CEQ regulations for implementing NEPA (40 CRF Part 1508) are the discussions of public involvement contained in the aforementioned documents. Those documents should be referenced in order to understand the full context of public involvement that has occurred relative to the DFE project and cumulative impacts within the entire Upper Trinity River Basin. A summary of the public involvement process just for this Supplement to the EIS for the Dallas Floodway Extension follows.

SCOPING

A Notice of Intent to prepare a Supplement to the Environmental Impact Statement appeared in the Federal Register on June 28, 2002. On July 3, 2002, interested individuals and agencies were mailed notices of the initiation of the public scoping process and date and location of the scoping meeting. A notice was also placed in the Dallas Morning News on July 14 providing the location, date, and time of the scoping meeting. The Public Scoping Meeting was held on July 16, 2002, at the Ramada Plaza Hotel, 1011 South Akard Street, Dallas, Texas.

Forty-five individuals signed the attendance list for the meeting. Following a brief presentation discussing the background reasons for holding the scoping meeting and the information the Corps of Engineers desired to receive through the process, participants were given the opportunity to review separate displays within the room documenting the location of proposed projects in the geographic area that the Corps of Engineers believed should be considered for identification and assessment of cumulative impacts. The public was afforded the opportunity to provide information regarding these projects, other projects known to them that they believed should be considered and the types of impacts and resources that would be impacted that should be considered in the supplemental EIS. The scoping meeting was held to provide several means for individuals to provide meaningful comment. Open discussion with Corps of Engineers project team members familiar with the Dallas Floodway Extension project was encouraged. In addition, notebooks at each display were available for individuals to list other projects or items that should be considered. Oral statements could be made to a Court Reporter present at the scoping meeting and written statements could be presented at the meeting or later by mail. The scoping period was open until August 31, 2002.

During the Scoping Meeting, six individuals left formal comments with the court reporter. A common theme of all comments received was that the format of the meeting was inhibitory to public participation because it did not provide for open public comment. Several comments expressed a desire for the Supplement to the EIS to reopen the evaluation of alternatives to the DFE. One commenter suggested that the geographic study area cannot be defined by strict boundaries as it relates to hydraulics and hydrology. Projects identified as having cumulative effects that should be examined included the Trinity River Corridor Master Implementation Plan, a Tollway along the West Fork, the Northwest Corridor MIS, the Southeast Corridor MIS, Raising the existing Dallas Floodway Levees by Two Feet, Trinity Parkway, Trinity Tollway, Woodall Rodgers Bridge, Stemmons North Industrial District, Great Trinity Forest Master Plan, Dallas Open Space Plan, Trinity River Bridge Replacements, Ecosystem Restoration Projects, Levees around McCommas Bluff Landfill, Section 404 Fill Permits in Dallas County, and lack of protection to development along White Rock Creek afforded by the Lamar Levee.

Ten written comments were received during the open scoping period. The USFWS stated that projects affecting the watershed, not just the floodplains, should be considered. The attorney for the plaintiffs expressed a number of concerns similar to those in the motion to the Court for the Northern District. The Federal Highway Administration referred the Corps of Engineers to TXDOT and to a listing of about 500 bridges that cross the Trinity River and its tributaries in the hydraulic study area. The Trinity Improvement

Association expressed support for the need for the DFE project and provided information on two potential reasonably foreseeable projects. DCURD expressed concern about the loss and the potential to lose the existing level of flood damage protection for investments within the Las Colinas development. Dallas City Packing requested consideration of slight modification to the proposed Cadillac Levee alignment to minimize disruption to its operations. Four individuals provided information on several activities that they believed should be considered as reasonably foreseeable projects. Individual commenters stated that the Supplement to the DFE EIS should go beyond what the court ordered and use the supplement as a means to disclose a wide variety of specific information about the proposed tollroad including maintenance costs and to include benefits of actions such as voluntary buyouts of Cadillac Heights and raising the elevation of the top of the existing Dallas levee system. One individual also requested that the Corps of Engineers should reevaluate alternatives to the DFE and to conduct the cumulative impact assessment without assuming DFE to be in place.

Overall the comments during the scoping process identified air quality, water quality, recreational, historic and cultural sites and the Great Trinity River and other bottomland hardwood resources such as high quality wildlife habitat, as environmental resources on which the effects of cumulative actions should be evaluated.

To gather additional information on future foreseeable actions that were not presented by meeting participants, letters were sent to federal agencies and state and local government offices, including private and public transportation offices requesting information from them on future projects that might have cumulative impacts to the DFE project. Follow-up telephone calls were made to Dallas Area Rapid Transportation and Dallas District Texas Department of Transportation. Meetings were held with North Texas Tollroad Authority, City of Dallas and the Dallas District TXDOT office. Agency coordination was also conducted to identify projects that were authorized by either Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbor Act since December of 1999, or for which applications have been received but have not been processed to date within a nine county area including Dallas and upstream counties through which flows the West Fork, Clear Fork Elm Fork, Main Stem or tributaries to these segments.

COORDINATION MEETINGS RELATED TO SCOPING

Trinity Interagency Executive Committee Meeting

This is a monthly meeting used to coordinate and update each participating agency on the status of on-going activities along the Trinity River Corridor within the City of Dallas. The agencies which attend this meeting are: City of Dallas, Corps of Engineers (SWF and SWD), Texas Department of Transportation, Texas Commission on Environmental Quality (TCEQ), Dallas County, Environmental Protection Agency (EPA), North Texas Tollway Authority (NTTA), and the North Central Texas Council of Governments (NCTCOG). These monthly meetings started in 1996.

Project Pegasus Work Group Meeting

The agencies attending this monthly meeting are: Texas Department of Transportation, Texas Transportation Institute, North Texas Tollway Authority (NTTA), Dallas Area Rapid Transit (DART), North Central Texas Council of Governments, Federal Highway Administration, Corps of Engineers, and the consultants performing the work. This project is the design and future construction/rebuild of the I-30 and I-35E highways in Dallas. This includes the rebuild of the interstate highway bridges crossing the existing Dallas Floodway. These meetings started in 2001.

Southern Gateway Work Group Meeting

The agencies attending this monthly meeting are: Texas Department of Transportation, Texas Transportation Institute, Dallas Area Rapid Transit (DART), North Central Texas Council of Governments, Federal Highway Administration, Environmental Protection Agency (EPA), City of Cedar Hill, City of Lancaster, Corps of Engineers, and the consultants performing the work. This project is the IH 35E/US 67 MIS/Preliminary Engineering in southern Dallas County. These meetings started in 2001.

Loop 12/IH 35E Corridor MIS Work Group Meeting
The agencies attending this meeting are: Texas Department of Transportation, Texas Transportation Institute, Dallas Area Rapid Transit (DART), North Central Texas Council of Governments, Federal Highway Administration, Environmental Protection Agency (EPA), City of Irving, City of Dallas, Dallas County, Corps of Engineers, and the consultants performing the work. This project is the Loop 12 / IH 35E MIS/Preliminary Engineering in the cities of Dallas and Irving. These meetings started in 1998 as monthly meetings and are now held quarterly.

SH 183 Corridor MIS Work Group Meeting
The agencies attending this meeting are: Texas Department of Transportation, Texas Transportation Institute, Dallas Area Rapid Transit (DART), North Central Texas Council of Governments, Federal Highway Administration, Environmental Protection Agency (EPA), City of Irving, City of Dallas, Dallas County, Corps of Engineers, and the consultants performing the work. This project is the SH 183 Preliminary Engineering and Environmental Assessment in the city of Irving. These meetings started in 1998 as monthly meetings and are now held quarterly.

DRAFT SUPPLEMENT 1 TO THE DFE EIS

Notice of Availability of the Draft Supplement was published in the Federal Register on December 6, 2002, establishing a comment period that was originally scheduled to end on January 21, 2003. Public notices were also mailed to all known individuals interested in the study. Copies of the Draft were provided to EPA, Department of Interior, and State of Texas. Copies were available at the Main Library in Dallas and offices at the City of Dallas. The Draft was available for review at the Fort Worth District Internet web page and were mailed to individuals requesting a copy. A public meeting was held at the Ramada Plaza Hotel in Dallas on January 8, 2003 to allow for public review and input on the Draft Supplement 1 to the EIS for the Dallas Floodway Extension. Several individuals and one agency requested an extension in time to comment on the Draft Supplement. A letter stating the Corps had extended the comment period was until February 4, 2003 was sent to all known interested parties. The extension thus provided an overall comment period on the Draft Supplement of 60 days from the date of the original notice.

A total of 38 individuals registered their attendance at the Public Meeting. Ten individuals made statements at the meeting. Including written copies of comments presented at the public meeting, a total of 21 written statements were received during the entire comment period. Comments received have been included in Appendix B of this Final SEIS. Several commenters continued to question the original plan formulation process for the DFE project and stated belief that modification of the existing Dallas Floodway first would negate the need for construction of a flood damage reduction project in the area of the Dallas Floodway Extension. Other commenters questioned the ability to even identify reasonably foreseeable projects in the study area, particularly within the Dallas Floodway due to the continued review of priorities and preferences for the ultimate use of that area. Several commenters expressed concern that the Corps was basing its cumulative impact assessment solely on the impacts associated with the recommended DFE plan, thus assuming that the DFE were already constructed. Based upon comments received, the Final SEIS was clarified by bringing information from the referenced PEIS, specifically hydraulic impacts, and the DFE GRR/EIS into the SEIS and assessment of cumulative impact was conducted on the final array of alternatives from the DFE GRR/EIS, rather than just on the recommended plan (Locally Preferred Plan).

FINAL SUPPLEMENT 1 TO THE DFE EIS

An additional public review period of at least 30 days will be provided in review of this Final Supplement 1 to the EIS.

CHAPTER 6 - CONCLUSIONS AND RECOMMENDATIONS

This Supplement to the EIS for the Dallas Floodway Extension (DFE) was prepared to address the cumulative effects of reasonably foreseeable projects of the Corps of Engineers and other entities within the geographic area of the Dallas Floodway Extension. It has been prepared in response to the April 10, 2002, order of the U.S. District Court for Northern District of Texas in Fort Worth. That order remanded the DFE project to the Corps of Engineers to address the cumulative impacts of other similar reasonably foreseeable actions in the geographic area of the DFE. An analysis of cumulative impacts of various past, present, and reasonably foreseeable future Corps of Engineers projects and projects of other entities was made in combination with the plan for the DFE project as recommended and approved in the GRR/EIS.

Existing environmental and socioeconomic resources of the study area are described in detail in the General Reevaluation Report and Environmental Impact Statement (GRR/EIS) for the Dallas Floodway Extension dated February 1999. Past actions and potential future projects of the Corps of Engineers and other entities within the study area are identified, along with an analysis of the effects that those actions have had on study area resources of the Upper Trinity River Basin in a Programmatic EIS dated June 2000. The PEIS was prepared to address the cumulative impacts of potential projects being formulated under the Upper Trinity River Feasibility Study. Both the GRR/EIS and the PEIS are incorporated into this document by reference.

The Dallas Floodway Extension Project was originally authorized for construction in 1965 and subsequently the authorization was modified in 1999 to include ecosystem restoration and recreation as project purposes. This document describes reasonably foreseeable Corps of Engineers actions and actions of other entities and takes a hard look at the cumulative effects of the DFE project along with those that are considered to be reasonably foreseeable. In addition to the potential Corps of Engineers projects identified through the Upper Trinity River Feasibility Study, projects other entities are proposing in the study area are identified and addressed. Among the projects under consideration by other entities within the watershed, the Trinity Parkway has the most potential to significantly effect the floodplain and water and related land resources. That project is a proposal of the North Texas Tollway Authority and the City of Dallas. The Federal Highway Administration is presently preparing an Environmental Impact Statement for the Trinity Parkway because Federal funds of that agency are involved. Five potential roadway alignments are being evaluated.

Impacts of each of the potential projects are analyzed to the extent that details of the various alternatives are available. Pertinent resources for which each project is evaluated include hydraulics and hydrology, vegetative cover, terrestrial resources, aquatic resources, air quality, cultural resources, socioeconomics and environmental justice, recreation, and open space. Individually, each of the plans has some positive and some negative effects, depending upon the plan and the resources impacted. In addition to addressing the relative impacts of each individual alternative, this Supplement attempts to address the cumulative effects that implementation of any of the proposals might have on resources of the overall study area in combination with the DFE project . At the level of detail available for these evaluations, none of the impacts of the identified plans, or any combination of plans or alternatives, were found to cause a significant impact to study area resources to prohibit the projects from further consideration. As to be expected, the output and impacts associated with the plans and combinations addressed in this Supplement vary among the projects, with some being more environmentally sustainable over the long term, while others are more focused on addressing the region's economic needs.

Based upon analyses associated with preparation of this Supplement, and with the previous PEIS, it appears that while some of the alternatives are controversial to either the environmental interests or to the developmental interests, any of the projects being considered could be implemented with appropriate mitigative measures. Other than the DFE project, none of the proposals identified has been designed, evaluated, or disclosed to a point yet that a final decision document under the National Environmental Policy Act (NEPA) has been prepared. Each of the projects identified in this Supplement is of a significance that will require more detailed evaluation and public input through separate NEPA documentation on a project specific basis. Further, any project in the study area that is carried forward will be subject to review under the Corridor Development Certificate process and Section 404 of the Clean Water Act. Any non-Corps of Engineers projects may also be subject to public interest review and individual permitting under Section 404.

Based upon analyses and findings developed as a result of preparation of this Supplement 1 to the EIS for the Dallas Floodway Extension project, it is believed that any of the projects being considered by the Corps of Engineers and other entities could be implemented with appropriate mitigative measures. Corps of Engineers higher authority will continue to review the various proposals as they progress and will have final policy approval of proposed Corps of Engineers project or permit actions. The cumulative impacts of any or all of the projects identified as reasonably foreseeable in this Supplement would need to be carefully ` planned, designed, and mitigated to acceptable levels to avoid, minimize, and mitigate identified adverse environmental effects.

LIST OF PREPARERS

The people primarily responsible for contributing to the preparation of this Supplement 1 to the Environmental Impact Statement for the DFE are listed below.

NAME	DISCIPLINE/ EXPERTISE	EXPERIENCE	ROLE IN DOCUMENT
Gene T. Rice, Jr.	Civil Engineer	20 years, Corps of Engineers	Project Management
Billy K. Colbert	Wildlife Management and Environmental Biology	14 years Corps of Engineers; 15 years U.S. Fish and Wildlife Service	Report Preparation, Impact Assessment
Charissa Kelly	Forestry and Wildlife Management	2 years Forestry experience 1 year with Corps of Engineers	Report Preparation, Forestry
Michelle Dippel	Cultural Resources and Applied Anthropology	1 years Corps of Engineers and 12 years other professional experience	Cultural Resources, Socio-economics, and Environmental Justice Analysis
David Wilson	Hydraulic Engineer	20 years, Corps of Engineers	Hydraulic Analysis
Valerie Sewell	Landscape Architect	1 year, Corps of Eng 5 years NRCS	Recreation Planner
Bryon Haney	Physical Scientist	9 years, Corps of Engineers, 3 years private professional experience	Geographic Information System
Stephen Swihart	Regulatory Specialist	25 years with Corps of Engineers	Regulatory Data gathering and Interpretation

APPENDIX A

HYDROLOGY AND HYDRAULICS

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSIS

GENERAL

The Hydrologic and Hydraulic information presented in this appendix is provided as a supplement to the Dallas Floodway Extension General Re-evaluation Report (DFEGRR) and integrated Environmental Impact Statement dated February 1999, but also is supplemental to the Programmatic Environmental Impact Statement (PEIS) for the Dallas Upper Trinity River Basin dated June 2000. The hydrologic and hydraulic information provided in Appendix A of the PEIS is referenced in full and this final Supplement to the Dallas Floodway Extension Environmental Impact Statement (SDFEEIS) is presented in the same format as the PEIS and the methodology used to determine the effects of the various alternatives is also the same as described in the PEIS. The hydrologic and hydraulic effects are represented in the tables (at the end of this Appendix) indicating the actual computed elevations and flow velocities at selected locations along the Trinity River. The primary purpose of this supplemental information is to show the effects of the various alternative plans that have been preliminarily developed for the Dallas Floodway in combination with each of the final array of alternatives for the DFEGRR. The final array of alternatives for the DFEGRR are 1) No Action Plan, 2) National Economic Development (NED) Plan, 3) Combination Non-Structural / Structural Plan, 4) Tentative Federally Supportable Plan (FSP), and 5) the Locally Preferred Plan as listed on page 4-72 of the DFEGRR. Please refer to the DFEGRR for a detailed description of each of these alternatives. The Dallas Floodway Alternatives presented in the PEIS are 1) No Action Plan, 2) Stemmons Manana Levee Plan, 3) Flood Damage Reduction (FDR) Plan, 4) Environmental Quality (EQ) Plan, 5) Dallas Floodway with Lakes Only Plan, 6) Lakes with Split Parkway – Riverside Alternative, and 7) the Dallas Floodway with Parkway on 1 Levee Plan. Please refer to the PEIS pages A-9 through A-25 for detailed descriptions of each of the Dallas Floodway alternative plans. A brief description of each of the alternatives for both the Dallas Floodway Extension and the Dallas Floodway is provided herein.

HYDROLOGIC AND HYDRAULIC MODELS

The hydrologic and hydraulic models used for this SDFEEIS follow the same development rationale as those used for the PEIS. The HEC-1 hydrologic models used for the SDFEEIS are the same as the models used for both the DFEGRR and the PEIS. These models are described in detail in Appendix A of both the DFEGRR and the PEIS. The hydraulic model development and history are described in detail in Appendix A of the PEIS. The hydraulic models used to analyze the various combinations of alternatives presented herein were developed using as a base the same HEC-RAS Version 2.2 hydraulic models as those described under Corridor Development Certificate (CDC) Model on Pages A-7 and A-8 of the PEIS. For the purpose of analysis of the various additional alternatives for the DFEGRR, the basic input data for these alternatives were converted to the HEC-RAS format since these alternatives were originally developed in the HEC-2 format for the DFEGRR. The original HEC-2 models developed for the DFEGRR alternatives were converted to the HEC-RAS model format and combined with the Upper Trinity CDC HEC-RAS model in the same manner that the Recommended Plan for the DFE project was combined with the various alternatives for the Dallas Floodway as described on Page A-9 under Dallas Floodway alternatives in the PEIS. Additionally, the same "future conditions" year 2050 hydrologic land use conditions were used to compute the data herein to maintain consistency with the data presented in the PEIS.

DALLAS FLOODWAY EXTENSION ALTERNATIVES

No Action Plan

The No Action Plan for the Dallas Floodway Extension (DFE) area is described as the without-project condition for this area meaning that the DFE Recommended Plan has not been implemented. The HEC-RAS hydraulic model for this area was derived from the original HEC-2 models described under Baseline Conditions Models in both the DFEGRR and the PEIS. The description of the Baseline Conditions Models can be found on page A-15 of the DFEGRR and on pages A-6 and A-7 of the PEIS. Even though the same CDC HEC-RAS models used in the PEIS were used in this SDFEEIS analysis, the input data for the CDC HEC-RAS model and the Baseline Conditions model in the DFE area are identical. The only changes made to the Baseline Conditions model to produce the CDC HEC-RAS model were on the West Fork Trinity River as described on Pages A-7 and A-8 of the PEIS and have no effect on the DFE area.

Locally Preferred Plan

The Locally Preferred Plan for the DFEGRR is also referred to as the Recommended Plan and includes the upper and lower chain of wetlands, the Lamar Street Levee, the Cadillac Heights Levee at the SPF level, and the realignment of the river channel at I.H. 45. An important clarification in terminology is needed in order to properly reference the information presented in the PEIS. The PEIS had a primary focus on reasonably foreseeable future projects by the Corps of Engineers and others including the Recommended Plan for DFE. It was determined that a reasonable establishment of the No Action Plan for the purposes of the PEIS would include all the potential projects and alternatives that had reached a level of development for local and federal approval for implementation. Therefore, the No Action Plan for the PEIS was defined as the condition where "no action" or implementation of any floodplain alternatives except the DFE Recommended Plan was considered. For the purposes of this SDFEEIS, the definition of the No Action Plan for the DFE area will be consistent with the DFEGRR and will be as described above under No Action Plan. The No Action Plan as described in the PEIS would more appropriately be called the Locally Preferred Plan in the context of the DFEGRR and this SDFEEIS since it includes the effects of the Recommended Plan for DFE. Therefore, the primary advantage of referencing the information presented in the PEIS is that the information will serve to represent fully the analysis for the Locally Preferred Plan for DFE and will not be repeated in this SDFEEIS.

National Economic Development Plan

The National Economic Development (NED) Plan for the reduction of flood damages within the DFE study reach calls for excavation of overbank swales within two sections along the Trinity River. The lower swale is located on the left overbank looking downstream and extends from about 2,000 feet downstream of Loop 12 to the oxbow river bend near State Highway 310 (Central Expressway) and is 800 to 1200 feet in width. The upper swale is located on the right overbank and extends from the upstream side of the Central Mitigation Swale adjacent to the Central Wastewater Treatment Plant to the confluence with Cedar Creek and is 1000 to 1100 feet in width. The swale is designed to function as a grass-lined floodway to be maintained free of woody vegetation to provide an efficient means of conveying floodwater. A detailed description of the NED Plan is provided on pages A-16 through A-19 of the DFEGRR.

Combination Non-Structural / Structural Plan

The Combination Non-Structural / Structural Plan includes the same structural flood damage reduction measures as the Locally Preferred Plan with the exception of the SPF Cadillac Heights Levee. In lieu of the Cadillac Heights Levee a non-structural alternative for the Cadillac Heights flood damage area would be combined with the remaining components of the Locally Preferred Plan. A non-structural alternative for the Cadillac Heights area would involve the acquisition and removal of homes and businesses from the floodplain. For economic analysis purposes, this alternative was analyzed for removal of structures at various flood damage levels. For the hydrologic and hydraulic analysis purposes the Cadillac Heights area was modeled as existing conditions without the Cadillac Heights Levee combined with the remaining features of the Locally Preferred Plan. The primary net effect of this alternative compared with the Locally Preferred Plan is the water surface elevations are slightly lower upstream of the Cadillac Heights area.

Tentative Federally Supportable Plan

The Tentative Federally Supportable Plan was so named because at the time of the DFEGRR, the final federal economic participation in this alternative had not been determined. For the purposes of this SDFEEIS, this alternative will be referred to as the FSP. The FSP has the same structural flood damage reduction measures as the Locally Preferred Plan with the exception of the Cadillac Heights Levee. The Cadillac Heights Levee component of the FSP has been designed with a levee height at an approximate 100-year level instead of the SPF Cadillac Heights Levee in the Locally Preferred Plan. The FSP combines the 100-year Cadillac Heights Levee with the remaining features of the Locally Preferred Plan. The primary net effect of this alternative compared with the Locally Preferred Plan is the water surface elevations are slightly lower upstream of the Cadillac Heights area.

DALLAS FLOODWAY ALTERNATIVES

General

The purpose of the hydrologic and hydraulic analysis and the development of the alternatives in the PEIS were to provide planning information for the most reasonably foreseeable alternatives to the extent at which they are known. As previously mentioned, none of these Dallas Floodway alternatives have been developed sufficiently to be locally and federally approved for implementation.

No Action Plan

The No Action Plan for the Dallas Floodway is for "no action" or implementation of any floodplain modifications, either federal or non-federal, within the Dallas Floodway and is represented by the CDC HEC-RAS hydraulic model described in the PEIS. The No Action Plan for the Dallas Floodway has been shown for comparison to each of the alternatives for the Dallas Floodway in the same manner as the PEIS. The No Action Plan for the Dallas Floodway is described herein as applying only to the Dallas Floodway for comparison with the various alternatives for the Dallas Floodway as combined with each of the final array of alternatives in the DFE area. Therefore, when the term "No Action Plan" is used it is used to describe basically current floodplain conditions for each of the Dallas Floodway reach and the Dallas Floodway Extension reach of the Trinity River separately. This is in contrast to the way the No Action Plan was presented in the PEIS which was in combination with the Recommended Plan for DFE.

Stemmons Manana Levee Plan

The Stemmons Manana Levee Plan included in the PEIS has been subsequently determined to lack economic justification for federal participation. Therefore, this alternative has not been included in this SDFEEIS.

Flood Damage Reduction Plan

The Flood Damage Reduction (FDR) Plan was developed with the intent to determine on a preliminary basis the National Economic Development (NED) Plan for the Dallas Floodway and is a federal requirement for determination of cost apportionment. The NED Plan is that plan which maximizes the net economic benefits for flood damage reduction. This plan appeared to be the NED Plan in the context of the PEIS but since it is preliminary in nature at this stage of development, it was referred to as the FDR Plan instead of the NED Plan. The FDR Plan consists of raising the Dallas Floodway Levees by means of additional earth fill up to a consistent height of 2 feet above the design SPF water surface profile. This design is based on the SPF design water surface profile for the PEIS with the Recommended Plan for the DFE in place. Although this is the same design approach that was used for the existing Dallas Floodway levees designed by the Corps in the 1950's, it is important to note that the levee crest height for this plan is determined at every point along the levee by the SPF design water surface profile and is not determined relative to the existing levee height since the existing levee crest profile was designed from a different design water surface profile. The design water surface profile for the levee system is determined according to the established criteria for determining the SPF discharge and selecting the appropriate design hydraulic conditions for the project reach. The design water surface profile in the Dallas Floodway is based on a specific water surface profile within the Dallas Floodway that is strongly influenced by downstream conditions. Since the DFE Recommended Plan is the only alternative that has reached the final approval stage for implementation, this plan was selected as appropriate for determining the design SPF water surface profile for design of the FDR Plan within the Dallas Floodway. From the hydrologic and hydraulic analysis perspective, the data presented herein combining the FDR Plan for the Dallas Floodway with the various alternatives within the DFE area, the same FDR levee raise plan for the Dallas Floodway has been used. The hydrologic and hydraulic data presented both in the PEIS and this SDEIS is only to show the comparative effects of this one specific plan and is not specifically recommended as a flood damage reduction plan. This is also true of each of the Dallas Floodway alternatives presented.

Environmental Quality Plan

The Environmental Quality (EQ) Plan was developed as a stand-alone plan to restore environmental habitat and aesthetic features to the Dallas Floodway and the river channel. The EQ Plan for the Dallas Floodway consists of excavation of a new meandering low flow channel between the levees, the establishment of forested areas and additional wetlands, and raising the levees to provide a comparable flood damage risk as the No Action Plan condition. The meandering channel is designed to mimic the original natural Trinity River channel with respect to plan form, side slope, and capacity. The meandering channel alignment diverges from the existing channel alignment upstream of the Dallas Area Rapid Transit (DART) Bridge at the downstream end and diverges from the existing channel near the confluence of the Elm Fork and the West Fork at the upstream end. The plan includes features that provide for increased forest and wetland area within the floodway which increase flood levels within the floodway and upstream. The plan includes the raising of the existing Dallas Floodway Levees sufficiently to compensate for the increased flood damage risk due to the environmental features such that the flood overtopping risk is approximately the same as the No Action Plan. This plan was developed for the PEIS and with the DFE Recommended Plan in place. Therefore, the flood damage risk in the Dallas Floodway for this plan combined with other alternatives in the DFE area would not be the same as for this plan combined with the DFE Recommended Plan.

Lakes with Split Parkway – Riverside Alternative

The plan consists of a series of lakes, split channels, floodwalls, wetlands, parkland, grasslands, and toll roads on the riverside slopes of the East and West Levees. As evaluated within the main text of the PEIS, this alternative is referred to as the "Lakes with Split Parkway - Riverside Alternative".

Parkway on 1 Levee Plan

The Parkway on 1 Levee Plan was developed with specific modifications to the Lakes with Split Parkway – Riverside Alternative. The plan was developed for the H&H analysis by assuming that the Parkway would be constructed only on the riverside of the East Levee rather than on both levees. The Parkway on 1 Levee Plan has been modeled with an earthen embankment having a traffic lanes width of 150 feet for all of the traffic lanes in both directions on the riverside of the East Levee.

Lakes Only Plan

The "Lakes Only" plan was adapted from the Lakes with Split Parkway - Riverside Alternative by the Corps of Engineers to determine the hydrologic and hydraulic effects of a plan that provides primarily recreational and aesthetic benefits but may provide modest flood damage reduction benefits when combined with other plans due to the localized reduction of hydraulic roughness within the Dallas Floodway. The plan was developed for the H&H analysis by assuming that the Parkway would not be constructed between the levees of the Dallas Floodway. Using the Lakes with Split Parkway - Riverside Alternative hydraulic model as a base, the hydraulic model for the Lakes Only Plan was developed by modeling the East and West Levee slopes in their existing configuration and using all other modeled features of the Lakes with Split Parkway - Riverside Alternative. This plan is conceptual and prepared for the purposes of determining the approximate H&H impacts only.

PRESENTATION OF DATA

The presentation of the hydrologic and hydraulic effects follows the same format as those presented in the PEIS. Comparison tables are provided for water surface elevation and average flow velocity at selected points along the Trinity River. Comparison is made in each table for the No Action Plan for the Dallas Floodway versus the various Dallas Floodway Alternatives in combination with each of the remaining final array of alternatives for the DFE study area. The PEIS provides these comparison tables for the combination of the Dallas Floodway Alternatives with the Recommended Plan for the DFE study area.

CONCLUSIONS

Flow Velocities

The computed flow velocities provided in the tables are very similar to the results indicated in the PEIS. The conclusions described in the PEIS for average flow velocities are applicable to the additional data provided herein and no significant changes to flow velocity have been observed.

Cumulative Impacts

The cumulative effects of the various Dallas Floodway alternatives combined with alternatives downstream in the DFE study area and the results of the hydrologic and hydraulic analysis are discussed in the PEIS. These results are presented in terms of the individual projects impacts to the water surface profiles and flow velocities both upstream and downstream. In general, the data presented indicates that a project which raises the water surface profile upstream of the project results in lowering the water surface profile downstream of the project and vice versa due to the valley storage losses or gains resulting from implementation of the project. These phenomena are also observable in the additional data presented herein and the reasons are essentially the same as those discussed in the PEIS and will not be repeated here. Please see the PEIS for discussion of the valley storage effects of the various Dallas Floodway alternatives. However, one important conclusion can be drawn from the additional data presented in the SDFEEIS. The relative scale of the effects both upstream and downstream for each of the Dallas Floodway alternatives when compared to the No Action Plan for the Dallas Floodway and combined with the final array of alternatives for DFE is very similar to those observed in the PEIS. In fact, the results show that all of the alternatives of the Dallas Floodway cause relatively insignificant impacts downstream. For example, the 100-year water surface (WS) elevation difference for the Recommended Plan DFE/FDR Plan combination in the PEIS is -

0.16 ft. and the 100-year WS elevation difference for the No Action DFE/FDR Plan combination is –0.16 ft at the West Fork / Elm Fork confluence. The same comparison for the SPF WS elevation is 0.15 ft. for the Recommended Plan DFE/FDR Plan and is –0.05 ft. for the No Action DFE/FDR Plan. One should keep in mind that all of the data presented in the PEIS includes the Recommended Plan for DFE. Also the data indicates that the difference in the scale of the upstream water surface elevation impacts compared to the downstream impacts of the Dallas Floodway alternatives is quite high. This difference is observed in some cases higher than a 10:1 ratio upstream to downstream which means that an alternative that raises the water surface elevation upstream from the project of about 1.0 foot will generally result in lowering the water surface downstream of about 0.1 feet or less. This same hydrologic and hydraulic phenomenon is observed in the DFE alternatives and works to a distinct advantage for the DFE Recommended Plan which results in lowering the water surface elevation upstream in the Dallas Floodway reach significantly where extremely high flood damage values are located and raises flood levels downstream an insignificant amount where very low flood damage values exist.

The cumulative impacts can also be observed in the data when comparing the same plan for Dallas Floodway with various alternatives for DFE. For example, the SPF water surface (WS) elevation comparison upstream of the EQ Plan at the West Fork/Elm Fork Confluence for the EQ Plan/No Action DFE combination with the EQ Plan/Recommended Plan in DFE combination equals –0.57 (437.32 - 437.89) and the same comparison downstream at Loop 12 would equal 0.53 (411.63 – 412.16). This comparison yields the results of adding the Recommended Plan for DFE if the EQ Plan were implemented first. Almost identical results are obtained comparing the No Action in Dallas Floodway/No Action DFE combination and the No Action in Dallas Floodway/Recommended Plan for DFE combination.

Another way of using the data in a cumulative way would be to compare the implementation of two plans simultaneously in both the Dallas Floodway and the DFE area with the No Action Plan for both areas (Existing Conditions). Using the data in the previous example would yield an upstream elevation change for the SPF water surface at the West Fork/Elm Confluence of +1.18 (437.32 – 436.14) and a downstream change at Loop 12 of +0.38 (412.16-411.78). This example yields the impacts of implementation of the EQ Plan and the Recommended Plan for DFE compared with existing conditions.

Dallas Floodway Project Combinability

Each Dallas Floodway alternative presented has been developed individually by focusing on specific benefits to the environment or the economy. For example, the FDR Plan would provide primarily flood damage reduction benefits for the levee protected areas and the EQ Plan would provide primarily terrestrial and aquatic habitat benefits. As mentioned previously, none of the Dallas Floodway alternatives presented have reached a level of development to be recommended for implementation but have been developed sufficiently to determine the plan's economic and environmental feasibility, the hydrologic and hydraulic effects and the potential for mitigating any negative effects. It can be seen from the detailed descriptions of each plan in the PEIS that some of the plans conflict with one another and even have features that if plans were combined would need to occupy the same space. Since it is would be impossible to combine plan features occupying the same space or that otherwise may have conflicting purposes it is also not possible to view the hydrologic and hydraulic impacts of these preliminary individual plans developed for the Dallas Floodway as additive. For example, if it was found that one plan raised the water surface one foot at a point and another plan lowered the water surface at the same point the same amount then it might be construed that if the plans were combined the net effect would be approximately no change. This would be invalid because combining plans in most cases would require significant modification to either plan. However, the data provides indications to the overall effects of these types of projects and is valuable in the planning process for ultimately developing a recommended plan that may individually provide several types of benefits and provide the most efficient means of satisfying the needs of the region both economically and environmentally. It is therefore likely, based on the findings of this data that a combination of the various features of the preliminary alternatives could be developed to produce a plan which results in very insignificant hydrologic hydraulic impacts both upstream and downstream while providing many of the desired benefits. Some specifics of this process would be that since levee raises impact the design of a riverside Parkway reliever route, the Parkway could be located farther toward the river to allow for riverside levee fill required to raise the levees. Also for example, floodplain recreational lakes that tend to lower water surface elevations could be used in some locations while forested areas as in the EQ Plan, that tend to raise water surface elevations could be used in other areas to compensate.

Flood Damage Reduction Plan For Dallas Floodway

The FDR Plan for Dallas Floodway is a plan for raising the existing levees to a height based on the SPF design water surface profile. This plan as presented herein was developed with the SPF design water surface profile resulting from implementation of the DFE Recommended Plan. Under these design conditions, the plan has tentatively been determined to optimally provide significant additional flood damage reduction benefits to the Dallas Floodway protected areas of West Dallas and the Central Business District. These benefits are additional to those benefits gained from implementation of the Recommended Plan for DFE. The claim has been made that a plan for raising the Dallas Floodway Levees without the Recommended Plan for DFE would be more cost effective in terms of providing benefits to the Dallas Floodway area. This claim has been made by opponents of the Recommended Plan for DFE without the benefit of an economic analysis of such a plan and without due consideration of the significant additional design constraints. The claim might seem to be reasonable in terms of the goal of providing flood damage reduction benefits solely for the Dallas Floodway protected area but would be totally ignorant of the primary purpose of the Recommended Plan for DFE which is to provide substantial flood damage reduction benefits to the DFE area. A levee raise plan such as the FDR Plan or any levee raise plan implemented solely for the existing Dallas Floodway levees would provide absolutely no flood damage reduction benefits to the DFE area. So it obviously would be ludicrous to only consider plans to increase flood damage protection for an area that already has a high level of flood protection and ignore a significant development center such as the DFE area that has none. However, the questions of whether or not the DFE Recommended Plan would be economically justified or would be significantly altered if a levee raise plan for the Dallas Floodway levees were implemented prior to the DFE Recommended Plan are valid. An economic analysis for this scenario has been completed for a Dallas Floodway levee raise plan with the same crest height as the FDR Plan and costs reflecting the additional features required to function without the DFE Recommended Plan. It should be noted that this stand-alone levee raise plan without the DFE Recommended Plan would cost more and provide less flood damage reduction benefits for the Dallas Floodway area than the FDR Plan. This is due to the fact that without the DFE Recommended Plan the SPF design water surface profile is higher. Therefore, this levee plan would be at risk of overtopping more frequently than the FDR Plan. The plan costs substantially more because the East Levee extension to high ground at the DART bridge consisting partly of earth embankment and partly of concrete floodwall would also need to be raised and extended. This lateral extension portion of the East Levee is no longer needed if the DFE Recommended is implemented because the downstream end of the East Levee and the upstream end of the Lamar St. Levee as part of the DFE recommended Plan would form one continuous levee. The economic analysis indicates that the DFE Recommended Plan is economically feasible both as a first added and a last added plan when compared to this levee raise plan for Dallas Floodway. Also the implementation of the DFE Recommended Plan prior to a levee raise plan for the Dallas Floodway is advantageous both from the elimination of the need to reconstruct the lateral extension of the East Levee but also from the standpoint of providing a comparable level of protection for the Dallas Floodway as the DFE Recommended plan provides. In order for a levee raise plan for Dallas Floodway to provide the same benefits to the Dallas Floodway area without the DFE Recommended Plan as with the DFE Recommended Plan, it would need to be raised higher than the FDR Plan because of the difference in the SPF water surface profile. Raising the levees higher would likely cause additional impacts to highway bridges which mostly cross the levees at or near the current crest of the levees and will also result in extending the length of East Levee farther in order to tie to high ground. Therefore, implementation of the DFE Recommended Plan prior to raising the Dallas Floodway levees makes good economic sense and is appropriate for providing the best overall flood damage reduction benefits for the Dallas Floodway protected areas and the DFE area.

H&H DATA TABLES

No Action in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	424.12	425.30	1.18
Hampton Road	421.87	422.99	1.12
Commerce Street	419.40	420.42	1.02
DART Rail Line	417.61	417.59	-0.02
State Highway 310	410.80	410.74	-0.06
State Highway 12	403.14	403.07	-0.07

No Action in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	436.14	437.89	1.75
Hampton Road	434.00	435.75	1.75
Commerce Street	430.72	432.39	1.67
DART Rail Line	427.55	427.41	-0.14
State Highway 310	421.98	421.85	-0.13
State Highway 12	411.78	411.63	-0.15

No Action in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.0	2.0	2.1	3.8	2.3	0.0	-1.2	0.3
Hampton Road	1.9	4.3	2.0	1.8	3.0	1.9	-0.1	-1.3	-0.1
Commerce Street	2.6	6.1	2.6	2.8	4.5	2.8	0.2	-1.6	0.2
DART Rail Line	1.7	4.9	1.7	1.7	4.9	1.7	0.0	0.0	0.0
State Highway 310	1.7	6.3	2.5	1.7	6.3	2.5	0.0	0.0	0.0
State Highway 12	2.2	8.1	2.2	2.2	8.1	2.2	0.0	0.0	0.0

No Action in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.9	6.0	2.8	2.8	4.5	3.0	-0.1	-1.5	0.2
Hampton Road	2.8	5.5	2.9	2.7	3.8	2.7	-0.1	-1.7	-0.2
Commerce Street	4.2	8.5	4.0	4.3	6.1	4.2	0.1	-2.4	0.2
DART Rail Line	2.8	7.4	2.8	2.8	7.3	2.8	0.0	-0.1	0.0
State Highway 310	2.1	8.7	2.4	2.1	8.7	2.4	0.0	0.0	0.0
State Highway 12	2.1	11.8	2.3	2.1	11.8	2.2	0.0	0.0	-0.1

No Action in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	424.12	423.96	-0.16
Hampton Road	421.87	421.72	-0.15
Commerce Street	419.40	419.29	-0.11
DART Rail Line	417.61	417.56	-0.05
State Highway 310	410.80	410.80	0.00
State Highway 12	403.14	403.15	0.01

No Action in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	436.14	436.09	-0.05
Hampton Road	434.00	433.92	-0.08
Commerce Street	430.72	430.63	-0.09
DART Rail Line	427.55	427.14	-0.41
State Highway 310	421.98	421.95	-0.03
State Highway 12	411.78	411.75	-0.03

No Action in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.0	2.0	2.1	4.9	1.9	0.0	-0.1	-0.1
Hampton Road	1.9	4.3	2.0	2.0	4.4	2.1	0.1	-0.1	0.1
Commerce Street	2.6	6.1	2.6	2.7	6.2	2.7	0.1	0.1	0.1
DART Rail Line	1.7	4.9	1.7	1.5	4.2	1.4	-0.2	-0.7	-0.3
State Highway 310	1.7	6.3	2.5	1.7	6.3	2.5	0.0	0.0	0.0
State Highway 12	2.2	8.1	2.2	2.2	8.1	2.2	0.0	0.0	0.0

No Action in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.9	6.0	2.8	2.9	5.8	2.7	0.0	-0.2	-0.1
Hampton Road	2.8	5.5	2.9	2.8	5.6	2.9	0.0	0.1	0.0
Commerce Street	4.2	8.5	4.0	4.2	8.7	4.1	0.0	0.2	0.1
DART Rail Line	2.8	7.4	2.8	2.4	6.2	2.4	-0.4	-1.2	-0.4
State Highway 310	2.1	8.7	2.4	2.1	8.7	2.4	0.0	0.0	0.0
State Highway 12	2.1	11.8	2.3	2.1	11.8	2.2	0.0	0.0	-0.1

No Action in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	424.12	423.57	-0.55
Hampton Road	421.87	421.37	-0.50
Commerce Street	419.40	418.91	-0.49
DART Rail Line	417.61	417.49	-0.12
State Highway 310	410.80	410.83	0.03
State Highway 12	403.14	403.19	0.05

No Action in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	436.14	435.10	-1.04
Hampton Road	434.00	432.98	-1.02
Commerce Street	430.72	429.84	-0.88
DART Rail Line	427.55	427.27	-0.28
State Highway 310	421.98	422.09	0.11
State Highway 12	411.78	411.92	0.14

No Action in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.0	2.0	2.1	5.2	2.1	0.0	0.2	0.1
Hampton Road	1.9	4.3	2.0	1.2	2.9	2.3	-0.7	-1.4	0.3
Commerce Street	2.6	6.1	2.6	2.4	4.0	2.2	-0.2	-2.1	-0.4
DART Rail Line	1.7	4.9	1.7	1.6	4.7	1.7	0.0	-0.2	0.0
State Highway 310	1.7	6.3	2.5	1.7	6.3	2.5	0.0	0.0	0.0
State Highway 12	2.2	8.1	2.2	2.2	8.2	2.2	0.0	0.1	0.0

No Action in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.9	6.0	2.8	3.0	6.3	2.9	0.1	0.3	0.1
Hampton Road	2.8	5.5	2.9	2.2	3.8	3.3	-0.7	-1.7	0.4
Commerce Street	4.2	8.5	4.0	7.1	5.5	3.1	2.9	-3.0	-0.9
DART Rail Line	2.8	7.4	2.8	2.7	6.9	2.7	-0.1	-0.5	-0.1
State Highway 310	2.1	8.7	2.4	2.1	8.7	2.4	0.0	0.0	0.0
State Highway 12	2.1	11.8	2.3	2.1	11.8	2.3	0.0	0.0	0.0

No Action in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	424.12	423.61	-0.51
Hampton Road	421.87	421.42	-0.45
Commerce Street	419.40	418.92	-0.48
DART Rail Line	417.61	417.49	-0.12
State Highway 310	410.80	410.83	0.03
State Highway 12	403.14	403.19	0.05

No Action in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	436.14	435.11	-1.03
Hampton Road	434.00	432.98	-1.02
Commerce Street	430.72	429.82	-0.90
DART Rail Line	427.55	427.27	-0.28
State Highway 310	421.98	422.09	0.11
State Highway 12	411.78	411.92	0.14

No Action in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.0	2.0	2.1	5.2	2.1	0.0	0.2	0.1
Hampton Road	1.9	4.3	2.0	1.2	2.8	2.3	-0.7	-1.5	0.3
Commerce Street	2.6	6.1	2.6	2.2	3.9	2.3	-0.4	-2.2	-0.3
DART Rail Line	1.7	4.9	1.7	1.6	4.7	1.7	-0.1	-0.2	0.0
State Highway 310	1.7	6.3	2.5	1.7	6.3	2.5	0.0	0.0	0.0
State Highway 12	2.2	8.1	2.2	2.2	8.2	2.2	0.0	0.0	0.0

No Action in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.9	6.0	2.8	3.0	6.3	2.9	0.1	0.3	0.1
Hampton Road	2.8	5.5	2.9	1.9	3.8	3.4	-0.9	-1.7	0.5
Commerce Street	4.2	8.5	4.0	4.2	5.3	4.5	0.0	-3.2	0.5
DART Rail Line	2.8	7.4	2.8	2.7	6.9	2.7	-0.1	-0.5	-0.1
State Highway 310	2.1	8.7	2.4	2.1	8.7	2.4	0.0	0.0	0.0
State Highway 12	2.1	11.8	2.3	2.1	11.8	2.3	0.0	0.0	0.0

No Action in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	424.12	423.49	-0.63
Hampton Road	421.87	421.24	-0.63
Commerce Street	419.40	418.94	-0.46
DART Rail Line	417.61	417.50	-0.11
State Highway 310	410.80	410.82	0.02
State Highway 12	403.14	403.17	0.03

No Action in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	436.14	435.17	-0.97
Hampton Road	434.00	433.06	-0.94
Commerce Street	430.72	429.96	-0.76
DART Rail Line	427.55	427.26	-0.29
State Highway 310	421.98	422.09	0.11
State Highway 12	411.78	411.91	0.13

No Action in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.0	2.0	2.1	5.3	2.1	0.0	0.3	0.1
Hampton Road	1.9	4.3	2.0	1.2	2.8	2.3	-0.7	-1.5	0.3
Commerce Street	2.6	6.1	2.6	2.0	3.8	2.1	-0.6	-2.3	-0.5
DART Rail Line	1.7	4.9	1.7	1.5	4.4	1.6	-0.2	-0.5	-0.1
State Highway 310	1.7	6.3	2.5	1.7	6.3	2.5	0.0	0.0	0.0
State Highway 12	2.2	8.1	2.2	2.2	8.2	2.2	0.0	0.0	0.0

No Action in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.9	6.0	2.8	3.0	6.2	2.9	0.1	0.2	0.1
Hampton Road	2.8	5.5	2.9	1.8	3.9	3.4	-1.0	-1.6	0.5
Commerce Street	4.2	8.5	4.0	3.1	5.5	3.3	-1.1	-3.0	-0.7
DART Rail Line	2.8	7.4	2.8	2.5	6.7	2.6	-0.3	-0.7	-0.2
State Highway 310	2.1	8.7	2.4	2.1	8.7	2.4	0.0	0.0	0.0
State Highway 12	2.1	11.8	2.3	2.1	11.8	2.3	0.0	0.0	0.0

NED Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	422.87	422.62	-0.25
Hampton Road	419.74	419.46	-0.28
Commerce Street	415.80	415.57	-0.23
DART Rail Line	412.26	412.21	-0.05
State Highway 310	407.17	407.17	0.00
State Highway 12	403.36	403.36	0.00

NED Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	434.20	434.09	-0.11
Hampton Road	431.37	431.23	-0.14
Commerce Street	426.78	426.64	-0.14
DART Rail Line	421.83	421.69	-0.14
State Highway 310	417.24	417.21	-0.03
State Highway 12	412.24	412.21	-0.03

NED Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.2	5.5	2.1	2.2	5.4	2.1	0.0	-0.1	0.0
Hampton Road	2.2	4.9	2.3	2.2	5.1	2.3	0.0	0.2	0.0
Commerce Street	3.1	7.5	3.1	3.2	7.7	3.2	0.1	0.2	0.1
DART Rail Line	2.0	6.6	2.1	1.8	5.8	1.8	-0.2	-0.8	-0.3
State Highway 310	3.2	4.5	1.6	3.2	4.5	1.6	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.3	2.3	8.2	2.3	0.0	0.0	0.0

NED Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.1	6.5	3.0	3.1	6.4	2.9	0.0	-0.1	-0.1
Hampton Road	3.1	6.1	3.2	3.1	6.2	3.2	0.0	0.1	0.0
Commerce Street	4.7	9.9	4.6	4.8	10.2	4.7	0.1	0.3	0.1
DART Rail Line	3.4	9.3	3.4	2.9	7.8	2.8	-0.5	-1.5	-0.6
State Highway 310	4.3	6.1	2.1	4.3	6.1	2.1	0.0	0.0	0.0
State Highway 12	2.1	11.6	2.3	2.1	11.6	2.2	0.0	0.0	-0.1

NED Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	422.87	424.18	1.31
Hampton Road	419.74	421.16	1.42
Commerce Street	415.80	417.47	1.67
DART Rail Line	412.26	412.24	-0.02
State Highway 310	407.17	407.10	-0.07
State Highway 12	403.36	403.28	-0.08

NED Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	434.20	435.97	1.77
Hampton Road	431.37	433.20	1.83
Commerce Street	426.78	428.83	2.05
DART Rail Line	421.83	421.67	-0.16
State Highway 310	417.24	417.10	-0.14
State Highway 12	412.24	412.09	-0.15

NED Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.2	5.5	2.1	2.2	4.2	2.4	0.0	-1.3	0.3
Hampton Road	2.2	4.9	2.3	2.0	3.4	2.1	-0.2	-1.5	-0.2
Commerce Street	3.1	7.5	3.1	3.2	5.4	3.2	0.1	-2.1	0.1
DART Rail Line	2.0	6.6	2.1	2.0	6.6	2.1	0.0	0.0	0.0
State Highway 310	3.2	4.5	1.6	3.3	4.5	1.6	0.1	0.0	0.0
State Highway 12	2.2	8.2	2.3	2.2	8.2	2.2	0.0	0.0	-0.1

NED Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.1	6.5	3.0	3.0	4.8	3.2	-0.1	-1.7	0.2
Hampton Road	3.1	6.1	3.2	2.9	4.3	3.0	-0.2	-1.8	-0.2
Commerce Street	4.7	9.9	4.6	4.8	7.0	4.7	0.1	-2.9	0.1
DART Rail Line	3.4	9.3	3.4	3.3	9.3	3.4	-0.1	0.0	0.0
State Highway 310	4.3	6.1	2.1	4.3	6.1	2.1	0.0	0.0	0.0
State Highway 12	2.1	11.6	2.3	2.1	11.6	2.2	0.0	0.0	-0.1

NED Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	422.87	422.35	-0.52
Hampton Road	419.74	419.19	-0.55
Commerce Street	415.80	415.17	-0.63
DART Rail Line	412.26	412.16	-0.05
State Highway 310	407.17	407.19	0.02
State Highway 12	403.36	403.39	0.03

NED Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	434.20	433.07	-1.13
Hampton Road	431.37	430.21	-1.16
Commerce Street	426.78	425.58	-1.20
DART Rail Line	421.83	421.60	-0.23
State Highway 310	417.24	417.34	0.10
State Highway 12	412.24	412.34	0.10

NED Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.2	5.5	2.1	2.3	5.8	2.2	0.1	0.3	0.1
Hampton Road	2.2	4.9	2.3	2.3	3.3	2.6	0.1	-1.6	0.3
Commerce Street	3.1	7.5	3.1	2.8	5.0	2.5	-0.3	-2.5	-0.6
DART Rail Line	2.0	6.6	2.1	2.0	6.4	2.0	0.0	-0.2	-0.1
State Highway 310	3.2	4.5	1.6	3.2	4.5	1.6	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.3	2.3	8.2	2.3	0.0	0.0	0.0

NED Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.1	6.5	3.0	3.2	6.9	3.1	0.1	0.4	0.1
Hampton Road	3.1	6.1	3.2	2.3	4.3	3.7	-0.8	-1.8	0.5
Commerce Street	4.7	9.9	4.6	8.1	6.5	3.6	3.4	-3.4	-1.0
DART Rail Line	3.4	9.3	3.4	3.2	8.9	3.3	-0.2	-0.4	-0.1
State Highway 310	4.3	6.1	2.1	4.3	6.1	2.1	0.0	0.0	0.0
State Highway 12	2.1	11.6	2.3	2.1	11.7	2.3	0.0	0.1	0.0

NED Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	422.87	422.37	-0.50
Hampton Road	419.74	419.25	-0.49
Commerce Street	415.80	415.17	-0.63
DART Rail Line	412.26	412.16	-0.10
State Highway 310	407.17	407.20	0.03
State Highway 12	403.36	403.39	0.03

NED Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	434.20	433.12	-1.08
Hampton Road	431.37	430.27	-1.10
Commerce Street	426.78	425.58	-1.20
DART Rail Line	421.83	421.60	-0.23
State Highway 310	417.24	417.35	0.11
State Highway 12	412.24	412.34	0.10

NED Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.2	5.5	2.1	2.2	5.8	2.2	0.0	0.3	0.1
Hampton Road	2.2	4.9	2.3	1.3	3.2	2.6	-0.9	-1.7	0.3
Commerce Street	3.1	7.5	3.1	2.5	4.8	2.6	-0.6	-2.7	-0.5
DART Rail Line	2.0	6.6	2.1	2.0	6.4	2.0	0.0	-0.2	-0.1
State Highway 310	3.2	4.5	1.6	3.2	4.5	1.6	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.3	2.3	8.2	2.3	0.0	0.0	0.0

NED Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.1	6.5	3.0	3.2	6.9	3.1	0.1	0.4	0.1
Hampton Road	3.1	6.1	3.2	2.1	4.3	3.7	-1.0	-1.8	0.5
Commerce Street	4.7	9.9	4.6	4.7	6.3	5.0	0.0	-3.6	0.4
DART Rail Line	3.4	9.3	3.4	3.2	8.9	3.3	-0.2	-0.4	-0.1
State Highway 310	4.3	6.1	2.1	4.3	6.1	2.1	0.0	0.0	0.0
State Highway 12	2.1	11.6	2.3	2.1	11.7	2.3	0.0	0.1	0.0

NED Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	422.87	422.23	-0.64
Hampton Road	419.74	418.95	-0.79
Commerce Street	415.80	415.10	-0.70
DART Rail Line	412.26	412.13	-0.13
State Highway 310	407.17	407.19	0.02
State Highway 12	403.36	403.38	0.02

NED Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	434.20	433.09	-1.11
Hampton Road	431.37	430.22	-0.15
Commerce Street	426.78	425.72	-1.06
DART Rail Line	421.83	421.60	-0.23
State Highway 310	417.24	417.35	0.11
State Highway 12	412.24	412.34	0.10

NED Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.2	5.5	2.1	2.3	5.8	2.2	0.1	0.3	0.1
Hampton Road	2.2	4.9	2.3	1.3	3.3	2.6	-0.9	-1.6	0.3
Commerce Street	3.1	7.5	3.1	2.4	4.7	2.5	-0.7	-2.8	-0.6
DART Rail Line	2.0	6.6	2.1	1.9	6.1	1.9	-0.1	-0.5	-0.2
State Highway 310	3.2	4.5	1.6	3.2	4.5	1.6	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.3	2.3	8.2	2.3	0.1	0.0	0.0

NED Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.1	6.5	3.0	3.2	6.9	3.1	0.1	0.4	0.1
Hampton Road	3.1	6.1	3.2	2.0	4.4	3.8	-1.1	-1.7	0.6
Commerce Street	4.7	9.9	4.6	3.6	6.5	3.9	-1.1	-3.4	-0.7
DART Rail Line	3.4	9.3	3.4	3.1	8.5	3.2	-0.3	-0.8	-0.2
State Highway 310	4.3	6.1	2.1	4.3	6.1	2.1	0.0	0.0	0.0
State Highway 12	2.1	11.6	2.3	2.1	11.7	2.3	0.0	0.1	0.0

Federal Supportable Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	423.44	423.24	-0.20
Hampton Road	420.78	420.58	-0.20
Commerce Street	417.70	417.55	-0.15
DART Rail Line	415.32	415.27	-0.05
State Highway 310	407.61	407.62	0.01
State Highway 12	403.35	403.35	0.00

Federal Supportable Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	434.93	434.79	-0.14
Hampton Road	432.40	432.20	-0.20
Commerce Street	428.43	428.20	-0.23
DART Rail Line	424.47	424.18	-0.29
State Highway 310	418.05	418.02	-0.03
State Highway 12	412.30	412.27	-0.03

Federal Supportable Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.3	2.1	2.1	5.2	2.0	0.0	-0.1	-0.1
Hampton Road	2.0	4.6	2.1	2.1	4.7	2.2	0.1	0.1	0.1
Commerce Street	2.8	6.7	2.8	2.9	6.8	2.9	0.1	0.1	0.1
DART Rail Line	1.8	5.5	1.8	1.6	4.8	1.6	-0.2	-0.7	-0.2
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.2	8.2	2.3	0.0	0.0	0.1

Federal Supportable Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.0	6.2	2.8	0.0	-0.1	-0.1
Hampton Road	2.9	5.8	3.0	3.0	5.9	3.1	0.1	0.1	0.1
Commerce Street	4.4	9.2	4.3	4.5	9.4	4.4	0.1	0.2	0.1
DART Rail Line	3.0	8.2	3.1	2.6	6.8	2.6	-0.4	-1.4	-0.5
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.6	2.3	0.0	-0.1	0.0

Federal Supportable Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	423.44	424.70	1.26
Hampton Road	420.78	422.05	1.27
Commerce Street	417.70	418.99	1.29
DART Rail Line	415.32	415.30	-0.02
State Highway 310	407.61	407.55	-0.06
State Highway 12	403.35	403.27	-0.08

Federal Supportable Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	434.93	436.64	1.71
Hampton Road	432.40	434.12	1.72
Commerce Street	428.43	430.20	1.77
DART Rail Line	424.47	424.32	-0.15
State Highway 310	418.05	417.91	-0.14
State Highway 12	412.30	412.16	-0.14

Federal Supportable Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.3	2.1	2.2	4.0	2.3	0.1	-1.3	0.1
Hampton Road	2.0	4.6	2.1	1.9	3.2	2.0	-0.1	-1.4	-0.1
Commerce Street	2.8	6.7	2.8	3.0	4.9	3.0	0.2	-1.8	0.2
DART Rail Line	1.8	5.5	1.8	1.8	5.5	1.8	0.0	0.0	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.2	8.2	2.2	0.0	0.0	0.0

Federal Supportable Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.0	4.7	3.1	0.0	-1.6	0.2
Hampton Road	2.9	5.8	3.0	2.8	4.1	2.9	-0.1	-1.7	-0.1
Commerce Street	4.4	9.2	4.3	4.6	6.6	4.4	0.2	-2.6	0.1
DART Rail Line	3.0	8.2	3.1	3.0	8.2	3.0	0.0	-1.4	-0.1
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.6	2.2	0.0	-0.1	-0.1

Federal Supportable Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	423.44	422.92	-0.52
Hampton Road	420.78	420.28	-0.50
Commerce Street	417.70	417.21	-0.49
DART Rail Line	415.32	415.23	-0.09
State Highway 310	407.61	407.65	0.04
State Highway 12	403.35	403.39	0.04

Federal Supportable Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	434.93	433.79	-1.14
Hampton Road	432.40	431.23	-1.17
Commerce Street	428.43	427.31	-1.12
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.16	0.11
State Highway 12	412.30	412.40	0.10

Federal Supportable Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.3	2.1	2.2	5.5	2.1	0.1	0.2	0.0
Hampton Road	2.0	4.6	2.1	1.3	3.0	2.5	-0.7	-1.6	0.4
Commerce Street	2.8	6.7	2.8	2.6	4.4	2.3	-0.2	-2.3	-0.5
DART Rail Line	1.8	5.5	1.8	1.8	5.3	1.8	0.0	-0.2	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.1	0.0	0.1

Federal Supportable Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.1	6.6	3.0	0.0	0.3	0.1
Hampton Road	2.9	5.8	3.0	2.3	4.0	3.5	-0.6	-1.8	0.5
Commerce Street	4.4	9.2	4.3	7.6	6.0	3.4	3.2	-3.2	-0.9
DART Rail Line	3.0	8.2	3.1	3.0	7.7	3.0	0.0	-0.5	-0.1
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

Federal Supportable Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	423.44	422.94	-0.50
Hampton Road	420.78	420.33	-0.45
Commerce Street	417.70	417.21	-0.49
DART Rail Line	415.32	415.23	-0.09
State Highway 310	407.61	407.65	0.04
State Highway 12	403.35	403.39	0.04

Federal Supportable Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	434.93	433.82	-1.11
Hampton Road	432.40	431.26	-1.14
Commerce Street	428.43	427.30	-1.13
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.17	0.12
State Highway 12	412.30	412.40	0.10

Federal Supportable Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.3	2.1	2.2	5.5	2.1	0.1	0.2	0.0
Hampton Road	2.0	4.6	2.1	1.2	3.0	2.5	-0.8	-1.6	0.4
Commerce Street	2.8	6.7	2.8	2.4	4.3	2.4	-0.4	-2.4	-0.4
DART Rail Line	1.8	5.5	1.8	1.8	5.3	1.8	0.0	-0.2	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.0	0.0	0.1

Federal Supportable Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.1	6.6	3.0	0.1	0.3	0.1
Hampton Road	2.9	5.8	3.0	2.0	4.0	3.5	-0.9	-1.8	0.5
Commerce Street	4.4	9.2	4.3	4.4	5.8	4.8	0.0	-3.4	0.5
DART Rail Line	3.0	8.2	3.1	3.0	7.7	3.0	0.0	-0.5	-0.1
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

Federal Supportable Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	423.44	422.80	-0.64
Hampton Road	420.78	420.08	-0.70
Commerce Street	417.70	417.16	-0.54
DART Rail Line	415.32	415.22	-0.10
State Highway 310	407.61	407.64	0.03
State Highway 12	403.35	403.38	0.03

Federal Supportable Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	434.93	433.83	-1.10
Hampton Road	432.40	431.27	-1.13
Commerce Street	428.43	427.43	-1.00
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.16	0.11
State Highway 12	412.30	412.40	0.10

Federal Supportable Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.3	2.1	2.2	5.6	2.2	0.1	0.3	0.1
Hampton Road	2.0	4.6	2.1	1.2	3.1	2.5	-0.8	-1.5	0.4
Commerce Street	2.8	6.7	2.8	2.2	4.1	2.3	-0.6	-2.6	-0.5
DART Rail Line	1.8	5.5	1.8	1.7	5.0	1.7	-0.1	-0.5	-0.1
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.1	0.0	0.1

Federal Supportable Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.1	6.6	3.0	0.1	0.3	0.1
Hampton Road	2.9	5.8	3.0	1.9	4.1	3.6	-1.0	-1.7	0.6
Commerce Street	4.4	9.2	4.3	3.4	6.0	3.6	-1.0	-3.2	-0.7
DART Rail Line	3.0	8.2	3.1	2.8	7.5	2.9	-0.2	-0.7	-0.2
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.6	0.0	0.0	0.1
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

Non-Structural / Structural Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	423.26	423.04	-0.22
Hampton Road	420.46	420.24	-0.22
Commerce Street	417.15	416.98	-0.17
DART Rail Line	414.51	414.45	-0.06
State Highway 310	407.61	407.62	0.01
State Highway 12	403.35	403.35	0.00

Non-Structural / Structural Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	FDR Plan	Difference
West Fork/Elm Fork Confl.	434.93	434.79	-0.14
Hampton Road	432.40	432.20	-0.20
Commerce Street	428.43	428.20	-0.23
DART Rail Line	424.47	424.18	-0.29
State Highway 310	418.05	418.02	-0.03
State Highway 12	412.30	412.27	-0.03

Non-Structural / Structural Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.4	2.1	2.2	5.3	2.0	0.1	-0.1	-0.1
Hampton Road	2.1	4.7	2.2	2.1	4.8	2.2	0.0	0.1	0.0
Commerce Street	2.9	6.9	2.9	3.0	7.1	3.0	0.1	0.2	0.1
DART Rail Line	1.9	5.8	1.9	1.7	5.0	1.6	-0.2	-0.8	-0.3
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.1
State Highway 12	2.2	8.2	2.2	2.2	8.2	2.3	0.0	0.0	0.1

Non-Structural / Structural Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			FDR Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.0	6.2	2.8	0.0	-0.1	-0.1
Hampton Road	3.0	5.9	3.0	3.0	6.0	3.1	0.0	0.1	0.1
Commerce Street	4.5	9.3	4.3	4.5	9.5	4.4	0.0	0.2	0.1
DART Rail Line	3.1	8.3	3.1	2.6	6.9	2.6	-0.5	-1.4	-0.5
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.6	2.3	0.0	-0.1	0.0

Non-Structural / Structural Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	423.26	424.54	1.28
Hampton Road	420.46	421.78	1.32
Commerce Street	417.15	418.54	1.39
DART Rail Line	414.51	414.49	-0.02
State Highway 310	407.61	407.55	-0.06
State Highway 12	403.35	403.27	-0.08

Non-Structural / Structural Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	EQ Plan	Difference
West Fork/Elm Fork Confl.	434.93	436.64	1.71
Hampton Road	432.40	434.12	1.72
Commerce Street	428.43	430.20	1.77
DART Rail Line	424.47	424.32	-0.15
State Highway 310	418.05	417.91	-0.14
State Highway 12	412.30	412.16	-0.14

Non-Structural / Structural Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.4	2.1	2.2	4.1	2.3	0.1	-1.3	0.2
Hampton Road	2.1	4.7	2.2	2.0	3.3	2.0	-0.1	-1.4	-0.2
Commerce Street	2.9	6.9	2.9	3.1	5.0	3.1	0.2	-1.9	0.2
DART Rail Line	1.9	5.8	1.9	1.9	5.8	1.9	0.0	0.0	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.2	8.2	2.2	0.0	0.0	0.0

Non-Structural / Structural Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			EQ Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.0	4.7	3.1	0.0	-1.6	0.2
Hampton Road	3.0	5.9	3.0	2.8	4.1	2.9	-0.2	-1.8	-0.1
Commerce Street	4.5	9.3	4.3	4.6	6.7	4.5	0.1	-2.6	0.2
DART Rail Line	3.1	8.3	3.1	3.1	8.3	3.1	0.0	0.0	0.0
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.6	2.2	0.0	-0.1	-0.1

Non-Structural / Structural Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	423.26	422.73	-0.53
Hampton Road	420.46	419.94	-0.52
Commerce Street	417.15	416.62	-0.53
DART Rail Line	414.51	414.42	-0.09
State Highway 310	407.61	407.65	0.04
State Highway 12	403.35	403.39	0.04

Non-Structural / Structural Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Pkwy on 1 Levee	Difference
West Fork/Elm Fork Confl.	434.93	433.79	-1.14
Hampton Road	432.40	431.23	-1.17
Commerce Street	428.43	427.31	-1.12
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.16	0.11
State Highway 12	412.30	412.40	0.10

Non-Structural / Structural Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.4	2.1	2.2	5.6	2.2	0.1	0.2	0.1
Hampton Road	2.1	4.7	2.2	1.3	3.1	2.5	-0.8	-1.6	0.3
Commerce Street	2.9	6.9	2.9	2.6	4.6	2.4	-0.3	-2.3	-0.5
DART Rail Line	1.9	5.8	1.9	1.8	5.5	1.9	-0.1	-0.3	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.1	0.0	0.1

Non-Structural / Structural Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Pkwy on 1 Levee			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.2	6.7	3.0	0.2	0.4	0.1
Hampton Road	3.0	5.9	3.0	2.3	4.1	3.5	-0.7	-1.8	0.5
Commerce Street	4.5	9.3	4.3	7.7	6.1	3.4	3.2	-3.2	-0.9
DART Rail Line	3.1	8.3	3.1	3.0	7.9	3.0	-0.1	-0.4	-0.1
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

Non-Structural / Structural Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	423.26	422.75	-0.51
Hampton Road	420.46	419.99	-0.47
Commerce Street	417.15	416.62	-0.53
DART Rail Line	414.51	414.42	-0.09
State Highway 310	407.61	407.65	0.04
State Highway 12	403.35	403.39	0.04

Non-Structural / Structural Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes/Split Pkwy	Difference
West Fork/Elm Fork Confl.	434.93	433.82	-1.11
Hampton Road	432.40	431.26	-1.14
Commerce Street	428.43	427.30	-1.13
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.17	0.12
State Highway 12	412.30	412.40	0.10

Non-Structural / Structural Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.4	2.1	2.2	5.6	2.2	0.1	0.2	0.1
Hampton Road	2.1	4.7	2.2	1.2	3.1	2.5	-0.9	-1.6	0.3
Commerce Street	2.9	6.9	2.9	2.4	4.4	2.5	-0.5	-2.5	-0.4
DART Rail Line	1.9	5.8	1.9	1.8	5.5	1.9	-0.1	-0.3	0.0
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.1	0.0	0.1

Non-Structural / Structural Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes/Split Pkwy			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.2	6.7	3.0	0.2	0.4	0.1
Hampton Road	3.0	5.9	3.0	2.0	4.1	3.6	-1.0	-1.8	0.6
Commerce Street	4.5	9.3	4.3	4.5	5.9	4.8	0.0	-3.4	0.5
DART Rail Line	3.1	8.3	3.1	3.0	7.9	3.0	-0.1	-0.4	-0.1
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.5	0.0	0.0	0.0
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

Non-Structural / Structural Plan in DFE
100-year Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	423.26	422.61	-0.65
Hampton Road	420.46	419.72	-0.74
Commerce Street	417.15	416.57	-0.58
DART Rail Line	414.51	414.40	-0.11
State Highway 310	407.61	407.64	0.03
State Highway 12	403.35	403.38	0.03

Non-Structural / Structural Plan in DFE
SPF Water Surface Elevations (ft.)

Location	No Action Plan	Lakes Only Plan	Difference
West Fork/Elm Fork Confl.	434.93	433.83	-1.10
Hampton Road	432.40	431.27	-1.13
Commerce Street	428.43	427.43	-1.00
DART Rail Line	424.47	424.15	-0.32
State Highway 310	418.05	418.16	0.11
State Highway 12	412.30	412.40	0.10

Non-Structural / Structural Plan in DFE
100-year Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	2.1	5.4	2.1	2.2	5.6	2.2	0.1	0.2	0.1
Hampton Road	2.1	4.7	2.2	1.2	3.1	2.5	-0.9	-1.6	0.3
Commerce Street	2.9	6.9	2.9	2.3	4.3	2.4	-0.6	-2.6	-0.5
DART Rail Line	1.9	5.8	1.9	1.7	5.3	1.8	-0.2	-0.5	-0.1
State Highway 310	1.5	6.3	4.2	1.5	6.3	4.2	0.0	0.0	0.0
State Highway 12	2.2	8.2	2.2	2.3	8.2	2.3	0.1	0.0	0.1

Non-Structural / Structural Plan in DFE
SPF Flow Velocities (feet per second)

Location	No Action Plan			Lakes Only Plan			Difference		
	Left	Chan	Right	Left	Chan	Right	Left	Chan	Right
West Fork/Elm Fork Confl.	3.0	6.3	2.9	3.2	6.7	3.0	0.2	0.4	0.1
Hampton Road	3.0	5.9	3.0	1.9	4.2	3.6	-1.1	-1.7	0.6
Commerce Street	4.5	9.3	4.3	3.4	6.0	3.6	-1.1	-3.3	-0.7
DART Rail Line	3.1	8.3	3.1	2.8	7.6	2.9	-0.3	-0.7	-0.2
State Highway 310	2.3	7.5	5.5	2.3	7.5	5.6	0.0	0.0	0.1
State Highway 12	2.1	11.7	2.3	2.1	11.7	2.3	0.0	0.0	0.0

APPENDIX B

COMMENT AND RESPONSE

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United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
Post Office Box 649
Albuquerque, New Mexico 87103

IN REPLY REFER TO:

January 24, 2003

ER 02/1115

Gene T. Rice, Jr., Project Manager
U.S. Army Corps of Engineers
Fort Worth District, CESWF-PM-C
P.O. Box 17300
Fort Worth, TX 76102-0300

Dear Mr. Rice:

1. The U.S. Department of the Interior has reviewed Draft Supplement No. 1 to the Environmental Impact Statement for the Dallas Floodway Extension, Trinity River, Dallas County, TX. As the U.S. Army Corps of Engineers has incorporated all the recommendations provided previously by the U.S. Fish and Wildlife Service, we have no further comments. Thank you for the opportunity to review this document.

Sincerely,

Stephen R. Spencer
Acting Regional Environmental Officer

1. The Corps incorporated planning aid recommendations by the U.S. Fish and Wildlife Service and support from the Service through the Fish and Wildlife Coordination Act, including Texas Parks and Wildlife Department concurrence, for the development of emergent wetlands in the DFE project and in determining environmental mitigation for resource impacts from project features.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

JAN 16 2000

Mr. Gene T. Rice, Jr.
U.S. Army Corps of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, TX 76102-0300

Dear Mr. Rice:

In accordance with the responsibilities established under Section 309 of the Clean Air Act, the Region 6 Office of the U.S. Environmental Protection Agency (EPA) has completed the review of Supplement 1 to the Final Environmental Impact Statement (EIS) and General Reevaluation Report for the Dallas Floodway Extension (DFE) within the Trinity River Basin in city limits of Dallas, Texas.

EPA found the Final EIS dated June 2000 to adequately respond to EPA comments offered on the Draft EIS filed in December of 1999. Our review and comments on the DFE EIS have been limited to the scope of the Congressionally authorized Federally assisted flood control project. It was subsequent to a court order, and not at EPA's request, that this supplement was developed. This information supplements the earlier EIS that was prepared for the DFE project.

We understand that the Fort Worth District Corps of Engineers completed a Programmatic Environmental Impact Statement (PEIS) under NEPA for the Upper Trinity River Basin dated June 2000, but additional potential activities were identified as well. An additional Draft EIS is now under preparation by the Federal Highway Administration and the Corps of Engineers to fully address all future actions and their cumulative impacts affecting the Trinity River and the Dallas Floodway; including the Trinity Parkway and the Chain of Lakes and related features of these proposals as they affect the Trinity River and the environment. EPA agrees that none of the projects addressed in the Supplement have been developed in sufficient detail that this document could represent a final decision document under NEPA, except for the DFE project itself. Further, any project in the study area that is carried will need to be reviewed under the Corridor Development Certificate process, adopted by local study participants, and will likely require individual permitting and public interest review under Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act.

Response: Thank you for your comments.

EPA appreciates this opportunity to comment and requests a copy of the Final Supplement be provided for our files. If you have any questions regarding these comments, please call me at (214) 665-2258 for assistance.

Sincerely yours,

Robert D. Lawrence, Chief
Office of Planning and
Coordination (6ENXP)

CITY OF DALLAS

January 28, 2003

U.S. Army Corps of Engineers
Fort Worth District
Mr. Gene T. Rice, Jr., P.E.
ATTN: CESWF-PM-C
P.O. Box 17300
Fort Worth, Texas 76102-0300

RE: City Comments for the Draft SEIS in support of the DFE Project

Dear Mr. Rice:

The following are the City of Dallas's comments regarding the U.S. Army Corps of Engineers' draft Supplement to the Environmental Impact Statement (SEIS) for the Dallas Floodway Extension (DFE) Project dated December 2002. I understand that the public review and comment period is scheduled to conclude on February 4, 2003 and the Final SEIS is due to be completed during the summer of 2003.

1. Elm Fork: page IV (fourth para), and pages 3-10 and 3-27. The Elm Fork Floodplain Management Study by the City is a preliminary design approach to a master plan for the Elm Fork corridor within Dallas. The City is expecting to brief City Council in March 2003 on the proposed project components and seek City Council adoption. The City has an estimated $30 million in Trinity Bond Funds approved by voters and dedicated towards these Elm Fork project components.

2. Trinity Parkway: page VII (first para) and page 3-19 / 3-21. The Trinity Parkway also has a sixth alternative, the "no-build" alternative.

3. Completed Section 205 Projects: page 3-2. Since Dry Branch and Delaware Creek are included, it seems that Johnson Creek (Grand Prairie) project should also be included.

1. We understand that there are no specific reasonably foreseeable projects identified by the City in the Elm Fork area at this time.

2. The second paragraph on page 3-19 was modified to indicate that NTTA is also evaluating the no-build alternative.

3. Johnson Creek Grand Prairie Section 205 project has been added.

Comment	Response
4. Comprehensive Land Use Plan (CLUP); page 3-18 (Current Status) and page 3-28 (fourth para). The CLUP study has yet to be briefed to City Council. This is expected to occur during mid-2003. The study in now expected to be completed by end of 2003.	4. Current status was updated based upon this information.
5. Bridge Crossings of the Trinity River; page 3-22. IH-30 and IH-35 have been identified as possible signature bridges by the City. The $12 million is for pursuit of signature bridge I-30 design.	5. This section has been corrected.
6. Woodall Rodgers Extension and Bridge; page 3-22. The last sentence of this paragraph needs to be changed to establish that the Continental Avenue Bridge would be totally converted to a pedestrian bridge as part of the Woodall Rodgers Extension project.	6. This statement has been corrected.
7. Beckley Avenue Enhancement; page 3-22. The schedule for design and construction is dependent on the Trinity Parkway selection. At worst, this Beckley project is expected to be completed during 2008.	7. The section has been revised to indicate City's estimated time schedule.
8. Elm Fork Area; page 3-27. This Elm Fork Floodplain Management Study includes *intermodal* transportation initiatives, but not transportation projects as project components to be carried forward as funded initiatives. Example; the Luna Road expansion, Luna Road and NW Highway interchange, DART initiatives, Walnut Hill extension to Luna Road, etc. are projects that would not be funded by the Trinity Bond Funds as part of the Elm Fork Study.	8. The paragraph was clarified to indicate that Trinity Bonds funds wouldn't be used to build transportation projects within the Elm Fork Floodplain Management Study area.
9. Equestrian Center and Trinity Interpretive Center; page 3-28. The first two sentences should be as follows; "A feasibility study and master plan for the Interpretive Center, Equestrian Center and other associated components is being contracted by the City of Dallas to the Brown Reynolds Watford Architects' team. The study/design was initiated in October 2002 and should be completed by March 2004.	9. The information in this paragraph has been updated.
10. ISTEA Trails; page 3-28. Replace the full paragraph with the following; "Three ISTEA-T21 grants have been awarded to the City of Dallas for two projects. Two of the grants are being applied to the Santa Fe Trestle Trail, which is described in its own section. The other grant was issued in the mid-1990's for the Trinity Trails, which is a trail project that is planned to extend 14 miles in length between Westmoreland and Corinth within the Dallas Floodway. The Trinity Trails project is pending the further development of the Urban Design Study and the concurrent Lakes Study for the Dallas Floodway.	10. The information in this paragraph has been clarified.

Comment	Response
11. South Loop 12 Boat Ramp; page 3-29. Regarding the last sentence, the final design is completed and construction is expected to commence during mid-2003.	11. This section has been updated.
12. Moore Park; page 3-30. A sentence should be included as follows; "Detailed design should be completed during 2003 and construction completed during 2004.	12. The updated information has been included.
13. The Texas Parks and Recreation Department Master Plan; page 3-32. It should be noted that this master plan is otherwise known as the Great Trinity Forest Park Master Plan that was finalized in 1997 and adopted by Dallas County and the City of Dallas in 1997. The City of Dallas subsequently produced the Master Implementation Plan for the Dallas Floodway and the Great Trinity Forest vicinity in 1999 that embraced the Great Trinity Forest Park Master Plan.	13. Noted.
14. McCommas Bluff Landfill Extension; page 3-33. A final sentence could be added to establish that final design is expected to be completed during 2003.	14. The scheduled design completion date was added.
15. Other Dallas Floodway Projects or Activities; page 3-34. The last sentence of this paragraph should be modified as follows; "The City of Dallas is contracting with Camp, Dresser & McKee on a Lakes Study for the Dallas Floodway to fulfill three objectives. First; review previous work and make a recommendation regarding the best approach for lake configuration, on-channel lakes verses on-channel lakes. Secondly; provide technical guidance and input to the Urban Design Study consultant. Lastly; address in further detail the functionality and operability issues of the preferred lake configuration for the Dallas Floodway. The overall Lakes Study is anticipated to be completed by end of 2003."	15. Additional information has been included in this section.
16. Other Developments; page 3-34. The Center is now scheduled to be completed in February 2003. The word, Landfill, should be capitalized. The word, "three", should be changed to "other".	16. Updates and corrections have been made.

17. Table 4-2; page 4-7.

a. Water Quality: Comment — Floodway Lakes should be shown with a green arrow. Such lakes are proposed to use some effluent discharge from the CWWTP for lake recharge. As part of the lakes system, nutrient removal (phosphorous and nitrogen) would be required through the use of new wetland complexes or a special treatment unit at the CWWTP. Such an improvement to the recharge water is a water quality improvement for the overall Trinity River, as this recharge water will have a higher water quality before discharge to the river.

b. Aquatic Resources: Comment — The Combined Riverside and the Split Riverside should have the same quantification.

c. Floodplain Recreation: Comment — The ATSF bridge transformation into a major pedestrian access to the Dallas Floodway via the Fair Park vicinity, Moore Park vicinity, 8th Street DART facility, and the zoo vicinity would provide very important high-volume public access potential. This should be rated a double green arrow.

d. Floodplain Recreation: Comment — The Combined, Split Riverside, and Split Landside alternatives require floodway excavation that would create a 120-acre lake for recreation in the Westmoreland and Hampton vicinity of the Dallas Floodway. These three alternatives should be given a green arrow. Whereas, the Industrial alternative would result in no near term funding capability for the 120-acre lake.

e. Environmental Justice: Comment — The Split Riverside alternative would not have any more adverse impact than the Combined or Industrial alternatives.

f. Upstream H&H: Comment — The Floodway Levee Raise should be shown to have a "no effect" symbol. The excavation to produce the levee raise would come from inside the Dallas Floodway, which would actually improve conveyance and lower upstream H&H.

17. a. The general plans we have seen include some wetlands adjacent to the lake or lakes, however, absent specific design and operational information, it is not possible to say they will provide an improvement in effluent water quality. By the same token, the water if derived from the CWWTP will be subject to evaporation within the lake causing potential concentration of some water quality constituents. We believe that a neutral impact, non-significant benefit to water quality would be derived from the descriptions of the floodplain lakes.

17. b. We disagree. While the acreages of existing aquatic habitat that would be impacted as indicated in Table 4-1 of the DSEIS are similar, the Split Riverside would affect more individual drainage areas.

17. c. While we agree the bridge could be modified to provide the linkages described, we do not believe the bridge would provide more than minor intensification of floodplain recreation.

17. d. The currently available information from NTTA indicates that they would likely excavate the material needed to build the road bed from the area between the levees. It would be up to some future activity to complete construction of the lake. The cumulative impacts of a Lake alternative therefore were evaluated under the Recreation section of Table 4-2.

17. e. The Split Riverside would cause potential impacts to access to the floodway and increased noise levels to the area along the West Levee. No other road alternatives would produce that impact.

17. f. For the assumptions used to date by the Corps for the Dallas Floodway levee raise, the statement is true for the 100-yr event, however the SPF event causes a slightly elevated water surface in the upstream reaches (see pages 4-14 and 4-15 of PEIS).

City Comments for the Draft SEIS
Page Five
January 28, 2003

g. Upstream H&H: Comment — The Combined and Split Riverside alternatives should be shown to have a "no affect" symbol. The excavation to produce the road bench would come from inside the Dallas Floodway, which would actually improve conveyance and lower upstream H&H. This was demonstrated in H&H modeling for the TxDOT MTIS and the Corps' PEIS.

h. Upstream H&H: Comment — The Frazier Dam project should be shown to have a "no affect" symbol. The project includes hydraulic mitigation to produce no upstream H&H impact.

i. Flood Damages: Comment — The Elm Fork initiatives carry significant improvements for providing flood protection within the study area with respect to channel improvements, ring levee, and removal of properties from flood risk. This alternative should warrant a green arrow.

j. Flood Damages: Comment — The Combined and Split Riverside alternatives should be shown with a "no affect" symbol. Both alternatives allow for increased levee strengthening, possible upstream H&H improvements (no change at worst), and a no significant increase in flood damage potential downstream.

k. Cultural Resources: Comment — The Industrial alternative should be shown with a red arrow. This alternative has significant potential of impacting cultural resources due to buildings of historical significance.

If you should have any questions about the above comments to the draft SEIS, please contact me at 214-671-9504. The City of Dallas continues efforts to acquire real estate in preparation for a construction start by end of 2003. The City looks forward to the full implementation of this very important project in a timely manner.

Sincerely,

Greg Ajemian

Greg Ajemian, P.E.
Executive Coordinator
Trinity River Corridor Project
City of Dallas

17. g. The Corps of Engineers through review of existing Corps projects such as the Dallas Floodway, the procedures implemented as a result of the Trinity River Programmatic EIS for permit actions and the CDC process all establish criteria to minimize cumulative H&H impacts. However at this stage of planning, the plans for this alternative have not been sufficiently completed to state absolutely there would be no affect. However, assuming sufficient H&H mitigation is incorporated, our own modeling exercises and information provided to us indicate the potential, for any changes in H&H can be minimized to a point the affects would not be significant.

17. h. This proposed permit action is still being reviewed as this SEIS is being finalized. At this point, it appears that some project modification would be required to eliminate potential impacts to existing levees in the area. The modifications under consideration would have to be further evaluated to determine the H&H mitigation requirements; therefore, we believe that it is most appropriate to consider that the proposal has potential upstream H&H affects.

17.i. Until the Elm Fork Study initiatives by the City of Dallas progress further and more details are available, we believe it is appropriate to consider that the potential for upstream and downstream impacts remain, as should the no affect determination for cumulative flood damages at the Elm Fork study area.

17. j After further review, we concur and have made the changes. The rationale behind the original assignment of impact was based upon the fact that the Riverside alignments will be placed just above the 100-yr floodplain elevation and will be subject to significant economic damages when floods reach that level (a direct impact to the road structure and function.). The cumulative flood damages to outside of the Floodway won't be increased however.

17.k. We agree that the Industrial alternative might impact visual aspects of some historic buildings or structures.

FER
cf: PM-C

OFFICE OF THE GOVERNOR

RICK PERRY
GOVERNOR

Thursday, February 20, 2003

Mr. Michael J. Morak, P.E., Deputy Dist. Engineer
Department of the Army, Ft. Worth DCE
P.O. Box 17300
Fort Worth, TX 76102

RE: TX-R-20021209-0005-50

EIS-Draft Supplement #1 for Dallas Floodway Extension

Dear Mr. Morak:

Your application for assistance referenced above has been reviewed. The comments received are summarized below.

1. This application was submitted for comment to the Texas Commission on Environmental Quality, the General Land Office, the Texas Water Development Board, the Texas Department of Transportation, the State Water and Conservation Board and the North Central Council of Governments. The Texas Commission on Environmental Quality stated that any demolition, construction, rehabilitation or repair project will produce dust and particulate emissions, these actions should pose a significant impact upon air quality standards. All the other agencies listed did not respond. No other substantive comments were received.

We appreciate the opportunity to review your proposal. Please let me know if we can be of further assistance.

Sincerely,

Denise S. Francis, State Single Point of Contact
DSF/dsi

Post Office Box 12428 Austin, Texas 78711 (512) 463-2000 (Voice)/(512) 475-3165 (TDD)

1. Management practices will be put into place during construction of the DFE project to control dusts and particulates. We appreciate TCEQ concurrence that no significant impacts to air quality will result from DFE project implementation.

TEXAS COMMITTEE ON NATURAL RESOURCES
4144 COCHRAN CHAPEL ROAD
DALLAS, TEXAS 75209
(214) 352-8370

WITHDRAW THE 1998 DESTRUCTIVE BOND APPROACH
AND SAVE THE TRINITY RIVER AND GREAT TRINITY FOREST
By Edward C. Fritz, Chair Emeritus
January 8, 2003

1. The Army Corps and Dallas staff have failed to present adequate facts and data on several aspects of their Trinity River bond program, including proposed lakes and highway between the levees, and digging a swale through the Great Trinity Forest.

The swale would involve cutting of thousands of good trees where we now take walks in the forest, inviting all citizens, many of whom participate. Our next walk there is on Sunday, January 19, at 3:00 p.m., starting at a parking lot on the north side of Martin Luther King bridge. The entire public is invited, as usual.

The terrible bond plan for a proposed Dallas Floodway Extension includes new levees downstream, along with the swale. Theoretically, they would protect the Cadillac Heights houses from a highest flood. It would be far better to offer a voluntary buyout of all houses and lots in Cadillac Heights, a plan that was supported by Mayor Laura Miller.

2. Some other cities, such as Boston and Washington, D.C., provide popular walks through forests along rivers. The Great Trinity Forest is even better, containing numerous species of trees, flowers, birds and animals. Visitors from the rest of the world would relish such walks. Digging swales and building levees would vastly damage the Great Trinity Forest.

Attached hereto is my answer to the U.S. Corps Draft Supplemental EIS, of December, 2002.

1. Comments on specific allegations of inadequacy are addressed as presented on the "attached hereto answer to U.S. Corps Draft Supplemental EIS"

2. The DFE, including recreational trails proposed, would facilitate recreational access to and through the Great Trinity Forest. Cumulative recreational benefits could occur from incorporation of features at Moore Park and the Equestrian Center, and the ATSF railroad modification.

TEXAS COMMITTEE ON NATURAL RESOURCES
4144 COCHRAN CHAPEL ROAD
DALLAS, TEXAS 75209
(214) 352-8370

Comments on Draft Supplemental EIS of December, 2002
By Edward C. Fritz
January 8, 2003

The Army Corps has attempted to slip through its analysis of the Court's order without presenting data or even key facts, but mainly with self-serving claims. They also are inadequate.

3. On page 4-6, under Aquatic Resources, the draft says that the downstream project "would not generate as many acres of surface waters as plans consisting of lakes between the Dallas Floodway levees, but the quality of the aquatic habitat created would be greater". This almost admits that the upstream lakes would reduce the habitat between the levees. It further implies that such reduction would be less downstream. It fails to provide data. It evades an admission that the more lakes or new channels the Corps would create between existing channels, the less forest and natural plants would remain there, and the more flooding would occur downstream (an
4. excuse for new swales).

The draft does not even present acreages much less damages, of destroyed or harmed areas.

5. On page 4-6, the Corps further states, "Most of the flood damage reduction projects identified have only a minor potential to cause direct impacts to wetlands." It presents no data. Actually, the projects would wipe out huge acreages of natural wetlands. The projects also would cut swales through excellent natural forests.

It says, "these impacts would only be minor from a cumulative standpoint". Once again it fails to present data. Actually, the impacts will include ruination of an immense part of the Great Trinity Forest.

-1-

3. The statement on page 4-6 references the cumulative aquatic resources impacts to projects both upstream and downstream of the DFE. The statement indicates that the EQ plan in the Dallas Floodway, which emphasizes restoration of a meandering river and associated overbank wetlands would provide more aquatic benefits than a lake at the same location. Data identified to the Corps related to acreage impacts within the Dallas Floodway caused by the floodway lakes are presented in Table 4-1.

4. The data is in Table 4-1. The data indicates that the projects, as identified to us, would vary in their cumulative impacts. Cumulatively, the data indicates that, depending on which tollroad alternative is selected, following ecosystem restoration and the suggested mitigation of existing plans would result in a net gain of emergent wetlands ranging from 269 acres to 416 acres. The Dallas Floodway Extension data reflects the changes in future without a project conditions. Of the DFE area to be impacted, approximately 50% has been classified as wetland, most already forested with the future conditions projected to be forest.

5. Table 4-1 data shows that the net cumulative impact would be a net gain of over 1300 acres in forested lands that are protected and improved through acquisition, preservation and management following implementation and identified mitigation within the area of the Great Trinity Forest.

6. Toward the bottom of page 4-6, it finally claims it would conduct mitigation (which would never make up for the loss of forest) but adds, without data, "cumulative impacts would be minor, primarily resulting from the relocation of these resources at a different site from where they occurred". It never gives data or details. We say that the replacement of natural resources would be highly destructive and virtually meaningless.

7. On p. 4-9, the Army Corps writes vaguely of two losses of areas and loss of 70 acres of forest, "the majority of which has been identified within the White Rock Creek corridor". It does

8. not say exactly where. Actually, an extension of levees downstream from existing levees, plus a series of wide swales, would eliminate more of the Great Trinity Forest, barely mentioned by the Army Corps as the "bottomland hardwood forest ecosystem". The Corps says vaguely, "In addition, the recommended environmental restoration project feature, which includes the development of emergent wetlands, would help reverse the trend to losses to this important

9. resource, by restoring 123 acres". It never says how, or precisely where. Actually, cutting the forest for swales and levees would ruin much more of the ancient forest and will never be adequately replaceable anywhere else, no matter where the Corps might offer to replace it.

10. As to air quality, the Corps, at top of p. 4-10, evades data, especially as to new roads between levees, by saying it would be determined during detailed studies. Obviously, toll roads between levees would inflict harmful air on any persons walking or boating between levees, and on any animals or birds there.

On p. 4-10, the draft refers to "some forestlands that have developed during the past 30 to 40 years", but never says where they are, how valuable they are environmentally, nor how much

-2-

6. The data has been provided in Table 4-1 as a basis to determine cumulative impacts from reasonably foreseeable activities. Mitigation of forest impacts will be conducted following development of detailed plans and specifications for Corps of Engineers projects. The Corps planning process requires us to try to avoid impacts to resources where possible, then minimize impacts if unavoidable. Mitigation is required for unavoidable impacts. The DFE project goes a step farther by incorporation of a plan to restore emergent wetlands as an integral part of the flood damage reduction swales. On the contrary, we believe that replacement of impacted natural resources is totally necessary and hardly meaningless.
7. The 70 acres of impacts to vegetation from the SE Dart Corridor implementation would mostly be in the White Rock Creek drainage along Scyene and Jim Miller roads. The route and areas of vegetation impact from that proposal are shown on Figures 5.29 through 5.37 of the Dart Southeast Corridor Draft Environmental Impact Statement dated February 2002.
8. All features of the DFE project are fully described in the Chapter 6 of the DFE GRR/EIS.
9. There are a few old trees in the area that would be impacted by the DFE, but the impacted area of the majority of the forest is neither old growth, ancient nor rare (See Table 4-25, DFE GRR/EIS).
10.The air quality discussion provided in the DSEIS is accurate. The discussion continues onto page 4-10, where it is noted that traffic introduced to the levee area could increase site-specific air quality problems.

11. The DFE impacts by acre and by value to forestlands were thoroughly described and documented in the DFE GRR/EIS, which the SEIS supplements and incorporates by reference.

12.	it would cost to mitigate them, as proposed. They would probably be better for society left as they are, and better for birds and animals. Trees in Great Trinity Forest are in ages up to hundreds of years.	12. The forested areas and the quality of those forests that would be impacted, and the location and cost of mitigation of those forested areas were clearly identified in the DFE GRR/EIS, (see Table 4-25).
13.	On p. 4-11, the Draft Supplement mentions Cadillac Heights but fails to consider the alternative of a voluntary buyout, which environmentalists have urged. Laura Miller supported it, as councilwoman, and now supports at least a partial buyout as mayor. A buyout would enable all the residents to move out of the floodplain, including out of the area where residents are subject to unhealthful soil contaminated by previous business operations. The City of Dallas is now planning about the voluntary buyout of at least part of Cadillac Heights. A full buyout would relieve the houses from needing a swale and levee through the Great Trinity Forest. The Army Corps should consider this, making a swale and levee unnecessary, and thereby saving the Great Trinity Forest for all.	13. The Corps of Engineers has revisited the potential for a non-structural buyout of the Cadillac Heights area on several occasions during the iterative planning process and continually finds that it is not in the federal interest to do so. There is not sufficient federal interest to justify a buyout of Cadillac Heights. The City has every right to reject the Corps of Engineers project and go forward on their own, but we have no indication that there is any intention to do so; therefore, it is not a reasonable foreseeable action. The SEIS will document cumulative impacts in relation to the DFE alternatives of all other reasonably foreseeable actions in the DFE area, including the partial buyout of a few homes in the Cadillac Heights area that are located above the 100-yr floodplain elevation.
14.	On p. 4-14, the Corps' Draft says, "recommended DFE project would not contribute to cumulative noise impacts". Actually, the proposed toll roads would create loud noises, as well as harmful air discharges for quite a distance from wherever such roads would be built. Inside the existing levees, the noises and bad air will harm everyone who walks or boats between the levees.	14. The DFE project would not cumulatively contribute to noise in the study area. The proposed roads under any alignment would contribute to noise in the study area, regardless of whether the DFE was constructed or not.
15.	On p. 4-14, the Draft admits that unnamed endangered species may migrate through the proposed area, and that the least tern nests in the Wastewater Treatment Facility. Actually, the least tern also nests in other parts of the natural area involved in this proposal. All endangered species in the area would be even more endangered by the proposal.	15. The least tern has been documented to nest in the Southside Water Treatment Plant area, far south of the DFE project area. The U.S. Fish and Wildlife Service has concurred with our assessment that the proposed DFE project would not threaten or jeopardize this species.

-3-

16. On p. 4-16, the Corps Draft agrees "to maximize forested resource benefits". It should Present data on locations, specify costs, and benefits. Actually, virtually all species would survive far better if none of the proposed roads, lakes, new swales, and new levees were built.

17. On p. 4-16, the Corps states that "its policy specifies no net loss of wetlands". It should provide new plans in conformance with this policy before further Court orders. The Corps cannot carry out the 1998 bond program, including swales and levees through the Great Trinity Forest, without a net loss of the wild wetlands scheduled to be heavily cut, swaled, and levied by the Corps.

-4-

16. The Corps and resource agencies evaluations of the existing DFE area do not support your conclusions. The area that would be impacted by the DFE alignment has been selected to minimize impacts to those areas of younger trees consisting primarily of green ash, cottonwood, willow, cedar elm and other light seeded invader or early colonizer trees. There are a few older trees that would be unavoidably impacted by the channel realignment. The mitigation plan would provide 1179 acres of forest and grassland that would be improved by planting mast trees that would increase habitat diversity and functional quality.

17. The City of Dallas, not the Corps of Engineers is responsible for carrying out any bond programs. The Corps of Engineers will not carry out the Dallas 1998-bond program. Our data indicates there would be a long-term net improvement of habitat acreage and quality following implementation of the DFE with the approved mitigation features. In addition, to the strong flood damage reduction benefits the project would also provide much sought after public recreational access

STATEMENT AT JANUARY 8, 2003
MEETING RE TRINITY FLOODWAY EXTENSION
BY EDWARD C. FRITZ

CORP OF ENGINEERS
WITH ~~YOUR~~ HELP WE CAN PREPARE A NEW APPROPRIATE PLAN FOR TRINITY RIVER IN DALLAS.

1\. THE ARMY CORPS AND THE CITY HAVE FAILED TO PRESENT ADEQUATE DATA ON THE HARMFUL RESULTS OF BUILDING HIGHWAYS AND LAKES BETWEEN EXISTING LEVEES AND CUTTING SWALES DOWNSTREAM THROUGH THE CITY'S GREAT TRINITY FOREST, AND OTHER HARMFUL FACTORS.

THE TOLLROADS WOULD RAISE THE FLOOD LEVELS AND SPREAD AIR POLLUTION WITHIN THE LEVEES. A LAKE WOULD NARROW DOWN THE WALKING AREA NEXT TO DOWNTOWN DALLAS AND

1\. This is a written copy provided by Mr. Fritz's following his statement at the Public Meeting on January 8, 2003. These general and more detailed comments were included in a letter from Mr. Fritz representing the Texas Committee on Natural Resources dated January 8, 2003. Since the January 8, 2003 letter is more inclusive, responses to Mr. Fritz's comments were provided there.

WIPE OUT MUCH OF THE FLOWERS AND OTHER NATURAL PLANTS THERE. THERE IS ALREADY A LAKE SOUTH OF THE SYLVAN BRIDGE. ANOTHER BAD EFFECT OF NEW ROADS BETWEEN LEVEES, AND MAYBE OF THE LAKES AND A SWALE WOULD BE MORE FLOODING OF THE GREAT TRINITY FOREST. PEOPLE ARE ENTITLED TO FAR MORE DETAILS ABOUT THE HARMFUL RESULTS THAT THE TRINITY FLOODWAY EXTENSION WOULD BRING.

WE REFER TO APPENDIX A OF THE AMERICAN INSTITUTE OF ARCHITECTS, DALLAS CHAPTER, TRINITY POLICY OF 2001 SHOWING VARIOUS ERRORS OF THE 1998 BOND PLAN, WITH ONLY 1.6% MAJORITY.

I PRESENT COPIES OF TWO FURTHER COMMENTS.

1. WITHDRAW THE 1998 RESTRICTIVE AND INAPPROPRIATE

2. COMMENTS ON DRAFT SUPPLEMENTAL EIS OF OCTOBER 2002.

Statement for USACE, Jan.8. 2003 re: supplement #1, DFE-EIS

By Mary Vogelson, LWVD, Trinity River Study chair

Good Evening. I am Mary Vogelson, representing the LWV of Dallas. Our League has been involved with the Trinity River studies by the Corps and others for over 35 years. We understand the need to proceed with a project that has been pending since 1965, and we understand the frustration of trying to work with the city of Dallas when the city itself has been unable to establish guidelines for a cooperative program with the Corps for most of this time.

LWVD wrote extensively in response to the 1998 DFE-GRR EIS draft that the Corps had not met NEPA's requirements to evaluate the cumulative effects of all foreseeable projects including its own DFE proposals & alternatives. Our concerns, in part, echo the, Office of Management and Budget when they state: "the corps elected not to evaluate" the flood solution proposals having the highest net economic benefits, and that decision, in effect, removed from consideration an entire set of reasonable options...." Thus, the OMB states, "The Corps presented an incomplete picture of the available choices and their impacts, and prevented an informed public discussion of the merits of the proposed project."

The Corps has still not made a public evaluation of its own DFE project in conjunction with other known proposals and discussing the cumulative environmental impacts on the city and its citizens. Furthermore, evaluating cumulative impacts of the newly proposed EQ plan, a plan much more in keeping with the "new, green" Corps, against currently existing conditions might have resulted in very different NEPA outcomes, but unfortunately we do not know this as a result of this document.

Attempting to secure the Corps DFE project and THEN evaluating the cumulative impacts of known future proposals/alternatives as this document purports to do, is not our understanding of meeting the NEPA requirements (see Federal Court for the Northern District of Texas' ruling, p.54- 57 of the opinion, April, 10, 2002 which demands that "the cumulative impacts of these projects" be addressed "WITH the DFE project").

1. This is a written copy of the statement presented by Ms. Vogelson at the Public Meeting held January 8, 2003. Please see responses within the Official Record for that meeting.

The League of Women Voters is concerned about the best use of public funds, cumulative affects on the environment upstream and downstream, meeting the requirements of NEPA, and accurate and complete information being given to the citizens of Dallas in order to make democracy work for all Dallas' citizens. We hope to continue to work with the Corps of engineers to meet these goals.

We will be sending written comments and would appreciate a two-week extension of the comment period.

Thank you.

02/04/2003 15:48 2143541639 MARY VOGELSON PAGE 01

LEAGUE OF WOMEN VOTERS *of Dallas*

Feb. 4, 2003

USACE, Ft. Worth District
ATTN: CESWF-PM-C (Mr. Gene T. Rice, Jr.)
Fax: 817-886-6442

Comment for League of Women Voters of Dallas
Re: supplement #1, DFE-EIS

By Mary Vogelson, LWVD, Trinity River Study chair

The LWV of Dallas has been involved with the Trinity River studies by the Corps and others for over 35 years. We understand the need to proceed with a project that has been pending since 1965, and we understand the frustration of trying to work with the city of Dallas when the city itself has been unable to establish guidelines for a cooperative program with the Corps for most of this time.

1. LWVD wrote extensively in response to the 1998 DFE-GRR EIS draft that the Corps had not met NEPA's requirements to evaluate the cumulative effects of all foreseeable projects including its own DFE proposals & alternatives. Our concerns, in part, echo the, Office of Management and Budget when they state: "the corps elected not to evaluate" the flood solution proposals having the highest net economic benefits, and that decision, in effect, removed from consideration an entire set of reasonable options...." Thus, the OMB states, "The Corps presented an incomplete picture of the available choices and their impacts, and prevented an informed public discussion of the merits of the proposed project."

2. The Corps has still not made a public evaluation of its own DFE project in conjunction with other known proposals and discussing the cumulative environmental impacts on the city and its citizens. Comments, for instance, like those on p.4-12 and 4-13 are examples of the kind of analysis we had hoped for without the DFE as a baseline. In the Stemmons Corridor the Corps states that job growth could "potentially increase " as a result of flood reduction programs. Under the H&H heading, the Corps

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1. Flood solution proposals were evaluated in the formation of the DFE GRR-EIS. All available choices were considered and fully evaluated. The final document addressed the five final alternatives of the Dallas Floodway Extension with various reasonably foreseeable by others to determine the cumulative impacts of each scenario using the best available data for each of the projects,. None of the reasonable foreseeable projects have been fully studied or designed.

2. The SEIS has analyzed the DFE project along with other reasonably foreseeable projects without the DFE as a baseline. The final document addressed the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects, which have not been fully studied or designed.

notes that the prospective toll road could "act as concrete lined channels" to propel the water faster through the floodway. These example statements express, variously, the Corps' concern for job creation and increased velocities in river flows. They are troublesome in that they ignore the environmental impacts of sluicing the water into the DFE area (and therefore the forest) but without the analysis off what the impacts might have been without the current DFE project. Also, we do not have the comparative analysis with no DFE project of "job creation" vs. increasing the health of those residents who might have been bought out and moved to less toxic lands. These are but two examples of issues that could have been helpful to the public decision-making process on whether or not to pursue the present DFE alternatives, or, indeed if there were better alternatives based on undisclosed information.

3 There is one problem stated in regard to the Cadillac Heights "zoning" and impacts for environmental justice. The Corps states that this residential area was never "re-zoned" and carries the same zoning since 1965, but that the city had gone through a change in zoning "definitions". Since the LWV participated heavily in this process, it may be helpful to point out that prior to this "re definition" process, land with "higher" use zoning was allowed to support "lower" usages until or unless the owner chose to act upon the higher zoning designation. With the 1985-87 "redefinition" of zoning categories, the only use to be allowed of the land is that which is in compliance with the zoning designation. In other words, any industrially zoned land with residences on it, previously allowed under the old system, would now render these residences as being in "non-compliance" with the zoning category. While this is not technically a re-zoning, we understand how the comment could have been made to the Corps by someone who was familiar with the impact on the Cadillac Heights community even though perhaps not technically correct.

4 In any event, the result is the same for this community. Residences, in this case, in non-compliance with the zoning have limited chances of being able to get money for upgrading or repairing their homes, and they live not knowing when a toxin producing user might move next door! All previous and present comments in relation to the importance of having a buy-out, non- structural solution for this neighborhood is still more important in terms of an environmental justice solution than the Corps seems to have addressed to date. Comparing the buy out cost for this neighborhood with the swale required for the largest levee proposal, and

3. Examination of Dallas zoning maps indicate the re-definition process has impacted a small area of Cadillac Heights. Since these few homes are being allowed to remain even under the re-definition the existing conditions remain unchanged. The future with and without project conditions for those few homes might be slightly different, however, it would appear that if they were in an area of non-compliance, that it might be difficult to resell or borrow funds for maintenance.

4. The Dallas Floodway project as authorized is in compliance with the Executive Order on Environmental Justice. All analyses of the various alternatives have been conducted pursuant to applicable laws and regulations. After completing our analysis, it was concluded that there was not sufficient federal interest to justify a non-structural approach for Cadillac Heights.

the cost of that larger levee does not honestly reflect a true cost comparison. We suggest that, again, the public should be afforded the opportunity to compare the smaller levee/swale cost that would ensue with a buy out of the neighborhood, or a buyout without the DFE FSP levee assumptions.

5 Evaluating cumulative impacts of the newly proposed EQ plan, a plan much more in keeping with the "new, green" Corps, against currently existing conditions might have resulted in very different NEPA outcomes, as well as better environmental justice outcomes. Unfortunately we do not have this information as a result of this document. We thank the Corps for this extremely important plan and the suggested future thrust of Corps thinking on flood plain, flood control and floodway issues

6 Attempting to secure the Corps DFE project and THEN evaluating the cumulative impacts of known future proposals/alternatives as this document purports to do, is not our understanding of meeting the NEPA requirements (see Federal Court for the Northern District of Texas' ruling, p.54- 57 of the opinion, April, 10, 2002 which demands that "the cumulative impacts of these projects" be addressed "WITH the DFE project").

7 The League of Women Voters is concerned about the best use of public funds, cumulative effects on the environment upstream and downstream, meeting the requirements of NEPA, and long range planning to ensure a better, healthier quality of life for all Dallas citizens. In order to make democracy work for all Dallas' citizens, accurate and complete information must be available. We hope to continue to work with the Corps of engineers to meet these goals.

Thank you.

5. Thank you for your comment. The EQ plan will be fully investigated and analyzed when the existing Dallas Floodway Feasibility Study is completed.

6. The EIS addresses the cumulative impacts of all reasonably foreseeable projects including the DFE. Authority for the DFE was provided under Section 351 of the Water Resources Development Act of 1996 and 356 of the Water Resources Development Act of 1999. Neither the GRR-EIS nor the SEIS attempt to secure the project but rather considered various alternatives for the DFE together with the impacts of reasonably foreseeable projects. The final document addressed the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects, which have not been fully studied or designed.

7. Thank you for your comment.

Mixmaster Business Association
6060 North Central Expressway
Suite 333 Dallas, Texas 75206-5204
214-739-4025 Fax 214-739-4026
E-mail: mba@advico.com

January 17, 2003

U.S. Army Corps of Engineers
Fort Worth District
ATTN: CESWF-PM-C (Mr. Gene T. Rice, Jr.)
P. O. Box 17300
Fort Worth, TX 76102-0300

Subject: Dallas Floodway Extension (DFE), Trinity River, Texas
RE: DRAFT Supplement No. 1 to Environmental Impact Statement (EIS)

1. We continue to strongly support the Dallas Floodway Extension as described in the Record of Decision signed on December 1, 1999. Implementation of that decision should occur without further delay. The City of Dallas is vulnerable now to at least $8 billion of flood damages if a large flood event should occur, and Dallas does not have Standard Project Flood protection along the existing Dallas Floodway.

2. This organization represents an area most critically impacted if a flood event were to occur before completion of the DFE. This area lies along the downtown Dallas side of the current Dallas Floodway from Continental Avenue near the American Airline Arena south to the Dallas Area Rapid Transit Light Rail line to Oak Cliff. Although the current levee protects this area from three hundred year (300-year) event floodwaters, a lesser flood event (>140-year) would seriously damage our properties and businesses. This damage will occur because the sanitary sewage treatment facility for a major portion of Dallas will flood and raw sewage will be released into the old Trinity River channel that flows through our area. It is likely that sewage and floodwaters will be in most buildings. Sewage pumps and treatment facilities will be out of operation for an extended period of time, even weeks or months.

3. The cumulative effects of possible projects affecting the DFE have been properly considered, and the Supplement No. 1 is sufficient for the US District Court for the Northern District of Texas to rule in favor of the Corps. We urge the Courts, Congress, and the Corps to implement the Dallas Floodway Extension before monumental flood damage occurs.

Mixmaster Business Association

Marcus Wood
Executive Vice President

MW/s

1. Cumulative impacts from many past actions have led to hydrology and hydraulics and economic conditions described in the DFE/GRR.

2. Recent flooding in San Antonio and particularly Houston and the results of the major water supply break in downtown Dallas indicate that severity of flood damages, mainly in subsurface storage and facilities handing areas have likely been underestimated in the past.

3. The Corps is complying with the Courts and Federal regulations to move forward with construction of the DFE.

Mixmaster Business Association
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January 21, 2003

U.S. Army Corps of Engineers
Fort Worth District
ATTN: CESWF-PM-C (Mr. Gene T. Rice, Jr.)
P. O. Box 17300
Fort Worth, TX 76102-0300

Subject: Dallas Floodway Extension (DFE), Trinity River, Texas
RE: DRAFT Supplement No. 1 to Environmental Impact Statement (EIS)

Our January 17, 2003 letter summarized our overall support for the Dallas Floodway Extension as described in the Record of Decision signed on December 1, 1999 and the Draft Supplement No. 1.

The purpose of this letter is to describe detail comments and suggestions regarding specific wording in the Draft Supplement No.1. In some instances these are simply typographical corrections. These comments are attached hereto.

Mixmaster Business Association

Marcus Wood
Executive Vice President

MW/s

COMMENTS REGARDING DRAFT SUPPLEMENT NO. 1
DALLAS FLOODWAY EXTENSION, TRINITY RIVER, TEXAS

	PAGE	Comments
1.	i	The description mentions levee construction, but does not mention that an extension of existing Corps levees is involved. This wording should be added.
2.	ii	**It is very important to state that the existing Dallas floodway no longer provides SPF protection. In fact, the Summary states just the opposite which is inaccurate.** (See paragraph 3: "Both levees are designed to provide SPF level of protection (estimated at about 800-year frequency of occurrence) to the adjacent neighborhoods, *which is comparable to the protection provided by the existing Dallas Floodway to the Central Business District."*).
3.	1-3	Last paragraph has typographic error of "or" rather than "of".
4.	Fig 3-1	It would be helpful to show which of the highways would not be covered by a SPF under current protection. Or does it already accurately show that all highways would be flooded?
5.	3-19	The descriptions of the Industrial alignments are inaccurate. Neither alignment follows the existing city street, but rather curves gently for higher speeds. Thus some of the data shown in the report may be in error (particularly Table 4-1) (contact NTTA).
6.	3-19+	The descriptions of the various alternatives as to right-of-way and costs are misleading. For some alternatives much of the right of way is already publicly owned and not that case for others. One suggestion would be to differentiate the public/private right of way amounts; another would be to use the total project costs (contact NTTA for data).
7.	3-22	The description of the Corinth Street Bridge is not accurate since a couplet bridge is proposed (contact TxDOT).
8.	3-29	Reference is made to "Medical City", but that hospital is located many miles away near US 75 and Forest Lane. Better wording might be "the hospital and medical school area along Harry Hines Boulevard."
9.	4-2	There is no mention of Transportation Projects in the West Fork of the Trinity area. Are there not any?
10.	Table 4-1	Question accuracy of Industrial impacts, particularly Elevated and the Forest Conversion. This is particularly true since the Industrial Parkway alignments do not exactly follow the current roadway.
11.	4-6	The Wetlands section wording seems inconsistent in that there is no sponsor for an EQ plan, so it should be described in "not well defined" terms similar to other such plans.
12.	Table 4-2	The Transportation Improvements should all show improved air quality because of reduced traffic congestion. As presented here, it is inconsistent with NCTCOG studies and planning.

1. The intent of the Dallas Floodway Extension Project is to provide flood damage reduction benefits to an area downstream of the existing federal project downstream. The levee construction would link the existing levee on the east side with the existing downstream Rochester levee and would link the existing levee with the existing Central Wastewater Treatment Plant levee on the west side of the river. These details were thoroughly provided with the GRR/EIS.
2. Statement in FSEIS has been revised to clarify that with DFE in place, the DF would be restored to provide SPF level protection.
3. Error has been corrected.
4. The intent of this figure is to show the extent of the SPF as currently known in the Upper Trinity River area. Many local, state and federal roadways would be impassible should an SPF even occur in any area shown. In addition thousands of homes, and businesses could be isolated or partially inundated.
5. Information in Table 4-1 was provided by NTTA.
6. The details of the Parkway/tollroad alternatives are being fully developed by the NTTA and will be disclosed in a Draft EIS. We have attempted to provide sufficient description of those alternatives being considered to adequately consider the cumulative impacts of those alternatives with the Dallas Floodway Extension alternatives.
7. The description has been modified.
8. The description has been changed.

9. Only transportation projects believed to have cumulative impacts to the DFE alternatives were carried forward and assessed in Chapter 4.

10. Impacts were obtained for Parkway alternatives directly from NTTA documentation.

11. The EQ plan was developed by the Corps of Engineers for consideration as an alternative scenario for the modification of the Dallas Floodway and documented in the Corps PEIS dated June 2000. Therefore we have a better-defined description of what that plan could be. There is no current sponsor for the EQ plan, however, it will be further refined as the Corps continues studies on the existing Dallas Floodway.

12. The cumulative impacts of all the transportation projects could result in regional improvement, but the relocation of traffic to other areas, could result in degradation at that new alignment. We believe that the minimal improvement in traffic conditions from the parkway project if implemented would produce very minor air quality changes on a regional basis. Based upon results in other metropolitan areas, the new roads will also quickly become congested resulting in further reducing the potential of improving air quality.

13.	Table 4-2	There is no section or description of "Public Services".
14.	Table 4-2	It is difficult to understand there being any Water Quality differences between those Parkway alternatives within the river since all would result in improved water quality.
15.	Table 4-2	We do not agree with the differences shown between the Parkway comparisons, particularly the Combined and Split Riverside with Industrial. The effects are not consistent with the PEIS table. The Industrial and Landside routes negatively impact Environmental Justice, Cultural Resources, and economic development.
16.	Table 4-2	Sump capacity is likely to be reduced with Industrial and Landside alignments. This negative impact is not properly reflected in the Flood Damages section.
17.	4-11	Because the areas along the Dallas floodway do not have SPF protection today, the lack of such protection negatively impacts both existing property uses and redevelopment potential that no new transportation improvement is going to overcome completely. The current draft wording implies otherwise.
18.	4-13	We suggest that the Aesthetic statement is subjective and open to dispute. We know that vast numbers of people would like to drive along a parkway and see the area within the floodway. The majority of Dallas voters support such a riverside parkway. This difference of opinion should be reflected in the Supplement wording.

13. A description of "Public Services" has been added to the final.
14. The parkway was evaluated as presented without any mitigation. Without mitigation, we fail to see how the parkway alignments would improve water quality.

15. Environmental Justice impacts were considered based on the foreseeable projects potential effects to minority and economically depressed populations. These impacts would occur along the West side of the floodway, if a project decreases the ability to access the floodway or increases noise levels effects. Although we are not aware of studies done that show cultural resources would be impacted by the Industrial alignment, we concur that the potential is always possible for buried resources to be along the alignment. We are aware that there is consensus that construction of the Industrial alignment would be more costly from a real estate acquisition standpoint, we believe that cumulatively, within the DFE area, the alignment would make little to no impacts to economic development.

16. The City of Dallas is legally responsible for maintaining sump capacity associated with the existing Dallas Floodway. For the analysis we determined that the City would continue to fulfill its requirements and would require that sump capacity be maintained.

17. Discussion in the 3rd full paragraph of page 4-11 clearly identifies that cumulative change to property uses would occur following implementation of both a reliever route and the DFE flood damage reduction project.

18. We concur that aesthetic evaluations are subjective by nature. Some would enjoy the view of the floodway from atop the levee. However the view would likely be greatly minimized due to the fact that a large length of the parkway, if located on the inside of the levee, either as a split or on one side, would be shielded by floodwalls that would be necessary to protect the parkway to the 100 yr flood elevation. A statement was added to the FSEIS to discuss the opposing aesthetic viewpoint.

Mr. Hunter
Speaker # 1

"The cause of America is, in a great measure, the cause of all mankind. Many circumstances have, and will arise, which are not local, but universal, and through which the principles of all lovers of mankind are affected, and in the event of which, their affections are interested. The laying a country desolate with fire and sword, declaring war against the natural rights of all mankind, and extirpating the defenders thereof from the face of the earth, is the concern of every man to whom nature hath given the power of feeling; of which class, regardless of party."
–Thomas Paine, February 14, 1776 in Common Sense.

A Petition for Global Peace, Security and Justice

WHEREAS we citizens of North Texas are also citizens of the United States of America who consider ourselves citizens of the world, as well;

WHEREAS when our nation differs with another on matters of either nation's 'national security' the result is often institutionalized violence which typically kills and maims not only many of our fellow U.S. citizens but many others, both civilian and military, in other parts of the world as well;

WHEREAS the Congress has granted President George W. Bush its approval in advance for any violence he may wish to undertake as our military's commander-in-chief against the present government of Iraq and the Iraqi people;

WHEREAS since renewals of UN inspections for weapons of mass destruction in Iraq no evidence of any such weapons has been reported by the UN inspectors, nor have they reported any undue interference in their searches by the Iraqi government or its military

THEREFORE we the undersigned urge President Bush to authorize no military action against Iraq —or against any other nation— unless and until such nation actually deploys its weapons outside its own borders with an obvious intent to harm others, a situation which would far more clearly justify a military response.

WE FURTHER urge President Bush and the U.S. Congress —

a) to recognize that as the 1.4 billion Chinese and millions of other people the world over increasingly seek to emulate America's vaunted and envied 'standard of living' the capability of the planet to provide the necessary natural resources will —absent our nation's leadership to prevent it— finally be outstripped, and that we must begin now deciding upon what the 'rightful share' of those natural resources for our own population/consumption is and will be five, twenty and fifty years down the road

b) to consider that if USAans, a mere 4.6% of the world's people, continue to consume 25% of the world's energy, this will likely generate a great deal of resentment against us by many hundreds of millions of the less-fortunate among the remaining six billion other humans on the planet — especially among those living under non-elected tyrants who maintain their wealth and regimes by selling their nation's natural resources, notably its oil, to U.S. and other foreign corporations, *and*

c) to direct the Office of Homeland Security to establish a Quality of Life Commission to develop a USSPPP —a U.S. Sustainable Population Policy Program— aimed at bringing our nation's energy consumption down to not over *three* times the world average nor over 2/3 present levels by 2008 or earlier and at making us at least 80% energy independent by 2038 *without* drilling in the Arctic National Wildlife Refuge (ANWR) or in any other wildlife sanctuary, to help other nations establish and activate similar programs to stabilize their own populations at sustainable levels and to work with them to forestall the ecological catastrophe to which we are by all accounts now headed.

[over, please..]

1. Thank you for your comments. Unfortunately, these are outside the scope of this document and do not address the issues being considered for this SEIS.

Growth debate offers choice ranging from A to B

—by Al Knight, *Denver Post* Columnist August, 2000

As recently as the 1970s, most environmental groups were on record urging a stabilized population. The reasoning was simple—damage to the environment, they said, can be reduced in only two ways:

> "Consumption by institutions and individuals can be lessened *and/or* the number of groups and individuals can be reduced."

Makes perfect sense. What doesn't make any sense is trying to reduce the consumption factor while allowing the number of groups and individuals to increase without limit. Yet that is precisely what is taking place right now in many countries, most notably in the United States.

Total population growth, 70 percent of which is driven by recent immigration (—and 100% in the U.S. by its immigrants of the past twenty-five years and their progeny!)— is wiping out any advances that have been made in lessening individual and institutional environmental impacts through greater efficiency and reducing consumption.

The U.S. Census Bureau says current trends will continue and predicts a U.S. Population of 400 million in the next 50 years. Meanwhile, environmental groups that once talked of stabilizing our population by 1990 have accepted these numbers as a kind of inevitable fate and prattle on about conservation of resources as though nothing has happened.

"I endorse the *'Petition for Global Peace…'* And I (1-Strongly agree / 2-Agree / 3-Not sure / 4-Disagree / 5-Strongly disagree) that we need to begin now to stabilize local/regional population at present levels or below.

(To vote on stabilizing population levels place the appropriate number after your name— this 'Vote' is optional.)

Name	Vote?	Address	Zip	City / State	e-mail / Phone
Bruce Hunter	1	7418 Daingerfield	[illegible]	Dallas, TX	[illegible].com
Stephanie Frizzell	1	15944 Peterson #1023	75240	Dallas TX	frizzell[illegible]@yahoo.[illegible]
Russell Frizzell	5	15444 Peterson #[illegible]	75240	Dallas TX	972-387-8846
AJ Anderson		[illegible] #1239	75[illegible]	Dallas TX	ajanders@[illegible]
Jae Wicks	1	[illegible]	[illegible]	[illegible]	[illegible]
Jo [illegible]	1	3910 [illegible]		Dallas TX 75204	214-526-6598
[illegible]		9524 Milton	75243	Dallas TX	214-873-025[illegible]

February 4, 2003

US. Army Corp of Engineers
Fort Worth District
P.O. Box 17300
Fort Worth, Texas 76102
ATTN: CESWF-PM-C Mr. Gene Rice

Dear Mr. Rice:

1. Save Open Space (SOS) is very concerned about Supplement #1 to the DFE EIS. The response does not meet the requirements of either the NEPA or the Federal Court Order.

2. To meet the NEPA and Federal Court requirements, Supplement #1 cannot start with a baseline of the Dallas Floodway Extension being built. The starting point for Supplement #1 must be the current un-built condition downstream from the existing Dallas Floodway.

3. Both NEPA and the Federal Court Order say the Army Corps of Engineers must analyze, evaluate and compare the cumulative impacts of diffderent aspects of the Dallas Floodway Project (which is immediately upstream from the Dallas Floodway extension). The Dallas Floodway Project has not yet been fully designed. The design is not projected to be ready until late summer of 2003. At that time the Dallas Public Works Department of the City of Dallas will present its plans for the Dallas Floodway Project.

4. The Dallas Floodway Project, also known as Dallas' Trinity River Plan, will include lakes, roads and bridges. After those designs have been presented in the summer of 2003, the Army Corps will be in a position to analyze, evaluate and compare the cumulative impacts of the Dallas Floodway Project and the Dallas Floodway Extension alternatives.

5 There must be, according to NEPA and the Federal court, analysis, evaluation and comparison of the cumulative impacts of all alternatives to each component of the Dallas Floodway Project and the Dallas Floodway Extension.

6. SOS supports the Environmental Quality Plan for the Dallas Floodway Project.

Sincerely,

Ms. Joanne Hill

Ms. Joanne Hill
President, Save Open Space

1. This document is designed to bring the GRR-EIS in full compliance with NEPA.

2. The SEIS has been amended. The new baseline does not assume that the DFE is in place.

3. The final document addressed the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects, which have not been fully studied or designed.

4. The final document addressed the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects which have not been fully studied or designed.

5 . The cumulative impacts to all alternatives to the DFE have been addressed in the SEIS. The cumulative impacts of the Dallas Floodway project have been addressed to the extent known. Since this project has not been finalized or authorized, all possible alternatives are not known at this time.

6. Thank you. That potential project will be fully studied at a later date.

Comments on Supplement No. 1
To the
Environmental Impact Statement
Dallas Floodway Extension
Trinity River, Texas

January 8, 2003

David D. Gray
9432 Viewside Dr.
Dallas, Texas 75231

General

1. This SEIS is intrinsically flawed for summarizing the "cumulative impacts" of one only alternative for the DFE, the Recommended Plan. The Corps has assumed that for the purposes of this Supplement the DFE has been built in place according to the Recommended Plan. But the purpose of an EIS is conduct an evaluation of the alternatives and impacts of those alternatives in order to be sure the most optimal plan is chosen.

2. The federal judge has remanded the DFE EIS back to the Corps to conduct an analysis of cumulative impacts. It is insufficient to simply say that all "reasonable and foreseeable actions" will add some more or less cumulative impacts to the DFE. It is necessary to compare the cumulative impacts of such actions with each of the alternatives, e.g., the No Action plan. Only with a comparison of the full impacts of all related actions can a reasonable and informed choice of the least damaging and most beneficial alternative be made.

3. Furthermore, there are no data or evidence with analysis presented to back up any of the specious claims made by the SEIS. There are no cost-benefit estimates for any of the proposed, reasonably foreseeable, or other actions in combination wish or without the DFE.

SUMMARY
Summary of Major Environmental Effects, p. vii

4. "These bridges were not evaluated in this Supplement..." The proposed Calatrava suspension bridges could very well provide beneficial flood water elevations effects in the Dallas Floodway, reducing the need for the badly damaging swale of the DFE's Recommended Plan. (It could, however, expand the floodplain of the DFE project area.)

Areas of Controversy, p. vii

5. "The potential for resultant adverse impacts created the need to address the environmental consequences of the reasonably foreseeable actions." This is a wise statement, but this SEIS completely fails to carry it out. We still do not what the flood surface elevations of all the reasonably foreseeable actions (DFE, toll roads inside the levees, Chain of Lakes, AT&SF bridge, suspension bridges, etc.) Without data and without comparisons, we are unable to determine whether or not, in fact, the DFE actually does provide any benefits that other actions already proposed or planned don't also provide, which if proven would make the DFE a huge waste of money with devastating ecological impacts.

CHAPTER 3--AFFECTED ENVIRONMENT

FLOOD DAMAGE REDUCTION
Removal/Replacement of ATSF, p. 3-26

6. "...thus potentially providing hydraulic relief while while maintaining possible trail access." Well, how much relief? Is this a significant and inexpensive way to relieve flood elevations in the Dallas Floodway? If so, this action would reduce the extent and cost of the DFE swale.

1. The final array of alternatives from the DFE GRR/EIS have been evaluated in the final SEIS.

2. The analysis has been conducted including the cumulative impacts of reasonably foreseeable projects for all all DFE alternatives considered in the final array as indicated in response 1.

3. NEPA does not require that the agency consider the costs benefits of reasonably foreseeable actions. 40 CFR 1508.25(c) requires the agency to consider cumulative impacts which are defined under 40 CFR 1508.7 as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions..." A cost benefit analysis does not fit within this definition. We have carefully reviewed the cost benefits of the DFE project alternatives, as we will do for other Corps of Engineer project proposals.

4. There are no known benefits from any of the proposed bridges. The bridges are potential obstructions creating backwaters increasing the flood damages.

5. This information was provided in the PEIS, and is incorporated by reference in the SEIS. For clarity, that information has been included in final SEIS.

6. Any relief from removal of portions of the ATSF would be minor and accrue upstream of the DFE and only if backwater from downstream obstructions has been removed. The DFE was not formulated to provide optimum benefits to the CBD, and therefore removal of ATSF would not reduce the size or cost of the DFE flood damage reduction measures.

CHAPTER 4—ENVIRONMENTAL CONSEQUENCES

CUMULATIVE IMPACTS, p. 4-1

"Administrative priorities promoting nonstructural flood damage projects including buy-outs and environmental protection alternatives are becoming more prevalent." These priorities don't seem to be taken seriously by the Ft. Worth District. A reasonable and affordable nonstructural alternative to the Recommended Plan of the DFE is available that would offer much less environmental impact and better flood damage reduction. This alternative is outlined in a letter from the White House OMB director, Mitchell Daniels, to the Army Corps.

	Comment	Response
7.	FLOOD DAMAGE REDUCTION PROJECTS, p. 4-1 "Studies underway by the City of Dallas indicate a potential for future actions to protect existing investments in the Stemmons industrial area may eventually evolve, however, nothing has been specifically elevated to the point of any specific project could be considered as reasonably foreseeable." How elevated does it have to get? We already know the Corps has fully evaluated this alternative from evidence found in the administrative record. Why the Corps continues to keep this information from us is a mystery. It's a well known fact that the Corps and the City plan to propose just such a project, but only *after* the DFE is built. This statement was given by Corps representatives, in my presence, to Mayor Miller.	7. The Corps disclosed in the PEIS the affects of a potential Stemmons levee. We have further accurately stated that preliminary investigations reveal this alternative doesn't appear to be feasible for implementation by the Corps. The City has indicated that if some of the proposed actions in the study were to be implemented there would be beneficial impacts to upstream and downstream H&H. Insufficient information is available to ascertain that this is a reasonably foreseeable project for the Stemmons area, other than the ongoing filling in that area that was previously permitted by the City. These fills do cause cumulative minor impacts to the adjacent areas and included that assessment in our DSEIS and in the FSEIS.
8.	CUMULATIVE IMPACT IDENTIFICATION, p. 4-5 "In other cases, the information may have been developed but has not been made available to the Corps of Engineers." It is well known that the Corps has participated regularly in multi-agency meetings about the Trinity Corridor and the related projects. The fact that NTTA (through its contractor Halff Associates) has studied the hydrology and hydraulics of the toll roads and Chain of Lakes cannot be a secret to the Corps. Regardless, the fact that the toll roads EIS has been delayed, expanded to include the Chain of Lakes, and delayed again, should not prevent the Corps from asking to see it. The fact that fairly advanced and detailed schematics have been shown to the public for the toll roads alignment might suggest to the Corps that there is a large amount of study already done on the toll road project and the various alignments. The Corps does not need to wait for the data for these proposed actions "to be made available" to do a serious, factual analysis of the cumulative impacts of these mega-projects. They merely need to ask to see it.	8. No agency is required to provide information to the Corps of Engineers merely because we ask. However, we have previously provided in the PEIS an analysis of the effects on H&H the various tollroad/parkway alignments would have. That information was incorporated by reference in the DSEIS and has been included in the FSEIS and utilized in our analysis of the cumulative impacts.
9.	TABLE 4-2, CUMULATIVE IMPACT ANALYSIS, p. 4-6 In this table, we some indication of the importance of the data that is missing from the SEIS. Under the Floodway Levee Raise column in the Flood Damages row, we have two green triangles that mean Moderate Beneficial Effects. (There are no better effect labels than Moderate listed in the table.) People living in the Stemmons area where these beneficial effects might be felt would probably like to know how beneficial they are, and so would we. In fact, the benefits might so beneficial as to eliminate the need for the DFE swale, and prevent the devastation of the Great Trinity Forest that the DFE project would entail. Similarly, the column ATSF Bridge Modification is listed in the same row as Slight Beneficial Effects. How slight? Many slight effects might add up to a sum of Vast Beneficial Effects. Other Slight Beneficial Effects include the column Floodway Lake.	9. No alternatives that have been identified in the Floodway or within the Stemmons area evaluated singularly or in combination would minimize the quantity and/or timing of flood events within the downstream area of DFE to any significant level. There is a possibility however for some of the reasonably foreseeable alternatives to cause minor negative impacts to hydrology and hydraulics.
10.	On the other hand, under the column Combined Riverside and Split Riverside (toll roads) we have Slight Adverse Effects. It is reasonable to think that if we remove Slight Adverse Effects and add Slight to Moderate Beneficial Effects we get an overall Vast Beneficial Effect. So vast, in fact, that the need for the DFE (except for the protection of residents in the floodplain through a voluntary buyout) would be totally obviated.	10. The authorized DFE project is to provide flood damage reduction to the residents of South Dallas. Other benefits to the CBD occur as a result of the authorized DFE project.
11.	LAND USE / FLOODPLAIN VALUES, p. 4-10 "Most flood damage reduction projects, such as being evaluated in the feasibility study of the Dallas Floodway, require siting within the floodway, however, the multipurpose study and construction authorities associated with Corps of Engineers projects could ameliorate and even enhance the natural floodplain values[. (sic)]" Please explain this sentence. The Corps is claiming that the toll roads and Chain of Lakes projects within the Dallas Floodway would have basically	11. The statement indicates that the Corps has broad authority to consider multipurpose water resource related projects generating outputs and benefits such as wetlands, fish and wildlife habitat, recreation, water quality etc. The statement in no way intended to indicate the tollroads have neutral affects. Please see Tables 4-1 and 4-2 of the draft report.

"neutral effects". Well, since many of us disagree with that claim, we would like to some some evidence or at least some data to backup that general, unsubstantiated foregone conclusion.

12. "Physical features of the project would directly impact some forestlands...; however, these losses would be mitigated, resulting in a larger area of preserved and reestablished floodplain forests." This is a misleading claim, since mitigation is intended to protect habitat equivalent to or better than that being destroyed. But this does not increase the area of the specific habitat since the area being used for mitigation could also be preserved without the necessity of mitigation, and especially because the project destroys the original area being mitigated for. In fact, habitat of rare, old-growth, bottomwood, hardwood habitat is not sufficiently available for one-to-one "mitigation" of such habitat.

p. 4-11

13. "The economic stimulus associated with the project,...would result in a higher order of economic use of the affected lands..." This intent of the DFE project contradicts the purpose of an Executive Order forbidding flood control projects intended to foster economic development (on the backs of taxpayers).

14. "The nature, location, and extent of land use changes or economic redevelopment that would occur cannot be predicted with certainty at this time." The Comprehensive Land Use Plan has already presented preliminary growth figures and maps to the City Council and to the public, so this statement would appear to be false.

ENVIRONMENTAL JUSTICE / COMMUNITY STRUCTURE, p. 4-11

15. "Until sufficient scoping of all the project proposals and coordination with affected communities can be completed, only a preliminary discussion of cumulative effect is possible." It would seem that this scoping should be the exact objective of this SEIS, but the Corps apparently admits that it has not accomplished that objective.

p. 4-12

16. "...the DFE project would result in an enhancement of the area through reductions in flood damages...and would produce positive benefits for the future." This seems like an inflated assumption, especially since the Corps just admitted that the economic redevelopment "cannot be predicted with certainty" and only a "preliminary discussion" is possible. But the most disturbing figure is we don't yet know what the cumulative flood predictions for the area would be and no data is available to compare various combinations of components or alignments.

HYDROLOGY AND HYDRAULICS, p. 4-12

17. "Thus, the cumulative hydraulic impacts would be similar to the sum of the two projects." While most of this section is speculative, generalized, unsubstantiated, unjustified conclusions, there is no data, evidence, or analysis to support any sort of impact. Furthermore, no conclusions are even presented on the impact of the Flood Damage Reduction Alternative downstream nor is it clear what the Flood Damage Reduction Alternative is. The Corps should say exactly what the impacts of the sum of the two projects would be, and provide evidence and analysis to support it.

12. The statement is correct and true. The Great Trinity Forest is currently unprotected, that is existing land owners have the option of removing the trees for firewood, clearing the lands, or whatever other purpose they should desire. Acquisition and management would protect and improve the value of these areas. In addition the mitigation plan calls for conversion of 223 acres of existing grassland to bottomland hardwood forest, thus accelerating the development of the forest. There are a few old trees within the project area that would be impacted, but the majority of the forest is neither old growth nor rare.

13. Executive Order 11988 on Floodplain Management does not prohibit floodplain development; rather it requires federal agencies to determine that there are no practicable alternatives to implementing an alternative action within the 100-yr floodplain and to take practical steps to minimize adverse impacts to the floodplain from project implementation. The authorized DFE project as designed complies with the Executive Order.

14. The CLUP is a master plan lacking official City approval and funding.

15. The statement was revised. The word "scoping" was used, inappropriately in this case, to indicate that the reasonably foreseeable project plans are not mature for decision on their own. Given these circumstances the social issues impacts assessments don't provide the accuracy that other evaluation elements have.

16. The statement is true. The DFE project would generate significant economic benefits through reduction of flood damages once implemented. Cumulative flood predications are provided in the H&H analysis.

17. The statement has been clarified in the final SEIS. In addition, data within the PEIS, incorporated by reference in the DSEIS has been included in the FSEIS.

Date: Jan. 8, 2003

To : US Corps of Engineers

Joe Wells

From: Joe Wells, Dallas Sierra Club 2726 Kingston St. Dallas 75211

Subject: Comments on Dallas Floodway Extension SEIS

1. The SEIS fails to meet the intent of the National Environmental Policy Act because it does not adequately address how other projects in the floodplain relate to the DFE nor does it adequately quantify the cumulative impacts of these proposed projects (i.e. Trinity Parkway and Floodway Lakes) will have in combination with the DFE. These SEIS should include alternatives without the DFE project in place and should look at variations of the DFE alternatives including voluntary buy out in lieu of levees and swales.

2. The Sierra Club requests the Corps include cost-benefit figures for raising the levees by various amounts, not just by 2 to 2.5 feet.

3. The SEIS should not be completed until studies of the Proposed Toll roads and Floodway Lakes commissioned by the City of Dallas are complete (probably in April or May of 2003 according).

4. The SEIS fails to include meaningful analysis of the cumulative impacts of the Trinity Parkway and the lakes in the DFE. To Date the Corps DFE EIS, PEIS and now the SEIS have failed to comply with NEPA requirements. A Federal Court will have the opportunity to correct this repeated violation of federal law unless the Corps comply ed with NEPA requirements by amending this SEIS.

The Dallas Sierra Club adopts and supports comments about the SEIS, which are attached as submitted by David Gray, Ned Fritz and Campbell Green. (AS ATTACHED) AND REITERATED COMMENTS SUBMITTED EARLIER BY THE SIERRA CLUB (DALLAS CHAPTER) (ATTACHED)
Because of the significant and controversial nature of this project and lack of compliance as ruled previously by a Federal District Court with NEPA requirements the Dallas Sierra Club requests that the Corps extend the deadline for written comments.

1. The final Supplement to the DFE EIS has been modified to include disclosure of cumulative impacts of each of the final array of alternatives for the DFE as disclosed in the DFE /GRR.
2. A preliminary cost estimate for raising the existing levees by 2-feet has been included in this Supplement. More detailed evaluations are pending, awaiting decisions on potential roadway alignments or other potential developments within the floodway. Various levels of levee modifications will be analyzed during any subsequent Corps formulation within the Dallas Floodway.
3. The draft SEIS disclosed known cumulative impacts from reasonably foreseeable projects, including the parkway and lakes within the existing Dallas Floodway. Where available the hydraulic impacts were incorporated by reference to the Corps PEIS dated June 2000. Additional hydrology and hydraulic information has been included in the final SEIS to address cumulative impacts of the DFE/GRR final array of alternatives rather than just the recommended DFE plan.
4. The comment period was extended as requested.

Date: January 22, 2000
To: U.S. Army Corps of Engineers, Fort Worth District
From: Joe Wells, Dallas Sierra Club , Trinity Pkwy MIS/EIS CAC
2726 Kingston St.
Dallas, Tx. 75211
Subject: Comments on PEIS Upper Trinity River Basin DRAFT

Following review of the DRAFT PEIS on the Upper Trinity River Basin I am submitting these comments and requesting a copy of the FINAL PEIS be mailed to my home address indicated above.

1. The Dallas Sierra Club urges protection and preservation of the Trinity River floodplain, and Dallas floodway and the Trinity River's environmental values. The Dallas Sierra Club opposes proposals to construct public works projects including floodway Tollroads and Dallas Floodway Extension Levees and Swales due to the environmental damages that these proposed floodplain alteration projects will cause.

The DRAFT PEIS analysis of various public works projects does not justify the radical shift in purpose and use of the Dallas Floodway which local sponsors propose. These projects including the placement of eight lanes of Tollroads within the Dallas Floodway and the construction of Levees and a swale below the existing Dallas Floodway damage and unwisely and inappropriately convert use of the Dallas Floodway and Trinity River floodplain from its primary purpose, which is to protect over a third of the City of Dallas' tax base from flooding. Flood protection is the reason Federal and local taxpayers funded the construction of the Dallas Floodway. Flood protection should remain its primary purpose.

This DRAFT PEIS of the Upper Trinity River is a insufficient, unscientific, vague and after the fact analysis of cumulative impacts of proposed Corps of Engineers and other public works projects. The PEIS does not evaluate all direct and indirect environmental consequences of these proposed floodplain development projects per EPA guidance correspondence dated June 15, 1999. The PEIS is unclear which projects have been considered in combination in order to evaluate their combined affects of reducing flood protection, increasing flood damages and causing significant adverse impacts on environmental resources of the Upper Trinity River. While the Draft PEIS was in development significant changes in proposed public works projects have occurred. It is unclear whether these changes have been evaluated. If not the final PEIS should evaluate the combined affects of all proposed projects as they are currently proposed to be built: including City of Dallas Masterplan Lakes, park access roads, Spilt Channels, Dallas Floodway Extension, Trinity Parkway, raising current Dallas Levees and the impacts of future development activity which proponents of these combined projects claim will occur as a result.

1. See responses to this attachment within the Final Programmatic Environmental Impact Statement, Upper Trinity River Basin, Trinity River, Texas. June 2000

The Draft PEIS avoids through consideration of the indirect affects of assumed economic development which will be attracted to previously unprotected areas of floodplain along the DFE ,and in the Industrial / Stemmons area as a result of the doubling (or more) of traffic carrying capacity by proposed Stemmons Freeway and Trinity Tollroad improvements. What will the air quality and non point water pollution impacts of this new development adjacent to the floodway be on the Trinity River and its floodplain? What amount of increased flood damages will occur if flood protection is inadequate for a future flood of these newly developed properties?

The PEIS has avoided necessary consideration of EPA Section 309 and Executive Order #12898 Environmental Justice impacts of the Dallas Floodway Extension projects by inclusion of the DFE within the baseline. The direct and indirect impacts of extension of Levees are anticipated by project proponents to encourage commercial development of primarily minority low income neighborhoods including Cadillac Heights. The DFE EIS failed to consider a voluntary buyout option, which would be based on replacement costs not market values which is likely to be offered by commercial developers seeking buy out residents and rent house absentee owners following construction of Levees. Similarly Sec 309 Executive Order #12898 Environmental Justice evaluation of the local air and water pollution impacts of doubling of the freeway capacity along and within the Trinity Corridor through construction of the Trinity Tollroads and with doubling Stemmons Freeway capacity should be evaluated as a direct and indirect consequence of floodway projects evaluated in the PEIS. There is no such evaluation in the Draft PEIS.

This assessment of combined cumulative impacts should include air quality assessments since the Dallas Fort Worth area is currently designated Serious non attainment Ozone and is in the process of being further designated Severe non attainment. The PEIS should evaluate the air quality impacts associated with the construction of 8 lanes of freeway and its increased traffic volumes adjacent to the already traffic congested and future increased traffic capacity of the Stemmons Freeway and Central Business District Freeway and road systems. The PEIS should also evaluate traffic and area air pollution impacts on the proposed floodway parks and lakes which the Corps of Engineers and local sponsors propose for development adjacent to Floodway Tollroads.

This PEIS should have been completed prior to the development and Corps of Engineers adoption of the Record of Decision on the Dallas Floodway Extension Project. All current and potential future projects, which will have significant hydrological impact on the Upper Trinity River, should have been evaluated for their cumulative impacts including the Dallas Floodway Extension Project. Instead the Fort Worth District Corps of Engineers has chosen to segment the analysis of environmental impacts of various projects in order to minimize evaluation of the cumulative impacts caused by the combination of projects. The inclusion of the Dallas Floodway Extension within the baseline excludes the PEIS evaluation of its various elements (Levee and swale) on cumulative impacts that should be evaluated for the entire basin.

The 1988 Corps of Engineers Record of Decision and Corridor Development Certificate Process were developed at the urging of the Corps of Engineers in order to reduce and prevent the adverse cumulative consequences of floodplain developments and loss of Trinity River Floodplain storage capacity.

The PEIS cites the 1988 Corps of Engineers Upper Trinity Feasibility Study Record of Decision and Corridor Development Certificate criteria which state projects should not cause a rise in flood elevation, nor increases in erosive velocities, nor losses of Valley Storage. Further the Corps of Engineers has a regulatory responsibility to review and quantify projects as they relate to these criteria. The PEIS DRAFT fails in indicate the extent to which the projects evaluated violate each of these criteria. Apparently there has been no analysis of these Corps of Engineers criteria as they relate to the placement of Tollroads within the Dallas Floodway. By inclusion of the Dallas Floodway Extension in the baseline The PEIS ignores these criteria as related to the DFE construction of Levees and swale. The PEIS should include estimates based on currently available design of each proposed public works project indicating 1988 Record of Decision and CDC criteria evaluation for each project evaluated. (see attached City of Dallas July 7, 1999 correspondence to Joe Wells detailing estimates of CDC criteria variances caused by the Trinity Tollroad proposals: "10% loss of valley storage in the floodway which results in a quarter inch rise in the height of the flood discharges…velocities increase by approximately 8%") The PEIS should provide this level of assessment for each project evaluated including the Dallas Floodway Extension. In addition the Corps of Engineers should provide clear analysis in the PEIS of the combined impacts of the CDC, Record of Decision variances these projects will require, as well as the Corps of Engineers rationale for consideration of the granting of such variances. The public has a right to review this information in a timely manner and to comment on Corps of Engineers decisions related to the granting of variances.

The PEIS is vague in describing what portions of the City of Dalles Trinity Floodway Master Plan were included in the hydrologic modeling. A date of Aug 1999 is indicated, however since that time the City of Dalles has been presented a more specific plan which includes a split River Channel, A lake or two lakes, benches for placement of 8 lanes of Tollway and proposed Floodway Park roads and entrances, tree plantings, various bridge structures and other items which would have significant hydrologic impacts which should be evaluated as part of a cumulative analysis. The PEIS fails to indicate how much and specifically which of these floodway development plans were evaluated in the hydrological models. The Final PEIS should include evaluation of the most current and fully developed information regarding each of the proposed projects being evaluated.

The PEIS and the Dallas Floodway Extension EIS failed to evaluate appropriately and fairly as required by Federal law and regulation non structural alternatives. These alternatives would eliminate environmental damages to the Great Trinity Forest and which should have been evaluated to see if flood protection could be enhanced. No analysis has been made of the costs / benefits of construction of flood detention lakes within the current Dallas Floodway combined with downstream voluntary buyouts.

Proponents of placement of Tollroads within the Dallas Floodway have claimed no hydrological adverse impacts will occur as a result of increasing the width of the Dallas Floodway levees by filling at a four to one slope and filling for benches to place 8 lanes of Tollway at a level on the levees which will protect the roadway to 100 year flood level, with floodwalls under the bridges. If this is so, why is the Corps of Engineers suggesting the addition of 2 feet on top of the current Dallas Floodway Levees? Is this an added public cost of conversion of the Dallas floodway from its primary use of flood protection to use as transportation facility? The PEIS does not indicate what the costs of such a project would be or if its costs / benefits would allow for Corps of Engineers funding. The PEIS also does not indicate if the Tollroad filling did not occur whether there would still be the necessity to further raise the current Dallas Levee system or to extend the Levee system and construct the swales in the Dallas Floodway Extension Project. Nor does the PEIS indicate what if any adverse hydrological impacts might occur upstream or downstream as a result of these proposals. Where in the PEIS is the analysis of the combined cumulative hydraulic impacts both up and down stream of placement of the Dallas Floodway Extension levees and swales, the Split Tollroads within the floodway combined with other currently proposed projects including raising the current Dallas Floodway levees 2 feet and construction of conveyance lakes, spit river channels, park trails, tree plantings and park road vehicle and pedestrian access points? The PEIS should also analyze the combined affects with respect to Record of Decision criteria Loss of Valley Storage, Rise in Flood Elevation, and Velocity Increases for all of these projects as currently proposed when combined.

Finally the PEIS should include an evaluation of modern alternatives to projects which have been proposed and are evaluated in the Draft PEIS. These modern approaches include previously cited floodway detention lakes combined with a voluntary buy out program in lieu of the DFE Levee extension and swales. Modern environmentally sustainable alternatives to the proposed Trinity Tollroads include urban planning policies that reduce rather than increase dependency on automobiles as the primary means of urban transportation. These alternatives include more public investment in public mass transit systems including expanded DART light rail and commuter rail. Improved DART Bus and Van services. Urban planning which stimulates pedestrian / transit oriented urban design which includes higher densities, mixed use development that reduces dependency on automobile transportation and provides for opportunities for transit and pedestrian trips to work and recreation from residential / business mixed use areas. As is stated in the PEIS the development of Trinity Floodway Tollroads would be detrimental to proposed Trinity Corridor Park and recreation uses.

Forward looking communities do not destroy their best natural open spaces, forests and future recreational areas by the placement of 1950s highways through the middle of a proposed greenbelt.

The Corps of Engineers is encouraged to be more through and forward looking in its development of the Final PEIS on the Upper Trinity River. The Corps of Engineers and local project sponsors should carefully consider the future combined cumulative environmental, social and economic consequences and long term costs of these proposals before moving forward to implement them. Both prudence and federal law requires careful consideration and analysis of the long term adverse consequences prior to construction activities. The Trinity River should be preserved and protected for its natural values of flood protection / absorption, wildlife habitat and recreational potential.

Date: June 9,1998

To: Department of the Army, Fort Worth District, Corps of Engineers
PO Box 17300, Fort Worth , Tx. 76102-0300

Attention: Gene T. Rice Jr., P.E., Project Manager GRR/EIS Dallas Floodway Extension Project.

From: Joe Wells
2726 Kingston, Dallas Tx, 75211, Ph #214 948-3714

Subject: Comments re: GRR/EIS Dallas Floodway Extension / Trinity Parkway Air Quality and Transportation Facilities impacts not addressed in Draft EIS.

Omission of Planned Trinity Parkway / Freeway Impacts Evaluation

The Draft EIS omits consideration of the significant environmental impacts of the Trinity Parkway freeway which the local sponsor of the Floodway Extension Project the City of Dallas plans to construct within the floodway and on the Levees being evaluated in this EIS. This omission is in not in conformance with NEPA requirements. The Corps of Engineer Ft. Worth District is aware and has acknowledged City of Dallas, TxDOT and North Texas Tollway Authority planning related to the construction of an eight lane freeway system within the current Dallas Floodway system and the levee systems proposed in this Draft EIS in a letter dated August 7,1997 from William Fickel Director Trinity Projects. (attached) Yet the only reference in the Draft EIS mentions a "Parkway planned by others" with no consideration of the significant Hydraulic impacts (copy excerpt from Trinity Parkway MIS attached) , Air Pollution, Noise, Water Quality and Social impacts which this very significant portion of the Floodway Extension /Trinity Parkway Projects will cause. Clearly the hydraulic impacts of the Trinity Parkway Freeway system will affect the hydraulic impacts of planned Floodway Extension and vice versa. The Trinity Parkway MIS report refers to need for channelzation, excavation, and fill within the current Dallas Floodway and the Floodway Extension being evaluated. (attached Joe Wells Trinity Parkway MIS comments detailing significant environmental impacts) Presumably the Fort Worth District Corps of Engineers is aware of NEPA requirements that federally supported projects not be segmented into smaller projects so as to minimize consideration of significant environmental impacts. The Floodway Extension and planning and construction of a freeway system within the floodway are all part of the same federally supported public works project. The planning for the transportation projects is being coordinated among all the agencies involved including the local sponsor the City of Dallas. The impacts of the transportation projects must be evaluated within the same EIS as the Floodway Extension in order to fully measure and evaluate the impacts of the entire project. Evaluation in two separate EIS processes fails to comply with NEPA requirements.

Air Quality Impacts

The significant regional and localized adverse air quality impacts associated with the Trinity Freeway within the Floodway transportation projects including increased Nox emissions and depending of volume of traffic, congestion and speeds VOCs , particulate and Carbon Monoxide are completely omitted from consideration in the Draft EIS. Air quality impacts which are referred to in the Draft EIS are understated. No mention or evaluation is made of the future area and stationary source emissions which will result from commercial development in areas removed from the floodplain by construction of Levees. Commercial industrial development has already been permitted and encouraged by the City of Dallas within and adjacent to the Cadillac Heights neighborhood and Lamar street areas. According to an editorial by Henry Tatum May 98 in the Dallas Morning News more commercial development in areas "protected from flooding" by the Levee Extension projects is planned. Currently a Meat Rendering Plant and Chromium Recycling facility are sources of odor and toxic emissions adversely affecting the quality of life of residents of the Cadillac Heights neighborhood. This low income minority neighborhood formerly was subjected to lead emissions from a lead smelter. The impacts of future commercial industrial development in areas taken out of the floodplain by the Floodway Extension Projects should be evaluated in the EIS.

In addition the Draft EIS claims air quality benefits due to planned preservation of project mitigation areas, when without the project it is likely the same vegetation air quality benefits will be present since the mitigation areas are within the floodplain of the Trinity River and not subject to development or removal of trees as a result of federal, state and local regulation and law. Finally the Draft EIS claims air quality benefits through restoration and improvement of mitigation area forests. No mention of the timing of this claimed benefit as compared with the certainty of the negative air quality impacts associated with the Floodway Extension /Trinity Freeway projects which at a minimum will eliminate several hundred acres of high quality hardwood bottomland forest containing thousands of trees. This decrease in air quality benefits will occur at the time of project construction and any mitigation will occur slowly thereafter if at all. If the local sponsor City of Dallas is responsible for the restoration and maintenance of mitigation areas the City of Dallas track record in maintaining the current floodway has not been good. The City of Dallas does not have proven experience or demonstrated commitment to natural area restoration.

The Draft EIS characterizes the air emissions impact of off road mobile source construction equipment as "insignificant". According to the most recent regional air emissions inventory 18% of the VOC emissions come from off road mobile sources.

The Floodway Extension and Trinity Parkway / Freeway/ Chain of Lakes projects will be one of the largest public works projects ever constructed in the region and will require a large amount of earth moving equipment to be used over a period of years. The air emissions of such a project must be determined and its impact on the regions long term air pollution non attainment problem be gauged in order to assess its impact and consider alternatives fairly.

Attachments

Joe Wells

From:	Read, Campbell [cread@mail.smu.edu]
Sent:	Wednesday, January 08, 2003 3:22 PM
To:	Read, Campbell
Cc:	bezanson@texas.net; eafritz@hotmail.com; dgray@ran.hp.com; Joe Wells; birdsdallas@earthlink.net; Campbell Read; conniesandlin@hotmail.com; lisaspra@airmail.net; Marcy Brown; orivings@mail.airmail.net; rsh20@amdahl.com; schmotten@aol.com; anyshel@earthlink.net; WBUDallas@aol.com
Subject:	Response to the Army Corps of Engineers Supplement to the EIS for the Dallas Floodway Extension

January 8, 2003
To U.S. Army Corps of Engineers
Fort Worth District

From Campbell Read

Comments on the Supplement to the EIS for the Dallas Floodway Extension

The attitude of the Corps at the scoping meeting held in Dallas in 2002 was that they do not plan on reevaluating the Dallas Floodway Extension (DFE). Instead, they interpret the Court's ruling to require them only to comment on cumulative impacts of foreseeable future projects upstream of the DFE without regarding any of these projects as alternatives to the DFE. The attitude of the Corps in this matter is unacceptable.

That attitude is reflected in the EIS Draft Supplement. On page 2-3 it states:

"Until formal notice is made by the City of Dallas regarding their support of a plan that is different from that for which they have formally provided an endorsement, alternate plans discussed by individuals or the media cannot be considered as reasonably foreseeable. The plan recommended in the 1999 GRR/EIS, therefore, remains the Recommended Plan for analysis in this Supplement to the DFE EIS".

In our opinion, each and every project reviewed by the Corps in the Draft Supplement to the EIS should be regarded as a potential alternative to the DFE. Such an opinion is consistent with that part of the Federal Court order requiring the DFE project to be stopped. At the 2002 scoping meeting I asked Gene Rice why he thought the Court had ordered the DFE project to be stopped and he replied that he didn't know. However, "I don't know" isn't good enough as an answer. It certainly makes no sense for the Court to concur with the point of view in the quotation I just made from the Supplement to the EIS, and then to order the DFE project to be stopped. It makes no sense at all and Mr Rice knows that.

Chapters 4, 5, and 6 of the GRR/EIS (General Reevaluation Report and Integrated EIS for the DFE) of 1999, for example, contain multiple tables listing estimated costs and benefits in dollar terms of the so-called Recommended Plan as compared with making no changes to the floodplain. No such tables appear in this new Supplement, but we should all demand that they be compiled to include costs and benefits resulting from raising the Dallas Floodway by various heights, not only by 2 to 2.5 feet. The Corps argues that the lack of final agreement on the alignment of the so-called Trinity Parkway prevents them from computing costs and benefits deriving from it. But they have no such excuse where raising the Floodway levees by specified amounts is concerned; they can and must, produce a cost/benefit analysis.

If you turn to the discussion of raising the Floodway levees on page 3-11 of the Supplement, you will find that the discussion is confined to where the dirt would come from and where it would be put. That is all that the Corps presents on the subject of raising the levees. There is no related cost/benefit study that could be compared with those in the GRR/EIS for the so-called DFE Recommended Plan. The reason why the Corps has declined to do such a study, however, is plain. They are afraid that such a study would show the DFE to be less cost-effective than raising the floodway levees, with the

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1. This attachment to Mr. Wells' comments was provided directly by Campbell Read as well. See responses to these comments on Mr. Read's submittal.

undeniable consequent conclusion that the DFE would no longer remain viable under the Corps's own rules.

(For Save the Trinity, TCOWR and (in the past) Audubon Dallas)

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Comments on Supplement No. 1
To the
Environmental Impact Statement
Dallas Floodway Extension
Trinity River, Texas

January 8, 2003

David B. Gray
9432 Viewside Dr.
Dallas, Texas 75231

General

This SEIS is intrinsically flawed for summarizing the "cumulative impacts" of one only alternative for the DFE, the Recommended Plan. The Corps has assumed that for the purposes of this Supplement the DFE has been built in place according to the Recommended Plan. But the purpose of an EIS is conduct an evaluation of the alternatives and impacts of those alternatives in order to be sure the most optimal plan is chosen.

The federal judge has remanded the DFE EIS back to the Corps to conduct an analysis of cumulative impacts. It is insufficient to simply say that all "reasonable and foreseeable actions" will add some more or less cumulative impacts to the DFE. It is necessary to compare the cumulative impacts of such actions with each of the alternatives, e.g., the No Action plan. Only with a comparison of the full impacts of all related actions can a reasonable and informed choice of the least damaging and most beneficial alternative be made.

Furthermore, there are no data or evidence with analysis presented to back up any of the specious claims made by the SEIS. There are no cost-benefit estimates for any of the proposed, reasonably foreseeable, or other actions in combination with or without the DFE.

SUMMARY
Summary of Major Environmental Effects, p. vii

"These bridges were not evaluated in this Supplement..." The proposed Calatrava suspension bridges could very well provide beneficial flood water elevations effects in the Dallas Floodway, reducing the need for the badly damaging swale of the DFE's Recommended Plan. (It could, however, expand the floodplain of the DFE project area.)

Areas of Controversy, p. vii

"The potential for resultant adverse impacts created the need to address the environmental consequences of the reasonably foreseeable actions." This is a wise statement, but this SEIS completely fails to carry it out. We still do not what the flood surface elevations of all the reasonably foreseeable actions (DFE, toll roads inside the levees, Chain of Lakes, AT&SF bridge, suspension bridges, etc.) Without data and without comparisons, we are unable to determine whether or not, in fact, the DFE actually does provide any benefits that other actions already proposed or planned don't also provide, which if proven would make the DFE a huge waste of money with devastating ecological impacts.

CHAPTER 3--AFFECTED ENVIRONMENT

FLOOD DAMAGE REDUCTION
Removal/Replacement of ATSF , p. 3-26

"...thus potentially providing hydraulic relief while while maintaining possible trail access." Well, how much relief? Is this a significant and inexpensive way to relieve flood elevations in the Dallas Floodway? If so, this action would reduce the extent and cost of the DFE swale.

CHAPTER 4--ENVIRONMENTAL CONSEQUENCES

CUMULATIVE IMPACTS, p, 4-1

"Administrative priorities promoting nonstructural flood damage projects including buy-outs and environmental protection alternatives are becoming more prevalent." These priorities don't seem to be taken seriously by the Ft. Worth District. A reasonable and affordable nonstructural alternative to the Recommended Plan of the DFE is available that would offer much less environmental impact and better flood damage reduction. This alternative is outlined in a letter from the White House OMB director, Mitchell Daniels, to the Army Corps.

FLOOD DAMAGE REDUCTION PROJECTS, p. 4-1

"Studies underway by the City of Dallas indicate a potential for future actions to protect existing investments in the Stemmons industrial area may eventually evolve, however, nothing has been specifically elevated to the point of any specific project could be considered as reasonably foreseeable." How elevated does it have to get? We already know the Corps has fully evaluated this alternative from evidence found in the administrative record. Why the Corps continues to keep this information from us is a mystery. It's a well known fact that the Corps and the City plan to propose just such a project, but only *after* the DFE is built. This statement was given by Corps representatives, in my presence, to Mayor Miller.

CUMULATIVE IMPACT IDENTIFICATION, p. 4-5

"In other cases, the information may have been developed but has not been made available to the Corps of Engineers." It is well known that the Corps has participated regularly in multi-agency meetings about the Trinity Corridor and the related projects. The fact that NTTA (through its contractor Halff Associates) has studied the hydrology and hydraulics of the toll roads and Chain of Lakes cannot be a secret to the Corps. Regardless, the fact that the toll roads EIS has been delayed, expanded to include the Chain of Lakes, and delayed again, should not prevent the Corps from asking to see it. The fact that fairly advanced and detailed schematics have been shown to the public for the toll roads alignment might suggest to the Corps that there is a large amount of study already done on the toll road project and the various alignments. The Corps does not need to wait for the data for these proposed actions "to be made available" to do a serious, factual analysis of the cumulative impacts of these mega-projects. They merely need to ask to see it.

TABLE 4-2, CUMULATIVE IMPACT ANALYSIS, p. 4-6

In this table, we some indication of the importance of the data that is missing from the SEIS. Under the Floodway Levee Raise column in the Flood Damages row, we have two green triangles that mean *Moderate Beneficial Effects*. (There are no better effect labels than Moderate listed in the table.) People living in the Stemmons area where these beneficial effects might be felt would probably like to know how beneficial they are, and so would we. In fact, the benefits might so beneficial as to eliminate the need for the DFE swale, and prevent the devastation of the Great Trinity Forest that the DFE project would entail. Similarly, the column ATSF Bridge Modification is listed in the same row as Slight Beneficial Effects. How slight? Many slight effects might add up to a sum of Vast Beneficial Effects. Other Slight Beneficial Effects include the column Floodway Lake.

On the other hand, under the column Combined Riverside and Split Riverside (toll roads) we have Slight Adverse Effects. It is reasonable to think that if we remove Slight Adverse Effects and add Slight to Moderate Beneficial Effects we get an overall Vast Beneficial Effect. So vast, in fact, that the need for the DFE (except for the protection of residents in the floodplain through a voluntary buyout) would be totally obviated.

LAND USE / FLOODPLAIN VALUES, p. 4-10

"Most flood damage reduction projects, such as being evaluated in the feasibility study of the Dallas Floodway, require siting within the floodway, however, the multipurpose study and construction authorities associated with Corps of Engineers projects could ameliorate and even enhance the natural floodplain values[. (sic)]" Please explain this sentence. The Corps is claiming that the toll roads and Chain of Lakes projects within the Dallas Floodway would have basically "neutral effects". Well, since many of us disagree with that claim, we would like to seem some evidence or at least some data to backup that general, unsubstantiated foregone conclusion.

"Physical features of the project would directly impact some forestlands...; however, these losses would be mitigated, resulting in a larger area of preserved and reestablished floodplain forests." This is a misleading claim, since mitigation is intended to protect habitat equivalent to or better than that being destroyed. But this does not increase the area of the specific habitat since the area being used for mitigation could also be preserved without the necessity of mitigation, and especially because the project destroys the original area being mitigated for. In fact, habitat of rare, old-growth, bottomwood, hardwood habitat is not sufficiently available for one-to-one "mitigation" of such habitat.

p. 4-11

"The economic stimulus associated with the project,...would result in a higher order of economic use of the affected lands..." This intent of the DFE project contradicts the purpose of an Executive Order forbidding flood control projects intended to foster economic development (on the backs of taxpayers).

"The nature, location, and extent of land use changes or economic redevelopment that would occur cannot be predicted with certainty at this time." The Comprehensive Land Use Plan has already presented preliminary growth figures and maps to the City Council and to the public, so this statement would appear to be false.

ENVIRONMENTAL JUSTICE / COMMUNITY STRUCTURE, p. 4-11

"Until sufficient scoping of all the project proposals and coordination with affected communities can be completed, only a preliminary discussion of cumulative effect is possible." It would seem that this scoping should be the exact objective of this SEIS, but the Corps apparently admits that is has not accomplished that objective.

p. 4-12

"...the DFE project would result in an enhancement of the area through reductions in flood damages...and would produce positive benefits for the future." This seems like an inflated assumption, especially since the Corps just admitted that the economic redevelopment "cannot be predicted with certainty" and only a "preliminary discussion" is possible. But the most disturbing figure is we don't yet know what the cumulative flood predictions for the area would be and no data is available to compare various combinations of components or alignments.

HYDROLOGY AND HYDRAULICS, p. 4-12

"Thus, the cumulative hydraulic impacts would be similar to the sum of the two projects." While most of this section is speculative, generalized, unsubstantiated, unjustified conclusions, there is no data, evidence, or analysis to support any sort of impact. Furthermore, no conclusions are even presented on the impact of the Flood Damage Reduction Alternative downstream nor is it clear what the Flood Damage Reduction Alternative is. The Corps should say exactly what the impacts of the sum of the two projects would be, and provide evidence and analysis to support it.

Please comment to me on the following proposed answer, and use if you wish.

Answer to Corps Draft of Trinity, December, 2002

The Army Corps has attempted to slip through its analysis of the Court's order without presenting data or even key facts, but mainly with self-serving claims. They also are inadequate.

On page 4-6, under Aquatic Resources, the draft says that the downstream project "would not generate as many acres of surface waters as plans consisting of lakes between the Dallas Floodway levees, but the quality of the aquatic habitat created would be greater". This almost admits that the upstream lakes would reduce the habitat between the levees. It further implies that such reduction would be less downstream. It fails to provide data. It evades an admission that the more lakes or new channels the Corps would create between existing channels, the less forest and natural plants would remain there, and the more flooding would occur downstream (an excuse for new swales).

The draft does not even present acreages much less damages, of destroyed or harmed areas.

On page 4-6, the Corps further states, "Most of the flood damage reduction projects identified have only a minor potential to cause direct impacts to wetlands." It presents no data. Actually, the projects would wipe out huge acreages of natural wetlands. The projects also would cut swales through excellent natural forests.

It says, "these impacts would only be minor from a cumulative standpoint". Once again it fails to present data. Actually, the impacts will include ruination of an immense part of the Great Trinity Forest.

-1-

1. This document was also attached to Mr. Wells written comments. It appears to be comments to Mr. Wells from Mr. Fritz. Mr. Fritz submitted comments directly to the Corps as well. Please see specific responses to Mr. Fritz's comments.

Toward the bottom of page 4-6, it finally claims it would conduct mitigation (which would never make up for the loss of forest) but adds, without data, "cumulative impacts would be minor, primarily resulting from the relocation of these resources at a different site from where they occurred". It never gives data or details. We say that the replacement of natural resources would be highly destructive and virtually meaningless.

On p. 4-9, the Army Corps writes vaguely of two losses of areas and loss of 70 acres of forest, "the majority of which has been identified within the White Rock Creek corridor". It does not say exactly where. Actually, an extension of levees downstream from existing levees, plus a series of wide swales, would eliminate more of the Great Trinity Forest, barely mentioned by the Army Corps as the "bottomland hardwood forest ecosystem". The Corps says vaguely, "In addition, the recommended environmental restoration project feature, which includes the development of emergent wetlands, would help reverse the trend to losses to this important resource, by restoring 123 acres". It never says how, or precisely where. Actually, cutting the forest for swales and levees would ruin much more of the ancient forest and will never be adequately replaceable anywhere else, no matter where the Corps might offer to replace it.

As to air quality, the Corps, at top of p. 4-10, evades data, especially as to new roads between levees, by saying it would be determined during detailed studies. Obviously, toll roads between levees would inflict harmful air on any persons walking or boating between levees, and on any animals or birds there.

On p. 4-10, the draft refers to "some forestlands that have developed during the past 30 to 40 years', but never says where they are, how valuable they are environmentally, nor how much

-2-

it would cost to mitigate them, as proposed. They would probably be better for society left as they are, and better for birds and animals. Trees in Great Trinity Forest are in ages up to hundreds of years.

On p. 4-11, the Draft Supplement mentions Cadillac Heights but fails to consider the alternative of a voluntary buyout, which environmentalists have urged. Laura Miller supported it, as councilwoman, and now supports at least a partial buyout as mayor. A buyout would enable all the residents to move out of the floodplain, including out of the area where residents are subject to unhealthful soil contaminated by previous business operations. The City of Dallas is now planning about the voluntary buyout of at least part of Cadillac Heights. A full buyout would relieve the houses from needing a swale and levee through the Great Trinity Forest. The Army Corps should consider this, making a swale and levee unnecessary, and thereby saving the Great Trinity Forest for all.

On p. 4-14, the Corps' Draft says, "recommended DFE project would not contribute to cumulative noise impacts". Actually, the proposed toll roads would create loud noises, as well as harmful air discharges for quite a distance from whereever such roads would be built. Inside the existing levees, the noises and bad air will harm everyone who walks or boats between the levees.

On p. 4-14, the Draft admits that unnamed endangered species may migrate through the proposed area, and that the least tern nests in the Wastewater Treatment Facility. Actually, the least tern also nests in other parts of the natural area involved in this proposal. All endangered species in the area would be even more endangered by the proposal.

On p. 4-16, the Corps Draft agrees "to maximize forested resource benefits". It should Present data on locations, specify costs, ~~and benefits~~. Actually, virtually all species would survive far better if none of the proposed roads, lakes, new swales, and new levees were built.

On p. 4-16, the Corps states that "its policy specifies no net loss of wetlands". It should provide new plans in conformance with this policy before further Court orders. The Corps cannot carry out the 1998 bond program, including swales and levees through the Great Trinity Forest, without a net loss of the wild wetlands scheduled to be heavily cut, swaled, and levied by the Corps.

By NED FRITZ.

TRINITY COMMONS FOUNDATION

January 8, 2003

Dear Sirs,

The decision time is now. In 1965, Congress saw the need for increased flood protection in Dallas. In 1998, we finally came up with a plan that met the government guidelines and also won community approval. That year, the citizens of Dallas approved $86.2 million for flood protection in the Trinity River corridor.

1. The need for the project is clear. It will protect 13,000 homes and businesses and avoid the losses from a major flood that are estimated to be $8 billion. Additionally, this effort will help protect the Central Wastewater Treatment Plant (CWWTP). If that facility should ever flood, raw sewage would back up into homes, businesses, churches, and schools. In the past four years, Houston and New Braunfels have experienced flood levels that would have overtopped the levees, flooding downtown and west Dallas, and inundated the CWWTP if they had occurred here.

2. Because of the complexity of the overall Trinity project, it is not just flood protection, but it is also lakes and transportation improvements, the Environmental Impact Statement has been a long time coming. The writers and the readers of such documents normally deal with one project, like a levee or a lake, not three.

3. Five years is a long time to wait, thirty-eight years is a really long time to wait. The need is real. All lawsuits have been decided in our favor or else are still in court. City Council authorization should happen this year. The time for hesitation is past, the time for moving forward is now.

Sincerely,

Mary Ceverha

Mary Ceverha
President,
Trinity Commons Foundation

c/o DCVB · 325 N. St. Paul, Suite 700 · Dallas, Texas 75201
Recreation · Conservation · Transportation

1. We concur that the benefits of providing the DFE exceed the costs.

2. The overall Trinity project is indeed a complex array of potential flood damage reduction, ecosystem restoration, recreation, and transportation options. Determination of the specific components or projects that would ultimately be constructed remains to be decided.

3. As identified by the District Court, the GRR/EIS failed to adequately address the cumulative impacts of reasonably foreseeable actions in the geographic area of the DFE. This SEIS was prepared to addresses that decision.

Trinity River Expeditions 615 South Montclair Dallas, Texas 75208 214-941-1757

February 1, 2003

Mr. Gene T. Rice, Jr.
Project Manager
U. S. Army Corps of Engineers
Fort Worth District
CESWF-PM-C
P. O. Box 17300
Fort Worth, Texas 76102-0300

Mr. Rice:

This letter contains comments in response to the publication of the Draft Supplement No. 1 to the Environmental Impact Statement for the Dallas Floodway Extension, Trinity River, Texas (DSEIS). These comments reflect my own views as a citizen of Dallas, as a Board member of the Save Open Space organization of Dallas County, as a member of Save the Trinity, as a member of the Trinity River Action Coalition, as owner of a business which provides aquatic recreation opportunities on the Trinity River and as a long time canoeist on the Trinity.

1. The DSEIS has been required by the U. S. District Court for the consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the Dallas Floodway Extension (DFE) project. Cumulative effects analysis should start with the establishment of a baseline condition against which the proposed action and reasonable alternatives can be evaluated. A correct determination of the baseline condition for the DFE would evaluate the "no-action" alternative considering the cumulative effects of all past, present and reasonably foreseeable actions, such as the Trinity Parkway, The Chain of Lakes, the raising of the existing levees in the Dallas Floodway and the removal of the AT&SF trestle and embankment in the Dallas Floodway. This has not been done. In the DSEIS the effects of the DFE are considered to be part of the baseline conditions. The DSEIS has not accurately described the baseline conditions against which the DFE project and reasonable alternatives should be evaluated.

2. The DSEIS has some analysis of the effects of reasonably foreseeable projects but it does not analyze the cumulative impacts of these projects, especially not with the DFE in place. The cumulative impacts of the raising of the existing Dallas Floodway levees, the construction of the Chain of Lakes and their function as conveyance basins, construction of the Trinity Parkway, and the removal of the AT&SF trestle and embankment to improve conveyance and lower flood levels will remove the threat of flooding from the Central Business District and the economic justification for the DFE as proposed.

3. The DSEIS does not identify and evaluate proposed actions or proposals that directly affect the DFE. There will be significant cumulative impacts related to the Dallas Floodway associated with the Trinity Parkway, the Chain of Lakes, Dallas Floodway modifications and other projects. There is no discussion of these clearly proposed actions and their cumulative

1. The final document addressed the five final alternatives of the Dallas Floodway Extension (DFE) with various potential projects by others to determine the cumulative impacts of each scenario.

2. The final SEIS addresses the five final alternatives of the DFE relative to various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects that have not been fully studied or designed. A new economic analysis of the DFE project was not considered necessary to evaluate the cumulative impacts of the projects.

3. The final document addressed the five final alternatives of the DFE with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects (including hydrology and hydraulics), which have not been fully studied or designed.

[redacted]

effects such as the cumulative hydrology and hydraulics, including the specific data on increases or decreases of water levels associated with the projects without the DFE, the impact on the Great trinity Forest, the impact on air quality, the impact on water quality and wetlands, or the impact on land use and development.

4. The decision of the U. S. District Court directs the Corps of Engineers to give "further consideration of the cumulative impacts of other similar, reasonably foreseeable future projects in the same geographical area as the DFE project." The dominant geographical feature in the DFE project area is the Trinity River, certainly by virtue of its periodic flooding which nominally necessitated the DFE project in the first place. The propensity of the river for flooding is due to its extensive drainage area in the Upper Trinity River Basin, over 6000 square miles upstream of the Commerce Street bridge in the Dallas Floodway, all of which drains into one waterway, the Main Stem of the Trinity River in the Dallas Floodway and the DFE project area. Every drop of runoff water in this 6000 square mile watershed will find its way into the Trinity Main Stem running through the DFE project area. The "same geographical area" for purposes of the U. S. District Court decision and the DSEIS is the Upper Trinity River Basin upstream of the furthest downstream portion of the DFE project area. The river does not begin or end at municipal or county boundaries, nor are the effects of projects upstream of the DFE project area limited by political boundaries. The cumulative impacts of projects in the Upper Trinity Basin, past, present, proposed and reasonably foreseeable are and will be felt in the DFE project area, such as the cumulative effects of the highway, bridge, or other construction projects in the Upper Basin where the area of jurisdictional waters impacted was below the threshold for mandated compensatory hydrologic or environmental mitigation, or the cumulative effects of the projects in the Upper Basin which involve alterations to the valley storage or conveyance characteristics of the floodplain. The importance of defining the "same geographical area" of the court decision as the entire Upper Trinity River Basin upstream of the DFE project area derives from the shape and drainage characteristics of the basin, all 6000 square miles of which drains entirely into the DFE project area, and from the resultant opportunity for cumulative incremental effects from projects over this large area to produce significant combined effects on the DFE project area.

5.

6. Table 4-2, Cumulative Impact Analysis, Dallas Floodway Extension, does not give specific data on the potentially impacted area or resource for the projects listed, only a subjective evaluation of slightly or moderately adverse or beneficial effects.

7. What proposal exists to mitigate the impacts on wetlands due to fill excavation in the Dallas Floodway that would result from a levee raise, as mentioned on page 4-6 under the heading of wetlands? Please comment in detail on the proposal referenced in the DSEIS. The Ecosystem Restoration Project, Old Trinity River, Dallas, referred to on page 3-14 has not been publicly announced or discussed for several years. If this study and project are indeed taking place, what is the most current status and recent history of this project? If this project is actually going to proceed and if the associated effects of environmental restoration are to be considered as cumulative effects of nearby projects on the DFE, what is the proposed source and amount of funding, and what are the details of the construction schedule?

• Page 2

4. The geographic area of consideration has been expanded to address potential water resource related projects with the Upper Trinity River Basin watershed.

5. The cumulative impact analysis presented in Table 4-2 is based on data found in Table 4-1.

6. The potential project of raising the existing Dallas Floodway levees has not been fully studied and therefore, the requirement for mitigation has not been determined.

7. The City of Dallas is the sponsor for studies ongoing on the Old Trinity 1135 project. The status of the project is unchanged from that disclosed in the draft SEIS. If approved by Dallas and the Corps of Engineers, Plans and Specifications would commence in early FY 04 and construction would start in late FY 04 and continue over a two-year period.

[redacted]

8. Please resolve the inconsistency between the statement on page 3-5 under the heading Dallas Floodway which says "The area between the levees of the existing Dallas Floodway consists of about 10,500 acres of urban open space" with the statement on page 3-10 under the heading Dallas Floodway (Interim Feasibility Study) which says "The Floodway extends along the Trinity River upstream from the AT&SF Railroad Bridge ... to the confluence of the Elm and West Forks ... then upstream along the West Fork for approximately 2.2 miles and upstream along the Elm Fork approximately 4 miles. There are approximately 1,422 acres in the study area." Are there 10,000 acres in the Dallas Floodway as stated on page 3-5 or are there 1,422 acres in the Dallas Floodway as stated on page 3-10? On page 3-10 it is stated that there are 51 acres of emergent wetland in the Dallas Floodway; I know from long years of personal experience in the Floodway that there are many more acres of emergent wetland than that. Please substantiate in detail your claim that there are only 51 acres of emergent wetlands in the Dallas Floodway, with specific references to national wetland inventories and other databases for verification.

9. What is the most current status on the Tarrant Regional Water District project mentioned in Table 3-1 on page 3-9 concerning the West Fork to Lake Worth and the Clear Fork to Lake Benbrook? Is this the same project that would involve turning the West Fork into a lake around Downtown Fort Worth? What is the most current status of the West Fork Corridor Major Investment Study mentioned on page 3-24? This is another study that has not been heard of for several years. The details of these and other reports and projects pertain to the cumulative effects of other projects on the DFE project area, and sufficient data for analysis has not been included in the DSEIS. The status of these reports is important for determining whether or not projects are likely to proceed, and whether or not their cumulative effects will be relevent to the DFE project.

10. On page 3-33 under the heading Frazier Dam Modification (Application Number 200100031) the last sentence states "It is anticipated that the increased water surface elevation within the Elm Fork channel would also result in some minor changes to the vegetation on the vertical surface of the river bank as well as a short distance horizontally from the channel." Does this statement mean that the loss of the only population of cardinal flowers (Genus Lobelia) known within the Dallas city limits, out of only three populations along the entire Elm Fork, due to raising the water level, is considered "minor changes to the vegetation?" These beautiful fall blooming perennials, usually found in deep East Texas, grow within a few feet of the waterline at a very few locations on the Elm Fork, but they cannot survive being inundated. Can the cumulative effects of various projects be accurately assessed when those same effects are minimized by the Corps, such as describing the extermination of rare wildflowers directly caused by the effects of a project, in this case a dam modification to raise water levels, as "minor changes to the vegetation?" Please comment on why the loss of these beautiful and rare wildflowers is considered "minor."

11. On page 4-14 of the DSEIS under the heading of Sections 9 and 10 Rivers and Harbors Act the split channel around the lakes in the Dallas Floodway is mentioned. The planned dams across the Main Stem of the Trinity River, a navigable waterway, at the downstream ends of

8. The text on page 3-5 of the draft was changed to clarify that the 10,500 acres associated with the Dallas Floodway include the area protected by the levees. The 1,422 acres in the Dallas Floodway study area were preliminarily identified as part of the ongoing vegetation analysis of the Dallas Floodway studies.

9. Description of the Central City and Riverside Oxbow studies that are both TRWD sponsored have been clarified in the Final SEIS. These studies are ongoing and have not been developed sufficiently to determine that a reasonably foreseeable activity would occur. As demonstrated for projects that are further along in the planning process which are located closer to the DFE area and can actually be viewed as "reasonably foreseeable" transportation projects, only minor impacts that could easily be mitigated have been identified. These findings indicate, prior to completion of studies of all reasonably foreseeable projects, that with mitigation as appropriate, their cumulative impacts to the DFE project would not be significant.

10. The cardinal flower is not a rare flower. The potential impacts are unknown to this flower, as its location is not known. During the comment period for the Frazier Dam Modification, no comments were received concerning impacts to this flower; therefore, it can be assumed that the potential impacts are minor, if any.

11. Selected early alternatives for lake construction in the Dallas Floodway considered an on channel lake, but the plans that appear reasonably foreseeable do not include on-channel dams. Also it is important to recognize that this SEIS does not have as its intent to authorize any activities of others entities, only to disclose how activities of others may cumulatively impact resources and determine whether these cumulative impacts effect DFE plan formulation. Further, this SEIS does not exempt other projects from complete environmental review, nor from compliance with Sections 9 and 10 of the Rivers and Harbors Act.

[redacted]

the split channels are an integral part of that plan, and would seem to contradict the statement in the preceding paragraph, "Since no evaluated alternative considers construction of a dam across a navigable waterway, Section 9 need not be considered further." Commercial recreational navigation has been taking place on the Trinity Main Stem for well over a decade - that is my business and my livelihood. I have established my company, Trinity River Expeditions, as a legitimate commercial business, I conduct guided and non-guided boat trips upon the river for which I am paid by my clients, and this is my sole occupation. Why does the Corps refuse to recognize that commercial navigation is taking place on the Trinity River, as stated on page 4-15 "...no commercial navigation occurs on the Upper Trinity River."? The completed boat ramp at Sylvan Avenue on the Main Stem and the boat ramp under construction at South Loop 12 on the Main Stem are concrete municipal recognition of the positive recreational qualities of the 10 mile stretch of river between the two ramps, yet this section will be segmented for both commercial and recreational boaters by the split channel dams. Would this not rightly be considered under Section 9 of the Rivers and Harbors Act as structures affecting the course, condition or capacity of navigable waters of the United States? Since the section of river between Sylvan and Loop 12 begins in the Dallas Floodway and ends in the southern end of the DFE project area, would not the effects of the split channel dams on navigation be considered among the cumulative impacts of a proposed project in the same geographical area, the split channel lakes, on recreation, recreational navigation and commercial navigation in both the Dallas Floodway and the DFE project area? Please respond to these issues and questions in detail.

Thank you for your serious consideration of these important issues. Please contact me if you have any questions or need more information about any of the subjects under discussion.

Sincerely,

Charles J. Allen

Charles J. Allen
Owner, Trinity River Expeditions

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January 24, 2003

Via Federal Express
Mr. Gene T. Rice, Jr., Project Manager
CESWF-PM-C
U.S. Army Corps of Engineers - Fort Worth District
819 Taylor, Room 3A28
Fort Worth, Texas 76120

RE: Comments to the Draft Supplement No. 1 to the EIS for the Dallas Floodway Extension Project of December 2002

Dear Mr. Rice:

In accordance with the U.S. Corps of Engineers January 14, 2003 notice extending the comment period until February 4, 2003, the comments enclosed are in response to the December 6, 2002 Notice of Availability published in 67 Federal Register 72669 regarding the Draft Supplement No. 1 to the Environmental Impact Statement for the Dallas Floodway Extension, Trinity River, Texas.

Thank you for your attention to this matter. Should you have any questions, please contact me at (713) 524-1012.

Sincerely,

BLACKBURN CARTER, P.C.

by ______________
James B. Blackburn, Jr.

Enclosures

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EXHIBIT 1

Considering Cumulative Effects Under the National Environmental Policy Act
Council on Environmental Quality
January 1997

COMMENTS BY JAMES B. BLACKBURN, JR.
TO THE FORT WORTH DISTRICT OF
THE U.S. ARMY CORPS OF ENGINEERS
ON THE SUPPLEMENTAL DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR THE DALLAS FLOODWAY EXTENSION PROJECT

COMMENTS
TO THE FORT WORTH DISTRICT OF
THE U.S. ARMY CORPS OF ENGINEERS
ON THE SUPPLEMENTAL DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR THE DALLAS FLOODWAY EXTENSION PROJECT

James B. Blackburn, Jr.
BLACKBURN CARTER, P.C.
January 20, 2003

These comments are submitted to the Fort Worth District of the United States Army Corps of Engineers (Corps) on behalf of several environmental and neighborhood groups in response to the Supplemental Draft Environmental Impact Statement (SDEIS) for the Dallas Floodway Extension (DFE) project released December 2002. Specifically, these comments are submitted on behalf of the Texas Committee on Natural Resources, the Dallas County Audubon Society, the Sierra Club, the Dallas Historic Tree Coalition, Taxpayers for Sensible Priorities, Friends of the Earth, Save the Trinity, and Citizens for a Safe Environment, litigants against the Corps of Engineers. To the extent that any of these groups have filed comments individually, these comments are intended to supplement those filings.

These comments are divided into two parts. In the first part, the deficiencies associated with SDEIS are addressed regarding the analysis of cumulative impacts. In the second part, the deficiencies associated with the SDEIS are addressed regarding the analysis of proposed actions. Initially, however, these comments will start with a discussion of the current status of the proposed action.

I. PROBLEMS WITH THE CUMULATIVE IMPACTS ANALYSIS IN THE SDEIS

There are several problems with the cumulative impacts analysis in the SDEIS that render the analysis flawed and ultimately in violation of the law. From the outset, the Fort Worth District has seemingly misunderstood the status of the DFE project and the legal requirements for preparing a cumulative impacts analysis. Second, the Corps misunderstood and in fact failed to correctly establish a "baseline", the first step in a correct analysis of cumulative impacts. And third, the Corps failed to incorporate its analysis of cumulative effects into its evaluation of alternatives, essentially rendering the analysis of cumulative effects without meaning. Each of these issues is discussed sequentially in the following paragraphs.

A. Current Status Misunderstood

In 2001, the Honorable Judge Means ruled that the Corps of Engineers had not correctly analyzed cumulative impacts and must redo that portion of the EIS for the DFE project. No final agency decision can occur before the completion of an EIS. The impact of the court's decision was that no alternative course of action had been decided upon by the Corps until the EIS was

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The Corps agrees that no agency decision can occur before completion of the EIS. In fact, no final decision has been reached at this time. The conclusion of the SDEIS is a recommendation of the DFE plan to the decision-makers. It is not itself a decision.

redone and until the cumulative impacts information had been incorporated into the analysis, fully disclosed to the public and to the decision-makers within the Corps and considered in the decision-making process. After the court's decision, there was no longer any approved DFE project.

1. From the initiation of this court-ordered evaluation of cumulative impacts, the Fort Worth District of the Corps has either misunderstood or intentionally misrepresented the situation. At the scoping meeting for the SDEIS, the citizens were told that the DFE project was still approved by the Corps, and that this restudy was only a bit of paperwork. This position is legally incorrect but was maintained throughout the process. For example, as the "baseline" for the hydraulics and hydrology cumulative impact assessment, the SDEIS used the "no action" alternative from the Programmatic EIS. Unfortunately, that "no action" alternative assumed the DFE project was already approved. Such an assumption is illegal and impermissible.

The DFE project is the project being proposed. The SOEIS concerns the DFE project. To assume that it already exists is to assume away the purpose of the analysis.

B. "Baseline" Incorrectly Determined for DFE Project

2. The Council on Environmental Quality (CEQ) is the federal agency charged with responsibility for overseeing the implementation of the National Environmental Policy Act (NEPA). It has written a set of regulations found at 40 CFR §1501 et. seq. that are binding on all federal agencies, including the Corps. CEQ has also issued a handbook regarding the manner in which cumulative impacts analysis should be undertaken. This handbook is titled "Considering Cumulative Effects Under the National Environmental Policy Act" (hereinafter 1997 CEQ Handbook) and is attached to these comments as Exhibit 1. This handbook is referenced by the Corps in the SDEIS on the DFE project. However, the handbook was not followed in the SDEIS.

The starting point for any analysis of cumulative impacts is the definition. The CEQ regulations define cumulative impacts at 40 CFR §1508.7 as "the impact on the environment which results from the incremental effect of the proposed action when added to other past, present and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions." Implicit in this definition is the establishment of a "baseline", reflecting all present, past and reasonably foreseeable future actions, against which the proposed action is to be evaluated, in order to show the incremental impact of the proposed action when added to the other actions.

This distinction makes sense. The idea of NEPA is to cause a decision-maker and the public to consider the implications of a particular action on the environment, taking into account other factors that are also affecting the environment. Consider the following hypothetical. If, for example, there are 100 acres of wetlands left in an area, and a proposed action would take 20 of those acres, one might conclude that you could go forward with the proposed action, destroy the 20 acres and still have 80 left. However, if the 100 acres of wetlands are considered in light of two other reasonably foreseeable projects that would each take 30 acres, the proposed loss of 20 acres would actually be 20 of 40 acres rather than 20 of 100 acres. The agency might still

1. The Corps disagrees with the premise that the study was done assuming the DFE project was still approved. This is not the case. These comments cannot speak to what might have been stated at the scoping meeting, other than to assure you that the Corps proceeded with the knowledge and understanding that the DFE project was not approved.

2. .The Corps established a baseline that comports with these requirements by its use of the "no action" alternative. This alternative was chosen because of the status of the current reasonably foreseeable future projects. The "no action" alternative provided the clearest view of the current and reasonably foreseeable future status of the resources. CEQ guidance states that, "The no action alternative is an effective construct for [establishing a baseline], but its characterization is often inadequate for analyzing cumulative effects." In this case, the no-action alternative was used as a baseline because the reasonably foreseeable projects were not sufficiently far along in the design phase to give a clear picture of the future of the various resources. Use of the "no action" alternative as the baseline was not inadequate in this case, and CEQ had no intention of forbidding the use of the "no action" alternative as the baseline where that is the clearest view of the future of the resources. The Corps included statements of how the conditions have changed over time and listed the reasonably foreseeable future actions. As a result, the CEQ guidance has been followed, in that the Corps has given the decision-makers and the public sufficient information to compare the environmental impacts of the various alternatives and the proposed plan.

determine to go forward with the destruction of the 20 acres, but it should clearly understand, and it should inform the public, that the implications of the loss of 20 acres is quite different when cumulative impacts are considered. The clear purpose of such a cumulative impacts analysis is to bring this information before the decision-maker and the public so that a decision can be made on the basis of the importance of the loss of 20 of the last 40 acres, rather than on the importance of the loss of 20 of 100 acres.

According to the CEQ handbook, a "baseline" must be established as the starting point in the analysis of cumulative impacts. In the above illustration, 60 acres would be the baseline under the CEQ regulations rather than 100 acres. The 1997 CEQ Handbook states:

> "The analyst's primary goal is to determine the magnitude and significance of the environmental consequences of the proposed action in the context of the cumulative impacts of other past, present and future actions. To accomplish this, the analyst must use a conceptual model of the important resources, actions, and their cause-and-effect relationships. The critical element in this conceptual model is defining an appropriate baseline or threshold condition of the resource, ecosystem, and human community beyond which adverse or beneficial change would cause significant degradation or enhancement of the resource, respectively.
>
> The concept of a baseline against which to compare predictions of the effects of the proposed action and reasonable alternatives is critical to the NEPA process. The no-action alternative is an effective construct for this purpose, but its characterization is often inadequate for analyzing cumulative effects. Much of the environment has been greatly modified by human activities, and most resources, ecosystems, and human communities are in the process of change as a result of cumulative effects. The analyst must determine the realistic potential for the resource to sustain itself in the future and whether the proposed action will affect this potential; therefore, the baseline condition of the resource of concern should include a description of how conditions have changed over time and how they are likely to change in the future without the proposed action. (1997 CEQ Handbook, p. 41).
>
> The separation of effects into those attributable to the proposed action or a reasonable alternative versus those attributable to past and future actions also allows the analyst to determine the incremental contribution of each alternative. Situations can arise where an incremental effect that exceeds the threshold of concern for cumulative effects results, not from the proposed action, but from reasonably foreseeable but still uncertain future actions. Although this situation is generally unexplored, the decision-maker is faced with determining whether to forgo or modify the proposed action to permit other future actions. Identifying incremental effects, therefore, is an important part of informing the decisionmaker." (1997 CEQ Handbook, p. 43).

JAMES B. BLACKBURN, JR. - DALLAS FLOODWAY EXTENSION PROJECT SUPPLEMENTAL DEIS COMMENTS p. 3 of 7

Acreages of all known features of reasonably foreseeable projects or their alternatives in the geographic area of the DFE have been determined and evaluated to the extent possible. Careful consideration of this information was given in order to determine which DFE alternative should be supported and recommended for implementation. Net gains in bottomland hardwood forest acreage, a significant resource, would occur from implementation of any of the DFE alternatives due to the included mitigation plans. Other potential or federally authorized (permitted) projects identified as reasonably foreseeable within the study area would result in lower percentage gains in bottomland hardwoods relative to, or in addition to, the DFE project. Therefore, the real significance is that the authorized DFE project, even if considered as a last added increment, would result in a net gain in bottomland forest

The Corps disagrees with Mr. Dunbar's methodology for the reasons stated above. The raising of the levee is not a reasonable alternative because the protection of downtown is not the only goal of the DFE. This argument is a rehash of the alternatives argument made by the plaintiffs in the original litigation. The baseline cannot logically be determined by including one or more proposed alternatives to the DFE.

The foregoing quotes from the 1997 CEQ guidance clearly state that the baseline condition should be established in the analysis of the no action alternative, and includes the past, present and reasonably foreseeable future action. Then the proposed project is evaluated in relation to the baseline analysis. That was not done in the SDEIS on the DFE project. Instead, the Corps performed its cumulative effects analysis by relying primarily on the "no action" analysis conducted by the Corps in 2000 as part of the Programmatic EIS (PEIS) prepared for the Upper Trinity River Feasibility Studies. However, the "no action" analysis for the PEIS includes the DFE project within the baseline. While this may have been correct for the PEIS project, it is clearly not correct for the "no action" analysis for the DFE project. The Corps cannot assume the proposed action exists in an analysis of "no action" of that proposed action. That is wrong and we believe it to be illegal as well. Obviously, such a baseline condition that includes the proposed DFE project cannot be used for evaluating the incremental effects of the proposed DFE project.

This criticism goes back to the first point in these comments. The Corps has never divorced itself in the SDEIS from the prior approval of the DFE project, an approval that was overturned by the court. Until the Corps recognizes that the proposed action has not been adopted and until the Corps goes back and utilizes the correct "baseline" in the SDEIS analysis, the SDEIS will not pass legal muster as a full disclosure document.

The correct baseline analysis is set out in the expert report from Lawrence G. Dunbar, P.E. that is attached hereto as Exhibit 2. A correct baseline analysis takes the "no action" alternative for the DFE project and adds the reasonably foreseeable future actions to that. In this manner, the "baseline" is identified. A correct baseline analysis would include the effects of putting the Trinity Parkway within the Dallas Floodway levee system, would include the impact of the Chain of Lakes and would include the impact of increasing the height of the existing Dallas Floodway levees. All of these actions are discussed in the SDEIS as reasonably foreseeable future actions. With these actions, the "baseline" then has virtually no flooding in downtown Dallas and the Great Trinity Forest has not been destroyed. That is the "baseline" against which the DFE project alternatives should be evaluated.

C. Failure to Incorporate Cumulative Impacts Analysis into Evaluation of Alternatives

A cumulative impacts analysis is not intended to be apart from the evaluation process. Instead, the opposite is true. Under CEQ regulations, the analysis of impacts is input into the evaluation of alternatives. Cumulative impacts are one set of impacts, just as vegetation loss and others are. However, it is also a baseline, a redefined starting point for the analysis of alternatives. It is only by bringing the cumulative impacts analysis back to the evaluation of alternatives – the "heart" of the EIS process (see 40 CFR §1502.14) – that the purposes and intent of NEPA can be realized.

The Corps has failed to evaluate the various alternatives for the DFE project as part of the cumulative effects analysis in the SDEIS, as required by NEPA. The SDEIS does not re-evaluate alternatives to the recommended DFE project, including the No-Action alternative. Chapter 2 of the SDEIS entitled "Alternatives" is simply a brief summary of the formulation

Only connected and cumulative actions are required to be considered in a single EIS. See 40 CFR 1508.25(a). The U.S. District Court has already decided that the actions at issue are not "connected." *See Texas Committee on Natural Resources v. U.S. Army Corps of Engineers,* 197 F. Supp.2d 586, 614 (2002). Therefore, the only question is whether the actions are "cumulative." From all available case law and other sources, it appears that if the proposed actions are not in front of the agency preparing the EIS, the actions cannot be considered "cumulative." For example, in *Kleppe v. Sierra Club*, 427 U.S. 390 (1976), the U.S. Supreme Court held that "when several proposals for coal-related actions that will have cumulative or synergistic environmental impact upon a region *are pending concurrently before an agency*, their environmental consequences must be considered together." *See Kleppe,* 427 U.S. at 410 (emphasis added). This interpretation supports the main purpose of NEPA, which is to "insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken." 40 CFR § 1500.1(b) (2002). Because none of the proposed actions are pending before the USACE, it follows that the USACE is not the decision-maker for any of those actions. Therefore, labeling the proposed actions of entities that make their own decisions, and prepare their own environmental documents "cumulative actions" does not further the purposes of NEPA. Cumulative impact analysis for all reasonably foreseeable future actions has been completed in this SEIS. Further, the various "proposed actions" that are also reasonably foreseeable future actions are considered in the final SEIS.

process of alternatives that was performed in the GRR/EIS report dated 1999 for the DFE project, and does not present a re-evaluation of these alternatives as part of the cumulative effects analysis.

The 1997 CEQ Handbook states that it is ". . . critical to incorporate cumulative effects analysis into the development of alternatives for an EA or EIS. Only by reevaluating and modifying alternatives in light of the projected cumulative effects can adverse consequences be effectively avoided or minimized." (p. v., Executive Summary). The Handbook further states:

> "NEPA and CEQ's regulations define the cumulative problem in the context of the action, alternatives, and effects. By definition, cumulative effects must be evaluated along with the direct effects and indirect effects. . . of each alternative. The range of alternatives considered must include the no-action alternative as a baseline against which to evaluate cumulative effects." (1997 CEQ Handbook, p. 1). [*emphasis added*]

Therefore, it is just as important to utilize the evaluation of cumulative effects as it is to conduct it. In the SDEIS, the Corps did neither correctly.

In the attached expert report, Lawrence G. Dunbar, P.E. has conducted a partial analysis of cumulative impacts associated with the DFE project and has attempted to do this analysis as per the CEQ requirements. In this analysis, Mr. Dunbar first discusses the hydrology and hydraulics (H&H) cumulative impacts with reference to the no-action alternative. Because there is no action being undertaken on the DFE project, there is no loss of the Great Trinity Forest due to the construction of the swale system proposed in the DFE project (a swale system that will remove 30,000 trees from a forest that is heavily impacted already). Under Mr. Dunbar's cumulative H&H analysis, the assumption is made that the Trinity Parkway and the Chain of Lakes are designed such that the H&H impacts of the Trinity Parkway's intrusion into the Dallas floodway are offset by the design of the Chain of Lakes. Further, by raising the levee of the existing Dallas Floodway two feet above the standard project flood (SPF), the flooding of downtown Dallas is basically eliminated. Each of these projects is a reasonably foreseeable future project.

Once this baseline has been established, the alternatives would be evaluated in light of that baseline. Almost immediately, a major flaw in the DFE analysis becomes evident. Because there is virtually no downtown flooding, there are no economic benefits for the DFE to claim in this regard. While there may be localized flooding issues that need to be addressed within the DFE, the overall economic justification for the recommended DFE levees and swales is altered in light of the reasonably foreseeable future actions. In turn, the DFE alternatives should be recast and reconsidered in light of this cumulative effects analysis. In this manner, the Cadillac Heights buy-out could be recast and reconsidered. That is what is required in a legally correct cumulative impacts analysis.

II. FAILURE TO CONSIDER AND ADDRESS THE ISSUE OF OTHER PROPOSED ACTIONS

The federal district court in Fort Worth instructed the Corps on remand to determine if any of the "reasonably foreseeable future" projects were also "proposed actions" that must be considered in the same EIS with the DFE, under the requirements of 40 CFR §1508.25(a)(2). (FN 44). The Corps acknowledged this requirement by the court at the bottom of page 1-3 of the SDEIS. However, nowhere in the SDEIS does the Corps discuss or determine if any of the future projects that are evaluated are considered to be "proposed actions" that must be considered in the same EIS.

There are several pending "proposed actions" or "proposals" that directly affect the same environmental setting, namely the Dallas Floodway area of the Trinity River. These proposed actions include the proposed DFE project, the proposed Trinity Parkway, the proposed Chain of Lakes project and the proposed increase in the height of the Dallas Floodway levees. The Corps of Engineers has seemingly agreed that each of these actions are "proposed actions", either by the treatment of these projects in the text of the SDEIS or in the text of the PEIS that was prepared by the Corps Fort Worth District.

The Corps of Engineers includes no section of the SDEIS that addresses the question of whether or not these proposed actions should be analyzed in the same environmental impact statement. There is no doubt that under certain conditions, several proposed actions should be analyzed in the same EIS. The basis for this requirement was clearly set forth in the Supreme Court decision of *Kleppe v. Sierra Club*, 427 U.S. 390 (1976), and is incorporated into the CEQ discussion of cumulative actions. According to 40 CFR §1508.25(a)(2), cumulative actions are actions which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

Under this definition, the appropriate step would have been for the Corps of Engineers to analyze the cumulative effects of the various proposed actions to determine whether or not the impacts of these projects would be cumulatively significant. Such an analysis would have to consider the cumulative hydrology and hydraulics aspects of these various projects, including the various increases and decreases associated with such projects. It would have to consider the impact on the Great Trinity Forest. It would have to consider the impact on air quality. It would have to consider the impact on water quality and wetlands. It would have to consider the impact on secondary development and land use.

The impacts of each of these projects alone is significant as indicated by the fact that an EIS was prepared and a SDEIS is being prepared for the DFE project, a PEIS has been prepared that evaluates the proposed Chain of Lakes project as well as the proposed Trinity Parkway and the proposed increase in the height of the Dallas Floodway levees and a separate EIS is currently being prepared for the proposed Trinity Parkway. There should be no doubt that the impacts of these projects are cumulatively significant. They are essentially affecting the same area and the same environmental resources at approximately the same point in time.

It is reasonable to ask what benefit may be gained from evaluating these projects together when each project could have cumulative impacts evaluated alone? The answer is – given the complex inter-relationships between the projects and the importance of the Great Trinity Forest, if these projects are reviewed together and are honestly evaluated, there will be no need to lose 30,000 trees in the Great Trinity Forest. If these projects are analyzed together, then it will become apparent that there is no justification for the DFE project if, in fact, the 2-Foot above SPF increase in the height of the Dallas floodway levees occurs.

There is a significant cumulative impact associated with these multiple pending projects. If these proposed actions are viewed together, a proposed course of action could be charted that would avoid significant environmental damage. The Corps would not be required to take this course of action under NEPA law. However, they are, at the least, legally obligated to evaluate these alternative proposed actions in the same EIS and disclose the truth. If they decide to go forward, they must do so only after fully and fairly informing the public and the decision-maker of these alternative courses of action and the fact that certain significant impacts could be avoided if certain alternative courses of action were followed.

III. CONCLUSION

The commenting groups are very concerned by the continued refusal of the Corps to conduct a fair and unbiased analysis of the DFE project. The regulations and guidance of the CEQ is clear. The Corps professes to have read these documents, yet they fail to bring forth an analysis that comports with these requirements. Why is the Corps failing to honestly and fairly evaluate these alternatives?

There can be only one reason. The Corps is attempting to push forward with its DFE project and is attempting to conceal the fact that there would be no justification for its DFE project if the Dallas Floodway levees were raised above the SPF by two feet. Rather than the current proposed action that would destroy 30,000 trees in the Great Trinity Forest, a combined project could be created that would solve the problems of Dallas flooding, buy-out the residential areas of Cadillac Heights and save the Great Trinity Forest.

NEPA was passed to prevent uninformed rather than unwise decision-making. We can't make the Corps adopt the best approach for the residents and environment of Dallas. But we will do our best to make the Corps follow the law and tell the truth, which they still have not done.

The raising of the levee alone was rejected in the alternatives analysis approved by the U.S. District Court in this case. The DFE is not meant to protect only downtown Dallas. Therefore, this plan is not a reasonable alternative. As stated above, it is unreasonable to include an alternative previously found to be unreasonable as part of the baseline for the project.

EXHIBIT 2

Expert Report
Lawrence G. Dunbar, P.E.
January 2003

COMMENTS BY JAMES B. BLACKBURN, JR.
TO THE FORT WORTH DISTRICT OF
THE U.S. ARMY CORPS OF ENGINEERS
ON THE SUPPLEMENTAL DRAFT
ENVIRONMENTAL IMPACT STATEMENT
FOR THE DALLAS FLOODWAY EXTENSION PROJECT

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EXPERT REPORT ON SUPPLEMENT NO. 1 DRAFT EIS DALLAS FLOODWAY EXTENSION PROJECT

by Lawrence G. Dunbar, P.E.
January 2003

EXPERT REPORT ON SUPPLEMENT NO. 1 DRAFT EIS DALLAS FLOODWAY EXTENSION PROJECT

by Lawrence G. Dunbar, P.E.
January 2003

I have reviewed the Corps' Supplement No. 1 Draft Environmental Impact Statement (SDEIS) for the Dallas Floodway Extension (DFE) project. The focus of my review pertains to the hydrologic and hydraulic aspects of the SDEIS, which is within the area of my expertise.

I am a professional engineer licensed in Texas with over 25 years of experience in the area of hydrology and hydraulics. I was employed for over 6 years with the Corps of Engineers, and was involved in the preparation of the hydrologic and hydraulic analyses associated with Environmental Impact Statements (including cumulative impact analyses) for numerous federal and local projects. As a private consultant over the past 15 years, I have reviewed and provided consultation on a number of environmental impact statements for both federal, state and local projects affecting flooding. I am also a licensed attorney in Texas, practicing in the area of environmental, water and drainage law. I have provided legal consultation regarding the legality of environmental impact statements and their compliance with NEPA and CEQ regulations. Attached is a copy of my resume.

My comments regarding the SDEIS are as follows:

D-1

I. Incorrect "Baseline" Condition

The Corps' purpose for this SDEIS was to perform a cumulative impacts (effects) analysis in response to a federal court order. According to the 1997 CEQ Handbook on "Considering Cumulative Effects" referenced in the SDEIS, such an analysis starts with the establishment of a "baseline" condition against which the proposed action and its reasonable alternatives are evaluated. The "no-action" alternative, including all past, present, and reasonably foreseeable future actions, should serve as the baseline condition, according to the CEQ Handbook.

For conducting the cumulative impact analysis of the hydrology and hydraulic impacts for this DFE project, the "baseline" condition therefore should have included not only existing conditions, but also those reasonably foreseeable future projects identified by the Corps, such as the Dallas Floodway plan, the Chain of Lakes plan, and the Trinity Parkway plan, and others identified in the SDEIS.

The Corps did a good job in Chapter 3 of the SDEIS of identifying those projects that have been implemented in the past and those reasonably foreseeable future projects that will potentially be implemented in the future. This is the first step in establishing the "baseline" condition. The next step is to evaluate the cumulative impact of these various past and future projects on the environment, including flooding, assuming the proposed action (i.e., the DFE project) is not in place (i.e., the no-action alternative). This next step was not done in the SDEIS, nor was it even attempted.

D-1. The 1997 CEQ guidelines do state that an appropriate "Baseline" condition should be established for determining the effects of a proposed action as well as any reasonably foreseeable future actions. The 1997 CEQ also states that the No-Action alternative is effective for establishing this baseline in some situations. The comments here on baseline condition, however, seem to favor the inclusion of the Dallas Floodway alternatives in the "baseline" for the express purpose of arguing against the DFE Recommended Plan rather than providing a full disclosure of the impacts of all reasonably foreseeable future actions. By using the "no action" alternative as the baseline, all reasonably foreseeable future actions including proposed actions and combinations thereof were evaluated and properly compared to the true "baseline" condition. Data provided in this SEIS is structured in this manner in accordance with the CEQ guidance.

In its discussion of the cumulative impacts on the hydrology and hydraulics of the Trinity River on page 4-12 of the SDEIS, the Corps simply refers to the analysis conducted in the Programmatic Environmental Impact Statement (PEIS) dated June 2000 for the Upper Trinity River Basin (incorporated herein by reference). However, the environmental impact analysis contained in the PEIS utilized as its "no action" alternative the condition that included the DFE project as already having been constructed. Note the following excerpt from the PEIS entitled Chapter 4 - Environmental Consequences:

> This chapter (Chapter 4 Environmental Consequences) presents discussion of the impacts of project alternatives being studied under the Corps of Engineers Upper Trinity River Basin authority that could result in subsequent recommendations for Congressional Authorization for construction. Potential impacts of these projects and alternatives are disclosed along with the cumulative impacts, to the extent that they can be identified, and of reasonably foreseeable projects of others.
>
> NO ACTION
>
> The no action alternative would include those activities to the extent known that would likely occur without additional Corps of Engineer's flood damage reduction or ecosystem restoration projects within the study area. The authorized Dallas Floodway Extension recommended in the Final General Reevaluation Report and Integrated EIS for the project, and the previous permitted action in the Dallas Floodway are considered to be in place for the "No Action" condition for these evaluations.

This no action alternative ("baseline" condition) from the PEIS may have been acceptable for evaluation of impacts due to the proposed actions being considered in the PEIS, but this same no-action alternative cannot be used as the baseline condition for evaluation of the proposed DFE project. It is nonsense for such a

This concern has been addressed in the Final SEIS.

baseline condition having the DFE project incorporated into it to also be used to evaluate the proposed DFE project itself.

Assuming that such projects as the Dallas Floodway plans (Flood Damage Reduction and EQ), the Chain of Lakes alternative, and the Trinity Parkway alternatives are not "proposed actions" but only reasonably foreseeable future projects, these projects and their cumulative impacts should have been assumed to be in place as part of the baseline condition, against which the proposed DFE project and its reasonable alternatives would be evaluated.

For example, the Flood Damage Reduction (FDR) alternative for the Dallas Floodway calls for raising the existing Dallas Floodway levees 2 feet above the Standard Project Flood (SPF) water level. The purpose of this FDR project, according to the Corps, is to maximize flood damage reduction benefits along the Trinity River within the Dallas Floodway that protects downtown Dallas. By assuming such a project to be in place as part of the baseline condition, significant flood damage reduction benefits to downtown Dallas (approximately $13M annually) are realized, virtually eliminating flood damages in downtown Dallas (see attached Table - HCAR 16035). This "baseline" condition would also negate the need for the DFE project alternatives to excavate such a large swale throughout the DFE area. The swales in place to help reduce flood levels in the Dallas Floodway would not be needed under the Baseline Condition and all of the 30,000 trees planned to be cut down under the current DFE proposal would be saved. This scenario of raising the existing floodway levees was analyzed by the Corps during the DFE project work of

The Flood Damage Reduction alternative is not a reasonable alternative for the DFE because it does not meet the goals and objectives of the DFE project, particularly the need to protect areas outside downtown Dallas.

the 1990's but was never discussed or disclosed in the GRR/EIS, nor is it discussed or disclosed in this SDEIS.

In addition, by including the Chain of Lakes plan with the Trinity Parkway alternatives into the baseline condition for the DFE project analysis, the cumulative effects on the Trinity River would be to reduce flood levels within the Dallas Floodway and slightly increase flood levels downstream, based on analysis performed in the PEIS. Unfortunately, the PEIS analyses assumed the DFE project was already in place; thus, the cumulative effects of these future projects without the DFE project has not yet been analyzed by the Corps.

II. No Evaluation of the "Cumulative Impact" of Future Projects

D-2

In Chapter 4 of the SDEIS where the cumulative impacts analysis is discussed, Table 4-2 identifies a qualitative evaluation of the various reasonably foreseeable future projects as to their individual direct and indirect effects on various environmental resources, including hydrology and hydraulics (H&H) and flood damages. However, there is no determination of the "cumulative effects" of these various projects on those same resources, including H&H and flood damages.

The Corps has hydrologic and hydraulic computer models of the Trinity River that it has used to evaluate the flooding impacts of many of the major future projects identified in the SDEIS. For example, the PEIS contains model results of the incremental impact on flood levels due to a number of these future projects, including the Dallas Floodway modifications, the Trinity Parkway alternatives, and

D-2. This concern has been addressed in the Final SEIS

D-3

the Lakes plan by the City of Dallas. However, nowhere in the SDEIS nor the PEIS has the "cumulative" impact from these reasonably foreseeable future projects been analyzed or modeled, especially without the proposed DFE project in place. This is what a "cumulative impacts" analysis is supposed to analyze, the cumulative effects of the various past, present and reasonably foreseeable future projects in the area.

III. No Identification of "Proposed Actions"

To the extent any of these reasonably foreseeable future projects are "proposals" or "proposed actions", they need to be analyzed and evaluated in a single EIS. That means each project is evaluated separately and cumulatively, including all of its reasonable alternatives. Clearly, the Trinity Parkway is a "proposed action", and both the Corps and the Federal Highway Administration (FHWA) identify it as such (see SDEIS and PEIS, and the attached notice dated June 16, 1999 in the Federal Register by the FHWA). Likewise, the Chain of Lakes project (or "Lake Plan") being proposed by the City of Dallas is a "proposed action", and has been identified by the FHWA as such and has been included in the EIS being prepared by the FHWA in conjunction with the Trinity Parkway (see attached notice dated December 12, 2000 in the Federal Register by the FHWA).

The Dallas Floodway modifications being proposed by the Corps are also "proposals" or "proposed actions" as noted by the Corps in its PEIS, and therefore must be evaluated in the same EIS as the DFE project, the Trinity Parkway and the Lakes Plan. (see pgs. 1-5 and 2-20 of the PEIS). The inter-relationship of these

D-3. Please see comment at B-59 addressing this issue.

"proposed actions" and their potential for cumulative impacts on the environment, especially flooding along the Trinity River in the vicinity of the Dallas Floodway and the DFE area is obvious and noted in the SDEIS. Such inter-relationships between these various projects is also recognized by the City of Dallas (see attached correspondence from Vinson & Elkins, the City of Dallas' bond attorneys).

IV. Summary and Conclusion

D-4

In summary, the SDEIS for the DFE project has failed to first identify the correct "baseline" condition against which the DFE project and its reasonable alternatives are to be evaluated. The CEQ regulations specifically require that the cumulative impacts analysis identify the incremental impact of the proposed action when added to the past, present and reasonably foreseeable future actions in the same geographic area. This has not yet been done for the DFE project. The PEIS that was prepared by the Corps for the Upper Trinity River Feasibility Study evaluated the hydrologic and hydraulic impacts associated with various projects and their alternatives, including the Dallas Floodway modifications being proposed by the Corps, the Trinity Parkway and its alternatives being proposed by the City of Dallas and the FHWA, and the Lakes Plan being proposed by the City of Dallas. Such an analysis could have and should have been performed for the DFE project, with the assumption that the DFE project is not yet built but with these other projects being in place. This is the proper "baseline" condition that is required by the CEQ

D-4. The correct "baseline conditions" or No Action Plan for the DFE area was established for evaluation of cumulative impacts of the DFE Recommended Plan and the other final array of alternatives for DFE in the DFE/GRR. The Dallas Floodway alternatives were not included as reasonable alternatives in the analysis for the DFE/GRR because none of these alternatives directly address the goals and needs of the DFE study area. Additionally, alternatives within the existing Floodway are purely conceptual within the feasibility study phase.

Analysis of alternatives for both the Dallas Floodway and the DFE area contained in this SEIS constitutes a full disclosure of the cumulative impacts analysis in as far as it can be determined to date.

Alternatives for the Dallas Floodway referred to as the Trinity Parkway, the Lakes Plan, and the Corps' Dallas Floodway modifications are "proposed actions" in the sense that these types of alternatives have not been eliminated from future consideration and are expected to be carried forward for future study for the Dallas Floodway. However, they are not cumulative or connected actions under the law. Therefore, it is not necessary to consider them in a single EIS.

regulations and discussed in the CEQ guidance against which the DFE project and all of its alternatives need to be evaluated.

Second, the SDEIS for the DFE project failed to identify the "cumulative impacts" of future projects when added to past actions, without the DFE project (i.e., the no-action alternative). Individual project impacts were qualitatively identified, but the cumulative effects of these future projects were not determined nor discussed in the SDEIS, such as on the hydrology and hydraulics of the Trinity River. This is what a cumulative impact analysis is intended to do, so that the incremental impact of the proposed action(s) can be identified when added to the past and future actions in the area.

Finally, there is no discussion nor separate evaluation of "proposed actions" in the SDEIS for the DFE project. Clearly, the Trinity Parkway, the city's "Lakes" plan, and the Corps' Dallas Floodway modifications are "proposals" or "proposed actions" as defined by CEQ regulations that are to be evaluated in the same EIS, along with their alternatives.

Lawrence G. Dunbar
Lawrence G. Dunbar, P.E.

01-22-03

Read, Campbell

To: Read, Campbell
Subject: Response to the Army Corps of Engineers Supplement to the EIS for the Dallas Floodway Extension

January 8, 2003
To U.S. Army Corps of Engineers
Fort Worth District

From Campbell Read

Comments on the Supplement to the EIS for the Dallas Floodway Extension

The attitude of the Corps at the scoping meeting held in Dallas in 2002 was that they do not plan on reevaluating the Dallas Floodway Extension (DFE). Instead, they interpret the Court's ruling to require them only to comment on cumulative impacts of foreseeable future projects upstream of the DFE without regarding any of these projects as alternatives to the DFE. The attitude of the Corps in this matter is unacceptable.

That attitude is reflected in the EIS Draft Supplement. On page 2-3 it states:

"Until formal notice is made by the City of Dallas regarding their support of a plan that is different from that for which they have formally provided an endorsement, alternate plans discussed by individuals or the media cannot be considered as reasonably foreseeable. The plan recommended in the 1999 GRR/EIS, therefore, remains the Recommended Plan for analysis in this Supplement to the DFE EIS".

1. In our opinion, each and every project reviewed by the Corps in the Draft Supplement to the EIS should be regarded as a potential alternative to the DFE. Such an opinion is consistent with that part of the Federal Court order requiring the DFE project to be stopped. At the 2002 scoping meeting I asked Gene Rice why he thought the Court had ordered the DFE project to be stopped and he replied that he didn't know. However, "I don't know" isn't good enough as an answer. It certainly makes no sense for the Court to concur with the point of view in the quotation I just made from the Supplement to the EIS, and then to order the DFE project to be stopped. It makes no sense at all and Mr Rice knows that.

2. Chapters 4, 5, and 6 of the GRR/EIS [General Reevaluation Report and Integrated EIS for the DFE] of 1999, for example, contain multiple tables listing estimated costs and benefits in dollar terms of the so-called Recommended Plan as compared with making no changes to the floodplain. No such tables appear in this new Supplement, but we should all demand that they be compiled to include costs and benefits resulting from raising the Dallas Floodway by various heights, not only by 2 to 2.5 feet. The Corps argues that the lack of final agreement on the alignment of the so-called Trinity Parkway prevents them from computing costs and benefits deriving from it. But they have no such excuse where raising the Floodway levees by specified amounts is concerned; they can and must, produce a cost/benefit analysis.

3. If you turn to the discussion of raising the Floodway levees on page 3-11 of the Supplement, you will find that the discussion is confined to where the dirt would come from and where it would be put. That is all that the Corps presents on the subject of raising the levees. There is no related cost/benefit study that could be compared with those in the GRR/EIS for the so-called DFE Recommended Plan. The reason why the Corps has declined to do such a study, however, is plain. They are afraid that such a study would show the DFE to be less cost-effective than raising the Floodway levees, with the undeniable consequent conclusion that the DFE would no longer remain viable under the Corps's own rules.

[For Save the Trinity, TCONR and (in the past) Audubon Dallas]
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1. The SEIS has been modified to disclose cumulative impacts of reasonably foreseeable projects in relation to the final array of alternatives considered for the DFE GRR/EIS.

2. An analysis was conducted to address this issue and has been included in the SEIS.

3. At present the Dallas Floodway studies are being held in abeyance at the request of the sponsor, awaiting a decision on any roadway alignment. The data presented in the report and within Appendix C reflects information available at this time. These data clearly reveals that DFE continues to be City supported plan to provide flood protection to the DFE area.

Timothy S. Dalbey
2719 Santa Cruz Dr.
Dallas, Texas 75227-9341
Phone: 214-388-5362

3 February 2003

U. S. Army Corps of Engineers
Fort Worth District
ATTN: (PM-C) Mr. Gene T. Rice, Jr.
819 Taylor Street
P. O. Box 17300
Fort Worth, Texas 76102-0300

Re: DFE SEIS first draft comments

Dear Mr. Rice,

I have enclosed my comments on the report titled: *Draft Supplement No. I to the Environmental Impact Statement for the Dallas Floodway Extension Trinity River, Texas* dated December 2002 by the Fort Worth District, U. S. Army Corps of Engineers. Thank you for the extension of the comment period.

Sincerely,

Timothy S. Dalbey

Timothy S. Dalbey

Comments by Tim Dalbey on the *Draft* Supplement No.1 to the Environmental Impact Statement for the Dallas Floodway Extension Trinity River, Texas, 2002, U. S. Army Corps of Engineers Fort Worth District (CESWF), Fort Worth Texas, also known as the DFE SEIS

I received a Notice Of Availability (NOA) for the DFE SEIS on 11 November 2002 by mail that stated the DFE SEIS will available on 6 December 2002. At the 16 July 2002 Scoping meeting held at the Ramada Inn on South Akard in Dallas the CESWF claimed the DFE SEIS will be out in October 2002. Instead, the DFE SEIS did not come out in a timely manner and was timed, most likely purposely, to come out over the Christmas - New Year holiday period when the public, and agencies are on holidays making it difficult to find the time to adequately comment on such an important report. CESWF's timing needs to be improved so that it does not conflict with this busiest time of the year.

1\. Even though I received a NOA for the July 2002 meeting, attended the meeting, provided written comments in a timely manner, and received a NOA for the DFE SEIS on 30 November 2002 I did not deceive a DFE SEIS report. I heard about the availability of the report through the grapevine and had to call Gene Rice (CESWF-PM-C) on 2 December to get a copy of the report. I do not have the Internet, so I could not go online and read the report. I did

2\. not receive a copy by 10 December 2002, called Gene Rice again. I finally received a mailed copy 2 weeks after the NOA of the report on 13 December 2002. In the future CESWF needs to be more prompt in mailing reports to those interested in the project. Thank you for the opportunity to comment on this revision, and keeping this report on the DFE (SEIS) less redundant and shorter to only 87 pages, although still lengthy for reporting on one aspect, "cumulative effects."

1\. P. 1-3, 3rd para., "On Count 3(B) of the motion, the Court ruled in favor of the plaintiffs argument that the GRR/EIS did not address the cumulative impacts of reasonably foreseeable future actions and remanded the matter to the Corps of Engineers *"for further consideration of the cumulative impacts of other similar, reasonably foreseeable projects in the same geographical area as the DFE project."* In the next sentence, the CESWF interprets this statement to mean it is their task in the supplement to, "The objective of this

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1\. The Notice of Availability forwarded to you and others noted that the Supplemental DFE was available for review and comment. The Corps provided a copy of the Draft to you after your request.

2\. As noted in the Notice of Availability, hard copies of the DSEIS were available on request. Copies were also available for viewing at two locations within the City of Dallas as well as on the Fort Worth District's internet home page.

Supplement to the DFE EIS is, therefore, to address the U S. Court for the Northern District of Texas' instruction by further examining the cumulative impacts of the DFE project and determining if any other projects are in fact 'proposed actions that must be considered in a single EIS'."

It seems clear from this statement, at least as the CESWF interprets it, the CESWF must do 2 things, the first is clear: 1) further examine the cumulative impacts of the DFE project in and around where the DFE is going to be built. The second part of the objective is muddled, either by the CESWF's own, or preferred interpretation of the judgment. Because as written in the second part, the CESWF considers their objective to be: 2) determine if other projects are "real" (my emphasis) proposed actions that must be considered in a single EIS.

From the way the judgement is written above, this interpretation is not the way the judgment is to be interpreted. Of course these other similar projects that are to built upstream in the floodplain from the DFE have to be considered under NEPA, because they effect valley storage, river flow, velocity, and downstream flooding in the DFE. As the CESWF interprets this second part, it is up to them to determine if other projects are "proposed actions." Of course they are proposed actions, many of these projects transcend proposed actions and are in progress, money has been spent, contracts have been let, and bonds have been passed for the projects.

As interpreted by the CESWF, the second part has nothing to do with the impacts (individually or collectively) of these projects downstream in the DFE, instead the CESWF is just suppose to list the "proposed actions." And list the proposed projects is all that the CESWF does in the DFE SEIS. The CESWF never tabulates or synthesizes the cumulative effects of one or all of the upstream projects with regard to downstream flooding through hydrology and hydraulic (H/H) models created from various flow analyses brought about by the future projects upstream. Therefore, it appears that the CESWF interpretation of the judgement is inaccurate as the CESWF shirks it's responsibility to adequately assess the cumulative impacts of the other projects and the effect these projects would have on the DFE H/H model.

My following comments attempt to point out how the CESWF did not reach the 2 objective(s) in the above statement CESWF did not previously, and still has not, examined the direct or indirect

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3. There is a large array of "proposed actions" under consideration within the geographic area of the DFE. Concerted efforts were made to identify from all known sources, which of these are reasonably foreseeable actions that would have potential cumulative impacts.

4. The Corps PEIS strived to thoroughly evaluate those reasonably foreseeable projects known at that time and quantified cumulative H&H impacts in that document. The PEIS was incorporated by reference into the DSEIS. Based upon comments received on the DSEIS, the final SEIS has been modified to include the H&H analysis from the PEIS and cumulative impacts of the final array of alternatives investigated in the GRR/EIS.

5. cumulative impacts to the environment in and around the DFE project impact site area, nor has the CESWF integrated the impacts of other floodplain projects upstream with the DFE. Instead, according to the wording by the CESWF provided above in the CESWF objective statement, they interpret the CESWF's task is to only list other projects in and around the DFE

6. The following comments refer to specific items by page and paragraph in the DFE SEIS.

2. In the Background Section p. 2-1, 3rd para., CESWF omitted how long the work on the Trinity river in the Dallas Floodway was halted for some years by a 1972-73 injunction and why the work was halted.

7 3. P. 2-2, 1st para. CESWF claims that, due to public opposition to the environmental impact of the 1,200 swale NED Plan in the DFE, that the proposed project would not be viable. What the CESWF does not recognize since 1965, is that the public is not in favor of any project in the DFE because the DFE represents a unique natural environment made up of many ecological niches, with the only stretch of original river channel remaining where the main stem of the Trinity river is formed No matter how it happened (through neglect by the city, or however) the DFE contains an extensive forest (6-11,000 acres), with wetlands, different patches of ecozones with different flora, with an urban fauna and robust diverse bird life composed of aquatic, waders, forest to open forest song birds, to raptors and scavengers, in the middle of the eighth largest city in the U. S. This is unique, the public knows this, and is ever protective and watchful for any impacts to this natural environment.

The CESWF, in their attempt to keep some kind of a Dallas Floodway civilian (non-military) project alive for the last 38 years (since 1965), after all previously proposed projects had failed, came up with the 1999 DFE project and was able to get the City of Dallas to sign on as the sponsor (2002) for the project after voters passed a bond election by 1,200 votes in May 1998 for the project. In a city where voter mail-in fraud and corruption has made State and National news it was not surprising that this proposition in the bond package passed. Over $3 million was spent by the lobby for the project versus $300,000 by grass roots groups and environmental organizations opposed to the project

3

5. Chapter 5 of the DSEIS quantified known cumulative impacts to resources. Table 4-1 quantified the cumulative impacts to resources and Table 4-2 provided our analysis of the importance of those impacts. Additional supporting information has been developed and information provided in the PEIS has also been incorporated into the Final SEIS.

6. An injunction was issued against certain projects known collectively as the Trinity River Project. The injunction was dissolved in 1986 and is not relevant to the GRR/EIS or the SEIS.

7. Selected members of public have also supported the DFE because of the flood damage reduction benefits it would provide. The Corps has recognized the intrinsic values of the environmental resources of the area identified as the Great Trinity Forest. Every effort was made to assess impacts of the DFE alternatives to this area minimized the impacts to the resources to the extent possible resulting from the DFE project. The authorized plan provides for additional wetland restoration in addition to mitigation actions that fully mitigate for all forested resource losses.

8. There was opposition to the 1,200 Swale NED Plan, but this was a CESWF proposed project that the City did not even buy into, and the opposition to this project was nothing compared to the present opposition to the DFE project. CESWF knew that the huge impact to the forest proposed by the 1,200 Swale NED Plan was not viable. There has been longer and more legal opposition to this plan, because of the 20-30 added projects within and/or bordering the Trinity river floodplain that add to the cumulative impacts (toll road inside the levees, the City's Master Implementation Plan in the DF, etc.), also because this plan has stayed alive longer. But any plan in the DFE that disturbs the environment integrity as proposed by the CESWF will continue to meet strong opposition, but the CESWF continually presses on for the project.

9. 4. P. 2-2, 1st para., goes into the Recommended Plan describing the swale (levee borrow ditch) dimensions that are reduced from those dimensions reported in the DFE FEIS, or as detailed in the drawn plans in Appendix C where depths reach 12 ft., each swale cell (borrow ditch) is more on the average of 5 ft. deep, and the impacted disturbed partly forested acreage creating the swales is more in the

10. range of 4-500 acres. How can the CESWF generate 3.2 million cubic yards of fill as reported in DFE FEIS from a borrow ditch (swale) 1.5 ft. deep over 123 acres? At this size, 123 acres at an average of 1.5 ft. deep would generate less than one million cubic yards. Obviously the "emergent wetlands are going to be at the bottom of the borrow ditches/swales. Moreover, in the DFE FEIS the acreage needed for impact mitigation was considered at a 1:1 ratio for impact to mitigation, therefore it was written in the DFE FEIS approximately 1,169 acres were needed for mitigation. The small amount of

11. acreage reported in the DFE SEIS at 123 acres for "emergent wetlands" within the larger swale (acreage not provided), plus the project features such as the 2 levees, 5 sumps, and channelization, do not begin to add up to the 1,169 mitigation acres? As written in the DFE SEIS it seems that the 123 acres of"emergent wetlands" is going to be only a small part of the total size of the swale. Even using the swale figures provided in this paragraph which total only 232 acres, the "emergent wetlands" take up only 53 percent of the swale. These figures do not compare to the figures provided in the DFE FEIS. This seems to need clarification. Second to last sentence is incomplete, emergent ?

4

8. The NED Plan was viable, however the City determined following numerous meetings with the affected local public that it could not support the NED Plan for Environmental and other reasons.

9. The wetlands would be shallow, however, there is a deeper area in each cell as you have indicated.

10. The Mitigation requirements presented in the DFE GRR/EIS were determined in cooperation with the US Fish and Wildlife Service utilizing the Services Habitat Evaluation Procedures (HEP). No preset mitigation ratio utilized. Corps analyses indicated that forested habitat values in the DFE area would increase substantially under future "without project" conditions. Additional mitigation measures were incorporated into the authorized DFE project to fully compensate for all future habitat losses. The HEP annualizes future with and without project conditions for both the impacts and potential mitigation benefits. A total of 1,179 acres of mitigation was determined the required level to fully mitigate forested impacts. The mitigation would occur within and adjacent to wooded areas in the area identified as the Great Trinity Forest. Table 4-10 in the GRR/EIS describes the upper and lower swales.

11. The sentence should say emergent wetlands.

5. P, 2-2, 1st para., continued What is the CESWF expertise is
12. creating synthetic "emergent wetlands" by using borrow ditches
(swale) along a river system such as the Trinity? CESWF does not
provide a comparative project to document that they have had any
success creating such a synthetic system on the Trinity in the past, or
that they can have success doing what is proposed in this river
system. This is not a reservoir where CESWF has recently tried to
establish wetlands, and it is still too soon to know if they were
successful. Moreover, once the CESWF finishes the DFE project, they
13. are not responsible for maintaining the success of the "emergent
wetlands." Maintaining the wetlands becomes the task of the City.
Under "cumulative effects" where is documentation that the City has
the expertise to maintain this type of "emergent wetlands." Clearly,
14. in Appendix M (DFE FEIS) Texas Parks and Wildlife Department
(TPWD) states that, the CESWF has had little expertise, or success, in
creating wetlands on open river systems of this nature with highly
sporadic flows.

6. P. 2-2, 1st para., continued. TPWD is even more concerned about
the detrimental cumulative effects of channelizing the river and the
total effects on the aquatic habitat. The CESWF never discussed this
15. direct DFE project impact, or the combined cumulative impact of the
other projects mentioned above, and their long term cumulative
impacts on the river aquatic system, or provide any documentation
pertaining to their expertise, or success, in channelizing this type of
river system.

Where the channelization is going to take place will likely destroy a large natural meander bend in the river that is an important aquatic feature in the river. Meander bends create differential flows, stream bed loads are deposited on the inside of meanders, and faster flows occur on the outer parts of the channel. The shallow inside of the meander creates an aerated aquatic habitat (often point bars, riffles) that is beneficial for different aquatic life forms such as microfauna consisting of ostracods, copepods, etc., and larger fauna such as fish, turtles, gastropods and bivalves (mussel shells), as well as aquatic bird waders, while the deeper outer faster flowing pool habitat supports a different faunal community.

The movement of the channel westward of the meander will straighten the channel and increase flow velocity Nothing is mentioned whether the new channel after channelization will be deeper, more shallow, wider, etc. A shallow channel would result in

5

12. The design and operation of the wetland system was developed in cooperation of U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department and in-house Corps specialists.

13. We concur that success of mitigation operations will be contingent on utilizing an operational plan with the sponsor. We have no reason to believe that the sponsor (the City) will not closely abide by the agreed upon plan. In addition, the Corps of Engineers will perform periodic inspections of the project, including the flood damage reduction features, restoration features, and the environmental mitigation to assure the project features and associated operations are being properly preformed. Adaptive management will be directed where required.

14. The Corps discussed the impacts of the realignment of the Trinity River in the GRR on both terrestrial and aquatic habitats.

15. The meander bend is more than 2000 feet downstream of the lower end of the channelization. The new channel will be almost identical in length and cross section to the old channel. No additional conveyance will be added.

16.

increased sinuosity of the river and erosion, decreased the upstream gradient, decreased mean particle diameter in stream bedload, and decreased competence of the stream to move its own sediment. A deeper channel would cause increase gradient, lack of sinuosity, chute cutoffs across point bars, new headward erosion as well as downstream erosion of banks.

The DFE features (2 levees, borrow ditch/swale, channelization, sumps with pumps) combined with the bank stability of 2 gabions on the right bank ca. 0.5 miles downstream at another CESWF project at another large meander at Joppa Preserve will likely result in the total degradation of the aquatic habitat from increased flow velocity resulting in increased bank erosion.

Recently we learned of yet another project, to the immediate south of the CESWF's Joppa Preserve project. This project is by the City of Dallas, permitted by the CESWF, where the City is going to construct a 400+ acre extension to the existing levee system around McCommas Bluff landfill so that the landfill can extend eastward into waters of the U. S. and further confine the river on another large meander bend, also creating another point source for waste to enter into the river system directly or through percolation into the substrate.

The cumulative effects of these types of projects on the river system need to be modeled, quantified, and effects listed for their impacts to the river system. These were never considered cumulatively for the DFE, Joppa Preserve and the McCommas Bluff levee extension. Moreover, in this DFE SEIS, CESWF repeatedly recommends (or sells) their Environmental Quality (EQ) alternative for the Dallas Floodway design they produced in the Dallas Floodway Programmatic EIS (2000). Relative to some of the effects to the river system mentioned above, the CESWF has written nothing on how these proposed projects (DFE, DF EQ, Joppa, and permitting the McCommas Bluff Landfill Extension) cumulatively will directly or indirectly effect over 20 miles of the river system. As stewards of the waters of the U. S. for them to not describe, model, or synthesize the cumulative impacts these projects will have on the river system is to shirk their environmental responsibility for an Environmental Impact Statement.

Yet, the CESWF in the Upper Trinity PEIS (2000) can sure tout their synthetic model of a meandering stream and its benefits in their synthetic Environmental Quality model for the Dallas Floodway. If the CESWF's DF model is such a feasible environmental quality

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16. The impacts of each of these projects are modeled prior to granting of Section 404/10 permits in the Upper Trinity Basin. In addition, the Corridor Development Certificate process requires that cumulative hydrologic and hydraulic impacts be negated on site .

17.

model with a man-made channelized meandering stream that creates such a beneficial aquatic habitat, why destroy the natural already existing high quality river system in the DFE and replace it with a man-made synthetic confined unnatural floodway?

Under current existing conditions within the natural DFE drainage, the unconfined floodplain in the DFE provides a substantial benefit for the channel confinement upstream in the DF by dissipating all the flow energy from the confined reaches upstream. To further confine the river through the DFE and downstream will cause instability of the river system, degrade the aquatic habitat, cause downstream and headward erosion, and alter the outflow drainage of tributaries within the drainage system. Although on a smaller scale with a less complex setting, Berger (1991, *The Blanco River*, pp. E30-E36; In Rosgen, D., 1993, ed., *Applied Fluvial Geomorphology*) documents an example of increased erosion along the Blanco River in Colorado as a result of the detrimental effect of confined flow caused by a COE project.

17. The channel realignment plan identified in the DFE GRR/EIS has a specific project purpose of eliminating the threats to a series of bridge pilings that support IH-45. The EQ plan, a floodplain development alternative incorporating fluvial geomorphologic principles within the Dallas Floodway, is discussed in the PEIS.

18.

7. P. 2-2, 1st para., continued and Recommended Plan (page 2-3). Furthermore, the CESWF never provided documentation (photographs, statement of request by TXDOT, or MOA, MOU, with TXDOT in either the DEIS or FEIS in Appendix L) that the I-45 bridge concrete supports were so heavily damaged that the river channel needs to be realigned. In June of 1998 I canoed past these supports and observed that the upstream concrete supports had a few scratches on the concrete support surfaces at various levels well above the river surface level from debris that had flowed passed the supports during higher faster flows since 1972. These scratches did not appear to jeopardize the integrity of the supports.

Recently, Tony Hartzel reported in the Sunday edition 12 January 2003, *Dallas Morning News, Metropolitan Section*, page 31, that 12 concrete pillars have deteriorated (see photograph and article on next page) under the I-30 bridge at Samuell Boulevard from storing the salt and sand mixture used for icy roads up against the concrete supports. When the salt and sand mixture got wet over the last 30 years it caused erosion of the concrete column surface exposing the reinforcing rebar steel. According to the article approximately 187,000 vehicles (trucks, cars, etc.) pass over the I-30 bridge daily, while only 75,000 vehicles (71.4% fewer vehicles) pass over the I-45 bridge daily. In the article, the TXDOT engineer that was interviewed stated, "It's not serious damage (referring to the

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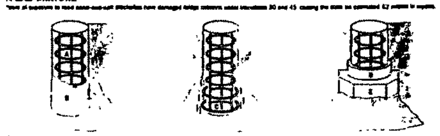
18. An incident prior to your canoe trip occurred that caused debris to pile up on a column causing sufficient hydraulic pressures to break the pier. The damaged pier was repaired prior to your site visit. The scratches you observed indicate that debris continues to strike the columns. There has not been another flooding event sufficient to cause new substantial damage. The need to protect IH-45 was described on page 4-69 of the GRR/EIS. Three alternatives including armoring of the columns were described, including cost and benefits to provide that protection were described on page 4-70 to 4-71. The river alignment alternative clearly has the lowest cost and provides the greatest benefit to cost ratio. Impacts of the aquatic and terrestrial impacts of the realignment were disclosed in Chapter 4.

Salt eats away at interstate pillars

Damage poses no danger, officials say

A BAD MIXTURE



...ward.

"In the heat of a storm, you do what you need to do," he said.

The damaged columns do not pose a danger to the estimated 187,000 vehicles that travel I-30 over Sunnell each day or the 75,000 vehicles a day that use I-45 around Pine and Hickory streets.

"The columns look pretty bad, but it's not as bad as it looks," said Gary Moonshower, an area engineer for the Texas Department of Transportation who will oversee the repairs that are to begin in May. "It's not serious damage that would affect the structural integrity of the bridges in any way."

Repairs will consist of a new concrete coat for all affected col-

See SALT Page 22A

Salt piles corrode interstate pillars

Continued from Page 31A

umns. Traffic should not be affected while crews patch the columns.

A state contract will pay for the repairs, but state officials will talk with city officials about sharing the cost. The sand and salt stockpiles belong to the city but are stored on a state right of way. At times, the city has shared its sand-salt reserves with the state, and the city has spread the mixture on state highways.

"This has happened over a 30-year period," Mr. Evans said. "All the benefit we've gotten out of those stockpiles in assisting traffic certainly has helped offset this deterioration cost."

City workers plan to install wooden boxes around the repaired columns to keep the salt and sand at bay.

"After a storm, we'll now get supervisors to inspect the stockpiles to make sure they're not getting pushed around the columns. If we need to, we'll clear away the piles after each storm," Mr. Evans said.

Some LBJ Freeway bridge columns near the Dallas High Five interchange project also are being repaired. In that case, the city kept construction-material stockpiles around the bridge columns.

Moisture from the stockpiles seeped into the concrete and expanded during freezing temperatures, causing the damage, said Bob Brown, the assistant Dallas district engineer for the Texas Department of Transportation. The salt in the sand stockpiles speeds up the corrosion, he added.

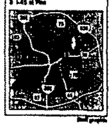
"We need to be more diligent in reviewing the stockpile locations and making sure they aren't placed where they can cause damage," Mr. Brown said.

Sand piles already have been moved to clear the way for the spring repairs. If they're lucky, Dallas crews won't have to move them or use them before then, Mr. Evans said.

"It hasn't done anything severe in the last several years," he said as January temperatures hovered around 70 degrees last week. "But Texas does have crazy weather."

SALT-DAMAGED OVERPASSES

1. I-30 at Samuell
2. I-45 at Hickory
3. I-45 at Pine



Staff graphic

Metropolitan
The Dallas Morning News
DallasNews.com
Sunday, January 12, 2003
11 Page 31A

damage to the supports like the one concrete eroded support column shown in the I-30 article photograph) that would affect the structural integrity of the bridges in anyway."

The surface scratch damage done to only the upstream sides of eight of the upstream columns, of the sixteen I-45 concrete support columns, where the river passes through is miniscule compared to the damage depicted in the newspaper photograph of the I-30 support columns. Moreover, the I-45 traffic is 71.4 percent less than the I-30 traffic.

According to the newspaper article some I-45 support columns
19. where sand and salt is stored under the bridge were also affected. The so-called damage by the river to the support columns was not mentioned as a problem. The TXDOT engineer did not even consider that the amount of deterioration depicted for the I-30 concrete supports affected the structural integrity of the bridge. Then how can the scratch damage to the I-45 concrete supports were the river flows justify moving and creating a new channel for the river and upset the entire riverine habitat?

In the newspaper photograph Item D was proposed by TxDOT
20. to repair the damage to the I-30 concrete support columns. Item D consists of an additional outer concrete ring, or sleeve added to the base of the damaged columns. Therefore, it seems simple, the I-45 concrete supports where the river flows under the bridge are not nearly as badly damaged as the I-30 columns, which the I-30 columns in their present degraded state do not pose a structural integrity threat to the bridge. To prevent damage in the future to the I-45 columns an outer concrete ring or outer sleeve could be contructed to protect the existing columns instead of moving the river channel.

21. 8. P. 2-2, 1st para., 123 acres of emergent ? (not defined).

9. P. 2-2, 4th para., throughout the DFE SEIS the CESWF does not mention the CBD (Dallas. Central Business District), that supposedly was threatened if the DFE project did not get built. However, in the CESWF PEIS 2000 (Programmatic EIS for the Upper Trinity River Basin including the Dallas Floodwey) it is made clear that the CBD can be additionally protected (SPF+) by adding 2+ feet to the inside of the existing levees, thus neutralizing this point of protection for the DFE. By including the CBD in the economics of the project the CESWF was able to elevate the economic benefits of the DFE project to make the

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19. While the photos show signs superficial damage at the columns impacted by storage of materials, these columns are not subjected to the higher hydraulic forces that the columns in the river channel must sustain.

20. The alternatives evaluated included strengthening existing columns but the remaining threat to life and property was determined too great.

21. The missing word "wetlands" has been added to the sentence in the final report.

project's BCR (Benefit to Cost Ratio) high enough to justify the project. Without the CBD the BCR was insignificant because the DFE only provides protection to Cadillac Heights and Lamar street, while making a huge impact on the natural environment In the DFE SEIS the CESWF still does not mention how these points affect the direct cumulative effects on the economic benefits in the DFE area after the project has been built. Many of the ongoing businesses along Lamar (n=41 of 77, or 53 %) such as: Auto Salvage/Automotive Repair/Tire Repair (n=18, or 23%), Container yards/Trucking Shipping Warehouses (n=11, or 14 %), Scrap metal yards (n=12, or 16%), have built up their land 10-20 ft. above the level of Lamar street to avoid flooding (Dalbey, 2002, report for NWF, OMB, TCONR, STT). What good will the Lamar levee do them? In addition there are 27 vacant/abandoned buildings, 12 vacant lots, 9 low income homes that could be bought out, and businesses (such as DISD in the old Proctor and Gamble building) on naturally high ground behind the proposed levee that were included in the economic assessment Furthermore, by the BCR omission in the SEIS, and according to the CESWF, cumulatively for the 22 projects listed in Table 4-2 the DFE project provides very little economic benefits (see no. 11 below).

22. This comment is addressed in the SEIS in Appendix A section on the Flood Damage Reduction plan.

10. P. 2-3, para 4, Recommended Plan, the cost of the project is higher. The cost for the DFE project is described as costing $154.4 million up from $127 million, a 22% increase, plus the extra the City has to pay for the Locally Preferred Plan (LPP). Why is the cost higher?

23. The lower cost of the DFE project was based on a detailed cost estimate performed for the GRR/EIS. The higher number is an updated cost, which reflects price level increases due to inflation.

11. P. 2-3, para 5, this paragraph is misleading. At the 25 November 2002 meeting at the CWWTP (Central Waste Water Treatment Plant) held in Cadillac Heights by the City with Councilman John Loza presiding along with other City representatives, the only buy out proposal offered for the Police Academy by the City was for those residences above the 100 year flood. The City offered nothing for those that live below the 100 year flood as defined by the City from 1970's data. The City by signing the Project Cost Sharing Agreement with CESWF forfeited any Federal dollars from the DFE with this agreement and is evidently prepared to go it alone, or through other channels to resolve the Cadillac Heights issues. During the buy out public meeting for the Police Academy held by the City, the City representatives and council members present were only concerned with the academy building The City representatives in their infinite

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24. The 100-year elevation is based on the models developed under the Upper Trinity Feasibility Study (1993 – 1998) and used in the DFE project. This model is based on 1991 topography and recent flood events data.

wisdom left out other necessary academy amenities such as firing ranges and physical training areas. According to Asst. City Manager Jill Jordan (21 January 2003 City Bond Proposal Public Meeting, Skyline Library) there is a Phase II in the works for buying out those residents below the 100 year floodplain in Cadillac Heights to accomodate the firing ranges and training grounds.

So, the City's plan for what they are going to do after the agreement does not necessarily have to include the CESWF, although participation by CESWF through the DFE project would have been highly desirable. The City essentially lost a $0.5 million law suit brought against the City by Mike Daniel representing several of the Cadillac Heights residents as they settled out of court. The City is now offering approximately $55,000.00 plus moving cost for ca. 190 households in Cadillac Heights which would come to $10.45 million. With the removal of the residences from Cadillac Heights, the Cadillac Heights levee would be protecting less value, which would drive down the dollar value of the benefits of the Cadillac Heights levee further, and lower the CESWF BCR even more. After the household removal the levee would be protecting a Police Academy firing range and physical training fields. How much value do these have?

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There were two lead (Pb) smelters (closed by 1991). Currently, a huge City waste treatment facility, chrome plating plant, meat rendering plants, animal fat rendering plant, large DART regional bus repair facility, etc. in Cadillac Heights plus other small industries that polluted and still are polluting the area. After the RSR Pb smelter National exposure in west Dallas the City recognizes they had better do something, even if CESWF does not recognize contamination problems and wants to go through the toxic Linfield Landfill.

The CESWF never recognized contamination in this area, except at Linfield Landfill next to the Joppa community. CESWF determined, based on some very limited, not thorough analyses outside of the direct impact areas, that contamination in the DFE is not significant. Even after an exposed slurry wall was built after a swale cell that was going to be excavated through the Linfield Landfill. CESWF did not test for contamination (such as arsenic, chromium, selenium, barium, lead, chlorine, ammonia, nitrates, hydrocarbons VOC, SVOC, PCB's, etc.) in areas they were going to directly impact. The direct and indirect cumulative impacts of contamination exposure to the air, water, and soil, were never addressed because the CESWF would not, and did not test for contamination in areas where they were going to build DFE project features (primarily the swale cells and sumps). If

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25. The DFE project's economic justification was based on existing property/structures in place at the time of the evaluation. The Corps is not allowed to include potential future development flood damage reduction benefits in its economic justification.

26. The Linfield Landfill was tested and the Corps received approval from the TCEQ on its plan for the excavation of the closed landfill. Continued testing will be performed as necessary on all property acquired for the project.

26	the CESWF through negligence does not test and analyze then there are no direct and indirect cumulative HTRW impacts. To neglect is a violation of NEPA, because direct and indirect impacts can not be ascertained. A Federal projects' direct and indirect impacts, and how they cumulatively effect the environment is what the NEPA process is all about, if HTRW impacts are neglected, NEPA is incomplete, and indirect and direct cumulative impacts can not be determined, or even an evaluation made.	26. HTRW has not been ignored. Site specific testing will be conducted as plans and specifications are developed for the project. Should HTRW materials be located, they would be handled in accordance with existing state and federal laws. The net result would be of improved environmental conditions for humans and fish and wildlife resources.
27.	12. P. 3-5, para 3, Corps of Engineers Reservoir Projects, CESWF states that, Grapevine, Ray Roberts and Lewisville reservoirs have the greatest effect on the hyrology of the study area of the DFE. This is not accurate because the CESWF Joe Pool reservoir that empties into the much smaller Mountain Creek reservoir can also have a large effect on the hydrology, especially when heavy rains in the southern part of the drainage occur.	27. Mountain Creek has a smaller overall drainage area and contributes less to the hydrologic effects in the DFE. However, all upstream reservoirs were taken into account in the determination of the hydrology for the study and design of all Corps projects in the Dallas area.
28	13. P 3-11, para. 1, No Action, only addresses CESWF proposed plans for the Upper Trinity River Basin Programmatic EIS (PEIS, 2000) Flood Damage Reduction Plan and their proposed Environmental Quality Plan (channelized meandering channel between the existing levees in the Dallas Floodway) and has nothing to do with "no action" in the DFE. The CESWF is suppose to address the DFE, that is the Dallas Floodway Extension, not the Dallas Floodway (DF) which is connected to the north end of the DFE. The CESWF DF plan and H/H models are predicated on the DFE being in place. This SEIS is about the DFE. Either the CESWF does not understand, or does not want to understand, that they are suppose to address the DFE cumulative effects, or they make the assumption that the readers of the SEIS are so ill-informed that they do not know the difference between the DFE and the DF, which is an insult to the public and agencies involved.	28. The GRR/EIS for the DFE thoroughly discussed and disclosed the impacts of the DFE. The Draft SEIS addresses the cumulative impacts of other reasonably foreseeable actions. Cumulative impacts in relation to the final array of DFE alternatives have been determined and are included in the Final SEIS.
29	14. P. 3-11, para 3, refers to many bridges across the Trinity as potential historic properties under Section 106. How many, and what are the particular bridges. How will the historic status of the bridges affect the DFE or PEIS?	29. There are five potential historic bridges (Commerce, Continental, Corinth, and Houston and the ATSF) in the area. The historic status of these bridges does not affect DFE or PEIS.
	15. P. 3-11 to 3-12, Flood Damage Reduction Plan and Environmental Quality Plan This is the first write up in this report, of many references throughout the report, to the CESWF's plan for the Dallas Floodway (DF) that the City Council has not voted for over their	

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30 Master Implementation Plan. Throughout the report the CESWF attempts to use the DFE SEIS report as a document to sell their DF EQ plan over the Master Implementation Plan that Halff and Associates designed for the City, that was paid for by the City with additional taxpayer money to the amount of over $5 million. This is not the proper venue for the CESWF to sell this project. The cumulative effects of projects in the PEIS do not provide any details on the hydrology combined with the other 21 projects upstream of the DFE, nor the protection (greater than SPF) to the CBD. The protection of the CBD in this project would neutralize the BCR benefits for doing the DFE, because the value of property, businesses, etc. in the DFE are not collectively high enough to stand alone to justify the DFE project if the DF levees are raised protecting the CBD.

31 16. P. 3-14, 1st para., Ecosystem Restoration, Old Trinity River, Dallas, modification of the Bickers Street Sump, and other features that no one seems to know about. This project was listed in a 1995 CESWF report on proposed projects for the Upper Trinity. It is not clear in the description how many acres are going to be modified but seems to be ca. 110 acres outside the floodway. A drawing should accompany the description of this project and how it will effect the Floodway.

32 17 General comment: list of projects with diagram(s) should be included for each of the 22 projects that the CESWF describes in the SEIS. The diagrams should show the impact(s) to the existing conditions, the total acreage alteration, and proposed final design.

33. 18. P. 3-14, 2nd para., downstream right bank erosion caused by the confined high velocity flows from the Dallas Floodway was used for the justification of the Joppa Preserve 1135 project. This $7 million project begins at the end of the DFE. Basically it is designed as a 123 acre swale cell with "emergent wetlands," south of Swale Cell G in the DFE with levees on the east side of the swale (Big Lemmon Lake), and 2 gabions on the right bank where the river meanders. The project is less than 100 feet south of the DFE hidden as an 1135 project and environmental restoration. Real environmental restoration would be to re-establish this land as bottomland hardwood forest with what is left of the creek re-establish a natural channel.

34. This project is in the floodplain and is subject to numerous

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30. The EQ plan was identified in the PEIS as an alternative that would reasonably provide ecosystem restoration benefits to the Dallas Floodway.

31. This comment is addressed in the SEIS in Appendix A section on the Flood Damage Reduction plan. Additional flood damage reduction within the Dallas Floodway, if the levees were raised, would not neutralize the benefits of constructing the DFE. Flood damage reduction benefits in the immediate area of the DFE are the primary output of the DFE project and those benefits would occur whether or not additional height is provided to the DFE levees

32. The project would not effect the Floodway but if implemented would provide cumulative benefits to fish and wildlife resources through improvement of wetlands and riparian forested resources. A draft detailed project report for is scheduled for public review this FY.

33. The actions that we were able to identify in the overall study area were evaluated. Most of the proposed projects lack sufficient detail to provide the information requested at this time. For those where sufficient data exists, their adverse and beneficial impacts are included in Table 4-1.

34. Erosion from both high and low flows and from flows through Lemmon Lake eroded the control structures in the past. The justification for the project is based upon restoration of modern historic conditions, which include a wetland complex within Lemmon Lake and Little Lemon Lake and riparian forest protection and improvement.

35	floods (I observed this land submerged 7 times in the first 7 months of 2002) Historically, the land was once a relatively level floodplain with a bottomland hardwood forest before it was used as a sand and gravel borrow early in the last century up through the 1960's by TXI Several episodes of Rod and Gun Clubs used the land for recreation. For a while the land was virtually unoccupied and the lakes were being filled in by dumping Big Lemmon Lake with levees around it was essentially dry in 2000 from silting up behind the levees.	35. The Lake was dry due to the failure of the water control structure.
36.	Dallas County obtained part of the land in 1980's and has expanded their ownership to almost 400 acres. It is their desire coaxed by the CESWF to re-establish Big Lemmon Lake as a body of water by diverting some of the water from the source that feeds Little Lemmon Lake Little Lemmon Lake has never dried up in the last 25 years due to a western water source (spring) that once flowed into Five Mile Creek before it was diverted to the south of McCommas Bluff Landfill. This project should have restored the floodplain to it's original condition as 390 acres of bottomland hardwood forest on the floodplain. Instead, $7 million of taxpayers money is going to be spent to temporarily restore a sand and gravel borrow pit to man-made synthetic conditions equal to those 40 years ago.	36. The stated intent of the restoration project as agreed to by the sponsor was to restore the aquatic and wetland features associated with Lemmon Lake, Little Lemmon Lake and to improve the existing riparian and bottomland hardwood
37	19. top of the page. Trinity River Corridor Comprehensive Land Use Plan (CLUP), conceived and paid for by the City of Dallas for a developmental contractor HTNB to come up with various developmental scenarios based on various plans and urban designs. This study is mostly limited to socio-economic urban development and does not satisfy the more broad considerations of an environmental impact. But, at least it attempts to consider what can happen in the foreseeable future assuming projects are completed. Although this is not required by the City as part of the Federal contract with the CESWF for the DFE, in this instance the City is using more foresight than the CESWF by attempting at least to assess the direct and indirect socio-economic cumulative effects of combined projects that include the DF, DFE, toll road, and the Great Trinity Forest. If the City can see that these Federal projects are all connected and that there will be cumulative developmental urban planned effects why can't the CESWF? This is the kind of study the CESWF should have conducted, or, had a contractor do for an assessment of cumulative impacts for the DFE FEIS.	37. The Corps considered the cumulative impacts on the broad social issues of public services, environmental justice, aesthetics, historic and cultural and environmental resources. The depth of the study being done by CLUP is important for the city of Dallas, but it sufficient information is available to assess the cumulative impacts related to the DFE project.

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Although early in the process, at the only public meeting held by HTNB (early 2001 at Reverchon Park Recreation Center) where HTNB wanted environmentalist input, their developmental/economic models stopped along the upper reaches of the DFE and virtually excluded the southern part to Loop 12 and beyond.

Moreover, the DFE and toll road have been touted by the Dallas Plan and the CESWF as bringing more economic development to the area south of the DF, however, no economic development came as a result of the the I-45 bridge built in the 1970's.

38. The DFE project is authorized for flood damage reduction. The DFE project could bring economic development to the area south of the Dallas Floodway.

20. P. 3-17, para. 5, Figure 3-3 should be on page 3-18.

39. Thank you for the comment.

21. P. 3-17, para. 6, CULP should be CLUP.

40. The correction was made in the final SEIS.

22. P. 3-18, para. 1, Current Status, referring to CLUP, most of these plans occur after the Trinity river corridor projects ie. toll road, DF, DFE, etc., are complete. These initiatives and urban plans reflect the direct and indirect cumulative impacts as a result of the combined projects and more detail needs to be included as cumulative impacts.

23. P. 3-19, 1st para., CESWF states (p.3-19) that, "By far, the proposed action within the general geographic area of the DFE with the greatest potential for cumulative effects is the proposed Trinity Parkway or Tollway." Why? CESWF needs to explain why the toll road has the greatest potential for cumulative impacts, than the collective projects that the CESWF is going to build, and or permit through their regulatory function. The CESWF will permit the Tollway, Segment IV of PGBT along the Elm Fork at the north end of the DF, will either build their version of the DF, or permit the City's MIP version, build the DFE, Joppa Preserve, and permit the McCommas Bluff landfill levee extension. The cumulative impacts of all these combined CESWF projects and permits is far greater to the river ecosystem than just the toll road. If the City decides to build the MIP in the DF rather than the CESWF EQ Plan, the CESWF will permit this project as well. Will the CESWF deny the toll road permit? Will the CESWF deny the City's MIP for the DF? Not likely, they hardly ever deny a large agency their permit. CESWF should list the projects and permits they have denied, and the reason(s) for denial. If the combined effects of CESWF projects and permitted actions represent less cumulative effects than the toll road, then the CESWF needs to explain how this is so. This statement also indicates

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41. From information currently available, the Tollway/Parkway alternatives that would utilize the existing Dallas Floodway levees would require a hydrologic and hydraulic mitigation plan, and an environmental mitigation plan. It is anticipated that the H&H mitigation plan would require extensive modification of the floodway. The combined footprint of the Parkway and H&H mitigation area would impact wetlands and forested areas that would need mitigation. Pending permit actions will also require mitigation to meet requirements established by Corps (PEIS) and local governments (CDC) to reduce cumulative impacts to riverine ecosystems.

42.

that the CESWF has already calculated lesser statistics, but does not provide them.

24. P. 3-19, 1st para., General comment continued relative to the "greatest potential for cumulative impacts" above in No. 23. In a table, the CESWF needs to tabulate the total acreage of all of these projects with their various alternatives that will alter the hydraulic and hydrologic (H/H) existing conditions. The existing conditions is what exists presently and represents the flow dynamics at present without the 22 projects listed in the SEIS, because the CESWF is involved with all of these projects by either building or permitting these projects, and because they regulate and control the waters of the U. S.

From what can be gathered from the project acreage in the report, although not all the acreage is provided, or listed as minimal acreage for the alternatives in the report, at a minimum at least 6,000 acres of the floodway/floodplain will be impacted by just 10 of the 22 projects. Acreage calculated from the following:

Segment IV of PGBT on the Elm Fork (170 acres, although mitigation is minimal and not located, represents 0.63 : 1.0 ratio of mitigation to project impact usually at 1:1 ratio),

Stemmons North (1,034 acres),

DF 2,005 acres (mean value [City's MIP 1,603 acres], or CESWF 2,406 total acres made up of [1,422 DF CESWF Flood Reduction], and [984 acres CESWF EQ Plan]),

S. H. 183/West Fork, if reliever route along north side of West Fork (not listed in SEIS) still in plan (several hundred acres [estimate ca. 300acres]),

Loop 12 /I-35 Corridor (20 acres),

Old Trinity Channel (110 acres),

Toll Road 500 acres inside existing levees,

DFE (1,169 acres),

Joppa (250 acres),

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42. The Corps has identified the similar reasonably foreseeable projects in the geographic area of the DFE and has assessed the cumulative impacts of those projects. Acreage data and effects on hydrology area were included in tables in the final SEIS.

McCommas Bluff Levee Extension (425 acres)

43. for a total of approximately 6,000 acres. How would the H/H in the DFE be altered relative to existing H/H conditions by each project, or combinations of projects, added cumulatively to include all the projects? The CESWF needs to model the H/H cumulative effects for these projects and how they will cumulatively effect the H/H in the DFE.

43. The cumulative impacts to H&H of reasonably foreseeable projects that could be identified were included in the final SEIS.

44. 25 P. 3-19, para. 2, according to M. Morris head of Transportation at NCTCOG (North Central Texas Council of Governments), at the first public meeting for S H. 183 renovation he said, "S. H. 183 renovation at the south end considers the toll road in place, in concert with the 2020 Transportation Vision NCTCOG developed that was contingent upon the toll roads being in place." This kind of "corporate agency pressure" for plans to proceed without clearance are presumptious, assumes environmental compliance and other regulations not issues, and can be very costly to the taxpayers. Under cumulative impacts the CESWF should also include NCTCOG 2020 and 2050 Vision statements for the central role the toll road plays in transportation plans because it relates to the indirect and direct impacts of the Trinity river corridor projects. Can the toll road be built without the DFE? Probably, by building it outside the levees. TxDOT with a CESWF permit, needs to determine and make public whether the toll road can be built inside the existing levees without the DFE. If it can not be built without the DFE then this would demonstrate the direct impact of the DFE on the toll road inside the levees.

44. The public is well aware that the Corps has planned to build the DFE project. It is understandable that other agencies who have interest in planning to construct roads, buildings, recreational features or anything else in the DFE area would initiate their process with their understanding of the most likely scenario for the DFE.

45. 26. P. 3-20, 21, paras. last and first, Combined Tollway-Riverside, width 332 feet (+ swale?) in the floodway, Split Tollway-Riverside width 246 feet. Is the total width of the Split Tollway 266 feet (road + 20 ft. swale), or 266 feet on each side for a total of 532 feet in width? This needs to be clarified. As written, it is incorrect that a split road would take up less acreage where two roadways have to be built on each side of the levees than a combined roadway on one side of a levee.

45. Roadway width refers to width for one direction, the Tollroad width refers to the total width for both directions. The combined roadway requires a smaller footprint.

27. P. 3-22, 1st para., Project Pegasus, at current TxDOT 3rd public MIS/EIS Pegasus meetings (21 and 23 January 2003), the agency assumes the DFE and toll road in place TxDOT spokesman leading public meetings Timothy Nesbitt, states that TxDOT will not build

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46.

Pegasus (Mixmaster I-30/35/Canyon I-30) unless the toll road in the Trinity is in place.

There is no doubt that the traffic congestion in the Canyon and Mixmaster needs to be relieved for many reasons. The toll road inside the levees is considered as a reliever for the project. If built the toll road inside the levees will service southeast Dallas with only 5% projected traffic growth to 2020 by TxDOT as stated at their first public meeting, and backed up by DART's (Southeast Corridor) traffic frequency study on Hwy. 175, where the traffic frequency was so low it could not even support an HOV lane. The toll road will not service the east corridor with I-30/Hwy 80, so the toll road will not relieve this traffic estimated at 180,000-200,000 vehicles a day (TxDOT at DART East Corridor MIS meetings). North to southwest traffic on I-35 (>200,000 vehicles per day) travels south across the river, or exits east to west on I-30, while traffic frequency traveling to the south central and southeast corridors is much less, primarily because of the large Trinity river floodplain that is undeveloped. I-45 to the south central corridor has 75,000 vehicles per day, and Hawn Freeway (Hwy. 175) to the southeast sector has about the same frequency or less than I-45. At the MIS meetings the toll road inside the levees is sold to the public as relieving the I-30 and I-35 traffic congestion but only ties into Hwy. 175, leaves out I-45, and Hwy 175 carries very low traffic frequencies with a projected growth of only 5% to 2020. Therefore, the northwest to southeast toll road inside the levees will relieve very little of the I-30/I-35 Canyon and Mixmaster traffic.

The agency does not even consider renovation of the I-30 Canyon/I-30/35 Mixmaster in a manner that Fort Worth renovated their Mixmaster. TxDOT did not even consider building a reliever road between the levees along the West Fork in Fort Worth. This is a relevant example of how indirect impacts of the DFE/toll road can get out of control by Federal agency pyramid building and Federal "agency corporate leveraging (or public blackmail)" when the agencies try to sell their project(s) to the public by assuming other projects such as the DFE/toll road are in place, or they will not build them. The toll roads are predicated on the DFE. Pegasus is predicated on the toll road. The direct and indirect impacts of these projects effect the alternatives that an agency will even consider. There is only one more public meeting on this project and the EIS is due to be completed by June of 2004 The CESWF description of this $770 million project is so minimal it is virtually useless.

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46. The needs for and justification for the tollroad reliever route are outside the Corps area of responsibility or expertise. However, we have evaluated the cumulative impacts of alternative alignments based upon information available.

	Comment	Response
47.	28 P 3-22, 3rd para., Woodall Rodgers Extension and Bridge is a very limited discussion. This is another project that is part of the direct and indirect effects pyramid that is contingent upon the toll road, that is contingent upon the DFE, leveraged by the agencies involved. This project cost has doubled from the 1995 $35 million bond initiative to $70 million with a designer bridge from private non-agency donations. According to the CESWF the environmental studies are in internal review, have not been made public for review. This seems rather presumptious, part of the "agency leverage pressure," if the design can not be determined until the toll road alignment is selected, or if TxDOT/NTTA can even build the toll road	47. Only the final design of this bridge is contingent upon design of other projects. The justification for the bridge is not based upon construction of DFE or other projects.
48.	29. P. 2-22, Segment IV of the President George Bush Turnpike (PGBT) - where are the mitigation locations? How will the H/H existing conditions in the DFE be effected by westward build up of the Segment IV levee and displacement of the floodwaters in the Elm Fork floodplain? NTTA/TxDOT did not know, or include H/H models of their project at their public meetings for their Segment IV EIS? The CESWF permitted this project without H/H impacts determined.	48. The applicant was required to perform detailed H&H studies to be considered during the review of this permit.
49.	30. P. 2-23, West Fork Corridor S. H. 183, at the first MIS public meeting in winter 2000 (see No. 25 above) for this project, M. Morris Head of Transportation for NCTCOG said, that this project was predicated on the completion of the Trinity river toll road, and the toll road was central to NCTCOG's 2020 Transportation Vision. This project included a western oriented reliever that was proposed within the West Fork floodplain along Hunter Ferrell road on the north side of the West Fork to Hwy. 360. This project is beyond MIS and is in EIS stages. The inclusion of the west reliever route within the West Fork floodplain would have a cumulatively large impact to the H/H in the West Fork, and combined with all of the other projects an even larger impact on the DFE H/H. The CESWF information on this project and whether the West Fork reliever is still included needs to be updated.	49. To date, the MIS resulted in selection of a recommended plan of construction that would result in the widening of existing Hwy 183 from 6 to 8 lanes with a HOV system and bicycle and pedestrian considerations. Reliever route studies are underway although broad alternatives have been considered no plan has been sufficiently identified to determine and that any route would be a reasonably foreseeable project.
	31. P. 3-25, para 2, DART SE Corridor Crossing White Rock Creek. A total of 13 water bodies are crossed (DART EIS, p. 3-88) and at least 16 acres of floodplain filled in (table on p. 3-90) to create grade within 100-year floodplain (DART EIS, p. 5, 111-114), at preliminary 5-10% complete designs in EIS This project began in 1988 with taking over ownership of the rail line, MIS studies in late 1998-1999	

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	Comment	Response
50.	and in revision of DEIS. Project crosses 2 mile wide White Rock Creek floodplain, with 5-10% complete designs that include build up of concrete ramp west of Dixon over UP RR, with elevated structure east of Dixon 2,200 ft. long with some earthen levee support across the floodplain, creating elevated conveyance structure (details unclear at this time) over White Rock Creek channel. DART did not do H/H for existing conditions, or H/H for build conditions to determine H/H impact of project on the White Rock Drainage. Project location description needs to be improved. Rail line will be located along to be built rail corridor from downtown through Deep Ellum, to Baylor Hospital, to Fair Park (west and east side), along existing rail ROW on Trunk street, running southeast paralleling Robert B. Cullum, east along existing DART owned rail right of way paralleling Scyene (Hwy 352), turning south through the forest along the west drainage of White Rock Creek west of Jim Miller road, turning southeast to parallel Hwy. 175, crossing Lake June road, and ending at Buckner Station at Loop 12 and Hwy. 175. It is obvious from CESWF unfamiliarity with this project that DART has not contacted CESWF on this project much seeking a CESWF permit.	50. The aspects of the Dart SE corridor project that impact floodplain resources were described and the cumulative impacts were addressed in the SEIS.
51.	32. P. 3-26, para. 3, inaccurate as to no zoning changes, in Dallas Plan 2nd public meeting 18 July 2000 Cadillac Heights Community Plan lengthy handout the CESWF is misleading that there have been changes in the zoning definitions. In the 1965 City zoning map provided in the brochure did not demarcate the 100 year flood, did not zone the areas to the north of Morrell, and listed an area on the northeast between Morrell and Cadillac as I-2 and areas to the south of Birdsong Drive as I-2. Areas to the east of Sargent road where Darling Industries is now located (fat rendering plant) and where National Lead and Dixie Metals were located, along with the huge City CWTTP have no zoning designation. In the current zoning map the 100 year floodplain is added, IM-Industrial Manufacturing is added to the north of Morrell where several scrap metal companies and one animal rendering plant is located. The I-2 in 1965 at the northeast corner between Morrell and Cadillac that was I-2 is now listed as IR for Industrial Research where an animal rendering plant and chrome plating plant are located. This is industrial research? The previous 1965 I-2 designations south of Birdsong Drive have been changed to IR (Industrial Research) for an engine and used truck parts company and a huge DART regional vehicular repair facility. These are industrial research? The industries on the east such as the CWWTP.	51. The intent of the discussion about zoning was to indicate that the homes that are in the Cadillac Heights area are allowed to stay under previous and existing zoning definitions.

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Darling Industries, etc., are not designated and the Dixie Metal toxic landfill is not designated, as well as the National Lead contaminated area is not designated. At least in the current zoning provided by the Dallas Plan the 100 year flood limit (although from 1970 data) was demarcated, something the CESWF did not do in either the DEIS or the FEIS on the DFE.

52. Paragraph 4 is inaccurate. See comment No. 11 above on page 10. City also contracted for >$100,000.00 study of drainage within Cadillac Heights that is not included in SEIS. CLUP study hardly touched on Cadillac Heights and was more interested developing within the the DF. There have been zoning changes, to the north from no designation to Industrial Manufacturing (IM), the 100 year floodplain has been added and demarcated, the areas of industrial facilities and waste treatment utility facility to the east of Sargent road are not labeled, at least in the Dallas Plan zoning map provided, I-2 (light industrial) without Dixie Metals and National Lead included, went to IR. This is the ridiculous and deceiving Industrial Research designations for a chrome plating plant, animal rendering plant, and truck and bus vehicular repair and parts, with toxic areas such as where Dixie Metals is located not mapped. Nothing can be built on top of the 13 acre Dixie Metals land more than 100 years (2001 TNRCC remediation meeting). The CESWF needs to refine their discussion of Cadillac Heights

53. 33. P. 3-27, Elm Fork Area, CESWF needs to discuss the City of Dallas desire to significantly raise Frazier Dam, and the effects the raising would have on the H/H above and below the dam. Recreation study by Freeze and Nichols, Inc. 2001 should have been mentioned. This will enhance bank erosion and inundate the flora along the banks. Is Mary Kay Lake going to be effected?

54. 34. P. 3-28, 1st para., DCRUD should read DCURD

55. 35. P. 3-28, 2nd para., "Chain of Lakes," is part of the MIP plan and only one lake would probably fit after the features of the other projects are built. If not toll road not built City would still have to get permit from CESWF to excavate in the floodway. Again this is predicated upon other projects and the pyramid of project features on top of other project features, all leading to cumulative impacts on the H/H of the DFE.

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52. The information in this section of the report is related to the potential for buyouts occurring by any entity of the Cadillac Heights area. Some have alleged that the Cities zoning definitions would ultimately make it easier for investment businesses to change the Cadillac Heights area from residential area to a business office, and high-density resident area once the levee is in place. Information available to us does not indicate that such a conversion is imminent, and should it occur, it would be through private investment likely at benefit to the current landowners.

53. This section of the report addresses flood damage reduction alternatives being considered. Frazier Dam is discussed under the section on fills and permits. Freese and Nichols conducted the Elm Fork Management study discussed in this section and the discussion includes recreation. Effects on Mary Kay Lake 54. Correction was made.

54. Noted

55.Cumulative impacts of "reasonably foreseeable projects" in the geographic area of the DFE have been fully analyzed.

56. 36. P. 3-28, 3rd para., Equestrian Center, Walford should read Watford. Intrepretive Center and Equestrian Center to cost ca. $20 million. CESWF Joppa project with equestrian trail is tied supposedly tied to this center, as well as the Loop 12 boat ramp, and Swale Cell G of the DFE, all located very near each other. However, at current public meetings about the Interpretive/Equestrian Center BRW does not where they will be built, or if they will be built together

56. Studies are still underway to determine location and project features of the Interpretive Center and Equestrian Center.

57. 37. P. 3-29, 1st para., Old Trinity Meanders Trail, what is the CESWF role in this? What White Rock Creek Trail? What White Rock Creek Park Chain? I was an active attendant at the Lower White Rock Creek charette with the NPS in May 2002 and I am on the White Rock Heritage District Trail Committee and Brochure Committee, and I have never heard of the White Rock Creek trail and park chain.

57. Other than attempting to obtain information on what projects might have cumulative impacts to DFE, the Corps has no role in the trails listed in this paragraph.

58. 38. P. 3-29, 2nd para., South Loop 12 Boat Ramp, construction date is April or May 2003 (Mary Ayala, TRCPO Recreation Department). CESWF already permitted the project after notified of an archaeological site to be impacted by project. CESWF by not requiring archaeology to be done is in violation of NHPA (National Historic Preservation Act of 1966). This is a violation of Section 404 permit regulations pertaining to NHPA under procedures found in 33 CFR Part 325, Appendix C, compliance with NHPA and other laws dealing with historic properties (Feferal Register vol. 67, No. 46, p. 10822, 8 March 2002). CESWF Regulatory Section has required archaeology to be done on many Section 404 projects as significant sites were located. CESWF ignores the existence of the site, especially under the new discoveries that have been made since August 2001.

The City's boat ramp goes through the north end of a large important stratified multi-component significant archaeological site (41DL350) radiocarbon dated to 600-1,000 years ago, that contained at least one human skeleton (burial). Under the Texas Antiquities Code pertaining to significant historic sites the TxSHPO requires the City to do archaeology on the north end of the site impacted by boat ramp.

CESWF does not consider 41DL350 directly or indirectly impacted by the DFE project. The site is located 100 feet from the south end of Swale Cell G at the south end of the DFE project. CESWF also ignores 41DL69/70 a prehistoric Native American site (reported with 7 human skeletons), and 41DL320 an historic City of Dallas landfill dating from ca. 1880-1920, both are within the footprint of

58. Site DL350 is currently being contracted out by the City of Dallas for excavation exactly for this reason. A local archaeological contractor has been selected to perform archaeological excavations of site 41DL350 in the near future. Site 41DL69/70 was tested by another local archaeological contractor several years ago and was determined to be ineligible for the National Register of Historic Places with SHPO concurrence. Sites such as 41DL320 would have to be investigated should the Corps look into a project affecting this area.

59.

the Lamar Street levee and sumps of the DFE project. CESWF is required to do the archaeology at these sites under direct and indirect impacts under NEPA and NHPA regulations in 36 CFR Part 800 (known as Section 106) for Federal undertakings (Federal

60. Register vol. 64, No. 95, pp. 27071-27087 18 May 1999, published as Part II by the Advisory Council on Historic Preservation). With the presence of human skeleton(s) at 41DL69/70 and 41DL350 the CESWF is also violating the regulations for Section 106 undertakings with regard to NAGPRA (Native American Graves Protection and Repatriation Act of 1990) consultation with native tribal groups that have a historic claim to the area (such as Caddo, Wichita, Comanche) To ignore these sites and not do anything is a violation of the laws outlined in Federal regulations pertaining to NEPA, NHPA and

61. NAGPRA under Section 106, and Section 404.

If the CESWF can justify the $7 million, 1135 Joppa Preserve Project because of downstream right bank erosion due to the Dallas Floodway that is 6 miles upstream; imagine the amount of erosion of the right bank once the Trinity river channel is realigned, levees are extended ca 2.5 miles downstream, and the southern end Swale Cell G ends 100 feet from river bank with archaeological site 41DL350.

62. Clearly, the direct and indirect cumulative impacts of the DFE on Cultural Resources (archaeological aspects) right at the DFE were ignored by the CESWF.

39. P 3-33, 1st para., 770 projects were authorized in the Upper Trinity River Basin during the study period. How long is the study period, from 1965, or 1998? What was the source of information provided here, the Upper Trinity River Basin (UTRB) PEIS? If that document was used the amount of forested areas in the UTRB declined relative to the baseline 1988 TREIS. The projects listed do not add up to the total projects.

40. P. 3-30, 2nd para., CESWF lists 4 significant permit actions, the first 3 are really huge:

a. 425 acre McCommas Bluff Landfill Levee Extension and Swale by the City of Dallas further confines the Trinity river downstream from the DFE and Joppa, and essentially fulfills the CESWF original 1992 plans to develop flood control south to I-20. This project will extend landfill refuse cast into waters of the U. S. and sediment carried in the overflow swale jeopardize the filling of large meander bends that

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59. NAGPRA is not valid for sites not on Federal land. Any sites where eligibility status is unknown or where the site has been determined potentially eligible to the Register would have to be investigated if we had a project that could potentially disturb them. Site 69/70 has been tested several years ago by Geo-Marine & SHPO has concurred the site is insignificant & ineligible for the National Register of Historic Places.

60. The analysis conducted in the Final SEIS (Appendix A) does not support the contention that the cumulative impact of DFE and reasonably foreseeable projects would promote additional downstream erosion over the existing conditions. See response to Comment 58.

61. 770 permits were authorized during the period December 1, 1999 to September 1, 2002. The source of the information as described in the section was from the Corps of Engineers Regulatory Branch.

62.The size of the project and its potential to impact wetlands and forested resources were considered in the FSEIS. These resource issues are also factors in issuing the permits for the proposed actions.

63.

have been cut off from the Trinity river by channelization. The old meanders provide excellent wetland habitat.

b. Raising Frasier Dam by 2 feet will raise the surface water level through 4 miles and erode the banks towards California Crossing dam, link drainage to an unspecified lake (Mary Kay?), transfer water to Bachman Creek drainage and the other ramifications of this project CESWF does not mention. The CESWF provides little information about this project, no maps, and the impacts need to be more fully described and detailed.

c. Basic Capital Improvement involves development of a 138 acre tract at I-635 and Luna road that will result in loss of >14 acres of open water, fill 39 acres of the 100 year floodplain with unspecified loss of valley storage, and development of two new lakes. Where are the 2 new lakes going to located? What is the location and impact of this project relative to Segment IV of PGBT which is not included in Figure 3-3? No details are provided and the CESWF is vague about who is doing the project, and provides no map.

64.

d. Park and Ride facility at I-30 and MacArthur Blvd.) that "have the potential to cause cumulative impacts in relation to the DFE." CESWF does not describe what the cumulative impacts would be?

Just these four permit projects together would have huge cumulative impacts on the H/H of the floodway altering approximately 1,000 acres of existing conditions upstream that would effect the H/H in the DFE and when combined with the other 18 projects the effects on H/H is much larger.

41. P. 3-34, end of chapter general comments. CESWF should have produced a map of all of the projects they describe in this chapter. CESWF produced a map, Figure 3-3 of all the CLUP possible developmental opportunities gathered in the past two years, but CESWF can not produce a map of all the projects they describe in the Trinity river corridor that they have known about for many years.

CESWF should have had the agency(s) or agency project managers of each project submit to them by July 2002 a brief summary report describing the project with alternatives and specifications on a schematic map of their project (with alternatives), instead of the CESWF using 34 pages of the report describing each

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63. All these permit considerations were evaluated in the cumulative impact analysis for resources in the SEIS and the FEIS.

64. Map included in PEIS and added to SEIS (See Figure 3-9) Extensive scoping was conducted to determine the projects proposed that might have cumulative impacts in relation to the DFE. Scoping included public meeting, public notice requesting information, newspaper notices, individual contact with agency employees and written correspondence to city representatives familiar with proposed development. The information we obtained came from these sources and from other published information.

65.

project in their limited terms. The other project managers know their respective project better than the CESWF. That way, the CESWF could have concentrated on the cumulative H/H impacts and run their HEC-2 (or whatever H/H models they use now) H/H models for these projects, so that, the public and the court could intelligibly assess the cumulative effect these projects would have on the Trinity river and the DFE. Instead, CESWF wasted a lot of time, space, and money, listing projects (some do not even effect flow models, some not listed), while providing nothing on the how these projects effect H/H. Moreover, the CESWF fails to address cumulative direct and direct impacts related to the DFE project proper.

In some instances the CESWF provides new information about projects, but, in many instances the information is minimal, dated by one year, or more, and CESWF tends to minimalize the impact to existing conditions. The CESWF should have provided a date for their information.

From my limited knowledge and involvement through the public process I have tried to point out some of the shortcomings, and omissions in the CESWF long list of 22 projects, and projects they missed that will be impacted cumulatively, either directly, or indirectly.

66.

42. P. 4-1, para. 3, Cumulative Impacts, most of this paragraph is whining, and argumentative. "To date, there remains no universally accepted approach to the preparation of cumulative effects analyses. "The same claim can be made that there is no universally accepted approach to the preparation of H/H models.

"CEQ...not practical to analyze cumulative impacts for other than those truly meaningful environmental effects." I assume the 22 projects described in the previous 34 pages of chapter 3 are meaningful.

"In addition, the determination of the level of effects that produces the threshold beyond which cumulative effects significantly degrade an ecosystem or other resources is difficult." The process is never easy just do the job The DFE project alone has cumulative impacts to the forest, archaeology, river aquatic ecosystem, the flow dynamics of the Trinity river through the DFE, and the other projects (called progress) up and downstream will have a cumulative impact on the H/H modeling in the DFE, that were not considered in the DFE DEIS or the DFE FEIS

"For a cumulative effects analysis to be worthwhile it must be

25

65. The final SEIS has a detailed discussion of the H&H cumulative impacts

66. The DFE has direct impacts to forests and other resources which were documented in the DFE GRR/EIS. Cumulative impacts of other reasonably foreseeable projects in the geographic area of the DFE have been addressed in this FSEIS.

67.

limited through scoping to the effects that can be evaluated meaningfully." On the contrary, cumulative effects analysis must not be limited through scoping, so the complete ramifications of individual projects can be understood in order to meaningfully evaluate each project in relation to others for the larger picture.

68. "Accordingly, the scope of this cumulative impact analyses has been limited to the projects and resources listed below." Which is essentially what was described in Chapter 3.

43. P. P. 4-1, para. 5, Flood Damage Reduction Projects only 2 listed. The DCURD project mostly reduces damages to the Las Colinas facilityand has small ramifications to the overall hydrological dynamics of the H/H of the river throught he DFE. The other project, Dallas Floodway modifications by the CESWF. Here, again the CESWF trys to sell their Flood Damage Reduction part of project in the Dallas Floodway directly upstream of the DFE by raising the existing levees (2 ft.) adding to the SPF level of protection for the CDB. If this was done it would negate the need for the DFE. If not, then the CESWF needs to demonstrate how the DFE would then still be a viable

69. project.

44. P. 4-2, top 4 paras., Transportation, Ecosystem Restoration, Recreation, Fills, Permits, Utilities, & Other Activities, maybe the heading on these four chapters should read, "Flood Damage Inducement Projects." Again another list of the projects described in Chapter 3.

45. P. 4-2, 1st para., Taken from the first paragraph, where the CESWF plays down the size and impact of all of the projects, "The majority of these individual projects are small," however, cumulatively cover over 25 river miles of the Elm Fork, West Fork and the Trinity river mainstem that the CESWF did not summarize. Then CESWF states, "In addition, the President George Bush Tollroad, Segment IV, largely falls on new alignment within the Elm Fork Corridor, and therefore, direct and cumulative impacts must be considered " Exactly, that is what the court ordered the CESWF to do, not to merely restate it has a cumulative impact. The public has commented in writing many times that the CESWF should have included the DFE project as well as many others.

46. P. 4-3, 4-4, Table 4-1, Estimated Project Impacts (Acres) To

26

67. We believe you have misinterpreted what we have indicated in this section. The intent of this section is to disclose to the public and decision makers that determination of cumulative impacts is not a well-founded science and the process is being slowly defined, as is being done through this document. Scoping was held to identify 1. Similar future reasonably foreseeable projects in or affecting the geographic area of the DFE and (2.) Resources that should be considered in the cumulative impact assessment. The projects considered in Chapter 4 are the ones we believe meet those criteria.

68. The need for DFE would not be eliminated by implementation of the FDR alternatives in the Dallas Floodway. The FDR in the Dallas Floodway does not provide protection for Lamar or Cadillac Heights area, nor improved protection for the Central wastewater treatment plant or for the Rochester Heights area.

69. Cumulative impacts of President George Bush Segment IV were considered in the cumulative impact tables and resulting analysis.

Comment	Response
Floodplain Resources By Reasonably Foreseeable Projects In Study Area. In this table the CESWF attempts to show for every impact there is an offsetting mitigation that negates any impact for the following ecotypes, to essentially indicate there is no cumulative impacts: Column labels: Waters of U. S. (not sure what this means, river?), Open Water, Wetland, Forest Improvement, Forest Conversion Grassland/Buffer. The columns are crossed with rows that list the projects and the amount of acreage negatively impacted followed by a row of mitigation positively impacted.	70. Data available was utilized and a cumulative impact assessment was conducted.
I am not going to go through each one of these and describe the deficiencies, but I will point out a few, to indicate that this table is incomplete as presented and needs revision Dallas Floodway Levee Raise does not include the 738.5 acres of grasslands that will be lost. George Bush IV lists -58.6 acres for Waters of the U. S., while nothing is listed for Water of the U. S. for the DFE. Channelizing the Trinity river is not Waters of the U. S.? Frasier Dam has no mitigation and impacts are not complete. Where are the 2 lakes to be added for the Basic Capital Management project? And so forth	
There is no summary total provided for Table 4-1 and nothing on how H/H flow, velocity, carrying capacity, and valley storage is effected through the the Trinity river corridor and the DFE.	
Even though there are elements taken away here, and elements put back as listed in Table 4-1, these trade offs can differ in kind and place, that can also reconfigure the flow that will alter the flow dynamics of a river system. CESWF does not address this.	
47 P. 4-5, 1st para., introduces Table 4-2. CESWF left out several important projects in Table 4-2 such as the DFE, Pegasus, CLUP, and the City's MIP for the DF to list a few. The CESWF continues to sell their project (FDR and EQ) for the Dallas Floodway by omitting the Dallas MIP for the Dallas Floodway.	71. Table 4-2 was revised as Table 4-7 in the FSEIS to clarify that the "Other Floodway Bridges" column includes Pegasus. No single defined ultimate development for the Floodway can be defined at this point. However the alternatives that have been proposed were included in the cumulative impact assessment.
Table 4-2 presents what appears to be a very busy matrix of projects with resources along the left margin forming rows (x-axis) and projects across the top forming columns (y-axis). Many of the agencies that are involved are not identified, however CESWF identifies their projects, but not the number of projects they will be permitting, because No 8, Section 10 and 404, is omitted. The rest of the matrix is filled in with the CESWF subjective (biased) judgement on the impacts of each project Not how they cumulatively will affect each other when they are located directly next to each other, or how	72. We believe the cumlative impact analysis was correctly conducted based upon information available and professional judgement.

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73.

collectively all the projects affect the Trinity river corridor through the DFE. Four (18%) of the 22 projects listed are CESWF projects. CESWF permitted projects No. 8 omitted, however would include the other 18 projects.

I have included some of the omissions, shortcomings, and examples in the following items from Table 4-2, these are only an example of a few, to go into more detail is too lengthy of a comment, but these should provide a brief example of the problems with this type of scoring.

Notice there are only 14 Potentially Impacted Resources in the first column. Seven (50%) of the resources have to do with water. Developmental resources, economic, HTRW, animal life (terrestrial and aquatic), downstream erosion/flooding, direct or indirect impacts of these are omitted.

The impacts are scored on the subjective basis of Slight, or Moderate, Adverse, or Beneficial Effects, or No Affect. These are meaningless impacts unless the CESWF defines what they mean by slight and moderate, and explains what these terms mean. In terms of H/H models the effects can be quantified. No total acreage is provided, There is no summary total column because of lack of quantification.

Notice out of 22 projects CESWF lists (although all projects are not listed) there are only 4 flood damage reduction projects, and of these only one is substantial (d below).

a.) The Stemmons area project (ca. 1,000 acres) should be negated as flood reduction because it probably will not get built by CESWF, and should be shifted to Fill Activities, as the City plans to fill in 473 acres of floodplain (discussed in para. 3, page 4-5, and below) and Stemmons should be changed to at least moderate adverse impacts.

b.) The Las Colinas levee raise of existing levee is a small project brought on by alteration projects up stream and nearby, such as Segment IV of PGBT, infill of batch plant east of North American Equipment, and probably the Basic Capital Management project that does not seem to get plotted on a map, or clearly described.

28

73. Acreage data where available was provided in table 4-1. Cumulative impacts of those activities are summarized in Tables 4-2 and 4-3 in the FSEIS. H&H data has been included in multiple tables in the FSEIS

74.

75.

76.

c.) The ATSF historic RR bridge next to the DART line in the DF is of eligible NRHP (National Register of Historic Places) historic importance under NHPA (National Historic Preservation Act). Alteration of the bridge existing conditions would have adverse effects. In Table 4-2 the ATSF bridge was rated as no effect under Cultural Resources, Aesthetics, Slight Beneficial for Public Services, and for H/H. Slight Beneficial upstream, and Slight Adverse downstream. The No Affect scoring seems confused for Cultural Resources and Aesthetics. On page 3-26, Figure 3-5, the historic status of the bridge is not stated, however it is probably eligible because they are going to leave the historic RR bridge, and there seems to be back and forth agency negotiations typical of Section 106 of the NHPA, concerning the type and kind of trestle abutment replacement that would allow conveyance and keep with the theme of historic RR bridge trestle and abutments Therefore, modification of the ATSF bridge has an adverse impact on Cultural Resources that is not correctly scored.

On page 3-26 CESWF states, "the existing configuration of the support piers and abutments cause substantial impacts to hydraulic conditions of the Dallas Floodway (upstream or downstream impacts not identified)." It seems that the bridge creates moderate adverse impacts (substantial) and after removal of the existing piers and abutments the status will change to Slight Beneficial effects upstream and Slight Adverse effects downstream. Therefore, in Table 4-2 under Flood Damage Reduction the RR bridge modification as described in the text in Chapter 3 (p 3-26) has no adverse effect on Cultural Resources even though the existing conditions are going to be changed and will have to be mitigated, but has a slight beneficial effect for Flood Damages upstream, and will have a slight adverse effect downstream. How the RR bridge project will have Slight Adverse Effects downstream needs to be explained. Moreover, with Slight Beneficial Effects scored for Floodplain Recreation under the ATSF bridge modification, how will Slight Beneficial Effects occur under Public Services? This is redundant scoring.

The discrepancies discussed above is just one example for a small project like the ATSF historic RR bridge. The larger projects become more involved and distorted for every project on the CESWF list. The CESWF should have been explaining the ramifications and effects of the projects in this SEIS instead of just listing projects.

d) the CESW DF Levee Raise is the only project under Flood Damage Reduction projects that is subjectively rated as having

29

74. Preliminary coordination by City of Dallas and Transportation interests with SHPO indicate that design of the modification of the ATSF bridge to allow for higher flows and pedestrian traffic while retaining its historic integrity is possible and would not produce a negative individual or cumulative impact on historic or cultural resource values

75. Public Services has been clarified in the FSEIS report to show that it differs from recreation.

76. The discussion you have made in your comments are related to a small project with small cumulative impacts. The more significant reasonably foreseeable projects have been described using data available and additional summarizing and modeling has been conducted to base the cumulative impact analysis conducted by the Corps of Engineers.

77.

78.

79.

Moderate Beneficial Effects under Flood Damages. Under Downstream H/H the levee raise is Slightly Beneficial and upstream H/H it will have a Slightly Adverse Effect. Only 5 of the 14 categories are rated, the rest are No Affect. The existing forest removal, the huge borrow ditches for levee fill, the reduction of >700 acres of grassland, etc. will have effects and these need to be evaluated cumulatively along with the project and the other projects..

There are three projects, all CESWF under Ecosystem Restoration· Dallas Floodway EQ Plan (although not identified as such), Old Trinity (outside of the levees), and Joppa Preserve (that could be left alone to revert back to floodplain bottomland hardwood forest, that will have no economic benefits, and as planned creates another Swale Cell south of Swale Cell G in the DFE).

Looking at the CESWF's Dallas Floodway EQ column one can easily notice the beneficial effects of environmental restoration as scored by CESWF. However enticing this might be, one should remember that this is a synthetic CESWF made meandering channelized project with some tree plantings that has Moderate Adverse Effects on H/H upstream. The CESWF should explain these effects.

Notice that throughout the three Ecosystem Restoration (not really as large as an ecosystem but an eco-niche, or a floodplain environmental enhancement) columns that almost all of the effects are beneficial as scored by the CESWF. True eco-restoration projects are beneficial, but these are not quite what they seem as touted by the bias CESWF.

Joppa Preserve is a $7 million CESWF project to essentially return Little Lemmon and Big Lemmon Lakes to their early 1970's status. These "lakes" were sand and gravel borrow pits created around the turn of the 20th century, expanded by J. J. Lemmon, that filled with water from floods later called "lakes" with Rod & Gun Clubs for fishing and hunting. In the 1960's Gifford-Hill continued to extract sand and gravel, operations finally stopped by 1970, TXU put a power line ROW through the land creating the two "lakes" and a levee was built around Big Lemmon Lake that trapped silt from floods, meanwhile, people dumped into the lakes, and still continue to do so, while Occidental Petroleum's Plant to the west released toxic levels of phosphates into the groundwater and the local environment.

30

77. A "No Affect" rating is also a rating and represents the Corps evaluation of the cumulative impacts we believe that project would provide to the resources listed.

78. Although justification of ecosystem restoration is based upon non-monetary analysis, the Joppa Preserve restoration plan is supported by Dallas County, the City of Dallas, U.S. Fish and Wildlife Service and the Texas Parks and Wildlife Department. Once implemented, the Joppa Preserve will provide substantial opportunity for outdoor recreational opportunities as well, which could produce economic benefits to the area.

79. The EQ plan was modeled for H&H impacts and displayed in the PEIS referenced in the DSEIS. To clarify, the results of the PEIS modeling along with additional modeling has been incorporated into the FSEIS.

80.

Mostly out of *neglect* because Dallas County does not fund DCPOS (Dallas County Parks and Open Space, Dallas County Brochure, 2001 budget $242 million, DCPOS gets $123,000, or 0.0005 % out of the budget) and DCPOS could not maintain the land, although through Federal funds DCPOS was able to expand the land they own to 339 acres. Land maintenancce is done by the Dallas City Parks and Recreation Department.

According to CESWF the reason for this project was downstream erosion (over 6 river miles) from the Dallas Floodway. Can you imagine the downstream erosion after the DFE levees are extended south by 2-3 miles, with the river channel straightened, and the swale cells to convey floodwaters faster through the DFE? Under the guise of an 1135 Project the CESWF with Dallas County as the local sponsor, wants to re-establish Joppa Preserve to essentially it's early 1970's man-made altered status by dredging out silt from
81. Big Lemmon Lake so the two lakes can retain water, reinforce the existing levees, put two gabions along a large meander of the Trinity
82. River right bank, and replace the Big Lemmon Lake outflow structure.

Most of "The Old Trinity" project is out of the floodway and has been discussed for over a decade, provides no flow effects.

The Dallas Floodway should be identified as the EQ Plan in the UTRB PEIS and should be discussed under item (d) discussed above having to do with the Flood Damage Reduction Floodway Levee Raise authorized under the same project by the CESWF. These are not two stand alone CESWF projects. The CESWF touts this project highly as ecosystem restoration because they want to be the ones to build the project. CESWF does not even include the City's Master Implementation Plan for the Dallas Floodway with a divided channel and lakes that was so highly touted in selling the bond package to the taxpayers that the City has spent several million dollars on for Halff & Associates to develop.

The other 18 projects under Transportation and Fill Activities are not beneficial and have various levels of Adverse Effects. None of the Adverse Effects are quantified and no H/H models are presented to even present an idea of the Adverse Effects. No summation of the Adverse Effects can be determined from this table.

Another interesting aspect of the subjective nature of the CESWF scoring projects can be seen under the first four left columns of Transportation that have to do with the Toll Road, although not labeled as such These four Toll Road columns are scored relative to

31

80. As you have indicated, once implemented, the Joppa Preserve Ecosystem Restoration project would be more easily maintained because of the stability provided.

81. At the present time, the Corps is not supporting the EQ Plan nor the Flood damage reduction plan . They are merely alternatives that are being considered.

82. The transportation plan, split riverside, includes the tollroads, lakes and some wetlands as derived from input from NTTA. This plan were closely approximates the City's Master Implementation plan. The NTTA alternatives have been evaluated from environmental and H&H perspective sufficient to conduct a cumulative impact assessment.

83.

84.

85.

each project alternative, instead of existing conditions in the Dallas Floodway and the DFE. What is noticeable is that the project along Industrial has the fewest impacts of all Trinity river projects.

For example, the left column of the Toll Road identified as Industrial, there is one Slightly Adverse Effect and 12 No Affects. CESWF scores the impact to Forested Resources as Slightly Adverse but would have to go to some length to establish that a toll road along Lamar significantly impacts trees. The Toll Road project alternatives should be scored relative to existing conditions instead of compared project to project. No project inside the levees, with, and without the DFE in place would have a different set of impacts than either built alternative inside the levees. While a project built outside of the levees on Lamar/Industrial would seem to have many more Beneficial Effects than those projects built inside the levees, but these benefcial aspects are not scored.

Also noticeable that in the four left columns having to do with the Toll Road, the CESWFs, almost across the board scoring of the Adverse Effects the Toll Road will have except Industrial. Hopefully, this sends a message to NTTA (although very weak with Slight Adverse Effects) that the toll road inside the levees is not advisable.

P. 4-6, last para., Floodplain Forest Resources, makes no mention of the amount of forest acreage that has been adversely impacted, which is substantial. CESWF again attempts to sell their projects in the DF in the following page 4-9.

P. 4-10, 3rd para., CESWF states, "Physical features of the project would directly impact some forestlands that have developed in the last 30-40 years; however, these losses would be mitigated, resulting in a larger area of preserved and reestablished floodplain forests." We have identified some of the trees and measured the diameters of some of the trees, for example, where DFE Swale Cell A will be placed.

There are oaks that measure 2-3.5 ft. in diameter, along with several pecans 2-3.25 ft. diameter, cottonwoods 2-3 ft. in diameter, black willow (>3 ft. diameter), and box elders >2 ft. in diameter I sent off a pecan tree trunk that measured 13 inches in diameter to the University of Arizona Tree Ring Laboratory to count the tree rings for the age of the tree. The ring count made this tree 75-80 years old (personal communication from Rex Adams to Tim Dalbey November 2002). If a 13 inch (1.1 ft.) diameter pecan tree is 75-80

32

83. With DFE levees in place the tollroad would cause minimal additional loss of forest within the Lamar Levee alignment. If DFE were not in place , we do not know for sure the alignment that would be followed by the tollroad, however, even if it followed the Lamar Levee alignment, it would not remove any more trees than the Lamar Levee would. Therefore, the cumulative impacts on forested resources would still be minor.

84. NTTA is aware of Corps evaluations of cumulative impacts related to the tollroad alternatives.

85. PEIS thoroughly documented recent changes in resources in the Upper Trinity Basin. The continued loss of bottomland forests is of concern and weighs heavy in the considerations of cumulative impacts. Environmental mitigation particulary when a high percentage of the mitigation preserves existing high quality resources provides cumulative benefits.

86.

years old a 3.0 to 3.5 ft diameter oak, or pecan, is in the range of over 200 years

The trees in some locations are young at 30-40 years old mixed with older trees, however they exist now and help clean the pollution in the air, and the public will not have to wait 30-40 years to get what already exists. Furthermore, the mitigation for the DFE project is based on a ratio of 1:1, so the mitigated forest would not produce a larger area 30-40 years from now

87. P. 4-10, 1st para., essentially the CESWF is commenting in a very weak manner that the Toll Road is not beneficial for air quality. "Entitles" should read entities.

88.

89. P. 4-10 bottom, 4-11 top, CESWF states, "Direct land use changes caused by the proposed DFE project would be compatible with floodplain functions and should have no negative effect on floodplain uses compared to conditions without the project. Since when are sumps, levees, swales, and channel realignment for the DFE compatible with natural floodplain functions?

90. P. 4-11, 2nd para., does the City of Dallas have a comprehensive floodplain management plan? It is not clear as written. If the City does have a plan the public has not been involved.

P. 4-12, 4th para., CESWF admits these projects will have cumulative effects when they state, The Dallas Floodway and Stemmons North Industrial District levee alternatives were combined to produce cumulative impacts." Thus the projects will no doubt accomplish with definite Adverse Effects on H/H, although not stated.

P. 4-12, 5th para., CESWF admits the toll roads will flood in a 100 year event without providing H/H quantification. If flooding does occur the riverside Toll Roads will function as flood water runoff conduits. Seems they left out the fact that the Toll Roads will have 30 foot high retaining walls on the riverside.

P. 4-13, 2nd para., the reduction in valley storage is not considered for the 22 projects listed and the ones CESWF omits. CESWF states, "Based on the small increases downstream of the DFE and the very limited potential for flood damages downstream of the project..., these increases are substantial As I have live in the study area of

33

86. The impacts of the DFE swales, wetlands and levees were thoroughly disclosed in the DFE GRR/EIS. The mitigation plan for the DFE was not based upon a mitigation ratio of 1:1 but was based upon use of the Fish and Wildlife Services HEP as thoroughly disclosed and discussed in the DFE GRR/EIS. The recommended plan for the DFE would impact 162 acres of forest and would be mitigated by acquisition and management of 926 acres of existing forestland that have currently has no protection primarily because they are in private ownership. In addition the plan would result in the active conversion of an additional 223 acres of floodplain grasslands to forest. Our analysis of future without conditions for the mitigation lands indicated a potential for those forested areas to be changed to grasslands

87. The proposed DFE project actually removes very little areas of resource value from the 100-year floodplain. Plate A-37 of the DFE GRR/EIS maps the area within the 1 Percent or 100-yr floodplain. The levees, swales and other project features combined with the area that would become public property between the levees as well as the tremendous amount of environmental mitigation lands which would all be in the 100-yr floodplain and would actually promote positive floodplain benefits compared to the no action alternative.
88. One will be required within one year of project implementation.
89. Instead of incorporating by reference the information in the PEIS study, H&H analysis has been incorporated into the FSEIS.
90. The plans we have seen incorporate floodwalls on the tollroad if it were constructed on the riverside of the levees.

91.

the DFE for 17 years, I have observed that a 4 inch rain in one day over Dallas and Collin County alone raises the river out of bank at Second Avenue, since the Rochester and CWWTP levees were installed in the early 1990's. Before these levees it would take a 10 inch rain to raise the water to the levels that it gets to now. No telling how high the water will get after the DFE levees are built and the other 22 projects that induce flooding.

92 P. 4-13, 4th para., Aesthetics, CESWF selling the their EQ Plan for the DF again. However, CESWF seems to very weakly support the Industrial Boulevard alternative for the Toll Road from, "a more natural perspective...," for their synthetic channelized meandering river EQ plan over the City's MIP, that was excluded.

93. P. 4-13, 4-14, Cultural Resources were discussed above. Reference to the Programmatic Agreement (PA) that was slipped into the DFE FEIS. This is an unsigned agreement that excluded interested persons, included the Native American tribes but thye did not know about the PA, resulting in exclusion from the Section 106 process. The PA process should have been carried out during the study and the DFE DEIS. Above I have mentioned several archaeological sites that have been ignored by the CESWF.

94. P. 4-14, last para. Executive Order 11988 should also include 11990 on wetlands. Avoid modifications to extent possible in the base 100 year floodplain. A buy out of Cadillac Heights would avoid modifications to the 100 year floodplain, but CESWF did not want to do this. Now the Cadillac Heights area will be bought out. Many of the properties along Lamar have filled in property to above 100 year floodplain.

95. P. 4-15, 2nd para. Section 202(C) of WRDA 1996, CESWF claims that tha City of Dallas has to have a Floodplain Management Plan (FPMP) one year after signing the Project Cooperative Agreement with CESWF. It has been about one year since the signing of the agreement, what is the status of the City's FPMP?

P. 4-15, 5th para., Section 404, each of the potential projects of others must be evaluated on it's own merits, but it is up to each project and the CESWF as stewards of the waters of the U S. to determine the cumulative impacts of these projects.

34

91. Our studies indicate that at the Loop 12 crossing, which is located close to the area you live in, the water surface elevation for the 100-year event currently is 403.15. Adding the LPP for DFE results in a 100-yr elevation of 403.35. Adding the split parkway/tollroad based upon currently available information would result in a 100-year elevation of 403.39. at Loop 12.
In addition, based upon our review of long term hydrology and hydraulics, the river has historically moved out of its banks at least on an annual basis through the DFE study area, even prior to the construction of the Rochester and CWWTP levees

92. The Programmatic Agreement has been signed.

93.The DFE project proposal is in compliance with Executive Orders 11988 and 11990.

94. The plan is not complete.

95. Cumulative impacts of the projects have been addressed.

97.

P. 6-1, para. 5, CESWF claims DFE has been designed, and none of the other projects have been designed. The DFE is not designed. Proposed designs have been made for all of the projects.

Comments respectfully submitted by Timothy S. Dalbey, 2719 Santa Cruz Dr., Dallas, Texas 75227-9341.

Timothy S. Dalbey
3 February 2003

97. In the context of the full sentence, sufficient design of DFE has been accomplished to conduct an EIS. Information available on other similar reasonably foreseeable projects in the geographic area of the DFE has been identified and a cumulative impact assessment has been conducted.

January 6, 2003
1435 Kings Hwy
Dallas TX 75208

Dear Corp,

1. I believe the focus of the Dallas Floodway Extension is to narrow. Upstream urbanization is increasing the flood levels of the Trinity and focus on only mitigation of a large volume of water past downtown is doomed to failure.

While it would be nice to create a reservoir at downtown Dallas it is impractical. The depth available (1.5 ft) does not create a reservoir and siltation and the accompanying pollution eliminates this effort with every flood.

2. Fortunately we still have available to us natures mitigation plan for flooding. The Great Trinity Forest catches, slows, and absorbs flood waters. We need to expand and focus on this area. This is the natural riparian system and forestry is what the cities above us use to deal with the river running through its cities. Rather than make we need more forest to absorb the flood.

In conjunction with this it may be necessary to increase the volume of the narrow portion before the forest. (Smaller and levees at downtown and alteration of the bend at the sewer treatment / Cadillac Height bend.) No structure should be placed in the flood plain that can not be abandoned when flooded and bladed clean of silt after the flood. To truly mitigate flooding it would be necessary to build 10,000

1. The analysis was expanded to include upstream sources for cumulative impacts to hydraulics.

2. The Great Trinity Forest does slow movement of floodwaters to downstream areas. It also contributes to some of the flooding that presently occurs in the Dallas Floodway Extension area. Preservation of existing forests in upstream areas has multipurpose benefits, however hydraulic models based upon realistic scenarios of development of the contributing basins, indicate that these forests won't prevent future need for other forms of flood damage reduction in the Dallas Floodway area..

3.

catch basin in the water basin and inject the water table so there is less run off water to the river. Catch basins in the flood plain like the one a Sylvan Bridge help mitigate the acceleration of the flood water and improve riparian habitat but can not reduce the volume of flood waters. Improvement of the riparian habitat at downtown would be asthetically pleasing and if done in conjunction with relief in the [illegible] down stream would be feasible.

Sincerely
William Henning
WILLIAM HENNING

3. While catch basins within the floodplain could provide minor relief during small flood events, their ability to contain major flood events is insufficient to be cost effective. Proposed wetlands in the DFE extension and restored floodplain associated with the Dallas Floodway EQ plan would provide cumulative fish and wildlife habitat benefits.

Sharp

Linda Sharp
12126 Vendome Place
Dallas, Texas 75230
Phone: 972.458.8585

February 2, 2003

U.S. Army Corps of Engineers
Attn: Mr Gene Rice
Ft. Worth, Texas

Via fax: 817.886.6442

Re: Supplement to Dallas Floodway Project

Dear Mr Rice:

I am writing to express my concern about the proposed Supplement to the Dallas Floodway Project. Having now had an opportunity to review Supplement #1, it does not appear to meet the requirements of the federal court's order.

1. The federal court ordered that the Army Corps of Engineers evaluate the cumulative impacts of the Dallas Floodway Project. At this time, the Dallas Floodway Project has not been completely designed and is not expected to be designed until sometime this summer. When that design is finalized, it is expected to include bridges, roads, and lakes. At that time, AFTER the design is complete, the Army Corps of Engineers will then be able to make a proper determination of the downstream impacts.

An attempt now to make an evaluation without a final design in place is certainly putting the cart before the horse. This is a waste of taxpayer money since any evaluation done now will be flawed and in non-compliance with the court order. Your work will probably have to be redone all over again.

2. I am in favor of the Environmental Quality Plan. This Plan is presently the only acceptable alternative design for the Dallas Floodway Extension.

Sincerely,

Linda Sharp

Linda Sharp

1. The final document addressed the five final array of alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the identified reasonably foreseeable projects. As you have noted, limited design information is currently available for the projects identified. All readily available data was sought and utilized to determine the direct and cumulative impacts these projects might induce.

2. The Environmental Quality Plan (EQ) would improve environmental features within the existing Dallas Floodway. Further analysis would be required to address adverse H&H affects when Dallas Floodway studies are reinitiated.

Comment	Response
January 23, 2003 Attention Planning, Environmental, and Regulatory Division Department of the Army Fort Worth District, Corps of Engineers P O Box 17300 Fort Worth, Texas 76102-0300 Ladies and Gentlemen of the Planning, Environmental and Regulatory Group Re The following are comments on the Trinity River Floodway in and down stream of Dallas	
1. The Trinity River Floodway Extension Plan is more of a Flood Improvement Plan at 249,000 CFS, a Standard Flood flow than a Flood Control Plan of 449,000 CFS flow established by the Corps of Engineers using the US Meteorological projection of a Maximum Probable Event. The TR Floodway Extension Plan uses the Standard Flood as criteria for flood flow Criteria for Standard Flood are used to establish only flood improvement in areas of lesser risk, not in areas for potential loss of life and heavy property damage Dallas does not have an adequate Backwater handling plan. Most Floodway plans include Backwater handling, usually a secondary waterway In the case of Dallas, White Rock Creek floodway and Five Mile Creek floodway would be examples of Backwater flood handling. Backwater handling, water that results from a storm event and that accumulates behind usual protected areas can far exceed the usual pumping capacity commonly used. Gravity flow of adequate capacity is most dependable and most used way of handling a backwater flood. Expressways and Bridge planning cannot be permanent without a permanent Floodway plan. TR Flood Extension Plan is less than a Flood Control Plan. It is approximately a half flood plan. It is only a Flood Improvement Plan for a Standard Flood	1. The DFE GRR/EIS did not investigate alternatives to provide flood protection against flows of 449,000 cfs. Evaluations on the cumulative impacts from other reasonably foreseeable projects have been limited to the SPF events. Major factors which make the investigation of protection against Project Maximum Flood (PMF) or Maximum Probable Events impractical include the extremely low probability of such an event actually occurring and the high probability that should such an event occur, destruction of property protected by the levees would occur from the massive interior rainfall and flooding that would occur before the river actually overtopped the levees.
2. Maximum Probable Event flooding would cause ravaging flood water not back water flooding to the city of Dallas Ravaging flood water flow through the city of Dallas, outside its floodway, could exceed recorded flow through the Dallas Floodway A comparable example might be approximately two miles of the private land on the east side of the East Fork flooding just downstream of I-20 The Corps has records of this referenced example This particular example played out more than once It would seem that Expressways and Bridges along and across the Trinity River should be permanent for the amount of investment. It seems impossible to know where to locate permanent improvements with just a Flood Improvement Plan, or a partial or temporary plan. Rather the time is ripe to sell and to go forward with good plans of major improvement that are used many fold to save lives and reclaim work for our people and protect property and significantly increases the net worth of our American Society Cleal Watts Cleal Watts Phone/FAX (214) 328-1665	2. The DFE/GRR NED plan provided for the maximum amount of flood protection, which yields the greatest amount of net annual economic benefits. However the LPP or recommended plan provides significant protection and serves to minimize adverse impacts to environmental resources. As indicated in response to comment 1, alternatives to protect against the PMF would be impractical.

US ARMY CORPS OF ENGINEERS

FORT WORTH DISTRICT

PUBLIC MEETING

DALLAS FLOODWAY EXTENSION

DRAFT SUPPLEMENT TO THE

ENVIRONMENTAL IMPACT STATEMENT

January 8, 2003

Ramada Plaza Hotel

Dallas, Texas

P R O C E E D I N G S

MR. RICE: My name is Gene Rice, I'm the project manager for the Dallas Floodway Extension Project for the Corps of Engineers in Fort Worth. And I would like to welcome you to the public scoping meeting for the supplement to the EIS. We appreciate you taking time out of your busy schedules to come and share your comments with us on the draft report.

The purpose of the meeting tonight is to get your comment on the draft report. We will take verbal comments tonight. We also have a court reporter you can give verbal comments after the meeting to We also will take written comments until the 21st of this month. So you have two ways, actually three. If you would like to email your comments in, we can also take those

At this time I'm going to summarize the draft report and then we'll go into the comment period at that time. Again, the purpose of this meeting is to the get your comments on the draft EIS -- supplement to the EIS for the Dallas Floodway Extension Project. And you can see what the area of -- the area of consideration is.

What we would like to do tonight on the procedure is to, obviously, get your comments and they'll be given consideration -- everybody's comment will be given consideration in the final report when the final report when is comes out. We would like everyone to comment, so we're going to limit your time on the comments to a three to five-minute range. And if you'll please help us with that just to make sure everyone gets a chance to comment. We do have to be out of here between 8:30 and 9:00 o'clock tonight.

And I'm just going to give you a little background on the Dallas Floodway Extension Project It was authorized in the 1965. It was part of the Trinity River and tributaries report that was authorized at that time. It was the overall project, which went from the Gulf of Mexico to Fort Worth, was authorized for navigation and flood control, recreation and fish and wildlife. It was inactive in the 1980s due to the lack of local interest. And after the floods of '89 and '90, it was reactivated and we had reevaluation report was initiated in 1991 and we had chief's report in 1999 with a record of decision in 1999, also.

The authorized project does provide standard project flood projection. The details of the project are shown on the screen, consist of levees, channelization, recreation. These consist of restoration and mitigation features.

The next few slides cover the complaint that was filed against the project and this kind of gives you a summary of what the complains were. I'm not going to read all of them for. You all should have a handout which lists them, also on the screen. And you have the complaints and you have the rulings by the

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district the federal judge in which he ruled in the favor of the Corps of Engineers for counts one and two. And on three he ruled partially for the Corps of Engineers and partially for the Plaintiffs, which is the reason we're here tonight. He ruled in against the Corps of Engineers on the cumulative impact portion of the complaint.

This is the summary or summation of the Judge's ruling stating that we need to consider -- further consider cumulative impacts of other projects were reasonably foreseeable in the sane geographic area of the Dallas Floodway Extension Project. And he halted any construction at that time, although he did allow by default for some cumulative design with the project. The Corps of Engineers at that time decided to go ahead and prepare a supplement to the EIS to address the cumulative impacted of other projects to address the Judge's concern and his ruling against us on that portion.

The notice of intent was published this past summer in June. We had a scoping meeting in July, which we had about 50 people attend and we received about 16 comments by individuals at that time.

This is a general study area or a general area of consideration that most of our efforts were focused on to look for other projects that were reasonably foreseeable, similar project, and we considered this the geographic area. I'm not going to go through each one of these, but these are the impact areas that we looked at for each of the projects that were identified to us either by the public or by contacting other agencies such as Texas Dot, ETCA, any state and local agency that has projects in the area and each of these reports were analyzed.

The conclusions out of our draft supplement are that some of the individual projects have some positive, some negative impacts, but collectively or cumulatively as a whole there was significant impacts to the resources of the area by all of the projects.

The notice of availability was published on this draft document December 6th. Tonight is the public scoping meeting. We will receive comments until the 21st of this month. And then we will address all of the comments. The reason I said we're looking for a final report this summer is, depending on how many comments we receive and what it takes to address those, that will impact when we actually will complete the final report itself.

Again, we will receive comments until the 21st of this month, which is about two weeks away. You can either mail them to me at the address given or in your handout. I've also given you my e-mail address, which you can send them to me electronically if you prefer. And if you do not have a copy of the report and still wish to do so, we have some copies available tonight, a hard copy. We have some on CD rom if you would care to get some of those. We do not have it -- or off of our website, which is listed at the bottom, you can download it off of there. Either way, just let us know, we'll be happy to supply a copy to. And it will be up there for the whole time during the comment period.

That was a brief rundown. I realize it was kind of fast, we wanted to go ahead and give you the most time possible for you to give us your comments. I would like to open it to the floor for y'all to give us the comments. I believe we have some people already signed up for the comment period.

We'll go ahead and have you come up to the microphone in the middle and give us your comments in the order in which you signed in this evening. And I apologize if I mispronounce your name. The first one was Mr. Bruce Hunter. Did you still wish to comment? If you'll come to the microphone and give us your comment, please, sir.

MR. HUNTER: I appreciate all the work that everyone has done with regard to trying to find the best solutions is to many conflicting problems. And I'm not familiar with all the details as some of the people in your audience I'm sure are or have proved themselves to be. So I'll lay something general on our audience tonight in regard to a petition that I developed for the president of the US congress that has to do with some very basic parts our environmental problems. And I think you'll see as he read these what those problems are.

These comments are beyond the scope of the SEIS and therefore cannot be answered. However, we thank Mr. Hunter for his concern and his comments.

We are expressing to Bush and the US congress:

A. To recognize that as the 1.4 billion Chinese and millions of other people the world over increasingly seek to emulate American's vaulted and envied standard of living, the capacity of the planet to provide the necessary natural resources will, absent our nation's leadership to prevent it, finally be outstriped; and that we must begin now deciding upon what the "rightful share" of those natural resources for our own population/consumption is now and what it will be five, ten, 20, 50 years down the road.

We also urge President Bush and the US congress to consider that if US aliens, to distinguish us American quote unquote from Central Americans and South Americans and Canadians, consider that if Us aliens, a mere 4.6 percent of the world's people continue to consume 25 percent of the world's energy, this will likely generate a great deal of resentment against us by many hundreds of millions of the less fortunate among the remaining six billion other humans on the planet, especially those livening under non-elected tyrants who maintain their wealth and their regimes by their own nations' natural resources, notably it's oil, to US and other foreign corporations.

And, finally, we urge President bush and the US congress the direct the Office of Homeland Security to establish a quality of life commission to develop n USSPP, that is an US sustainable population policy program aimed at bringing our nation's energy consumption down to not over three times the world average nor over two-thirds of present level, that is year 2002 levels, by the year 2008. That's five years from now, we could do it in one if we wanted. And at making us at least 80 percent energy independent by 2038, that's 35 years from now. You could have grandchildren born within that time even if you're not married yet. Pardon the diversion. And without drilling in the Arctic National Wildlife Refuge, Anwar, or in any other wildlife sanctuary. And to help other nations establish and activate similar programs to stabilize their own populations at sustainable levels and to work with them to forestall the ecological catastrophe to which we all are by all accounts now headed.

Just one or two brief comments. I don't know if any of you notice this news that I saw recently where China is now seeking to emulate our infatuation and addiction to the gasoline engine. They are now beginning to reduce the number bicycles allowed in some of their cities and they are in an expressway and road building program. And you think oil is a problem now with us sitting on about 3 percent of the worlds's reserves, I dread to think what it's going to be like when we have competition from a country the size of China if they begin to use like we do.

SO these general remarks, I think, I hope those in the audience will forgive help for directing more specifics to the particular topic at hand, but I hope that you will think about the impact all of us are having. As I was talk to a couple of gentlemen before the meeting, when you stop and think about it, if humankinds keeps reproducing and population keeps growing, pretty soon all of the fresh water on the planet be tried up in, guess what, people. We're all 97.9 water. Thank you.

MR. RICE: Thank you, sir. One other thing, I'm sorry. If you do have a prepare statement, after you're statement, if you would please, give a copy to our court reporter. It will help the transcript. Just one other minor thing. Mr. Campbell Reed is our next speaker.

MR. REED: Good evening. My name is Campbell Reed. I'm referring back to the scoping meeting that we held in Dallas in 2002. The Corps indicated that they do not plan to reevaluate the Dallas Floodway Extension, instead they interpret the ruling of the Court to require them only to comment on cumulative impacts of foreseeable future projects upstream of the DFE without recording any of these projects as alternatives. The attitude of the Corps in this matter is unacceptable.

That attitude is reflected in the EIS draft supplement. On page 2-3 it states, and I quote: "Until formal notice is made by the City of Dallas regarding their support of a plan that is different from that to which they have formally provided and endorsement, alternative plans discussed by individuals or the media cannot be considered as reasonably foreseeable. The

The final document will address the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario.

The court order specifically found that the Corps' analysis of the alternatives was appropriate. The court order's only effect on the alternatives analysis was the requirement that the alternatives already identified as reasonable be analyzed as they related to cumulative impacts.

plan recommended in the 1999 GRR/EIS, that's the general reevaluation report and integrated EIS to the DFE, therefore, remains the recommended plan for analysis in this supplement to the DFE EIS."

In our opinion each and every project reviewed by the Corps and the draft supplement to the EIS should be regarded as a potential alterative to the DFE. Such an opinion is consistent with the part of the federal court order requiring the DFE project to be stopped. At the 2002 scoping meeting I asked Gene Rice why he thought the court had ordered the DFE project to be stopped and he replied that he didn't know. However, "I don't know" is not good enough as an answer. It certainly makes no sense for the court to concur with the point of view and the quotation that I just read from the supplement to the EIS and then to order the DFE project to be stopped. It makes no sense at all and Mr. Rice knows that.

Chapters 4, 5, and 6 of GRR/EIS of 1999, for example, contain multiple tables listing estimated costs and benefits in dollar terms of the so-called recommended plan. No such tables appear in this new supplement, but we should all demand that they be compiled to include costs and benefits resulting from raising the Dallas Floodway by various heights, not only by 2 to 2.5 feet, by 1 foot, by 3 feet and so on. The Corps argues that the lack of final agreement on the alignment of the so-called Trinity Parkway prevents them from computing costs and benefits

The court ordered the project halted until an analysis of the cumulative impacts was completed. The court specifically found that the Corps' selection of reasonable alternatives was sufficient. The final document addresses the five final alternatives of the Dallas Floodway Extension with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects which have not been fully studied or designed, which fulfills the court's order.

Raising the levee was not considered a viable, reasonable alternative to the DFE project because the project's goal is to protect south Dallas, not the downtown area. The benefits to the downtown area are additional; they are not the goal of the DFE project. The court agreed with this analysis of this alternative. Economic data has been added to the project descriptions found in Chapters 2 and 3.

deriving from it. But they have no such excuse for raising the floodway levees by specified amounts is concerned; they can and must produce a cost/benefits analysis.

If you turn to the discussion of raising the floodway levees on page 3-11 of the supplement, you'll find that the discussion is confined to where the dirt would come from and where it would be put. That's all that the Corps presents in the subject of raising the levees. There's no related cost/benefit study that could be compared with those in GRR/EIS in the so-called DFE recommended plan. The reason why the Corps has declined to do such a study, however, is plain. They are afraid that such a study would show the DFE to be less cost-effective than raising the floodway levees, with the undeniable consequent conclusion that the DFE would no longer remain viable under the Corps's own rules. Thank you.

MR. RICE: Thank you. Mr. Reed, do you have a copy of your statement you would like to give the court reporter?

MR. REED: Yes, sir.

MR. RICE: Thank you very much. D. J. Young.

MR. YOUNG: I did not receive a copy of the supplement and I would like to have one. Consequently my remarks will be very brief.

I'm still at a loss to understand how cumulative impacts can be analyzed when you don't know what is going in

CEQ guidance for implementation of NEPA does not require an in-depth analysis of alternatives that are found to be unreasonable, as this option was.

upstream. The last time I checked the Trinity is still flowing toward the Gulf. I still think canoes and not cars belong in the floodway. Thank you.

MR. RICE: Thank you. Tim Dalbey.

MR. DALBEY: You want my name and address and all that stuff?

MR. RICE: That's all right, we have it on your card.

MR. DALBEY: I'm not done commenting, I'll have my written comments to by the 21st or whatever the date is. I didn't get mine until two weeks after it was out and Christmas kind of involved. Your timing was excellent coming out during the holidays when you said it would come out in October, that's the July meeting. The format of this meeting is much better, we get a chance to talk at y'all. I have several things on the comment from culture resources in that there's a site right at the DFE, Dl 350. It's quite a large site, human skeletons came out. It's going to be impacted by the project. And I commented on in the draft in the final, still it gets no credence, so I think you need to look at that and get Newman off his but and get out there to look at it.

There's also DL 6970, it's going to be under in the Lamar Street levee. And the historic dump at DL 320 at the end of Forest Avenue is also going to be impacted by the levee. I talked to Bill Martin about all this and we'll see where it

This concern was addressed by the inclusion of the upstream area in the final SEIS.

Very recently Dallas has contracted out the excavation of site 41DL350 to a local archaeological company due to impacts predicted from Dallas plans for construction of a boat ramp. Should any site ever be in an area of potential effect for a Federal Corps project, the site would be investigated as appropriate under cultural resources legislation and State Historic Preservation Officer consultation.

Site 41DL69/70 was tested by Geo-Marine in 1997 for the Dallas Floodway Project by the Ft. Worth Corps and determined ineligible to the National Register with State Historic Preservation Officer concurrence. Site 41DL320 would be investigated appropriately should a project be planned in that area.

goes. And I think you ought to reconsider those in lieu of the fact that these sites are pretty much directly in the footprint of projects and not the ones that you tested on the Meander Bend that really aren't in the footprint, although they'll be damaged by the flood velocity and everything through the floodway. So that's one thing I would like for you to maybe look at further.

Another thing is that the total impact of the toll road, whichever one you use, whether it's specific site on your PEIS environmental quality or master limitation plan, whichever one you need to do, you need to in corporate those, plus the segment for George Bush and some of the bigger projects, you need some add some hydrological or H&H model of how that's going to affect the flow. I mean, I know you don't know which project it's going to be, but I went to the segment four meetings and they 16 alternatives and they showed all 16 alternatives for people to look at. They didn't even do H&H on that, but they showed the projects and their impacts. It's not impossible to do, I know it's a lot of work, but I think you need to show the H&H. If this plan goes, if that plan goes, how is it going to increase the flow velocities and the change in the dynamics of the stream because at least just the floodway, the toll roads and segment four are going to affect in the neighborhood of 2 to 5,000 acres of land in the floodway and narrow and change the velocity and the dynamics of the river let alone the other 19 projects you listed as number 22.

The Ft Worth Corps will investigate total "APE's" (areas of potential effect) for all aspects of Federal projects.

The final document addressed the five final alternatives of the DFE with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects (including hydrology and hydraulics).

Also, I think you guys really try to sell your PEIS review plan in this document. It's only listed by eight different times, but I haven't tallied that yet. It's a better than the MIP, but that remains to be seen.

Campbell mentioned the cost/benefit ratio. You never how -- he testified this DFE project based upon the CBD, you don't even mention the CBD and projection in this plan, per se. I think you should do that if that's the justification for the protect. And as he I says, if you raise the levees a foot, 2 foot, 3 foot, you're increasing the SPF or higher SPF level protection. You have to demonstrate how that does not negate the DFE because you can't stand alone on the DFE protecting Cadillac Heights and Lamar Street levees.

And I don't think you've been down on the Lamar Street; levees. I did an inventory of all the businesses on Lamar and 53 percent are auto salvage or tire or some sort of scrap metal, trucking, warehouses. Most of them have raised their property levels to 10 to 20 feet above Lamar Street as it exists. So if you build your levee, those properties are already -- because they know they are going to get flooded and they got to do something. So they took it upon themselves -- I don't know who gave them the fill permit, but they have raised those properties up. So what's your cumulative effect of that. And at the HTNB, when we looked at all their economics, when we went to their one public meeting that I was able to attend, I don't

The final document will address the five final alternatives of the DFE with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects that have not been fully studied or designed. However, economic analysis of the potential projects is not part of the cumulative impacts. Further, raising the levees is not a reasonable alternative to the DFE because the DFE's goal is not to protect downtown Dallas; it is to protect south Dallas.

know that they had that many more, they showed all these great, I think you call it the comp plan, comprehensive land use plan, which you guys mess up and call the culp plan in your report. And decur is not decrud, by the way, it's decurd. Anyway, you messed these up. And you need to look at that plan. The HTNB showed all development and all this great building and all these things that can happen upstream, never looked downstream from the DFE. So you need to look at how that flow is going to change the stream downstream. I know now where I live, I live within the DFE, when it rains four inches, water is up into Second Avenue. It never used, it used to take at least a ten-inch rain to get it up there. And that's just the change from central waste water treatment and Rochester levee. When they put those in in '92 after the '89 and '90 floods. So now if you can come in and put up the Lamar levees, change the channel, put the swale in, I mean, it's going to raise the water down there. I don't see anything about how it's going to effect the water dynamics downstream and into Seagoville.

And that's I can go, I can go on forever, but that's where I'll stop.

MR. RICE: Thank you. Mr. Marcus Wood.

MR. WOOD: Good evening. I'm Marcus Wood, the executive vice president of Mixmaster Business Association, which is centered along Industrial Boulevard from Continental Street south to basically the DART light rail lane.

The concern regarding downstream effects and the hydrology and hydraulics information has been addressed in the final SEIS.

We speak in support of the cumulative and the supplemental Cotps work. We think that it is important to proceed as quickly as possible with the recommended DFE project. We're very concerned about the Court situation stopping any further action related to the construction.

Our area is an area that has supposedly the floodway levees. However, upon detailed review, we will find ourselves being drastically damaged by a flood of 140 years frequency. The levee itself supports currently a 300-year flood, but there are ways and damages that occur because of sanitary sewer water that would be flooding back into the old channel and all.

So in summary for us, we will be submitting other comments, but our main message is thank you very much. Please urge the Court and the Corps and congress to proceed with this as quickly as possible. You have done an magnificent job. Thank you.

MR. RICE: Charles Allen.

MR. ALLEN: Well, good evening. Thanks for this opportunity to address the Corps. I do have some problems with the document that we're discussing. So really beginning even in the summary.

Let's see. On page four of the summary we're talking about no projects proposed by the city reasonably foreseeable for the Elm Fork, leaves out the Elm Fork Flood Plane Management Study and the possible levee soon to be presented to the city

The Corps is currently in the process of reviewing the DFE plan and will proceed as expeditiously as possible in deciding whether the recommended plan is the appropriate plan to carry out the goals of the DFE.

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council by Freeze Nichols.

Potential adverse effects on habitat hydrology aversion **, not really discussed or included in there. No activities identified of significant cumulative effect in the study area resources. And I have to say that things like siltation, erosion and other processes like that, which may not be significant in one particular project in total, their cumulative effects are significant, especially if effects on hydraulics throughout the watershed here.

Again, or another thing I've noticed is citing the old Trinity River Project as anticipated to proceed with implementation within the reasonably foreseeable future. The last I've heard of it was several years ago in the now defunct Trinity River Corps of Citizens Committee. What is the current status of the old Trinity River Project? What's the budget, the source of funds for the old Trinity River Project? I don't take it for granted that this projected will ever take place much less contribute positively to cumulative affects on bottomland and hardwoods as it's stated on page seven.

The problem that I can see with the document is that alterations to floodplain valley storage, hydraulics and the effects or erosion, siltation and sedimentation are minimized with respect to the various projects under consideration. The cumulative affects of these are important. For example, erosion or sedimentation, they do become significant when they are

We have attempted to address the cumulative impacts of all reasonably foreseeable alternatives of the Corps and others on various resources in the SEIS.

The "Trinity River Project" as described in House Document 276, 89th Congress and Authorized by Section 301 of the Rivers and Harbors Act of 1965, included five local protection projects (West Fork Floodway, Dallas Floodway Extension, Duck Creek Channel, and Liberty Levee), four multi-purpose reservoirs (Lakeview (now Joe Pool), Roanoke, Aubrey (now Ray Roberts), and Tennessee Colony), a navigation channel from the Houston Ship Channel to Fort Worth, and a pipeline from Tennessee Colony to Benbrook Lake for water quality. Several of these features have been built (West Fork Floodway, Duck Creek Channel, Joe Pool Lake, and Ray Roberts Lake). Section 351 of WRDA 96 and Section 356 of WRDA 99 subsequently modified authorization for the Dallas Floodway Extension to be constructed as described in the GRR/EIS. That document is the subject of this SEIS. A Senate Committee on Environment and Public Works resolution dated April 22, 1988 requested the Corps to review the recommendations contained in House Document 276 "...with particular reference to providing flood protection, environmental enhancement, water quality, recreation, and other allied purposes in the Upper Trinity River Basin...". Preliminary findings of those investigations are disclosed in the PEIS for the Upper Trinity River Feasibility Study dated June 2000.

totaled when they are accumulated to spite the so-called best management practices.

Other problems with the document include statements made by the Dallas Floodway, particularly the amount and size of wetlands present in the floodway. The document here states that there's 51 acres of wetlands in the floodway. There's quite a bit more than that. In discussions before the '98 bond program of the size of lakes proposed by the City of Dallas 135-acre lake, at that time it was said that just that one lake near downtown Dallas would require the mitigation 80 -- between 80 and 90 acres of emergent wetlands, just that one small area. So I think there is problems with document, so I'm going to submitting a statement that will go into a lot more detail. But I think there's definitely some problems with it.

And I have to say for the benefit of all people in Dallas, I think we need to take our time about it. I don't think there is a good reason to be in a hurry about this and I think we need to take our time and examine it very thoroughly. Thank you very much.

MR. RICE: Thank you. Ned Fritz.

MR. FRITZ: Greetings. With the help of the Army Corps we can prepare a new appropriate plan for Trinity River in Dallas. The Army Corps and the city have failed to present adequate data on the harmful results of building highways and lakes between existing levees and cutting swales downstream

This concern is addressed in the detailed responses to Mr. Dalby's submitted written comments elsewhere in Appendix B.

The Corps concurs that a comprehensive multi-objective plan can and will likely be developed for the Trinity River in Dallas.

through the city's Great Trinity Forest and other harmful factors.

The tollroads would raise the flood levels and spread air pollution within the levees. A lake would narrow -- or more lakes would narrow down the walking area next to downtown Dallas and wipe out much of the flowers and other natural plants there. There is already a lake south of the Sylvan Bridge. Another bad effect of new roads between levees and maybe of the lakes and a swale would be more flooding of the Great Trinity Forest. People are entitled to fair -- to far more details about the harmful results that the Trinity Floodway Extension would bring. And I might add that the plan so far is very short on data, on facts as to what are the consequences.

We prefer Appendix A of the American Institute of Architects, Dallas Chapter, Trinity Policy of 2001 showing various errors in the 1998 bond plan, with only 1.6 percent majority that it won by.

And I'll submit more details. I certainly agree with a lot of the antagonism that many groups have raised so far on this project. And the details that I will submit in writing today includes withdraw the 1998 destructive bond approach and comments on the draft supplemental EIS of December 2002.

In brief, I hope that the Army Corps even and all others involved in this project will come forth with the facts and the details and the harm and the problems and save our Great

The cumulative impacts of reasonably foreseeable actions are addressed in the final SEIS.

Thank you for your comment

The bond package was passed by the City of Dallas. The Corps has no control over the City's bond proposals.

Trinity Forest and will come forward in due course with a different plan that will take care of things, especially now that the United States Court has shown how weak the previous plan was. Thank you.

MR. RICE: Thank you. Next we have David Gray.

MR. GRAY: Good evening. Unfortunately I believe that the supplemental EIS is inadequate and intrinsically flawed. For summarizing the cumulative impacts there's only one alternative for the DFE, the recommended plan. The Corps has assumed that for the purposes of this supplement the DFE has been built in place according to that plan, but the purpose of an EIS is to conduct an evaluation of all the alternatives and impacts of those alteratives in order to be sure that most optimal plan is chosen. The federal judge has remanded the DFE/EIS back to the Corps to conduct an analysis of cumulative impacts. It is insufficient to simply say that all reasonably foreseeable actions will add some cumulative impacts to the DFE under in recommended plan. It is necessary to compare the cumulative impacts of such actions with each of the alternatives. The most important, for example, being the no-action plan. Only with a comparison of the full impacts of all related actions can a reasonable and informed choice of the least damaging and most beneficial alterative be made. Furthermore, there are no date or evidence with analysis presented to back up any of the claims made by the supplement.

The final document addressed the five final alternatives of the DFE with various potential projects by others to determine the cumulative impacts of each scenario using the best available data for each of the projects. Your concerns have been addressed in the final document.

There are no cost/benefit instruments for any of the proposed reasonably foreseeable of other actions in combination with or without the DFE.

I would like to just hit on a couple of points I made any comments before I submit them. Under cumulative impacts, the Corps states administrative priorities promoting nonstructural flood damage projects, including buyouts and environmental protection are becoming more prevalent. While it's certainly true that such an alterative is available here, a reasonable and affordable nonstructural alternative to the recommended plan is available and would offer much less environmental impact and better flood damage reduction. That alterative it is outlined in a letter from the White House OMB Director Mithc Daniels to the Army Corps. The Corps states, "As a cumulative impact identification that in other cases concerning the tollroads information may have been developed, but it's not been made available to the Corps. It is well known that the Corps has participated regularly in multi-agency meetings about the Trinity core and related projects. In fact, H H information has been made available on a preliminary basis in the NTIS for the Trinity Parkway. The fact that NTTA has studied the hydrology and hydraulics of the tollroads and chain of lakes cannot be a secret. Regardless of the fact that the EIS for the tollroad has been delayed several times and has been expanded to include a chain of lakes, that should not prevent

A new economic analysis of the DFE project is not part of the cumulative impacts analysis. The court's decision specifically upheld the Corps' economic analysis of the project.

The court's decision specifically upheld the Corps' choice of alternatives for inclusion in the final array.

Hydrology and hydraulics information is included in the final SEIS. Therefore, this concern has been addressed.

the Corps from asking to see the data that has been generated. In fact, fairly detailed and advanced schematics have been shown to the public for tollroads alignment, so it's logical to believe that the study of these alignments are well advanced. The Corps should ask to see the H&H for those projects and present them in a detailed and factual manner.

I would to just speak briefly about Table 4-2, the cumulative impact analysis. This is the only indication we have that some project are better or worse than others. In fact, there are several projects that are beneficial to the floodway, including ATSF bridge modifications and potentially also the additional of suspension bridges. Similar things could be also studied for Loop 12 bridge.

Furthermore, the Corps indicates in that table that there are adverse effects from the floodway line of the tollroads. If we take all these effects together, we may find that the need for the devastating damage done by the DFE in its current form are not necessary except for the protection of people in the floodplain.

We urge the Corps to prepare a comprehensive detailed and factual supplement to the EIS that examines the cumulative effects of all the alternatives and we look forward to seeing that in the final SEIS.

MR. RICE: Thank you. Mary Vogelson.

MS. VOGELSON: Thank you. Good evening. I'm Mary

This concern has been addressed in the final SEIS.

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Vogelson representing the League of Women Voters of Dallas as the Trinity River Study chair for the league. Our league has been involved with the Trinity River studies by the Corps and others for over 35 years. We understand the need to proceed with a project that has been pending since 1965 and we understand the frustration of trying to work with the city of Dallas when the city itself has been unable to establish guidelines for a cooperative program with the Corps for most of this time.

League of Women Voters of Dallas wrote extensively in response to the 1998 DFE-GRR EIS, we've got those letters down, draft that the Corps had not met NEPA's requirements to evaluate the cumulative effects of all foreseeable projects including its own DFE proposals and alternatives. Our concerns, in part, echo the later office management and budget statement when they said the Corps elected not to evaluate the flood solution proposals having the highest net economic benefits and that decision, in effect, removed from consideration an entire set of reasonable options. Thus, the OMB states, the Corps presented an incomplete picture of the available choices and their impacts and prevented informed public discussion of the merits of the proposed project.

The Corps has still not made a public evaluation of its own DFE project in conjunction with other known proposals and discussing the cumulative environmental impacts on the city and

The court's decision specifically upheld the Corps' choice of alternatives for inclusion in the final array of alternatives. The other alternatives were found to be unreasonable by the Corps, and that decision was upheld by the Northern District of Texas.

This document explores the cumulative impacts of the DFE and the reasonable alternatives included in the final array, which complies with NEPA. NEPA does not require an analysis of alternatives found to be unreasonable.

its citizens. Furthermore, evaluating cumulative impacts of the newly proposed environmental quality plan, a plan much more in keeping with the "new, green" Corps against the currently existing conditions might have resulted in a very different NEPA outcome. Unfortunately we do not know this as a result of this document.

Attempting to secure the Corps DFE project and then evaluating the cumulative effects of known future proposals or alternatives as this document purports to do is not our understanding of meeting the NEPA requirements. The Federal Court for the Northern District of Texas ruling pages 54 through 57 in the opinion of April 10th, 2002, demands that the cumulative impacts of these projects must be addressed with the DFE project, not supplemental to the DFE project.

The League of Women Voters is concerned about the best use of public funds, the cumulative effects on the environmental upstream and downstream, requirements of NEPA, the accurate and complete information being given to the citizens of Dallas in order to make democracy work for all Dallas's citizens. We hope to the continue to work with the Corps of Engineers to meet this goals.

We will be sending further written comments in detail. And frankly, a point of personal privilege, since I'm out of town most of the month of December, is it possible to get a two-week extension? Thank you.

This concern has been addressed in the final SEIS.

MR. RICE: Mr. Joe Wells.

MR. WELLS: I'm Joe Wells and I submitted some written comments and I'll submit some more in writing before the deadline. One of the things -- I just want to say a couple of things. One is I wanted to join on behalf of the Sierra Club, several thousand members in the Dallas Sierra Club, to ask for an extension of the comment period, so that members of that group and other environmental groups that have for years pointed out to the Corps of Engineers and the city of Dallas very significant environmental impacts of this DFE project, the proposed tollroads and floodway lake proposals repeatedly in meetings like this and in writing, would have an ability to review the document, provide detailed comments. And I'm a little bit astounded that -- I think the problem is not that they are significant impacts on these proposed projects, but there hasn't been a significant effort by the Corps of Engineers to identify what the impacts, analyze them, publish them and let the public review and comments on them before you move forward, which we understand the National Environmental Policy Act requites. And we were joined in that by the federal district judge. And I urge you to provide this extension of comments time and look at the very serious issues that we're going to identify and have been identifying for a number of years in order that we can resolve this through a process that complies with the law. Thank you.

This extension was granted.

The court order required an analysis of the cumulative impacts of reasonably foreseeable future projects. This has been accomplished in the final SEIS.

MR. RICE: Thank you. That concludes the people who have signed up to speak. Is there anyone else who would wish to speak who has not signed up? In this case again we'll receive written comments until the 21st of this month. I appreciate your time. This concludes the meeting. Thank you very much.

THE STATE OF TEXAS)

COUNTY OF TARRANT)

I, Pam Alford, Certified Shorthand reporter in and for the State of Texas, do hereby certify that the above and foregoing contains a true and correct transcription of the proceedings had at the above-stated time and place, all of which were reported by me.

WITNESS MY HAND this the 3rd day of February, 2003.

Pam Alford

PAM ALFORD, TX CSR #459
Expirations Date: 12/31/04

APPENDIX C

RECORDS OF DECISION
for

GENERAL REEVALUATION REPORT and EIS,
DALLAS FLOODWAY EXTENSION

and

PROGRAMMATIC EIS
UPPER TRINITY RIVER BASIN FEASIBILITY STUDY

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

01 DEC 1999

RECORD OF DECISION
ENVIRONMENTAL IMPACT STATEMENT
DALLAS FLOODWAY EXTENSION, TEXAS

SYNOPSIS

In February 1999, the Final General Reevaluation Report and Integrated Environmental Impact Statement, which documented the results of a comprehensive reevaluation of the authorized Dallas Floodway Extension Project located in the Trinity River Basin, Texas, was filed with the U.S. Environmental Protection Agency. The review period was extended an additional 30 days in response to local interest requests. This Record of Decision completes the approval process for flood damage reduction, environmental (ecosystem) restoration, and recreation measures for the Dallas Floodway Extension, Texas, as described in the referenced report.

AUTHORITY

Authority for construction of water resource development features described in the Comprehensive Survey Report on Trinity River and Tributaries, Texas (reprinted as House Document 276/89/1), including the Dallas Floodway Extension, is contained in Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). The authority is commonly known as the Trinity River and Tributaries Basinwide Study Authority. All studies conducted under this authority serve as an interim response to the basin wide authority, and do not close out the granting authority. Section 351 of the Water Resources Development Act (WRDA) of 1996 (Public Law 104 303) and Section 356 of WRDA 1999 (Public Law 106-53) authorized several project modifications.

The Dallas Floodway Extension is one of five local flood protection projects authorized for construction in 1965 as part of the basin wide plan of improvement for the Trinity River and Tributaries, Texas. The authorized plan of improvement consisted of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection. The plan consisted of a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek.

A General Design Memorandum (GDM), which assessed the Dallas Floodway Extension in greater detail, was completed in 1981. In 1985, however, work on the project was suspended following a failed city of Dallas bond election. Final approval of the 1981 GDM was subsequently discontinued, resulting in the retention of the 1965 plan as the authorized plan.

The current General Reevaluation Study was the result of a request by the city of Dallas to reactivate the authorized Dallas Floodway Extension Project, following the severe flood event of 1989. The project was reactivated in 1990 under the provision that a general reevaluation be conducted prior to construction.

DECISION

It is my decision that the Recommended Federally Supported Plan (FSP) for the Dallas Floodway Extension Project should be implemented as soon as practicable as a means to alleviate potential flood damages, restore the natural environment, and provide recreation facilities within the Dallas, Texas, area. Authority to implement the project is partially provided by Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298). In addition, Section 351 of WRDA 1996 (Public Law 104-303) authorized that the sponsor built Rochester Park Levee and CWTP Levee be included in the project and that the sponsor receive credit for work carried out which is integral with the project as authorized and as currently recommended. Section 356 of WRDA 1999 (Public Law 106-53) authorized environmental restoration and recreation as project purposes. All project features of the Recommended FSP are either specifically authorized by Congress, or can be implemented within the discretionary authority of the Chief of Engineers [33 U.S.C. 701(m)] and no additional project authorization is needed.

FINDINGS OF THE FINAL GENERAL REEVALUATION REPORT AND INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

Implementation of the Recommended FSP, as presented in the Final General Reevaluation Report and Integrated Environmental Impact Statement, dated February 1999 (revised September 1999), would provide completion of a significant portion of the Authorized Plan for the Dallas Floodway Extension. The Recommended FSP, as described in summary below, is located within the authorized site, and includes smaller scale features of the authorized flood damage reduction plan. Future work efforts to more fully fulfill the scope of the authorized plan would not be adversely affected by the Recommended FSP.

COMPARISON OF ALTERNATIVE PLANS

Subsequent to the evaluation and assessment of potential water resources management measures in the Dallas area and formulation of those measures into plan components, various comprehensive plans were investigated. Evaluation of those plans in light of specified planning objectives and public involvement produced the array of alternative plans as detailed below.

The 1965 Authorized Plan consists of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection (approximately 800-year or 0.125 percent Annual Chance of Exceedence (ACE). The plan would include a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek. This plan would no longer be economically justified, with current flood control first costs of $199.2 million (January 1997 prices), annual flood control costs of $17.1 million (7.375 percent interest, 50-year period of analysis), negative annual net flood control benefits of $4.1 million, and a benefit-to-cost ratio (BCR) of 0.76.

The National Economic Development (NED) Plan consists of clearing the vegetation along an upper and a lower overbank swale. The upper overbank swale would be about 1,200 feet wide and would extend from the confluence of Cedar Creek, at the upstream end of the project, to the river crossing of IH-45 for a length of about 7,800 feet, or 1.5 miles. The lower overbank swale would be about 1,200 feet wide extending from Hwy. 310, beginning at least 100' from the edge of the east bank, downstream to about 2,000 feet below Loop 12, for a total length of 17,300 feet, or 3.3 miles. Fragmentation of habitat would be unavoidable and would require extensive mitigation. Acquisition and management of approximately 3,200 acres of land would be required to offset the adverse environmental impacts associated with the project's implementation. This plan would have estimated flood damage reduction first costs of $50 million (January 1887 prices), annual flood control costs of $5.5 million (7.375 percent interest, 50-year period of analysis), annual net flood control benefits of $8.1 million, and a BCR of 2.46.

The Combination Non-structural / Structural Plan (which is the environmentally preferable alternative) consists of a chain of wetlands, a Standard Project Flood (SPF) levee protecting the Lamar neighborhood, and a 10-year buyout of the Cadillac Heights area (seven structures). The buyout of seven structures would leave 158 structures within the 100-year floodplain in Cadillac Heights. This plan would have estimated flood damage reduction first costs of $67.0 million (January 1997 prices), annual flood control first costs of $7.6 million (7.375 percent interest, 50-year period of analysis), annual net flood control benefits of $5.3 million, and a BCR of 1.70.

The Recommended FSP is a multi-objective project consisting of a swale for reducing flood damages, with an incorporated chain of wetlands for environmental restoration purposes, SPF levees protecting the Lamar and Cadillac Heights neighborhoods, environmental mitigation, and recreation facilities compatible with a larger, regional recreation master plan. Also included in this plan would be a proposed realignment of the existing river channel at the IH-45 bridge to prevent catastrophic failure of this designated national defense route, and to reduce significant annual maintenance costs due to debris accumulations at the bridge. This plan is also the locally preferred plan. This plan will provide an approximate 800-year or 0.125 percent ACE level of protection to the areas adjacent to and upstream of the project area. This plan would have an estimated first cost of $127.2 million (October 1998 prices), annual costs of $9.3 million

(6.875 percent interest, 50-year period of analysis), annual benefits of $19.1 million, and a BCR of 2.06.

PLAN SELECTION CONSIDERATIONS

Plan selection considerations involved a comparison of the cost effectiveness, environmental – social – economic balance, broad social acceptability, and adverse environmental impacts of the final plans. Plans formulated were evaluated based on their contribution to the National Economic Development account, and they are consistent with protection and restoration of the Nation's environment. In addition to these National objectives, additional planning objectives evolved from meetings with area residents, from contact with the local sponsor, State and Federal agencies, and from observations made in the area. Specific needs, desires, and goals of the community were identified. The plan selection considerations for the Dallas Floodway Extension project were as follows:

* Reduce flood damages, provide better health and safety measures, reduce emergency services, reduce potential for loss of life due to high velocity flows, reduce isolations caused by flood waters, reduce overtopping of bridges and roads along the Trinity River, and reduce the loss of jobs and/or wages caused by flooding from the Trinity River within the city of Dallas.

* Preserve and protect existing environmental and aesthetically pleasing areas and maintain, as much as possible, the existing vegetation and wildlife habitat along the Trinity. The channel portion of the Trinity River is possibly the largest remaining natural channel within Dallas.

* Preserve and/or protect historically and culturally significant areas.

In summary, a comparison of the alternatives reveals the 1965 Authorized Plan, which did not include mitigation, is no longer the best plan nor is it cost effective or environmentally or socially acceptable; the NED Plan would not provide the maximum protection to the project area and would require significant mitigation, with approximately 3,200 acres of land being required to offset the adverse environmental impacts; the Combination Non-structural / Structural Plan (environmentally preferable alternative) was not selected because it would leave 158 structures within the 100-year floodplain in Cadillac Heights without flood protection and would provide disproportionate flood protection within the project area, while requiring 1,027 acres of mitigation; and the Recommended FSP which provides the maximum protection to the project area, while requiring 1,179 acres of mitigation, best satisfies cost-effectiveness, social, and environmental acceptability criteria and is the locally preferred plan.

ENVIRONMENTAL CONSIDERATIONS IN THE FINAL GENERAL REEVALUATION REPORT AND INTEGRATED ENVIRONMENTAL IMPACT STATEMENT

Compliance with applicable environmental review and consultation requirements has been accomplished through coordination of the Final General Reevaluation Report and Integrated Environmental Impact Statement. In addition to satisfying the Fish and Wildlife Service Coordination Act, full compliance has been accomplished with the Clean Water Act, including the preparation of a Section 404(b)(1) analysis, Clean Air Act, Comprehensive Environmental Resource Compensation and Liability Act, Resource Conservation and Recovery Act, Endangered Species Act, National Historic Preservation Act, Floodplain Management (Executive Order 11988), Section 9 (33 U.SC. 401) and Section 10 (33 U.S.C. 403) of the Rivers and Harbors Act of 1899, and Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (Executive Order 12898). The General Reevaluation Report and Integrated Environmental Impact Statement are being submitted to Congress to satisfy the requirements of Subsection 404(r) of the Clean Water Act [33 U.S.C. 1344(r)]. Subsection 404(r) waives the requirement to obtain the state water quality certification and requires that the project EIS be submitted to Congress prior to appropriation of funds for the project. The integrated project EIS provides information regarding the effects of the discharge of dredged or fill material, related to project construction of the Recommended FSP.

A signed Programmatic Agreement with the Advisory Council on Historic Preservation, Texas Historic Preservation Office, and other interested parties has been developed to address cultural resources with due diligence.

All practicable means to avoid or minimize environmental impacts have been adopted and were incorporated in the development of the Recommended FSP. The Final Fish and Wildlife Coordination Act Report, dated February 3, 1999, has been coordinated with Texas Parks and Wildlife Department. The conclusion was that if the Recommended FSP is implemented, the project should include the acquisition and intensive management of a minimum of 1,179 acres of terrestrial habitat, including 926 acres of bottomland hardwoods and reforestation of 253 acres of mixed grass-forb lands. Once the environmental restoration and mitigation features have been turned over to the non-Federal sponsor for long term operation and maintenance, a program to monitor the success of the environmental restoration and mitigation features of the project will be initiated. The U.S. Army Corps of Engineers, Fort Worth District, will conduct annual inspections of the environmental restoration and mitigation areas and any deficiencies would be documented. Enforcement procedures to rectify any deficiencies in the environmental restoration or mitigation features will be adopted and jointly implemented by the non-Federal sponsor and the U.S. Army Corps of Engineers. The non-Federal sponsor will be responsible for all Operation, Maintenance, Repair, Rehabilitation, and Replacement requirements of the environmental restoration and mitigation features.

CONCLUSIONS

I have reviewed and evaluated all documents concerning the Fort Worth District Engineer's recommendation, including the views of other interested agencies and the general public, and have considered prevailing administrative policies and procedures. Based on these factors, I find the Recommended FSP as contained in the Final General Reevaluation Report and Integrated Environmental Impact Statement, dated February 1999 (Revised September 1999), suitable for use as a plan for implementation of flood damage reduction, environmental restoration, and recreation at Dallas, Texas. I further conclude that the Dallas Floodway Extension project should be implemented as soon as practicable.

Based on the conditions set forth in the Fort Worth District Engineer's findings and the conditions set forth herein, I conclude that the public interest is best served by the decisions as set forth herein.

H. V. W.

HANS A. VAN WINKLE
Major General, U.S. Army
Deputy Commander for
Civil Works

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

REPLY TO
ATTENTION OF:

RECORD OF DECISION
PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT
UPPER TRINITY RIVER BASIN
TRINITY RIVER, TEXAS

Study Authority, History and Objectives

The Programmatic Environmental Impact Statement (PEIS) describes and addresses cumulative impacts identified to date related to reasonably foreseeable Corps of Engineers actions that might result from ongoing Upper Trinity Feasibility Studies. These studies are being conducted in response to the authority contained in the United States Senate Committee on Environment and Public Works Resolution dated April 22, 1988, as follows:

> *Resolved by the Committee on Environment and Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on the Trinity River and Tributaries, Texas, House Document No. 276, Eighty-Ninth Congress, and other pertinent reports, with a view to determining the advisability of modifying the recommendations contained therein, with particular reference to providing improvements in the interest of flood protection, environmental enhancement, water quality, recreation, and other allied purposes in the Upper Trinity River Basin with specific attention on the Dallas-Fort Worth Metroplex.*

Existing environmental and socioeconomic resources of the study area are described in the PEIS. Likewise, past actions of the Corps and other entities within the study area are identified, along with an analysis of the effects that those actions have had on study area resources. The Corps and its project sponsors have constructed four Congressionally Authorized floodways and five multiple purpose reservoir projects within the upper Trinity River Basin. A fifth major floodway, the Dallas Floodway Extension Project (DFE), was authorized for construction in 1965 and modified in 1999 to include ecosystem restoration and recreation as project purposes. The DFE Project is considered to be in-place for defining baseline conditions. Additionally, under the Corps' Continuing Authority Programs, twelve projects for local flood damage-reduction, three projects for streambank stabilization, and one project for ecosystem restoration have been constructed within the study area. Collectively, these projects have directly altered and impacted the region's natural and cultural resources. They have further contributed to secondary impacts on these resources as population growth and associated land use intensification have occurred within the study area.

The primary objectives of the evaluations in the PEIS were: 1) provide a synopsis of existing conditions within the overall study area for key areas of concern, primarily hydraulic and floodplain environmental features; 2) describe changes in conditions since the Trinity Regional Environmental Impact Statement was completed in 1988; 3) address the programmatic effects of potential projects which could result from the Upper Trinity River Basin Feasibility Study; 4) identify reasonably foreseeable projects of others within the study area; 5) disclose direct, indirect, and cumulative impacts of potential Corps of Engineers projects relative to reasonably foreseeable projects of others.

Proposed projects considered in the PEIS

The study area is generally defined as the standard project floodplain (SPF) of the Trinity River in the Dallas and Fort Worth Metroplex. This area has undergone extensive alterations in the past 50 years due to rapid urbanization, the construction of various flood control and water supply reservoirs, major channel/levee projects, and numerous smaller projects which have affected the physical characteristics of the Upper Trinity River watershed. In addition, baseline conditions for cumulative assessment within the study area for the Upper Trinity River Feasibility Study assume the authorized Dallas Floodway Extension (DFE) project to be in-place. Originally authorized in 1965, the Dallas Floodway Extension project was modified by the Water Resources Development Act of 1999 (Public Law 106-053), Section 356, to include environmental restoration and recreation as project purposes. The Final EIS for the DFE project was circulated for public comment during the spring of 1999 and the Fort Worth District Engineer signed the Record of Decision on December 1, 1999. Project construction is scheduled to commence in January 2003.

Approximately 90 potential projects, which provide for flood damage reduction, ecosystem restoration, water quality, and recreation outputs, were identified within the study area during the course of the Upper Trinity River Feasibility Study. Of these, three potential Corps of Engineers projects have been carried into detailed feasibility studies and are addressed in detail in the PEIS. These projects include the Johnson Creek project, in Arlington, the Stemmons North Industrial project, in Dallas, and the Dallas Floodway project, in Dallas. A Feasibility Study Cost Sharing Agreement was signed for a fourth study in February 2000 during preparation of the Draft PEIS. The local sponsor for the West Fork and Clear Fork project is the Tarrant Regional Water District. This study will focus on ecosystem restoration, and flood damage reduction needs and opportunities. Study plans are under development and thus, no details are provided in the Final PEIS.

The authorized plan for Johnson Creek consists of the acquisition and removal of 140 structures from the 25-year floodplain. Recreation features would include 2.25 miles of concrete trails, information kiosks, security lighting, drinking fountains, and footbridges spanning the creek, 70 uncovered picnic sites and a pavilion. Ecosystem restoration measures include acquisition of 155 acres of undeveloped areas within the corridor. The undeveloped area includes 61 acres of grassland and 94 acres of riparian forest. Forest management techniques will be employed to improve the quality of habitat for wildlife. Recreation features including a concrete hike/bike trail will also be added to the ecosystem restoration lands. Project construction is scheduled to begin in November 2000.

The Stemmons North Industrial Corridor is generally bounded by the Elm Fork on the west and south, Loop 635 on the north, and IH-35 on the east. Present development of the area includes extensive commercial and industrial activities with mixed multi-family and high-density residential areas. A structural plan consisting of a levee and floodwall providing 500-year flood protection to approximately 1000 acres along Mañana Street has been preliminarily identified to be feasible. An earthen levee would begin at Interstate 35 (Stemmons Freeway) on the north side of Mañana Drive and extend west to Wasco Creek. An intermittent earthen levee / concrete floodwall system would then be utilized, continuing south and west along the creek to the Burlington Northern Railroad track, then south along the railroad track to Northwest Highway. An earthen levee would then resume, extending south and east, and eventually tying in to the embankment of Loop 12. A non-structural plan, which would provide for buy-out and removal of structures within various flood zones does not appear feasible based on the studies conducted to date, but will be further investigated.

A flood damage reduction alternative was developed within the area of the existing Dallas Floodway to maximize the flood protection in the area behind the existing levees. This alternative would consist of raising the existing Dallas East and West Levees to a crest height 2 feet above the projected SPF water surface. An additional 18 inches of road base material would be placed on top of the impervious fill to accommodate vehicular traffic for maintenance and inspections. No excavation of fill material would occur beneath any of the bridges. A separate environmental quality (EQ) alternative was also developed for the Dallas Floodway area. The objectives of the EQ alternative were to improve the environmental character of the study area to benefit fish and wildlife habitat, water quality, and aesthetic properties while minimizing adverse impacts to existing cultural resources and flood damage reduction benefits. The EQ alternative consists of excavating a new meandering, low-flow channel between the levees, the establishment of forested areas and additional wetlands, and raising the levees to provide a flood damage risk comparable to the "Future Without Project", or "No Action", alternative condition. Trees would be planted along the top of the bank of the meandering channel on one side at a minimum width of 100 feet. Other tree planting zones would be established in random locations within the floodplain.

Existing depressions in the floodplain would be preserved or enhanced to provide seasonal wetland functions and to support wetland vegetation. No structures for the purposes of water management of individual wetland sites are proposed.

An array of other reasonably foreseeable projects being proposed by other entities was also reviewed and has been included in the PEIS where sufficient details were available to evaluate their cumulative effect on water and related land resources. In 1998, the Texas Department of Transportation (TxDOT) completed a Major Transportation Investment Study (MTIS) encompassing much of the Upper Trinity River study area within the City of Dallas. Based upon support from the City of Dallas and the North Texas Tollway Authority, the Federal Highway Administration, on June 17, 1999, issued Notice of Intent to prepare an Environmental Impact Statement on the Trinity Parkway. The EIS will address four alternative alignments for the Trinity Parkway which will include: 1) combined parkway constructed on the East levee of the Dallas Floodway, 2) split parkway constructed on the riverside slopes of the Dallas Floodway East and West levees, 3) split parkway constructed on the landside slopes of the Dallas Floodway East and West levees, and 4) modifying or reconstructing the existing Industrial Boulevard to accommodate increased traffic load. Each of these alternatives is assessed in preliminary detail in this PEIS.

The City of Dallas Trinity River Corridor Master Implementation Plan, dated August 1999, was also reviewed and included in the PEIS. This plan proposes a series of lakes, a split river channel, constructed wetlands, recreation trails, parklands, grasslands, and pedestrian bridges. The lakes and split river channel would involve one large lake, minimally 135 acres in size with options to expand to 235 acres, and other smaller lakes or wetlands within the existing Dallas Floodway. A combination of groundwater and Central Wastewater Treatment Plant effluent, polished by wetlands, is currently being considered as a possible source of water for the lakes. The main river channel would be split into two channels running parallel to the levee on either side of the lower half of the Dallas Floodway. The lakes would be located between the split channels with a raised berm surrounding the lakes to prevent floodwater inundation of the lake up to a 2-year flood event. This alternative could also include all of the water-related recreational features mentioned. Different variations of this alternative are being considered with selected alternatives for the proposed Trinity Parkway route. The Trinity River Corridor Master Implementation Plan also proposes upgrading of several bridges that cross the Floodway slated for replacement to attain "signature" status. These bridges were not evaluated in this PEIS because their designs have not been sufficiently developed to allow evaluation.

Summary of Major Environmental Findings and Cumulative Effects

The studies conducted to prepare this PEIS indicate clearly that extensive changes in land use within the 100-year and standard project floodplains of the study area have continued to occur since 1988 within the study area. That date represents the date of the Trinity Regional EIS and Record of Decision. Cumulative hydraulic impacts have not been as significant as have impacts to vegetative cover within the study area. The greatest cumulative impact identified has been to the extent of floodplain forested resources. Habitat quality evaluation of the remaining forested areas was not conducted, however, it is likely that overall fragmentation of forest as a result of floodplain encroachments has also cumulatively diminished value for wildlife that utilized floodplain forest resources.

An analysis of cumulative impacts of various potential Corps of Engineers projects or alternatives was made in combination with selected features of the North Texas Tollway Authority's (NTTA) proposed Trinity Parkway and the City of Dallas' Trinity River Corridor Master Implementation Plan alternatives. The authorized Johnson Creek Project would contribute favorably in the areas of forested resources, floodplain recreation, natural floodplain values, aesthetics, and public services and community structure. The Stemmons corridor would have little cumulative effect on any factors other than hydraulics, but the levees would be slightly negative in terms of aesthetics and natural values while the non-structural alternative would be slightly beneficial in regard to those same parameters. The effects of the Stemmons alternatives on the hydraulics of other projects vary, depending upon the alternative considered.

Among the alternatives considered in the area of the Dallas Floodway, the, EQ, plan would be the most beneficial in terms of forested resources, floodplain recreation, natural floodplain values, and aesthetics, but without appropriate hydraulic mitigation would have the effect of increasing the flood risk for upstream floodplain areas not protected by the Dallas Floodway levees. The optimal flood damage reduction plan would be essentially neutral in terms of impacts on other resources, unless significant ecosystem restoration and recreation features were to be included. The "Lakes Only" Plan, if implemented by the City of Dallas, would have a slight negative effect on forested resources, or minimal effect with substantial plantings. This project should also be beneficial in terms of recreation and aesthetics. The NTTA Parkway alternatives, all of which would include the "Chain of Lakes", would have slightly negative to no effect (with substantial plantings) on forested resources, slightly negative effects on environmental justice issues and community structure and essentially a neutral effect on hydraulics.

Areas of Controversy

The potential for cumulative adverse impacts created the need to address the environmental consequences of all reasonably foreseeable proposed actions. Concerns were raised over the number and scope of potential projects being proposed for implementation by the Corps and others. The cumulative effects of various projects on flood damages and natural floodplain functions are considered to be controversial. Structural measures implemented to reduce flood damages often adversely impact natural flood plain values. Thus, many often consider use of flood plains controversial for purposes contrary to their natural function. Issues identified early in the public involvement process as controversial remained so throughout the review of the PEIS. Foremost among controversial issues was the proposal to place transportation features laterally within the floodplain, and the perception that the Dallas Floodway Extension project was being constructed in order to accommodate roadways between the existing levees.

Public Involvement

A Notice of Intent (NOI) to prepare a draft Programmatic EIS for the Upper Trinity River Basin was published in the *Federal Register* on November 8, 1996. The NOI provided background information related to the Upper Trinity Study, current status of ongoing studies and rationale for preparing the PEIS.

Notice of Public Scoping Meetings was mailed to all known interested parties on December 11, 1996. Scoping meetings were held on January 7, 1997 in Dallas, and on January 9, 1997 in Arlington, Texas. The Dallas meeting was held at the Downtown Public Library with approximately 50 individuals in attendance and 10 providing comments. The Arlington meeting was held in the City Council Chambers and 35 individuals attended. Four speakers presented comments. Major issues and concerns rose from these meetings dealt with the need for preservation of environmental quality, along with protection of life and property from flood damages. Another area of concern included overlapping of the PEIS study area with that of the proposed Dallas Floodway Extension (DFE) project area and any action undertaken on the DFE proposal prior to completion of the PEIS. The public also raised issues about the potential adverse impacts of multiple projects proposed within the Trinity River floodplain along the Dallas Floodway, the Elm Fork adjacent to Stemmons Freeway, and the West Fork on important ecosystem resources such as riparian and bottomland forests and wetlands. Issues also arose on the effects these multiple projects possibly would have on the ability of existing, and other proposed flood damage reduction projects to provide desired levels of flood protection. Concerns were also raised about the possible negative effects of the proposed Trinity Parkway on recreational use and West Dallas community cohesion.

In addition to the above-mentioned scoping meetings, other avenues provided opportunities to gather input for use in development of an understanding of the range of needs, opportunities and potential solutions identified that were addressed during the PEIS preparation. This included holding various meetings, on a recurring basis and additional coordination with multiple local, state and federal agencies and the City of Dallas to gather input needed to fulfill the NEPA process.

The Draft PEIS was filed with EPA in the Federal Register on December 17, 1999, and a Public Meeting was held in Dallas on January 13, 2000. Approximately 75 individuals attended the meeting with formal statements received from 31 of those present. The official comment period on the Draft EIS remained open through February 22, 2000, to allow others to provide written comments on the draft PEIS.

The principle issue of concern raised at the meeting was the location of the proposed tollway. Because of several verbal requests received at the public meeting, the public comment period was extended for an additional two weeks beyond the original 54-day comment period.

A total of 37 letters were received commenting on the Draft PEIS. Technical comments focused on the hydraulics and hydrology, water quality, community cohesion, recreation, and access to and from the Dallas Floodway considering the effects of the tollway. The business and industrial interests generally spoke in favor of a tollway between the levees. Several comments questioned the rationale for assuming the Dallas Floodway Extension to be in-place and commented specifically on features of that project which was documented previously under NEPA in the completed DFE EIS. Additional information was added to the PEIS to clarify cumulative impacts identified in the draft.

The Final PEIS was available for public review from June 30, 2000 to July 31, 2000. Five letters of comment were received addressing similar issues raised during review of the draft PEIS. All comments received on the Draft and Final PEIS were fully considered during the formulation of the Record of Decision for the PEIS.

Conclusions and Recommendations

Based upon analyses and findings developed as a result of preparation of this PEIS and the public comments received during review of the draft and final document, I have determined that any of the projects being considered by the Corps and other entities could likely be implemented provided appropriate environmental and hydraulic mitigative measures are followed. These mitigative measures include avoidance and minimization of impacts. This Record of Decision is not intended to replace regulatory criteria associated with the 1988 Trinity Regional EIS Record of Decision and the local communities' Corridor Development Certificate process. Those review mechanisms, along with new emphasis on floodplain management provided by Section 202(c) of Water Resources Development Act of 1996 provide support to bolster my commitment to protect and mitigate important floodplain resources. Ecosystem values and hydrology and hydraulics will continue to be given full consideration whenever the Corps has a role in the decision-making regarding potential floodplain modifications within the study area. Corps higher authority will continue to review the various proposals as they progress and will have final policy approval of proposed Corps project or permit actions. Any of the projects discussed and considered in this PEIS that may be carried forward for implementation must be carefully planned and designed to avoid or minimize adverse direct and cumulative impacts. Mitigation will be required to compensate for identified unavoidable adverse effects to existing hydrological and hydraulic conditions and to environmental resources of regional and national importance such as wetlands, riparian woodlands and recreation and other uses related to flood plains.

Gordon M. Wells
Colonel, Corps of Engineers
District Engineer

Date: September 15, 2000

DALLAS FLOODWAY EXTENSION

TRINITY RIVER BASIN, TEXAS

GENERAL REEVALUATION REPORT
AND
INTEGRATED
ENVIRONMENTAL IMPACT STATEMENT

Prepared by

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February 1999
(Revised: 13 August 1999)

(301)

GENERAL REEVALUATION REPORT
AND
INTEGRATED
ENVIRONMENTAL IMPACT STATEMENT

Responsible Agencies: The responsible lead agency is the U.S. Army Corps of Engineers, Fort Worth District.

Abstract: This document focuses on the portion of the Trinity River which flows through the southeast sector of the city of Dallas, Texas. The purpose of this study is to reevaluate the feasibility of implementing a previously authorized flood control project. This document addresses the economic and environmental feasibility and impacts of the authorized plan, and reformulated alternatives and recommendations. The flood control alternatives and recommendations previously developed by the Corps were reevaluated based on the current level of economic development and ecological value. As a result, a wide array of structural and non-structural alternatives were developed and investigated by the Fort Worth District. Based on the investigations performed, construction of an off-channel flood control swale incorporating environmental restoration in the form of a chain of wetlands, Standard Project Flood (SPF) levees on both sides of the river, and recreation facilities was found to be the best alternative for the study area, and is the Recommended Plan for this portion the Trinity River Basin. The term "Standard Project Flood" or "SPF", as used throughout this document, is defined as the flood that may be expected from the most severe combination of meteorologic and hydrologic conditions that are considered to be reasonably characteristic of the geographical region involved, excluding extremely rare combinations. The SPF usually has a 0.3 to 0.08 percent probability of being equaled or exceeded in any year, and is usually between 40 and 60 percent of a Probable Maximum Flood (PMF). The SPF represents a "standard " against which the degree of protection for a project may be judged and compared with protection provided at similar projects in other localities. For this project site, the SPF has a 0.125 percent probability of exceedance.

If you require further information on this document, contact:

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Note: This report includes an integrated environmental impact statement (EIS) within the report text; paragraphs required for compliance with the National Environmental Policy Act (NEPA) are noted by an asterisk in the Table of Contents.

GENERAL REEVALUATION REPORT
AND
INTEGRATED
ENVIRONMENTAL IMPACT STATEMENT

SYLLABUS

SUMMARY

This General Reevaluation Report presents the results of investigations conducted to identify water and water related land resource needs of the Dallas Floodway Extension floodplain within the Trinity River Basin in the city limits of Dallas, Texas. The report is a comprehensive reevaluation of an authorized project and of the current flood control, environmental restoration, and recreation needs. The Authorized Plan was one of five local flood protection projects authorized for construction by Section 301 of the Rivers and Harbors Act (Public Law 89-298), approved on October 12, 1965, as part of a basinwide plan of improvement for the Trinity River and Tributaries, Texas. The authorized plan of improvement consisted of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection with a design flow capacity of 270,000 cubic feet per second. The plan consisted of a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek.

In accordance with 33 CFR Parts 230 and 325 (ER200-2-2), "Environmental Quality; Procedures for Implementing the National Environmental Policy Act (NEPA)," dated 3 February 1988, the Environmental Impact Statement is integrated into this report. These studies were conducted under the authority of Section 301 of the Rivers and Harbors Act of 1965.

Historic flooding and damages were investigated and details of their effects are included in this report. The project study area extended along the Trinity River from the end of the existing Dallas Floodway to the north and extending southwest to the confluence of Five Mile Creek, a distance of approximately 9.5 miles. The entire area experienced severe property damages in May 1989 and May 1990 flood events. A total of 2,550 structures are located within the existing hydrologic condition Standard Project Floodplain of the study area downstream of the existing Dallas Floodway. Based on October 1998 prices, these structures are estimated to sustain equivalent annual damages of approximately $6.8 million. In addition, over 10,500 structures are located within the existing Standard Project Floodplain of the existing Dallas Floodway just upstream of the primary study area. Based on October 1998 prices, these structures are estimated to sustain equivalent annual damages of approximately $13.6 million.

A wide range of structural and non-structural flood control measures evolved from the analysis of available economic, environmental, engineering, and social data during the course of this study. Non-structural alternatives included flood proofing, relocation, and permanent evacuation. The structural alternatives analyzed during the preliminary screening included channelization, clearing and grubbing, detention dams, swales, levees and combination plans. Additionally, several variations of the final concept were analyzed to insure that the solution was properly located and sized to provide the highest net annual benefits.

The construction of two 1,200-foot bottom width swales were found to produce the greatest net benefits. The proposed swales, extending from upstream at the end of the existing Dallas Floodway downstream to approximately 2,000 feet below Loop 12, are separated at Interstate Highway (IH) 45. This plan was identified as the National Economic Development (NED) Plan.

Public opposition to the environmental impacts which the NED Plan would cause to the forested areas along the Trinity River prompted the city to request investigation of less environmentally detrimental alternatives. The Chain of Wetlands Plan emerged as the initial Locally

Preferred Plan (LPP), and was formally adopted by the Dallas City Council on August 28, 1996, with the caveat that the addition of levees to the plan would be further investigated. This plan included smaller swales, located as far west of the river as engineeringly and economically feasible to avoid the most pristine bottomland hardwood areas closer to the river, and included excavated wetlands and vegetative plantings added as environmental restoration features within the footprint of the swales. Recreation facilities compatible with the regional recreation master plan were added to this plan.

A comparative analysis between the NED Plan and the Chain of Wetlands Plan showed that the chain of wetlands would provide fewer net benefits than the NED Plan, but would also have a lower estimated first cost. From an environmental standpoint, the NED Plan would require acquisition of approximately 3,200 acres for mitigation, while the chain of wetlands would require only about 650 acres of mitigation. Based on these findings, and on the expected difficulty in implementing the NED Plan from a public acceptability standpoint, the chain of wetlands was designated as the first increment of the Federally Supportable Plan, in lieu of the NED Plan. The Cadillac Heights and Lamar levees were then investigated for possible inclusion in the Federally Supportable Plan.

The Chain of Wetlands Plus Levees Plan, which included SPF levees protecting the Lamar and Cadillac Heights areas, in addition to the features of the Chain of Wetlands Plan, emerged to meet the needs of the local sponsor, providing much needed flood protection to the neighborhoods within the study area comparable to the protection provided to the Central Business District by the existing Dallas Floodway. This plan was adopted as the final LPP by the Dallas City Council on March 26, 1997. Recreation facilities were also added to this plan.

Congressional legislation, passed in October 1996, in the form of the Water Resources Development Act (WRDA) of 1996, provided for credit toward the non-Federal share of the total project costs for the advanced construction of the portions of the Central Wastewater Treatment Plant Levee and the Rochester Park Levee deemed compatible with the authorized project. These non-Federal levees were constructed by the city following the devastating floods of 1989 and 1990. The total cost of this construction was approximately $27.0 million; however, the portion deemed compatible with the Recommended Plan was estimated at approximately $23.1 million. Of this amount, approximately $0.9 million was spent for lands, easement, rights-of-way and disposal areas (LERRD), which would be creditable to the sponsor as part of the overall LERRD requirements. Therefore, a maximum of approximately $22.2 million was creditable to the sponsor as compatible construction costs under the provisions of WRDA 1996.

In the April 1998 draft of this report, the Federally Supportable Plan (FSP) was identified as a plan that, except for the levee protecting the Cadillac Heights neighborhood, would provide a Standard Project Flood (SPF) level of protection at a high degree of reliability. In this plan, the Cadillac Heights Levee would only provide protection from the flood that would have a 1.0 percent chance of exceedance in any one year, with a 34.0 percent reliability. Upon further analysis, it was determined that the FSP is that plan that provides SPF protection for the entire Dallas Floodway Extension project for the following reasons. First, the alternative levee for the Cadillac Heights neighborhood would not meet the Federal Emergency Management Agency standards for protecting the area from a flood that would have a 1.0 percent chance of exceedance in any one year, nor would it provide an acceptable level of reliability, particularly when compared with other project elements. Second, the alternative levee for Cadillac Heights would allow continued damages in this area from major, although infrequent floods (greater than the flood that would have a 1.0 percent chance of exceedance in any one year), due to the construction of other project levees. Finally, Congress has already authorized the project, including the Cadillac Heights Levee, at a SPF level of protection. For the reasons noted above, the project providing a consistent SPF level of protection is the Federally Supportable Plan, and is therefore the Recommended Plan. The report has been modified to reflect this decision-making process as follows:

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- Throughout Chapter 4, the plan identified as the Federally Supportable Plan (FSP) in the draft report has been renamed as the Tentative Federally Supportable Plan (TFSP).

- In Chapter 5, following the optimization analyses for the Cadillac Heights and Lamar levees, and following the "BASIS FOR REQUEST FOR EXCEPTION" section, a new section entitled "ASA(CW) DECISION REGARDING REQUEST FOR EXCEPTION" has been inserted. This new section presents the pertinent data utilized in this decision-making process and identifies the project providing a consistent SPF level of protection as the Federally Supportable Plan. This plan is subsequently designated as the Recommended Plan.

- Chapter 6 presents final detailed information for the Recommended Plan, incorporating the revisions made per comments received since the release of the draft GRR/EIS, and updating costs to reflect October 1998 price levels and the current Federal interest rate of 6-7/8%.

An environmental mitigation plan for the Recommended Plan would involve acquisition of 1,179 acres in additional project lands. This plan would include acquisition, improvement and management of 926 acres of bottomland hardwood, and acquisition of 253 acres of mixed grassland/forbland, of which 223 acres would be aggressively converted to bottomland hardwood forest while the remaining 30 acres would be managed as grassland. The mitigation plan was estimated to cost approximately $4.7 million.

Environmental restoration features include the addition of 123 acres of emergent wetlands within the excavated flood control swale at an estimated cost of approximately $5.6 million. This restoration plan would provide an increase of 184 average annual habitat units (AAHU) at a cost per AAHU of $2,532.

The recreation component of the Recommended Plan would include construction of 18 miles of hike/bike trail, 8.5 miles of natural surface equestrian trail, 5 miles of natural surface nature trail, picnic areas and rest stop areas. Seven access areas are proposed, one of which would require no modifications. Three of the remaining six would be located at existing parks or areas with adequate parking facilities and would require minimal modifications. Three new access areas are also proposed. The total cost of the recreation facilities was estimated at approximately $5.4 million.

The original Dallas Floodway Extension project, authorized in 1965, contained levee, channel, and lake features designed to provide SPF protection to both the northern and southern portions of the city of Dallas. The current Recommended Plan provides for similar outputs at a lower total project cost. The current estimated cost of the authorized improvements to the Dallas Floodway Extension area, at October 1998 price levels, would be $202.7 million. Total annual benefits for the authorized project are estimated at $13.2 million. Under current economic conditions, the authorized project has negative net benefits of $3.0 million, with a BCR of 0.82. Comparatively, the Recommended Plan, as presented herein, would have an estimate first cost of approximately $127.2 million, and would yield total annual benefits of approximately $19.1 million, net annual benefits of $9.8 million, and a BCR of 2.06.

It has been recommended in this document that the non-Federal sponsor be authorized credit, in accordance with Section 351 of WRDA 1996, for the advanced non-Federal construction of the Central Wastewater Treatment Plant Levee upgrade and the portion of the Rochester Park Levee compatible with the Recommended Plan. The preliminary estimate for this compatible construction, subject to an audit for reasonableness, allocability, and allowability, is approximately $22.2 million. The Federal and non-Federal cost apportionments for the Recommended Plan are estimated at $83.6 million (65.7%) and $43.6 million (34.3%), respectively. The aforementioned credit in the amount of approximately $22.2 million was applied toward the non-Federal share of the flood control project costs.

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MAJOR CONCLUSIONS

The Recommended Plan was analyzed to ensure that its design, construction and operation components are the most effective means to accomplish the project's objectives.

The final array of alternatives formulated by the Fort Worth District, has been evaluated in accordance with traditionally required Federal evaluation procedures. These include procedures from the "Principles and Guidelines", the National Environmental Policy Act (NEPA), and other Federal environmental review and consultation requirements.

Consideration has been given to all significant aspects in the overall public interest, including engineering feasibility and economic, social, and environmental effects. The Recommended Plan described in this report provides the best solution for meeting the objectives of the Dallas Floodway Extension study area.

FURTHER ACTIONS

This General Reevaluation Report and Integrated Environmental Impact Statement will be transmitted to Headquarters for the Washington-level review process. A Chief's Report will be prepared by Headquarters, providing recommendations to the Assistant Secretary of the Army for Civil Works (ASA(CW)). The ASA(CW), representing the Secretary of the Army, will coordinate the documents with the Office of Management and Budget.

Following approval of this document, the next reporting step for the Dallas Floodway Extension project will involve the conduct of a Value Engineering (VE) study for various features of the project, followed by the preparation of Design Documentation Reports (DDR), development of plans and specifications, and subsequent implementation.

LIST OF ACRONYMS

AAHU	Average Annual Habitat Units
ASA(CW)	Assistant Secretary of the Army (Civil Works)
BCR	Benefit-to-Cost Ratio
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DFE	Dallas Floodway Extension
EIS	Environmental Impact Statement
FSP	Federally Supportable Plan
HQUSACE	Headquarters, United States Army Corps of Engineers
HTRW	Hazardous, Toxic and Radiological Waste
LPP	Locally Preferred Plan
NCTCOG	North Central Texas Council of Governments
NED	National Economic Development
NEPA	National Environmental Policy Act
SWD	Southwestern Division (Corps of Engineers)
TNRCC	Texas Natural Resource Conservation Commission
TORP	Texas Outdoor Recreation Plan
UFORE	Urban Forest Effects (U.S. Department of Agriculture Model)
USFWS	United States Fish and Wildlife Service
WRDA	Water Resources Development Act

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*B	Geotechnical Engineering
*C	Civil/Structural Design and Relocations
*D	Economics
*E	Real Estate
*F	Environmental Resources (Including Section 404(b)(1) Evaluation)
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CHAPTER 1

INTRODUCTION

CHAPTER 1
INTRODUCTION

This General Reevaluation Report and integrated Environmental Impact Statement documents the results of a comprehensive reevaluation of the authorized Dallas Floodway Extension Project located in the Trinity River Basin, Texas. These analyses update all pertinent information and reevaluate the water resource needs of the study area based on current hydrologic, economic and environmental conditions and criteria.

PROJECT AUTHORITY

Authority for construction of water resource development features described in the Comprehensive Survey Report on Trinity River and Tributaries, Texas (reprinted as House Document 276/89/1) is contained in Section 301 of the Rivers and Harbors Act approved 27 October 1965 (Public Law 89-298).

The authority granted by the resolution is commonly known as the Trinity River and Tributaries Basinwide Study Authority. All studies conducted under this authority serve as an interim response to the basinwide authority, and do not close out the granting authority.

THE AUTHORIZED PLAN

The Dallas Floodway Extension is one of five local flood protection projects authorized for construction in 1965 as part of a basinwide plan of improvement for the Trinity River and Tributaries, Texas. The authorized plan of improvement consisted of a combination flood control channel and floodway levees which would provide a Standard Project Flood (SPF) level of protection. The plan consisted of a 22-mile levee and floodway system with a 9.1 mile residual channel along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek. Figure 1-1 depicts the features of this plan.

A General Design Memorandum (GDM), which assessed the plan in greater detail, was completed in 1981. In 1985, however, work on the Dallas Floodway Extension Project was suspended following a failed city of Dallas bond election aimed at providing support for the project. Final approval of the 1981 GDM was discontinued, resulting in the retention of the 1965 plan as the authorized plan.

PARTICIPANTS AND COORDINATION

This reevaluation was conducted by the Fort Worth District, U.S. Army Corps of Engineers, and utilized a multi-disciplined team analysis concept. Coordination was maintained during the study with state and local government officials and agencies, the news media, local interest groups and citizens in the Dallas area. The regional office of the Natural Resources Conservation Service (NRCS), formerly known as the Soil Conservation Service, furnished applicable soil information and elevation data. Landfill information was obtained from the Texas Natural Resource Conservation Commission (TNRCC). The Federal Emergency Management Agency was also consulted for pertinent floodplain information. Direct coordination was maintained with the Texas State Historic Preservation Officer and the U.S. Fish and Wildlife Service in accordance with the National Historic Preservation Act and the Fish and Wildlife Coordination Act.

The Texas Department of Transportation provided bridge profiles and future transportation project information which could impact the study area. The Environmental Protection Agency and the Texas Parks and Wildlife Department were also consulted. Local coordination efforts involved the Dallas County Tax Appraisal District, Dallas County Open Space, and the City of Dallas Public Works, Parks and Recreation, Sanitation, and Water Utilities Departments.

STUDY PURPOSE AND NEED

The primary purpose of this study was to respond to a request by the city of Dallas to re-activate the authorized Dallas Floodway Extension Project. Following the severe flood event of 1989, the city of Dallas requested reactivation of the authorized Dallas Floodway Extension project. The project was reactivated in 1990 under the provision that a general reevaluation be conducted prior to construction. This reevaluation was required due to new environmental and economic criteria, as well as significant land use changes within the study area. Specifically, the new criteria and changes include:

New Criteria:

- No net loss of wetlands
- Chief of Engineers Strategic Directive for Environmental Engineering
- Corps primary mission includes Environmental Protection
- Undeveloped lands cannot be used to justify a Federal project
- Project evaluation based on a risk and uncertainty analysis

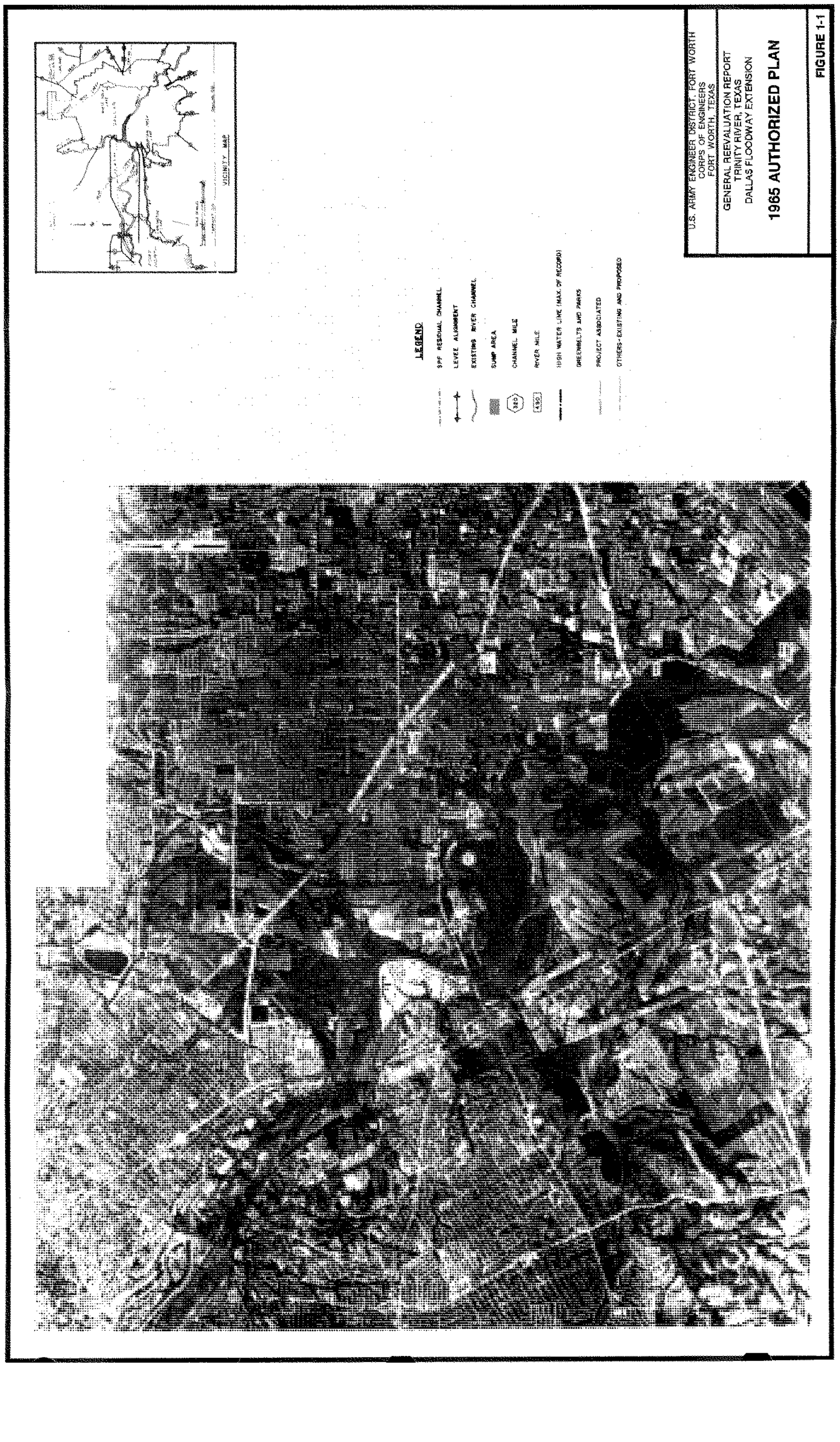
Land Use Changes:

- Acquisition and removal of residential structures in the Roosevelt Heights and Floral Farms subdivisions
- Construction of the Rochester Park Levee
- Raising of Central Wastewater Treatment Plant Levee

The modified project resulting from most recent reevaluations was designed according to current economic, environmental and design criteria.

PRIOR STUDIES AND REPORTS

Numerous studies have been conducted regarding flooding and emergency streambank erosion, water quality and water resource development within the Trinity River watershed. The following paragraphs provide pertinent information on previous studies and reports prepared by the Corps of Engineers and other Federal and State agencies which address water resource development within the Trinity River Watershed.



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
1965 AUTHORIZED PLAN
FIGURE 1-1
LEGEND
SPF RESIDUAL CHANNEL
LEVEE ALIGNMENT
EXISTING RIVER CHANNEL
SUMP AREA
CHANNEL MILE
RIVER MILE
HIGH WATER LINE (MAX. OF RECORD)
GREENBELTS AND PARKS
PROJECT ASSOCIATED
OTHERS-EXISTING AND PROPOSED
VICINITY MAP

CORPS OF ENGINEERS STUDIES AND REPORTS

Water Resources Development in Texas, 1971, 1981, 1988, 1989, 1991, and 1995. These reports were prepared by the Fort Worth District, Corps of Engineers. They provide current information about water resources activities conducted under the direction of the Secretary of the Army and the United States Congress. The information in these booklets have been consolidated to illustrate the role of the Corps in navigation, planning, construction, and operation of projects for flood control, hurricane flood protection, municipal and industrial waster supply, recreation, and other beneficial uses. Each booklet describes projects completed, under construction, or in the planning stage, and cites the specific authorization of Congress.

Report on Flooding, April - May 1990. This report provides a summary of the flood damages experienced and effectiveness of Fort Worth District projects between April and May of 1990. This report contains general information regarding storms and their impacts, a description of the rainfall and river basins that experienced heavy losses, flood losses sustained in the respective counties and cities significantly affected by the storm, and estimates of damages prevented by existing Corps of Engineers projects.

The Trinity River and all of its tributaries were above flood stage or bankfull stage for most of this time period. Flooding was experienced by private and public properties in the Dallas Fort Worth Metroplex. On May 2, 1990, the President declared the State of Texas a major disaster area because of the severe thunderstorms, flooding, and tornadoes that began in April and continued through early June 1990. Sixty-eight counties, with a total population exceeding five million and covering an area of almost 48,000 square miles, were declared as Disaster Areas.

Report on Flooding, May - June 1989. This report contains general information on the storms (and their resultant impacts) that occurred 3-5 May, 16-18 May, and 1-15 June 1989 in the Upper Trinity River Basin. Field investigations by Corps personnel were conducted primarily for making preliminary damage appraisals, determining high water marks, and obtaining stream flow data for selected rivers and streams. Urban reconnaissance surveys were conducted in the cities of Arlington, Burleson, Cleburne, Corsicana, Dallas, DeSoto, Duncanville, Euless, Everman, Fort Worth, Gainesville, Grand Prairie, Kennedale, Irving, Mansfield, Mesquite, Rendon, Watauga, and White Settlement, Texas. Field investigations were not conducted for approximately 75 additional counties that reported flooding. Information solicited included details on evacuation and flood fighting activities, damage estimates for private and public properties, agricultural damages, etc. A review of various local documents showed that flood related deaths numbered approximately 25.

Dallas Floodway Reconnaissance Report, February 1989. This study presents the results of a reconnaissance level investigation conducted on the Dallas Floodway under authority of Section 216, Public Law 91-611, in response to local concerns. Since completion of the floodway in 1959, substantial development has occurred in the upstream reaches of the Elm Fork and the West Fork of the Trinity River, causing a significant increase in the flood flows downstream. A structural plan was found to be economically feasible. The plan would entail enlarging the bottom width of approximately 49,000 feet of channel from 50 feet to 200 feet. Total first cost for this project was estimated at $45.5 million, with an average annual cost (including operation and maintenance) of $4.7 million. Total annual benefits were $5.1 million, yielding a benefit-to-cost ratio (BCR) of 1.1. Information from this report was used in the Upper Trinity River Basin reconnaissance study.

Upper Trinity River Basin, Reconnaissance Report, March 1989. This study presents the results of a reconnaissance level study conducted on the Upper Trinity River Basin under authority of United States Senate Committee on Environment and Public Works

Resolution, dated April 22, 1988, in response to local concerns. Based on the thirteen structural alternatives investigated, and the social and environmental impacts of each of these alternatives, eleven viable flood control projects were identified. These structural alternatives consisted of two detention structures, one channel modification plan, six levee enhancements, and two channel modification and levee combination plans.

Trinity River Project, Texas, Phase I General Design Memorandum, October 1981. This study investigated the following: (1) a multi-purpose channel from Fort Worth to Liberty, Texas; (2) the Tennessee Colony Lake; and (3) the Dallas Floodway Extension. The recommendations of this report included:

- The bottom width of the multi-purpose channel should be reduced from 320 to 200 feet. The narrower bottom width plan would produce a BCR of 1.8, and reduce adverse effects on the nearby marsh and commercial fisheries. This plan was recommended for approval.

- The Tennessee Colony Lake should be deferred until substantial amounts of lignite discovered at the site are removed.

- The Dallas Floodway Extension would provide Standard Project flood protection to about 98 percent of the residential and commercial units over a distance of 9.1 miles. About 5,000 acres would be preserved as greenbelt-open space-recreational area, with almost 2,000 acres of land in the protected area that would be of potential industrial development. Some additional flood control features are as follows:

    - Realignment and enlargement of the channel
    - Realignment and enlargement of tributary channels through levee areas
    - Construction of a parallel levees through low lying areas
    - Provision of interior drainage facilities
    - Provision of recreation facilities and greenbelt
    - Filling of areas outside levee areas with spoil material
    - Modification of bridges and construction of new roads
    - Acquisition of rights-of-way

Due to a lack of local sponsorship, action on approval of the Dallas Floodway Extension project, as proposed in this GDM, was not pursued.

Trinity River Project, Texas, Habitat Mitigation Report, December 1981. This report includes habitat and associated economic evaluations, and addresses habitat losses and mitigation requirements associated with the Multiple Purpose Channel to River Mile 45. The evaluations presented in this report indicate that the acquisition of approximately 11,700 acres of lands adjacent to Wallisville Lake lands is reasonable and justified to mitigate for terrestrial habitat losses caused by the Multiple Purpose Channel. Further, it is recommended that the project authorization be modified to include fee simple acquisition of the identified 11,700-acre mitigation area. This mitigation was subsequently authorized by the Water Resources Development Act of 1986.

Trinity River Project, Texas, Project Design Memorandum No. 4, Phase 1 General Design Memorandum, August 1974. The subject memorandum and accompanying Environmental Impact Statement presented a current update and re-analysis of the water resource plan. The memorandum covers that portion of the main stem of the Trinity River from the existing Fort Worth Floodway (River Mile 551.45) to Trinity Bay. Elements of the Trinity River Project recommended in this report included: a multiple-purpose lake at Tennessee Colony; an urban floodway on the West Fork between Dallas and Fort Worth; an extension of the existing Dallas Floodway downstream to Five Mile Creek; and a multiple-purpose channel from Fort Worth to Trinity Bay. This memorandum recommended that the economically justified plan be approved as a basis for further advanced planning and possible construction of the project. The estimated initial Federal construction cost of this recommended Trinity River Project (including navigation features) amounted to over $1.6 billion. Because of the failure of a March 1973 bond election for the Trinity Basin project funding by the TRA, Congress directed that no further study or planning of navigation features for the Trinity River Project be undertaken. The initial Federal construction cost of the Trinity River Project with deferral of navigation was estimated at $517.7 million.

Comprehensive Survey Report on Trinity River and Tributaries, Texas, June 1962. The report recommended a comprehensive plan for the development and control of the water and related land resources in the basin. The plan included five flood control projects, a multi-purpose channel, and four multi-purpose lakes. Flood control measures for the Dallas Floodway Extension included a total of 22 miles of levees and a 9-mile, 200-foot bottom width relief channel. The total estimated cost of the proposed plan was $101,000,000 (1962 price levels) with a BCR of 1.6. The estimated Federal share was $52,900,000. This plan of improvement consisted of 11 segments:

- Five local flood protection projects: West Fork Floodway, Elm Fork Floodway, Dallas Floodway Extension, Duck Creek Channel Improvements, and Liberty Levee.
- Four multiple-purpose lakes (Lakeview, Roanoke, Aubrey, and Tennessee Colony).
- A multiple-purpose channel along the Trinity River from the Houston Ship Channel to Fort Worth, Texas.
- A water conveyance system from Tennessee Colony Lake to Benbrook Lake for the improvement of water quality.

OTHER STUDIES AND REPORTS

Flood Insurance Study, Dallas County, Texas. Conducted for FEMA. This study investigated and revised data on the existence and severity of county-wide flood hazards, including the city of Dallas. The updated technical flood risk data was used to develop flood insurance rate maps, establish actuarial rates and promote sound floodplain management in conjunction with the guidelines of the National Flood Insurance Program.

Texas Water Commission, Trinity River Basin Study, September 1992. This study was mandated by the state of Texas Legislature (Senate Bill 1543), and was sponsored by State Senator Carl Parker. The Texas Water Commission was directed to investigate the flooding problems in the Trinity River Basin. Alternatives which were to be investigated by this study were: Pre-release of water in reservoirs, county regulations, reservoir operations, flood insurance programs, flood emergency operations, land treatment and watershed improvement.

The report concluded that the existing flood control programs can be responsive to a state policy when one exists. Alternative approaches to the traditional flood control programs are yet to be fully utilized by the State. Many of these alternatives take advantage of the natural flood plain characteristics that can moderate flood effects. Therefore, rather than creating vast new programs, the report concluded the opportunity exists to bring these existing efforts together to develop more effective approaches to flooding in Texas and the Trinity River Basin.

Water for Texas, Today and Tomorrow, December 1990. This report was prepared by the Texas Water Development Board, Austin, Texas. The report updates and presents the 50-year plan for the state of Texas. This summary document presents the current and prospective water uses, identifies water supplies, and estimates facility needs and costs. The plan also describes water problems and opportunities, outlines significant environmental concerns and water issues, and offers program and policy recommendations.

The Texas Statewide Inventory of Flood Protection Needs, May 1990. This report was compiled to provide an up-to-date, community-specific inventory of flooding problems and solutions for 756 cities and towns in Texas that could be incorporated into the revised state water plan. This inventory contains data from Corps of Engineers planning studies and National Flood Insurance Program (NFIP).

Water for Texas, November 1984. This two-volume report was prepared by the Department of Water Resources, Austin, Texas. Volume one, A Comprehensive Plan for the Future, of the amended 1969 Texas Water Plan is an executive summary that sets forth planned actions and policy recommendations. Volume II, Technical Appendix, is a technical document that provides details of current water development and use, projected future water supply and treatment needs, and potentially developable water supplies to meet future water needs in each river and coastal basin of the state.

The Texas Water Plan, November 1968. Prepared by the Texas Water Development Board. The report outlines a flexible guide for the orderly development, conservation, and wise management of the State's water resources to meet the needs of the state to the year 2020. The plan includes the possibilities of importing large quantities of surplus water from the Mississippi River's lower reaches to areas of greatest need in Texas.

Table 1-1 provides a chronological list of additional studies and reports by non-Federal agencies, i.e., State and local agencies, for the Trinity River watershed and the relevant aspects of the Dallas Floodway Extension.

Table 1-1
Studies and Reports by Non-Federal Agencies

STUDY	AGENCY	DATE
Upper Trinity River Basin Comprehensive Sewerage Plan	North Central Texas Council of Governments (NCTCOG)	1970
North Central Texas Regional Water Supply Study	NCTCOG	1974
Water Quality Management Plan for the Trinity River Basin	Trinity River Authority (TRA)	1974
Long Range Water Supply	City of Dallas	1975
Gauging Our Water Supply	NCTCOG	1976
Trinity River Basin Master Plan	TRA	1977
Priorities for Clean Water	NCTCOG	1978
1978 Annual Water Quality Management Plan for North Central Texas	NCTCOG	1978
Non-Point Sources	NCTCOG	1978

NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS

The National Environmental Policy Act of 1969 (NEPA), as amended, is the nation's charter for environmental protection. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Section 102 (2) of the Act includes a provision to prepare a detailed statement - Environmental Impact Statement (EIS) - on the effects of the proposed Federal action. The Federal regulations for implementing the procedural provisions of NEPA were published by the Council on Environmental Quality (CEQ) in the Code of Federal Regulations (CFR) as 40 CFR Parts 1500-1508 (43 Federal Register 55978-56007, November 29, 1978).

Corps regulations permit an EIS to be a self-standing document or an integration of NEPA required discussions in the text of the report. Regarding the environmental nature of the Dallas Floodway Extension study area and in the interest of reducing paperwork, costs, and redundancies the Corps elected to integrate these documents. Sections in this integrated report that include NEPA required discussions are marked with an asterisk in the Table of Contents to assist readers in identifying such material. The document addresses alternatives evaluated to address flood damage reduction and environmental restoration in the Dallas Floodway Extension study area and discloses the direct, indirect and cumulative impacts of the proposed project, and those of interrelated projects, to the extent that they can be reasonably foreseen.

CHAPTER 2

DESCRIPTIVE OVERVIEW

CHAPTER 2
DESCRIPTIVE OVERVIEW

This chapter provides a general description of the Trinity River Watershed, the city of Dallas, Texas, and the primary study area under current conditions. The pertinent information includes climatology, physiography, geology, sociological, environmental, cultural and recreation data.

TRINITY RIVER WATERSHED

The Trinity River Basin lies in the eastern portion of the State of Texas, and is bounded on the north by the Red River Basin, on the east by the Neches and Sabine River Basins, on the west by the Brazos River Basin and on the south by the San Jacinto River Basin. The basin, with an overall length of about 360 miles and a maximum width in the headwaters of about 100 miles, extends along a northwest-southeast axis from Archer County to the northwest to Chambers County and continues in a southeasterly direction until it empties into the Gulf of Mexico at Trinity Bay near Galveston. The total drainage area of the basin encompasses more than 17,900 square miles.

The Trinity River, in the vicinity of the study area, is composed of four branches, the Clear, West, Elm and East Forks. The headwaters of each are located north and west of Dallas and Fort Worth and converge within the Metroplex. Specifically, the main stem of the Trinity River is formed in Dallas by the confluence of the West Fork and Elm Fork. The West Fork extends approximately 209 miles from Archer County and flows in a southeasterly direction to the city of Fort Worth where it is joined by the Clear Fork. The river continues in an easterly direction another 53 miles to its junction with the Elm Fork in Dallas. The Elm Fork rises in Montague County and flows in a southeasterly direction to join the West Fork and form the Trinity River at Dallas. The East Fork, although not specifically within the study area, rises in Grayson County from the northeast and flows southward to join the Trinity River 20 miles southeast of Dallas.

Within the area described above, the Trinity River Basin is influenced by more than 2,500 minor flow retarding structures and twelve major reservoirs. The Corps of Engineers constructed six of these reservoirs, including Benbrook, Joe Pool, Ray Roberts, Lewisville, Lavon and Grapevine. Other major Corps of Engineers flood control projects include the Dallas and Fort Worth Floodways. Non-Federal lakes influencing the basin include Amon Carter, Bridgeport, Eagle Mountain, Weatherford, Arlington, Mountain Creek, White Rock, and Ray Hubbard. These flood control, recreation, hydropower and water conservation projects are shown in figure 2-1.

The Trinity is considered an urban river in all respects. It is significantly influenced by the amount of water it receives from watershed runoff, overflows from surrounding man-made reservoirs, and the controlled discharge of effluent from the sewage treatment plants.

The area hydrologically modeled in this study consisted of the entire drainage area upstream of the point where Five Mile Creek flows into the Trinity River near the intersection of the Trinity River and Interstate Highway 20 (about 10 miles southeast of downtown Dallas). This drainage area is shown in figure 2-2. The total drainage area at that point is approximately 6,275 square miles and lies within the Dallas/Fort Worth Metropolitan area. The total drainage areas of the Trinity River at the Elm Fork-West Fork confluence and at the Dallas Gage are 6,061 and 6,106 square miles, respectively. The terrain elevation varies from 1,200 feet National Geodetic Vertical Datum (NGVD) at the headwaters of the West Fork of the Trinity River approximately 35 miles south-southwest of Wichita Falls, Texas, to 380 feet NGVD at the confluence of Five Mile Creek and the Trinity River.

The Trinity River in the study reach is characterized as a main channel with an average depth of about 30 feet, a top width of about 200 feet and an average discharge of about 2,000 cubic feet per second (cfs) over the period of record from 1955 to 1992. The overbanks are generally very wide relative to the broad channel. The river channel has an average bottom slope of about 2.6 feet per mile and has proven to be very stable.

THE CITY OF DALLAS

The city of Dallas is located in Dallas County in north central Texas and serves as the county seat. The city is 35 miles east of Fort Worth and 245 miles north-northwest of Houston. Dallas has expanded to a highly diversified city since its incorporation in 1846, and is now the second largest city in the state of Texas. Dallas is a city of commerce, transportation, banking, retail and wholesale trade, conventions and trade shows. With its centralized location, Dallas is a favorite destination for tourists and has become one of the nation's busiest transportation hubs, being served by one of the world's busiest airports, Dallas Fort Worth International.

Dallas' diversified economy began as an agricultural trade center in the 1840's and has progressed into the wholesale and retail market center of the southwest. This economic strength fueled growth in banking, insurance, data processing, and electronic components which account for a major portion of the Dallas economy. In addition, Dallas is home to more than thirty-two Fortune 500 corporate headquarters, the World Trade Center, the Dallas Convention Center, Dallas International Market Hall, the Infomart and Reunion Arena. The county has 22 colleges and universities, 34 hospitals, 22 libraries and 68 banks.

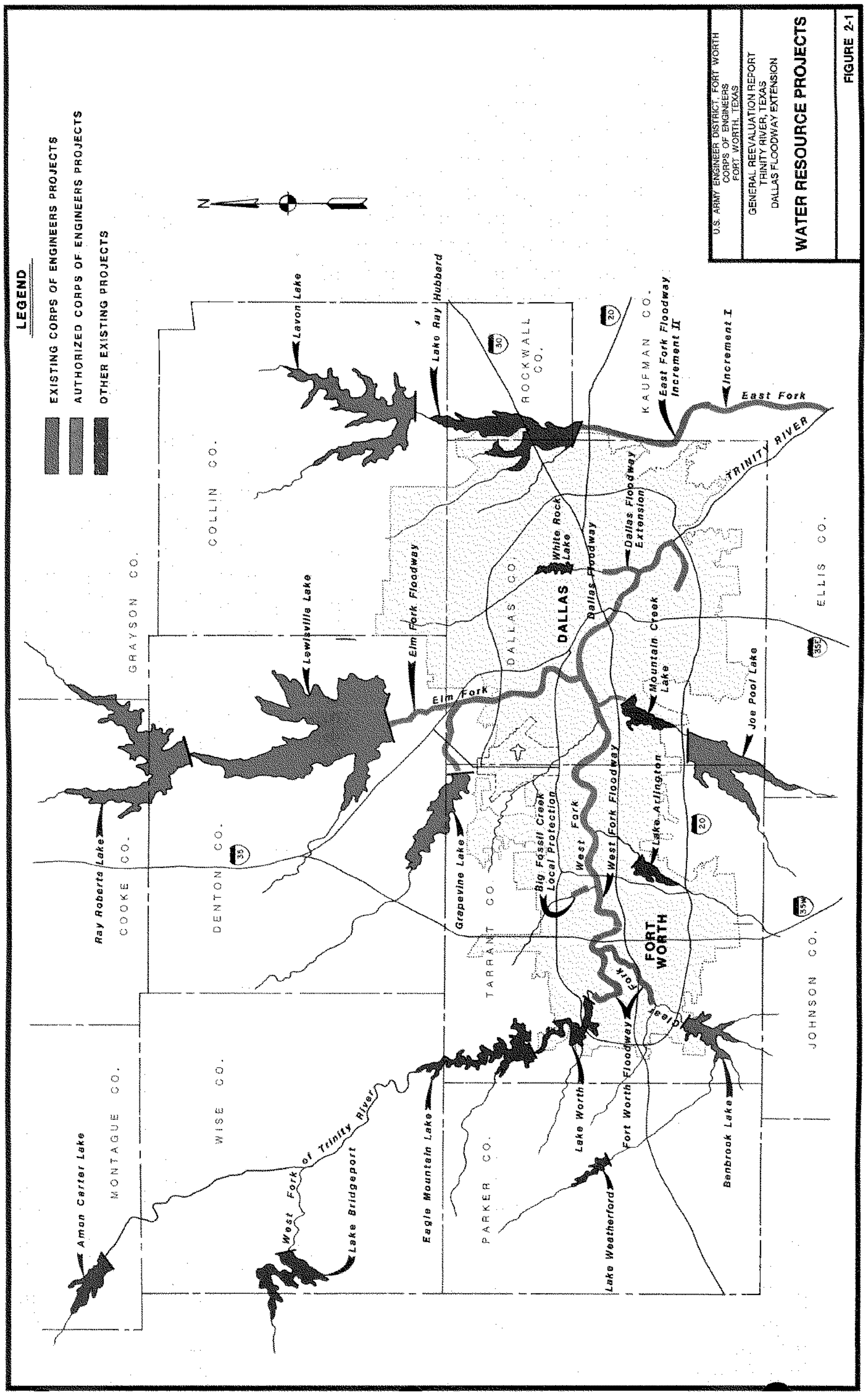
The Trinity River's original name, La Santisma Trinidad (the Most Holy Trinity), is derived from the convergence of three branches which come together in Dallas. The river flows easterly through a significant portion of the city of Dallas and influences land use in both the northern and southern sectors.

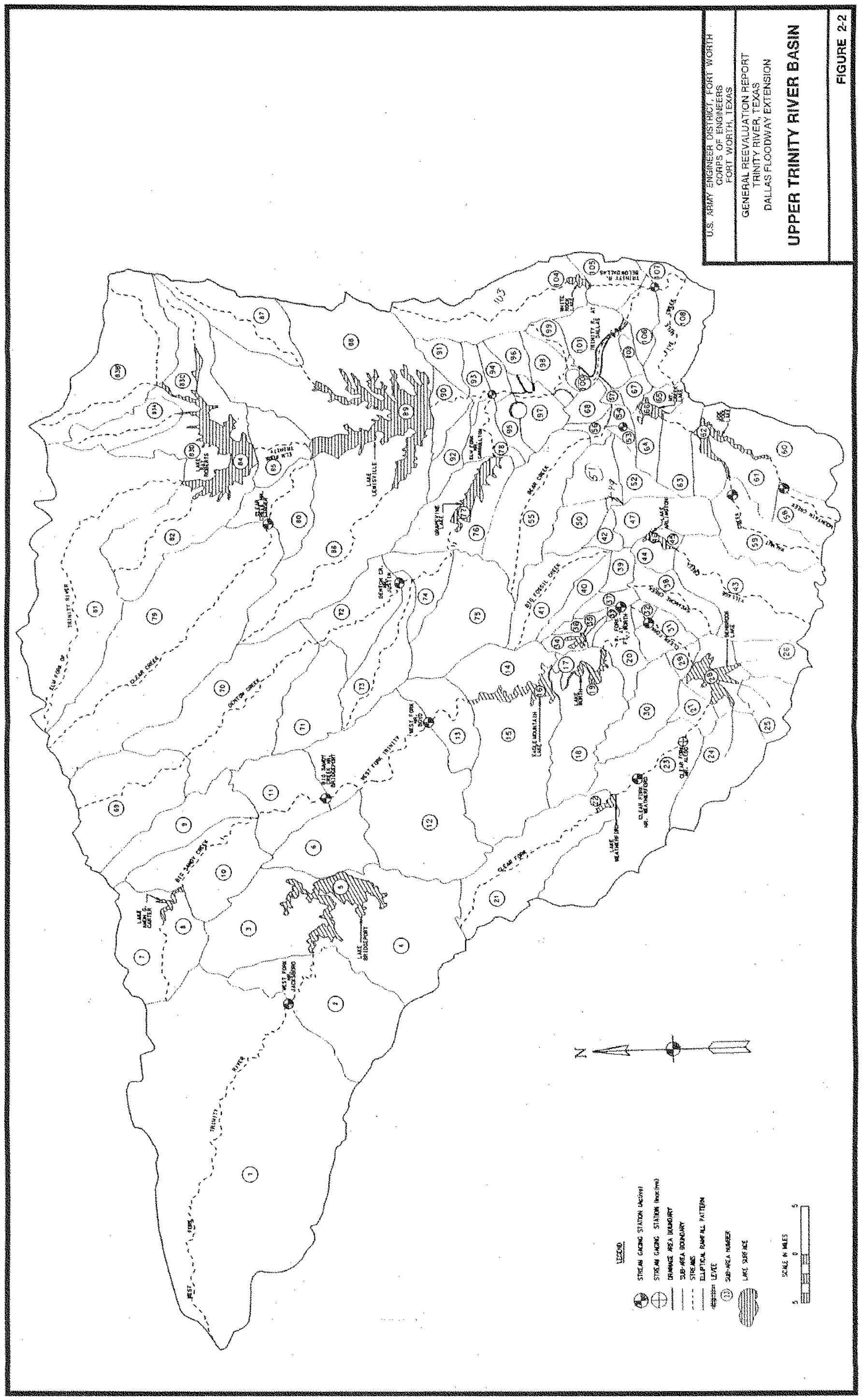
STUDY AREA

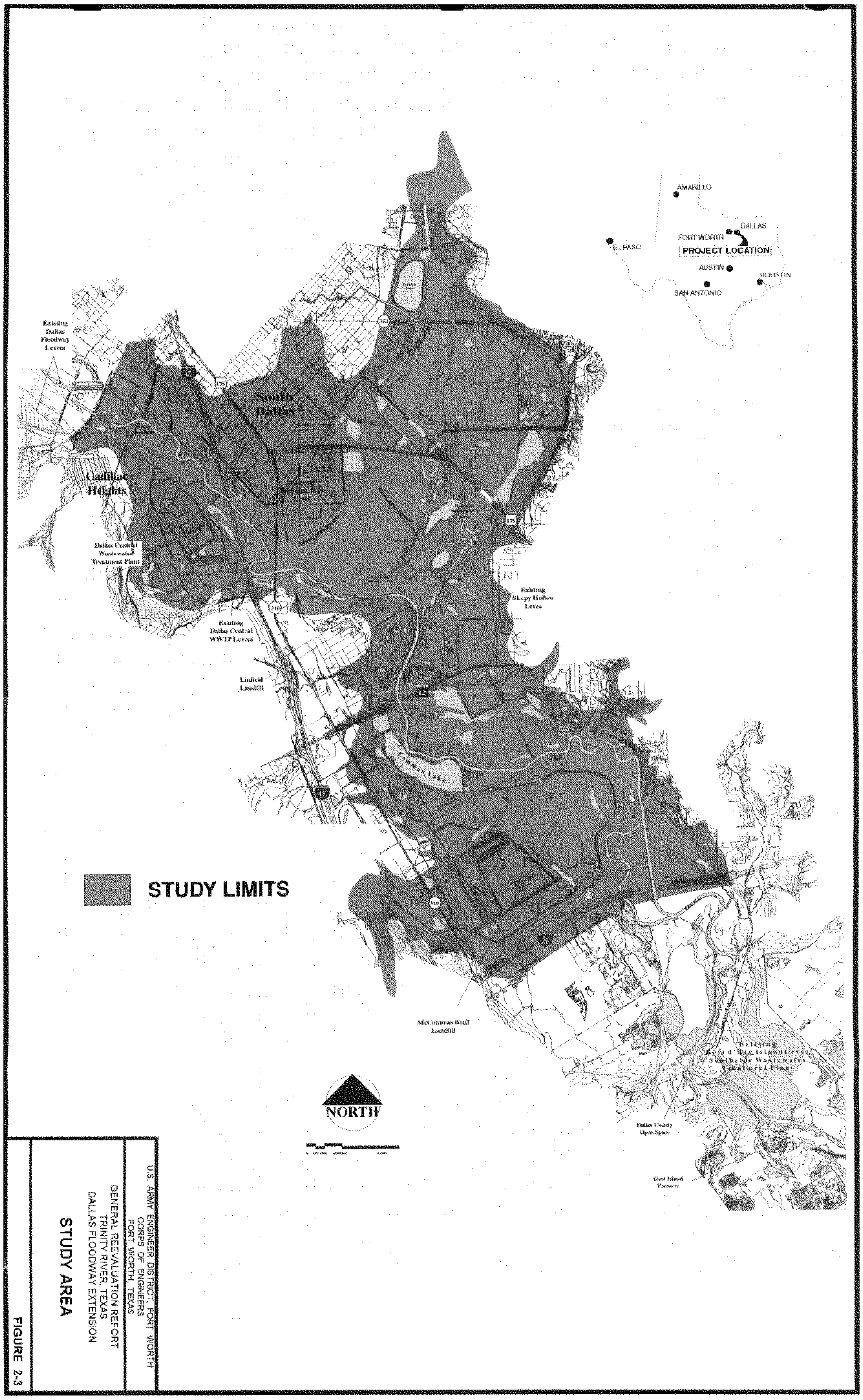
The study area is located in the southern sector of Dallas, southeast of the downtown area. Specifically, the study area investigated can be defined as that portion of the Trinity River between the confluence of Five-Mile Creek, near the intersection of the Trinity River and Interstate Highway 20 (about 10 miles southeast of downtown Dallas) and the downstream end of the existing Dallas Floodway Levee System and bounded by the SPF limits. The study area also includes the White Rock Creek tributary between IH-30 from the northeast to its confluence with the Trinity River. The entire study area is located within the corporate city limits of Dallas, Texas. A map of the study area is shown in figure 2-3.

CLIMATOLOGY

The Trinity River watershed is located in a region of temperate mean climatological conditions, experiencing occasional extremes of temperature and rainfall of relatively short duration. According to the National Oceanic and Atmospheric Administration Station at Fort Worth, Texas, the 30-year mean rainfall amount is 33.7 inches per year with the most recent ten year (1987-1996) average being 37.88 inches. The extreme annual rainfall values since 1887 are a maximum of 53.54 inches occurring in 1991, and, a minimum of 17.91 inches occurring in 1921. The mean relative humidity is 65 percent with an average temperature of 65.8°Fahrenheit. The average first freeze date in the fall is November 13, while the average last freeze date in the spring is March 23.


LEGEND
EXISTING CORPS OF ENGINEERS PROJECTS
AUTHORIZED CORPS OF ENGINEERS PROJECTS
OTHER EXISTING PROJECTS
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
WATER RESOURCE PROJECTS
FIGURE 2-1
Lavon Lake
Lake Ray Hubbard
East Fork Floodway Increment II
Increment I
East Fork
TRINITY RIVER
White Rock Lake
Dallas Floodway
Dallas Floodway Extension
Lewisville Lake
Elm Fork Floodway
Elm Fork
DALLAS
Mountain Creek Lake
Joe Pool Lake
Ray Roberts Lake
Grapevine Lake
Big Fossil Creek Local Protection
West Fork
West Fork Floodway
Lake Arlington
FORT WORTH
Amon Carter Lake
West Fork of Trinity River
Lake Bridgeport
Eagle Mountain Lake
Lake Worth
Fort Worth Floodway
Lake Weatherford
Benbrook Lake
GRAYSON CO.
COLLIN CO.
ROCKWALL CO.
KAUFMAN CO.
DALLAS CO.
ELLIS CO.
COOKE CO.
DENTON CO.
TARRANT CO.
JOHNSON CO.
MONTAGUE CO.
WISE CO.
PARKER CO.


U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
UPPER TRINITY RIVER BASIN
FIGURE 2-2



AMARILLO
EL PASO
FORT WORTH
DALLAS
PROJECT LOCATION
AUSTIN
HOUSTON
SAN ANTONIO
South Dallas
Cadillac Heights
STUDY LIMITS
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
STUDY AREA
FIGURE 2-3

Generally, the major storms experienced in the study area are produced by heavy rainfall from frontal-type storms which occur in the spring and summer months, but major flooding can also be produced by intense rainfall associated with localized thunderstorms. These thunderstorms may occur at any time during the year, but are more prevalent in spring and summer months. Table 2-1 presents a summary of climatological statistics for the city of Dallas.

Table 2-1
Climatological Statistics for Dallas, Texas
(Based on 109 years of Record)

RAINFALL	
Average Annual (1987-1996)	37.88 inches
Maximum Annual (1991)	53.54 inches
Minimum Annual (1921)	17.91 inches
Maximum 24-Hour (September 1932)	9.57 inches
TEMPERATURE	
Average Daily	65.8 °F
Daily Maximum (June 1980)	115 °F
Daily Minimum (December 1989)	-1 °F
RELATIVE HUMIDITY	
Average Daily	65 percent

The prevailing winds for this area are from the south or southeast, except during portions of the winter months. During this time, occasional high pressure polar air masses from the northwest result in north winds over most of the area.

BASIN PHYSIOGRAPHY AND GEOLOGY

The Trinity River Basin, situated in east central Texas, encompasses more than 17,900 square miles, and includes all or portions of 38 counties. Altitudes range from 1,500 feet above mean sea level in upper extreme reaches of the basin to sea level at the mouth in Trinity Bay. The gradient of the river decreases from almost 4.0 feet per mile to about 0.8 feet per mile toward the mouth. The basin is situated within two physiographic provinces, the Central Lowland province in the headwaters, with rock outcrops indicative of the Pennsylvanian and Permian age, and the Coastal Plain province, which includes varying outcrops throughout the basin. In the extreme upper basin, moderately rugged eastward-facing escarpments and stream valleys with narrow and steep-sided floodplains are indicative of a newly forming erosional cycle. The topography changes to primarily flat to gently rolling in the mid-basin prairies and Cross Timbers regions, becomes gently rolling to hilly through the East Texas timber belt, and then gradually levels out to very flat treeless areas (in uplands) in the Coastal Prairie.

STUDY AREA PHYSIOGRAPHY AND GEOLOGY

The Dallas Floodway Extension study area is located within the northernmost section of the Gulf Coastal Plains, which is characterized by essentially flat lying to gently dipping unconsolidated terrace and flood plain deposits. All physiographic features within this area were formed during the Cenozoic Era. Fluvial terrace deposits and alluvial deposits of the Quaternary Age occupy the floodplain area of the Trinity River. These deposits consist of gravel, sand, silt, and clay deposits.

The underlying bedrock consists of the lower and middle members of the Austin Chalk Formation, a chalky limestone with thin bentonitic beds scattered in the lower part. Within the study area, the Austin Formation has an estimated thickness of 300 feet to 700 feet and gently dips to the southeast.

Geologic structural features within the project area do not pose a significant threat to the integrity of the project. However, Paleozoic formations of the Ouachita series of Oklahoma extend south into this region and, at great depth, underlie the Cretaceous rocks exposed at the surface. The Ouachita series is characterized by intense folding and faulting. Normal and reverse faults north and east of Dallas, as well as the famous Balcones fault zone to the south, have been correlated with this regional structural feature. Regardless of these features, any seismic risk within the project area is considered to be minimal. Additionally, this project is located within zone "zero" on the seismic risk map of the United States, indicating no damage is expected as a result of earthquake activity. It is anticipated that all excavations can be accomplished with conventional earth moving equipment.

EXISTING DALLAS FLOODWAY LEVEES

The existing Dallas Floodway Levee System is a federally sponsored project currently maintained by the city of Dallas. The Dallas Floodway Extension study initially had a primary focus to evaluate current conditions and proposed improvements for those areas downstream of the Dallas Floodway that are susceptible to flood damages up to and including the SPF event. However, due to changes in the floodplain and the backwater effects on the downstream end of the Dallas Floodway Levees, the risk of overtopping of these levees has become a major consideration. Therefore, the Dallas Floodway Levee System is included in this investigation. The design of the Dallas Floodway Levees was based on construction of the levee crest to the SPF flood water surface elevation plus four feet of freeboard. The SPF flood elevations used to establish the original design grade of the levees were computed using hand backwater calculations. Subsequent studies, using an LRD-1 hydraulic model, confirmed the original SPF flood elevations. The HEC-2 hydraulic model compiled for this study, updated for current conditions, computes higher water surfaces downstream of the Dallas Floodway than those computed with the earlier model.

The downstream end of the Dallas Floodway levees is located near the abandoned Atchison, Topeka, and Santa Fe (AT&SF) Railroad bridge. The East Levee has a terminal section extending perpendicular to the river along the AT&SF Railroad tracks and directly beneath the newly constructed DART Rail Line bridge to high ground. A portion of this extension of the East Levee is earth embankment with a design crest elevation of 425.2, while the remainder is a concrete floodwall up to 7 feet in height extending to the high ground limit. The concrete floodwall portion of the levee has a design crest elevation of 423.0 and includes two integral stoplog closure sections. One of these stoplog structures provides passage for a dual track Southern Pacific Railroad line. The other stoplog structure formerly served the same purpose, but the tracks have been removed as part of the construction of the DART Rail line bridge. For the purpose of this study, the stoplog structures have been assumed to be in place prior to the occurrence of a major flood event and reliable up to the floodwall design crest elevation of 423.0.

A topographic survey compiled from aerial photographs taken in February of 1991 indicated that a length of about 600 feet of the East Levee embankment near the AT&SF Railroad bridge had degraded to an elevation of about 422.0. The West Levee, at the same location along the river, has not degraded significantly below the design grade elevation of 425.2. The survey also indicated that other portions of both the East and West Levee crests have degraded below the design grade, but this location on the East Levee was the most critical. The city has restored the East Levee design grade at the AT&SF Railroad with work completed during 1996. The city initiated additional work within the Dallas Floodway in late 1998 to address other levee crest deficiencies upstream. In light of the city's progress and continued efforts to restore levee design grade, the overtopping elevation chosen to be used in this analysis for the Dallas Floodway East Levee was based on the crest elevation of the concrete floodwall of 423.0. The current hydraulic study computed a baseline conditions SPF water surface elevation at the AT&SF Railroad bridge of 426.0, and a 500-year water surface elevation of 422.4. This analysis indicates that under current conditions, the occurrence of an approximate 500-year flood event would overtop the concrete floodwall portion of the East Levee.

EXISTING ROCHESTER PARK LEVEE

The Rochester Park Levee was constructed during the time this study was performed and has been hydraulically modelled in the baseline conditions hydraulic model. The design of the levee was based on the SPF water surface from previous hydraulic analysis plus four feet of freeboard which yielded a design elevation of 417.0. This elevation was computed by the earlier LRD-1 hydraulic model discussed above and was used for the entire levee crest without allowance for the slope of the hydraulic grade line from the portion of the levee farthest downstream to the upstream end of the levee. The upstream end of the Rochester Park Levee terminates at a natural ground elevation of 415.5. Based on the earlier hydraulic study, this elevation provided about two feet of freeboard above the SPF water surface at that location. As originally designed, flood discharges exceeding the design capacity of the levee system would initially enter the protected area at the upstream end of the levee, across broad natural ground areas at an elevation lower than the levee crest, thus preventing a catastrophic failure of the levee. However, as more detailed topographic mapping became available, it was determined that farther upstream from the end of the levee, at Hatcher Street and South Central Expressway, the underpass would allow flood waters to enter the areas protected by the Rochester Park Levee at an elevation lower than at the area near the upstream end of the levee. The elevation at the underpass above which flood waters would begin to inundate those areas protected by the Rochester Park Levee north of the C.F. Hawn Freeway is estimated to be 413.0 and the elevation above which flood waters would begin to inundate those areas south of the C.F. Hawn Freeway is estimated to be 414.5. The current hydraulic study computed a 100-year water surface elevation at Hatcher Street, under baseline conditions of 412.0, and a 500-year water surface elevation of 418.1. Based on this analysis, the current level of protection provided by the Rochester Park Levee is approximately the 110 -year flood event. This approximate evaluation of level of protection is used primarily to show the difference between the results of this study and the previous hydraulic analysis that was used for the design of the levee system. The location of this levee is shown on figure 2-4.

EXISTING CENTRAL WASTEWATER TREATMENT PLANT LEVEE

The Central Wastewater Treatment Plant (CWWTP) is located on the right overbank of the Trinity River between the Missouri-Kansas-Texas Railroad bridge and the Interstate Highway 45 bridge. It is protected from flooding by a ring levee system that surrounds the main structures of the treatment plant. The levee survived the flood of 1990 without overtopping, but required emergency repairs during the flood. The city of Dallas has since implemented a plan, designed by the engineering firm of Albert H. Halff & Associates, Inc. of Dallas, to upgrade the CWWTP Levee and other plant facilities to comply with Texas Water Commission requirements to provide 100-year flood protection plus three feet of freeboard. The results of the hydraulic analysis used to establish the design levee crest elevation of 415.0 compares very closely with the water surface profiles presented in this report. This elevation was used to estimate the CWWTP levee level of protection at approximately the 140-year flood event. This levee is shown in figure 2-4.

EXISTING SLEEPY HOLLOW COUNTRY CLUB LEVEE

The Sleepy Hollow Country Club Golf Course is located between the Linfield Landfill and the Loop 12 bridge on the right bank of Trinity River. A small levee approximately 10 feet in height is located along the right bank of the river channel and provides about a 10-year level of protection for the golf course based on observance of recent flood events and analysis of recent topographic data. For flows less than a 10-year frequency event, the levee encroaches upon the main bridge opening of the Loop 12 bridge for about 50 percent of its length. The Loop 12 highway crossing of the floodplain consists of two additional relief bridges that are not affected by the golf course levee.

ENVIRONMENTAL SETTING

GENERAL

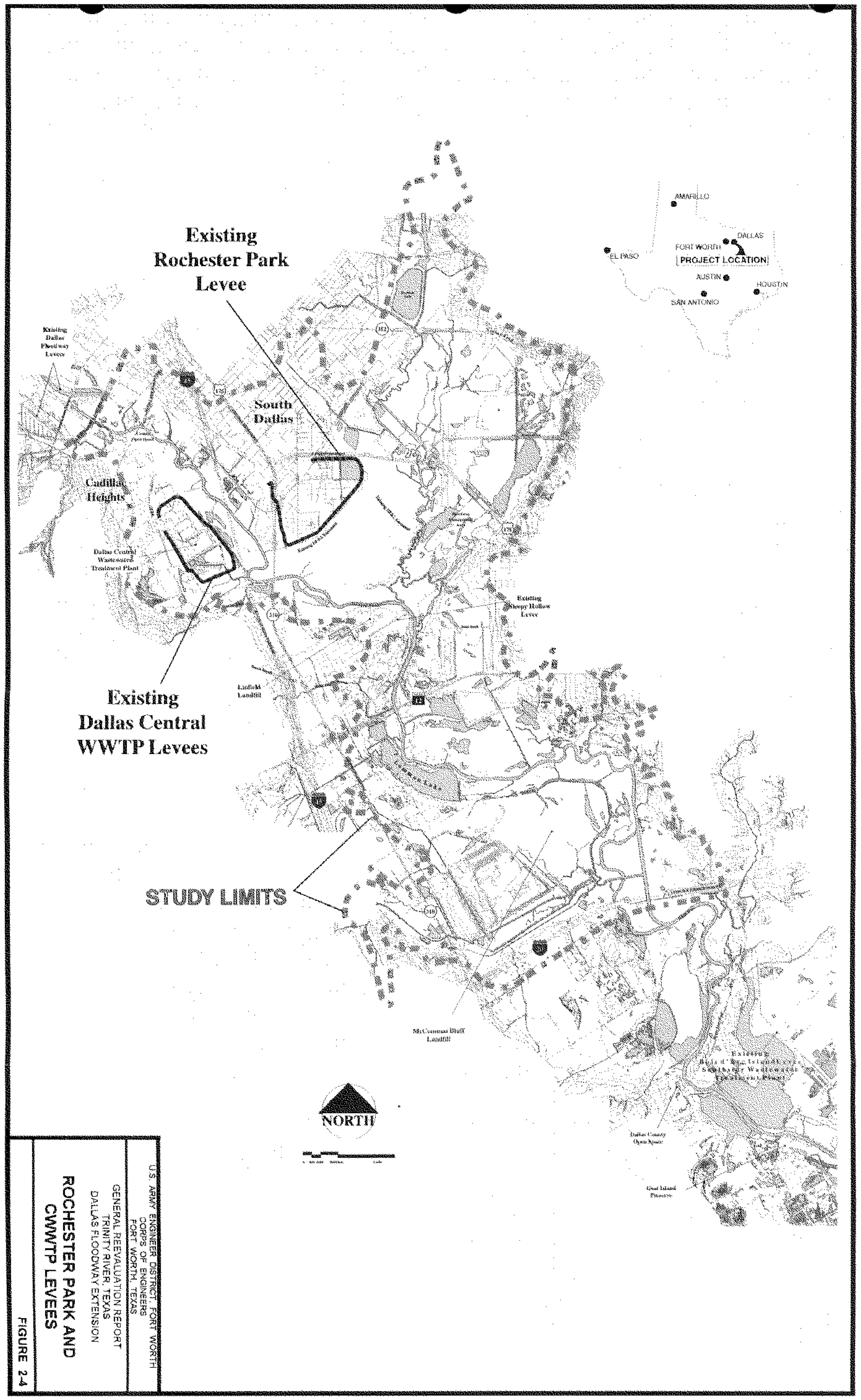
Of major concern, environmentally, to this study are the floodplain areas adjacent to the river. The study area is located within a fully developed metropolitan area, and the environmental setting varies significantly. Located immediately upstream of the study area is the Dallas Floodway Project, which was constructed with Federal funds in 1957 and consists of a channel and levee system that extends from Mountain Creek to the Atchison, Topeka, and Santa Fe (AT&SF) Railroad bridge. Since the construction of this project, the environmental characteristics of the area have been significantly modified, although some riparian vegetation and wildlife habitat have reestablished naturally. From the AT&SF Railroad bridge downstream to the Interstate Highway 20 Trinity River crossing, the topography consists mainly of bottomland hardwoods, scattered wetlands, open water areas, gravel pits, and open fields which are used for grazing livestock. The project area is within an area known as the "Great Trinity Forest", which roughly encompasses the Trinity River mainstem floodplain between the existing Dallas Floodway and the IH-20 crossing, and the White Rock Creek floodplain from the confluence with the Trinity River upstream to IH-30. A summary of the environmental setting is provided below. The complete analysis is provided in Appendix F.

AIR QUALITY

The project study area is located within the Environmental Protection Agency's Air Quality Region (AQCR) 215 for Texas, which consists of 19 counties, including Dallas, Denton and Tarrant. AQCR 215 is classified as a serious non-attainment area for ozone and attainment/unclassifiable for other National Ambient Air Quality Standards including lead, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter of aerodynamic shape less than or equal to 10 micrometers in diameter.

In 1995 and 1996, the Texas Natural Resource and Conservation Commission (TNRCC), Office of Air Quality, reported that the average annual criteria pollutant concentrations for the city of Dallas were as follows: lead - 0.03 micrograms per cubic meter ($\mu g/m^3$); PM10 - 29 $\mu g/m^3$; carbon monoxide - 0.75 parts per million (ppm); sulfur dioxide - 0.003 ppm; ozone - 0.0023 ppm; and, nitrogen dioxide - 0.017 ppm.

Trees influence air quality. Direct effects are generally more local in nature, while indirect effects may be more generalized. Trees lower local air temperatures by shading and transpiration. Trees may also alter air flows which, depending on the location of the trees and adjacent buildings, may either reduce energy use or increase it. A dense forest or row of trees upwind of a building may cause a heat island to form around the building during the summer time by blocking off air flow. A windbreak upwind of a building during the winter, however, may result in reduced heating requirements. Energy use, in turn, affects air quality on a regional basis by influencing the extent of fossil fuel use. Living trees can either directly remove or contribute to atmospheric pollution. Generally, the benefits of trees outweigh their detrimental impacts. Quantification of their effects on removal of air pollutants has been measured, and models developed, which have application to the project area. Estimates of the annual pollution removal rates of trees within the study area were developed using the United States Department of Agriculture's Urban Forest Effects (UFORE)


Existing
Rochester Park
Levee
Existing
Dallas Floodway
Levees
South
Dallas
Cadillac
Heights
Dallas Central
Wastewater
Treatment Plant
Existing
Sleepy Hollow
Levee
Linfield
Landfill
Existing
Dallas Central
WWTP Levees
STUDY LIMITS
McCommas Bluff
Landfill
NORTH
Dallas County
Open Space
AMARILLO
EL PASO
FORT WORTH
DALLAS
PROJECT LOCATION
AUSTIN
HOUSTON
SAN ANTONIO
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
ROCHESTER PARK AND
CWWTP LEVEES
FIGURE 2-4

program. It is assumed that herbaceous vegetation also has some pollutant uptake capabilities since they are functionally similar to trees. However, due to a lack of published materials describing these pollutant removal coefficients, herbaceous vegetation was not included in this analysis. Table 2-2 provides a summary of the total current pollution removal rates of trees within the Great Trinity Forest, the city of Dallas, and the detailed project area (under existing conditions and future without-project conditions).

Table 2-2
Air Pollution Removal Rates By Trees
(Tons / Year)

Area	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Particulate Matter (10μm)	Ozone
Existing Great Trinity Forest	13.30	11.74	32.93	77.16	145.19
Existing City of Dallas	137.72	128.92	355.96	955.24	1,491.82
Detailed Project Area - Existing Conditions	1.41	1.24	3.48	8.17	15.37
Detailed Project Area - Future Without-Project	2.02	1.78	4.99	11.70	22.02

WATER QUALITY

The portion of the Trinity River in which the proposed project lies is designated by the TNRCC as segment 805. While the water quality of the Trinity River continues to improve, four areas of concern remain in this segment. According to tests conducted every two years by the TNRCC, nitrite+nitrate, orthophosphorus, total phosphorus and fecal coliform concentrations were outside criteria or screening levels 92.5%, 97.67%, 94.59%, and 38% of the time, respectively. Dissolved oxygen levels have historically been considered a serious problem but have shown great improvement and are now rarely lower than the standards criteria of 5.0 milligrams per liter. Low flow rates and high temperatures, typical in the dry summer months, create conditions under which water quality problems such as high algal growth and low dissolved oxygen levels may exist.

The Texas Department of Health issued an aquatic life closure for a stretch of the Trinity River in January 1990 due to elevated levels of chlordane in fish tissue. This 66-mile stretch of the Trinity River, denoted as Segment 806, extends from Fort Worth to IH-20 in southern Dallas County, which includes the DFE project area. Fishing can be conducted, but no taking of fish is currently allowed. In addition, the TNRCC does not support contact recreation within the waters of Segment 806 due to continued water quality violations discussed in the above paragraphs.

Effluent from several wastewater treatment plants discharge into the Trinity and tributaries throughout the Dallas / Fort Worth Metroplex. The Central Wastewater Treatment Plant (CWWTP) in Dallas meets and often exceeds stringent requirements as stated in the discharge permits issued by the state. In the last three years, 15 chronic toxicity tests have been conducted for the organism *Ceriodaphnia dubia* in 100% effluent. All tests results have been negative, indicating that the effluent may be used to provide fish and wildlife habitat.

VEGETATIVE COVER

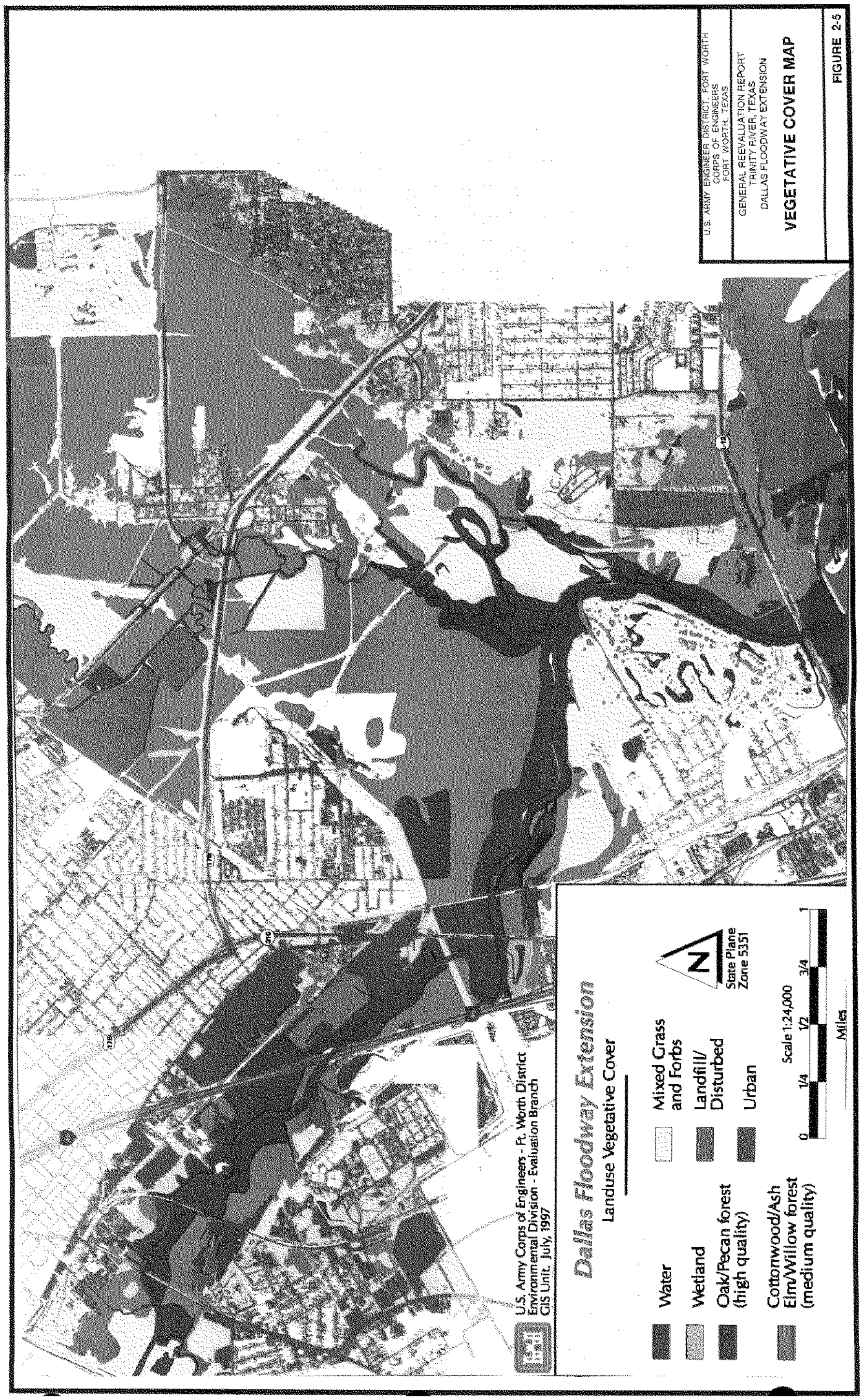
General

The proposed project is located in the Blackland Prairies vegetative ecoregion, and the predominant soil is classified as frequently flooded Trinity Clay. Tree species common to this area include- elms, sugarberry, pecan, oak, black willow, cottonwood, and osage orange.

The "Great Trinity Forest", as defined above, encompasses approximately 5,956 acres, of which 5,456 acres are woodland and include bottomland hardwoods, mixed Deciduous, and wetlands/bottomland hardwoods. The remaining 500 acres are composed of water, grassland, scrub/shrub, and urban areas. Table 2-3 shows the vegetative/land cover types, by number of acres and percent of total cover, within the Great Trinity Forest. A vegetative cover map is shown in figure 2-5.

Table 2-3
Types of Vegetative/Land Cover Within the Great Trinity Forest

Type of Cover	Acres	Percent of Total Cover
Bottomland Hardwoods	4,198	70.5
Wetlands/Bottomland Hardwoods	1,045	17.5
Water	233	3.9
Mixed Deciduous	213	3.6
Pasture/Unmanaged Grasslands	121	2.0
Scrub/Shrub	63	1.1
Agriculture	37	0.6
Urban/Roads/Bare Ground	15	0.3
Low Density Urban & Residential	13	0.2
Managed Grassland	12	0.2
Unclassified/Bare Ground	3	0.1
Bare Ground	3	0.1
TOTAL	**5,956**	**100**


U.S. Army Corps of Engineers - Ft. Worth District
Environmental Division - Evaluation Branch
GIS Unit, July, 1997
Dallas Floodway Extension
Landuse Vegetative Cover
Water
Wetland
Oak/Pecan forest (high quality)
Cottonwood/Ash Elm/Willow forest (medium quality)
Mixed Grass and Forbs
Landfill/ Disturbed
Urban
Scale 1:24,000
0 1/4 1/2 3/4 1
Miles
N
State Plane Zone 5351
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CORPS OF ENGINEERS
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TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
VEGETATIVE COVER MAP
FIGURE 2-5

Bottomland Vegetation

Bottomlands occur in the transition zone between aquatic and upland ecosystems, and bottomland hardwoods are considered to be Texas' most diverse ecosystem. Within the Dallas Floodway, the dominant species is black willow and cottonwood. Downstream from the AT&SF Railroad bridge to the Dallas County line, the dominant tree species are mature black willow, cedar elm, sugarberry, green ash, pecan, American elm, box elder, cottonwood, red mulberry, and osage orange. The dominant understory shrubs, woody vegetation and vine species consist of immature tree species of the same type mentioned above, along with western soapberry, swamp privet, common greenbrier, honeysuckle, and poison ivy. In areas of dense canopy cover, the dominant herbaceous groundcover species include poison ivy, wild onion, violets, Virginia creeper, and Canadian wild rye. In areas where the canopy cover is more open, the tree species are the same, but the percent cover of herbaceous vegetation increases, with the dominant species being marsh elder, ragweed and sedges.

Wetland Vegetation

Wetlands are defined as those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation typically adapted to life in saturated soil conditions. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. The wetlands located in the study area are scattered throughout the flood plain in isolated depressions or very low gradient drainages, and contain marsh elder, ragweed, cottonwoods, green ash, and black willows, with occasional box elders. Rapid growth of invading cottonwood, green ash and willows has resulted in a rapid conversion of emergent wetlands to bottomland hardwood wetlands during the recent past.

Grasslands

Open grasslands developed from reclaimed mine areas and abandoned agriculture fields are commonly used as grazing lands for livestock, with vegetation characteristic of disturbed bottomland pastures. Common grass species include purple threeawn, King Ranch bluestem, sideoats grama, Japanese brome, tumble windmillgrass, bermuda grass, jungle rice, barnyard grass, plains lovegrass, perennial ryegrass, Texas wintergrass, Dallisgrass, annual bluegrass, and Johnson grass, while dominant herbaceous species include giant ragweek, annual sunflower and goldenrod. These open areas are expected to eventually succeed to bottomland hardwood forests, based on a comparison of historic and recent photographs.

FISH AND WILDLIFE RESOURCES

Similar to the plant species of the flood plain, fish and wildlife species vary considerably within the study area. Influence of man, his developments and residual wastes have brought about significant changes in the habitat, food supplies and, thus, resident populations of fish and wildlife resources. Predator control, indiscriminate hunting, use of pesticides, and various forms of air, water, and land pollution has been responsible for modified distribution of fish and wildlife populations throughout the area. The surviving fish and wildlife live in a modified natural habitat within the immediate influence of an encroaching urban complex.

Fish (Aquatic) Resources

In addition to the mainstem of the Trinity River, adjacent wetlands and open water areas support a variety of fish species. Within the mainstem of the river, concerns about the quality of the fishery habitat include turbidity and oxygen-demanding pollutants, which interact to produce lowered dissolved oxygen concentrations. Physical habitat for fisheries is scarce, particularly in the channelized reaches within the existing Dallas Floodway upstream of the project area. Several studies verify that stream fisheries have improved during the last twenty years, due primarily to improved water quality resulting from improved waste water treatment. Sportfish present in the study area include largemouth bass, channel catfish, crappie, and white bass. Other species which tend to be more tolerant of moderate levels of nutrients and lower dissolved oxygen present in the area include common carp, river carpsucker, longnose gar, freshwater drum, several species of shiners, and bullhead catfish. Non-sport species found in the study area that are less tolerant to pollutants include gizzard shad, mosquitofish, and several sunfish species.

Wildlife Resources

The river channel, wetlands, open water areas, and forested areas support a variety of wildlife species for cover, food, and nesting areas. Bird species which have been reported or observed within the study area, include migratory warblers and sparrows, meadowlark, mourning dove, crow, red-tailed hawk, American kestrel, herons, egrets, mallard, wood duck, blue-winged teal, green-winged teal, lesser scaup, grackle, scissor-tailed flycatcher, kingbird, logger-head shrike, black birds and swallows. A major heron rookery exists within a heavily wooded area along Rector Road west of the Central Wastewater Treatment Plant. At least five species of birds have been observed nesting in the rookery. Amphibians, reptiles, and mammals which are common to the area include frogs and toads, snakes, turtles, cottontail rabbit, cotton rat, field mice, opossum, raccoon, bobcat, beaver, nutria and coyotes.

THREATENED AND ENDANGERED SPECIES

Table 2-4 provides a list of federally protected species that may occasionally migrate through the project area.

Table 2-4
Federally Listed Threatened and Endangered Species Whose Migratory Corridor Includes Dallas County, Texas

Species	Scientific Name	Status
American peregrine falcon	*Falco peregrinus anatum*	Endangered
Arctic peregrine falcon	*Falco peregrinus tundrius*	Threatened
Bald eagle	*Haliaeetus leucocephalus*	Threatened
Black-capped vireo	*Vireo atricapillus*	Endangered
Interior least tern	*Sterna antillarum*	Endangered
Piping plover	*Charadrius melodus*	Threatened
Whooping crane	*Grus americana*	Endangered

(Source: U.S. Fish and Wildlife Service, June 1997)

CULTURAL RESOURCES

The cultural resources under consideration in the project area may be identified as archaeological sites and architectural or structural elements in the landscape that are at least 50 years of age. The Dallas Floodway Extension (DFE) study area or area of potential effect (APE) has been defined as that terrain along the Trinity River between the Corinth Street Viaduct and U.S. Interstate 635 falling within the SPF floodplain. The proposed project footprint is that portion of the APE which is scheduled to be directly impacted by terrain modification and construction activity. Once archaeological deposits are extensively disturbed, reconstruction or rehabilitation of the evidence to explain past behavior is extremely limited to absent. The material remains (artifactual data) of prehistoric and historic archaeological sites make up the record of the human past, and it is the analyses and interpretation of the contextual relationships between the artifactual remains which provides us with our window to the past. Evidence indicates that the inception of human activity in the project area likely dates to around 12,000 years ago. Prehistoric exploitation of the riverine system lasted until the early 1800s.

Historically, the Trinity River may have been visited by Luis de Moscoso de Alvorado between 1541 and 1545, as he led the survivors of the Hernando de Soto Expedition back to Mexico following de Soto's death on the Mississippi River in 1541. Later, the area came under the domain of Spain, which was competing with the French to the north for land entitlement. By 1823 the area was under the rule of the Republic of Mexico until Texas won independence in 1836. John Neely Bryan established a post at Dallas 1842, and some early settlers arrived in the project area by 1844, such as William Perry Overton and family. Dallas County was organized in 1846, and less than a year later in 1847, another settler in the area, William Brown Miller, started the first ferry service across the Trinity River at the large meander in the middle of the project area.

To date there are 41 archaeological sites known within or immediately adjacent to the DFE Study Area, which includes seven that are outside of the APE and seven that are only partially within the APE. Fourteen of the sites are reportedly within the project footprint, six of which have been destroyed by development. Of the remaining eight archaeological sites, seven are prehistoric, while the eighth is an old City of Dallas dump dating between ca. 1890 and 1940. Generally, prehistoric sites within the study area will represent riverine habitats exploitation. A typical site may consist of large occupational horizons composed of small activity-specific loci such as molluscan (Naiad) exploitation sites. These sites, many of which have not been extensively examined, may have been repeatedly revisited either seasonally or throughout a season by an undetermined population.

The Late Prehistoric period, which includes all ceramic-bearing culture groups, are most frequently identified at sites in the project area and footprint, although Late Archaic occupations are also recorded in modest numbers, while Early and Middle Archaic components are less frequently encountered. One explanation provided assumes that older sites are deeply buried. For example, at the Aubrey Site, a Paleoindian occupation located upstream on the Elm Fork of the Trinity River, intact and in situ cultural materials were recovered more than eight meters below the current flood plain surface. This condition indicates that early prehistoric sites in the mainstem portion of the Trinity River incorporating the project area may be at least as deep. Prehistoric sites positioned within floodplains may be subjected to massive erosional or depositional forces. In addition, during stable periods with little sediment movement, the surviving deposits will be subjected to extensive weathering through soil formation processes, which generally have greatest expression in floodplain settings.

Archaeological sites that are either located on old fill deposits (terraces) in the modern floodplain are positioned on benches or finger ridges along the lower edge of the Pleistocene valley wall, will likely present a more compressed soil stratigraphic sequence. These kinds of locations rely on overland flow deposition or sheetwash erosion as a means of covering or deflating archaeological deposits. However, they generally provide nearly flat surfaces where the context of cultural remains may remain relatively intact, even during times of local sediment gain or loss. These deposits are not as thick as those in active river bottoms. As in the floodplain, soil development during stable depositional periods is moderately well expressed on these bench and finger ridge features. However, bio-turbation due to such agents as roots, bugs and burrowing animals, becomes a more important factor in assessing artifactual distributions in the thinner deposits.

The edge of the 100-year flood stage is between the current channel and the valley wall. It may be considered roughly synonymous with the Late Holocene floodplain margin. Topographic settings, such as knolls and flood plain rises, in this portion of the upland bottom may likely contain buried prehistoric deposits. As noted above, these areas are stable and receive sediment from the valley wall. In addition, these areas are likely to have topographic features that formed old surfaces and were later buried. As the City of Dallas expanded rapidly during the second and third quarter of the 20th century, much of this area was impacted by the development of light industry and manufacturing, as well as residential enclaves. In addition, sand and gravel quarrying, as well as waste disposal, have had a major impact on the area.

A total of 748 architectural resources or buildings and structures were identified in the APE, 49 of which are in the project footprint. However, 43 of the 49 structures are either destroyed, not historic or have poor integrity. A complete listing of the historic and prehistoric sites, as well as the architectural inventory, for the area of potential effect and project footprint area is provided in Appendix H.

HAZARDOUS, TOXIC AND RADIOLOGICAL WASTE (HTRW)

In 1993, a study titled "Initial Assessment for the Evaluation of Hazardous and Toxic Wastes" was conducted by Albert H. Halff Associates, Inc. The objective of the study was to research existing areas of HTRW contamination, and to identify suspect or previously unknown HTRW sites located within the Dallas Floodway Extension project area. In the report, nine areas of suspected HTRW contamination were identified, which represented the original areas of concern and thus formed the basis of subsequent Corps HTRW site investigations and project decisions.

Follow-up investigations were conducted by several different firms. Environmental Sciences and Engineering conducted a feasibility level site investigation at a number of these sites. Freese and Nichols investigated Linfield Landfill and one of the adjacent gravel pits. Geo-Marine conducted further feasibility level site investigations and developed cost estimates for this report. Tetra Tech NUS conducted an additional site investigation at Linfield Landfill. Results of these five studies, plus results of Corps of Engineers efforts in interviewing local residents and officials, searching regulatory agency files for studies conducted by others, and visually inspecting the project area increased the number of areas with suspected HTRW contamination to the 14 listed below, which are described in more detail in Appendix J of this report.

1. Praxair (formerly Linde Gas) - Acetylene gas manufacturing / packaging facility
2. Tri-Gas / Occidental Chemicals - Industrial gas facility and active silicate plant
3. Dallas Public Schools (formerly Proctor and Gamble)
4. Trinity Recycling (now Okon Metals) - Metals recycling facility
5. Various Gravel Pits - Near Trinity Recycling, near IH-45, ponded area near Dixie Metals, and ponded area near Linfield Landfill
6. Valley Steel & W.E. Grace Manufacturing Company - Industrial facilities
7. Dallas Demolition Company
8. Vacant Land Near Dal-Chrome
9. Energy Conversion Systems & Darling International
10. Vacant Land North of Central Wastewater Treatment Plan
11. Municipal Sludge Disposal Lagoon E
12. Union Pacific Railroad Landfill - Located northeast of Linfield Landfill
13. Linfield Landfill
14. Open Dump Near Linfield Landfill - Located due west of Linfield Landfill

SOCIO-ECONOMIC CONDITIONS

The Bureau of the Census reports the population for the city of Dallas as 904,100 persons in 1980 and 1,007,600 persons in 1990, while the North Central Texas Council of Governments shows the 1997 population at 1,052,300. These figures account for more than 80 percent of the population in Dallas County, and show an annual growth rate of over 10 percent.

Over this ten-year period, employment in the service industry has increased almost 50 percent, highlighting a significant shift from a manufacturing-based economy to a service related economy. Non-farm employment increased almost four percent between 1990 and 1994, while the construction industry led the job growth figures in 1994 with an increase of over 10 percent.

The D/FW area is one of the nation's leading distribution centers, generating a significant demand for warehouse space. The Metroplex is also an established transportation center for the nation. The Dallas Fort Worth International Airport covers 17,500 acres and was designed to meet the future needs of the entire North Texas area. The Metroplex exhibits positive growth trends that are anticipated to continue into the future. The location and climate are pleasant.

Due to the location of the Cadillac Heights residential neighborhood in relation to the downstream end of the existing Floodway and the potential impacts of any flood damage reduction project in this area, a comparison of socio-economic data for this neighborhood and the city of Dallas as a whole is presented in table 2-5. The majority of the data represents 1990 Census Bureau data. Unemployment figures for the city of Dallas, in 1994, were reported at 5.3 percent. In 1996, this rate decreased to 3.9 percent, and is currently reported at 3.6 percent. Local industries and employment are well diversified and unemployment rates are lower than the State average. Per capita income for 1995 was estimated at $18,180, with an average salary of about $30,000.

Table 2-5
Comparative Socio-Economic Data -
Cadillac Heights vs. City of Dallas

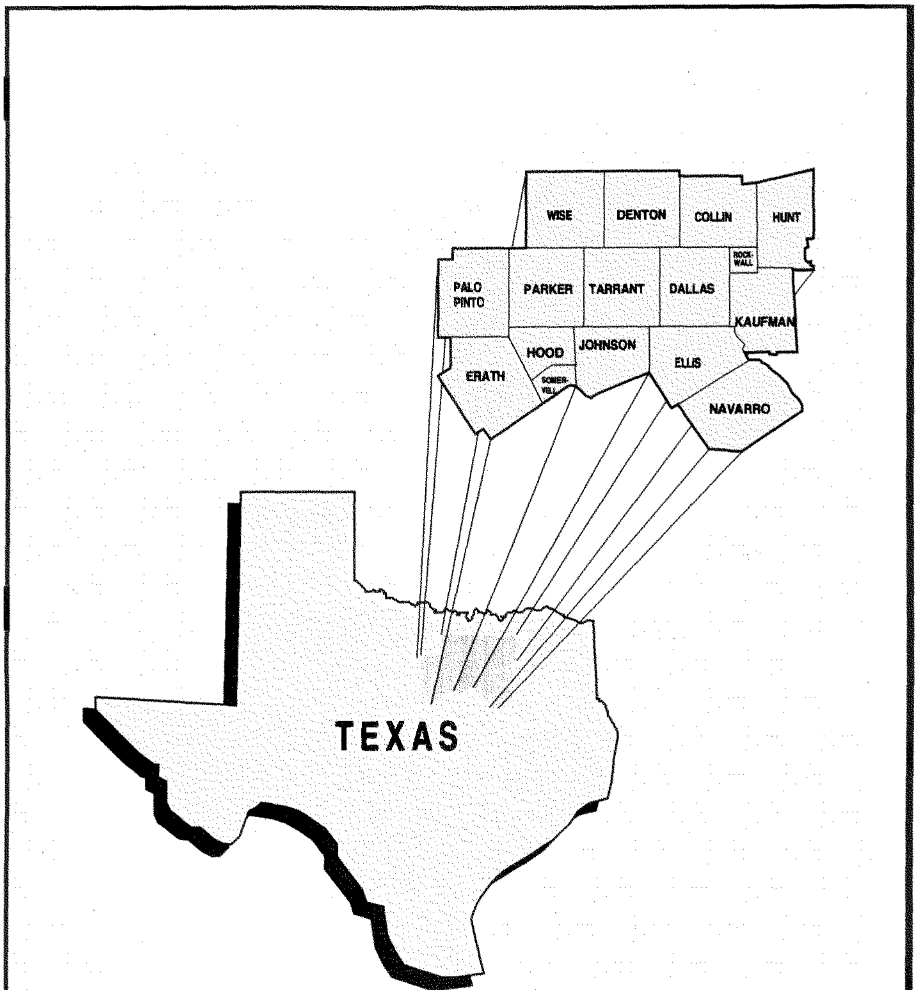
	Cadillac Heights	City of Dallas
Number of Homes	416	479,622
High / Low Price of Homes	$53,500 / $3,960	$11,949,900 / NA
Average Appraised Value	$17,500	$64,700
Percent Homeowners	51.5%	44.1%
Percent Single-Family Units	64.9%	47.5%
Percent Multi-Family Units	31.0%	50.4%
Number of Persons	1,168	1,052,300
Percent Persons Under 18	35.5%	25.0%
Percent Persons Over 65	6.8%	9.7%
Total Percent Hispanic	58.0%	20.3%
Total Percent Black	40.9%	29.5%
Total Percent White	1.0%	47.7%
Total Percent Without High School Degree	73.4%	26.5%
Total Percent Unemployed	9.1%	7.4%
Average Income	$15,089	$27,489
Percent Households on Public Assistance	35.4%	5.7%
Number of Persons Below Poverty Level	46.6%	17.8%

RECREATIONAL RESOURCES

REGIONAL RESOURCES

The 1990 Texas Outdoor Recreation Plan (TORP), prepared by the Texas Parks and Wildlife Department (TPWD), identifies existing recreational facilities, usage trends, and projected recreational needs for 23 regions within the state. The Dallas Floodway Extension is located within a 16-county area designated in the TORP as Region 4, shown in figure 2-6.

Region 4 has experienced several years of rapid population growth. With 336.6 people per square mile, the density of Region 4 is surpassed only by the Houston region. Many of the small towns and rural areas within Region 4 have become part of the rapidly expanding metropolitan area as people have moved



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION

REGION 4 - TORP

FIGURE 2-6

from the heavily populated cities to the suburbs. People in these urbanizing areas are finding open space increasingly scarce. The region now ranks twenty-first out of twenty-three regions in recreation land per thousand populations.

Residents of Region 4 are generally worse off than the state as a whole in recreational facility supply. Of 19 commonly used facilities or designated resources, 13 have a below average supply. The supply of baseball fields, swimming pools, and campsites is among the lowest in the state. A complete listing of region four facilities is provided in Appendix I. State parks located within a one hour drive of the study area include Lewisville Lake State Park and Cedar Hill State Park at Joe Pool Lake. The Texas Legislature has authorized the acquisition of approximately 1,500 acres along the Trinity River within the study area for a future low density recreational area to be named Trinity River State Park. Funding sources for acquisition of all of these lands, however, have not been identified.

Residents in the Metroplex need not drive far to find recreational waters because many of the state's major reservoirs are located in the metropolitan area. A total of 232,581 surface acres gives the region more lake acres than all regions except Deep East Texas; however, the large numbers of people residing in the region make the suitable surface acres per thousand population still fall below the state average.

With so many reservoirs in the area, the value of the free-flowing sections of the region's rivers increases as they become more rare. Public agencies within Region 4 are taking a fresh look at the valuable natural resources along these long neglected streams. Many cities have identified linear corridor resources within their jurisdictions which are highly desirable for recreation. Sites within the Trinity River floodplain are among those most actively studied. Nine cities and three counties within the region are participating with North Central Texas Council of Governments in the development of a *Common Vision* to protect the resources within this corridor. Goals include the development of a regional construction permit system and cooperation in the creation of a linear greenbelt of parks and trails along and adjacent to the river and its tributaries.

LOCAL RESOURCES

More than 6,000 acres of existing parks, open spaces, natural areas, and cemeteries are available for present or future public use within an 80 square mile section of the county that includes the study area. These public and private lands and facilities provide recreational opportunities for residents of the Metroplex, especially those who are unable to travel to recreational sites outside the metropolitan area. Most of the recreational resources within the study area are owned and managed by the City of Dallas, the Dallas Independent School District, and the Dallas County Open Space Board. A list of these resources and their approximate acreages is shown in table 2-6, and in Appendix I.

RECREATION ON THE TRINITY RIVER AND TRIBUTARIES

The most scenic wooded areas in Region 4 are often found in stream and river corridors. Scenic corridors along the Trinity, with natural meandering water courses bordered by riparian hardwoods or dense stands of trees and shrubs, are the most desirable segments of the river and the portions most intensely used by the recreating public. Use of these segments is the heaviest during higher stream flow periods, generally during the spring and fall seasons.

Recreation providers have expressed concern over stream bank erosion, in-stream flows and the quality of the water for contact recreation. In order to give citizens higher quality water resources, some users advocate tighter standards for the designation of stream segments as fishable and swimmable. Minimum in-stream flows are needed to preserve fish and wildlife habitat and historical and recreational resources.

Table 2-6
Recreational Resources Within the Study Area

Recreation Resource / Land Use Type	Number of Facilities	Approximate Acreage
Lakes	1	149
Landfills	1	2,009
Private Parks / Recreational Facilities	1	4
Golf Courses	4	627
Cemeteries	5	340
Public Parks	81	5,617
Natural Parks	2	243
City Open Space	4	765
Large Outdoor Stadiums	2	33
Proposed City Parks / Open Space	16	824
Proposed State Parks / Open Space	5	1,245

The Elm Fork of the Trinity River and its tributaries are currently being used for a variety of recreational activities, though access is limited or restricted. In spite of these limitations, avid canoeists, kayakers, fishermen, bicyclists, and bird watchers have located access points where park areas, roads, and bridges intersect with the river.

The Dallas Parks and Recreation Department conducted a recreational user survey in the communities surrounding the project area. Questionnaires were distributed to area residents through six neighborhood recreation centers. A copy of the questionnaire form and detailed findings are included in Appendix I. The activities most often selected from the list were picnicking, hiking/walking/jogging, bicycling, and fishing. While the survey is not statistically reliable due to the method of sampling, it does provide some insight into the types of activities residents of the area enjoy.

TRINITY RIVER STATE PARK

The Trinity River State Park is authorized by Chapter 22, Subchapter S, of the Parks and Wildlife Code. The Trinity River State Park would be established under the jurisdiction of the Texas Parks and Wildlife Department on property acquired under the 1983 Act of the 68th Legislature. A total of 5 parcels of land has been designated for this purpose, though no land has yet been acquired.

Parcels 1 and 2 consist of a 200-foot corridor extending about 11 miles along the east and west banks of the Trinity River. Parcel 3 includes about 90 acres and is located within the boundaries of Rochester Park. Parcels 4 and 5 designate 320 and 1,152 acres, respectively, for acquisition. In accordance with the 1983 Act, acquisition of the necessary park lands does not restrict the construction of flood control projects.

LAND USE

As is typical of investment in a floodplain, development is scattered. Existing land use within the study area consists of residential structures east of Lamar Street. Industrial properties are located along the west side of Lamar between Corinth Street and U.S. Highway 75 (Central Expressway), and along both sides of U.S. 75. Commercial properties are scattered throughout the study area.

MAJOR TRANSPORTATION ARTERIALS

The entire study area is served by transportation facilities, including public transit, highways, thoroughfares, and rail service. The Dallas Area Rapid Transit (DART) system provides public transportation between the communities within the study area and downtown Dallas. Highways serving the city and the study area are Interstate Highways 30, 35, 45, 67 and 20/635, U.S. Highways 75 (Central Expressway) and 175 (C. F. Hawn Freeway). The arterial street system consists of multiple four-lane roads, and Loop 12, which is a four-lane highway encircling the city. Utilization of the interstate highways have made the D\FW area a major trucking center for a five-state region.

Dallas is also a major hub for many rail routes. The Southern Pacific (SP) railroad has a major rail yard in the study area north of Loop 12 and east of U.S. 75. The Missouri, Kansas and Texas (MKT) railroad extends along IH-45 northward to the Central Business District. The St. Louis Southwestern railroad runs along the east bank of the Trinity River, west of Lamar Street, to its junction with the SP and Union Pacific line near the center of the study area. Burlington Northern railroad also serves the city.

LANDS IN PUBLIC OWNERSHIP

The city of Dallas has acquired a considerable amount of land in the study area. Over 300 acres of parkland have been acquired, including Moore, Rochester, Grover, and Roosevelt parks, and several miscellaneous parcels scattered throughout the project area. Major acquisitions at the Central Wastewater Treatment Plant, the McCommas Bluff Landfill, Floral Farms, Roosevelt Heights, and the Southeast Service Center have resulted in a total of over 3,000 acres being acquired by the City since 1980.

LANDFILLS

Four significant landfill areas are located within the floodplain in the vicinity of the study area. The McCommas Bluff Landfill, currently operated by the city, is located upstream of Highway 635 (IH-20), and is a primary site for solid waste disposal for the city. The South Loop Landfill is located immediately downstream of Loop 12 on the left overbank and was closed in 1983. The Elam Landfill is located immediately upstream of Loop 12 on the left overbank and was closed in 1980. The Linfield Landfill located on Linfield Road on the right bank of the Trinity River was closed in 1975. The Linfield Landfill has a significant influence on flood elevations due to its close proximity to the river channel, and due to fill placed above the 100-year water surface elevation. This landfill is located opposite the river channel from a natural narrowing of the left overbank, which combine to create a significant encroachment of the floodplain at this location.

INTERRELATIONSHIP TO OTHER PROPOSED ACTIONS

Several proposals within the Dallas area could be considered related to the proposed Dallas Floodway Extension area. The Corps of Engineers has begun studies to address the existing Dallas Floodway and the Stemmons North Industrial area. These studies were initiated to determine if further activities were justified to reduce flood damages within the area and to determine the needs and benefits of ecosystem restoration and other allied measures.

Dallas County has an active Open Space Program in place and, as a result of their activities, extensive acquisitions of key areas along the Trinity River floodplain have occurred. Recently, the citizens of Dallas approved a bond proposal that called for moving forward with actions that would accelerate acquisitions, and other actions that would promote acquisition and preservation of the "Great Trinity Forest".

The Trinity Parkway Corridor Major Transportation Investment Study (MTIS), conducted by the Texas Department of Transportation (TxDOT), was intended to develop a locally-preferred plan of action to solve transportation problems along the Trinity Corridor in Dallas, and to integrate with community plans and goals for the Trinity River Floodway, a major open space resource. The study started with identification of the transportation problem and ended with the selection of a locally-preferred alternative.

The study was focused on transportation needs in the IH-30/IH-35E interchange on the west edge of downtown Dallas, locally known as the "Mixmaster," and the depressed segment of IH-30 south of the downtown, locally known as the "Canyon." The study area was enlarged beyond downtown to cover a reasonable area of influence of the Canyon and Mixmaster on area transportation facilities.

The Recommended Plan of Action, as presented in the "Study Report, Trinity Parkway Corridor, Final Report, March 17, 1998", is comprised of seven elements in the corridor, including the Trinity Parkway, extension of Woodall Rodgers Freeway, and improvements to IH-30/IH-35E. Details of the study and recommended elements can be found in the referenced document.

Of the actions included within TxDOT's recommended plan, a proposed Trinity Parkway along the Trinity River would interface extensively with existing Corps of Engineers project features, including the Dallas Floodway levees. Furthermore, the initial alignment shown in the TxDOT document would run generally parallel to the Southern Pacific Railroad tracks near Lamar Street within the DFE study area.

The transportation planning will continue for several years before being finalized. TxDOT has recognized that additional environmental studies would be needed, and it is likely that an Environmental Impact Statement would be required to address the myriad of issues that the proposal would bring forward. In addition, should any aspect of the plan involve the discharge of dredged and fill material into the waters of the United States, including adjacent wetlands, prior approval from the U.S. Army Corps of Engineers would be required. Additionally, all proposed work within the limits of the existing Dallas Floodway or the Dallas Floodway Extension, if constructed as proposed, would be evaluated and approved by the U. S. Army Corps of Engineers. The evaluation of the proposed project would ensure there are no detrimental affects on the flood carrying capacity of ability to maintain the floodway. Furthermore, any development activity within the Trinity River Corridor must obtain a Corridor Development Certificate prior to construction.

CHAPTER 3

IDENTIFICATION OF PROBLEMS AND NEEDS

CHAPTER 3
IDENTIFICATION OF PROBLEMS AND NEEDS

This chapter identifies and investigates the problems and needs of the study area with regard to flood damage reduction, recreation, and environmental resources.

IDENTIFICATION OF FLOOD DAMAGE REDUCTION NEEDS

HISTORICAL FLOOD DATA

The Trinity River frequently exceeds its channel capacity and floods its banks. A number of major floods have been recorded in the study area prior to and since the turn of the century. The flood of record occurred in May 1908 and had an estimated peak discharge of 184,000 cubic feet per second at the Dallas gage. This flood caused the death of 11 persons and produced over $5 million in damage. Significant floods and the peak discharge recorded for each are listed in table 3-1.

Table 3-1
Significant Flood Events and
Peak Discharges Recorded at Dallas Gage

Time of Significant Flood Event	Dallas Gage Discharge (CFS)
May 1908	184,000
Apr 1922	69,600
Jun 1941	77,000
Apr 1942	111,000
Mar 1945	52,900
May 1949	82,500
May 1957	75,300
May 1966	42,100
May 1969	67,000
Nov 1981	37,400
May 1989	58,700
May 1990	82,300
Dec 1991	62,200

Continued urbanization throughout the watershed is a significant factor influencing both the current and future flood problems. Various Federal and non-Federal flood control projects have been constructed to alleviate the flooding problems. Federal projects which have significantly reduced the threat to life and property include the Fort Worth and Dallas Floodways and six reservoirs.

In 1989, Dallas recorded rainfall amounts of 9.6 inches in May and 8.8 inches in June. Several lives were lost along the Five Mile Creek tributary, and damages of over $1 million were incurred. The most destructive flood event in recent years, produced from the effects of Hurricane Norma, occurred in October 1989, causing at least $6 million in damages. Over 450 homes and businesses were damaged, and an additional 30 homes were completely destroyed. Dallas County was declared a disaster area by the President. Particular details of these storm events can also be found in National Weather Service Storm Data Reports. The December 1991 flood devastated residents in the Rochester Park neighborhood for the third consecutive year, and occurred in the midst of construction of a much needed levee in the neighborhood.

Channel capacities of the Trinity River within the study area are inadequate to confine events beyond the 2-year frequency. Increased urbanization in the upper watershed area and increased vegetation growth in the primary area of concern has intensified the flooding problem.

Flood prone areas within the 100-year floodplain of the watershed were identified by FEMA in March 1984. Dallas enrolled in the National Flood Insurance Program's Emergency Program since June 19, 1970 and the Regular Program since July 23, 1971, and currently holds 2,833 flood insurance policies valued at $146,577,700.

EXISTING CONDITIONS ANALYSES

General

In order to accurately assess the need for flood damage reduction measures, an analysis of annual damages under existing conditions was performed. Due to the complexity and length of this study, the existing conditions hydrology, hydraulic, and economics models used in the initial investigation phase (1991 - 1993) were modified to reflect more recent topographic data, and changes in design and economic parameters. The phases are referenced chronologically as "1991-1993", "1994-1996", and "1996-1997". The following sections discuss the basis for the existing conditions models for each phase of this study.

1991-1993

Hydrology. The hydrology model used during this initial phase of the study was developed from the Upper Trinity River Reconnaissance Study model and expected probability water surface elevations. The watershed area was divided into 110 subareas in order to be responsive to the timing of each major tributary's runoff contribution to the total flood hydrograph and also to obtain detailed flow information (flood hydrographs) at all major points of interest on the Clear, West, and Elm Forks, as well as the mainstem of the Trinity River. The United States Army Corps of Engineers (USACE) Hydrologic Engineering Center (HEC) program "HEC-1" was used to model the hydrology of this watershed. A one-hour computation time interval was used. All reservoirs with flood control storage were assumed to be at conservation pool level at the start of frequency related storms/floods and at a level corresponding to one-third of the full flood control pool (except at Lewisville Lake which was started at 89 percent full) at the start of the USACE Standard Project Flood (SPF). All reservoirs without flood control storage were assumed to be at normal (conservation pool) level at the start of all storm/flood events. Lake Bridgeport, Eagle Mountain Lake, Lake Worth, and Lake Arlington were assumed to reside at a level corresponding to 2, 3, 2, and 3 feet, respectively, above normal (conservation pool) level at the start of the SPF event. Comparisons were made between the frequency versus discharge relationships determined based on the statistical analysis of historical data at the major streamflow gages and those based on results of the HEC-1 modeling. Adjustments were made to the rainfall losses for some subareas in order to produce a better correlation.

Hydraulics. The hydraulic analysis for this study included that portion of the Trinity River from Interstate Highway 20/635 upstream to the confluence of the West Fork and the Elm Fork of the Trinity at the upstream end of the existing Dallas Floodway. The river, within the study area, is a perennial stream characterized by a main channel with an average depth of about 30 feet, a top width of about 200 feet, and overbanks which are generally very wide and flat. The historically stable river channel has an average bottom slope of about 0.05 percent. Channel migration and bank stability problems were not revealed by an analysis of historical topographic data and aerial photographs taken periodically over the past 47 years. The overbank areas in the floodplain are generally covered with heavy vegetation. Examination of historical aerial photographs revealed that a gradual increase in the density of the vegetative cover on the floodplain areas has occurred and has led to an increase in the hydraulic roughness of the floodplain. The areas that have the greatest density of vegetation are covered with mature trees of sufficient height to extend above the water surface of the highest flood flows considered in this analysis; therefore, a consistent roughness value was assumed for all depths of flows.

The HEC-2 Water Surface Profiles computer program was used to hydraulically model and compute water surface profiles. The hydraulic model utilized topographic maps, provided by the city of Dallas, which were compiled from aerial photography flown in March 1977. These maps were updated to reflect the contours of two city landfills completed after 1977. Channel geometry was input from surveyed cross sections used in previous Trinity River hydraulic models. The White Rock Creek confluence with the Trinity River and the low-lying residential areas north of the Rochester Park Levee store significant volumes of flood water during major flood events, and separate HEC-2 models were created to more accurately represent these storage volumes in the computation of peak discharges for the various flood events.

Economics. Detailed economic investigations and analyses were conducted in connection with this study. The principal purpose of these economic analyses was to identify the extent of the flood problem and, on a comparable basis, evaluate solutions to reduce flood losses. These analyses were conducted following procedures and guidelines as set forth in the Water Resources Council's Principles and Guidelines (March 10, 1983).

As part of these activities, field surveys were conducted to identify the numbers and types of property, as well as the market value of the investment, affected by flooding. Damageable property and costs associated with flooding are divided among five damage categories, as shown in table 3-2.

A full range of water surface profiles based on existing stream conditions were provided by the hydrology and hydraulics models, as described above. These profiles were used to delineate the floodplain limits and determine the relationship of damageable properties to both elevation and frequency of flood occurrence.

Table 3-2
Major Damage Categories

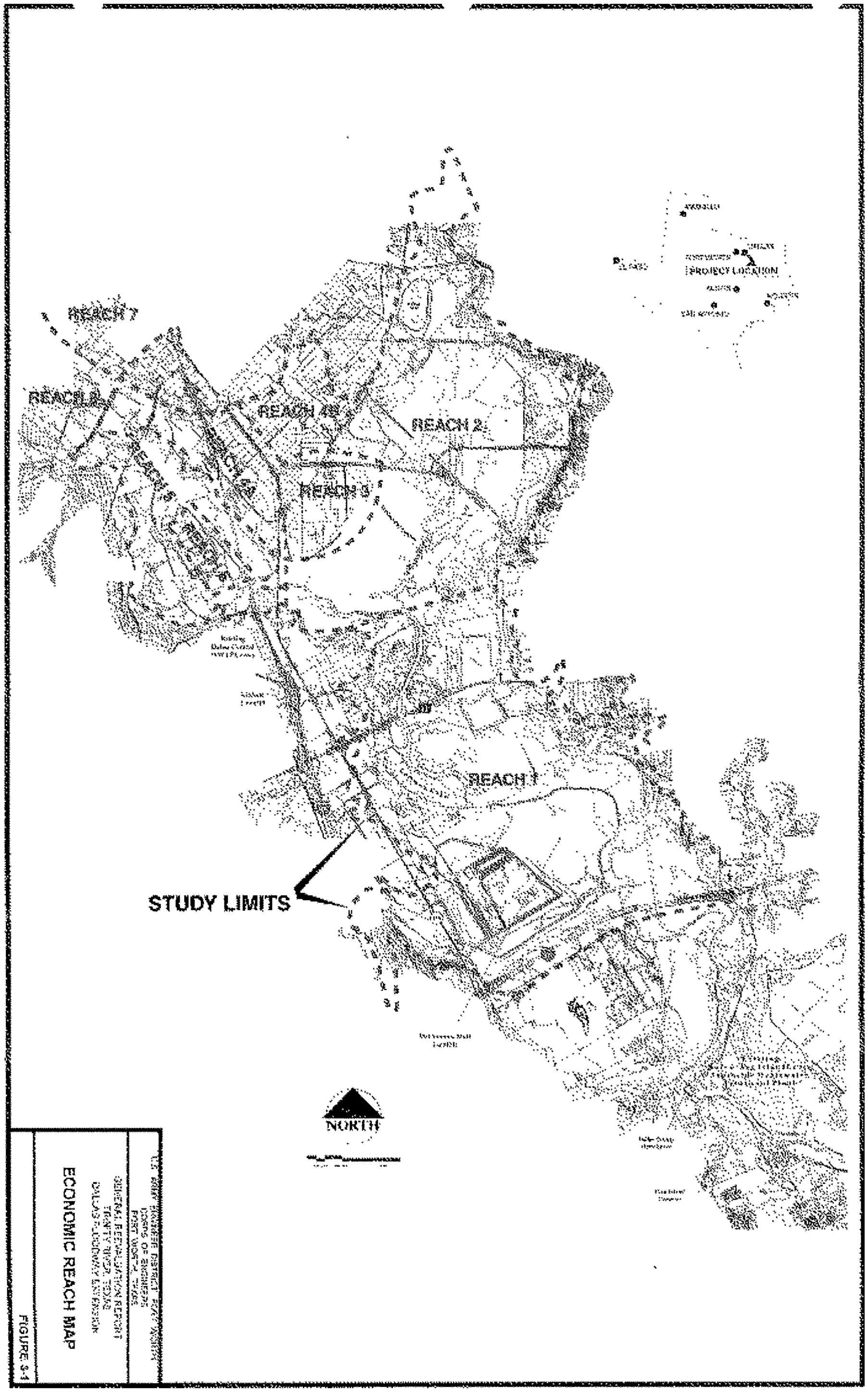
Damage Category	Activity Description
Residential	Single and multi-family dwellings
Commercial and Industrial	Retail and wholesale businesses
Public	Public and quasi-public buildings
Flood Insurance Administration	Costs to the public for flood insurance program administration
Other:	
Transportation	Streets, highways, and bridges
Communications and Utilities	Electrical, gas, telephone, sewerage, and water supply facilities and buildings
Public Health and Relief	Flood-fighting and related emergency management activities

Although the primary area of investigation is defined as that portion of the Trinity River between the confluence of Five Mile Creek near IH-20 downstream and the terminus of the existing Dallas Floodway Levees upstream, preliminary analysis revealed significant hydraulic correlations between the extension area and the leveed area upstream. Consequently, about eight miles of the existing Dallas Floodway was included in the study area. These primary and secondary study areas were further subdivided into reaches based on concentrations of damageable properties. The primary study area is defined as reaches 1 - 6, while the secondary study area includes reaches 7 and 8. These reaches are shown in figure 3-1 and defined as follows:

- **Reach 1 (Sleepy Hollow):** Extends from the confluence of White Rock Creek south eastward to the confluence of 5-Mile Creek. The reach is bounded by IH-20, the MKT Rail Road, and Linfield and Riverwood Roads. This reach includes the Sleepy Hollow Golf Course located near the river and Loop 12. The land use includes commercial, industrial, residential, and public facilities. The McCommas Bluff and Linfield landfill sites are located in this reach. The total investment value of this reach was estimated at $32 million.

- **Reach 2 (White Rock):** Includes a portion of the White Rock Creek Tributary from IH-30 upstream to its confluence with the Trinity River near Linfield Street. The reach is further bounded by Pemberton Road, IH-30, the Southern Pacific Railroad and the Rochester Park Levee. Land use includes single and multi-family residential, commercial and industrial properties. The total investment value of this reach was estimated at $7 million.

- **Reach 3 (Rochester Park):** This reach is located near the center of the study area and is predominately enclosed along its southern border by the Rochester Park Levee. The reach is further bounded by Hwy. 175 (Hawn Freeway), and Hwy. 310 (Central Expressway). The land use is predominately single and multi-family residential and a few commercial and public properties. The total investment value of this reach was estimated at $55 million.


REACH 7
REACH 6
REACH 4B
REACH 2
REACH 3
REACH 1
STUDY LIMITS
PROJECT LOCATION
NORTH
ECONOMIC REACH MAP
FIGURE 3-1

- **Reach 4A (Lamar):** This reach (initially combined with reach 4B) is located within the SPF floodplain limits along the east bank of the Trinity River. Beginning near the intersection of Lamar Street and Hwy. 175 and continuing northerly upstream to the AT & SF railroad. The reach is bounded on the east by Hwy. 310 (Central Expressway). The major land use categories include residential, commercial and industrial facilities. The total investment value of this reach was estimated at $45 million.

- **Reach 4B (Oakland Channel):** This reach (initially combined with reach 4A) is located parallel and to the east of Reach 4A. It is bounded by Hwy. 310 and Second Avenue. The Oakland Channel, which flows into White Rock Creek is located within this reach. The primary land use categories are single and multifamily residential and some commercial facilities. The total investment value of this reach was estimated at $217 million.

- **Reach 5 (Cadillac Heights):** Located on the West Bank of the Trinity River, the SPF limits of this reach extends from IH-45 to the AT&SF Railroad at the end of the existing Dallas Floodway. This area includes single-family residential, commercial, industrial and public properties. The total investment value of this reach was estimated at $27 million.

- **Reach 6 (Treatment Plant):** This reach is located downstream of Reach 5 and consists solely of the Central Wastewater Treatment Plant facility. This public facility represents the greatest single investment in the study area. The total investment value of this reach was estimated at $459 million.

- **Reach 7 (East Levee):** This reach, located upstream of the primary study area, encompasses the SPF flood plain limits protected by the East Levee of the existing Dallas Floodway System. The area includes the Central Business District and a mixture of all land use categories. Commercial facilities dominate the reach (69 percent) with almost 1982 structures. A total of 2,885 structures were identified with an estimated value of over $4.8 billion.

- **Reach 8 (West Levee):** This reach, located upstream of the primary study area, encompasses the SPF flood plain limits protected by the West Levee of the existing Dallas Floodway. The area includes all land use categories - residential, commercial and industrial, and public facilities. Residential structures account for over 90 percent of the land use in this reach with over 6,900 identified. A total of 7,700 structures were identified with an estimated value of over $934 million.

Estimates of expected annual damages under existing conditions were calculated through integration of frequency-damage data. Generally, this involved multiplication of the mean damages between each pair of flood events by the difference in exceedance probabilities for that pair of events, repeated over the entire range of flood events through the SPF, for each category of damageable property. Incidental damages (comprising transportation, communications and utilities facilities, and public health and relief operations) were estimated on the basis of the historical information submitted by the local sponsor documenting Federal Emergency Management Agency (FEMA) claims.

Initial estimates of existing flood damages and benefits presented herein reflect June 1993 prices and level of development. The prevailing Federal interest rate of 8.0 percent was applied to convert first costs and undiscounted future damages and benefits to average annual equivalent values. A 50-year period of analysis was used, extending from 1997 to 2047. The STDMA Flood Damage Program was used to determine single event and expected annual damages (EAD). The total equivalent annual flood losses in the study area were estimated at over $20.8 million, based on June 1993 prices, and the prevailing Federal interest rate of 8.0 percent. This information is detailed by reach in table 3-3.

Table 3-3
Expected Average Annual Damages
(June 1993 prices and level of development, 8.0% interest, 50-year period of analysis)

Reach	Annual Damages			Description
	Direct	Incidental	Total	
1	$311,800	$32,427	$344,200	Below White Rock
2	$53,300	$5,543	$58,800	White Rock
3	$166,300	$17,295	$183,600	Rochester Park
4	$1,741,100	$181,074	$1,922,200	Lamar/Oakland Area
5	$1,086,900	$113,038	$1,199,900	Cadillac Heights
6	$1,930,800	$200,803	$2,131,600	Treatment Plant
Subtotal	$5,290,200	$550,181	$5,840,300	Study Area
7	$11,800,000	$1,227,200	$13,027,200	East Levee
8	$1,7968,000	$186,867	$1,983,700	West Levee
Subtotal	$13,596,800	$1,414,067	$15,010,900	Upstream Levees
Total	$18,887,000	$1,964,248	$20,851,200	

1994-1996

Hydrology and Hydraulics. The hydrology and hydraulic models were updated to incorporate the results of the Upper Trinity River Feasibility Study, which utilized more recent topographic maps developed from aerial photography flown in February 1991, estimated to have an accuracy of plus or minus 0.5 feet. Therefore, models for this study are a subset of the models used for the Upper Trinity Feasibility Study, thereby maintaining consistency between the two studies. A calibration of these models was accomplished by the methods described in Appendix A, to closely match the May 1990 Flood.

Baseline conditions were assumed to represent estimated watershed development for the year 2000, based on land use data obtained from the North Central Texas Council of Governments (NCTCOG), and "percent urbanization" and "percent imperviousness" for each subarea as derived from the Geographic Information System (GIS).

The development of the baseline model was based on the requirements of the Upper Trinity River Feasibility Study that certain projects which influence the hydraulic and hydrologic conditions within the floodplain would be incorporated into the HEC-2 model to form a basis for future hydraulic studies within the Trinity River corridor. The following projects are future permitted projects and/or projects constructed, or under construction, since the 1991 aerial photography and mapping was completed. All landfills have been represented as completed.

- Southside Sewage Treatment Plan Levee modification
- McCommas Bluff Landfill and Swale
- Rochester Park Levee
- Central Wastewater Treatment Plant Levee modification
- DART OC-2 Rail Line Bridge
- Dixie Metals Company Landfill
- Dallas Floodway channel and levee modifications (AT&SF Railroad bridge to Houston Street bridge)
- Various small permitted fill areas

A complete description of the hydrologic and hydraulic analysis for this baseline condition and corresponding water surface profiles are presented in Appendix A.

Economics. The expected annual damages for this baseline condition were revised based on the modifications to the hydrology and hydraulics models, as described above, and on supplemental data gathered from surveys and the Dallas County Appraisal District for the Upper Trinity Feasibility Study. In addition, a risk-based analysis was incorporated, in accordance with recent USACE guidelines. The NexGen Hydrologic Engineering Center-Flood Damage Assessment (HEC-FDA) program integrates hydrologic engineering and economic analysis through application of the Monte Carlo simulation, calculates stage-damage-uncertainty information at damage reach index locations, and computes equivalent annual damages. The revised expected annual damages for baseline conditions, based on October 1995 prices and a prevailing Federal interest rate of 7.63 percent, are shown in table 3-4.

Traditional expression of the frequency of flood events has been in terms of the recurrence interval in years, such as, the "100-Year Flood". The more appropriate expression of the probability of a particular flood magnitude is in terms of "percent chance exceedance", especially as it relates to a risk-based analysis. Therefore, the "100-Year Flood", which is defined as "the magnitude of flooding which has a 1 percent probability of being equaled or exceeded in any given year" would be expressed as the "1 percent chance flood". For comparison purposes, the nine flood events computed for this study, traditionally referred to as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 500-year, and the Standard Project Flood (SPF), would be referred to, in probabilistic terms, as the 99 percent, 50 percent, 20 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent chance flood, and the SPF, respectively. Although the analyses contained herein were performed as risk-based analyses, results of these investigations are expressed in traditional terms for the benefit of the reader.

Table 3-4
Revised Expected Average Annual Damages
(October 1995 prices and level of development, 7.63% interest, 50-year period of analysis)

	Annual Damages			
Reach	Direct	Incidental	Total	Description
1	$338,200	$35,173	$373,400	Below White Rock
2	$58,400	$6,074	$64,500	White Rock
3	$168,000	$17,472	$185,500	Rochester Park
4	$1,853,800	$192,795	$2,046,600	Lamar/Oakland Area
5	$986,000	$102,544	$1,088,500	Cadillac Heights
6	$1,254,200	$130,437	$1,384,600	Treatment Plant
Subtotal	$4,658,600	$484,494	$5,143,100	Study Area
7	$12,131,000	$1,261,624	$13,392,600	East Levee
8	$1,102,400	$114,650	$1,217,000	West Levee
Subtotal	$13,233,400	$1,376,274	$14,609,600	Upstream Levees
Total	$17,892,000	$1,860,768	$19,752,700	

1996-1997

Hydrology and Hydraulics. The major change instigating the need for a revised hydraulic model during this phase of the study was the passage of the Water Resources Development Act (WRDA) of 1996, in October 1996. Section 351, contained therein, provided that the city of Dallas would be granted credit for the portions of two previously constructed non-Federal levees deemed compatible with the Federal plan. These levees included the Rochester Park Levee and the modifications to the Central Wastewater Treatment Plant (CWWTP) Levee, and were constructed by the city of Dallas in response to the floods of 1989-1991. Section 351 states the following:

> *(a) IN GENERAL -- The project for flood control, Dallas Floodway Extension, Dallas, Texas, authorized by section 301 of the River and Harbor Act of 1965 (79 Stat. 1091), is modified to provide that flood protection works constructed by the non-Federal interests along the Trinity River in Dallas, Texas, for Rochester Park and the Central Wastewater Treatment Plant shall be included as a part of the project and the cost of such works shall be credited against the non-Federal share of project costs.*
>
> *(b) DETERMINATION OF AMOUNT. -- The amount to be credited under subsection (a) shall be determined by the Secretary. In determining such amount, the Secretary may permit credit only for that portion of the work performed by the non-Federal interests that is compatible with the project referred to in subsection (a), including any modification thereof, and that is required for construction of such project.*
>
> *(c) CASH CONTRIBUTION.-- Nothing in this section shall be construed to limit the applicability of the requirement contained in section 103(a)(1)(A) of the Water Resources Development Act of 1986 (33 U.S.C. 2213(a)(1)(A)) to the project referred to in subsection (a).*

In order to accurately assess the economic benefits associated with these levees, it was necessary to revise the existing conditions hydraulics model to reflect the characteristics of the study area prior to 1991 when the construction of these levees was initiated. Water surface profiles derived from this revised model are presented in Appendix A.

Economics. Table 3-5 displays the numbers and estimated total values of properties (structures and contents) located within the study area after applying the revised hydraulic model. A total of 2,550 structures were identified within the SPF limits. As shown, the total flood plain investment within the SPF limits of the primary study area is valued at over $841.0 million based on January 1997 prices.

Expected annual damages were tabulated for the final phase, utilizing the HEC-FDA program, based on the aforementioned revisions, and on the current prevailing Federal interest rate of 7.375 percent. Incidental damages, comprised of transportation, communications and utilities facilities, and public health and relief operations, were added to the results to obtain the total expected annual damages.

Table 3-6 shows the total expected annual damages for the SPF floodplain under these revised existing conditions. The primary study area could expect damages totaling over $6.5 million and the secondary study area over $13.1 million. The combined expected annual damage exceeds $19.6 million.

Table 3-5
Total Floodplain Investments by Reach
Under Existing Conditions
(January 1997 Prices and Level of Development)
(1,000's $)

Reach	Single-Family Residential		Multi-Family Residential		Commercial/ Industrial		Public		Total Structure Investment		Vehicles	Rail	Total Investment
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Primary Study Area													
1	73	1,768.3	0	0.0	26	22,876.1	3	2,558.8	102	27,203.2	192.9	4,443.8	31,839.9
2	68	4,339.9	3	476.1	19	1,707.7	0	0.0	90	6,523.7	430.9	0.0	6,954.6
3	247	6,463.4	112	9,234.0	8	199.0	4	36,651.5	371	52,547.9	2,021.0	0.0	54,568.9
4A	107	2,715.3	6	382.0	68	34,194.2	0	0.0	181	37,291.5	345.3	7,063.1	44,699.9
4B	1,432	34,189.1	0	0.0	61	5,102.8	4	177,768.0	1497	217,059.9	0.0	0.0	217,059.9
5	228	6,630.1	0	0.0	66	18,006.2	0	0.0	294	24,636.3	742.8	1,623.0	27,002.1
6	0	0.0	0	0.0	0	0.0	15	458,878.6	15	458,878.6	0.0	0.0	458,878.6
Area Total	2,155	$56,106.1	121	$10,092.1	248	$82,086.0	26	$675,856.9	2,550	$824,141.1	$3,732.9	$13,129.9	$841,003.9
%	84.5%	6.7%	4.7%	1.2%	9.7%	9.8%	1.0%	80.4%	100.0%		0.4%	1.6%	100.0%
Secondary Study Area													
7	869	75,871.6	3	1,691.3	1,982	4,553,940.5	31	$220,968.8	2,885	$4,852,472.2	$5,058.1	N/A	$4,857,530.3
8	6,493	$297,262.5	474	$110,933.0	642	$440,403.4	94	$58,497.6	7,703	$907,096.5	$27,221.7	N/A	$934,318.2
Area Total	7,362	$373,134.1	477	$112,624.3	2,624	$4,994,343.9	125	$279,466.4	10,588	$5,759,568.7	$32,279.8	$0.0	$5,791,848.5
%	69.5%	6.4%	4.5%	1.9%	24.8%	86.2%	1.2%	4.8%	100.0%		0.6%	0.0%	100.0%
Total Investment													
	9,517	$429,240.2	598	$122,716.4	2,872	$5,076,429.9	151	$955,323.3	13,138	$6,583,709.8	$36,012.7	$13,129.9	$6,632,852.4

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Table 3-6
Expected Annual Damages
Under Existing Conditions (Pre-1991)
(January 1997 prices and level of development, 7.375% interest, 50-year period of analysis)

Reach	Annual Damages			Description
	Direct	Incidental	Total	
1	$294,200	$54,271	$348,900	Below White Rock
2	$50,800	$9,449	$60,200	White Rock
3	$431,500	$80,259	$511,800	Rochester Park
4A	$1,350,000	$251,100	$1,601,100	Lamar Area
4B	$741,100	$137,845	$878,900	Oakland Area
5	$1,085,700	$201,940	$1,287,600	Cadillac Heights
6	$1,696,300	$162,845	$1,859,100	Treatment Plant
Subtotal	$5,649,600	$898,159	$6,547,600	Study Area
7	$10,054,700	$1,870,174	$11,924,900	East Levee
8	$998,500	$185,721	$1,184,200	West Levee
Subtotal	$11,053,200	$2,055,895	$13,109,100	Upstream Levees
Total	$16,702,800	$2,954,054	$19,656,700	

IDENTIFICATION OF RECREATIONAL NEEDS

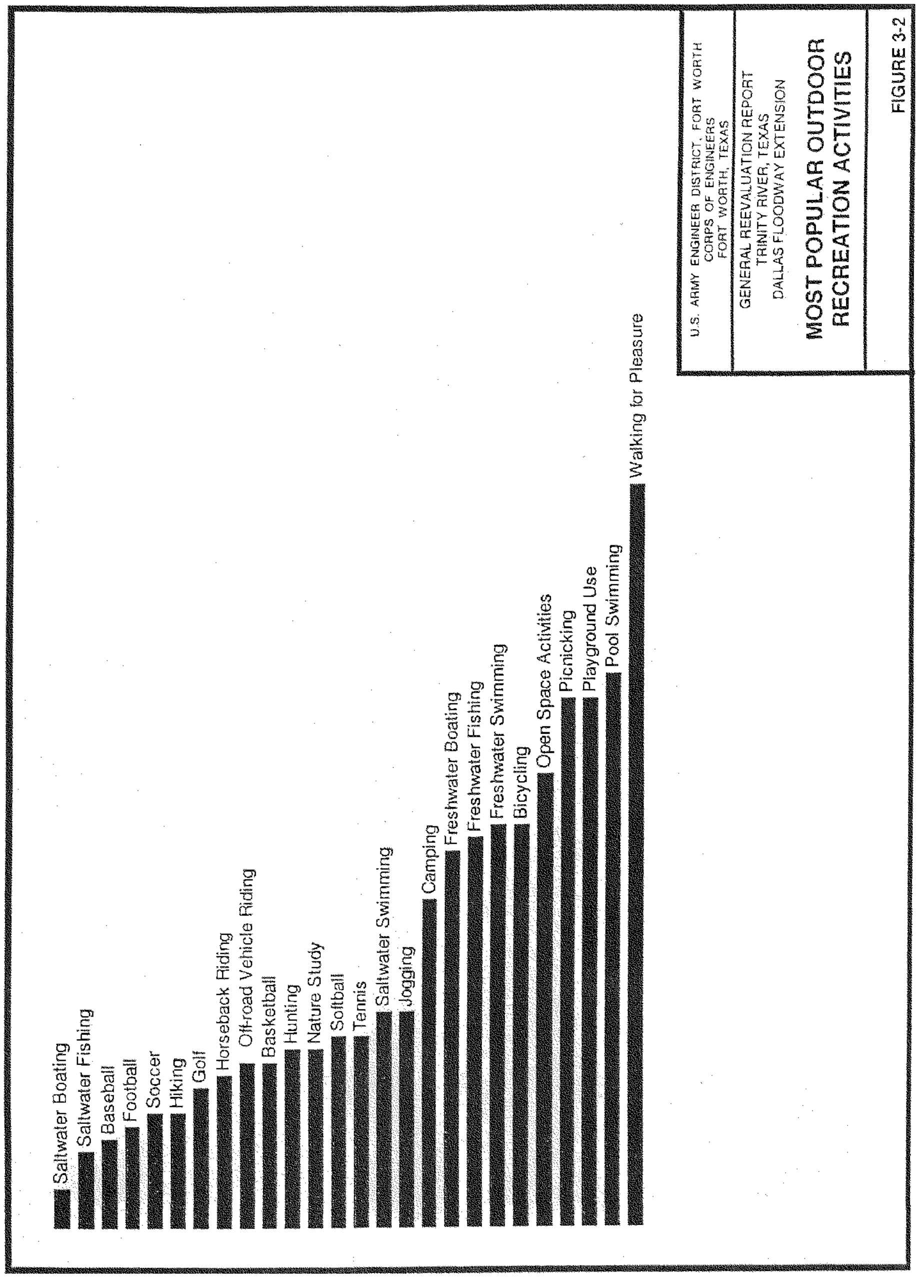
Open space and outdoor recreational facilities which currently exist within the study area are discussed in a preceding section of this report. While there are substantial amounts of open space and recreational facilities available to the residents of the area, projections show that the demand for these facilities is continuing to increase. Table 3-7 and figure 3-2 show the most popular outdoor recreational activities which were expected to occur in Region 4 in years 1995, and 2000, as projected in the 1990 Texas Outdoor Recreation Plan (TORP). Participation will increase for each projection year. Fresh water fishing, swimming, and picnicking will attract the most participation in the region for resource based activities. Participation in urban oriented activities projected for 1995 were over eight times as high as the participation in resource based activities in the region. This ratio is one of the highest in Texas. Texans from outside Region 4 will have little impact on the region's resources.

Table 3-8 shows regional facility needs for 13 of the 18 commonly used facilities/resources by 1995. Increases of more than 100 percent over existing supply are needed for five facilities (hiking, horseback, and multi-use trails, playgrounds, and freshwater swimming areas). Table 3-9 ranks the outdoor recreation needs within the region. Multi-use trails are the highest need followed by freshwater swimming, playgrounds, and hiking trails. Public recreation providers in the region have repeatedly expressed a need for more parks and passive open space. In recent years, park land and open space have become increasingly scarce as available sites have been reduced. Rapid development has replaced many natural areas with buildings and pavement. Needed lands shown in table 3-8 represent only the acres required to develop recreational facilities. Most park providers have identified undeveloped land as their highest priority need (park sites, open space, and greenbelt acquisition). The next greatest need expressed is for upgrading and renovating existing facilities.

Table 3-7
Projected Urban Outdoor Recreation Participation for Region 4

Activity/Facility Use	Project Participation (in 1000's Annual User Occasions)		
	1990	1995	2000
Baseball	4,852	4,882	5,183
Basketball	5,662	6,020	6,379
Bicycling	41,405	44,140	46,880
Bicycling on Trails	2,551	2,719	2,888
Football	2,673	2,870	3,068
Golf	5,268	5,781	6,295
Horseback Riding	3,054	3,255	3,456
Horseback Riding on Trails	784	835	887
Jogging/Running	19,073	20,055	21,039
Jogging/Running on Trails	5,875	6,177	6,480
Off-road Vehicle (ORV) Riding	5,374	5,723	6,074
ORV Riding on Trails	1,053	1,121	1,190
Open Space Activities	13,358	14,076	14,794
Playground Use	19,374	20,435	21,497
Soccer	5,748	6,073	6,398
Softball	6,607	6,911	7,217
Swimming, Pool	24,685	26,216	27,749
Tennis	5,732	6,132	6,533
Walking (Pleasure/Exercise)	57,876	63,100	68,330
Walking on Trails	13,549	14,772	15,996

Source: 1986 Participation Survey, Parks Division, TPWD, 1987.



MOST POPULAR OUTDOOR RECREATION ACTIVITIES

FIGURE 3-2

Table 3-8
Additional Urban Outdoor Recreation Facilities/Resources Needed in Region 4

Facility/Resource	1986 Facility Supply	Facilities Needed Above 1986 Supply		
		1990	1995	2000
Baseball Fields	310	24	46	68
Basketball Goals	469	214	258	301
Boat Ramp Lanes	423	*	*	*
Campsites	5,393	*	*	*
Fishing Structures, (yd.)	8,167	316	967	1,619
Golf Holes	666	*	28	89
Hiking Trail Miles	23	63	69	76
Horseback Riding Trail Miles	31	81	89	96
Lake Acres (BFS Suitable)	165,749	*	*	*
Off-Road Vehicle Riding Acres	2,899	*	*	*
Picnic Tables	8,947	*	*	*
Playground Acres, Equipped	915	930	1,031	1,133
Soccer/Football Fields	564	103	118	134
Softball Fields	478	*	16	37
Swimming, Freshwater (1000 yd^2)	390	1,029	1,100	1,170
Swimming, Pool (1000 yd^2)	90	67	77	87
Tennis Courts	877	621	726	830
Trail Miles, Multi-Use (Walk,Bike,Jog)	118	263	292	322
Developed Land, Acres		4,572	5,457	6,709

* *Indicates no needs exist based on a regional analysis of supply and participation; however, needs may exist locally within the region due to inadequate distribution of existing facilities.*

Source: Parks Division, TPWD, 1988

Table 3-9
Ranking of Outdoor Recreation Facility/Resource Needs in Region 4 through 1995

Need by Rank	Facility/Resource
1	Trail Miles, Multi-Use (Walk, Bike, Jog)
2	Swimming, Freshwater (1000 yd^2)
3	Playground Area, Equipped
4	Hiking Trail Miles
5	Horseback Riding Trail Miles
6	Soccer/Football Fields
7	Swimming, Pool (1000 yd^2)
8	Tennis Courts
9	Basketball Goals
10	Baseball Fields
11	Golf Holes
12	Fishing Structures, Freshwater (yd.)
13	Softball Fields
14	Boat Ramp Lanes, Freshwater
15	Campsites
16	Picnic Tables
17	Off-Road Vehicle Riding Acres
18	Lake Acres (BFS Suitable)

Source: Parks Division, TPWD, 1988.

The City of Dallas and the Dallas County Open Space Board have specific plans to acquire additional lands to meet future public recreational demands. Proposed acquisitions are often dependent on the availability of public funds and are influenced by private development pressures and development permit approvals. Both the City and the County have bond funded open space acquisition programs. The recent slump in the Texas economy has temporarily suppressed rising land costs, making the present a very good time to pursue needed acquisitions.

As would be expected, river and creek segments which have had trees and shrubs removed, have been channelized, lined with levees, or heavily developed are less desirable and the least utilized by area canoeists, bicyclists, hikers, and bird watchers. Many of these channelized and leveed river segments offer recreation potential but will need to be enhanced with river access points, trails, play areas, sports fields, tree and shrub plantings and wildlife habitat improvements in order to attract recreational users to the floodway.

Without exception, the recreational master plans and sector plans of the cities and counties with jurisdiction along the Trinity River call for utilization of the flood plain for open space, linear parks, access areas, active and passive use areas, interpretive areas, natural areas, "urban wilderness" areas, and a system of linked hiking, biking and equestrian trails. A regional goal is to tie public lands and open space within the Trinity Corridor and its tributaries from Lewisville Lake, Lewisville, Coppell, Carrollton, Irving, White Rock Lake, Dallas, Grand Prairie, Mountain Creek Lake, Joe Pool Lake, Arlington, Fort Worth, Lake Worth, Benbrook Lake and other publicly owned areas. The cities have expressed interest in exploring Federal cost sharing options for acquiring riparian forests, open fields and wetlands which border the Trinity River and its tributaries, and have encouraged the Corps to consider the full potential for cost sharing in the acquisition of natural areas and open space, and in the construction of recreational facilities in conjunction with structural and nonstructural flood protection alternatives.

Working toward a system of parks, recreational areas, and linear trails along the Trinity is an integral portion of the North Central Texas Council of Government's ***Common Vision*** work program. NCTCOG has identified the Trinity River Corridor as a "unique regional resource." The value of this resource is increased because of its location within the heart of a growing Metroplex. The 100-mile long corridor encompasses the SPF flood plain of the West Fork above Eagle Mountain Lake and the Clear Fork from Benbrook to the Elm Fork, and along the Elm Fork from Lewisville Lake through the mainstem of the river, with its major tributaries, downstream to south Dallas.

While there are obviously conflicts between desires to reclaim the flood plain or preserve it, there is room within the 70,000 acres of the Corridor for both of these desires to be met. "The Trinity River Corridor is valuable to all 4 million residents of the Region and the millions to come." (NCTCOG, 1989)

The North Central Texas Council of Governments (NCTCOG) is pursuing a Trinity Greenbelt of major parks linked by a regional trail system. According to NCTCOG, "Tens of thousands of acres of open space are being preserved within the river corridor with outstanding potential for active and passive recreation. Using the Trinity River Information Network, local park departments and recreational professionals will prepare a realistic Trinity Greenbelt strategy of major parks linked by a regional trails system." It is the intent of NCTCOG to implement a "world class" Trinity Greenbelt strategy.

Local bicycle, equestrian, and conservation groups have shown a keen interest in the development of trails as part of a recreation plan for the study area, and have offered many recommendations for consideration. These recommendations are presented in appendix I.

IDENTIFICATION OF ENVIRONMENTAL NEEDS

The Dallas-Fort Worth Metroplex has experienced extensive urban development, and expansion continues into surrounding counties. The need to provide protection against ravaging floods in these areas has escalated along with the new development, as continually increasing areas of impervious surfaces associated with rooftops, parking lots, and highways yields greater volumes of storm water runoff. In addition, local drainage programs tend to increase the speed of runoff, thereby necessitating on-going improvement of flood control features. Within the Metroplex, the Corps of Engineers has constructed Benbrook, Joe Pool, Grapevine, Lewisville, and Ray Roberts Lakes, all of which are multi-purpose projects providing flood damage reduction benefits to the area. In addition, the Corps has constructed the Fort Worth and Dallas Floodways, which are composed of levees and channels, that provide needed protection for the downtown business districts of the respective cities.

With the exception of Joe Pool Lake and Lake Ray Roberts, these projects were constructed prior to the enactment of legislation requiring environmental review. Joe Pool Lake and Lake Ray Roberts were authorized prior to Corps authorities to mitigate environmental losses. Review of available information indicates that, while providing needed flood damage reduction and water supply for the Metroplex, these projects also forever altered the landscape. The most significant losses that occurred were to the bottomland hardwood areas that existed as riparian forested stringers along the main stem river and tributaries. In addition, many small emergent wetland areas along the streams were either inundated and lost or were removed through the grading and leveling process of channel construction in the leveed reaches. Reduction of flooding brought about by these large projects has also increased secondary development throughout the region. Prior to the mid-1970's, there were no regulatory processes to protect or require mitigation for any of these wetland losses.

In 1985, the Corps of Engineers began a study to address the impacts of unrelated development projects along the Trinity River and it tributaries in Dallas, Denton, and Tarrant Counties. The *Final Regional Environmental Impact Statement* completed in 1987 indicated that within the 73,000-acre study area, only 570 acres of herbaceous wetlands were identifiable within the 100-year floodplain, and only 745 acres within the Standard Project Flood zone. Even without a definitive historic record of emergent wetlands losses within the area prior to the major Corps construction activities, it is clear that significant losses have occurred. These losses to wetlands adjacent to the riparian woodlands in the form of scars, seeps and cutoffs have also impacted many species of migratory shore birds, wading birds, reptiles, and amphibians. From a resource protection standpoint, it could be easily argued that priorities should be established for efforts to maintain and improve the integrity of bottomland hardwood forests because of their ecological significance, their visibility and appeal to observers, and the length of time required to re-establish a mature forest. Emergent wetlands also have ecological significance and can be established comparatively quicker than forests; therefore, annualized benefits can be quite high. Furthermore, emergent wetlands can be established in conjunction with other project features without inducing flood damages or compromising flood reduction benefits.

In summary, natural habitat in the area has given way to increased urbanization, making the remaining natural habitat more important. Accordingly, future actions should focus on protecting and enhancing the remaining natural environment of the area. Any fish, wildlife and environmental mitigation plan to be proposed for impacts that would accrue to bottomland hardwood forests will be based upon recognition of the importance of offsetting unavoidable losses to this significant habitat.

CHAPTER 4

PLAN FORMULATION

CHAPTER 4
PLAN FORMULATION

This chapter details the steps that were taken to formulate a plan which best meets or exceeds the planning objectives as set forth below. The formulation of a plan to resolve the flood related problems and needs necessitated the exploration of possible alternative measures, including structural and non-structural solutions. Beneficial and adverse contributions of each alternative were evaluated against existing conditions.

As stated previously in this report, the plan formulation process was performed in three phases, each predicated by changes deemed significant enough to necessitate reevaluation and revision of existing conditions hydrology, hydraulic and/or economic models. These changes included, but were not limited to, the availability of more recent technical data, the addition of risk-based analysis requirements, and the passage of legislation providing for inclusion of previous non-Federal construction in the Federal plan. Two of these phases were completed during the development of the NED Plan, while the third was initiated during selection of the Locally Preferred Plan (LPP).

PLANNING OBJECTIVES

Planning objectives are an expression of public and professional concerns about the use of water and related land resources resulting from the analysis of existing and future conditions in the study area. These planning objectives were used in guiding the development of alternative plans and their evaluation for the 1997 to 2047 period of analyses.

Legislation requires that Federal water and related land resources planning be directed at contributing to National Economic Development (NED), consistent with protecting the Nation's environment. Contribution to NED is achieved by increasing the net value of the nation's output of goods and services, expressed in monetary units. NED contributions must also consider the environmental effects of proposed changes on ecological, cultural, and aesthetic attributes of natural and cultural resources.

Plans formulated as part of this study were evaluated based on their contribution to the National Economic Development, and they are consistent with protection of the Nation's environment. In addition to these National objectives, additional planning objectives evolved from meetings with area residents, from contact with the local sponsor, State and Federal agencies, and from observations made in the area. Specific needs, desires, and goals of the community were identified. The planning objectives for the Dallas Floodway Extension General Reevaluation study are as follows:

- Reduce flood damages, provide better health and safety measures, reduce emergency services, reduce potential for loss of life due to high velocity flows, reduce isolations caused by flood waters, reduce overtopping of bridges and roads along the Trinity River, and reduce the loss of jobs and/or wages caused by flooding from the Trinity River within the city of Dallas.

- Preserve and protect existing environmental and aesthetically pleasing areas and maintain, as much as possible, the existing vegetation and wildlife habitat along the Trinity. The channel portion of the Trinity River is possibly the largest remaining natural channel within Dallas.

- Preserve and/or protect historically and culturally significant areas.

PLANNING CONSTRAINTS

In order to provide direction for the plan formulation efforts, maximize good impacts, minimize bad impacts, and reflect restrictions of the General Investigation Program, the following constraints were taken into account:

- Flood control projects which solve problems in one area but compound them in others should be avoided, unless overriding public interest favors implementation of such a plan.

- Total benefits must exceed total costs for a plan to be implemented with the Corps of Engineers as a participant, unless a specific exception is granted to allow such participation.

FORMULATION AND EVALUATION CRITERIA

Consideration was given to economic, social, and environmental impacts for each alternative during the development of long term solutions to the flood problems within the Trinity River watershed. Appropriate Corps of Engineers engineering and design manuals, criteria, and regulations relating to flood control channels, outlet works, embankment, streamflow routing, backwater computation, cost estimates, environmental mitigation, environmental restoration, recreation features, etc., were used in developing alternative plans.

TECHNICAL CRITERIA

Alternative plans must be feasible, practicable, and soundly engineered to provide a project life of at least 50 years. Existing facilities should be utilized to the maximum extent possible. The plan should be complete within itself and not require additional future improvements other than normal operation and maintenance.

ECONOMIC CRITERIA

The NED objective is the maximization of the economic worth of alternative plans as set forth in *Principles and Guidelines for Planning Water and Related Land Resources Implementation Studies*. The NED objective is to increase the nation's output of goods and services and improve national economic efficiency. For flood control projects, this objective relates to a plan's capability to prevent flood damages by comparing the plan's economic benefits with the project cost. The amount that a project's economic benefits exceed the project cost is defined as net benefits. In the plan formulation process, the plan that yields the greatest net benefits best meets the NED objective.

The plan selected as the recommended plan should seek to provide a maximum of net benefits, unless certain provisions can be applied to supercede this criteria. One such provision, stated in Planning Guidance Letter 97-10, allows a locally preferred plan to be selected as the recommended plan if the plan yields greater net benefits than any smaller scale alternative. In such instances, larger scale plans need not be investigated in an effort to identify the NED Plan. The other provision allowing recommendation of a plan other than the NED Plan involves the granting of an exception by the Assistant Secretary of the Army (Civil Works). Such an exception may be granted for an economically justified plan when overriding and compelling reasons favor the selection of such a plan. Recommended plans which are less costly than the NED Plan would be cost shared on the same basis as the NED Plan. Federal participation in a recommended plan which is more costly than the NED Plan would be limited to the Federal share of the NED Plan, unless the increased development is deemed worthy of warranting Federal participation, and is specified as such in the exception. Cost sharing would then be calculated on the same basis as the NED Plan.

To meet the Federal guidelines for planning water resource projects, the following economic criteria were followed:

- The recommended plan must be economically feasible, i.e. the plan's benefits must exceed the cost of the plan.

- Alternative plans must be evaluated using the current Federal interest rate and price levels, and a 50-year period of analysis.

- Annualized costs must include the cost of operation and maintenance.

Economic feasibility of a plan is displayed as a relationship of benefits to costs, expressed in terms of a benefit-cost ratio (BCR). Identified as benefits are the monetary savings or benefits due to damages prevented, reduction in the cost of emergency services, and reduction of economic disruption. These project benefits are subsequently annualized to represent an annual benefit applicable for the life of the project. The project cost, which includes the construction or first cost, the interest on the first cost during construction, the operation and maintenance costs, and the interest to amortize the project cost over the life of the project are also annualized to represent an annual project cost applicable for the analysis period of the project. The annual benefits and the annual costs are then related in a ratio of benefits to costs. To be economically feasible, a plan must have greater benefits than costs or, more specifically, a BCR greater than 1.0.

ENVIRONMENTAL AND SOCIAL CRITERIA

Plans formulated under Federal directives should be consistent with protecting and enhancing the existing environment by the management, conservation, preservation, creation, or improvement of the quality of certain natural and cultural resources and ecological systems in the proposed project area. Structural and non-structural measures must be evaluated in accordance with guidelines established by the National Environmental Policy Act of 1969 (Public Law 91-190), as amended, and the *Principles and Guidelines for Water and Related Land Resources Implementation Studies*, as developed by the U.S. Water Resources Council, dated July 1983. The following environmental and social criteria were considered:

- Promote the protection and enhancement of areas of natural beauty and human enjoyment.

- Protect areas of valuable natural resources.

- Protect quality aspects of water, land, and air resources in the watershed.

- Protect against possible loss of life and hazards to health.

- Promote safety

- Preserve and enhance social, cultural, educational, and historical values within the project area.

- Minimize and, if possible, avoid the displacement of people and destruction or disruption of community cohesion.

IDENTIFICATION OF THE NED PLAN

The following sections provide a chronological review of the plan formulation process for the development of the NED plan for this study. This process included a preliminary analysis of alternatives, an In-Progress Review (IPR) meeting, and a final analysis of NED alternatives.

INITIAL SCREENING OF ALTERNATIVES

An extensive number of non-structural and structural flood damage reduction alternatives were investigated from the study initiation in January 1991 through July 1993. During this time frame, environmental restoration was not a desired project feature of either the local sponsor or special interest groups. During this period, the focus of all environmental concerns was directed primarily toward minimization of impacts to bottomland hardwoods.

Investigated Non-Structural Alternatives

The objectives of non-structural measures are to avoid flood damages by removal of damageable properties from the flood prone areas, and to manage the development of the floodplain in a manner that will minimize flood damage. The full range of non-structural alternatives includes no action, floodplain management, flood warning, flood proofing, structure relocation, and permanent evacuation.

No Action Plan. The fundamental alternative to any flood control plan is the no action plan. Adoption of this alternative implies acceptance of the costs and adverse effects of continued flooding. For the city of Dallas, these estimated costs equate to over $6,500,000 annually. In addition, the residents would continue to suffer from the social and economic stresses associated with repetitive flooding and the potential for loss of life. Although citizens with flood insurance would be partially compensated for future damages, these damages would nonetheless continue to occur and Federal funds would continue to be expended in the flood insurance program and in federal emergency flood assistance and relief. The no action plan is recommended only when no other solutions are feasible or when environmental damage would be irreparable.

Floodplain Management. Effective floodplain management is dependent on the development of enforceable regulations which insure that uses of floodplain lands are compatible with the level of flood hazard. Several means of regulation are available to control future development, including zoning ordinances, subdivision regulations, and building codes.

Zoning ordinances promote prudent use and development of the floodplain to prevent excessive property damage, expenditure of public funds, inconvenience, and loss of life due to flooding. Subdivision regulations guide the division of large land parcels into smaller lots and requires proof of compliance with other regulations and ordinances. A subdivision ordinance with special reference to flood hazards would require installation of adequate drainage facilities, prohibit encroachment in floodway areas, require the placement of critical streets and utilities above a selected flood elevation, and require that building lots be filled or structures be elevated above a selected flood elevation.

Building codes specify the design and construction materials of both new construction and repair of flood damaged structures. The specifications can require proper anchorage of buildings, restrict materials which tend to deteriorate when exposed to water, require water-tightness of exterior walls, placement of valves on sewer lines, and placement of utilities such as heaters and air conditioners at high elevations to reduce flood damages.

Floodplain management is the most effective means to control future development of the floodplain, and insure that existing flood problems do not worsen. This alternative did not require further consideration because the city of Dallas presently participates in the regular phase of the National Flood Insurance Program, and has adopted the Trinity River Corridor Development Certificate (CDC) process.

Flood Warning. Flood forecasting and temporary evacuation involves the determination of imminent flooding, implementation of a plan to warn the public, and organization of assistance in the evacuation of persons and some personal property. Notification of impending flooding can be accomplished by radio, siren, individual notification or by elaborate remote sensor devices. Some type of flood warning and emergency evacuation effort should be a part of any flood control plan. These measures normally serve to reduce the hazards to life and damage to portable personal property. It was not necessary to evaluate this alternative since the city of Dallas currently has a flood warning system in place.

Flood Proofing. Damage to existing structures can be reduced or eliminated through various flood proofing measures. These methods protect damageable property by preventing flood waters from entering the building and/or reaching the contents inside. Flood proofing is most easily applied to new construction, and most applicable where flooding is of short duration, low velocity, infrequent occurrence and of shallow depths. Flood proofing is usually employed in locations where structural flood protection is not feasible or where collective action is not possible. Typically, flood proofing techniques include water-tight door and window seals, raising of structures, installation of check valves on gravity-flow water and sewer lines, incorporation of seepage controls, and sandbagging of door openings during emergency situations.

Flood proofing of single-family residences within the floodplain would be impractical in frequently flooded zones where flooding depths can easily exceed the window sill heights and the structural integrity is poor. This alternative could be beneficial to commercial and industrial structures. For structures located within less-frequent flood event zones, such measures as sandbagging or altered landscaping adjacent to entryways could be helpful, since flooding depths would be shallow. However, any method requiring personal attendance, such as sandbagging, has a low reliability due to occupant absence and the occurrence of late night floods. The hydrologic characteristics of the Trinity River and the poor structural characteristics of the residential structures makes it impractical to implement the outlined flood proofing techniques.

Raising Structures In-Place. One method of flood proofing evaluated in detail was that of raising the structures at their existing site. This plan is most applicable where a limited number of structures are receiving a large portion of the total flood damages along a given stream reach. However, there is still the potential for loss of life with this alternative, since flooding could easily exceed the level of protection provided and residents are apt to ignore or respond slowly to warnings.

The city of Dallas participates in the Federal Emergency Management Agency (FEMA) floodplain management program. Requirements of the program specify that certain regulations be incorporated into the code of any community participating in the National Flood Insurance Program. One of these regulations stipulates that any substantial improvement made to an existing structure located within the 100-year floodplain should also elevate the structure at least 1 foot above the 100-year flood elevation. Substantial improvement is expressed as the cost of structural repairs equivalent to at least 50 percent of the structure's fair market value. Therefore, structures within the 10-year floodplain would have to be elevated at least 1 foot above the 100-year flood plain, or an average of about 4 feet above their existing finished floor elevations.

Many of the structures in the study area's 10-year floodplain were built in the 1940's or 1950's. Frequent flooding over the structure life has contributed to the dilapidation of these structures. Many of the residential structures do not have the structural integrity required to undergo raising. Furthermore, for those structures which might survive raising in place, the number of feet they would have to be raised is cost prohibitive, could induce damages on adjacent property, and would not be aesthetically pleasing. The majority of the commercial and industrial properties are already elevated 5 feet above ground level and the nature of these businesses makes it impractical to be raised above the 100-year floodplain. Based on the above findings, a raise-in-place plan was determined to be infeasible for this study area.

Relocation. Plans for structure relocation would move the existing frequently flooded structures from the floodplain to a non flood-prone site. The practicality of this measure depends on the frequency of flooding, the value of the property, its importance to the community, and the need for land use areas that are more compatible with floodplain constraints.

Each of the structures within the study area was analyzed on an individual basis, with benefits being limited to the average annual losses covered by subsidized flood insurance plus the public damages prevented. All structures within the 10 year-flood zone were evaluated based on this economic criteria. As in the case of raising the structures in-place, either the structural integrity or the type of business made it impractical to consider this alternative further.

Permanent Evacuation. Flood plain evacuation involves the acquisition and removal or demolition of frequently flooded structures from the floodplain. This alternative was evaluated for the evacuation of individual structures within the 10-year flood frequency zone in accordance with the non-structural economic criteria previously outlined. Benefits were also derived for the evacuation of all structures within individual flood zones, including the 2-, 5-, 10-, and 100-year zones. Eligibility under the evacuation alternative rests primarily with the economic criteria and the frequency of flooding. The structural integrity of the structure was not a factor in determining feasibility as is the case in other non-structural plans.

Benefit Methodology. Benefits for removing individual structures from the floodplain are limited to the sum of:

annualized residual value of the vacated land, *or* average annual recreation benefits for the land

plus:

reduction in annual flood insurance subsidy:

agency cost:

average annual damages to the structure and its contents,

plus:

agent fee (at 15 percent of the estimated premium), and other administrative costs (at $131 per policy)

minus:

policy holder's cost:

estimated annual insurance premium (at $0.55 per $100 of structure value for the first $45,000 and $0.17 per $100 thereafter, plus $0.65 per $100 of contents value for the first $15,000 and $0.30 per $100 thereafter),

annual deductible ($500 each for structure and contents per flood occurrence, times the probability of a flood in a typical year), and

annual uninsured losses (5 percent of the structure value per flood occurrence, times the probability of a flood in a typical year)

plus:

average annual public damages prevented (that is, damages to communications and public utilities facilities, and costs for flood fighting and public relief) based on actual FEMA claims.

Analysis Results - Individual Structure Evacuation. Reaches 2 and 5 contain commercial and industrial structures within the 2- to 5-year flood frequency zone which meet this non-structural economic criteria. Table 4-1 presents a summary of the economic analysis for the evacuation of eligible structures in reaches 2 and 5. The investigated alternative yielding the greatest net benefits is shown shaded in the table. The cost estimates include land acquisition, demolition and disposal, and the remediation of asbestos, lead based paint, and other hazardous non-CERCLA contaminants.

In reach 2, about $154,300 in annual damages would be eliminated with the permanent evacuation of 5 commercial structures. The first cost for this plan is estimated at about $874,800. The annual costs and claimable annual benefits are $75,800 and $145,600, respectively, with a resultant benefit-to-cost ratio of 1.9 and excess benefits of $69,800.

In reach 5, an estimated $419,000 in annual damages could be eliminated with the evacuation of only 2 commercial structures. The first cost for this plan is estimated at about $580,300. The annual costs and claimable annual benefits are $50,800 and $410,800, respectively with a resultant benefit-to-cost ratio (BCR) of 8.1 and excess benefits of $360,000. The benefits derived in this reach signal the need for additional investigation to obtain empirical flooding evidence associated with the contents in these structures.

In summary, the permanent evacuation plans were found to be economically feasible for 7 commercial structures. Total damages would be reduced by 12 percent in the immediate study area. The combined plans would have an estimated project first cost of $1,455,100. The total annual costs and benefits would be $126,600 and $556,400, respectively. The resultant BCR would be 4.2, with excess benefits of $429,800.

The Uniform Relocation Assistance Program requires that displaced property owners be compensated for losses attributable to evacuation. A maximum of $22,000 is allowed for residential structures to cover moving expenses, temporary lodging, and the cost to obtain housing in accordance with Federal guidelines. Maximum relocation expenses have not been set for commercial/industrial structures. These costs would be 100 percent non-Federal.

The local sponsor desires recreational facilities; however, a specific recreation design was not considered at this point since the BCR is greater than 1.0, and the structures are randomly located throughout the flood plain. It is recognized that individual structures may be selected for evacuation in conjunction with other flood control measures.

Table 4-1
Economic Analysis of Individual Structure Evacuation Plan
(June 1993 prices, 8.0% interest, 50-year period of analysis)
(Thousands of Dollars)

Reach	Number of Structures	First Costs	Annual Costs	Annual Benefits	Benefit/Cost Ratio	Net Benefits
2	5	$874.8	$75.8	$145.6	1.9	$69.8
5	2	$580.3	$50.8	$410.8	8.1	$360.0
Combined	7	$1,455.1	$126.6	$556.4	4.2	$429.8

Investigated Structural Alternatives

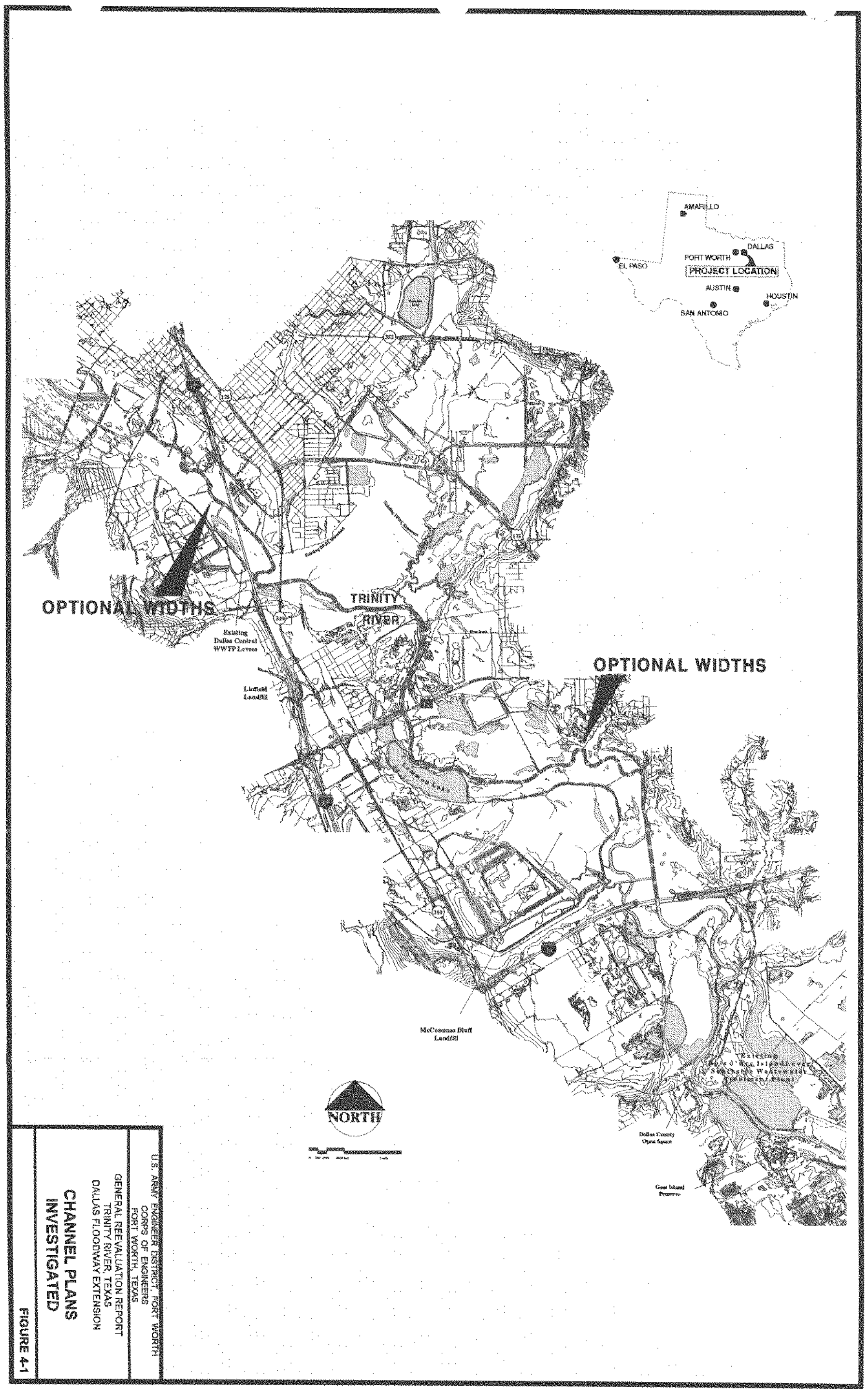
Various structural alternatives were investigated in this study, including construction of channels, levees, swales, and combinations thereof, as well as vegetation management plans. The following paragraphs describe the individual plans investigated.

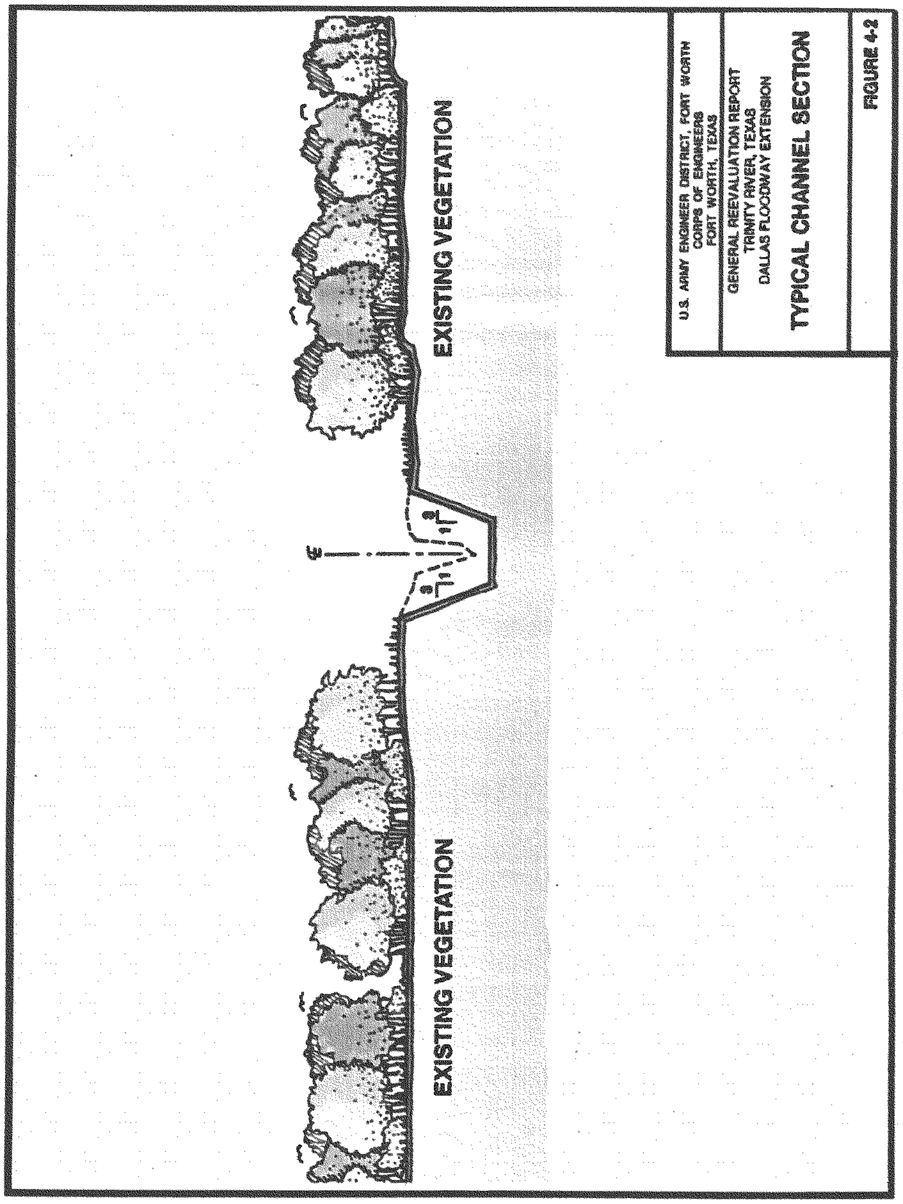
Channel Plans Investigated. The preliminary design featured a 5-mile channel extending from the downstream end of the existing Dallas Floodway downstream to Loop 12, as shown in figure 4-1. The channel would be a grass-lined trapezoid with 3-foot horizontal to 1-foot vertical side slopes. Between the existing Floodway upstream and continuing to just below IH-45, the channel alignment would be along the west bank of the Trinity River. At IH-45, the channel would veer to the east and cross the river to the east bank, rejoining the natural channel at the center of the large oxbow and continuing along the east bank to IH-20. The channel would be aligned to preserve at least one side of the river bank. Channel sizes investigated for this alignment included 100-, 150-, 200-, and 250-foot bottom widths. Figure 4-2 shows a typical channel section. The results of the analysis are shown in table 4-2.

Project first costs ranged from about $38.9 million to $78.3 million. Each plan was deemed feasible, with benefit-cost ratios ranging from 1.7 to 2.8. The optimum bottom width would be 150 feet. All four designs would increase the level of protection in the primary and secondary study portions of the study area and reduce damages in the unprotected primary study area by 50 to 75 percent. However, due to intense public concern regarding environmental impacts of this plan, other plans with fewer environmental impacts were evaluated.

Table 4-2
Summary of Channel Alternatives
(June 1993 prices, 8.0% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
100' BW	$38.9	$3.6	$11.1	2.8	$6.5
150' BW	$52.1	$5.0	$11.9	2.4	$6.9
200' BW	$74.2	$6.3	$12.5	2.0	$6.2
250' BW	$78.3	$7.6	$13.2	1.7	$5.6


AMARILLO
EL PASO
FORT WORTH
DALLAS
PROJECT LOCATION
AUSTIN
HOUSTIN
SAN ANTONIO
OPTIONAL WIDTHS
TRINITY RIVER
Existing Dallas Central WWTP Levees
Linfield Landfill
OPTIONAL WIDTHS
McCommas Bluff Landfill
Dallas County Open Space
Goat Island Preserve
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
CHANNEL PLANS INVESTIGATED
FIGURE 4-1


EXISTING VEGETATION
EXISTING VEGETATION
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
TYPICAL CHANNEL SECTION
FIGURE 4-2

Levee Plans Investigated. Levee designs providing 100-year and SPF levels of protection were investigated for the east and west banks of the Trinity River between the existing Dallas Floodway Levee System and U.S. Hwy. 75 (Central Expressway). Figure 4-3 shows the general layout of these levees.

> **Lamar Street Levee**: This levee would be constructed along the east bank with an average SPF height of about 27 feet, with 1v:3.5h side slopes, and a length of about 2.5 miles. The 100-year levee would consist of a series of small levees with a typical height of about 15 feet including freeboard, and an aggregate length of about 13,200 feet.

> **Cadillac Heights/Treatment Plant Levees:** Constructed along the west bank of the Trinity River between the Cedar Creek confluence and Hwy. 75, these investigated levees are referred to as the Cadillac Heights Levee (Reach 5) and Central Wastewater Treatment Plant (CWWTP) Levee (Reach 6). The average height would be about 25 feet for the SPF levee and 15 feet for the 100-year levee, including freeboard. The total length would be about 1.3 miles.

As shown in table 4-3, individual annual levee costs would be supported by the annual benefits. It was not considered practical to construct single levees along the east or west bank of the Trinity due to induced damages which would occur along the opposite bank. However, as a combined levee system, induced damages to the existing Dallas Floodway produced negative net benefits. Levees providing 100-year levels of protection to the Lamar and Cadillac Heights areas would raise water surface elevations at the downstream end of the existing Floodway by 0.3 feet. Comparatively, SPF levees would raise water surface elevations 0.6 to 2.0 feet, assuming the event occurred within the Floodway. Therefore, the conclusion was reached that construction of levees would require a relief channel or swale to offset the effects to the existing Floodway.

Table 4-3
Summary of Levee Alternatives
(June 1993 prices, 8.0% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
100-Year Lamar	$9.0	$.8	$1.5	1.9	$0.7
100-Year Cadillac	$9.1	$.8	$1.2	1.5	$0.4
SPF Lamar	$14.6	$1.3	$2.2	1.7	$0.9
SPF Cadillac/ CWWTP	$29.3	$2.6	$2.8	1.1	$0.2
All 100-Year	$18.2	$1.6	$2.6	1.6	($1.1)
All SPF	$43.9	$3.9	$1.8	0.5	($2.1)

Vegetation Management Plan Investigated. This plan would clear non-endangered species underbrush from the downstream end of the existing Dallas Floodway to Loop 12. The width of the clearing would extend approximately 1,000 feet from the centerline of the river to both the east and west banks, leaving an overstory of tree cover above 20 foot. Although some selective clearing and pruning would be required, there would be an attempt to leave a 100-foot wide buffer zone for riparian habitat along both sides of the river channel. Small parcels of the understory (shrubs and other vegetation of approximately 3-5 acres in size) would be left in their existing state throughout the 2,000-foot area. All remaining understory vegetation would be removed. Hydraulic performance of this alternative demonstrated the significant impact of vegetation on the water surface elevations. The alternative was removed from consideration due to the requirement for expensive, intense maintenance, and the significant impact to environmental resources which this plan would cause. However, hydraulic findings regarding the impact of vegetation removal initiated development of the swale alternative.

Swale Plans Investigated. An economic analysis was conducted to ascertain the performance of overbank swales. These grass-lined swales would be divided into lower and upper swales, with the dividing line at the IH-45 river crossing. Various swale sizes were investigated, including average bottom widths (BW) ranging from 300 - 1,500 feet. The swale plan would also include clearing the site of all non-endangered species vegetation. These swales are shown in figure 4-4, and described below. Figure 4-5 shows a typical swale section.

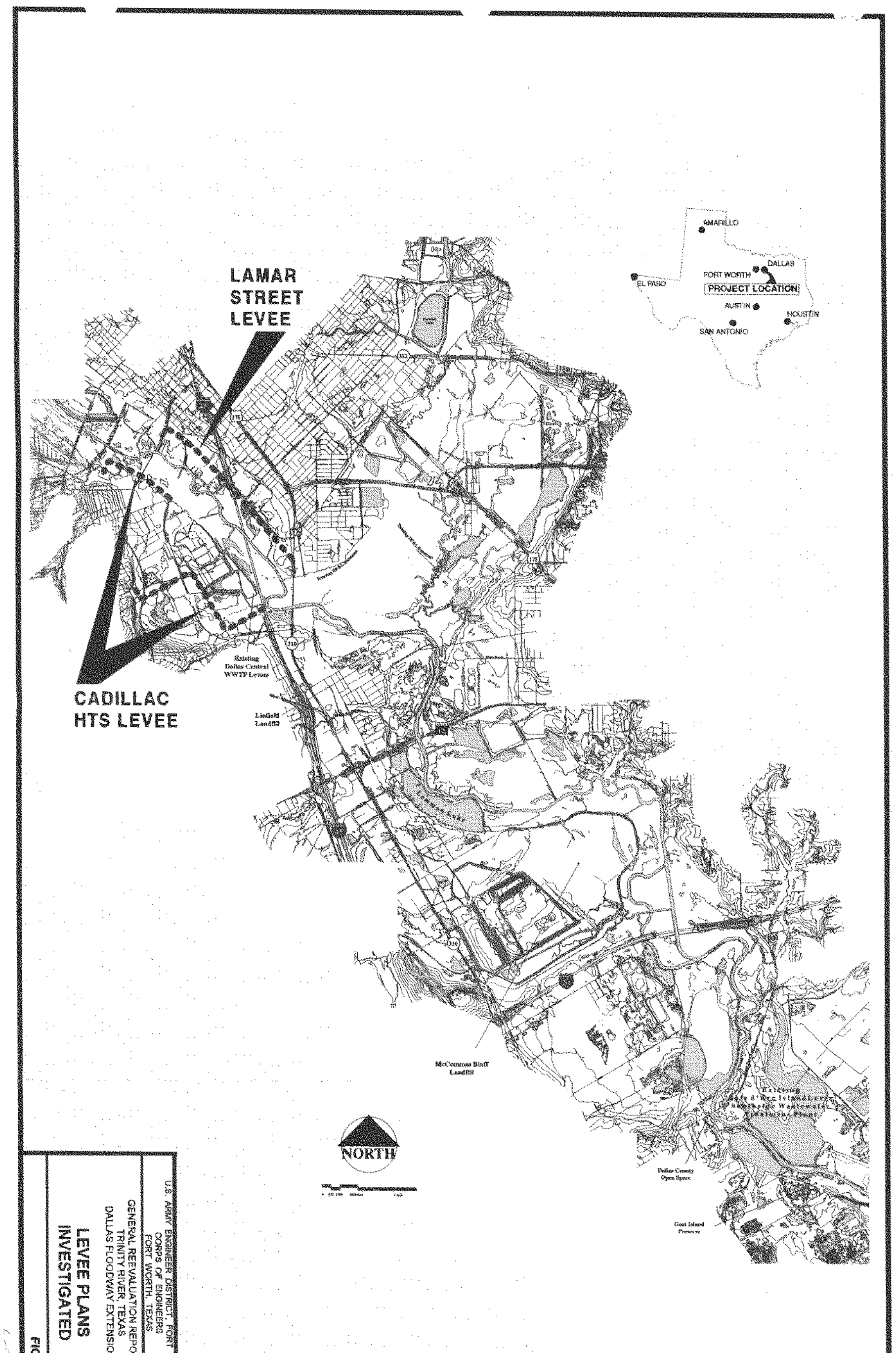
> **Lower Overbank Swale:** This swale would extend from Hwy. 310, beginning at least 100' from the edge of the east bank, downstream to about 2,000 feet below Loop 12, for a total length of 17,300 feet, or 3.3 miles. The lower swale would be designed with a slope of .0005 ft/ft.

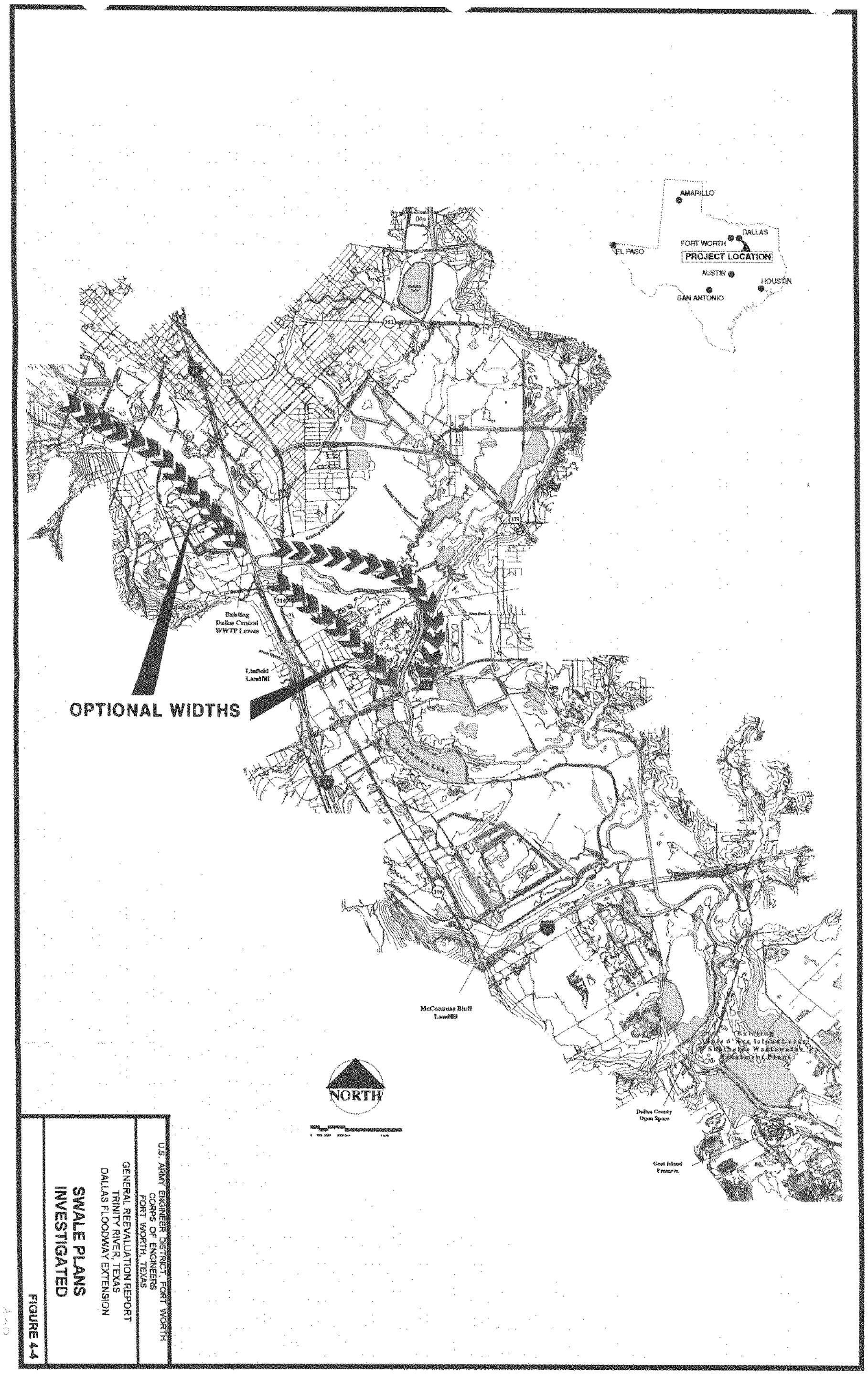
> **Upper Overbank Swale:** This swale would be designed to work in conjunction with the lower overbank swale to maximize channel relief. The length of the upper swale would be about 7,800 feet, or 1.5 miles, and would extend from the confluence of Cedar Creek, at the upstream end, to the river crossing of IH-45.

The Multiple Object Management (MOM) approach was incorporated into the design of the swales to avoid and minimize environmental impacts. The wider swales would impact the higher quality habitat to a greater extent than the 300- to 500-foot swales. Fragmentation of habitat would be unavoidable and would require significant mitigation. Approximately 3,200 acres of land would be required to offset the environmental impacts. All swale sizes were economically feasible, with benefits ranging from about $7.8 million to $11.0 million. The results of the analysis of the swale alternatives are shown in table 4-4. As shown, the 1,200-foot BW swale would produce the greatest net benefits among all the swale plans, and among all the alternatives evaluated in the 1991 to 1993 time period.

Table 4-4
Summary of Swale Alternatives
(June 1993 prices, 8.0% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
300' BW	$15.2	$1.4	$ 9.3	6.6	$7.8
500' BW	$21.6	$1.9	$11.5	6.0	$9.5
600' BW	$23.7	$2.3	$11.8	5.2	$9.5
900' BW	$31.9	$3.1	$12.7	4.1	$9.6
1,200' BW	$43.8	$4.4	$15.3	3.5	$11.0
1,500' BW	$54.8	$5.4	$15.7	2.9	$10.2


AMARILLO
DALLAS
FORT WORTH
EL PASO
PROJECT LOCATION
AUSTIN
HOUSTON
SAN ANTONIO
LAMAR STREET LEVEE
CADILLAC HTS LEVEE
Existing Dallas Central WWTP Levee
McCommas Bluff Landfill
NORTH
Dallas County Open Space
Goat Island Preserve
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
LEVEE PLANS INVESTIGATED
FIGURE 4-3


AMARILLO
EL PASO
FORT WORTH
DALLAS
PROJECT LOCATION
AUSTIN
HOUSTIN
SAN ANTONIO
Existing Dallas Central WWTP Levees
Linfield Landfill
OPTIONAL WIDTHS
McCommas Bluff Landfill
Dallas County Open Space
Goat Island Preserve
NORTH
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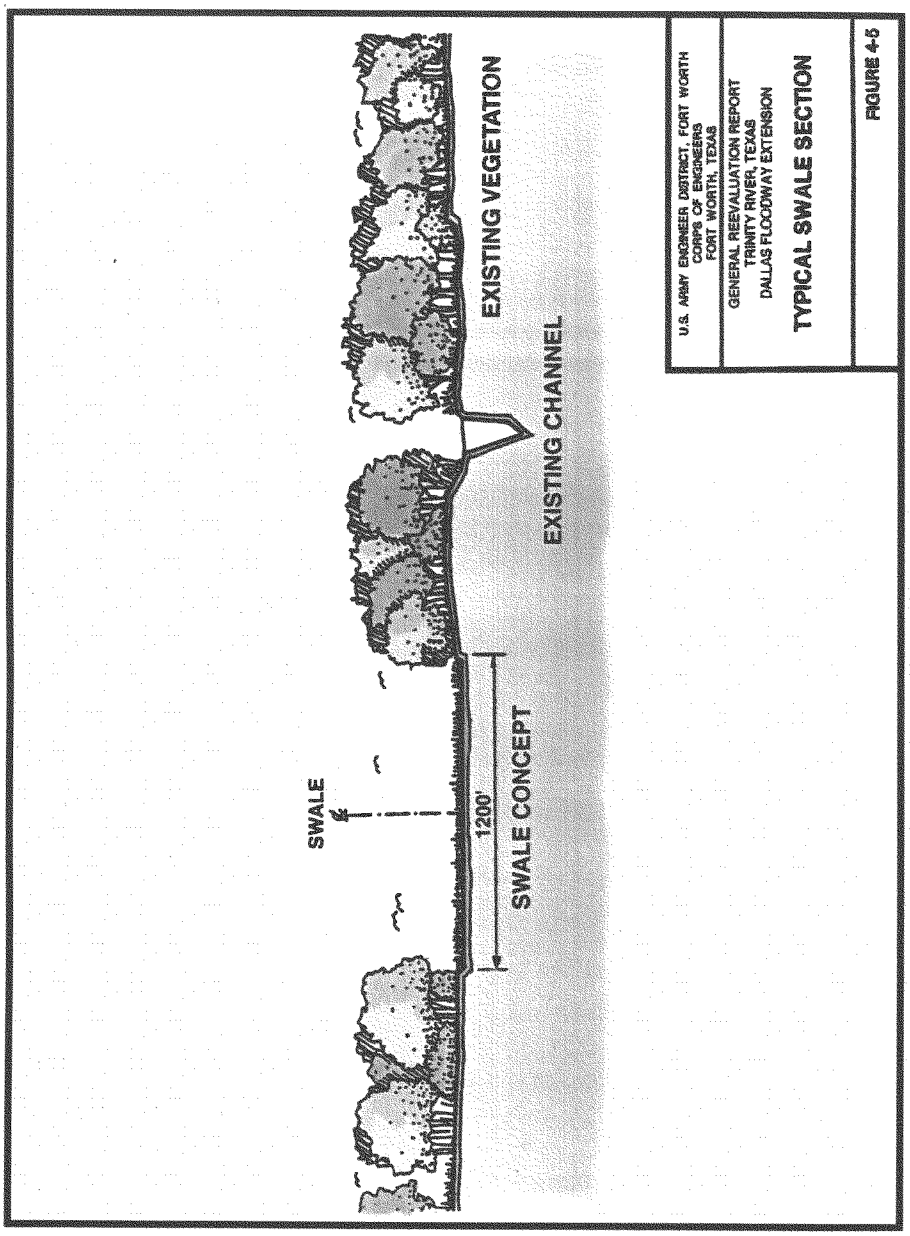
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
SWALE PLANS INVESTIGATED
FIGURE 4-4



EXISTING VEGETATION
EXISTING CHANNEL
SWALE
1200'
SWALE CONCEPT
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
TYPICAL SWALE SECTION
FIGURE 4-5

Recreation Plan Investigated. Benefits for the initial recreation plan were derived based on Region 4 facility needs and carrying capacity factors extracted from the Texas Outdoor Recreational Plan (TORP). Since the TORP does not identify a net need for picnic facilities, benefits were calculated only for the trail system. This project would generate at least $1.0 million in annual recreation benefits. The total estimated project first cost for the recreation plan would be about $8.9 million, with a resulting BCR of 1.2. These recreation features could be adapted to any of the proposed swale alternatives.

Summary of Initial Alternatives

The costs and benefits associated with the most feasible plans investigated from 1991-1993 are summarized in table 4-5, not including recreation. The results of these analyses served as the basis for identifying the preliminary NED Plan and as an aid to the local sponsor in the selection of a locally preferred plan.

As shown in the table, the 1,200-foot bottom width upper and lower swale alternative was identified as the plan producing the greatest net benefits. The general layout of this plan is shown in figure 4-6. An optimization curve is presented in figure 4-7. The net benefits were calculated at $11.0 million based on a first cost of $43.8 million. Accordingly, this plan was designated as the NED Plan and carried forward in the formulation process.

Table 4-5
Summary of Economic Analyses of Investigated Plans
1991-1993 (Flood Control Only)
(June 1993 prices, 8.0% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
Non-Structural: 7 Individual Structures	$1.46	$0.13	$0.56	4.2	$0.4
Channels: 150' BW	$52.1	$5.0	$11.9	2.4	$6.9
Swales: 1,200' BW	$43.8	$4.4	$15.3	3.5	$11.0

IN-PROGRESS REVIEW MEETING

Subsequent to the preceding analyses and designation of the preliminary NED Plan, an in-progress review (IPR) was held on July 19, 1993, with representatives from Headquarters, U.S. Army Corps of Engineers (HQUSACE), Southwestern Division (SWD), and the Fort Worth District (SWF) in attendance. The major pertinent discussions, concerns, issues, and concurrences included the following:

- Proposed Section 215/104 agreements regarding credit to the local sponsor for non-Federal construction of the Rochester Park Levee and modifications to the CWWTP Levee were deemed invalid due to the timing of the requests and/or lack of prior approval from the Assistant Secretary of the Army (Civil Works). To receive credit, the local sponsor must seek Legislative approval.

- Initial guidance received August 21, 1992, specified a risk-based analysis would be required only for levees. Subsequent guidance, however, directed risk-based analysis be accomplished and integrated into the analysis regardless of the alternatives.

FINAL ANALYSIS OF NED PLAN

Key Revisions and Assumptions.

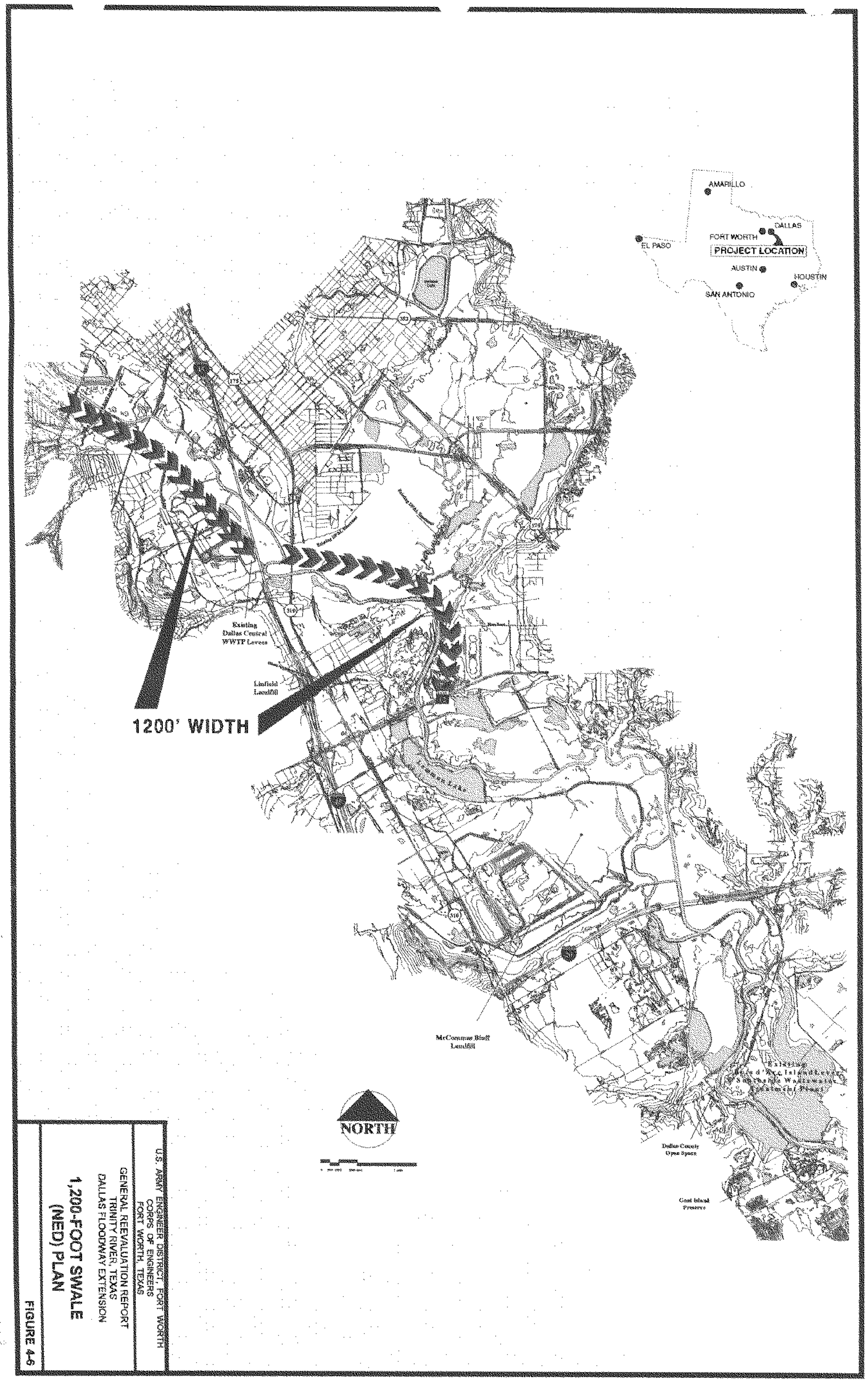
During this phase of the plan formulation process, the following revisions were made regarding engineering and economic parameters:

- The hydrology model developed for the Upper Trinity River Feasibility Study was approved for use in this study, thereby ensuring compatability of the results of this analysis with future Upper Trinity River studies. The revised hydraulic model included computed probability water surface elevations, incorporated the effects of extending the 100-foot benched channel within the existing Floodway, and assumed design grade for the levees in the existing Floodway. In addition, updated aerial photography was used to establish digital topography.

- Current floodplain investment data was gathered through field surveys and from the Dallas County Appraisal District.

- A risk-based analysis was incorporated into all assumptions and benefit calculations. Traditional expression of the frequency of flood events has been in terms of the recurrence interval in years, such as, the "100-Year Flood". The more appropriate expression of the probability of a particular flood magnitude is in terms of "percent chance exceedance", especially as it relates to a risk-based analysis. Therefore, the "100-Year Flood", which is defined as "the magnitude of flooding which has a 1 percent probability of being equaled or exceeded in any given year" would be expressed as the "1 percent chance flood". For comparison purposes, the nine flood events computed for this study, traditionally referred to as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 500-year, and the Standard Project Flood (SPF), would be referred to, in probabilistic terms, as the 99 percent, 50 percent, 20 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent chance flood, and the SPF, respectively. Although the analyses contained herein were performed as risk-based analyses, results of these investigations are expressed in traditional terms for the benefit of the reader.

- Cost data was updated to reflect October 1995 prices and level of development, and the prevailing Federal interest rate of 7.63 percent was applied to the economic analyses.


AMARILLO
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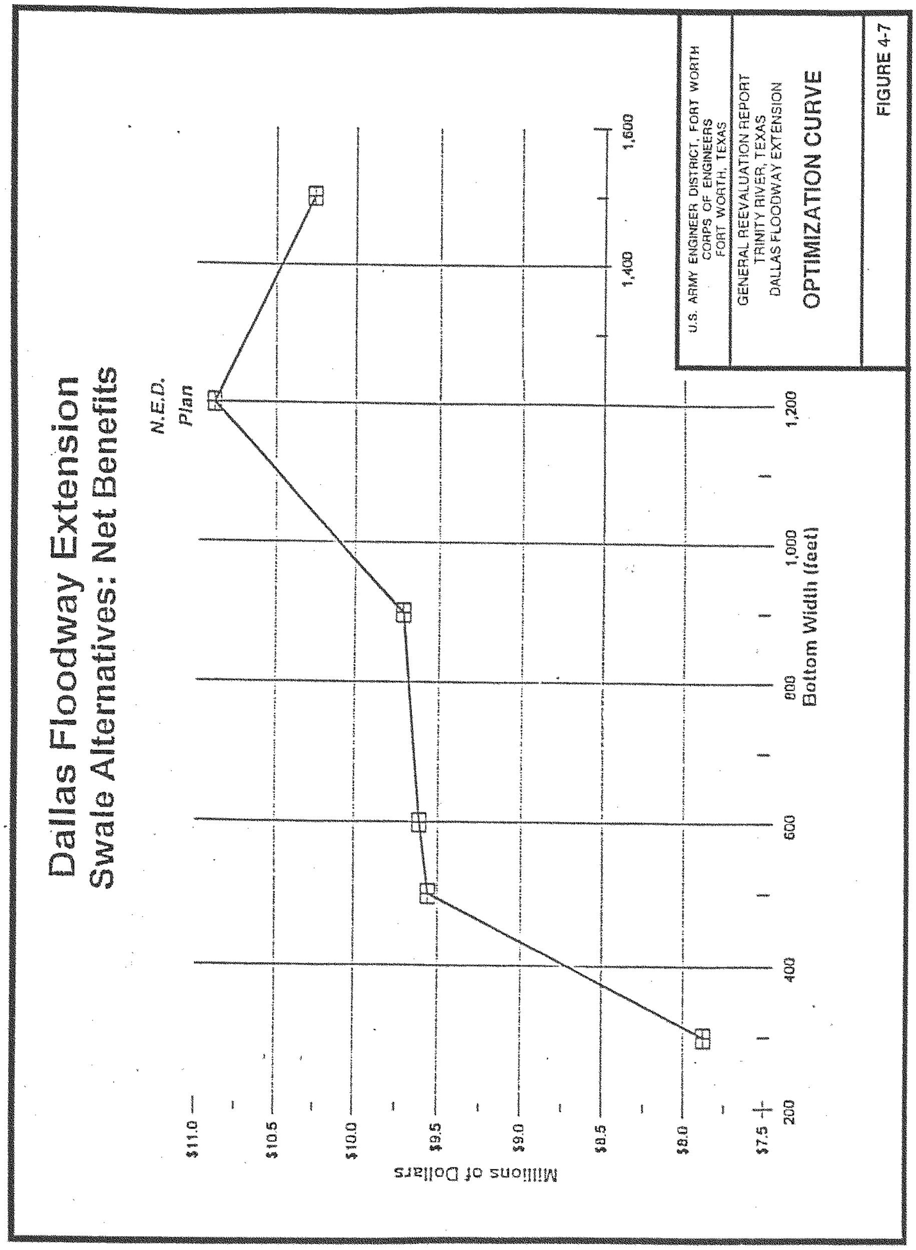
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
1,200-FOOT SWALE
(NED) PLAN
FIGURE 4-6


Dallas Floodway Extension
Swale Alternatives: Net Benefits
N.E.D. Plan
$11.0
$10.5
$10.0
$9.5
$9.0
$8.5
$8.0
$7.5
Millions of Dollars
200
400
600
800
1,000
1,200
1,400
1,600
Bottom Width (feet)
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
OPTIMIZATION CURVE
FIGURE 4-7

Investigated Structural Alternatives

Revised Swale Plans Investigated. Examination of the results of the preliminary investigations indicated that the majority of benefits for the 1,200-foot swale would be realized in the existing Floodway. Smaller swales, while not providing as many upstream benefits, would yield benefits in the immediate study area at significantly reduced costs, and would cause fewer adverse impacts to environmental resources. Also, in accordance with the request of the local sponsor, a west bank alignment for the lower swale was considered.

The upper swale alignments developed in this phase of the study would be designed to work in conjunction with a lower swale to maximize channel relief and minimize environmental damage. The investigated upper swale would have an approximate 300-foot bottom width and would extend from the Cedar Creek confluence to the oxbow near IH-45. The complementary lower swale would consist of an approximate 500-foot bottom width swale, aligned between Loop 12 and IH-45, and traversing either the Linfield Landfill or the historic Joppa neighborhood, as shown in figure 4-8 and described below:

Linfield Swale: In conjunction with the upper 300-foot swale, this alignment would consist of a 500-foot bottom width channel beginning at Loop 12, at the Sleepy Hollow Golf Course, and extending through the Linfield Landfill. The maximum depth would be about 30 feet, with a minimum depth of about nine feet. Preliminary HTRW investigations indicate manageable levels of contaminants within the landfill. This alignment would reduce damages in the study area and raise the level of protection in the existing Floodway to the 500-year frequency.

Joppa Swale: This plan would consist of a 500-foot bottom width channel beginning at Loop 12, at the golf course, and would pass through the Joppa neighborhood, thereby avoiding the Linfield Landfill. This alignment would displace approximately 17 residents and impact about 68 structures. This alignment would also traverse a large pond previously used as a gravel pit, and a parcel of the Southern Pacific railroad property which has been cited as an illegal dumping area. This alignment would reduce damages in the study area and raise the level of protection in the existing Floodway to the 500-year frequency. This neighborhood, however, is located outside the floodplain.

Adverse environmental impacts would be significantly reduced with either of these west bank alignments when compared to the east bank alignment as proposed in the 1,200-foot swale plan. Flood damage reduction benefits would be similar with either of these west bank alignments, each reducing damages in the study area by more than 30 percent and in the existing Floodway by more than 20 percent. While the preliminary cost estimates for going through the landfill would be comparable with costs associated with relocating and abating contaminated areas within the Joppa neighborhood, the Linfield swale, in conjunction with the 300-foot upper swale, would produce greater net benefits than the Joppa swale. Opposition to disrupting the Joppa neighborhood and the historic, cultural nature of the area prompted the city to request further refinement of the Linfield swale to optimize benefits and to incorporate wetlands and vegetation within the swale. This request was used by the design team to incorporate the chain of wetlands concept into both the upper swale and lower (Linfield) swale.

The Chain of Wetlands alternative would utilize the best identified swale plan (300-foot upper swale and 500-foot Linfield swale), but would also include connected wetlands and pockets of sparsely planted trees within the open grassy areas. The average depth of the swale would be about 2 feet, with the wetland areas approximately 2 - 4 feet deep. The vegetated areas would contain about 10 trees per acre. This plan is shown in figure 4-9.

Comparative costs and benefits for the above mentioned alternatives are presented in table 4-6. As shown, the Chain of Wetlands alternative would provide the greatest amount of net benefits, and was, therefore, carried forward in the formulation process.

Table 4-6
Summary of Revised Swale Alternatives
(October 1995 prices, 7.63% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
300' / 500' Linfield Swale	$34.5	$2.9	$7.2	2.5	$4.4
300' / 500' Joppa Swale	$33.4	$2.8	$6.3	2.3	$3.5
Chain of Wetlands	$50.6	$4.2	$9.4	2.2	$5.2

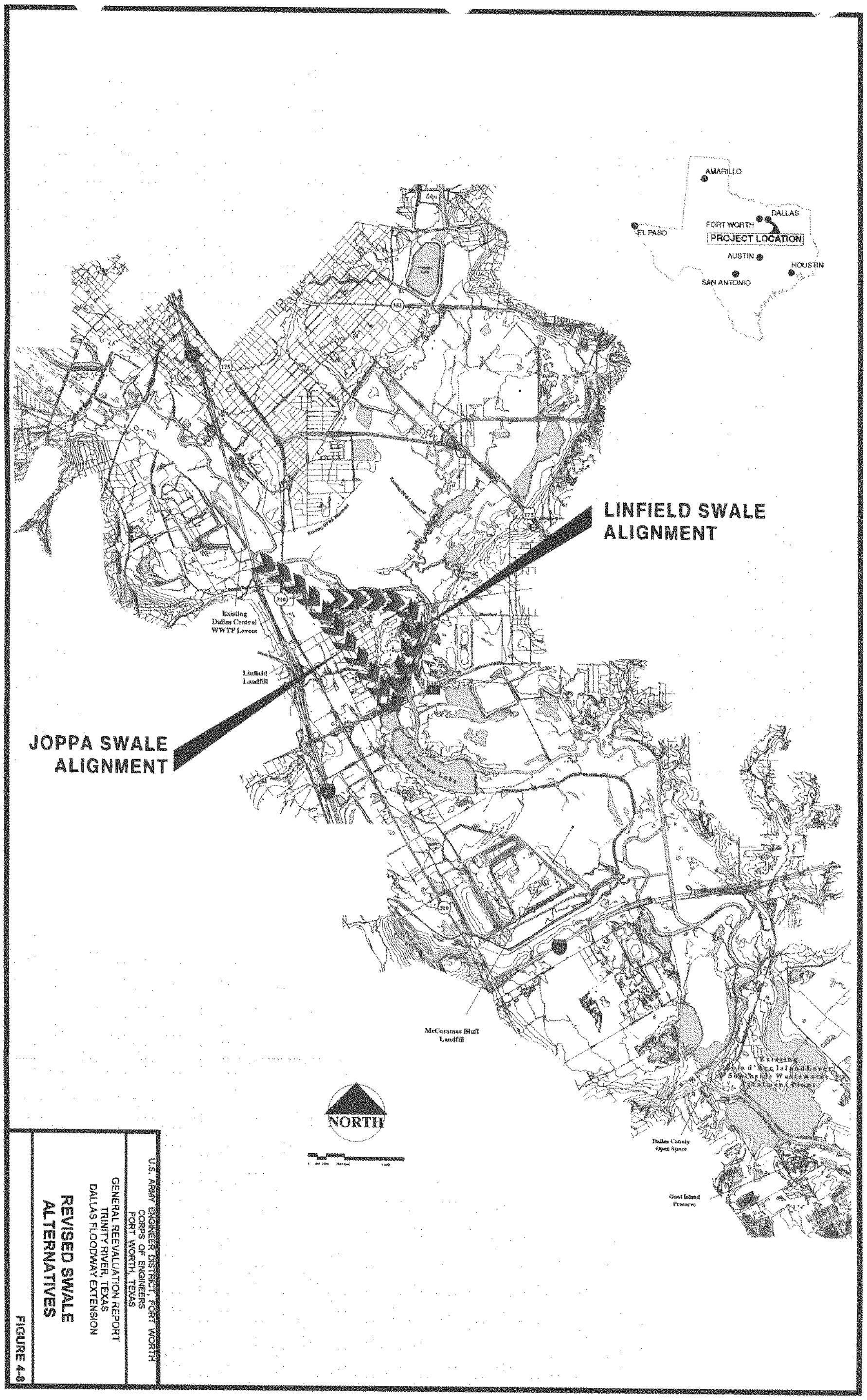
NED Plan Determination

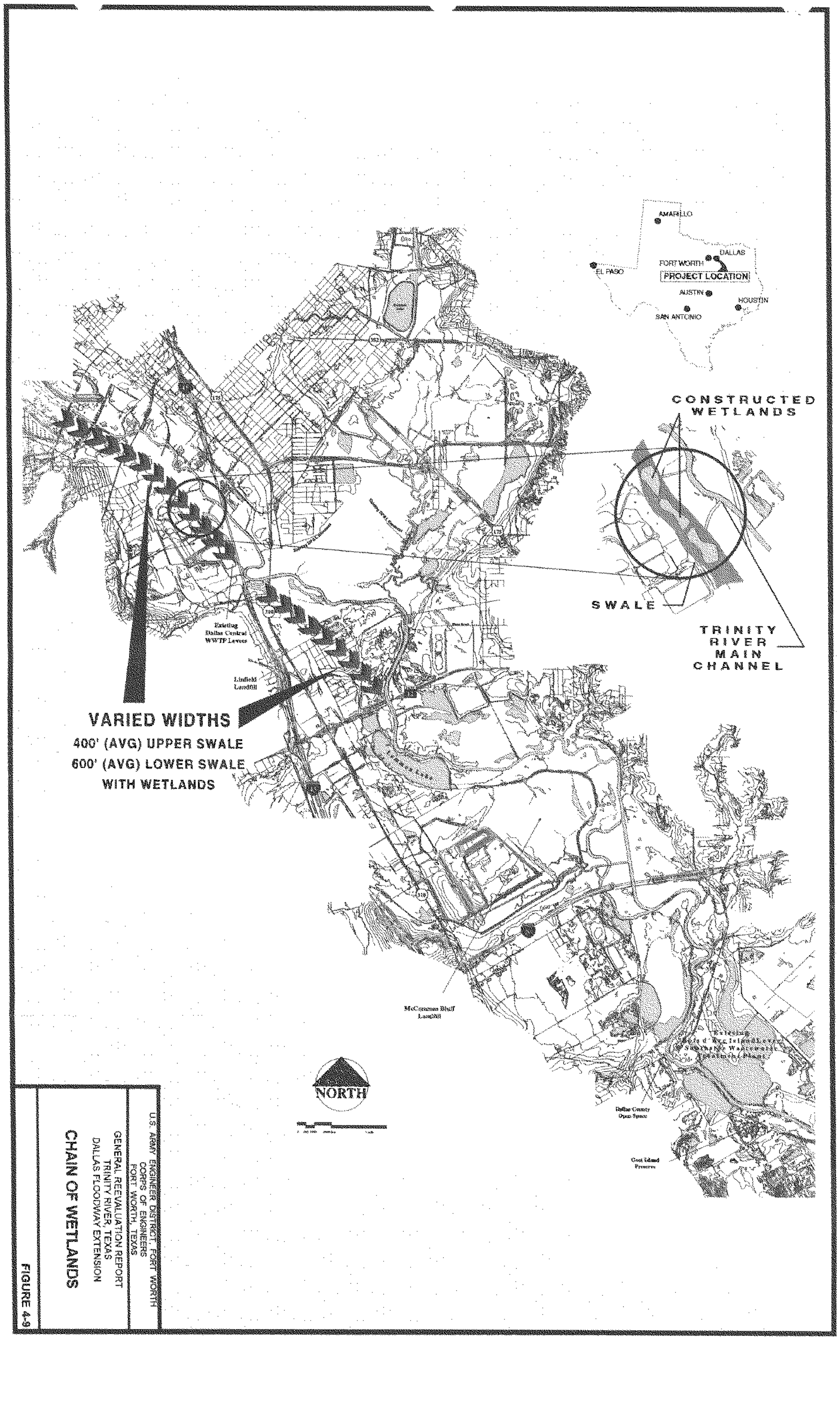
Due to the revisions to hydrology and economic models in this phase of plan formulation, and due to the similarity of benefits between the 900-foot swale and the 1,200-foot swale in the preliminary formulation phase, both of these alternatives were carried forward for further analysis. The 1,200-foot swale was designated as the preliminary NED plan in 1993. The Chain of Wetlands was carried forward from the more recent studies due to the sponsor's interest in including wetland features. Also included in this array of alternatives was the Chain of Wetlands Plus SPF Levees alternative, due to indications that this plan would be the most likely candidate for being selected as the LPP. This alternative would include the addition of SPF levees on both sides of the river, at Lamar Street and at Cadillac Heights, as shown in figure 4-10. Table 4-7 presents the array of alternatives investigated in the final determination of the NED plan.

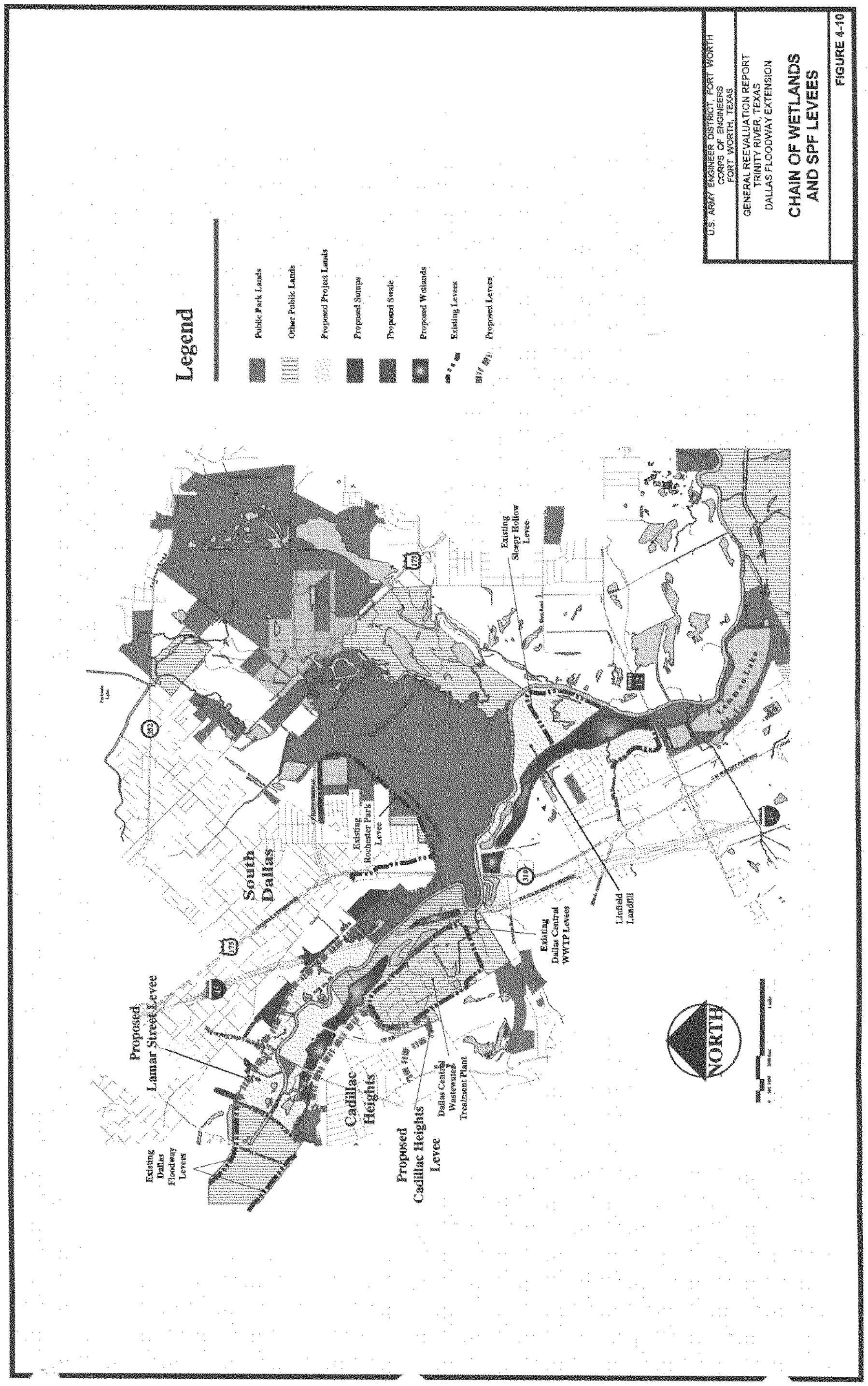
Based on applicable criteria, the 1,200-foot swale would produce the greatest net benefits and was designated as the NED plan. As shown, the NED plan would have net benefits of $8.6 million and a first cost of $47.5 million, without recreation.

Table 4-7
Final Array of Alternatives - NED Plan
(October 1995 prices, 7.63% interest, 50-year period of analysis)
(Millions of Dollars)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
1,200' BW Swale	$47.5	$4.3	$12.8	3.0	$8.6
900' BW Swale	$40.7	$3.7	$11.6	3.2	$7.9
Chain of Wetlands	$50.6	$4.2	$9.4	2.2	$5.2
Chain of Wetlands with SPF Levees	$82.6	$7.2	$11.5	1.6	$4.3


LINFIELD SWALE
ALIGNMENT
JOPPA SWALE
ALIGNMENT
AMARILLO
DALLAS
FORT WORTH
EL PASO
PROJECT LOCATION
AUSTIN
SAN ANTONIO
Existing
Dallas Central
WWTP Levees
Linfield
Landfill
McCommas Bluff
Landfill
Dallas County
Open Space
Goat Island
Preserve
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
REVISED SWALE
ALTERNATIVES
FIGURE 4-8


AMARILLO
DALLAS
FORT WORTH
EL PASO
PROJECT LOCATION
AUSTIN
HOUSTON
SAN ANTONIO
CONSTRUCTED WETLANDS
SWALE
TRINITY RIVER MAIN CHANNEL
VARIED WIDTHS
400' (AVG) UPPER SWALE
600' (AVG) LOWER SWALE
WITH WETLANDS
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
CHAIN OF WETLANDS
FIGURE 4-9


U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
CHAIN OF WETLANDS
AND SPF LEVEES
FIGURE 4-10
Legend
Public Park Lands
Other Public Lands
Proposed Project Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Existing Dallas Floodway Levees
Proposed Lamar Street Levee
South Dallas
Cadillac Heights
Proposed Cadillac Heights Levee
Dallas Central Wastewater Treatment Plant
Existing Dallas Central WWTP Levees
Existing Rochester Park Levee
Linfield Landfill
Existing Sleepy Hollow Levee
NORTH

SELECTION OF THE LOCALLY PREFERRED PLAN

The selection of the Locally Preferred Plan (LPP) began during the development of the NED plan. Many of the alternatives developed by the Corps were deemed worthy of further investigation as potential candidates for the LPP. Following HQUSACE and SWD approval of the preliminary plan formulation process, a series of informal discussions and meetings were held with the city and local interest groups to seek public input for various alternatives. The following issues were deemed worthy of further consideration and resolution:

- Due to the presence of pristine bottomland hardwoods on the east bank in the lower swale area, and the subsequent public input regarding the adverse impacts a 1,200-foot swale would have in this area, further studies were requested by the city.
- The city requested an evaluation of a west bank alignment for the lower swale.
- The city requested that the plans incorporate environmental restoration and recreation features into the flood control options.
- The city sought maximum flood protection for the area residents by construction of SPF levees along Lamar Street and the Cadillac Heights and wastewater treatment plant areas.

NON-STRUCTURAL ALTERNATIVE

The non-structural analysis performed in the preliminary phase of the study investigated the feasibility of evacuation of individual structures within the study area. These investigations revealed only seven structures scattered throughout the floodplain could be economically justified for acquisition. Such a plan was not adopted because it did not adequately address the area's flood problems and did not offer a comprehensive solution. Given these findings, an evaluation of non-structural buyout options from an entire flood zone perspective was performed. Table 4-8 presents a summary of the economic analysis for the evacuation of all structures within various flood zones.

Table 4-8
Economic Analysis of Flood Zone Evacuation Plans
(October 1996 prices, 7.63% interest, 50-year period of analysis)
(Millions of Dollars)

Zone	Number of Structures	First Costs	Annual Costs	Annual Benefits	Benefit/Cost Ratio	Net Benefits
0-2 Year	0	$0.0	$0.0	$0.0	0	$0.0
0-5 Year	13	$13.0	$1.1	$0.9	0.8	($0.2)
0-10 Year	37	$24.0	$2.0	$1.2	0.6	($0.8)
0-100 Year	508	$60.0	$5.8	$1.3	0.2	($4.5)

In the 0 - 5-year flood zone, one residential, five commercial, and seven industrial structures would be removed. The first cost of this plan was estimated at $13,000,000, with a BCR of 0.8.

In the 0 - 10-year flood zone, three residential, 20 commercial, and 14 industrial structures would be removed. The first cost of this plan was estimated at about $24,000,000, with a BCR of 0.6.

In the 0 - 100-year flood zone, 378 residential, 88 commercial, 39 industrial, and three public structures would be removed. The first cost of this plan was estimated at about $60,000,000, with a BCR of 0.2.

These plans would provide unacceptably small impacts on flood damages and were, therefore, screened from further consideration.

The local sponsor decided to focus efforts on the Chain of Wetlands concept, with the possible addition of levees on both sides of the river. The following sections present the development of the LPP, including descriptions of the various features considered, and rationale behind the selections of preferred solutions.

CHAIN OF WETLANDS

The Chain of Wetlands concept was formulated through the iterative process of addressing several issues raised by the city, and from further analysis regarding the hydraulic improvements which could be attained through various vegetation management plans within the area. First, intense concern voiced by citizens and special interest groups over the adverse impacts a 1,200-foot swale would have on important environmental resources in the Trinity River corridor prompted the city to look at smaller swale alternatives, which would provide a reasonable degree of protection in the immediate study area, though providing less benefits to the existing upstream Floodway. Second, the city's desire to add project features which would restore some of the corridor's fish and wildlife habitat qualities shifted the investigations to the examination of a series of connected wetland pools within the open, grass-lined swales.

Swale

Initial Alignment. The original Chain of Wetlands plan would consist of an off-channel swale designed to allow the natural river to retain its meanders, natural banks and bottom, and to preserve the tree canopy along the most ecologically significant vegetation adjacent to the river. The swales would resemble a broad meadow, with side slopes less than the crown of a football field. The centerline of the swales would follow the alignment of the 1,200-foot swale plan. The upper swale would have an average bottom width of approximately 300 feet, and would extend from the upstream end near the Cedar Creek confluence with the Trinity River to the oxbow near IH-45. The complementary lower swale would extend from the State Highway (S.H.) 310 bridge to Loop 12. This swale would have an approximate 500-foot bottom width from S.H. 310 through the Linfield Landfill, but would widen out to a 1,300-foot width through the Sleepy Hollow Golf Course. The maximum depth of the lower swale would be 30 feet through the Linfield Landfill, while the minimum depth would be seven feet.

Revised Alignment. Extensive public involvement revealed continued concerns regarding disturbance of existing environmental resources. Further investigations determined that the higher quality forested zones existed in the areas closest to the river; consequently, it was decided the original alignment of the upper portion of the swale would be shifted to the west to avoid these areas to the extent possible. Downstream of the upstream end of the CWWTP levee, no alignment changes would be necessary. Upstream of this point, the swale would be relocated to the west a distance varying from 200 feet to 500 feet, with an average of approximately 400 feet. Further movement to the west would be prohibited by existing underground utility lines, including three 60-inch diameter and one newly constructed 120-inch diameter pipes. The possibility of locating the swale west of these lines was evaluated, but was considered cost prohibitive. The higher ground elevation west of the utility lines would have required vastly greater excavation quantities, resulting in an estimated $11 million increase in construction costs alone, not including expected higher costs for real estate and for removal of hazardous, toxic and radiological wastes (HTRW).

When comparing these alignments, it is noted that the initial (eastern) alignment would require acquisition of 940 acres of additional land, at an estimated cost of approximately $4.6 million, to mitigate for impacts to 280 acres of high quality forested areas. The revised (western) alignment would impact 287 acres of lower quality trees, but would require only 635 acres of mitigation, at an estimated cost of approximately $3.1 million. The lower quality forested areas impacted by the western alignment would require significantly less mitigation.

Environmental Restoration (Wetlands)

The proposal to modify the flood swale for restoration of shallow water and emergent wetlands was developed to provide values to fish and wildlife resources, primarily migratory waterfowl, shore and wading birds that utilize the Trinity River corridor as part of the spring and migratory flights. The wetlands would be managed primarily as moist soil units that would optimize production of insects, seeds, tubers and vegetative structures to support several wildlife species during times of critical energy needs. Evaluation of existing constructed wetland features in the area indicated that it was desirable to consider the possibility of using a permanent water source, such as the existing Central Wastewater Treatment Plant effluent, to assure that water for flooding the wetland cells would be available when needed for wildlife usage. An analysis comparing construction of the wetlands with and without a dependable water supply was made.

The design for the proposed restoration plans was developed based upon extensive input from the U. S. Fish and Wildlife Service (USFWS), literature on wetland development in the Trinity River Basin, and from consultation with other biologists within the Corps of Engineers familiar with development of wetlands within this ecoregion for promotion of fish and wildlife benefits. Aside from development of gradual side slopes and provision of a deep permanent water pool, the major characteristics which promote optimized environmental benefits are the ability to regulate water levels with control structures and ability to provide flooding at proper periods during the year. The wetlands as proposed for the chain of wetlands, with control structures and a pumping system designed to deliver water from a continually available source, reflect optimized conditions based upon the available local expertise.

Table 4-9 reflects development of the wetlands without the capability to provide water from a local permanent water source. Based upon existing hydraulic models, it was determined that a flow of approximately 8,000 cubic feet per second would provide overbank flows sufficient to flood the wetlands. Based upon watershed characteristics, it was determined that the overbank flood events would coincide with local rainfall sufficient to fill the wetlands and would thus be a good estimator for frequency of flooding without the use of a pumping system. Hydraulic and hydrologic analyses indicate that approximately 67 % of the time, there would be sufficient water available under natural conditions, during the spring and early summer, to flood the wetlands and stimulate initial growth of emergent and moist soil plants along the perimeter of the wetlands. However, it was found that a flooding event would occur only 5 % of the time during August to irrigate and promote optimum seed production of wetland plants. Flooding would occur approximately 40% of the time during the October to January period, when food and cover produced by the wetlands vegetation would be critical for migratory waterfowl and shorebirds. From these data, the average habitat suitability was adjusted to reflect the effect of reduced flooding on the wetlands. It could additionally be argued that the actual average size of the wetlands would also diminish significantly. Considering suitability values only, there would remain an increase in average annual habitat units in this alternative; however, approximately 83 % of the values would be attributed to the grassland portion of the complex and less than 16 % of the values would be attributable to the wetland portion. The average habitat value of the permanent water feature would be almost totally lost because of the low frequency of flooding that occurs naturally during the summer months.

The wetland complex, as proposed with dependable water supply available (Table 4-10), would provide significant increased fish and wildlife resources values, as indicated by the increases in habitat values of the permanent water, emergent wetlands and grassland portions of the complex. The plan would provide for development of 123 acres of emergent wetland, which would yield over 117 average annual habitat units, and would more than triple the total resource values over the flood damage reduction swale as it would exist without the proposed emergent wetland complex development alternative. By contrast, the chain of wetlands without a dependable source of water would provide for development of only 83 acres of emergent wetland, providing only 19 average annual habitat units for the priority emergent wetland resources. This analysis shows an increase of 48% in acres and a 516% increase in average annual habitat units of emergent wetlands attributable to a dependable water source.

Cost Effectiveness And Incremental Analysis. While an economic standard has been set that requires a justifiable flood damage reduction plan to have economic costs be no more than the economic benefits, a similar scale does not exist for environmental restoration proposals due to the fact that, although costs are measured in dollars expended, benefits are measured in terms of environmental outputs, such as habitat units, acres, etc., that preclude development of a benefit to cost ratio to eliminate undesirable, non-supportable project alternatives. Cost effectiveness and incremental analysis techniques, as reported by Robinson, et al. 1995, are useful tools for the decision maker to eliminate poor alternatives and to guide the thought process in determining which project alternatives would be supportable when environmental output levels continue to increase with increased expenditure of economic resources.

Cost Effectiveness of Emergent Wetland Restoration. The procedures outlined by Robinson, et al. (1995) were followed to evaluate the environmental benefits and costs of the two broad environmental restoration alternatives for the proposed chain of wetlands. These alternative management plans include providing necessary water when need to optimize fish and wildlife benefits to the proposed emergent wetland complex. This analysis evaluates the benefits that would be derived from the wetland complex relying on naturally occurring weather events versus a pumped supply to provide water for the wetlands. Output information used in the analysis were derived from tables 4-9 and table 4-10. An operation and maintenance cost of $50,000 was estimated for the alternative with a dependable water source, and $35,000 for those without dependable water.

Pertinent information related to the cost effectiveness for the two action alternatives and the no action alternative are displayed in table 9 of Appendix F. Initial analysis indicates that both action alternatives are cost effective in that both provide benefits and that the slightly more expensive plan with dependable water supply provides higher environmental output than the less expensive plan.

The plan without dependable water supply provides a net increase in benefits over the no action alternative, at an average annual cost of $8,678 per average annual habitat unit (AAHU), which appears to be more costly on average than would be expected in this ecoregion. The benefits of adding a dependable water supply are clearly demonstrated by the analysis. For an additional annual cost of $30,503, an additional 130.77 AAHUs can be developed. Furthermore, evaluation of the data indicates that the best buy would the alternative providing dependable water, enabling optimum management of the wetland complex. The no action plan as well as the alternative providing the swale with the wetlands without the capability to provide water when needed provide habitat, the majority of which is associated with the grassland portion of the complex. This scenario, with minimal resource values attributable to the wetlands proper, does not provide restoration of priority habitat and should not be considered further. The emergent wetland restoration plan which includes provision of a dependable water supply appears to be justified based upon the analysis conducted.

Table 4-9
Chain of Wetlands Habitat Evaluation, with Water Supply not available for Management

	Upper Swale						Lower Swale					
	Area (acres)		HSI		Habitat units		Area(acres)		HSI		Habitat Units	
	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands
Grassland/ Forbland	105	65.77	0.25	0.56	26.25	36.83	165.99	114.44	0.25	0.56	41.50	64.08
Permanent Water		3.25		0.2	0	0.65		4.93		0.20	0	0.99
Emergent Wetlands		**35.98**		0.23	0	**8.28**		**46.62**		0.23	0	**10.72**
Total					26.25	45.76					41.50	75.79
Grand Total											**67.75**	**121.55**

Notes: *With Flood Control Only reflects on-site conditions if only the flood control portion of the swale were constructed.*
Projected with Chain of Wetlands reflects projected conditions with wetland restoration superimposed on flood control project.
Grand Total is the sum of the Upper and Lower Swale values.

Table 4-10
Chain of Wetlands Habitat Evaluation, with Water Supply Available for Management

	Upper Swale						Lower Swale					
	Area (acres)		HSI		Habitat units		Area(acres)		HSI		Habitat Units	
	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands
Grassland/ Forbland	105	33.3	0.25	0.90	26.25	29.97	165.99	68.96	0.25	0.90	41.50	62.06
Permanent Water		18.03		0.95	0	17.13		27.40		0.95	0	26.03
Emergent Wetlands		**53.71**		0.95	0	**51.02**		**69.59**		0.95	0	**66.11**
Total					26.25	98.12					41.50	154.20
Grand Total											**67.75**	**252.32**

Notes: *With Flood Control Only reflects on-site conditions if only the flood control portion of the swale were constructed.*
Projected with Chain of Wetlands reflects projected conditions with wetland restoration superimposed on flood control project.
Grand Total is the sum of the Upper and Lower Swale values.

Incremental Analysis of Emergent Wetlands by Cell. Since both action alternatives are considered to be cost effective, further analysis is necessary to determine the optimum extent of environmental restoration through construction of emergent wetlands that is warranted. As in the analysis used to demonstrate that provision of dependable water was desirable and justifiable, an analysis was conduced to determine if the entire chain of wetlands was justifiable or if only a portion of the complex should be constructed and managed. The chain of wetlands, as proposed and evaluated, could contain from one to seven cells (See Figure 2 of Appendix F, and Plates C-21 through C-29 of Appendix C) that would be connected to the water source. A series of water distribution and control structures would be used to manage the emergent wetlands for optimum habitat output. For this analysis, the cells were named in alphabetical order, with the uppermost or northern wetland cell named Cell A, with the most southerly located cell named Cell G. The detailed incremental analyses for each cell is presented in Appendix F, the results of which are shown in table 4-11.

Table 4-11
Incremental Analysis of Environmental Restoration Plan

PLAN	ANNUAL COST	AAHU OUTPUT	INCREMENTAL COST	INCREMENTAL OUTPUT AAHU	INCREMENTAL COST/AAHU
No action	0	68	N/A	N/A	N/A
Cell D	$ 63,349	75	$ 63,349	+ 7	$9,050
Cell C	$ 94,688	99	$ 31,339	+24	$1,306
Cells D and E	$180,927	135	$ 86,239	+36	$2,396
Cells C, D, E and F	$255,615	166	$ 74,688	+31	$2,409
Cells A, B, C, D, E and F	$332,532	196	$ 76,917	+30	$2,564
Cells A, B, C, D, E, F and G	$497,360	252	$164,828	+56	$2,943

Summary - Environmental Restoration Plan. The planning goal for environmental restoration for the proposed project area was to develop a wetland complex providing maximum wetland and related deepwater and grassland habitat gains within the confines of the proposed swale area in a cost effective manner. The proposed restoration plan should not cause additional unacceptable impacts to fish and wildlife resources, nor should it cause impacts to flood damage reduction benefits within the study area, or preclude the development of any additional flood damage reduction actions that might be needed in the future. The seven cells that were designed individually meet all criteria, except they do not maximize total restoration output of important habitat (emergent wetland) that could be achieved. The cost effectiveness and incremental cost analyses was conducted to assist in the determination of whether the plan that does maximize total habitat output (plan with all seven cells) is cost effective and, based upon its incremental cost, should be supported as the recommended environmental restoration plan.

By analysis, it was determined that the plan with all seven cells is cost effective, as were the other five action plans, and these alternatives were carried forward for the final incremental analysis (Table 4-11). All seven of the final alternatives were considered viable alternatives that must be carefully evaluated under the question, "Is this level of output worth the cost?" The analysis conducted shows that for the six action plans that remained after prior screening, environmental benefits increased with each successive increment of wetlands added. Additional increments of wetland restoration, if designed, would likely also continue to show increased output; however, other planning constraints would be exceeded. For example, additional emergent wetlands could be designed for location off the flood control swale but this could only occur at the expense of bottomland hardwood habitat that is nationally recognized for its importance. Restoration activities should not result in damages that would require environmental mitigation. Studies in the upstream area of the existing Dallas Floodway have only recently begun under separate authorities and it would be imprudent to design emergent wetlands in that area prior to completion of necessary engineering studies to determine needs for that reach of the system.

Therefore, within the constraints of this project and planning area, it appears that the development of the complete chain of wetlands would achieve the goal of maximizing emergent wetland habitat within this area without violating other developed criteria. Going beyond the no action alternative is relatively simple in that a determination has been made that environmental needs are present in the basin that can be obtained by project construction. The output of 68 AAHUs for the no action alternative was based upon the native grassland complex that would result from construction of the flood damage reduction swale, and would essentially provide no benefits attributable to emergent wetlands, the priority output. The next increment, or the first action proposal, construction of Cell D alone, produces only 7 AAHU at a relatively high cost due to the initial high cost of providing the water supply infrastructure and the relatively small size of the Cell. The next measure, construction of Cell C, provides an additional 24 AAHU at a cost of $1306 per AAHU. Additionally, these two increments represent the first in a logical implementation sequence upon which all other cells are dependent.

The remaining alternatives, as listed, continue to provide additional output. Again, the average cost of $2,564 per added AAHU for the plan which includes wetland Cells A through F, and intermediate plans are judged to be worth the additional expense to gain the additional environmental output. The final alternative, which includes all cells, causes need for additional thought in determining whether the additional expense in adding Cell G to provide an additional 56 AAHUs, at an incremental average cost of $2943, is worthwhile. For comparison purposes, an analysis conducted for a similar emergent wetland complex developed on Corps lands for mitigation of another project indicates that the incremental addition of this cell to the plan is warranted.

Following guidance by Robinson, et al., the tendency to select the plan that minimizes average cost, or in other words, is most efficient in production has been bypassed. Instead, a rational decision has been made based upon careful examination of the costs and benefits of all potential combinations of wetland cells. The final array of alternatives was examined in the same manner as if a NED plan were being sought. In our evaluation , the incremental environmental outputs continued to rise with increased expenditure of economic resources. The cap or limit to development of additional alternatives with more wetlands was based upon environmental constraints that precluded development of additional emergent wetlands.

In addition, very few opportunities of this magnitude exist to develop emergent wetlands as proposed in the chain of wetlands, particularly when considering the other non-habitat benefits such as water quality, aesthetics, sightseeing and possibly other recreational benefits that could be attributable to the emergent wetland complex features of this multi-objective plan. The increase in habitat that would be obtained by addition of Cell G appears to environmentally, economically, and socially justifiable. Therefore, the entire wetland complex, with Cells A through G, is included in the environmental restoration plan.

Summary

The Chain of Wetlands Plan is, therefore, defined as the westernmost aligned swale, as described above, into which a connected series of wetlands would be developed and managed utilizing treated effluent from the CWWTP as a source of water, when needed, to supplement overbank flows from the Trinity River. The Dallas City Council, in response to the public opposition voiced against the NED Plan, and in support of the multi-objective outputs of the Chain of Wetlands Plan, voted to adopt the Chain of Wetlands Plan as the initial LPP on August 28, 1996. The total first cost of this plan was estimated at approximately $68.2 million, of which $48.9 million would be for flood control, $10.1 million would be for environmental restoration, and $9.3 million would be for recreation. This plan would yield average annual flood control benefits of $10.9 million, with a flood control benefit-cost ratio of 1.75. Total net annual flood control benefits for the Chain of Wetlands Plan would be $4.7 million.

However, intense social and public pressure to provide added flood protection in the immediate study area comparable to that provided to the Central Business District by the existing Dallas Floodway levees prompted the city to request additional levee solutions aimed at removing more residents and businesses from flood risk.

CHAIN OF WETLANDS PLUS LEVEES

Public desires to provide greater flood protection to the neighborhoods downstream of the existing Dallas Floodway prompted further, more detailed investigation of plans involving a combination of levees and channels. In order to provide equitable protection to these areas, the city requested that SPF levees be designed on both sides of the river in the Lamar Street and Cadillac Heights areas.

Lamar Levee

Initial Alignment. The initial alignment of the Lamar Levee, located on the east side of the river, would parallel and abut the Southern Pacific Railroad line from Interstate Highway 45 (IH-45) on the upstream end to a point just upstream of S.H. 310 on the downstream side. Upstream of IH-45, the levee alignment would move away from the railroad and connect to the east levee of the existing Dallas Floodway. On the downstream end, from the point upstream of S.H. 310, the levee alignment would shift toward the river, follow a high embankment around and under S.H. 310, and connect to the existing Rochester Park Levee at the east embankment of the Southern Pacific Railroad. This levee alignment, as shown in figure 4-11, would be designed to protect all structures on the east side of the Trinity River.

Secondary (Couplet) Alignment. Concurrent studies conducted by the Texas Department of Transportation (TxDOT) regarding major transportation projects within the downtown Dallas area, including the current study area and the existing Dallas Floodway, yielded preliminary designs which indicated conflicts between roadway alignments and levee alignments within the study area might be minimized by shifting the entire levee closer to the Southern Pacific Railroad. The upstream end of the levee would tie into the east levee of the existing Dallas Floodway, as in the initial alignment, but would shift adjacent to the railroad much further upstream, near Martin Luther King, Jr. (MLK) Boulevard, thereby eliminating flood protection for all businesses in the area. The downstream end of this proposed levee would remain adjacent to the railroad downstream of S.H. 310, and would then roughly parallel the railroad and connect to the Rochester Park Levee at approximately the same location as proposed in the initial alignment. This alignment is also shown in figure 4-11.

The investigation of this proposed alignment revealed several obstacles to feasibility. First, the alignment would eliminate protection to all businesses between the river and the railroad, thereby reducing economic benefits derived from the levee. Second, the placement of the levee adjacent to the railroad would require acquisition of structures along the more densely populated east side of the tracks for construction of sump areas, thereby further reducing economic benefits while increasing project costs. Third, the proposed alignment underneath S.H. 310, on the downstream end, would yield no hydraulic benefit due to the high, existing embankments at this highway, which would restrict conveyance of flood waters to a greater degree than the levee. Vast amounts of excavation and bridge construction would be required to produce hydraulic benefits within this area. For these reasons, the couplet alignment was eliminated from further investigation.

Final Alignment. The next alignment investigated, shown in figure 4-11, would be very similar to the initial alignment, with the exception that the upstream end of the levee would be aligned through the large warehouse structure previously owned and occupied by Proctor & Gamble, but which had essentially been abandoned since the previous analysis. The acquisition of this structure was deemed advantageous for the hydraulic benefits derived from moving the levee further from the river, and for the potential use of this property as a sump area behind the levee.

Summary. As a result of these analyses, the Lamar Street Levee, included in the Chain of Wetlands Plus Levees Plan is defined as a SPF plus 2 foot earthen levee connecting the downstream end of the east levee in the existing Dallas Floodway, at the east abutment of the old Atchison, Topeka and Santa Fe (AT&SF) Railroad bridge, with the existing Rochester Park Levee, at the east abutment of the Southern Pacific Railroad bridge. The levee would have an average height of 21 feet and would be about 3 miles long. This extension would not require raising any portion of the existing Floodway levee, and only about 1,000 feet of the Rochester Park Levee would have to be raised less than one foot. About 4,500 feet of the existing Rochester Park Levee would be made unnecessary by the Lamar Levee. Although the alignment of this levee would be adjacent to several commercial businesses, the majority of these businesses would not require relocation. The Proctor and Gamble storage facility and some smaller commercial structures at the downstream end of the Lamar Levee, near S.H. 310, would require relocation, however.

Cadillac Heights Levee

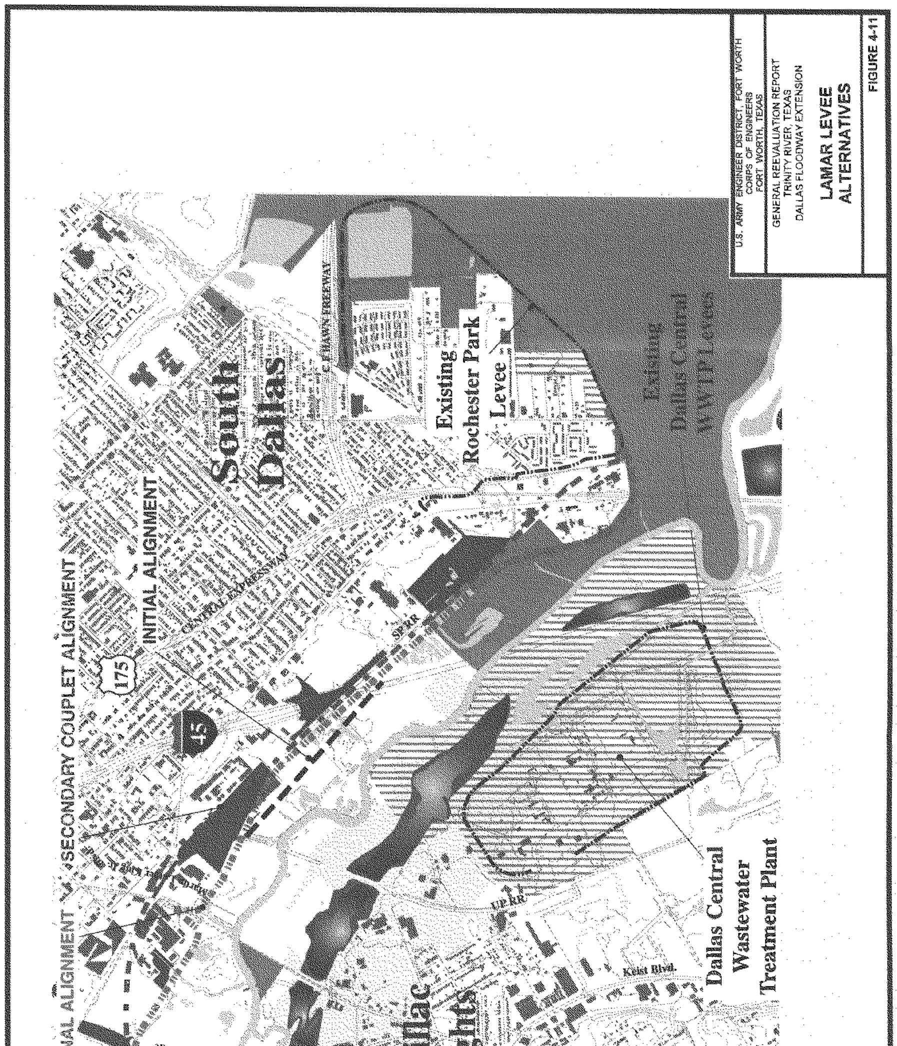
The Cadillac Heights Levee, on the west side of the river, would be composed of new construction and modification of previous construction. Several design iterations were required prior to a final alignment. A proposed new levee would be constructed between Cedar Creek and the CWWTP, a modification to the existing CWWTP Levee would be required, and an extension of the proposed levee behind the CWWTP would be necessary. Two major areas of concern regarding the location of this levee were the possible adverse environmental impacts which this levee might create, and the possible disruption of businesses within the area. Additional obstacles with which the design of this levee had to contend were the presence of large underground sewer lines running parallel with the general flow of the river, and the presence of a utility easement on which large Texas Utilities (TU) towers were located. The underground sewer lines, alluded to previously, included three active 60-inch diameter lines and one 120-inch diameter line, in addition to two abandoned 36-inch diameter lines. The alternatives investigated for this levee are described in the following sections, and are shown in figure 4-12.

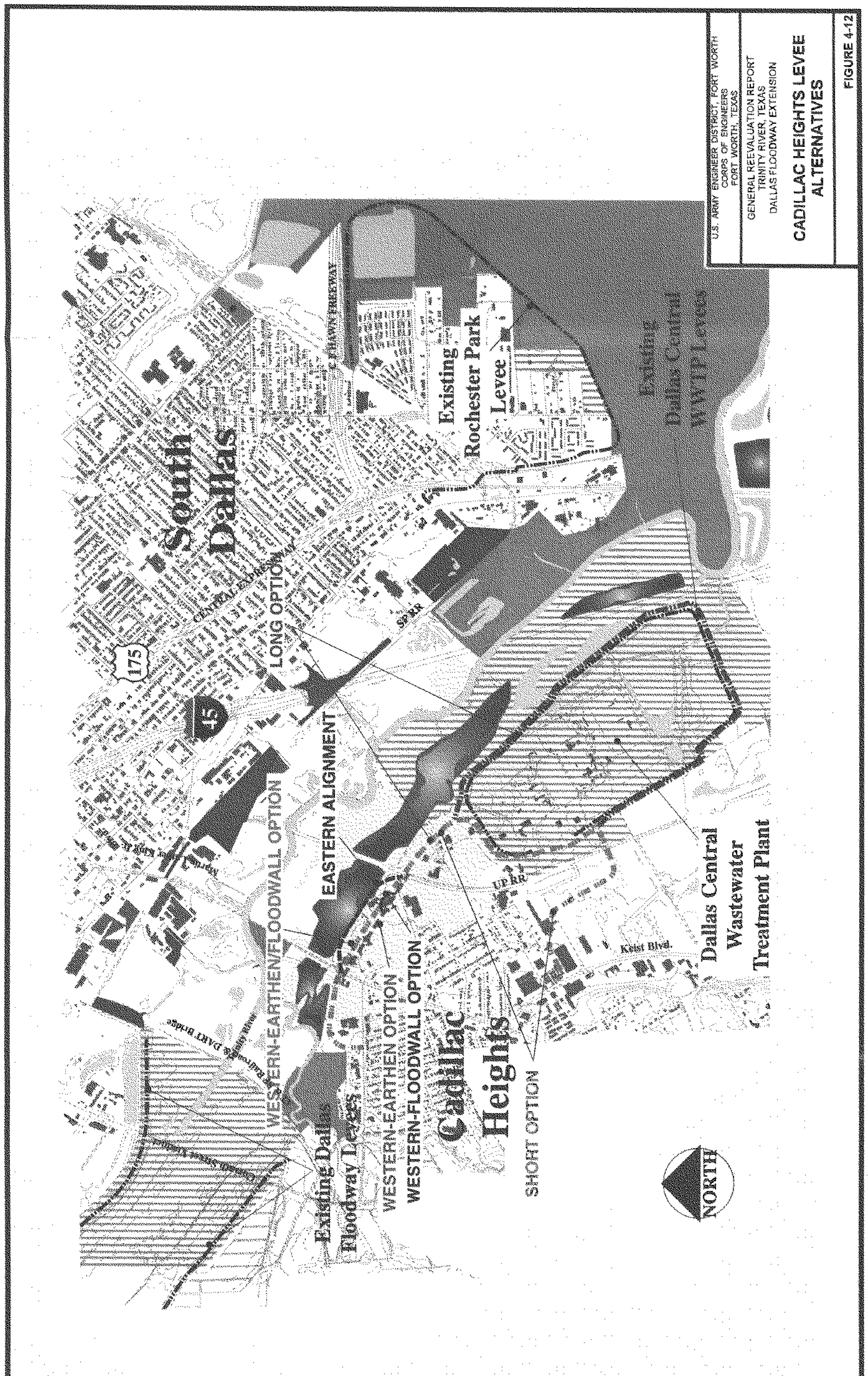
New Levee - Eastern Alignment. The initial alignment of the proposed earthen levee would begin upstream near the confluence of Cedar Creek with the Trinity River. Downstream of the MLK Boulevard bridge, the levee would cross over to the east side of the underground sewer lines and TU easement, and then proceed downstream and connect to the CWWTP Levee. Although this alignment would protect a meat packing plant, several potentially insurmountable issues were identified. Foremost, placement of a levee at this location in the floodplain would create significant adverse hydraulic impacts to upstream water surface elevations. In addition, the swale and chain of wetlands would have to be moved closer to the river to accommodate the levee, thereby eliminating the environmental benefits which instigated the realignment of the chain of wetlands as far west as possible. Furthermore, serious concerns were voiced about crossing over major sewer lines with a levee, due to the need for access to the lines and due to potential hazards to the levee in the event of a sewer line break. For these reasons, this "eastern" alignment was eliminated from further consideration.

New Levee - Western Alignment. Several options were investigated for placement of a levee west of the sewer lines, with varying degrees of impact to existing businesses. The upstream end of each levee would match the initial, eastern alignment from Cedar Creek to MLK Boulevard. Downstream of MLK Boulevard, however, each of these "western" alignments would be located on the west side of the sewer lines. These options are described as follows:

Western - Earthen Option. This option would include an entirely earthen levee constructed through the existing meat packing plant, thus requiring acquisition and relocation of the plant. This alignment would cause no impacts to the sewer lines.

Western - Floodwall Option. The alignment of this levee would be the same as the western-earthen option, with the exception that a floodwall would be constructed around the packing plant's main facility, and would require relocation of a barn structure. The floodwall would be required to cross the sewer lines at two locations.


FINAL ALIGNMENT
SECONDARY COUPLET ALIGNMENT
INITIAL ALIGNMENT
175
45
CENTRAL EXPRESSWAY
C.F. HAWN FREEWAY
SP RR
UP RR
Kiest Blvd.
South Dallas
Existing Rochester Park Levee
Existing Dallas Central WWTP Levees
Dallas Central Wastewater Treatment Plant
Cadillac Heights
Existing Dallas Floodway Levees
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
LAMAR LEVEE ALTERNATIVES
FIGURE 4-11


U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
CADILLAC HEIGHTS LEVEE ALTERNATIVES
FIGURE 4-12
South Dallas
175
45
CENTRAL EXPRESSWAY
C.F. HAWN FREEWAY
Existing Rochester Park Levee
Existing Dallas Central WWTP Levees
SP RR
LONG OPTION
EASTERN ALIGNMENT
WESTERN-EARTHEN/FLOODWALL OPTION
UP RR
Keist Blvd.
Dallas Central Wastewater Treatment Plant
WESTERN-EARTHEN OPTION
WESTERN-FLOODWALL OPTION
Cadillac Heights
SHORT OPTION
Existing Dallas Floodway Levees
NORTH

Western - Earthen/Floodwall Option. The intent of this option would be to minimize the levee footprint to accommodate placement between the westernmost 60-inch sewer line and the 120-inch line, from MLK Boulevard to the Missouri-Kansas-Texas (MKT) Railroad upstream of the CWWTP. Within this area, the earthen levee would require 3:1 side slopes, a 15-foot crest width and a 6-foot high concrete floodwall on top. There would be some overburden placed on the sewer lines within this area. The remaining portions of the Cadillac Heights Levee would consist entirely of earthen embankments with side slopes of 4:1 and crest widths of approximately 20 feet. This alignment would also require relocation of the Dallas City Packing barn facility.

A comparison of direct construction costs, preliminary real estate acquisition and relocation costs, and environmental impacts revealed that these options would be economically and environmentally comparable. However, from an engineering and operation and maintenance standpoint, the risks associated with constructing a floodwall and/or earthen levee on top of sewer lines would make such options much less desirable; therefore, subsequent engineering recommendations endorsed the western-earthen option.

Based on the preceding discussions, decisions were made that further analysis of the Cadillac Heights Levee would be based on an earthen levee located west of the underground sewer lines between Cedar Creek and the CWWTP, thereby requiring acquisition and relocation of several businesses, including the meat packing plant.

CWWTP Levee Tie-In. The proposed new levee, as described above, would be designed to tie into and utilize the existing CWWTP Levee. Two options were investigated for the CWWTP Levee, as shown in figure 4-12, and as described below.

Short Option. In this option, the proposed new levee would tie into the CWWTP Levee, utilize and raise the northwest corner of this levee at the plant entrance to SPF levels, and then extend from the west side of the CWWTP Levee to high ground near the intersection of Kiest Boulevard and McGowan Avenue. This short option, in combination with the Chain of Wetlands and the Lamar Levee, would provide approximately 500-year flood protection to the CWWTP, as opposed to the current 140-year protection. The upstream impacts to the SPF flood elevation at the downstream end of the existing Dallas Floodway for the short option (including the Chain of Wetlands and Lamar Levee) would be an overall reduction of 1.1 feet.

Long Option. The long option would encompass and provide SPF protection to the entire CWWTP. This option would raise the entire CWWTP Levee about 4 feet, except for the northwest corner at the entrance, and would utilize the alignment of the existing levee system. The long option would tie into high ground in the same manner as the short option. The upstream impacts to the SPF flood elevation at the downstream end of the existing Dallas Floodway for the long option (including the Chain of Wetlands and Lamar Levee) would be an overall reduction of 0.45 feet.

The long option was estimated to cost $3.5 million more than the short option, and would yield a loss of benefits in the existing Dallas Floodway of approximately $0.9 million compared to the short option. Due to the increased cost and decreased benefits of the long option, the local sponsor would be responsible for 100% of the increased cost. Based on these findings, the city opted to support the short option.

Summary. The Cadillac Heights Levee to be included in the Chain of Wetlands Plus Levees Plan is defined as a SPF plus 2 foot earthen levee beginning upstream near the confluence of Cedar Creek and the Trinity River and extending on the west side of the underground sewer lines to the CWWTP Levee. The short option, as described above, would be utilized around the CWWTP. The average height of the Cadillac Heights Levee would be about 20 feet, with a length of approximately 2.3 miles.

Interior Drainage

While providing a substantial degree of riverine flood damage reduction to existing properties in the Dallas Floodway Extension study area, the proposed Lamar Street and Cadillac Heights levees would trap a major portion of the surface runoff from about 1,264 and 337 acres of localized subbasin area, respectively. Current Corps policies require that the interior drainage facilities (sumps and sluice outlets) be designed so as to ensure that this runoff does not contribute to any induced flood damage, and that the interior drainage system be designed to operate in such a way that it does not impair the effective operation of the proposed levee. In addition, current Corps engineering manuals indicate that the minimum facilities from which to begin sump optimization planning procedures should at least meet any minimum design standards established by the local sponsor's drainage ordinance.

The facilities along the proposed levees were initially sized to accommodate collection and/or passage of the 100-year frequency (.01 probability of exceedance) localized runoff event, in accordance with drainage system standards of the local sponsor, the City of Dallas. Along the Lamar Street Levee, this design entailed the proposed implementation of a series of five sumps with related outlet sluice facilities. Areas exhibiting the more low-lying terrain adjacent to the landward side of the proposed levee alignment were chosen for use as sumps. Three of these sites would require extensive excavation, while the existing terrain at the other two sites was found to be adequate in providing the necessary sump storage. Along the Cadillac Heights Levee, this design entailed the proposed implementation of a series of four outlet sluice facilities. Due to the higher terrain along the proposed Cadillac Heights Levee, in contrast with that along the Lamar Street Levee, it is possible to adequately pass the interior runoff design hydrograph without having to temporarily store significant floodwaters. As a result, no specific sump excavations are currently proposed along the Cadillac Heights Levee.

In all instances, any known existing storm sewer lines capable of draining portions of the localized runoff into the Trinity River were assumed to remain in place, and be supplemented with a flap gate, to ensure that the occasionally high river stages do not cause a reversal of flow into the landward side of the proposed levees. Flows capable of being diverted to the river, using the existing storm sewer lines, were subtracted from the total localized runoff in order to develop effective inflow hydrographs at each facility for the design event. The actual sizing of any required sump excavation and the outlet sluice facilities was accomplished by first taking advantage of the mostly vacant real estate pockets along the landward side of the proposed levees, by next varying the size and number of outlet conduits (up to reasonable limits), and by lastly incorporating a degree of surface excavation, to the point that it could be ensured that the 100-year frequency (initial design level) event could be passed without creating a pooling effective on adjacent, non-sump properties.

Summary. The sumps along the proposed Lamar Street Levee would be situated from upstream to downstream as follows, and as shown in figure 4-11. The first would be located immediately southeast of the Dallas Area Rapid Transit (DART) rail line. It would require no excavation, but would inundate 1.68 acres under the design condition. The second would be located at the southwest "dead" end of Forest Avenue. It would require some limited excavation (on the southwest side of an existing commercial activity) and would inundate 1.80 acres under the design condition. The third would straddle the Missouri-Kansas-Texas (MKT) Railway and occupy the long triangular area bounded by that railway, the Southern-Pacific (SP) Railway, and the proposed Lamar Street Levee. It would require extensive excavation and would inundate 17.10 acres under the design condition. The fourth would be located beneath the north end of the Interstate Highway 45 (Julius Schepps Freeway) bridge over the Trinity River valley. It would require no excavation, but would inundate 8.08 acres under the design condition. The fifth would be located along the northeast side of the SP Railway, behind the active commercial entities along the more southeastern end of Lamar Street. It would require substantial excavation and would inundate 12.20 acres under the design condition.

The interior drainage facilities (sluice structures) along the proposed Cadillac Heights Levee, none of which would require significant excavation or would be expected to create a significant area of inundation, would be situated from upstream to downstream as follows. The first would be located west of Martin Luther King Jr. (Cedar Crest) Boulevard. The second would be located adjacent to the west side of the MKT Railway, at the point where it crosses the northeastern leg of the proposed levee alignment. The third would be located several hundred feet east of the MKT Railway. The fourth would be located adjacent to the MKT Railway, at the point where it crosses the southern leg of the proposed levee alignment.

Those sump areas which would be excavated would have three-on-one side slopes, and generally flat bottoms (sloped very slightly to the outlet). The outlet sluice facilities are proposed as simple rectangular conduits with both a flapgate (at the outlet end) and a manually operated sluice gate. Pertinent data on the sumps and outlet sluice structures, including hydrologic effects, are presented in table A-9 of Appendix A.

Summary

The Chain of Wetlands Plus Levees Plan is defined as the Chain of Wetlands Plan, described previously, in combination with SPF plus 2 foot levees protecting the Lamar and Cadillac Heights areas. Preliminary analyses indicated this plan would impact about 600 acres of environmental resources, including approximately 193 acres of bottomland hardwoods, and would require approximately 1,400 acres of mitigation at an estimated cost of about $6.0 million.

FINAL ANALYSIS OF THE LOCALLY PREFERRED PLAN

As stated previously, the formulation process for this study was comprised of three distinct phases, two of which were completed during identification of the NED Plan. The revisions in the third phase of this process entailed the use of January 1997 price levels and application of the prevailing Federal interest rate of 7.375 percent in all economic analyses, incorporation of Congressional legislation, specifically the Water Resources Development Act (WRDA) of 1996, and inclusion of final revisions to the hydrologic model from the Upper Trinity River Feasibility Study. The following sections reflect the impact these revisions had on overall project cost and benefit analyses.

Impacts of WRDA 1996

On October 12, 1996, during the alternative formulation process and prior to final selection of the LPP, Congress passed WRDA 1996 (Public Law 104-303), which necessitated several revisions in the analysis of alternatives for this project. As stated previously, the local sponsor's request for a Section 215 or Section 104 agreement regarding credit for the non-Federal construction of the Rochester Park Levee and modifications to the CWWTP Levee was denied due to the timing of the request and/or lack of prior approval from the Assistant Secretary of the Army (Civil Works). The sponsor subsequently sought legislation approving the credit. Section 351 of WRDA 1996, quoted in Chapter 3 of this document, is the culmination of that effort.

In summary, Section 351 recognized and acknowledged that the Rochester Park and CWWTP Levees, previously constructed by the non-Federal sponsor (City of Dallas), should be treated as the first element of the project. The actual cost of these levees was $26,958,000 ($14,220,000 for CWWTP, and $12,738,000 for Rochester Park). The legislation stated that costs for the portions of the previously constructed levees compatible with the authorized project, as modified, would be credited toward the non-Federal share of the Federal project. Finally, it specified that the requirement for a 5% cash contribution during construction, stated in WRDA 1986, would remain applicable.

The inclusion of costs for the Rochester Park and CWWTP Levees as part of the overall project costs necessitated revision of the "existing conditions" hydraulic and economic models to reflect pre-1991 conditions in order to capture the benefits derived from these levees. Revised existing conditions damages are presented in table 3-6, in Chapter 3, of this report.

Further guidance received from HQUSACE provided instructions on the implementation of Section 351 in regard to economic justification requirements for the non-Federal levees, and the extent of inclusion of their respective costs and benefits into the various alternatives investigated. This guidance indicated that the portions of the non-Federal levees that are compatible with the authorized project shall be included in the Federal plan, and that if the levees are incrementally economically justified, they shall be included in the NED Plan as well. This guidance, therefore, required incremental analyses of the non-Federal levees, as described in the following paragraphs.

Central Wastewater Treatment Plant Levee

The Central Wastewater Treatment Plant (CWWTP) was previously protected by a levee providing adequate protection from storms with an exceedance probability of 0.02 or greater (50-year). After the flood event in 1990, when access to the plant was curtailed and a near failure occurred, some difficult decisions were made. Dallas Water Utilities estimated $90 million of flood damages would be incurred for any overtopping of its levees, not including costs for clean-up, downstream environmental problems associated with uncontained raw sewage, fines levied by the Environmental Protection Agency, and loss of customer service to the city for the time the CWWTP is down. Due to the amount at risk, both monetary and non-monetary, the city could ill afford to wait for the Federal process. Thus, in 1992-1994, coordination with Corps officials took place to ensure that the levee placement would be physically compatible with the alignment of the Authorized Plan, and the levee protecting the CWWTP was upgraded to its current height. The upgraded levee now provides protection from storms with an exceedance probability of 0.01 (100-year), with a level of confidence of 66%, which indicates an approximate 140-year level of protection.

Table 4-12 contains the benefits and actual costs of the CWWTP levee upgrade. Total investment cost is $14.2 million, with net benefits of $22,000, yielding a BCR of 1.02.

Table 4-12
Benefit Cost Analysis for the CWWTP Levee Upgrade
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Project Alternatives Include Land/Mitigation & HTRW Costs	CWWTP Levee
ESTIMATED FIRST COST	
Non-Federal Levee Cost	$14,220,000
ANNUAL CHARGES	
Interest	$1,048,725
Amortization	$30,765
Operation/Maintenance ($/year)	$75,000
Replacements	$0
TOTAL ANNUAL CHARGES	$1,154,490
ANNUAL BENEFITS	
Inundation Reduction	$1,085,300
Existing Dallas Floodway	$91,208
TOTAL BENEFITS	$1,176,508
NET BENEFITS	$22,018
BENEFIT-COST RATIO	1.02

** The estimated first costs reflect actual expenditures for the CWWTP Levee upgrade in 1993.*

Rochester Park Levee

The Rochester Park Levee was constructed from 1991-1993, following a series of floods that devastated the area. Public outcry resulted in the city taking immediate action to extend protection to the citizens most vulnerable to flooding. Sufficient funds were not available to construct the entire eastern levee (referred to in this text as the Lamar Levee), so the city built only a portion of the system following the alignment proposed in the Authorized Plan, to the extent possible. In order to provide the maximum protection possible with the funds available, the upstream portion (tail) deviated from the alignment and tied back to high ground in as short a distance as possible. As a stand alone project, the Rochester Park Levee is not economically justified, yielding a BCR of about 0.5.

Construction of the remainder of the Lamar Levee, as proposed in the Chain of Wetlands Plus Levees Plan, would mean that about 4,500 feet of the upstream portion of the Rochester Park Levee would be abandoned, i.e., it would be physically incompatible with the Lamar Levee. The downstream portion of the levee, however, would be fully utilized as part of the system.

Since only a portion of the Rochester Park Levee would qualify for credit under the criteria of physical utilization, economic viability of this piece was tested as part of the Lamar Levee system. An evaluation of the benefits and costs for the Lamar Levee system, with the compatible portion of Rochester Park included, shows the system to be justified as a second added element to the Chain of Wetlands swale. These benefits and costs are provided in table 4-13. Note that the creditable portion of Rochester Park was estimated at approximately $8.9 million, and is shown in the line item entitled "Non-Federal Levee Cost".

Table 4-13
Benefit Cost Analysis for the Lamar Levee System
(Including the Compatible Portion of Rochester Park Levee)
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Project Alternatives Include Land/Mitigation & HTRW Costs	Lamar Levee Incremental
ESTIMATED FIRST COST	$15,631,200
Annual Interest Rate	0.073750
Project Life (years)	50
Construction Period (months)	24
Compound Interest Factor	25.77523
Capital Recovery Factor	0.0759135
Interest During Construction	$1,166,944
Non-Federal Levee Cost	$8,900,000
Investment Cost	$25,698,144
ANNUAL CHARGES	
Interest	$1,895,238
Amortization	$55,598
Operation/Maintenance ($/year)	$181,000
Replacements	$0
TOTAL ANNUAL CHARGES	$2,131,836
ANNUAL BENEFITS	
Inundation Reduction	$1,061,700
Existing Dallas Floodway	$1,450,200
TOTAL BENEFITS	$2,511,900
NET BENEFITS	$380,100
BENEFIT-COST RATIO	1.18

** The estimated first costs reflect actual expenditures for construction of the Rochester Park Levee from 1991 - 1993.*

In accordance with the policy guidance received, and based on Section 351 of WRDA 1996, the total project costs and benefits for all the plans investigated for the LPP were increased to account for the portions of the non-Federal levees deemed compatible for each alternative, as summarized below.

- **NED Plan:** The economic infeasibility of the Rochester Park Levee as a stand alone project preclude the inclusion of the costs and benefits of this levee in the NED Plan. Therefore, only the costs and benefits of the CWWTP Levee upgrade would be added. The cost of this levee upgrade was $14,220,000. Included in this amount was $190,000 in lands, easements, relocations, rights-of-way, and disposal area (LERRD) costs.

- **Chain of Wetlands Plan:** Should the Chain of Wetlands Plan be identified as the final Recommended Plan, the requirements of Section 351 of WRDA 1996 to include the non-Federal levees in the authorized project would allow the costs and benefits of both levees to be included in this alternative. The total cost of both levees was $26,958,000, of which $1,272,000 was defined as LERRD costs.

- **Chain of Wetlands Plus Levees Plan:** The compatible portions of non-Federal levees for this plan would include the entire CWWTP Levee and the portion of the Rochester Park Levee physically utilized in the Lamar Levee system. The estimated cost of the "compatible" portion of Rochester Park was $8,900,000, including $756,000 in LERRD costs. Total non-Federal levee costs added to this alternative would amount to $23,120,000, including $946,000 in LERRD costs.

Table 4-14 presents costs for each of these plans, at January 1997 price levels and level of development. The total cost of the NED Plan, as shown in the table, would be increased to $73.5 million. Should the Chain of Wetlands Plan be designated as the Recommended Plan, it would have an estimated cost of $95.2 million. The Chain of Wetlands Plus Levees Plan would have an estimated cost of $119.2 million. Flood control only costs are presented in the bottom portion of this table.

The residual average annual damages and benefits of each of these alternatives were calculated by reach, and are shown in table 4-15. Table 4-16 presents an economic analysis for each of these plans. It is noted that the estimated first costs shown in this table do not include environmental restoration costs. Outputs for these features are non-monetary and are not included in the benefit-cost ratio. Also, costs for the compatible non-Federal levees are shown separately from estimated first costs of currently proposed components of each plan.

Table 4-14
Costs of Locally Preferred Plan Alternatives
(January 1997 prices, 7.375% interest, 50-year period of analysis)

	PROJECT COSTS		
	NED Plan With CWWTP Levee	Chain of Wetlands With CWWTP and Rochester Park Levees	Chain of Wetlands Plus Levees With CWWTP and Compatible Rochester Park Levees
LERRD *(NON-FEDERAL LEVEES)*	$190,000	$1,272,000	$946,000
RELOC./UTIL. *- FLOOD CONTROL*	$5,321,426	$1,525,247	$3,260,902
- ENVIRONMENTAL RESTORATION		$169,472	$169,472
- RECREATION			
EXCAV./DISP. *- FLOOD CONTROL*	$18,303,092	$16,366,595	$23,949,640
- ENVIRONMENTAL RESTORATION		$8,812,782	$8,812,782
- RECREATION			
FILL - FLOOD CONTROL	$97,854	$72,825	$1,808,192
- ENVIRONMENTAL RESTORATION			
- RECREATION			
HTRW - FLOOD CONTROL	$0	$4,041,908	$4,041,908
- ENVIRONMENTAL RESTORATION			
- RECREATION			
OTHER CONST. *- NON-FEDERAL LEVEES*	$14,030,000	$25,686,000	$22,174,000
- FLOOD CONTROL	$3,897,441	$16,294,824	$19,759,933
- ENVIRONMENTAL RESTORATION			
- RECREATION	$8,272,400	$8,272,400	$8,272,400
MITIGATION (W/O LAND) *- FLOOD CONT.*	$2,940,163	$377,800	$626,487
- ENVIRONMENTAL RESTORATION			
- RECREATION			
REAL ESTATE *- FLOOD CONTROL*	$4,687,800	$2,464,384	$11,779,560
- ENVIRONMENTAL RESTORATION			
- MITIGATION (FLOOD CONT.)	$11,107,200	$3,104,200	$5,140,513
ENG'RING. & DESIGN *- FLOOD CONTROL*	$1,833,599	$2,320,752	$3,206,824
- ENVIRONMENTAL RESTORATION	$0	$538,935	$538,935
- RECREATION	$496,344	$496,344	$496,344
CONST. MGMT. *- FLOOD CONTROL*	$1,833,599	$2,320,752	$3,206,824
- ENVIRONMENTAL RESTORATION	$0	$538,935	$538,935
- RECREATION	$496,344	$496,344	$496,344
TOTAL PROJECT COSTS	**$73,507,261**	**$95,172,499**	**$119,225,995**
FLOOD CONTROL COSTS ONLY (WITHOUT LOCAL LEVEES)	$50,022,173	$48,889,287	$76,780,782
LOCAL LEVEE COSTS DEEMED "COMPATIBLE"	$14,220,000	$26,958,000	$23,120,000
TOTAL FLOOD CONTROL COSTS	$64,242,173	$75,847,287	$99,900,782

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Table 4-15
Annual Residual Damages and Benefits of LPP Alternatives
(January 1997 prices, 7.375% interest, 50-year period of analysis)

NED PLAN

Reach	Annual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$209,600	$38,986	$248,600	$100,300
2	$20,500	$3,813	$24,300	$35,900
3	$32,300	$6,008	$38,300	$89,200
4A	$524,500	$97,557	$622,100	$979,000
4B	$306,600	$57,028	$363,600	$515,300
5	$384,400	$71,498	$455,900	$831,700
6	$361,100	$34,666	$395,800	$1,463,300
Subtotal	$1,839,000	$309,555	$2,148,600	$4,014,700
7	$2,544,900	$473,351	$3,018,300	$8,906,600
8	$433,300	$80,594	$513,900	$670,300
Subtotal	$2,978,200	$553,945	$3,532,200	$9,576,900
Total	$4,817,200	$863,500	$5,680,800	$13,591,600

CHAIN OF WETLANDS PLAN

Reach	Annual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$269,700	$50,164	$319,900	$29,900
2	$29,800	$5,543	$35,300	$24,900
3	$47,400	$8,816	$56,200	$455,600
4A	$631,200	$117,403	$748,600	$852,500
4B	$420,300	$78,176	$498,500	$380,400
5	$459,200	$85,411	$544,600	$743,000
6	$538,400	$51,686	$590,100	$1,269,000
Subtotal	$2,396,000	$397,200	$2,793,200	$3,754,400
7	$4,449,800	$827,663	$5,277,500	$6,647,400
8	$602,700	$112,102	$714,800	$469,400
Subtotal	$5,052,500	$939,765	$5,992,300	$7,116,800
Total	$7,448,500	$1,336,965	$8,785,500	$10,871,200

CHAIN OF WETLANDS PLUS LEVEES PLAN

Reach	Annual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$269,700	$50,164	$319,900	$29,000
2	$29,800	$5,543	$35,300	$24,900
3	$16,600	$3,088	$19,700	$492,100
4A	$18,400	$3,422	$21,800	$1,579,300
4B	$132,200	$24,589	$156,800	$722,100
5	$13,800	$2,567	$16,400	$1,271,200
6	$688,900	$66,134	$755,000	$1,104,100
Subtotal	$1,169,400	$155,507	$1,324,900	$5,222,700
7	$4,737,000	$881,082	$5,618,082	$6,306,818
8	$873,900	$162,545	$1,036,445	$147,755
Subtotal	$5,610,900	$1,043,627	$6,654,527	$6,454,573
Total	$6,780,300	$1,199,135	$7,979,427	$11,677,273

Table 4-16
Economic Analysis of LPP Alternatives
(January 1997 prices, 7.375% interest, 50-year period of analysis)

	NED Plan		Chain of Wetlands Plan		Chain of Wetlands Plus Levees Plan	
	Flood Control Only	With Recreation	Flood Control Only	With Recreation	Flood Control Only	With Recreation
INVESTMENT						
Estimated First Cost	$50,022,173	$59,287,261	$48,889,287	$58,154,374	$76,780,782	$86,045,870
Annual Interest Rate	0.0738	0.0738	0.0738	0.0738	0.0738	0.0738
Project Life (years)	50	50	50	50	50	50
Construction Period (months)	24	24	24	24	36	36
Compound Interest Factor	25.77523	25.77523	25.77523	25.77523	40.15579	40.15579
Capital Recovery Factor	0.0759	0.0759	0.0759	0.0759	0.0759	0.0759
Interest During Construction	$3,734,394	$4,426,078	$3,649,819	$4,341,502	$8,810,783	$9,873,974
Cost of non-Federal Levees	$14,220,000	$14,220,000	$26,958,000	$26,958,000	$23,120,000	$23,120,000
Investment Cost	$67,976,567	$77,933,339	$79,497,106	$89,453,876	$108,711,565	$119,039,844
ANNUAL CHARGES						
Interest	$5,013,272	$5,747,584	$5,862,912	$6,597,223	$8,017,478	$8,779,189
Amortization	$147,067	$168,609	$171,992	$193,533	$235,197	$257,543
Operation/Maintenance ($/year)	$375,000	$375,000	$175,000	$175,000	$495,000	$495,000
Replacements	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$5,535,339	$6,291,193	$6,209,904	$6,965,757	$8,747,675	$9,531,731
ANNUAL BENEFITS						
Inundation Reduction	$4,014,700	$4,014,700	$3,754,400	$3,754,400	$5,222,700	$5,222,700
Existing Dallas Floodway	$9,576,900	$9,576,900	$7,116,800	$7,116,800	$6,454,573	$6,454,573
Recreation	$0	$1,000,000	$0	$1,000,000	$0	$1,000,000
TOTAL ANNUAL BENEFITS	$13,591,600	$14,591,600	$10,871,200	$11,871,200	$11,677,273	$12,677,273
NET ANNUAL BENEFITS	$8,056,261	$8,300,407	$4,661,296	$4,905,443	$2,929,598	$3,145,542
BENEFIT-COST RATIO	2.46	2.32	1.75	1.70	1.33	1.33
ENVIRONMENTAL RESTORATION	$0	$0	$0	$10,060,125	$0	$10,060,125
TOTAL PROJECT COSTS	$64,242,173	$73,507,261	$75,847,287	$95,172,499	$99,900,782	$119,225,995
No. of Structures No Longer at Risk from 100-yr Flood Event	**403**		**511**		**719**	
No. of Structures No Longer at Risk from SPF Event	**580**		**241**		**688**	

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To further aid the local sponsor in the LPP selection process, estimated cost apportionment calculations were performed showing approximate Federal/non-Federal cost sharing responsibilities for each plan. These calculations were performed assuming that the cost sharing provisions of WRDA 1986 would be applicable to flood control and recreation costs, while WRDA 1996 cost sharing requirements would be appropriate for environmental restoration features, due to the need for a Congressionally authorized amendment to the original 1965 authorization adding environmental restoration as a project purpose. The non-Federal share of project costs for each of these purposes would be as follows:

- Flood Control: 25 - 50%
- Environmental Restoration: 35%
- Recreation: 50%

Furthermore, Federal cost sharing for recreation features would be limited to 10% of the Federal share of flood control costs.

In order to calculate cost apportionments, the methodology for determining the appropriate amount of credit for "compatible" non-Federal construction was established. The amount of credit applied toward the non-Federal share of project costs for the advanced construction of the Rochester Park and CWWTP Levees would vary for different plans and would not necessarily be equal to the cost added to the plan for these levees. This credit was calculated in the following manner:

- The costs for the compatible portions of these levees applicable to each plan, as previously identified, were added as a flood control project cost.
- Federal and non-Federal project costs were then calculated *as if these levees were being constructed during implementation of the currently proposed project.*
- The required 5% cash contribution was calculated and Federal/non-Federal costs were revised accordingly.
- The non-Federal share was assessed in regard to compliance with the applicable cost sharing percentages, as described above, and Federal/non-Federal apportionments were again revised, as necessary.
- The amount of credit applied toward the non-Federal share of project costs for each plan was calculated as the non-Federal share (as derived above) minus the required 5% cash contribution, with a maximum credit equal to the total cost of the "compatible" non-Federal levees added to that particular plan.

A summary of these calculations is presented in table 4-17.

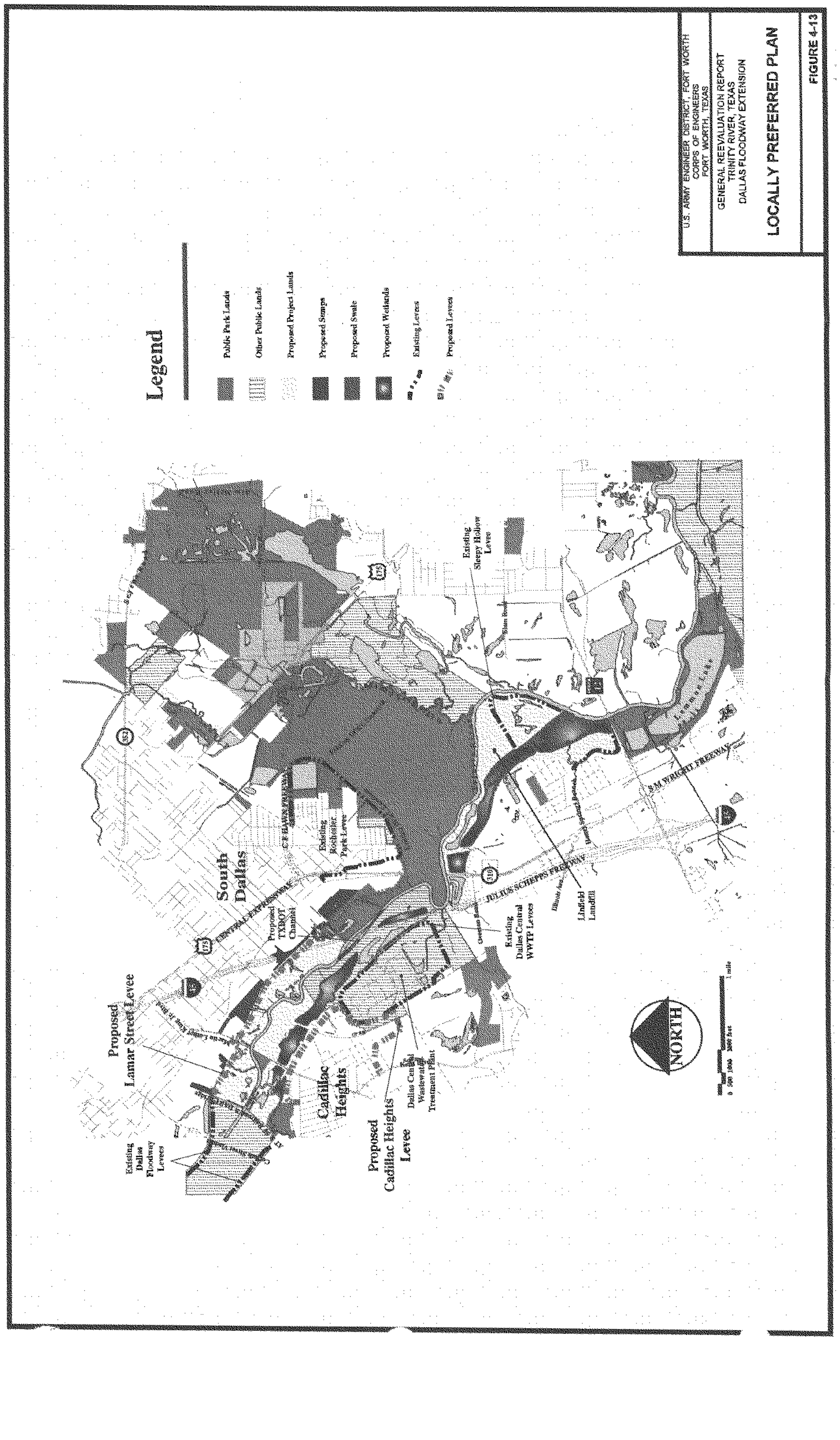
Summary

Based on these analyses, and because the Chain of Wetlands Plus Levees Plan satisfactorily met the city's desire for a multiple objective project providing flood protection to the study area comparable to that provided upstream by the existing Dallas Floodway, this plan was formally adopted by the Dallas City Council as the final LPP on March 26, 1997. Figure 4-13 presents a general layout of the features of this plan.

Table 4-17
Cost Apportionment Data For LPP Alternatives
(January 1997 prices)

Investigated Alternative	Federal Share	Non-Federal Share
NED Plan		
Total Project Cost	$73,507,261	
Share Prior to Levee Credit	$44,356,182	$29,151,079
Percent of Total Project Cost	60.3%	39.7%
Amount of Levee Credit	$14,030,000	($14,030,000)
Remaining Share of Project Cost	$58,386,182	$14,741,079
Uncredited Compatible * Non-Federal Construction	$0	
Chain of Wetlands Plan		
Total Project Cost	$95,172,499	
Share Prior to Levee Credit	$68,057,090	$27,115,410
Percent of Total Project Cost	71.5%	28.5%
Amount of Levee Credit	$15,169,457	($15,169,457)
Remaining Share of Project Cost	$83,226,547	$11,945,952
Uncredited Compatible * Non-Federal Construction	$11,788,543	
Chain of Wetlands Plus Levees Plan		
Total Project Cost	$119,225,995	
Share Prior to Levee Credit	$84,950,393	$34,275,602
Percent of Total Project Cost	71.3%	28.7%
Amount of Levee Credit	$21,126,975	($21,126,975)
Remaining Share of Project Cost	$106,077,368	$13,148,627
Uncredited Compatible * Non-Federal Construction	$1,993,025	

** "Compatible" costs of non-Federal Levees vary with each plan, as defined on pages 4-51 and 4-52 of this document.*



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
LOCALLY PREFERRED PLAN
FIGURE 4-13
Legend
Public Park Lands
Other Public Lands
Proposed Project Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Proposed Lamar Street Levee
Existing Dallas Floodway Levees
Cadillac Heights
Proposed Cadillac Heights Levee
Dallas Central Wastewater Treatment Plant
South Dallas
Proposed TXDOT Channel
Existing Rochester Park Levee
Existing Dallas Central WWTF Levees
Lindfield Landfill
Existing Sleepy Hollow Levee
JULIUS SCHEPPS FREEWAY
S M WRIGHT FREEWAY
CENTRAL EXPRESSWAY
NORTH

FORMULATION OF THE RECOMMENDED PLAN

This section presents the identification of the Tentative Federally Supportable Plan (TFSP), and the final array of alternatives investigated for designation of the Recommended Plan.

Also presented herein are details of a proposal by the Texas Department of Transportation (TxDOT) to include a realignment of a section of the river channel at the IH-45 bridge.

IDENTIFICATION OF THE TENTATIVE FEDERALLY SUPPORTABLE PLAN

The Federally Supportable Plan (FSP) can be defined as the plan which sets the maximum limit for Federal participation in the implementation of a project. Due to maximization of net benefits, the NED Plan is normally denoted as the FSP. However, designation of a plan (larger or smaller) other than the NED Plan is permitted if there are overriding or compelling reasons favoring selection of such a plan. A recommended project which is smaller (less costly) than the NED Plan would, with appropriate approval, be designated as the FSP, thereby establishing lower Federal participation constraints. Should the local sponsor prefer a plan which is more costly than the NED Plan, an exception to the NED requirements may be granted by the Assistant Secretary of the Army for Civil Works (ASA(CW)), should the increased development warrant full Federal participation. Such an exception would be cost shared the same as the NED Plan and would become the Federally Supportable Plan. This section provides comparative data between the final array of alternatives investigated, prior to any decisions by the ASA(CW) regarding an exception, and presents rationale for designation of a plan other than the NED as the Tentative Federally Supportable Plan (TFSP). The final Federally Supportable Plan (FSP) will be designated following the decision of the ASA(CW).

Due to the significant adverse environmental impacts associated with implementation of the NED Plan, an incremental analysis of the separable flood control elements of the LPP was performed to determine whether a Tentative Federally Supportable Plan could be established which would complement the LPP. These separable elements include the swale (with incorporated chain of wetlands), the SPF Lamar Levee, and the SPF Cadillac Heights Levee. In accordance with Section 351 of WRDA 1996, the costs and benefits of the CWWTP Levee and the "compatible" portion of the Rochester Park Levee are included in this analysis, shown in table 4-18. Note that the benefits for the chain of wetlands *increment* of the LPP are different than the benefits for the Chain of Wetlands Plan presented in table 4-16. The reason for this difference is that the Chain of Wetlands Plan would include the costs and benefits of the CWWTP Levee upgrade and the *entire* costs and benefits for the Rochester Park Levee. However, the LPP would only include the costs and benefits for the CWWTP Levee upgrade and the *portion* of the Rochester Park Levee which would be compatible with the LPP. Since the Rochester Park Levee would be an integral part of the Lamar Levee system, the costs and benefits of its "compatible" portion were included in the Lamar Levee increment, while the CWWTP Levee was included in the chain of wetlands increment.

Given the three separable flood control features, it was assumed that the chain of wetlands swale must be the first added element. It would achieve benefits from all reaches, the net benefits would be far greater than the other elements, and it is the only feature which would not adversely impact adjoining areas due to increased water surfaces for given storms. The chain of wetlands swale and CWWTP Levee, when analyzed as an increment of the LPP, would have a flood control first cost of $63.1 million ($48.9 million for the chain of wetlands and $14.2 million for the CWWTP Levee), a BCR of 2.05, and net annual flood control benefits of $5.4 million. Comparatively, the NED Plan would have estimated flood control costs of $64.2 million ($50.0 million for the 1,200-foot swale and $14.2 million for the CWWTP Levee), net annual flood control benefits of approximately $8.1 million, and a BCR of 2.46. From an environmental standpoint, the NED Plan was estimated to directly impact over 725 acres of environmental resources, including 504 acres of mature bottomland hardwoods, and would require the purchase of 3,200 acres of mitigation land. The chain of wetlands portion of the LPP was preliminarily estimated to directly impact only 287 acres of lower quality terrestrial, including 114 acres of bottomland hardwoods, requiring only 635 acres of mitigation.

As shown, the Chain of Wetlands Plan would yield fewer net benefits than the NED Plan, but would have a lower estimated first cost. Based on these findings, and on the expected difficulty in implementing the NED Plan from a public acceptability standpoint, general consent, by ASA(CW) and HQUSACE representatives, for designation of the chain of wetlands as the first increment of the Tentative Federally

Supportable Plan, in lieu of the NED Plan, was given during the Alternative Formulation Briefing, held June 19, 1997. Furthermore, policy guidance allows for the addition of incrementally justified elements of the LPP to the Tentative Federally Supportable Plan, with full cost sharing provisions. The levees were analyzed as separate increments for possible inclusion in the Tentative Federally Supportable Plan.

The SPF Cadillac Heights Levee was analyzed as the second added element by combining it with the swale. Results showed this increment would have a negative contribution, with a BCR of 0.81.

The SPF Lamar Levee system, however, fared much better as a second added element, with an incremental BCR of 1.36. Combined with the swale, net annual benefits of $6.1 million would be achieved. This levee was, therefore, incorporated into the Tentative Federally Supportable Plan.

Finally, both levees were evaluated as a system to determine overall economic efficiency. As a total system, the LPP would have net annual flood control benefits of $2.9 million, with a BCR of 1.33.

Due to the incremental infeasibility of the SPF Cadillac Heights levee, further analysis was performed to determine whether or not a 100-year levee could be economically justified. This analysis, shown in table 4-19, revealed that a 100-year levee would be incrementally justified, and can be added to the Tentative Federally Supportable Plan.

Summary

The identified Tentative Federally Supportable Plan, as shown in figure 4-14, would consist of the following elements:

- **Chain of Wetlands:** The chain of wetlands increment would consist of upper and lower swales, separated at Interstate Highway (IH) 45. The upper swale would have an average 400-foot bottom width and would extend from Cedar Creek to the oxbow lake at IH-45, a distance of about 1.5 miles. The lower swale would have an average 600-foot bottom width, would extend between IH-45 and Loop 12, a distance of about 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course to minimize impacts to forested areas and nearby residential areas. Excavated wetlands and vegetative plantings would be added as environmental restoration features within the footprint of the swales to form a "chain of wetlands."

- **SPF Lamar Levee:** This increment would include construction of an earthen levee providing SPF protection (.00125 probability of exceedance) for the Lamar Street area and. This levee would extend from the existing Dallas Floodway East levee to the previously constructed Rochester Park Levee, a distance of 2.9 miles.

- **100-Year Cadillac Heights Levee:** This increment would include a levee / floodwall system providing 100-year protection (.01 probability of exceedance) for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), a distance of 1.1 miles.

- **Non-Federal Levees:** In addition to the levees described above, the Tentative Federally Supportable Plan would also include the costs and benefits of the portions of the previously constructed non-Federal levees. The total cost for the compatible portions of these levees was estimated at $23.1 million ($14.2 million for the CWWTP Levee upgrade and $8.9 million for the compatible portion of the Rochester Park Levee).

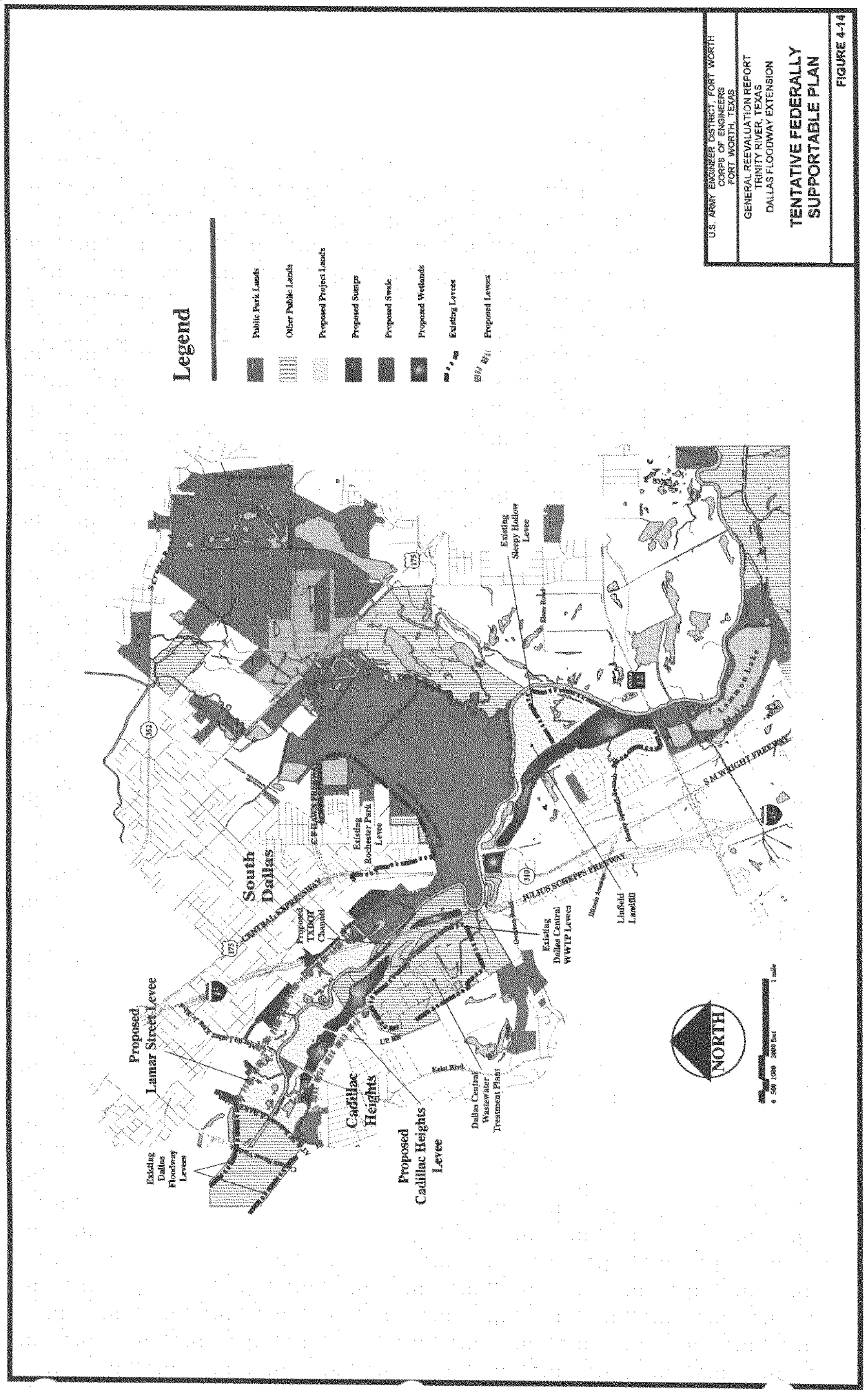
- **Recreation Features:** The Tentative Federally Supportable Plan would include recreation amenities compatible with the regional recreation master plan, including hike/bike trails, equestrian trails, canoe launches and pavilions.

Table 4-18
Incremental Analysis of the LPP - Flood Control Only
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Description	Chain of Wetlands	Chain of Wetlands Plus SPF Cadillac Heights	SPF Cadillac Heights Incremental	Chain of Wetlands Plus SPF Lamar	SPF Lamar Incremental	Chain of Wetlands Both SPF Levees
INVESTMENT						
Estimated First Cost	$48,889,287	$61,149,587	$12,260,300	$64,520,487	$15,631,200	$76,780,782
Annual Interest Rate	0.073750	0.07375	0.07375	0.073750	0.073750	0.073750
Project Life (years)	50	50	50	50	50	50
Construction Period (months)	24	24	24	24	24	36
Compound Interest Factor	25.77523	25.77523	25.77523	25.77523	25.77523	40.15579
Capital Recovery Factor	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135
Interest During Construction	$3,649,819	$4,565,109	$915,290	$4,816,763	$1,166,944	$8,810,783
Cost of Non-Federal Levees	$14,220,000	$14,220,000	$0	$23,120,000	$8,900,000	$23,120,000
Investment Cost	$66,759,106	$79,934,696	$13,175,583	$92,457,250	$25,698,144	$108,711,565
ANNUAL CHARGES						
Interest	$4,923,484	$5,895,184	$971,700	$6,818,722	$1,895,238	$8,017,478
Amortization	$144,433	$172,939	$28,505	$200,031	$55,598	$235,197
O&M ($/year)	$50,000	$189,000	$139,000	$231,000	$181,000	$495,000
Replacements	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$5,117,917	$6,257,123	$1,139,204	$7,249,753	$2,131,836	$8,747,675
ANNUAL BENEFITS						
Inundation Reduction	$3,370,100	$4,289,800	$919,700	$4,816,100	$1,443,000	$5,222,700
Existing Dallas Floodway	$7,116,800	$7,116,800	$0	$8,567,000	$1,450,200	$6,454,578
TOTAL ANNUAL BENEFITS	$10,486,900	$11,406,600	$919,700	$13,383,100	$2,893,200	$11,677,273
NET ANNUAL BENEFITS	$5,368,983	$5,149,477	($219,504)	$6,133,347	$761,364	$2,929,598
BENEFIT - COST RATIO	2.05	1.82	0.81	1.85	1.36	1.33

Table 4-19
Incremental Analysis of the
100-Year Cadillac Heights Levee - Flood Control Only
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Description	Chain of Wetlands Plus SPF Lamar	Chain of Wetlands, SPF Lamar and 100-Year Cadillac Heights Levees	100-Year Cadillac Heights Incremental
INVESTMENT			
Estimated First Cost	$64,520,487	$67,224,987	$2,704,500
Annual Interest Rate	0.073750	0.073750	0.073750
Project Life (years)	50	50	50
Construction Period (months)	24	24	24
Compound Interest Factor	25.77523	25.77523	25.77523
Capital Recovery Factor	0.0759135	0.0759135	0.0759135
Interest During Construction	$4,816,763	$5,018,668	$201,904
Cost of Current Levees	$23,120,000	$23,120,000	$0
Investment Cost	$92,457,250	$95,363,654	$2,906,404
ANNUAL CHARGES			
Interest	$6,818,722	$7,033,069	$214,347
Amortization	$200,031	$206,319	$6,288
O&M ($/year)	$231,000	$370,000	$139,000
Replacements	$0	$0	$0
TOTAL ANNUAL CHARGES	$7,249,753	$7,609,389	$359,635
ANNUAL BENEFITS			
Inundation Reduction	$4,816,100	$5,272,300	$456,200
Existing Dallas Floodway	$8,567,000	$8,567,000	$0
TOTAL BENEFITS	$13,383,100	$13,839,300	$456,200
NET ANNUAL BENEFITS	$6,133,347	$6,229,911	$96,565
BENEFIT - COST RATIO	1.85	1.82	1.27



Legend
Public Park Lands
Other Public Lands
Proposed Project Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
TENTATIVE FEDERALLY SUPPORTABLE PLAN
FIGURE 4-14
Proposed Lamar Street Levee
South Dallas
Cadillac Heights
Proposed Cadillac Heights Levee
Existing Dallas Floodway Levee
Dallas Central Wastewater Treatment Plant
Existing Dallas Central WWTP Levees
Proposed TXDOT Channels
Existing Rochester Park Levee
Existing Sleepy Hollow Levee
Linfield Landfill
CENTRAL EXPRESSWAY
JULIUS SCHEPPS FREEWAY
S.M. WRIGHT FREEWAY
NORTH

The flood control first cost of the Tentative Federally Supportable Plan would be $67.2 million, plus $23.1 million for the non-Federal levees, for a total of $90.3 million. Total annual flood control benefits would equal $13.8 million, net annual flood control benefits would be $6.2 million, and the BCR would be 1.82.

CHANNEL REALIGNMENT PROPOSAL AT IH-45 BRIDGE

During the Environmental Impact Statement (EIS) scoping process, the Texas Department of Transportation (TxDOT) submitted a proposal to realign the Trinity River at IH-45 as a part of the Dallas Floodway Extension project. TxDOT provided documentation that the bridge at IH-45 was constructed in 1972 to complement the authorized navigation channel of the Dallas Floodway Extension portion of the Trinity River Project. The bridge, which consists of 23 spans, varying in length from 78 feet to 480 feet, was constructed such that the longer spans would be located over the proposed navigation channel. The navigation channel, however, was never built. Currently, three of the shorter 78-foot spans span the existing Trinity River. In the years following construction, the constricted flows through the existing 78-foot spans have resulted in blockage and subsequent damage to the existing piers, due to debris accumulations. This proposal cited a 1984 flood event in which massive accumulations of driftwood precipitated a fracture in one of the bridge columns supporting the section spanning the river. The narrow bridge span at this crossing was deemed the cause of the debris blockage.

IH-45 has been designated as a major transportation corridor for national defense, and TxDOT has considered replacement of the bridge spans over the existing channel as a solution to the on-going maintenance costs and to provide long-term integrity of the structure. Alternatively, TxDOT has proposed a plan to relocate the existing river channel to pass normal river flow beneath the existing 320-foot bridge span that is located nearest the river channel. A plan to relocate a portion of the existing river channel has been designed to accomplish these goals at a significantly lower cost than replacement of the short bridge spans. The plan calls for realignment of about 3,300 feet of existing river channel. The proposed channel would have a trapezoidal cross section with a 30-foot bottom width, 3H:1V side slopes, and a top width of approximately 180 feet. The existing river channel in the reach where the realignment is proposed has an average bottom slope that is nearly zero. Therefore, the proposed channel realignment section has been designed with a zero bottom slope from beginning to end. The proposed channel has an average depth of 15 feet and has been designed to closely approximate the channel flow capacity and the flow velocities of the existing river channel. The proposed channel alignment would be centered between the nearest 320-foot span of the IH-45 bridge which has a face-to-face clearance distance between the piers of about 200 feet normal to the flow. Excavation around the piers would not be required. The proposed realignment will result in the channel being moved laterally a maximum distance of about 350 feet. The existing channel would be filled to the existing top of bank elevation 396.0 to prevent further collection of debris. Relocation of the channel would result in modifications to the existing Central Mitigation Swale, which would be reduced in size by filling of the portion of the swale near the proposed channel realignment. A minimum of 150 feet from the top of bank of the proposed river channel realignment to the top of the bank of the Central Mitigation Swale would be required.

Several alternatives regarding filling of the old river channel have been investigated. The investigated alternatives accomplish the primary goals of the IH-45 bridge channel realignment project to some degree, but the proposed plan for the channel realignment accomplishes these goals with a minimal risk to the bridge structure and a minimal filling of the old channel. The primary objective of the project is to reduce the risk of damage to the bridge piers from floating debris and reduce or eliminate the cost of continual maintenance to remove the debris and periodically repair the structure. The proposed plan to fill the old channel is to fill from the upstream diversion of the river channel to the downstream side of the bridge. The fill will be placed up to the level of the existing overbank areas at the approximate elevation of 396.0 and will be placed around the existing bridge piers located within the old channel. This is the only partial channel fill plan that will ensure complete diversion of channel confined flows and minimize the risk to the existing bridge piers. The channel fill will terminate at the downstream end with a very gradual slope of the fill to the streambed of the old channel just downstream of the bridge piers. A portion of the old channel downstream of the IH-45 bridge is to remain unfilled as existing. This unfilled portion of the old channel will provide a slack water area for use as a possible river access point and may provide some habitat diversity near the river. However, slack water areas such as this have a tendency to collect trash and debris both from flood events and from the ease of public access. Therefore, additional maintenance to remove trash may be required for the unfilled portion of the old river channel. The filled portion of the old river channel will maximize the diversion of channel confined river flows to the new channel alignment, stabilize the bridge piers in the old channel, and minimize the risk of floating debris collecting on the bridge piers. The Texas Department of Transportation (TXDOT) maintains an access road directly beneath the IH-45 bridge which provides access to the river channel from either side of the river. Filling of the old river channel beneath the bridge as proposed will provide continued access to the river channel within the TXDOT right-of-way for inspection and maintenance. A plan view of the proposed relocation of the Trinity River channel at IH-45 may be found in Appendix C.

TxDOT's proposal included relocation of a section of the existing Trinity River to an adjacent span, beneath a 1,120-foot plate girder unit structure that was originally designed and constructed to span the river. This continuous plate girder unit, which consists of two 320-foot end spans and a 480-foot center span, has considerably stronger columns and drill shafts designed specifically for lateral forces, in anticipation of possible boat or debris impacts.

Alternatives for IH-45 Proposal

Three alternatives were investigated to determine the economic feasibility of a solution to the problem. The alternatives included the following:

- No Action
- Column/Pier Armoring
- River Realignment

In the absence of a project to reroute the Trinity River, the "No Action" alternative, TxDOT indicated that the 78-foot bridge spans spanning the river, in its existing location, would be replaced by a single 320-foot span, which would span the existing river in its entirety. This work effort would be accomplished at a future data, either in a planned replacement scenario, or as a reaction to a catastrophic or partial failure of the bridge during a flood event. This larger span would reduce the risk of loss of life due to bridge failure, prevent extensive and expensive repairs due to partial failure of the bridge in a flood event, reduce routine maintenance costs associated with removal of accumulated debris around the bridge columns, and reduce the possibility of significant costs associated with rerouting of traffic and loss of potential wages due to delays should this major thoroughfare between Dallas and Houston catastrophically fail. The first cost of this reconstruction was estimated to be $12.5 million, with an annualized cost of $1.1 million.

The second alternative would involve armoring the six sets of columns in the existing Trinity River with concrete to protect them against impacts similar to those which caused the 1984 column failure. The first cost of this alternative was estimated to be $4.9 million, with an annualized cost of $0.5 million. However, an element of risk exists with this alternative. It would still be possible to have a large flood event carrying sufficient debris to cause the bridge to fail.

The third alternative investigated would involve rerouting a portion of the existing Trinity River to a new site beneath the adjacent 1,120-foot plate girder structure. This location would follow the original authorized navigation channel project location and would provide the needed cross-sectional area under the bridge to avert potential damage from high debris flows. This alternative was estimated to have a first cost of $1.9 million, and an annualized cost of $0.2 million.

Economic Analysis of IH-45 Proposal

An economic analysis of this proposal was performed, using the "No Action Plan" as the basis for project benefits. This analysis assumes that in time, with no changes in annual maintenance of the existing bridge, the bridge would fail or be damaged to such an extent as to require complete replacement. The results of this analysis are presented in table 4-20. As shown, the alternative which involved armored protection of the existing columns was economically feasible, with net benefits of $0.6 million, and a BCR of 2.30. The alternative providing maximum net benefits, however, was determined to be the rerouting of the river to an adjacent span. This alternative yielded $0.9 million in net benefits, with a BCR of 6.69. The general layout of this plan is shown in Appendix C.

Table 4-20
Economic Analysis of IH-45 Proposal
(January 1997 prices, 7.375%, 50-year period of analysis)

Project Alternatives Include	No-Action Plan	Column/Pier Armoring	River Realignment
INVESTMENT			
Estimated First Cost	$12,449,000	$4,874,000	$1,935,000
Annual Interest Rate	0.0738	0.0738	0.0738
Project Life (years)	30	30	50
Construction Period (months)	6	6	6
Compound Interest Factor	6.09295	6.09295	6.09295
Capital Recovery Factor	0.0836	0.0836	0.0759
Interest During Construction	$224,093	$87,738	$34,831
Investment Cost	$12,673,225	$4,961,870	$1,969,831
ANNUAL COSTS			
Interest	$934,650	$365,938	$145,275
Amortization	$125,379	$49,089	$4,262
Operation/Maintenance	$10,000	$50,000	$10,000
Replacements	$0	$0	$0
Total Annual Costs	$1,070,000	$465,000	$160,000
Annual Cost Reduction	$1,070,000	$1,070,000	$1,070,000
Total Annual Benefits	$1,070,000	$1,070,000	$1,070,000
Net Benefits	$0	$605,000	$910,000
Benefit-Cost Ratio	1.00	2.30	6.69

Summary of IH-45 Proposal

The investigations performed to evaluate the feasibility of rerouting the Trinity River at the IH-45 bridge indicate that such a proposal is warranted. As indicated on page A-25, Appendix A, the proposed realigned channel has been designed to closely approximate the channel flow capacity and flow velocities of the existing channel. The new channel length would also be almost identical to the existing length. Reestablishment of streambank riparian vegetation would also be accomplished. With these factors considered, the proposal would have no hydraulic effect on the project, either upstream or downstream, and no inundation reduction benefits have been included for this proposal. Due to the independent nature of this work effort, from a flood damage reduction standpoint, this proposal can be implemented in conjunction with any of the plans included in the final array of alternatives. Therefore, the costs and benefits of this proposal are not included in the economic comparisons of these alternatives, but will be added to the final Recommended Plan.

FINAL ARRAY OF ALTERNATIVES

In accordance with Section 102 (2) of the National Environmental Policy Act (NEPA) of 1969, as amended, a final alternative incorporating non-structural measures was evaluated and included in the final array of alternatives, which includes the following:

- No Action Plan
- NED Plan
- Combination Non-Structural / Structural Plan
- Tentative Federally Supportable Plan
- Locally Preferred Plan

In addition, for comparison purposes, the 1965 Authorized Plan was analyzed to ascertain the economic viability of this plan under current conditions. All plans in the final array are compared against the No Action Plan.

Combination Non-Structural / Structural Plan

The combination non-structural / structural plan investigated for the final array of alternatives would involve the acquisition and removal of homes in the Cadillac Heights area (Reach 5), in lieu of the construction of a Cadillac Heights Levee, as the last-added increment of an overall plan also including the construction of the chain of wetlands and the SPF Lamar Levee. This buyout was analyzed for the 2-, 5-, 10-, 25-, 50-, and 100-year flood zones. The economic analysis of this non-structural increment of the overall combination structural / non-structural plan is shown in table 4-21. For comparative analysis, also included in this table are the incremental costs and benefits of constructing a last-added 100-year levee in the Cadillac Heights area.

The table reveals that the greatest incremental net benefits of a non-structural plan in the Cadillac Heights area would occur for a buyout of the 10-year flood zone. This alternative would have an estimated first cost of $2.5 million, would produce incremental benefits of $179,700, and would include the acquisition of seven structures. Comparatively, the 100-year Cadillac Heights Levee would have an estimated first cost of $2.7 million, would produce incremental net benefits of $96,600, and would protect 158 structures. From the perspective of desiring to remove people and property from the risk of flood damage, the levee alternative would be much more cost effective.

Table 4-21
Economic Analysis of Non-Structural Increment in Final Array of Alternatives
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Flood Zone	Chain of Wetlands Plus Lamar Levee Plus Buyout of Cadillac Heights Area (Buyout Increment Only)	Chain of Wetlands Plus Lamar Levee Plus 100-Yr. Cadillac Heights Levee (Levee Increment Only)
0 - 2 Year Zone		
No. of Structures	0	0
0 - 5 Year Zone		
No. of Structures	3	0
Total Costs	$1,176,000	$0
Annual Costs	$79,100	$0
Annual Benefits	$194,100	$0
Net Benefits	$115,000	$0
BCR	2.5	N/A
0 - 10 Year Zone		
No. of Structures	7	0
Total Costs	$2,463,100	$0
Annual Costs	$165,300	$0
Annual Benefits	$345,000	$0
Net Benefits	$179,700	$0
BCR	2.1	N/A
0 - 25 Year Zone		
No. of Structures	24	0
Total Costs	$5,052,700	$0
Annual Costs	$334,900	$0
Annual Benefits	$365,900	$0
Net Benefits	$31,000	$0
BCR	1.1	N/A
0 - 50 Year Zone		
No. of Structures	126	0
Total Costs	$12,851,600	$0
Annual Costs	$823,600	$0
Annual Benefits	$401,100	$0
Net Benefits	($422,500)	$0
BCR	0.5	N/A
0 - 100 Year Zone		
No. of Structures	160	158
Total Costs	$19,388,000	$2,704,500
Annual Costs	$1,311,200	$456,200
Annual Benefits	$404,900	$522,800
Net Benefits	($906,300)	$96,600
BCR	0.3	1.3

ENVIRONMENTAL IMPACTS OF ALTERNATIVES

Overview

Table 4-22 shows the current status of studies in relation to requirements for environmental policy compliance. The report is in compliance for most of these requirements for this phase of the study process.

The most positive impacts that would result from the decision to develop a flood damage reduction project with restoration of emergent/deepwater wetlands would be that the flooding that threatens lives, damages residential and business properties and causes general disruptions to traffic and economic vitality of the area would not continue to occur. The economic benefits of the project would extend well beyond the area of proposed construction to include the downtown Central Business District (CBD). The environmental restoration aspect of the chain of wetlands would develop emergent wetlands that would be managed to provide important feeding and winter cover for migratory waterfowl, shorebirds and wading birds, in addition to supporting neotropical songbirds. Negative impacts resulting from development of either the combination non-structural / structural plan, the TFSP or the LPP include the loss of bottomland hardwood forest values, including fish and wildlife habitat and potential loss of archeological resources.

Four environmental and cultural resource items were identified by state, local and federal agencies and the public during the EIS scoping process as important in the overall decision-making process. These resources include emergent wetlands, aquatic resources, forested areas and cultural/historic resources. The comparative impacts of the investigated alternatives to these key resources are discussed below and shown comparatively in table 4-23. During review of the Draft EIS, a number of other concerns were identified which required additional analysis and discussion. Among those concerns were land use impacts, visual and aesthetic impacts, and impacts on utilities. Discussion of the proposed project impacts on these and other resources is contained in the following sections.

Emergent Wetlands

Emergent wetlands in the study area are currently lacking. Some areas of permanent and semi-permanent water exist, primarily resulting from past excavations. However, these areas do not provide appropriate conditions for development of emergent wetland vegetation. An area adjacent to IH-45, between IH-45 and Highway 310 on the south side of the river, has been excavated to provide mitigation for impacts associated with a previous Section 404 permitted activity associated with the Central Wastewater Treatment Plant. Emergent and wetland vegetation occasionally dominate approximately 11.25 acres of this excavation. This area would not be impacted by any of the proposed project alternatives. The only alternative feature considered that could be constructed as a single component that provides an impact to emergent wetlands is the chain of wetlands. The combination non-structural / structural plan, the TFSP, or the LPP alternative, with the environmental restoration features included, would provide an additional 123 acres of emergent wetland that would be managed by providing a dependable water source and appropriate water elevation control structures. None of the alternatives (the NED Plan, the TFSP, the LPP, or the combination non-structural / structural plan) would result in a negative impact to emergent wetlands.

Aquatic Resources

It is envisioned that only minor changes in the aquatic resources would occur without the project, as sedimentation fills excavated ponding areas during the 50-year period of analysis. The NED Plan would cause the largest negative impact to aquatic resources by removing 16 acres of aquatic area. The chain of wetlands would provide a positive impact by adding eight acres of permanent water area as a part of the environmental restoration plan. The Lamar Levee would impact five acres of ponded water and the Cadillac Levee would impact an additional one acre. The proposed realignment of the Trinity under the IH-45 bridge would result in the loss of approximately eight acres of existing river channel. As part of the combination non-structural / structural plan, the TFSP, or the LPP, this area would be restored within the diversion channel, resulting in no net loss of channel area. The impact from construction activities to the aquatic environment of the channel would be temporary. Additional information related to the temporary nature of these impacts is addressed in the Section 404(b)(1) guidelines analysis in Appendix F, and in the following sections.

Table 4-22
Extent of Plan Compliance with Environmental Requirements

Federal Policies	NED Plan	TESP / LPP (By Increment)			Non-Structural / Structural Plan	IH-45 Diversion
		Chain of Wetlands	Lamar Levee	Cadillac Levee		
Fish and Wildlife Coordination Act	All plans in full compliance					
Endangered Species Act	All plans in full compliance					
National Historic Preservation Act of 1966	All plans in full compliance					
Archaeological and Historic Preservation Act	All plans in full compliance					
Wild and Scenic Rivers Act	Not applicable					
National Environmental Policy Act	Full compliance					
Clean Water Act	All plans in full compliance					
Clean Air Act	All plans in full compliance					
Coastal Zone Management Act	Not applicable					
Coastal Barrier Resources Act	Not applicable					
Floodplain Management (E.O. 11988)	All plans in full compliance					
Protection of Wetlands (E.O. 11990)	All plans in full compliance					
Farmland Protection Policy Act/EPA Policy to protect environmentally significant agricultural lands	No prime or environmentally significant agricultural lands in study area					
Wilderness Act	Not applicable					
Sections 9 and 10 of Rivers and Harbors Act	All plans in full compliance. Only temporary navigation obstructions would occur.					
Land and Water Conservation Fund Act	All plans in full compliance.					
Native American Graves Protection and Repatriation Act	All plans in full compliance.					
Environmental Justice, E.O. 12898	All plans in full compliance.					

Table 4-23
Comparative Impacts of Alternatives
Future condition with feature in place exclusive of mitigation
(Indicates net gain or losses)

	Emergent Wetlands (Acres)	Aquatic Resources (Acres)	Forested Area (Acres)	Cultural/Historic Sites
Existing Conditions	11.25	233	5,956	41 known archaeological and 748 architectural sites
MEASURES				
Chain of Wetlands	(+123)134.25	(+8) 241	(-90*) 5,866	unknown
IH-45 Diversion Channel	(0) 11.25	(+1) 234	(-9*) 5,947	No known added sites or structures; survey required
Lamar Levee Increment	(0)11.25	(-5) 228	(-53*) 5,903	unknown
100-Yr. Cadillac Heights Levee/ Floodwall Increment	(0) 11.25	(0) 233	(-2.4*) 5,954	unknown
SPF Cadillac Heights Levee Increment	(0) 11.25	(-1) 232	(-9.4*) 5,947	unknown
ALTERNATIVES				
No-Action Plan (Future Without)	11.25	minor change	minor change	unknown
NED Plan	(0) 11.25	(-16) 217	(-504**)5,452	not evaluated
Combination Non-Structural / Structural	(+123)134.25	(+3) 236	(-143*) 5,813	unknown
TFSP	(+123)134.25	(+3) 236	(-155*) 5,801	27 archaeological and 699 architectural sites
LPP	(+123)134.25	(+2) 235	(-162*) 5,794	27 archaeological and 699 architectural sites

** Approximately 50% of bottomland hardwood forests in area are forested wetlands*
*** Approximately 90% of bottomland hardwood forest in NED footprint are forested wetlands*

Forested Areas

The most significant resource issue raised by the public was the concern about loss of bottomland hardwood forest within the project area. The forest has developed during the past three to four decades around a remnant stringer of mature trees along the river bank and on isolated high grounds that had minimal disturbance in the past. The forested area has filled in most of the old field areas that have been abandoned, so it is believed that little additional forest would accrue in the future without-project condition. No decreases in forested area are expected to occur without the project.

The NED Plan would cause the most significant impacts, resulting in a direct loss of 504 acres through clearing and grading, and cumulative impacts through fragmentation of habitat to an additional 99 acres of bottomland hardwood. Because of the adverse impacts of the NED, additional planning was conducted to design a project which would be economically favorable and produce less negative impacts. The chain of wetlands would negatively impact bottomland hardwoods by removal of approximately 90 acres of forest by clearing, of which approximately 50%, or 45 acres, are forested wetlands. The Lamar Levee would provide an additional impact of 53 acres by removal of trees within the footprint and temporary work area along the levee and within the proposed sumps. Construction of the Cadillac Heights Levee would impact through removal of approximately nine acres of bottomland hardwood forest. The levees, by design, would reduce overbank flow to some small areas of forest; however, the bottomland forests that would be protected from overbank flow are along relatively high elevations and would not be adversely impacted by the reduction in flows from overbank conditions. In addition, tributary flows would not be impacted and the riparian stringers within the protected zone of the levees would not be adversely impacted. The combination of these three measures as part of the LPP would negatively impact 153 acres of bottomland hardwoods, of which approximately 81 acres are forested wetlands. The proposal to realign the river under the IH-45 bridge would result in nine acres of impact to bottomland hardwoods. Furthermore, the realignment would necessitate encroachment into the riparian buffer containing mature forest along the river bank. This total impact of 162 acres would be significantly less than that caused by the NED Plan; however, this loss was considered significant and required development of a compensatory environmental mitigation plan.

The combination non-structural / structural plan would impact approximately nine fewer acres of forest than the LPP. In addition to evaluation of the loss of forested area per se, evaluation of the effect of those losses on local climate, air quality and other resource issues are discussed in the following sections.

Water Quality

With no action, water quality in the Trinity River, within the segment of the Dallas Floodway Extension (DFE), would continue to improve. In addition to more stringent Federal and state regulations aimed at reducing water pollution, comprehensive watershed management programs in the upper watershed of the Trinity River are being initiated by local governments and municipalities. An objective of the these programs is to restore the river and floodplain back to its natural condition. A functional benefit and output of this program has been an overall improvement in all aspects of water quality throughout the entire Trinity River system, including the DFE segment. This trend is expected to continue without the project.

Any and all of the project alternatives considered which would include Corps of Engineers participation would require preparation of a comprehensive floodplain management plan by the project sponsor. This management plan is a requirement of Section 202 of the Water Resources Development Act of 1996, which requires that project sponsors develop plans within one year of entering into a Project Cost Sharing Agreement with the Corps of Engineers. The comprehensive floodplain management plan, at a minimum, must conform to the requirements of the Federal Emergency Management Agency's requirements for participation in the National Flood Insurance Program. But more than that, the plan must consider watershed management strategies which will not worsen flood runoff conditions in the future. This requirement has implications for both future flood elevations and runoff water quality with implementation of a Federal project. These plans must be reviewed and approved by the Corps prior to completion of construction and must be implemented within one year of completion of construction.

The water quality of the Trinity River would not be altered as a result of implementing the combination non-structural / structural alternative. Future development adjacent to the project or utilization of the areas included in the non-structural measures would be consistent with a comprehensive floodplain management plan, and could positively influence water quality in the DFE segment of the Trinity River. Sump areas, project lands, and the emergent wetlands of the chain-of-wetlands would all have a positive effect on retention times and nutrient and pollutant uptake prior to local runoff entering the Trinity River. During high flow events, these project features should have a slight positive effect on water quality.

Water quality impacts resulting from the NED alternative, development of a 1,200-foot bottom width overland swale, would occur from the removal of trees and soil disturbances. A reduction in the number of trees within the floodplain would temporarily increase water turbidity and nutrient loads from rain events during construction. This impact would be temporary and would cease after turfing. Water temperature of temporarily stored waters in the off-channel swales could increase slightly because of reduced canopy shading, and the possible decrease in dissolved oxygen levels could temporarily impact water quality in the river during the first minutes of a flushing event. Over the long term, adverse impacts associated with loss of woody vegetation should be offset by the establishment of grasslands and some emergent wetlands within the swale, and by implementation of a floodplain management plan by the City of Dallas.

Placement of levees in the DFE area with the TFSP or the LPP could increase the velocity of river water during flood events; however, the levees would not be constructed without a compensating swale with chain-of-wetlands, which would tend to balance velocities. The levees would only function during extreme flooding events, in which case the velocity increases would be negligible. Sump areas would extend water retention times of storm water runoff, allowing for turbidity reduction and possible contaminant removal prior to entering the Trinity River. During non-flood and no rainfall periods, the levees and sumps would not affect water quality in the Trinity River. Temporary impacts to turbidity from runoff during construction could occur. The chain of wetlands would provide both beneficial and adverse impacts to the water quality of the Trinity River. As proposed, the wetlands would beneficially impact the water quality of the river by assimilating nitrogen, phosphorus, and any heavy metals from the Central Wastewater Treatment Plant stream which would be used to hydrate the wetlands. The wetlands would also provide beneficial filtration and cleanup of wastewater prior to groundwater recharge. The net effect would be similar to tertiary cleaning of some of the Central Wastewater Treatment Plant's treated effluent prior to it being reintroduced into the Trinity River. During rare conditions of low sunlight, high water temperature, no wind, and low wetland exchange rate, dissolved oxygen concentrations in the chain of wetlands could be low and the Biochemical Oxygen Demand (BOD) of the water high from the organic matter generated. During the early stages of flushing events under these conditions, water flowing from the wetlands into the Trinity River might cause temporary adverse impacts to the water quality of the river at the point of entry and downstream from oxidation of wetland organic matter. Should adverse conditions develop as described, pumpage of water through the wetlands could be altered as necessary to improve water quality within the wetland effluent. It is anticipated that over time, management of the wetlands can be fine tuned to the point that adverse impacts from the wetlands can be eliminated. It is also anticipated that the wetland water quality, vegetational assemblages and use by local and migratory wildlife would benefit from use of the wastewater effluent. Currently, the entire effluent passes through an existing lake prior to discharging into the Trinity River. The lake supports largemouth bass and channel catfish according to locals who have been observed fishing when access is available. It is not anticipated that water quality would adversely impact the proposed wetlands. During construction of the wetland outflow points on the river channel, there would be temporary increases in the turbidity of Trinity River.

During construction and initial stabilization of the Trinity River realignment at the IH-45 bridge, a short-term increase in river turbidity would occur in and immediately downstream of the project. A temporary increase in Biochemical Oxygen Demand (BOD) or Chemical Oxygen Demand (COD) could also occur depending upon the molecular composition of the disturbed river sediment. The reduction in light transmittal from elevated turbidity would temporarily shade oxygen-producing phytoplankton and cause lower dissolved oxygen levels.

Aquatic Habitat, Aquatic Invertebrates, and Fisheries

Under without-project conditions, the development of comprehensive watershed management plans in the upper watershed would allow the aquatic habitat of the mainstem of the Trinity River, within the project area, to continue to improve corresponding to the improvement in the water quality. The diversity and number of aquatic invertebrate and fish species would continue to increase in the DFE segment of the river as the pollution-sensitive aquatic organisms return to occupy former niches.

The condition of the aquatic habitat and fisheries resources following implementation of the combination non-structural / structural alternative would not be significantly changed in the DFE segment of the Trinity River from conditions without the project. Beneficial or negative impacts to the aquatic habitat, aquatic invertebrates and fishes would be dependent on future land use changes and development of areas adjacent to the proposed project. The project could be expected to intensify adjacent development, resulting in some increased imperviousness. It is anticipated, however, that such land use changes induced by the economic stimulus of the project would result in less litter, oil and grease, and general debris, and no significant degradation of runoff water quality. Furthermore, sumps provided inland of the levee would increase retention time for storm water runoff and project lands, and the created emergent wetlands would serve to further reduce loadings to the river, thereby resulting in slight positive impacts to aquatic habitat and fisheries resources.

Impacts resulting from the development of a 1,200-foot bottom width overland swale would occur from the changes in water quality associated with tree removal and soil disturbances. Decreases in aquatic habitat quality would occur under environmental conditions incurred from the implementation of the NED alternative. There could be some loss in fisheries spawning areas that could result in overall reduction of fish production as the smooth nature of the swale area, when flooded, would not provide the spawning habitat associated with tree stumps, roots, and other structure in the forested area. However, the swale would not alleviate flooding conditions on other forested areas of the floodplain and, therefore, it is not anticipated that there would be a significant corresponding reduction in the species diversity of aquatic invertebrates and fish.

Placement of levees in the DFE area, as part of the TFSP or LPP, would provide no appreciable positive or negative impacts to aquatic habitat or fisheries resources. Sump areas would improve the water quality characteristics of storm water runoff entering the Trinity River and subsequently enhance the aquatic habitat for aquatic invertebrates and fish. The chain of wetlands would provide both beneficial and negative impacts to the aquatic habitat and fisheries resources of the Trinity River. Effluent from the Central Wastewater Treatment Plant currently enter the Trinity River near the IH-45 bridge after flow through a small lake. Diversion of some of the water through the proposed chain of wetlands would result in some loss of water due to infiltration and transpiration and evaporation. The improvement in water quality provided by the chain of wetlands would enhance the aquatic habitat and beneficially impact fish and aquatic invertebrate communities. The resultant overall improvement of water quality that ultimately would reach the river would offset any losses in quantity. The chain of wetlands would provide new habitat for fish and aquatic invertebrate species which prefer water velocities lower than the flow rates which occur in the mainstem of the river. Riprap armoring at wetland discharge points on the river would provide substrate for colonization by communities of aquatic invertebrates, and food, refuge, and spawning areas for fish. Rock placement to protect the stream bank at the outfalls would produce a structural bottom feature which would benefit fish by providing a congregational point for bait fish and higher predatory fish species. Aquatic habitat in the wetlands and the river would be adversely impacted if environmental conditions (low sunlight, high water temperatures, no wind, and low wetland exchange rates) which generate poor water quality prevail. Management of the wetlands would occur to minimize any impacts to the mainstem of the river. Construction of the wetland outflow points on the river channel would cause temporary negative impacts to aquatic species not tolerant of elevated turbidity levels.

As previously discussed in terms of water quality, inducement of more intensive use or redevelopment of lands adjacent to the proposed project as a result of the economic stimulus of the project would not be expected to have any negative effect on aquatic organisms. These development activities within the watershed would have no direct effect on the physical component of aquatic habitats. Likewise, the increased utilization of the project area and project lands for recreation pursuits would not be anticipated to result in any net negative impacts to aquatic organisms and fisheries habitats. In fact, use of project lands for recreation should result in less loading of trash and debris as a result of controls on illegal dumping. Any adverse impacts resulting from adjacent land use redevelopment and projected recreation use planned for the project should be more than offset by the positive effects of project features, increased operation and maintenance of the resource base, and by the comprehensive floodplain management plan developed and implemented by the City of Dallas.

Realigning the Trinity River at the IH-45 bridge would result in a short-term increase in river turbidity and decrease in dissolved oxygen concentrations, which would adversely impact the aquatic habitat. This would temporarily impact aquatic invertebrate and fish species not tolerant of elevated turbidity levels or reduced dissolved oxygen concentrations. Recolonization of the new channel and the impacted area downstream should begin immediately after completion of construction, and diversity should be restored within a one- to two-year time period. Moving the river channel to avoid bridge pilings would adversely impact the aquatic habitat by removing a feature which would provide structure for colonization by aquatic invertebrate communities, and a feeding area and congregational focal point for fish. The removal of the small area of habitat associated with the pilings would not be significant.

Micro-Climate Effects

One of the concerns raised by citizens and environmental groups was the impact that removing trees would have on micro-climate conditions of adjacent areas. McPherson, Nowak, and Rowntree (1994) (See Appendix F), in a report for the U.S. Forest Service document that, by transpiring water, blocking winds, shading surfaces, and modifying storage and exchanges of heat among urban surfaces, trees affect local climate and human thermal comfort. These benefits are also documented in Mapping Micro-Urban Heat Islands Using Satellite Imagery (Lowry and Aniello 1993) (See Appendix F) for Dallas County, but it must be understood that the micro-climate effects of trees to conserve energy and lower temperature are very localized in nature. Without directly being covered by the shade provided by trees, or close enough to take advantage of the benefits provided by trees as natural windbreaks, micro-climate effects are negligible. Therefore, the removal of trees in conjunction with any of the potential alternatives for the proposed DFE flood control project is expected to have little or no impact on micro-climate effects of those trees to surrounding residential, industrial and business neighborhoods. It is also important to remember that none of the potential alternatives call for the addition of any impervious surfaces which might be expected to add radiant heat and thereby increase local temperatures. The replacement of trees by herbaceous vegetation would not have this effect.

Implementation of the TFSP or the LPP is expected to create an economic stimulus within the project area. This economic stimulus, combined with the flood damage reduction afforded by the project will no doubt result in redevelopment and land use intensification on lands adjacent to project features. Some of the types of redevelopment which are being considered might include a police station, reuse of industrial areas for condominium apartments, along with along with residential and commercial services redevelopment, and possibly some light industry. There is also the possibility that commercial services in support of new recreation opportunities could be part of the projected redevelopment. Given the past uses of lands on both the Lamar Street and Cadillac Heights sides of the project, it could be anticipated that most redevelopment projects will incorporate existing vegetation into their landscapes to the extent feasible. Further, it is highly probable that any industrial redevelopment that may be induced will be "cleaner" in terms of physical presence as well as products and waste by-products produced. The net effect of these changes on micro-climate should be negligible from the without project condition.

The economic development of adjacent neighborhoods would be further spurred on by the portion of TxDOT's proposed Trinity Parkway which would extend from Hwy 175 along the proposed Lamar Street Levee alignment. This proposed project could have an effect, on it's own, to the micro-climate of the project area. Those effects will have to be considered and ameliorated to the extent that they can by TxDOT as they move forward with their own compliance under the National Environmental Policy Act. The cumulative effect of this proposed highway project on the micro-climate would likely be some measurable increase in ambient temperatures immediately adjacent to the highway due to increased reflective surface, and some reduction in shading due to some slight loss of tree or other vegetative cover. It is important to note, however, that neither the TFSP nor the LPP is dependent upon TxDOT's proposed roadway, that the effects of the TFSP or LPP on their own are not significant, and that TxDOT will be required to address the impacts of it's actions, and to mitigate any adverse effects to the extent practicable.

Air Quality

The "Future Without-Project (No Action) Alternative" would cause no significant adverse impacts to air quality within the proposed project area. Regional trends in air quality indicate that regulated pollutant levels are slightly increasing. Flooding episodes and floodplain regulations imposed by the city of Dallas within the project area would restrict further urban and commercial development. In the absence of urban and commercial growth, mobile and stationary pollution emitting sources would decrease as would their associated pollutants. Construction of the portion of the Trinity Parkway along the proposed Lamar Levee alignment, as proposed by TxDOT, could result in increases in pollutant levels, regardless of whether or not the proposed levee was built.

The development of some additional tree canopy in the area, without the project, would provide beneficial impacts through biogenic removal of regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities with this alternative indicate trees in the entire DFE area would have the capacity to assimilate 13.85 tons/year of carbon monoxide, 12.23 tons/year of sulfur dioxide, 34.30 tons/year of nitrogen dioxide, 80.37 tons/year of PM10, and 151.23 tons/year of ozone, or approximately 10.1% of the total capacity of trees in the Dallas, Texas, area. The additional tree canopy that would develop would provide a slight improvement of approximately 4.1% in air pollutant removal capability above the existing conditions (Table 1, Appendix F).

Implementation of the NED alternative would cause minor adverse impacts to the quality of air within the proposed project area. Utilization of diesel-fueled heavy equipment would result in minimal amounts of exhaust fumes, smoke, and dust during construction activities. There would be no stationary emitting sources and no on site storage of petroleum or petroleum based by-products to cause additional negative impacts to air quality. Disposal of cleared vegetation or other debris by burning during construction would be accomplished only as permitted by the TNRCC. Required maintenance activities required for the NED alternative would contribute little additional mobile air emissions. The reduction in tree canopy area from clearing activities for swale development would result in negative impacts through removal of biogenic sources which extract regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities by trees in the entire DFE project area with this alternative implemented indicate there would be a vegetation assimilation capacity of 12.07 tons/year of carbon monoxide, 10.66 tons/year of sulfur dioxide, 29.89 tons/year of nitrogen dioxide, 70.03 tons/year of PM10, and 131.78 tons/year of ozone, or approximately 8.8% of the total capacity of trees in the Dallas, Texas, area. The reduction in tree canopy would decrease the air pollutant removal capability below the existing conditions by 9.2% (Table 1, Appendix F). The NED Plan would call for revegetation of the cleared swale area. The planted vegetation would provide a small amount of air pollutant assimilative capacity and to a limited extent, ameliorate the air quality impacts caused from tree removal.

The implementation of the TFSP alternative would cause minor adverse impacts to the quality of air within the proposed project area. Utilization of diesel-fueled heavy equipment, would result in minimal amounts of exhaust fumes, smoke, and dust during construction activities. There would be no stationary emitting sources and no on-site storage of petroleum or petroleum based by-products to cause negative impacts to air quality. Disposal of cleared vegetation or other debris by burning during construction would be accomplished only as permitted by the Texas Natural Resources Conservation Commission (TNRCC). Maintenance activities required for the TFSP alternative would contribute few additional mobile air emissions. The reduction in tree canopy area from clearing activities for wetlands and levee development would result in negative impacts through removal of biogenic sources which extract regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities of trees in the detailed project area under future conditions as listed in table 1,

Appendix F, indicated there would be an vegetation assimilation capacity of 2.02 tons/year of carbon monoxide, 1.78 tons/year of sulfur dioxide, 4.99 tons/year of nitrogen dioxide, 11.70 tons/year of PM10, and 22.02 tons/year of ozone, or approximately 1.5% of the total capacity of trees in the Dallas, Texas, area. Impacts of tree removal to assimilative capacities as a result of implementing elements of the TFSP are delineated in table 4-24.

As can be seen from Table 4-24, impacts to all parameters are minimal. In addition, acquisition and preservation of the proposed fish and wildlife mitigation area would greatly exceed the losses from implementation of the project features. The proposal to implement mitigation features of hastening the conversion of existing grasslands within the mitigation areas to bottomland hardwood forest by intensive tree plantings would result in more gains in air quality purification than would be lost by the project features, individually or cumulatively. The TFSP plan would call for re-vegetation of the cleared swale and levee areas. The new vegetation would provide a small amount of air pollutant assimilative capacity and, to a limited extent, ameliorate the air quality impacts caused from tree removal.

Air quality impacts associated with implementing the combination non-structural / structural alternative would be very similar to those impacts previously described for the TFSP. The only differences in air quality impacts between the TFSP and the non-structural alternative would result from the reduction in construction activity associated with the Cadillac Heights Levee. Not building this levee as part of the project would reduce the use of heavy equipment for earth moving activities which may cause minor adverse impacts to the air quality through emission of exhaust fumes, dust, and smoke. This alternative would also allow the tree canopy to remain and develop in the areas where the levee construction would have impacted. The remaining tree canopy would provide air quality benefits through air pollutant removal. The tree canopy in the areas delineated for mitigation would provide beneficial impacts through removal of regulated gaseous air pollutants. The addition of the tree canopy in the mitigation areas to that of the canopy area in the TFSP would increase the total pollutant removal capability over each area individually.

The impacts of the LPP alternative would be similar to those of the TFSP, as described above. The difference between the two alternatives would be the size of the Cadillac Heights Levee. Neither of the Cadillac Heights Levee alternatives would impact large areas of existing forest and, therefore, their impacts to air quality would be minimal.

Land use changes adjacent to the project area, which would likely be an indirect result of the project, would have some effect, though likely unmeasurable, on air quality of the study area. Given that lands outside the immediate project area are already mostly urbanized, consisting of residential, commercial strip development, and some industrial, it is projected that most changes will be in the form of redevelopment and reuse of already developed lands. These land use changes would likely be an intensification of current uses adjacent to the proposed project. Acreage changes from one land use to another should not be significant as a result of project implementation. Reduction of recurring flood damages, combined with an economy stimulated by construction dollars, is projected to increase real estate sales, renovations, and reuse. Effect of this redevelopment on vegetation and natural processes controlling air quality parameters is expected to be minimal.

Bottomland Hardwood Forests

One of the main concerns of citizens and environmental groups has been the impacts of the various potential alternatives on the bottomland hardwood forests located within the proposed DFE project area. Table 4-25 shows the impacts for the construction alternatives in terms of tree quality and numbers. Pecan-Oak bottomland hardwoods (BLH) would be considered high quality, while Elm-Ash BLH would be considered medium quality. These designations were taken from data derived from vegetation cover and land use maps. The average number of trees per acre was estimated from data collected on-site. These figures were then used to estimate the number of trees impacted by the various alternatives.

Table 4-24
Annual Removal Rates of Regulated Air Pollutants
By Trees
(Tons / Year)

Site	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Particulate Matter (10um)	Ozone
Chain of Wetlands, Upper Swale	-0.15	-0.14	-0.38	-0.89	-1.67
Chain of Wetlands, Lower Swale	-0.09	-0.08	-0.21	-0.49	-0.93
Cadillac Heights Levee (TFSP)	-0.01	-0.01	-0.01	-0.03	-0.06
Cadillac Heights Levee (LPP)	-0.02	-0.02	-0.06	-0.13	-0.25
Lamar Street Levee	-0.13	-0.11	-0.32	-0.76	-1.42
IH-45 Channel Realignment	-0.02	-0.02	-0.05	-0.13	-0.24
Total Impact for TFSP	-0.40	-0.36	-0.97	-2.30	-4.32
Total Impact for LPP	-0.41	-0.37	-1.02	-2.40	-4.51
Total Impact for Combination Non- Structural / Structural Alternative	-0.37	-0.33	-0.91	-2.14	-4.02
Preservation Value of Proposed Mitigation Area	+2.24	+1.99	+5.58	+13.09	+24.60
Conversion of Grasslands to Forest in Mitigation Area (TFSP)	+0.55	+0.48	+1.36	+3.18	+5.98
Conversion of Grasslands to Forest in Mitigation Area (LPP)	+0.57	+0.50	+1.41	+3.30	+6.21

Table 4-25
Bottomland Hardwood Forest Impact Analysis

	NED Plan	Chain of Wetlands	Lamar Levee	SPF Cadillac	100-Yr. Cadillac	Combination Plan	IH-45	TFSP	LPP
Total Acres of Trees	503.9	89.9	53.3	9.4	2.4	143.2	9.0	154.6	161.6
Total Acres - Pecan-Oak BLH	146.6	5.9	10.6	0.0	0.0	16.5	4.1	20.6	20.6
Total Acres - Ash-Elm BLH	357.3	84.0	42.7	9.4	2.4	126.7	4.9	134.0	141.0
Avg. Number of Trees per Acre - Pecan-Oak BLH	196	196	196	196	196	196	196	196	196
Avg. Number of Trees per Acre - Ash-Elm BLH	218	218	218	218	218	218	218	218	218
Total Number of Trees Impacted - Pecan-Oak BLH (000's)	28.7	1.1	2.0	0.0	0.0	3.2	0.8	4.0	4.0
Total Number of Trees Impacted - Ash-Elm BLH (000's)	77.9	18.3	9.3	2.0	0.5	27.6	1.1	29.2	30.7
Total Number of Trees Impacted (000's)	106.6	19.4	11.3	2.0	0.5	30.8	1.9	33.2	34.7

Long-term survivability of the bottomland hardwood forest within the proposed project area, without a project, would depend on the City of Dallas' Floodplain Management Plan and any future development, natural disturbances (e.g., prolonged flood events, tornados) and encroachment by human activities. Current regulations and public concern indicate, however, that the bottomland hardwood forest will increase in size and quality over time without the project.

Approximately nine fewer acres of trees would be impacted by the federal project if the combination non-structural / structural alternative were implemented instead of the LPP. Unless this area is protected through other regulatory means, however, they could be impacted by any future development.

The NED alternative would have major adverse impacts on the bottomland hardwood forest ecosystem now found in the proposed project area. One hundred forty seven acres of Pecan-Oak BLH and 357 acres of Ash-Elm BLH would be lost and the quality of the surrounding bottomland hardwood habitat would be greatly compromised. Fragmentation of forested habitat often eliminates its suitability for certain species which need a more continuous range in order to survive. It also opens up more fringe area to be inhabited by species who would not normally be found in a bottomland hardwood system, which could also lead to losses in bottomland hardwood dwelling species who are then not able to adequately compete against the new invader species.

The TFSP alternative would impact a portion of the bottomland hardwood forest found within the study area, but the impacts would be located in that portion of the proposed project area that has already seen significant impact by human activities such as gravel, dirt, and topsoil mining, landfills, and years of illegal dumping activities. Another consideration is that the bottomland habitat impacted by the TFSP would, for the most part and by design, be located in an area which is of lesser habitat quality than the NED Plan. Implementing the TFSP rather than the NED Plan would save over 73 percent of the bottomland hardwood acres that have been identified as being within the NED project area. Perhaps more importantly, over 90 percent of the bottomland hardwood forest acres determined to be Pecan Oak (high quality) habitat within the study area would be protected through public ownership. Roughly 50 percent of the forested land that would be impacted by the TFSP would be considered forested wetlands by U.S. Army Corps of Engineers determinations. The impact of the LPP would be very similar to that of the TFSP, as described above, but would impact seven acres more bottomland hardwoods than the TFSP.

Fish and Wildlife Habitat

The plan formulation process carefully followed a step-wise progression leading to minimization of impacts to bottomland hardwoods and other significant resources. Planning leading to the determination of the NED Plan eliminated channelization plans for flood damage reduction from further consideration due to adverse environmental effects. A vegetative management plan was considered, but eliminated, because it would have seriously diminished stream aquatic, riparian and bottomland hardwood habitats that have high national priority for protection. An array of swale alternatives, including the NED Plan, although causing significant losses to bottomland hardwoods, was developed. These swales were aligned to avoid the highest quality forested habitats to the extent possible. The swale plans did not receive endorsement by the entire environmental community, but appropriate mitigation plans were found to be feasible for the proposals.

The Chain of Wetlands alternative alignment was developed from a smaller swale plan around desires expressed by the sponsor following extensive public involvement. A major planning objective by the Corps and sponsor included the commitment to continued avoidance of Pecan-Oak forested areas and minimization of impact to any bottomland hardwood forested areas. The alignment within the upper reach was moved to the west as far as technically and economically justifiable. The alignments of the Cadillac Heights and Lamar Levees have also been extensively considered, and it has been determined that no other reasonable alignments would produce less impacts to important resources. Alignment of the Cadillac Heights Levee was adjusted during plan formulation to avoid direct impacts to an existing rookery located adjacent to Rector Street. Additional investigations would be done during future detailed planning to adjust the alignment if possible should the rookery expand into existing woodlands that the levee would remove.

Based upon experience, and lessons learned dealing with other levees in the area, it has been determined that the more gradual slope of the proposed levees, although causing slight additional impact due to a widened footprint, would be necessary to reduce slumping, possible failure and otherwise high operation and maintenance costs. Any additional adjustments to the proposed project features that would reduce environmental impacts to significant resources have been judged to have immediate or long term costs that are not warranted.

Table 4-26 provides a breakdown by project feature indicating the extent of impacts (losses of acres of habitat) to important resources that would occur if the project or feature were implemented.

Table 4-26
Impacts to Significant Resources
(Acres)

Resource	NED Plan	Chain of Wetlands	Lamar Levee	SPF Cadillac	100-Yr. Cadillac	Combination Plan	IH-45	TFSP	LPP
Pecan-Oak Bottomland Hardwood	*175.6	5.9	10.6	0.0	0.0	16.5	4.1	20.6	20.6
Ash-Elm Bottomland Hardwood	*427.7	84.0	42.7	9.4	2.4	124.9	4.9	134.0	141.0
Mixed Grass Forblands	196.7	125.5	44.5	41.7	10.6	170.0	0.0	180.6	211.7
Open Water	24.3	37.8	4.9	1.0	0.0	42.7	7.6	50.3	51.3

**Includes area affected by habitat fragmentation caused by NED project within White Rock Creek floodplain.*

Using these assumptions, the Corps of Engineers and the U.S. Fish and Wildlife Service modeled future with- and without-project conditions to determine impact to fish and wildlife habitat. The losses in habitat are directly related to losses in wildlife species that utilize the specific habitat. The Habitat Evaluation Procedures (HEP) were used to evaluate several plans to determine impacts to wildlife resources and to satisfy mitigation requirements for bottomland hardwood forest habitats impacted by the proposed project. A basic assumption of the HEP is that species habitat requirements can be modeled and that selection of representative species for analysis can better account for impacts to the numerous species of wildlife that utilize various components of the habitat than trying to discuss the individual species requirements. According to these studies, the project features of the LPP, including the IH-45 channel realignment would result in impacts to 21 acres of pecan/oak forest (High Quality), 141 acres of ash/elm (Medium Quality) forest, and 212 acres of mixed grass forbland. Details of the HEP analysis are provided in Appendix G (USFWS Coordination Act Report). The HEP indicated that these impacts would result in losses of 14 Average Annual Habitat Units (AAHU) to pecan/oak forest and 91 AAHU to ash/elm forest over a 50-year period of analysis, when compared to the future without-project conditions. Alternative mitigation plans were developed to provide no net loss of bottomland hardwood habitat. The recommended mitigation plan would impact the area by setting aside a specific area for long term management for fish and wildlife resources. There would also be positive impacts of the mitigation plan, as evidenced not only by meeting policy of no net loss of bottomland hardwood habitat values, but also by providing long-term stability of the structural and functional values of what has been termed the Great Trinity Forest, including air pollutant removal capacity, and fish and wildlife resource values.

Forest Mitigation Plan

Three potential mitigation tracts, which remain in private ownership, were identified in coordination with the U.S. Fish and Wildlife Service (USFWS), and evaluated for their potential to offset the losses to fish and wildlife habitat that would result from implementation of the plan which would have the largest footprint, and therefore, the largest impact to important resources. This plan was identified as the LPP and the IH-45 Diversion. These tracts are located within the Trinity River floodplain near the proposed project (See figure F-3 in Appendix F). These tracts contain grasslands that have potential for conversion to bottomland hardwoods and areas of Ash-Elm BLH and Pecan-Oak BLH habitat.

Using the models for species evaluated, measures were developed to optimize habitat conditions on these tracts through conversion of existing grasslands to bottomland hardwoods and the improvement of existing forest stands. While the largest gains in habitat values over the life of the analysis would occur from grassland conversion, the cost associated with this conversion, including land acquisition, would be the most expensive per acre. Also, within the tracts identified there is a limited amount of grassland available for conversion. Table 4-27 presents the costs and average annual benefits associated with the three mitigation plans evaluated. Target mitigation values were based on habitat losses of 14 Average Annual Habitat Units (AAHU) to pecan/oak forest and 91 AAHU to ash/elm forest.

Table 4-27
Incremental Mitigation Analysis
USFWS Plan

	Average Annual Habitat Units		Average Annual Mitigation Cost	Annual Cost / AAHU
Mitigation Plan Alternative	Pecan-Oak Bottomland Hardwood (HQ)	Ash-Elm Bottomland Hardwood (MQ)		
No Mitigation	0	0	0	--
Plan A	+9	+43	$307,589	$5,915
Plan B	+9	+55	$330,347	$5,162
Plan C	+14	+92	$444,472	$4,193

Mitigation Plan A would consist of modifying existing habitat at a tract located east of the Trinity River, in a corridor adjacent to Loop 12. The management plan to develop bottomland hardwood habitat would consist of conversion of 86 acres of grassland to bottomland hardwood, preservation of 10 acres of grassland, and improvement to habitat quality on 753 acres of existing bottomland hardwood.

Plan B would consist of adding an additional 34-acre tract located on the west side of the Trinity, adjacent to the proposed lower chain of wetlands. This site was identified as potentially multi-purpose, and would serve as a surplus soil disposal and mitigation area. The management proposal would be to convert the entire tract to bottomland hardwood.

Plan C would be a combination of Plan B and addition of a 271-acre tract near IH-635, within the floodplain near the southern end of the Dallas city limits boundary. Management in this tract would include conversion of 88 acres of grassland to bottomland hardwood, improvement of habitat quality on 173 acres and preservation of an additional 10 acres of grassland. Plan C would consist of a total of 1,154 acres with prescribed management practices that would fully mitigate projected losses to bottomland hardwoods attributable to the LPP and the IH-45 river realignment. In addition to providing full mitigation of these resources, Plan C presents the best buy in terms of cost per gain in habitat value. Plans A and B would be more costly per gain and would not provide the mitigation required to offset losses.

Subsequent evaluations by the Corps of Engineers indicated a more cost effective management approach for conversion of grasslands to forest would entail planting of bare-root seedlings in lieu of containerized trees and shrubs, as recommended by the USFWS, even though additional acreage would be required to satisfy the mitigation requirements. A detailed description of this Corps analysis is included in Appendix F.

Table 4-28 indicates the mitigation requirements by project feature, including the NED, for this revised mitigation plan, as proposed by the Corps. The analysis is another indicator of the relatively larger impacts that would be caused by the NED Plan as opposed to the TFSP or LPP.

Table 4-28
Required Mitigation by Alternative
(Acres)

Alternative	Mitigation Required
Chain of Wetlands	649
IH-45 Channel Realignment	71
Lamar Levee	400
Cadillac Heights Levee (TFSP)	15
Cadillac Heights Levee (LPP)	59
Tentative Federally Supportable Plan	1,135
Locally Preferred Plan	1,179
Combination Non-Structural / Structural	1,027
NED	3,200

Impacts to Threatened and Endangered Species

Following review of available information, including that provided by the U.S. Fish and Wildlife Service, it has been determined that the endangered black-capped vireo and interior least tern are the only federally listed species known to actively occupy suitable habitat for substantial periods of time other than as pure migratory birds. Both species are know to actively nest in Dallas County. Mountain plover is a candidate species of potential occurrence. There is no preferred habitat for the vireo or tern within the proposed project area. In addition, there is a lack of suitable habitat within the area for the mountain plover during its spring and fall migratory movements. Therefore, it has been concluded that the federally listed and candidate species are unlikely to be adversely affected by the proposed project.

Geology and Soils

Fluvial terrace deposits and alluvial deposits of the Quaternary Age occupy the floodplain area of the Trinity River within the study area. These deposits consist of gravel, sand, silt, and clay deposits. There has been no significant channel migration, bank stability problems or erosion document in the last fifty years within the project reach in spite of many man induced alterations from sand gravel operations, modifications associated with the Central Wastewater Treatment Plant or numerous other intrusions into the floodway. The construction of the project features would utilize soil derived from the project area and would be stabilized to reduce erosion during in-channel and overbank flows. During overbank flow events, much of the water would be routed through the chain of wetlands, which would resist erosion due to the nature of the established vegetation and construction design. The realignment of the river channel through the IH-45 bridge would result in a channel segment of equivalent length, depth and width as the existing channel. The bank of the channel would be stabilized with turf grasses and replanted with woody vegetation that would work together to stabilize the new segment. The levees and sumps would also be stabilized to reduce erosion. The combined effect of chain of wetlands, levees and sumps, and realignment of Trinity River channel would result in some increases in water velocity along the right over bank during the larger, but more rare events, such as the 100-year and SPF events; however, these flows would not substantially increase erosion within the project area.

Cultural Resources

Eight of the archaeological sites identified in the project footprint are considered eligible for the National Register of Historic Places (NRHP). They appear to retain the intact deposits that return data valuable in scientific research. Although additional work will be necessary to make a determination of eligibility, they will be treated as eligible rather than eligibility unknown until the additional investigations are completed. Seven of the sites are buried prehistoric occupations exposed in banks or cut profiles. They are covered with approximately 5 - 10 feet of alluvium. These resources will require additional study through data recovery prior to construction. One of the sites is historic. Four of the prehistoric sites would be in the chain of wetlands project element and three others would be impacted by the Cadillac Heights Levee construction. The single historic site would be in the western portion of the Lamar Levee element and is identified as a City of Dallas dump in use between 1890 and 1940. In addition, brief analyses of several historic maps, such as Sam Street's Map of Dallas County dated 1900 and U.S.G.S. Soil Survey of 1920, indicate numerous additional historic sites would be impacted by the project.

Six of the historic buildings and structures identified in the project footprint as potentially eligible for the NRHP will require additional evaluation, including documentation by an archivist and a historic architect. Five of the six structures would be in the Cadillac Heights Levee and chain of wetlands elements. The sixth would be adjacent to a proposed sump near the southern end of the proposed Lamar Levee element.

The potential for additional buried prehistoric sites is high. As noted above, extrapolation from the historic maps indicate the potential for historic sites throughout the project footprint is also considered high. Consequently, a two stage program has been designed for the project footprint which addresses the differences in the proposed undertakings. In the Cadillac Heights Levee and Lamar Street Levee elements, the work would be oriented to an intensive survey of the upper 2.5 feet, since excavation would be minor. By contrast, the Lamar sump areas and the chain of wetlands would require some sampling using probes, cores and backhoe trenches to identify and expose buried sites, as well as an intensive survey for historic period components. However, since the central channel in the chain of wetlands would extend to between 8 - 10 feet below surface, construction would be monitored and impacts to any uncovered or exposed sites would be mitigated in consultation with the Texas State Historic Preservation Officer (SHPO). Finally, the depth and width of the proposed river realignment under the IH-45 bridge would preclude deep trenching as a survey strategy. Although the upper one meter of deposit would be intensively surveyed for historic period sites, the remaining deposits would be initially investigated using probes and cores. The recovered data would be used to guide the more intensive oversight monitoring and possible mitigation during construction. Consultation with the SHPO is ongoing and would continue throughout the project.

Transportation Impacts

A detailed description of traffic corridors including railroads that would be impacted by construction and during operation of the project is described in Appendix C, beginning on page C-5. Implementation of the alternatives investigated would result in short term use of local streets for access to the construction locations and for access to major routes leading to disposal sites for material excavated from the project area or from removal of building materials associated with the non-structural plan. In addition, transportation would be impacted directly during construction of the levees and appurtenant features. The Lamar Levee would intersect with the Union Pacific Railroad owned lines in the area (MKT and and Southern Pacific). Rail traffic would be shifted between the two railroads as work was being conducted that interfered with traffic on the other. The Cadillac Heights Levee would cross the MKT line at two separate locations. Transportation impacts to IH-45 would not occur as a result of the channel realignment under the IH-45 bridge; however, allowing the threat to the major transportation corridor to continue would ultimately result in substantial impacts to use of the bridge. Also, other alternatives considered, such as strengthening the piers or refurbishing the bridge by shifting structural support locations would result in extensive periods of time when the structure would be unusable.

The Cadillac Heights Levee, as proposed in the TFSP, would not result in need for a closure across Martin Luther King (MLK) Blvd; however, the LPP would require a closure. The Lamar Levee would not require a closure at MLK for either plan. Central Expressway would not be impacted, provided the owner raises abutments as currently planned. No alteration to the IH-45 bridge is expected for any project alternative. The southern end of Sargent road would be abandoned with implementation of the LPP, requiring a permanent rerouting of traffic to other routes. The eastern terminus of the existing Rector Road, which has only occasional traffic, would be eliminated during the construction of the LPP, but would not under the TFSP, since the levee segment through this area would not be required for the TFSP. At locations where levees would cross through streets, traffic would have to rerouted during periods of flooding, since the gates would have to be closed to prevent flood damage to structures. However, these areas are already subject to closure when flooding occurs. Therefore, the impacts to traffic are negligible other than those caused by the permanent closing of Sargent Road. Traffic flow through this area is normally light and other streets should be sufficient to offset the losses.

Land Use Impacts

Each project alternative considered which would include Corps of Engineers participation would, by law, require preparation of a comprehensive floodplain management plan by the project sponsor. Section 202 of the Water Resources Development Act of 1996 requires that project sponsors develop comprehensive floodplain management plans for implementation within one year of completion of construction. The plans must not only conform to the requirements of the Federal Emergency Management Agency's requirements for participation in the National Flood Insurance Program, which had been a requirement prior to 1996, but the plans must also give consideration to watershed management strategies as they relate to future flooding and water quality.

The economic stimulus associated with development of the TFSP or LPP, combined with the reduction in frequency and intensity of flood damages, will result in economic development of lands adjacent to the project. The area of secondary or induced impact will not be limited to those lands immediately adjacent to the project but will be most visible there. Since most of this area is already in residential and light commercial and industrial development, the most obvious changes will be more in the form of redevelopment and reuse than outright land use changes. This redevelopment will likely be more gradual than abrupt, but noticeable over several years. Based upon the current state of development of these lands, the intensification of use should be minor. It cannot be determined with any degree of certainty at this time what specific, or even what general type of development may occur in any given area. Because the City of Dallas would be required to prepare a floodplain management plan addressing land uses within the watershed, it is likely that there will be opportunity for public input to any potential zoning changes.

Some of the developments which are currently being considered include a police station, reuse of industrial buildings and complexes for condominium apartments and attendant commercial services, refurbishing of residential neighborhoods within and adjacent to the Cadillac Heights, Rochester Park, and Joppa neighborhoods, along with residential and commercial services redevelopment, and possibly some light industry. There is also the possibility that commercial services in support of new recreation opportunities could be part of the projected redevelopment.

Prior to any new development or any redevelopment of currently developed lands, liability requirements for any environmental contamination must be addressed. This would include compliance with both Environmental Protection Agency and Texas Natural Resources Conservation Service requirements, as well as consistency with such programs as the "Brownfields" initiatives administered by those agencies. Although no specific proposals have been identified, it is probable that any industrial redevelopment that may be induced will be "cleaner" than former industrial development in the study area.

Redevelopment of adjacent neighborhoods could be further induced by the portion of TxDOT's proposed Trinity Parkway, which would extend from Hwy 175 along the Lamar Street Levee alignment. This proposed project could have an effect, depending upon number and location of access ramps, on the type of development adjacent to the project. In general, it would seem intuitive that light commercial and industrial developments might be more likely to occur at the access points, as opposed to both high and low density residential development being more appropriate away from major highway access points. Those effects will be considered by TxDOT as they move forward with their own compliance under the National Environmental Policy Act. One certain cumulative effect of the proposed roadway project on land uses in the project vicinity would be an additional economic stimulus. There would be some economic effect of the TxDOT project on land use, whether or not the TFSP or LPP proposal is constructed, but the two together would have a combined effect. It should be noted again, however, that neither the TFSP nor the LPP is dependent upon TxDOT's proposed highway project. TxDOT will be required to plan for, and to mitigate, any adverse impacts of it's actions on land use to the extent practicable, regardless of the ultimate fate of the DFE project.

Increased utilization of the project area and project lands for recreation pursuits is anticipated and, in fact, is designed into the project. The Corps of Engineers would participate in certain types of low density recreation activities such as hike and bike trails and day use facilities, which would result in a slight land use change on project lands which are currently within the floodplain. These lands will remain in the floodplain as open space but would be available for compatible public uses with the project. Corps policy provides for compatible low density recreation to occur on lands acquired and managed for habitat mitigation, provided that it is consistent with the wildlife management purpose. Recreation trails through the habitat mitigation area, therefore, are considered to be consistent with that land use. Development of more intensive recreation facilities is planned by the project sponsor for certain areas within the lands required for the project. This would include such facilities as athletic fields and a community center. Direct land use changes caused by the proposed project would be compatible with floodplain functions and should have no negative effects on floodplain uses without the project.

Noise Impacts

Implementation of any of the alternatives investigated in this study is not expected to adversely impact the noise-environment over the long-term. However, analysis of the alternatives in regards to temporary noise levels during the construction phase of the project was conducted, especially given the proximity of some of the proposed features to residential areas, specifically the Cadillac Heights and the Joppa neighborhoods.

Of concern are impacts on people near the construction sites who are performing activities which are totally unrelated to construction activities (e.g., area residents, office workers, schoolchildren, etc.). Important factors in determining noise levels that would potentially impact such populations include distance from the noise source; natural or man-made barriers between the source and the impacted population; weather conditions which could potentially absorb, reflect or focus sound (such as wind speed and direction and temperature inversions); and the scale and intensity of the particular construction phase (e.g., excavation, building or finishing).

The Noise Control Act of 1972, one of the earliest legislative bills to address noise concerns, directed the Environmental Protection Agency (EPA) to promote an environment for all Americans that is free from noise that jeopardizes their health and welfare. Several key federal agencies, including the EPA, Department of Transportation (FAA and FHWA), Department of Defense, and Department of Housing and Urban Development (HUD) agreed to a joint effort to incorporate noise considerations in development planning. This cooperation resulted in noise-impact-related data such as noise-zone classifications and land-use compatibility guidelines.

The most frequently used measure currently in general use to describe noise level impacts is the day night average sound level system, abbreviated as DNL and symbolized mathematically as L_{dn}. The day night average sound level is the 24 hour average sound level, expressed in decibels (dB), obtained after the addition of a 10 decibel penalty for sound levels which occur at night between 10PM and 7AM. This nighttime penalty is based on the fact that many studies have shown that people are much more disturbed by noise at night than at any other time. According to general guidelines established by the EPA, residential land use is deemed acceptable for noise exposures up to 65 L_{dn}. The noise exposure at this level may be of some concern but common building construction will make the indoor environment acceptable, and the outdoor environment will be reasonably pleasant for recreation and play.

The noise levels associated with heavy, earth moving equipment such as would be used in construction of levees and swale and wetland excavations range between 72 and 96 dBA (decibel readings weighted to average frequencies heard by the human ear) at a distance of 50 feet. Since sound travels through the air in waves, as the wave spreads (moves away from the sound source) the intensity of the sound at any given point diminishes. Because of the relatively large distances between the proposed construction sites and the nearest residential neighborhoods, most of the alternative plans investigated in this study were readily eliminated from consideration for significantly adverse noise impacts.

Two exceptions to this elimination from consideration were the alternatives proposing construction of either the 100-year or SPF levee around Cadillac Heights and the alternatives proposing the construction of a swale, with or without wetlands, adjacent to the Joppa neighborhood. In the Cadillac Heights neighborhood, more detailed noise analysis of the proposed levee alignments revealed that the only location where the noise levels from construction activities rise above the acceptable 65 L_{dn} would be in the residential area immediately across 11th Street from the end of the levee. The distance between the edge of the levee construction site and the nearest homes in this area is approximately 200 feet which means that construction noise levels outside these homes could vary between 60 and 80 dBA. The distance between the edge of the construction zone and the nearest residences in the Joppa neighborhood is approximately 400 feet. The construction noise levels outside the homes in this area varies between 54 and 76 dBA. Noise levels from earth moving equipment would not remain at a constant level but would fluctuate up and down as the equipment moves closer or farther away, so none of the nearby residents would be subjected to constant high noise levels for extended periods of time. Even though this is the case, it has been determined that where noise levels would consistently extend above the 65 L_{dn}, limits would be placed on the hours of construction operations. Work would not start before 7 AM and would be shut down by 6PM in these areas of concern.

Long-term adverse impacts to the noise environment in the areas adjacent to the proposed project site would not be significant upon completion of the construction phase of the project. Operations and maintenance (O&M) activities, such as mowing, would be conducted on a periodic basis, but the noise from these activities is not expected to reach levels above 65 L_{dn}. In addition, the topographic variations in land as a result of the construction of the proposed swales, wetlands and levees would serve as man-made barriers to noise in the areas surrounding project lands.

Visual Impacts

Visual and aesthetic resources and the interpretation of impacts to resources is varied due to the differences of opinions in what constitutes non-quantifiable elements, such as beauty or pleasantness of the surrounding vista. The proposed chain of wetlands would provide flood damage reduction by removal of forests that impede flow. This could be determined by some to be an adverse visual impact. However, the emergent wetlands would encourage various shore birds, wading birds, waterfowl and other wildlife to utilize the area. The grasslands surrounding the wetland complexes blending into the remaining woodlands should constitute a desirable visual quality even if not preferred by some. The levees would intrude visually into area due to their height. At the same time, development of the entire area as open space providing access to the area, the ability to observe the floodplain resources from atop the levees would be a benefit. Recently considerable growth of wildflowers has been observed on the existing Dallas Floodway levees. The natural propagation of wildflowers along the levees could also develop on the proposed levee extension. The realignment of the river under the IH-45 bridge would initially have adverse visual qualities, but over time as the banks stabilize and the forest is re-established on the banks, the new segment would take on the appearance of the existing channel through the area.

Utility Impacts

The linear levees, as proposed, would cross a number of utilities, such as sanitary sewers, storm drains, water lines, electric transmission towers, fiber optic or other communication cables. A detailed analysis of the known relocations of utilities that would be required is described in Appendix C, beginning on page C-8. The impacts associated with the utilities relocations would be minor. Only temporary disruptions in service would be expected. The utility relocations would be isolated to the immediate area near the construction site, and no additional impacts to important resources would occur. In addition, safeguards would be added to the relocated utilities as a means to lessen problems associated with operation of the project. For example, closure valves would be included for sewer pipelines reconstructed under the levees to be utilized in the event of a rupture. Storm drains would be equipped with emergency closure valves at each levee crossing to prevent flooding in the event of a malfunction of the flap gates. Water supply lines would be relocated to the upper surface of the levees, buried a minimum of two feet deep.

Hazardous, Toxic and Radioactive Waste (HTRW) Impacts

The goal of any design for a flood damage reduction project is to avoid construction in HTRW-contaminated areas and in areas where impact to an HTRW-contaminated site would occur. Avoidance of construction in these areas prevents releases to the environment from occurring. Should it be determined that a project feature must be constructed within an HTRW-contaminated area, or within an area which would have an impact on an HTRW-contaminated site, then a response action is taken to remediate or remove the site in order to eliminate the potential for a release and subsequent impact. This response action would be undertaken in accordance with applicable EPA and state regulations, with the total cost for the response borne by the local sponsor. Therefore, every effort is made to identify potential HTRW-contaminated areas as early as possible during the development of any flood control project design, so that project features can be adjusted to avoid these areas.

The no action alternative for this project would result in no HTRW environmental impact because no construction would occur. The regulatory community would continue to address HTRW-contaminated sites in accordance with the appropriate policies, and liability for environmental releases and impacts would remain with the responsible parties. All other alternatives could result in a potential for HTRW impact due to the construction which must occur for project features, which could result in a hazardous substance release to the environment. Alternatives allowing for the most flexibility in adjusting project features to avoid HTRW-contaminated sites would have the least potential for HTRW impact. The NED Plan is the alternative which would allow the least flexibility for avoiding HTRW-contaminated sites due to the large width and extent of the swale areas to be constructed. The other alternatives (Combination non-structural / structural plan, TFSP, and LPP) would allow the most flexibility for avoiding HTRW-contaminated sites due to its variety of project features and their various locations which allow for adjustments with minimal cost or project impacts.

The potential for HTRW impact from past and current activities within the study area is extensive. However, efforts to identify, investigate, and adjust project features will continue, with the intent of creating no environmental impact for the project due to HTRW-contaminated areas.

Disposal Impacts

The impacts of placement of excavated material along the alignment of the proposed levees have been addressed as part of the evaluation of these project features. The disposal site for surplus, non-contaminated material was selected because it had been previously approved as a disposal site and would cause not adverse impacts to environmental or cultural resources. The disposal site for contaminated, non-hazardous materials, as described in Appendix J, was tentatively selected because of its known capability to handle the type of wastes identified. The most significant impacts would be related to the hauling of material to these sites, including temporary increases in air pollutants, and the irretrievable commitments of non-renewable resources such as fuel for the hauling equipment.

ECONOMIC ANALYSIS FOR FINAL ARRAY OF ALTERNATIVES

Table 4-29 presents the comparative economic analysis of the flood control features for the final array of alternatives.

The 1965 Authorized Plan, as shown, was analyzed with the original interest rate of 3.25%, and with the January 1997 interest rate of 7.375%. This plan would no longer be economically justified, with current flood control first costs of $199.2 million, annual food control first costs of $17.1 million, negative annual net flood control benefits of $4.1 million, and a BCR of 0.76.

The NED Plan would have an estimated flood control first cost of $50.0 million, annual flood control first costs of $5.5 million, annual net flood control benefits of $8.1 million, and a BCR of 2.46.

The combination non-structural / structural plan reflects the costs and benefits of a plan which would include the chain of wetlands, the SPF Lamar Levee, and the 10-year buyout of the Cadillac Heights area. For equitable comparison of the non-structural plan with the NED and LPP, the costs and benefits of the economically justified CWWTP Levee upgrade and "compatible" Rochester Park Levees are also included in this plan. This plan has estimated flood control first costs of $67.0 million, annual flood control first costs of $7.6 million, annual net flood control benefits of $5.3 million, and a BCR of 1.70.

The TFSP would have estimated flood control first costs of $67.2 million, annual flood control first costs of $7.6 million, annual net flood control benefits of $6.2 million, and a BCR of 1.82.

The LPP would have estimated flood control first costs of $76.8 million, annual flood control first costs of $8.7 million, annual net flood control benefits of $2.9 million, and a BCR of 1.33.

Table 4-29
Economic Analysis of Final Array of Alternatives - Flood Control Only
(January 1997 prices, 7.375% interest, 50-year period of analysis)

	Authorized Plan		NED Plan	Combination Plan *	TFSP	LPP
	Original Rate	Current Rate				
INVESTMENT						
Estimated First Cost	$199,214,200	$199,214,200	$50,022,173	$66,983,587	$67,224,987	$76,780,782
Annual Interest Rate	0.0325	0.0738	0.0738	0.0738	0.0738	0.0738
Project Life (years)	100	50	50	50	50	50
Construction Period (months)	36	36	24	24	24	36
Compound Interest Factor	37.75981	40.15579	25.77523	25.77523	25.77523	40.15579
Capital Recovery Factor	0.0339	0.0759	0.0759	0.0759	0.0759	0.0759
Interest During Construction	$9,870,297	$22,860,317	$3,734,394	$5,000,645	$5,018,668	$8,810,783
Cost of non-Federal Levees			$14,220,000	$23,120,000	$23,120,000	$23,120,000
Investment Cost	$209,084,497	$222,074,517	$67,976,567	$95,104,232	$95,363,654	$108,711,565
ANNUAL CHARGES						
Interest	$6,795,246	$16,377,996	$5,013,272	$7,013,937	$7,033,069	$8,017,478
Amortization	$289,268	$480,458	$147,067	$205,758	$206,319	$235,197
Operation/Maintenance ($/year)	$250,000	$250,000	$375,000	$405,000	$370,000	$495,000
Replacements	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$7,334,515	$17,108,454	$5,535,339	$7,624,695	$7,609,389	$8,747,675
ANNUAL BENEFITS						
Inundation Reduction	$13,016,900	$13,016,900	$4,014,700	$4,134,600	$5,272,300	$5,222,700
Existing Dallas Floodway			$9,576,900	$8,789,500	$8,567,000	$6,454,573
TOTAL ANNUAL BENEFITS	$13,016,900	$13,016,900	$13,591,600	$12,924,100	$13,839,300	$11,677,273
NET ANNUAL BENEFITS	$5,682,400	(4,091,600)	$8,056,261	$5,299,405	$6,229,911	$2,929,598
BENEFIT-COST RATIO	1.77	0.76	2.46	1.70	1.82	1.33
No. of Structures No Longer At Risk From a SPF Event		Unknown	580	504	504	688

* *Combination plan includes the chain of wetlands, the SPF Lamar Levee, and a 10-year buyout of the Cadillac Heights area*

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SUMMARY

Due to the environmentally controversial nature of the NED Plan, implementation of this plan was deemed unfavorable by the local sponsor. The Tentative Federally Supportable Plan would yield greater net benefits than any of the other alternatives investigated, and will be considered in further detail in Chapter 5 of this document. In addition, due to the sponsor's desire to implement the LPP, more detailed designs and costs will be developed for this plan, as well.

CHAPTER 5

SELECTION OF THE RECOMMENDED PLAN

CHAPTER 5
SELECTION OF THE RECOMMENDED PLAN

This chapter presents data and rationale supporting designation of the Recommended Plan. The results of the plan formulation process, as described in the preceding chapter, were derived from preliminary cost estimates and economic benefits assuming current conditions. The costs and benefits presented in this chapter are not comparable to those shown in chapter 4, Plan Formulation, for the following reasons:

- The costs presented in this chapter reflect more detailed design and analysis of the proposed project's flood control, environmental mitigation, environmental restoration, and recreation features, and were estimated at April 1998 prices levels. Economic analyses were performed utilizing the fiscal year (FY) 1998 Federal interest rate of 7-1/8%.

- The economic benefits presented in this chapter reflect average annual equivalent benefits, which account for future changes in urbanization and hydrology. Comparatively, the benefits shown in chapter 4 were expected average annual benefits, which do not incorporate future conditions.

- The economic benefits in this chapter also include the addition of insurance subsidy benefits, defined as the annual savings in operating expenses for the administration of the flood insurance programs, due to the implementation of the proposed project.

In addition to these differences, a risk-based analysis was incorporated into all assumptions and benefit calculations. This type of analysis was also used in the latter phases of the plan formulation process, as explained on page 4-22 of this document. Traditional expression of the frequency of flood events has been in terms of the recurrence interval in years, such as, the "100-Year Flood". The more appropriate expression of the probability of a particular flood magnitude is in terms of "percent chance exceedance", especially as it relates to a risk-based analysis. Therefore, the "100-Year Flood", which is defined as "the magnitude of flooding which has a 1 percent probability of being equaled or exceeded in any given year" would be expressed as the "1 percent chance flood". For comparison purposes, the nine flood events computed for this study, traditionally referred to as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 500-year, and the Standard Project Flood (SPF), would be referred to, in probabilistic terms, as the 99 percent, 50 percent, 20 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent chance flood, and the SPF, respectively. Although the analyses contained herein were performed as risk-based analyses, results of these investigations are expressed in traditional terms for the benefit of the reader.

OPTIMIZATION OF THE LAMAR AND CADILLAC HEIGHTS LEVEES

Although the SPF Lamar and 100-year Cadillac Heights Levees were deemed incrementally justified in the preceding chapter, more detailed analysis was conducted to ensure optimization of the levee heights, thereby validating their proper inclusion in the Tentative Federally Supportable Plan.

CADILLAC HEIGHTS LEVEE

Height Limitations

The Cadillac Heights Levee being proposed as part of the Tentative Federally Supportable Plan, known as the "100-year levee," was set to a profile corresponding to elevation 412.15 at the economic index point. This compares to a Standard Project Flood (SPF) elevation of approximately 419.85, a difference of 7.7 feet. A key engineering constraint limits the levee from any further increases in height without adverse impacts upstream. Hydraulic analyses indicate that a higher levee in the Cadillac Heights area begins to cause an increase in the upstream SPF profile, which is the design profile for the existing Dallas Floodway. As shown in the incremental analysis of the SPF levee for Cadillac Heights, the economic analysis is extremely sensitive to changes in upstream conditions, primarily due to the billions of dollars in property being protected by the Dallas Floodway. Thus, **any** increase in upstream water surface for the SPF design flow immediately squelches any hope of higher net benefits for the Cadillac Heights Levee.

Inelastic Levee Costs

As a general rule, levee features have a certain amount of initial, constant costs which can be attributed to lands, easements, interior drainage requirements, relocations, etc. A significant variable in computing costs for various levee heights is usually the amount of select fill required. However, due to the chain of wetlands excavation, the proposed project is rather unique in this regard. Overall, there is actually an excess of material which, unless used in some way, must be hauled away and disposed. The detailed cost analysis indicates that it costs more to haul and dispose the excess material than it does to place it as select fill in the Cadillac Heights Levee. As a result, the cost curve for levee heights below elevation 412.15 is highly inelastic.

The inelastic levee costs were validated by computing a detailed cost of a levee with two feet less height than the previously investigated 100-year levee. The lower levee was estimated to have an incremental first cost (added to the chain of wetlands) of $4,795,400. This is $320,000 **more** than the higher levee.

There is, however, a point at which a substantial increase in levee length would be required to provide closure. This is the primary reason for the increased cost of the levee with index elevation 421.85.

Benefit Analysis

The computer program HEC-FDA was used to determine the amount of gross benefits which would be foregone in the Cadillac Heights area if a levee of two feet less height were constructed. The analysis indicates that residual damages (year 2000 only analyzed) would increase, thereby reducing benefits, by $51,600. Additionally, floodplain user benefits totaling $15,500 could no longer be claimed because no structures would be removed from FEMA's 100-year floodplain. Total benefits foregone would be approximately $67,100 annually.

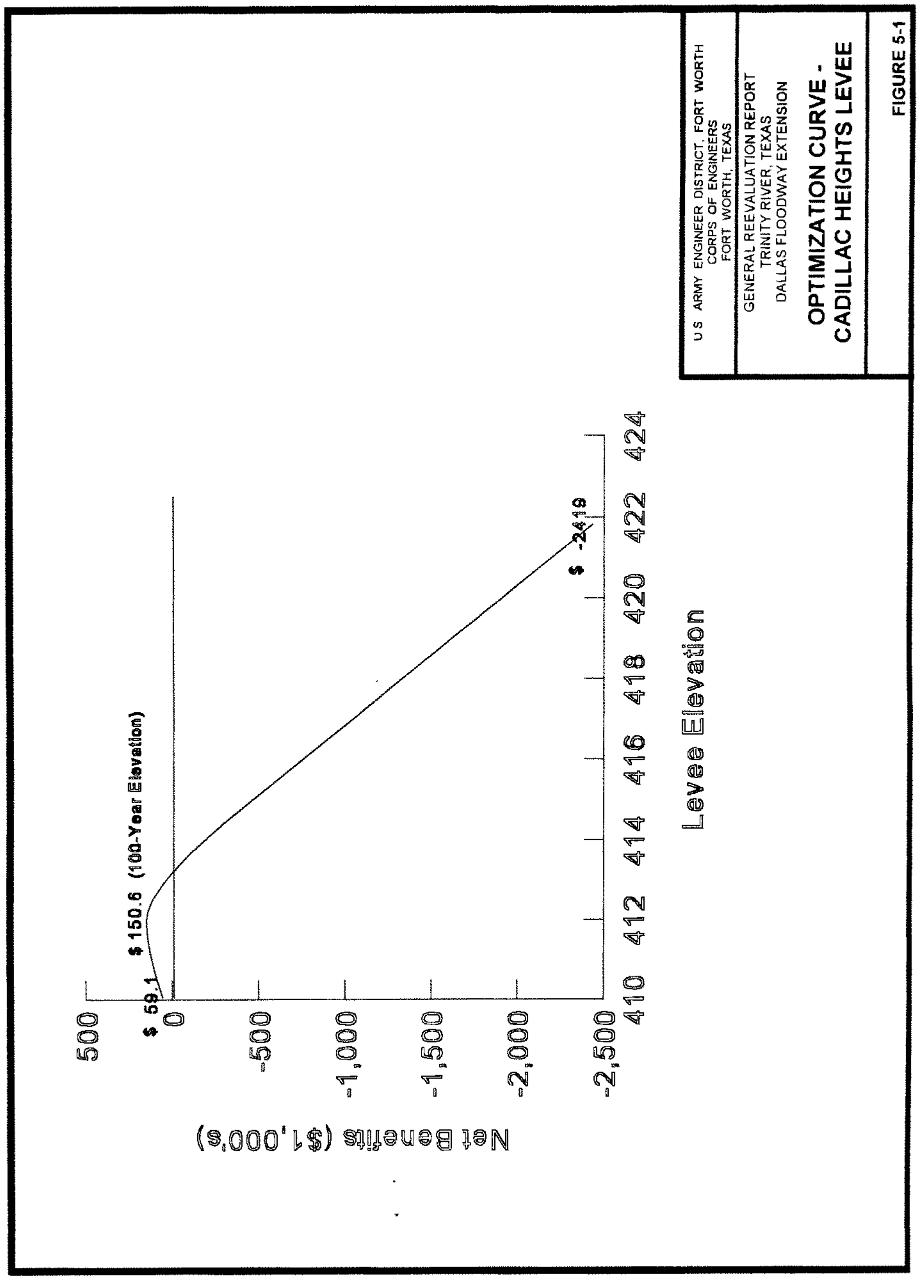
Conclusion

Net benefits continue to increase as the Cadillac Heights Levee increases, fueled by a unique scenario where benefits increase and costs decrease for a higher levee providing protection around Cadillac Heights. However, at a height roughly equal to that of the levee currently being proposed as part of the Tentative Federally Supportable Plan, hydraulic impacts upstream result in an abrupt downturn in the total benefits being achieved. This is summarized in the optimization table 5-1 shown below, and graphically represented in the optimization curve in figure 5-1. This analysis confirms the inclusion of the 100-year Cadillac Heights Levee in the Tentative Federally Supportable Plan.

Table 5-1
Cadillac Heights Levee
Incremental Costs and Benefits for Various Heights
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Levee Elevation at Index Point	Incremental First Costs	Annualized Cost*	Incremental Benefits	Net Benefits of Levee
410.15	$4,795,400	$364,100	$408,700	$44,600
412.15	$4,474,900	$339,700	$475,800	$136,100
421.85	$9,112,700	$691,700	($1,738,800)	($2,430,500)

** Interest during construction not included*



U S ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
OPTIMIZATION CURVE - CADILLAC HEIGHTS LEVEE
FIGURE 5-1
Net Benefits ($1,000's)
500
0
-500
-1,000
-1,500
-2,000
-2,500
Levee Elevation
410
412
414
416
418
420
422
424
$ 59.1
$ 150.6 (100-Year Elevation)
$ -2419

LAMAR LEVEE

As with the Cadillac Heights Levee, the Locally Preferred Plan calls for a levee of sufficient height to provide essentially the same level protection as was originally provided by the existing Dallas Floodway. However, the two levees differ substantially in their performance and effects to upstream areas. The design of the Lamar Street Levee is such that the critical breach elevation of the existing East Levee, located immediately upstream and adjoining the Lamar Levee, is increased by constructing the Lamar Levee to the same height as the existing East Levee. Significant benefits are realized by the Lamar Levee as a result. If, however, the height of the Lamar Levee is decreased, benefits to the upstream reach are also decreased. To validate this assumption, a Lamar Street Levee with 3.1 feet less height than the proposed Tentative Federally Supportable Plan was analyzed. This height matches the current critical breach elevation of the East Levee in the existing Floodway. No levee with a height greater than the Tentative Federally Supportable Plan was analyzed, as this is also the levee height of the Locally Preferred Plan.

Costs of a Lower Levee

The costs associated with a lower levee protecting the Lamar Street area would increase in a similar manner to those of the Cadillac Heights Levee described above, when analyzed on an incremental basis with the chain of wetlands. Due to the amount of excess material present, the incremental cost to construct a lower levee is actually greater than the cost of a higher levee. The first cost of the Lamar Street Levee with a height of 3.1 feet less than the assumed Tentative Federally Supportable Plan is $18,511,200. This is $498,700 **more** than the cost of the higher levee.

Benefit Analysis

The computer program HEC-FDA was again used to determine the amount of gross benefits which would be foregone if a Lamar Street Levee of 3.1 feet less height were constructed. The analysis indicates that residual damages (year 2000 only analyzed) would increase (benefits would decrease) by $2,471,600.

Conclusion

Table 5-2 compares the costs and benefits of a levee protecting the Lamar Street area for two heights, the greater of which is the proposed Tentative Federally Supportable Plan as well as the Locally Preferred Plan. Since the higher levee is the largest plan being pursued by the sponsor, and in accordance with Planning Guidance Letter 97-10, no levee with a greater height than this was analyzed. The comparison shown in the table, and presented in figure 5-2, clearly indicates that the levee height identified in the proposed Tentative Federally Supportable Plan achieves higher net benefits.

Table 5-2
Lamar Street Levee
Incremental Costs and Benefits for Various Heights
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Levee Elevation at Index Point	Incremental First Costs*	Annualized Cost**	Incremental Benefits	Net Benefits of Levee
417.90	$18,511,200	$1,405,300	$134,500	($1,270,800)
421.00	$18,012,500	$1,367,400	$2,606,100	$1,238,700

* *Cost of Existing Rochester Park Levee not included*
** *Interest during construction not included* .

This analysis confirms the inclusion of the SPF Lamar Levee, as did the analysis of the 100-year Cadillac Heights Levee, in the Tentative Federally Supportable Plan.

CONFIRMATION OF INCREMENTAL JUSTIFICATION

Due to the development of more detailed designs and cost estimates for the TFSP and the LPP, a re-analysis of the flood control components of these plans was performed to confirm incremental justification. The costs and benefits of the IH-45 proposal have been included in the chain of wetlands increment for this analysis.

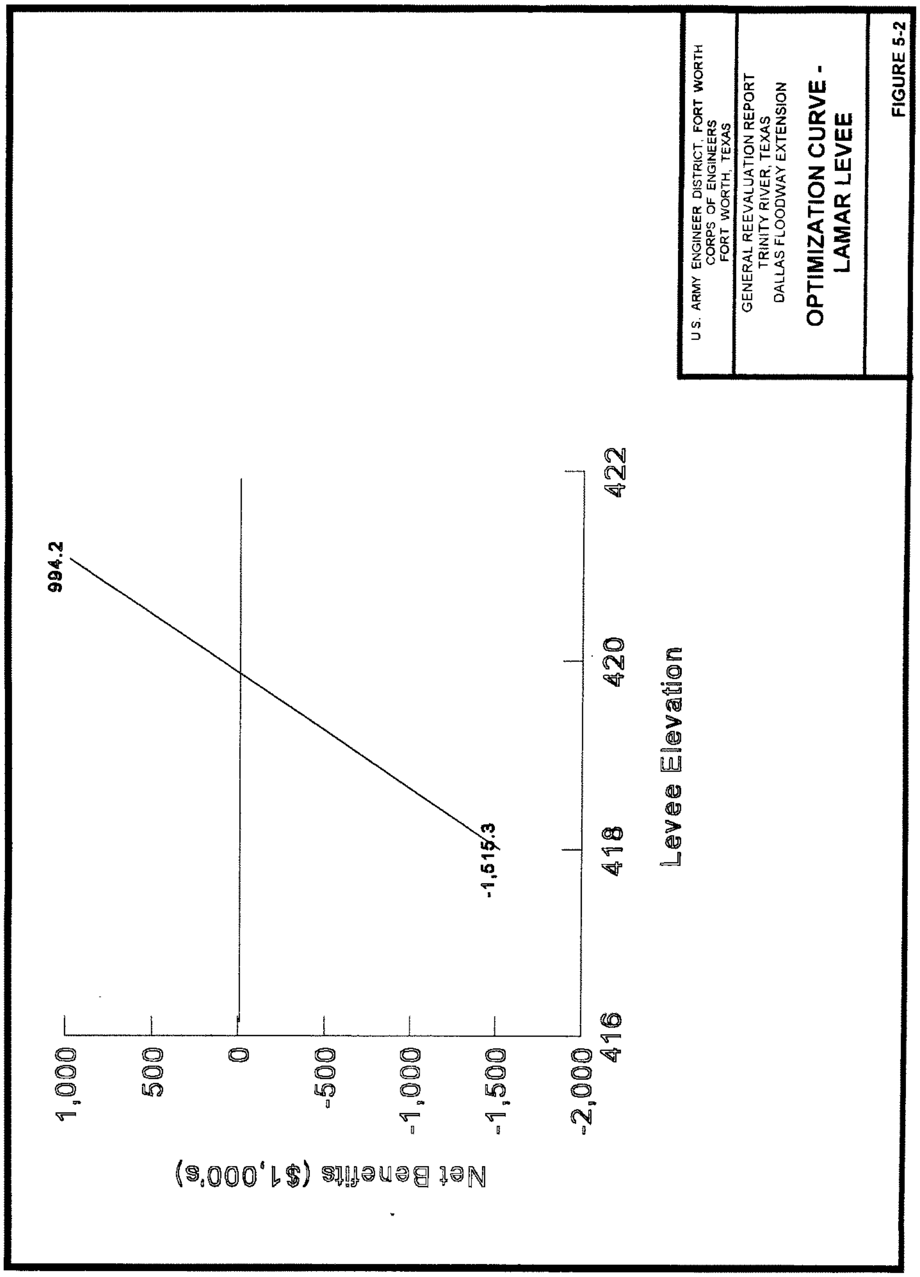
Equivalent annual damages (EAD) were calculated for the TFSP and the LPP to account for changes in urbanization and hydrology. The analysis was performed over a 50-year period from the year 2000 to 2050. All remaining economic analyses presented in this report reflect equivalent annual damages.

In addition to direct inundation reduction benefits to both the immediate study area and the upstream Dallas Floodway area, an annual savings in administration of the flood insurance programs operating expenses would be realized for any structures removed from the 100-year (one percent annual chance of exceedance) floodplain. Estimates of these savings were calculated for each increment of these plans, and incorporated into the overall flood control benefits.

Due to the magnitude and complexity of the proposed plans, phased construction is anticipated. The "Interest During Construction" (IDC) used for the economic analyses was, therefore, calculated in such a manner as to reflect this phased construction, as shown in table 5-3.

Table 5-3
Computation of Interest During Construction
For Incremental Analysis
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Plan	First Cost	Construction Period (months)	Interest During Construction
Chain of Wetlands Only	**$56,034,200**	21	**$3,514,100**
Chain of Wetlands + Lamar	**$74,046,700**		**$3,601,500**
Phase 1	$38,803,400	15	$1,718,000
Phase 2	$35,243,300	18	$1,883,500
Chain of Wetlands, Lamar and 100-year Cadillac Heights (TFSP)	**$78,521,600**		**$3,840,600**
Phase 1	$38,803,400	15	$1,718,000
Phase 2	$39,717,300	18	$2,122,600
Chain of Wetlands, Lamar and SPF Cadillac Heights (LPP)	**$83,159,400**		**$4,499,800**
Phase 1	$38,803,400	15	$1,718,000
Phase 2	$44,356,000	21	$2,781,800



U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
OPTIMIZATION CURVE - LAMAR LEVEE
FIGURE 5-2
Net Benefits ($1,000's)
1,000
500
0
-500
-1,000
-1,500
-2,000
416
418
420
422
Levee Elevation
994.2
-1,515.3

It was assumed that, if the chain of wetlands were the only increment of this project to actually be implemented, construction would be performed under one contract. As shown in table 5-3, the IDC for this effort would total approximately $3.5 million.

It was decided that the addition of levee work, however, would most effectively be designed and managed by breaking the construction into phases. The lower swale, downstream of IH-45, was viewed as the most favorable element to be constructed first. Hydraulic impacts to other project areas would be minimal, and any minor adjustments to design would not likely significantly affect other project features, such as the levees. The cost of constructing the lower swale was estimated at $38.8 million, yielding an IDC amount of approximately $1.7 million. This construction is shown as Phase 1 in table 5-3, for each plan.

For each added increment of the TFSP and the LPP, the incremental cost difference between total construction and the construction of the lower swale is shown as Phase 2, with corresponding IDC amounts. The IDC calculated for each phase of a plan were then added to determine total IDC for implementation of that particular plan.

Table 5-4 presents the incremental economic analysis for the flood control features of the TFSP and the LPP. As shown, the Lamar Levee remains economically justified, with $369,400 in net annual flood control benefits and a BCR of 1.17. The 100-year Cadillac Heights Levee also remains economically justified, with $62,900 in net annual flood control benefits and a BCR of 1.15. The SPF Cadillac Heights Levee is not incrementally justified.

BASIS FOR REQUEST FOR EXCEPTION

Based on these findings, the only difference between the Tentative Federally Supportable Plan and the Locally Preferred Plan would be the incremental height difference between the 100-year (.01 probability of exceedance) Cadillac Heights Levee and the SPF (.00125 probability of exceedance) levee. The corresponding incremental cost difference between the two plans would be the responsibility of the local sponsor, unless an exception is granted from ASA(CW), allowing full Federal participation in the LPP.

In light of sensitive social equity issues which would arise from the city's support for building a project providing less protection to the neighborhood on one side of the river than on the other, the city requested full Federal participation in the LPP, which would include the non-justified increment of the Cadillac Heights Levee from the 100-year level of protection to the SPF level. The following sections provide comparative data between the two plans, and rationale for such an exception.

ECONOMIC COMPARISON OF PLANS

Table 5-5 presents a side-by-side comparison of the proposed TFSP and the LPP. As a total system, the Tentative Federally Supportable Plan would have net annual flood control benefits of $6.8 million, with a BCR of 1.81. Comparatively, the LPP would have net annual flood control benefits of $4.1 million, with a BCR of 1.46. These lower net benefits for the LPP would be attributable to higher water surface elevations caused by greater confinement of extreme-event flows with SPF levees.

DIFFERENCES BETWEEN THE TENTATIVE FEDERALLY SUPPORTABLE PLAN AND THE LPP

The improvements which the LPP would give to the project area above the Tentative Federally Supportable Plan are as follows:

- The LPP would provide a higher level of protection to the project area (Cadillac Heights).
- The Tentative Federally Supportable Plan would leave a portion of the study area subject to flooding from major events above 100-year frequencies. Comparatively, the LPP would provide SPF protection to the major damage centers within the study area. With implementation of the LPP, 287 structures in the Cadillac Heights area would no longer be at risk from the SPF event. Construction of the Tentative Federally Supportable Plan would allow that 207 structures would no longer be at risk from the 100-year flood event within the same area, but would leave 271 structures subject to inundation in SPF events.
- The Tentative Federally Supportable Plan would provide lower levels of protection to one side of the river, while the LPP would provide equal SPF protection to both sides.
- The environmental impacts to critical natural resources, such as bottomland hardwoods and/or wetlands, would not increase when going from the Tentative Federally Supportable Plan to the LPP.
- The LPP would add $0.5 million in annual costs and would reduce annual net benefits by $2.7 million. The length of the Cadillac Heights levee is 1.1 miles (TFSP) and 2.25 miles (LPP).
- The Tentative Federally Supportable Plan would not fully offset the adverse hydraulic impacts to the residential areas in the Floodway Extension area that have resulted from construction of upstream portions of the existing Dallas Floodway and from upstream changes in watershed development. The LPP would fully offset these impacts.

Trade-offs exist between the two plans. The Tentative Federally Supportable Plan offers more net flood damage reduction benefits, whereas, the LPP offers flood protection greater than 100-year at a small increase in cost.

The LPP would reduce expected annual flood damages in the study area by $13.1 million from baseline conditions. Comparatively, the Tentative Federally Supportable Plan would reduce expected annual flood damages by $15.3 million, or $2.2 million more. The LPP would reduce flood protection for extreme events upstream in the existing Dallas Floodway, while increasing the level of protection for rare, but relatively more frequent events, to the people in the Cadillac Heights neighborhood.

Table 5-4
Incremental Analysis of the TFSP and LPP - Flood Control Only
(April 1998 prices, 7.125% interest, 50-year period of analysis)

Description	Chain of Wetlands	Chain of Wetlands Plus SPF Lamar	SPF Lamar Incremental	Tentative Federally Supportable Plan	100-Year Cadillac Incremental	Locally Preferred Plan	SPF Cadillac Incremental
INVESTMENT							
Estimated First Cost	$56,034,200	$74,046,700	$18,012,500	$78,521,600	$4,474,900	$83,159,400	$9,112,700
Interest During Construction	$3,514,100	$3,601,500	$87,400	$3,840,600	$239,100	$4,499,800	$898,300
Cost of Non-Federal Levees	$14,220,000	$23,120,000	$8,900,000	$23,120,000	$0	$23,120,000	$0
Investment Cost	$73,768,300	$100,768,200	$26,999,900	$105,482,200	$4,714,000	$110,779,200	$10,011,000
ANNUAL CHARGES							
Interest	$5,256,000	$7,179,800	$1,991,300	$7,779,300	$347,700	$8,169,900	$738,300
Amortization	$173,900	$237,500	$58,400	$228,200	$10,200	$239,700	$21,700
O&M ($/year)	$199,000	$386,000	$187,000	$441,000	$55,000	$527,000	$141,000
Replacements	$0	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$5,628,900	$7,803,300	$2,236,700	$8,448,500	$412,900	$8,936,600	$901,000
ANNUAL BENEFITS							
Inundation Reduction	$3,798,200	$4,876,700	$1,078,500	$5,337,000	$460,300	$5,286,800	$410,100
Insurance Subsidy	$30,500	$78,700	$48,200	$94,200	$15,500	$94,200	$15,500
Existing Dallas Floodway	$7,311,400	$8,790,800	$1,479,400	$8,790,800	$0	$6,626,400	($2,164,400)
IH-45 Proposal	$1,043,500	$1,043,500	$0	$1,043,500	$0	$1,043,500	$0
TOTAL ANNUAL BENEFITS	$12,183,600	$14,789,700	$2,606,100	$15,265,500	$475,800	$13,050,900	($1,738,800)
NET ANNUAL BENEFITS	$6,554,700	$6,986,400	$369,400	$6,817,000	$62,900	$4,114,300	($2,639,800)
BENEFIT - COST RATIO	2.16	1.90	1.17	1.81	1.15	1.46	-1.93

NOTE: Costs and benefits shown are not comparable to those presented in tables 4-27 and 4-28, due to the incorporation, in this table, of more detailed cost estimates, the addition of insurance subsidy benefits, and the inclusion of average annual equivalent benefits, which account for future changes in urbanization and hydrology.

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Table 5-5
Benefit-Cost Comparison of Tentative Federally Supportable Plan and LPP
Flood Control Only

(April 1998 prices, 7.125% interest, 50-year period of analysis)

Project Alternatives Include Land/Mitigation & HTRW Costs	TFSP	LPP
INVESTMENT		
Estimated First Cost	$78,521,600	$83,159,400
Interest During Construction	$3,840,600	$4,499,800
Cost of Non-Federal Levees	$23,120,000	$23,120,000
Investment Cost	$105,482,200	$110,779,200
ANNUAL CHARGES		
Interest	$7,779,300	$8,169,900
Amortization	$228,200	$239,700
Operation/Maintenance ($/year)	$441,000	$527,000
Replacements	$0	$0
TOTAL ANNUAL CHARGES	**$8,448,500**	**$8,936,600**
ANNUAL BENEFITS		
Inundation Reduction	$5,337,000	$5,286,800
Insurance Subsidy	$94,200	$94,200
Existing Dallas Floodway	$8,790,800	$6,626,400
IH-45 Proposal	$1,043,500	$1,043,500
TOTAL BENEFITS	**$15,265,500**	**$13,050,900**
NET BENEFITS	**$6,817,000**	**$4,114,300**
BENEFIT-COST RATIO	**1.81**	**1.46**

OTHER SPECIAL CONSIDERATIONS

- The original Dallas Floodway Extension project, authorized in 1965, contained levees, channels, and lake features designed to provide SPF protection to both the northern and southern portions of the city of Dallas. The Locally Preferred Plan would provide for similar outputs at a lower total project cost. The estimated cost of the authorized improvements to the Dallas Floodway Extension area, at April 1998 price levels, would be $199.2 million. The TFSP, at the same price levels, was estimated to cost $118.5 million, including $23.1 million for compatible portions of previously constructed non-Federal levees. The LPP was estimated to cost $123.2 million, including $23.1 million for compatible portions of previously constructed non-Federal levees.

- The existing Dallas Floodway (which consists of levees and channels) was built in the 1950's to the SPF level of protection. The upstream channels convey flood waters downstream more quickly and the upstream levees confine flood waters which previously spread out over the upstream floodplain. Both factors have raised the downstream water surfaces and led to more severe flooding in the Dallas Floodway Extension area when storm events occur.

- The DFE areas to receive increased flood protection include Cadillac Heights, Joppa, South Dallas, and Lamar Street Industrial area. These areas are mainly low income minority residential neighborhoods and light industrial facilities.

- Flood records clearly demonstrate the need for downstream improvements. Over the years repeated flooding has caused losses of life, and led to significant financial losses to residences, businesses, and infrastructure in the Dallas Floodway Extension area. In addition, repeated flooding has created undesirable physical conditions within the area forcing some people and businesses to relocate from the area. Such conditions have also prevented economic growth and adversely affected community economic health.

- The Texas Department of Transportation initiated a Major Investment Study of the traffic congestion in the Dallas area in June 1996. This study recommends improvements estimated to cost in excess of $1 billion, and include a road way (Trinity Parkway Reliever) within the existing floodway and extend southward utilizing a portion of the proposed Dallas Floodway Extension project. Construction of the SPF levee around the Cadillac Heights area would protect both existing roads as well as any new improvements from catastrophic flood events.

ASA(CW) DECISION REGARDING REQUEST FOR EXCEPTION

This section describes the pertinent information submitted to the ASA(CW) for use in making a decision regarding the Request for Exception. **It is noted that the plan identified as the Tentative Federally Supportable Plan (TFSP) in the preceding sections, and in Chapter 4, of this report, was referred to as the Federally Supportable Plan in the April 1998 draft GRR/EIS. This designation was in accordance with the District's interpretation of current policy guidelines. The formal Request for Exception, and all supplemental information submitted to the Office of the ASA(CW) subsequent to the release of the draft GRR/EIS, as discussed below, reflect the designation of this plan (which includes the one percent Cadillac Heights Levee) as the Federally Supportable Plan. The final decision regarding the appropriately designated Federally Supportable Plan is presented below.**

FORMAL SUBMITTAL OF REQUEST FOR EXCEPTION

On June 3, 1998, a formal Request for Exception was submitted by the Fort Worth District, Corps of Engineers, to the Southwestern Division Commander, which presented comparative data between the Federally Supportable Plan (as identified in the draft GRR/EIS) and the Locally Preferred Plan, and recommended that the request be granted, thereby allowing the LPP to be constructed with full Federal cost sharing. This request, accompanied by the Division Commander's endorsement, is included in Appendix M herein. This document contained the information shown in the "BASIS FOR REQUEST FOR EXCEPTION" section above, and additional information required by paragraph 5.17 of ER 1105-2-100. The pertinent information contained in the request, beyond that previously presented, included the following:

- **Urban Flood Protection:** Neither the FSP nor the LPP would leave urban areas within the post-project 100-year floodplain, although the confidence limits applied to the protection of Cadillac Heights would be rather low. The FSP would, however, leave a portion of the study area, including the Cadillac Heights area, subject to flooding from major events above the one percent probability of exceedance.

- **Cost Sharing Impacts:** Based on the data and price levels presented in the draft GRR/EIS, table 5-6 presents the total Federal / non-Federal cost apportionment data, after application of the levee credit, for the FSP, the LPP with an exception, and the LPP without an exception.

Table 5-6
Comparative Cost Apportionment Data in
Request for Exception
(April 1998 prices)

Cost Apportionment	FSP *	LPP With Exception	LPP Without Exception
Federal Cost	$101,019,300	$102,216,600	$101,019,300
Non-Federal Cost	$17,470,200	$20,942,600	$22,139,900
Total Cost	$118,489,500	$123,159,200	$123,159,200

** FSP, as identified in the April 1998 draft GRR/EIS, which included the one percent Cadillac Heights Levee*

- **Residual Damages:** The SPF Cadillac Heights Levee in the LPP is less likely to overtop and fail due to its increased height relative to the one percent levee in the FSP. Annual residual damages from the Trinity River, in the Cadillac Heights area, would be $100,500 with the one percent levee and $17,100 with the SPF levee. Annual residual damages for the entire project area would be $6.0 million with the one percent levee and $8.2 million with the SPF levee.

- **Concentration of Damages:** The proposed Lamar Levee is justified at the SPF level. Implementing the Cadillac Heights Levee at a comparatively lower height would cause flood damages to concentrate in the Cadillac Heights area when flood events exceed the one percent annual chance of exceedance (ACE).

- **Characteristics of Protected Area:** The Cadillac Heights Levee would protect an area with a mix of commercial, residential, and public infrastructure facilities. However, the primary beneficiaries of the increased flood protection would be the residents. The sponsor's commitment to providing equal protection to the residents is highlighted by their desire to pursue higher flood protection for Cadillac Heights, while electing not to pursue increased flood protection to the city-owned Central Wastewater Treatment Plant.

- **Concerns of Others:** The sponsor was very concerned about the social inequity and public acceptability issues that construction of the FSP could generate. Social inequity is already an issue due to perceptions that the Dallas Floodway project shifted flood damages from the central business district to low-income and minority neighborhoods.

The Request for Exception was reviewed by Headquarters, U.S. Army Corps of Engineers (HQUSACE), and forwarded to the Office of the Assistant Secretary of the Army (Civil Works), by letter dated August 18, 1998. This letter, .which is included in Appendix M herein, provided additional discussion regarding the FSP (as identified in the draft GRR/EIS) and the LPP, and identified three cost sharing options, as presented below:

- **Federally Supportable Plan (FSP):** The FSP would restore SPF level of protection to the existing Federal levees, would provide the same to the Lamar Street Community, but would only provide protection from the 1.0% ACE (100-year) flood for the Cadillac Heights Community. With implementation of the FSP, a flood event greater than the 1.0% ACE flood would overtop at the Cadillac Heights Levee and subject the community to a real possibility of loss of life. The Cadillac Heights Levee, being lower, would overtop prior to the other higher levees. A 1.0% ACE flood would likely overtop the proposed FSP Cadillac Heights Levee. About 131 residential and 29 commercial structures would incur damages, putting approximately 328 people at risk. The maximum flood depth, which is measured at the lowest protected structure, would be 10.7 feet. A Standard Project Flood would overtop the FSP at the Cadillac Heights levee by over 9 feet. About 215 residential and 66 commercial structures would incur damages, putting approximately 538 people at risk. The maximum flood depth would be approximately 20 feet.

- **Locally Preferred Plan (LPP):** The LPP would provide the same level of protection to the Cadillac Heights Community as would be provided to the Lamar Levee, and to the East and West Levees of the existing Dallas Floodway. Current risk and uncertainty modeling programs, which calculate levels of confidence only up to a 0.2% ACE (500-year) flood, show that these levees would provide protection from the 0.2% ACE (500-year) flood, with confidence levels varying from 86% to 92%. They would pass the SPF with lesser confidence levels. It is likely that the LPP will be the recommended plan in the final report, as the sponsor is not willing to implement the FSP. The non-Federal sponsor is fully aware that the LPP would provide a lesser, but consistent level of protection for the four leveed areas. In all cases, the level of protection that would be provided by the LPP would be far greater than that provided without a project. The community is willing to accept this trade-off condition. The Sponsor, and community at large, do not feel that the Federally Supportable Plan (as identified in the draft GRR/EIS) is implementable because of the social impacts that are evident; that is, providing a lower level of protection, and higher risk of loss of life, to the low-income, minority community of Cadillac Heights.

- **Options:**

  1. Construct the FSP with traditional cost sharing (75% Federal; 25% non-Federal).
  2. Construct the LPP at 100 percent non-Federal cost above the FSP level.
  3. Construct the LPP at full traditional cost sharing (75% Federal; 25% non-Federal).

The recommendation of HQUSACE was for selection of Option 3, as it was felt that not only would the FSP be socially unacceptable from the sponsor's point of view, but the economic cost of the LPP should not be weighed against the increased risk to life in a low-income, minority community, while a higher level of protection and lower risk to life would be provided to the rest of the community. By selecting the LPP, emphasis would be placed on lives, people, equality and implementability.

SUPPLEMENTAL INFORMATION

Prior to finalizing a decision regarding the request for exception, additional information was requested by the office of the ASA(CW). This supplemental information was provided, as seen in Appendix M, and included the following: a tabularized listing of flow capacity (design discharge) and level of protection for the authorized plan, for existing conditions, and for future conditions without the project, with the FSP, and with the LPP; data regarding levels of confidence for the various levees; hydrologic conditions (current or future) upon which the levels of confidence are based; information regarding whether the FSP Cadillac Heights Levee would meet FEMA certification requirements; determination of whether the Cadillac Heights Levee is needed to mitigate the effects of other elements of the project; and, comparative socio-economic data between the Cadillac Heights neighborhood and the city of Dallas.

In response to these requests, the following information was provided:

- Table 5-7 presents the flow capacity and level of protection for various scenarios and provides a general understanding of the changing conditions.

Table 5-7
Flow Capacity and Level of Protection
for Various Scenarios

Scenario	Flow Capacity (cfs)		Level of Protection	
Existing Dallas Floodway (1960)	226,000 (design)		SPF	
Authorized Plan	270,000 (design)		SPF	
Current Conditions	212,000		550-year (Floodway only)	
Year 2050 without Project	192,000		400-year (Floodway only)	
Year 2000 with FSP	Cadillac	Remainder	Cadillac	Remainder
	115,200	269,200	100	SPF
Year 2000 with LPP	269,200		SPF	

- Two tables in the GRR/EIS (Tables D-34 and D-35 in Appendix D) provide the levels of confidence for the levees in the FSP and the LPP, respectively. These tables do not provide confidence levels for the SPF. The model used for the computation, HEC-FDA, does not provide this information primarily because the SPF varies in frequency from watershed to watershed. Table 5-8 presents a comparative summary of the levels of confidence for passage of the 100-year (1% ACE) and the 500-year (0.2% ACE) flood events in the critical reaches (Cadillac Heights, Lamar Street, East Levee of existing Floodway, West Levee of existing Floodway) of the study area with implementation of the FSP and the LPP.

Table 5-8
Levels of Confidence for Levees

Levee / Reach	FSP		LPP	
	100-Year Flood (1% ACE)	500-Year Flood (0.2% ACE)	100-Year Flood (1% ACE)	500-Year Flood (0.2% ACE)
Lamar	98%	80%	99%	92%
Cadillac Heights	34%	5%	99%	91%
East Levee	99%	92%	99%	86%
West Levee	99%	90%	99%	86%

- The levels of protection cited in the Request for Exception are based on year 2000 hydrology. Year 2050 hydrology was used in the development of average annual equivalent economic damages. In summary, the LPP would provide essentially consistent levels of protection to all reaches except the Central Wastewater Treatment Plant (CWWTP). The FSP would provide consistent levels of protection to all reaches except the CWWTP and Cadillac Heights. If the FSP were built, the 100-year Cadillac Heights Levee would be the only urban flood levee within the Fort Worth District to have a design level lower than SPF.

- The height of the Cadillac Heights Levee in the FSP was derived during the economic optimization process, without regard to the FEMA certification requirements. For this levee to meet FEMA's requirements, it would have to be approximately three feet higher than formulated. Therefore, the economic benefits ($15,500) previously attributed to the FSP Cadillac Heights for reduction in administration costs for insurance subsidy programs would be invalid. This reduction in benefits, however, would not change the economic feasibility of the levee.

- It is the District's belief that the Cadillac Heights Levee would not be constructed as mitigation for other project elements, and that from an economic and hydraulic perspective, this levee is a separable element. However, from the public perspective, its separability is questionable due to the public belief that the lower Cadillac Heights Levee was designed as a safety valve to protect the Central Business District and the north side of the Trinity River at the expense of the minority population in the poorer Cadillac Heights neighborhood.

- Table 5-9, provided by the City of Dallas, presents comparative socio-economic data between the Cadillac Heights neighborhood and city as a whole.

Table 5-9
Comparative Socio-Economic Data -
Cadillac Heights vs. City of Dallas

	Cadillac Heights	City of Dallas
Number of Homes	416	479,622
High / Low Price of Homes	$53,500 / $3,960	$11,949,900 / NA
Average Appraised Value	$17,500	$64,700
Percent Homeowners	51.5%	44.1%
Percent Single-Family Units	64.9%	47.5%
Percent Multi-Family Units	31.0%	50.4%
Number of Persons	1,168	1,052,300
Percent Persons Under 18	35.5%	25.0%
Percent Persons Over 65	6.8%	9.7%
Total Percent Hispanic	58.0%	20.3%
Total Percent Black	40.9%	29.5%
Total Percent White	1.0%	47.7%
Total Percent Without High School Degree	73.4%	26.5%
Total Percent Unemployed	9.1%	7.4%
Average Income	$15,089	$27,489
Percent Households on Public Assistance	35.4%	5.7%
Number of Persons Below Poverty Level	46.6%	17.8%

FINAL IDENTIFICATION OF FEDERALLY SUPPORTABLE PLAN

Upon evaluation of the request to recommend a Standard Project Flood (SPF) level of protection for the DFE project, and based upon the data submitted in support of this recommendation, the Assistant Secretary of the Army (Civil Works), by letter dated November 9, 1998, decided that the project providing a consistent SPF level of protection did not require an exception to policy guidelines, but is the Federally Supportable Plan. In other words, the Locally Preferred Plan is the Federally Supportable Plan.

This decision was made for the following reasons. First, the alternative levee for the Cadillac Heights neighborhood would not meet the Federal Emergency Management Agency standards for protecting the area from a flood that would have a 1.0 percent annual chance of exceedance (ACE), nor would it provide an acceptable level of reliability, particularly when compared with other project elements. Second, the alternative levee for Cadillac Heights would allow continued damages in this area from major, although infrequent floods (greater than the 1.0% ACE), due to the construction of other project levees. Finally, Congress has already authorized the project, including the Cadillac Heights Levee, at a SPF level of protection.

IDENTIFICATION OF THE RECOMMENDED PLAN

In accordance with the decision of the Assistant Secretary of the Army (Civil Works) designating the Locally Preferred Plan as the Federally Supportable Plan, this plan is therefore designated the Recommended Plan, and is recommended for implementation. This plan would consist of the following elements:

- **Chain of Wetlands:** The chain of wetlands increment would consist of upper and lower swales, separated at Interstate Highway (IH) 45. The upper swale would have an average 400-foot bottom width and would extend from Cedar Creek to the oxbow lake at IH-45, a distance of about 1.5 miles. The lower swale would have an average 600-foot bottom width, would extend between IH-45 and Loop 12, a distance of about 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course to minimize impacts to forested areas and nearby residential areas. Excavated wetlands and vegetative plantings would be added as environmental restoration features within the footprint of the swales to form a "chain of wetlands."

- **Channel Realignment at IH-45:** The channel realignment at IH-45, as proposed by TxDOT, would allow the river to flow within a wider span of the IH-45 bridge which was better designed to accommodate river flows. This realignment would reduce the risk of catastrophic failure of this vital bridge, and would significantly reduce current annual maintenance costs associated with debris removal around the bridge columns.

- **SPF Lamar Levee:** This increment would include construction of an earthen levee providing SPF protection (.00125 probability of exceedance) for the Lamar Street area. This levee would extend from the existing Dallas Floodway East Levee to the previously constructed Rochester Park Levee, a distance of 2.9 miles.

- **SPF Cadillac Heights Levee:** This increment would include an earthen levee and providing SPF protection (.00125 probability of exceedance) for the Cadillac Heights area. This levee would extend from near Cedar Creek to the Central Wastewater Treatment Plant (CWWTP), would utilize and raise of portion of the northwest comer of the CWWTP Levee, and would extend to high ground near the intersection of Kiest Boulevard and McGowan Avenue, a total distance of approximately 2.2 miles.

- **Non-Federal Levees:** In addition to the levees described above, the Recommended Plan would also include the costs and benefits of the portions of the previously constructed non-Federal levees. The total cost for the compatible portions of these levees was estimated at $23.1 million ($14.2 million for the CWWTP Levee upgrade and $8.9 million for the compatible portion of the Rochester Park Levee).

- **Recreation Features:** The Recommended Plan would include recreation amenities compatible with the regional recreation master plan, including hike/bike trails, equestrian trails, nature trails and pavilions.

At April 1998 price levels, the flood control first cost of the Recommended Plan was estimated at approximately $78.5 million, plus $23.1 million for the non-Federal levees, for a total economic flood control first cost of $101.6 million. Annual flood control costs were estimated at $8.4 million, with net annual flood control benefits of $6.8 million, and a BCR of 1.81.

Additional details and costs for the Recommended Plan are presented in Chapter 6 of this document.

CHAPTER 6

RECOMMENDED PLAN

CHAPTER 6
RECOMMENDED PLAN

This chapter provides details on the Recommended Plan, as determined in the preceding chapters of this report, and as modified per the comments received from higher Corps authorities, the public, and various local, state and Federal agencies during the 90-day public review period, which ended August 14, 1998. These comments, with appropriate responses, are included in Appendix N of this document. The revised, detailed cost estimate for this plan is shown in Appendix K. In addition, the costs and economic analyses presented in this chapter were updated to reflect October 1998 price levels and the current Federal interest rate of 6-7/8%. Federal and non-Federal cost apportionment data for implementation of the plan are also presented.

The Recommended Plan would consist of flood damage reduction features, with associated environmental mitigation requirements, environmental restoration features, including a chain of wetlands, and recreation amenities. Due to the complexities of displaying all the features at a legible scale, figure 6-1 presents the features of the Recommended Plan, excluding recreation. Figure 6-2 shows all the project features of the Recommended Plan, but at a reduced scale.

PLAN FEATURES

CHAIN OF WETLANDS AND CHANNEL REALIGNMENT AT IH-45

The chain of wetlands portion of the proposed project would consist of an upper wetland chain, with four separate wetland cells, and a lower wetland chain, with three separate cells, each of various lengths and shapes. During flooding, the upper and lower chains would act as flood control channels to convey flood waters to outfalls east of IH-45 and north of Loop 12, respectively. During non-flood periods, the chains would serve as wetland areas for various wildlife and aquatic growth. Each cell would have a concrete stoplog inlet control structure and a standard concrete headwall outlet structure, connected by 36-inch diameter reinforced pipe. The typical section of a wetland cell would vary in depth from 1.5 feet to 7 feet, with various slopes and shelves to support aquatic life and vegetation. These wetland cells are described and shown in more detail in Appendix C.

Flooding from the Trinity River would be the main source of water for the wetland cells; however, in times of low flows or drought, water would be pumped from an existing wetland cell just north of the Central Wastewater Treatment Plant.

Drilling and testing operations were conducted in the proposed project area to ascertain geotechnical data, HTRW data, and cultural resource information. Geotechnical parameters developed as a result of this drilling and testing are discussed in Appendix B. Results of HTRW testing are explained in detail in Appendix J, while significant cultural/historic resource information is presented in Appendix H.

Quantities and costs for the chain of wetlands are provided in Appendix K. Since the chain of wetlands would include both flood control features and environmental restoration features, these quantities were calculated separately. Real estate costs for the swale were estimated at $13.7 million, including $2.6 million for mitigation lands. Environmental mitigation costs for the flood control portion of the chain of wetlands, excluding lands, were estimated at $0.3 million.

A review of preliminary HTRW investigations indicated the presence of lead-containing leachate at the Linfield Landfill site, through which the lower chain of wetlands would traverse. Avoidance of this area has been restricted by the presence of a historic neighborhood on the west side of the landfill, and the river on the east. The chain of wetlands has been designed at the extreme western boundary of the landfill in order to avoid more hazardous materials thought to be present in the eastern portions of the landfill. Alternatives which would provide for construction of a channel on the east side of the river, opposite the landfill, have been vigorously opposed due to the environmental significance of the "Great Trinity Forest" which encompasses that area. A slurry trench was designed to prohibit leachate from entering the swale from the landfill during and after construction, and a three-foot cover of select material was proposed for the exposed material within the swale. More detailed investigations completed in November 1998 concluded that the leachate did not warrant classification as hazardous waste, but could be handled as Class I industrial waste. Detailed results of the HTRW investigations are provided in Appendix J.

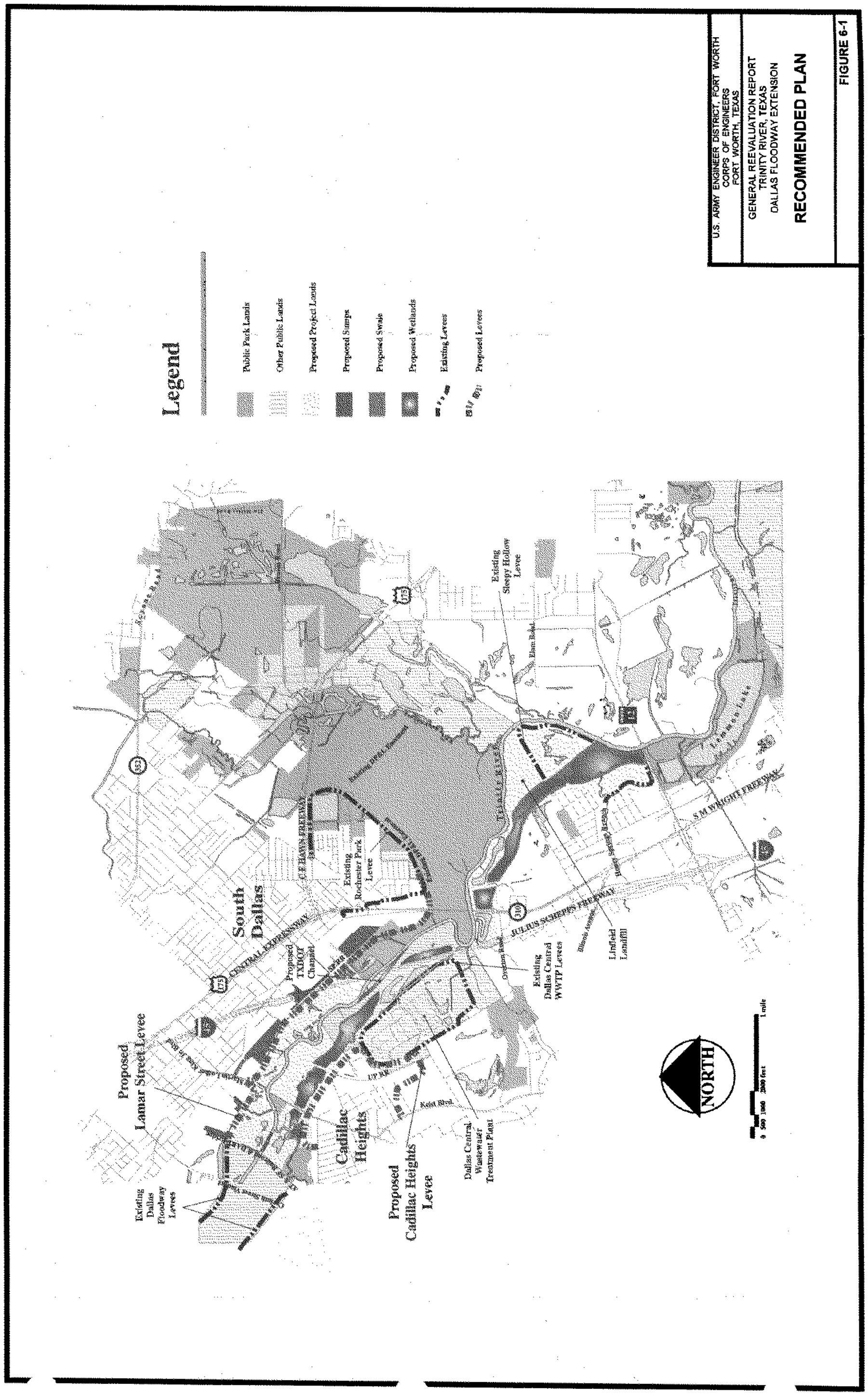
Channel Realignment at IH-45 Bridge

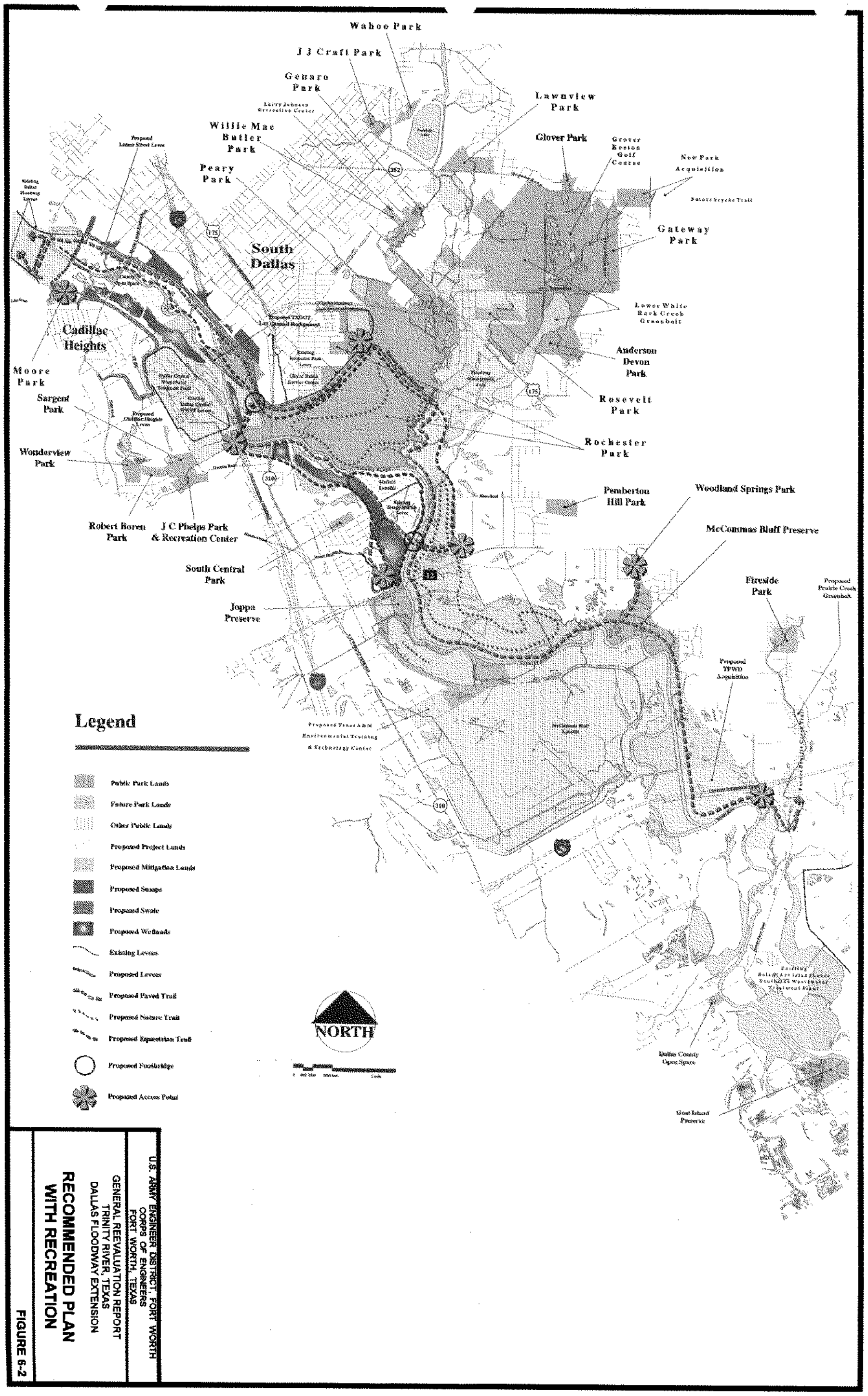
The proposed trapezoidal channel would be approximately 3,300 feet in length, with a 30-foot bottom width, 3H:1V side slopes, and a top width of approximately 180 feet. The existing river channel in the reach where the realignment is proposed has an average bottom slope that is nearly zero. Therefore, the proposed channel realignment section has been designed with a zero bottom slope from beginning to end. The proposed channel would have an average depth of 15 feet and has been designed to closely approximate the channel flow capacity and the flow velocities of the existing river channel. The proposed channel alignment would be centered between the nearest 320-foot span of the IH-45 bridge. Excavation around the piers would not be required. The proposed realignment will result in the channel being moved laterally a maximum distance of about 350 feet.

The existing channel would be filled to the existing top of bank elevation 396.0 to prevent further collection of debris. Relocation of the channel would result in modifications to the existing Central Mitigation Swale, which would be reduced in size by filling of the portion of the swale near the proposed channel realignment. A minimum of 150 feet from the top of bank of the proposed river channel realignment to the top of the bank of the Central Mitigation Swale would be required.

Several alternatives regarding filling of the old river channel have been investigated. The investigated alternatives would accomplish the primary goals of the IH-45 bridge channel realignment project to some degree, but the proposed plan for the channel realignment would accomplish these goals with a minimal risk to the bridge structure and a minimal filling of the old channel. The primary objectives of the project would be to reduce the risk of damage to the bridge piers from floating debris and reduce or eliminate the cost of continual maintenance to remove the debris and periodically repair the structure. The proposed plan to fill the old channel would be to fill from the upstream diversion of the river channel to the downstream side of the bridge. The fill would be placed up to the level of the existing overbank areas at the approximate elevation of 396.0 and would be placed around the existing bridge piers located within the old channel. This alternative was deemed the only partial channel fill plan that would ensure complete diversion of channel confined flows and minimize the risk to the existing bridge piers. The channel fill would terminate at the downstream end with a very gradual slope to the streambed of the old channel just downstream of the bridge piers. A portion of the old channel downstream of the IH-45 bridge would remain unfilled. This unfilled portion of the old channel would provide a slack water area for use as a possible river access point, and may provide some habitat diversity near the river. The filled portion of the old river channel would maximize the diversion of channel confined river flows to the new channel alignment, stabilize the bridge piers in the old channel, and minimize the risk of floating debris collecting on the bridge piers. TxDOT maintains an access road directly beneath the IH-45 bridge which provides access to the river channel from either side of the river. Filling of the old river channel beneath the bridge, as proposed, would provide continued access to the river channel for inspection and maintenance. A plan view of the proposed relocation of the Trinity River channel at IH-45 may be found in Appendix C.

Approximately 287,200 cy of excavation would be required for this channel, and approximately 60,300 cy of fill would be placed within the existing channel, as described above. The total construction cost for the channel realignment proposal was estimated at approximately $2.0 million, and would provide annual benefits of $1.0 million. Approximately 71 acres of mitigation would be required for this work effort.


Legend
Public Park Lands
Other Public Lands
Proposed Project Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Proposed Lamar Street Levee
South Dallas
Cadillac Heights
Proposed Cadillac Heights Levee
Existing Dallas Floodway Levees
Existing Rochester Park Levee
Existing Sleepy Hollow Levee
Proposed TXDOT Channel
Existing Dallas Central WWTP Levees
Dallas Central Wastewater Treatment Plant
Linfield Landfill
CENTRAL EXPRESSWAY
C F HAWN FREEWAY
JULIUS SCHEPPS FREEWAY
S M WRIGHT FREEWAY
NORTH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
RECOMMENDED PLAN
FIGURE 6-1


Wahoo Park
J J Craft Park
Genaro Park
Lawnview Park
Willie Mae Butler Park
Glover Park
Grover Keeton Golf Course
New Park Acquisition
Peary Park
South Dallas
Gateway Park
Lower White Rock Creek Greenbelt
Cadillac Heights
Moore Park
Anderson Devon Park
Sargent Park
Rosevelt Park
Wonderview Park
Rochester Park
Pemberton Hill Park
Woodland Springs Park
Robert Boren Park
J C Phelps Park & Recreation Center
McCommas Bluff Preserve
South Central Park
Fireside Park
Joppa Preserve
Proposed TPWD Acquisition
Legend
Public Park Lands
Future Park Lands
Other Public Lands
Proposed Project Lands
Proposed Mitigation Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Proposed Paved Trail
Proposed Nature Trail
Proposed Equestrian Trail
Proposed Footbridge
Proposed Access Point
NORTH
Dallas County Open Space
Goat Island Preserve
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
GENERAL REEVALUATION REPORT
TRINITY RIVER, TEXAS
DALLAS FLOODWAY EXTENSION
RECOMMENDED PLAN WITH RECREATION
FIGURE 6-2

Summary

Total costs for the flood control portion of the chain of wetlands and channel realignment at IH-45, including preconstruction engineering and design and construction management were estimated at approximately $59.1 million. The addition of $14.2 million for the non-Federal CWWTP Levee upgrade, in accordance with Section 351 of WRDA 1996, brought the total estimated cost for the flood control portion of the chain of wetlands increment of the Recommended Plan to approximately $73.3 million.

The detailed cost estimate for the environmental restoration features of the chain of wetlands increment of the Recommended Plan, including preconstruction engineering and design and construction management was calculated at approximately $5.6 million, with an annualized cost of approximately $465,800. Table 6-1 presents the breakdown of costs per unit of output for the final environmental restoration plan, as derived through incremental analyses in Chapter 4, and in Appendix F, of this document.

Table 6-1
Analysis of Environmental Restoration Features
(October 1998 prices, 6.875% interest, 50-year period of analysis)

	Annual Cost	AAHU Output	Cost / AAHU
Environmental Restoration	$465,800	184	$2,532

LAMAR LEVEE

The proposed Lamar Levee would extend over a total length of 16,419 feet, with top of levee elevations varying from 417.0 at the downstream end to 426.0 at the upstream end. The average height of the levee would be 17.6 feet, with a maximum height of 31.0 feet. A 20-foot crown width and 1 vertical to 4 horizontal side slopes would be utilized, based on performance of existing levees within the area, and on a slope stability analysis. The alignment of the levee would impact the Southern Pacific (S.P.) Railroad at one location and the Missouri-Kansas-Texas (M.K.T.) Railroad at one location, requiring 20-foot wide stoplog structures at each site, with heights of 8 feet and 14 feet, respectively. No major roads would be impacted by gated structures; however, at the junction of the levee with Martin Luther King Boulevard, the levee was realigned to reach a higher ground tie-in point. The downstream end of the levee would tie into the previously constructed Rochester Park Levee. This non-Federal levee has a top of levee elevation of only 415.0, thereby requiring raising of a portion of the Rochester Park Levee to transition into the downstream Lamar Levee elevation of 417.0. Two major freeway bridges would cross the proposed levee, but would require no modification since the low chord beam elevations would be well above the top of the levee. Detailed descriptions and drawings of this levee are included in Appendix C of this report. Excavation of almost 600,00 cubic yards of material would be required for construction of sumps behind the levees, as described in Appendix A.

Various utilities would be affected by the alignment of the levee and the location of the sumps, and relocation procedures would be required prior to construction. Sanitary sewer lines, storm sewer lines, and fiber optic cables would require relocation, as described in Appendix C. Relocation costs were estimated to total approximately $3.4 million for the Lamar Levee. In addition, five sluice structures would be required for discharge of sump areas through the levees. These structures, as well as all closure structures, are described and presented in Appendix C. The geotechnical design and structural design parameters are provided in Appendix B and Appendix C, respectively.

Real estate costs for the Lamar Levee were estimated at approximately $5.8 million, of which $1.0 million would be relocation assistance costs for displaced persons and business, and $1.4 million would be for mitigation lands. Environmental mitigation costs, not including lands, were estimated at $0.2 million. The breakdown of these costs is provided in Appendix E, and in the detailed cost estimate shown in Appendix K.

No known HTRW sites would be affected by construction of this levee and associated sumps, as the sumps have been relocated to avoid potential HTRW sites. It is noted, however, that further testing may reveal HTRW sites which are unknown at this time. Should such sites be discovered, for which avoidance were not possible, the costs for removal of the contaminated material would be the responsibility of the sponsor. More detailed results of the HTRW investigations are presented in Appendix J.

The total economic costs for the Lamar Levee increment of the Recommended Plan were estimated at $18.3 million, including preconstruction engineering and design and construction management. Since a portion of the Rochester Park Levee would be compatible with the Lamar Levee, the costs for this compatible portion, totaling approximately $8.9 million, were added to the Lamar Levee. The total cost of the Lamar Levee, therefore, was estimated at $27.2 million.

CADILLAC HEIGHTS LEVEE

The Cadillac Heights Levee would extend over a total length of 11,891 feet, with top of levee elevations varying from 421.5 at the downstream end to 426.0 at the upstream end. The average height would be 14.9 feet, with a maximum height of 25.75 feet. The crown width would be 20 feet, with side slopes of 1 vertical to 4 horizontal, based on performance of existing levees within the area, and on a slope stability analysis. Four flood control closure structures would be required at railroad and street crossings. The M.K.T. Railroad would cross the levee three times, thereby requiring three 20-foot wide stoplog structures, the heights of which would vary from 6.5 feet to 17.5 feet. One floodgate would be required at Martin Luther King Boulevard, and would measure 65 feet wide and 5 feet high.

Approximately 600 feet of the existing non-Federal levee surrounding the CWWTP, near the entrance, would be utilized by raising the levee six feet.

Sump requirements for the Cadillac Heights Levee would be non-existent; however, four sluice structures would be provided for drainage of the areas behind the levees.

Various sanitary sewer lines, storm sewer lines, water supply lines, electrical supply towers, and the roadway entrance to the CWWTP would require relocation and/or reconstruction.

Detailed drawings and descriptions of each of these design and relocation elements are presented in Appendix C.

Real estate costs for the Cadillac Heights levee were estimated to be $6.1 million, of which $3.1 million would be for relocation of displaced persons and businesses, and $0.2 million would be for mitigation lands. Environmental mitigation costs, not including lands, were estimated at $0.02 million.

Preliminary investigations, prior to the release of the draft GRR/EIS in May 1998, indicated no known HTRW sites would be affected by construction of this levee. After release of the draft GRR/EIS, and prior to the preparation of the Final GRR, follow-on site visits in the vicinity of Area 9 (as defined in Appendix J) identified construction underway in the southern portion of Area 9 (Darling International). Examination of TNRCC files was conducted to determine the purpose and nature of the activities in the southern portion of Area 9. The examinations revealed new documents that confirm the presence of hazardous levels of lead in the southern portion of Area 9. Given a similar site history, it is likely that hazardous levels of lead exist in the northern portion of

Area 9 (Energy Conversion Systems). The current owners of the northern portion of Area 9 will be performing investigations, but results are not yet available.

The hazardous levels of lead at Area 9 appear to be associated with buried lead slag and battery casings. It does not appear that the high levels of lead extend beyond the immediate area being capped. This conclusion is supported by data obtained from construction of an adjacent 120-inch interceptor line by the City of Dallas. The interceptor line runs parallel to the Trinity River and immediately adjacent to Area 9. Data developed for the City of Dallas along the new interceptor line indicate total lead levels up to 1000 mg/Kg to a depth of 6 feet. These samples tested to be non-hazardous, however, with a maximum Toxicity Characteristic Leaching Procedure (TCLP) value of only 0.22 mg/L. TCLP values that are equal to or greater than 5.0 mg/L are considered to be hazardous for lead.

Refinement of the Cadillac Heights levee alignment in this area will be a priority for future investigations. Final design will balance disturbance of known contaminants, costs for handling and disposal of special wastes, and impacts to natural resources.

The economic costs for the Cadillac Heights Levee increment of the Recommended Plan were estimated at $9.3 million, including preconstruction engineering and design and construction management.

INTERIOR DRAINAGE - SUMP AREAS

In the final analyses of the Recommended Plan, specific efforts were undertaken to evaluate the potential for increasing the economic effectiveness of the initial design proposals. However, based on current USACE policy, only the subtle changes in potential flood damages around the interior drainage facilities which result from variation of the proposed design were eligible as measures of the benefits to be gained (or lost) under alternative design scenarios. Since many of the adjacent improved properties are comprised of warehouse-style construction, significant increases in the residual flood damages would require that the potential pool levels in the interior facilities be raised several feet, causing impoundment over substantially larger acreages than that resulting from the initial design conditions. The larger flooding area, in and of itself, is not reflected in direct flood damages, under the current economic assessment strategy. Residual flooding damages for a 500-year interior flood event are presented in table 6-2 for the sump areas behind the Lamar Levee. As shown in the table, and for the reasons noted above, the residual damages are very minimal for this area. It was estimated that there would be no annualized residual damages in the Cadillac Heights sump areas.

It is clear that larger interior drainage facilities can not be economically justified, given these constraints. Smaller facilities may be economically justified, but those alternatives would not meet the provision that the minimum facilities meet the local sponsor's design standards, as established by ordinance, and would be impractical. The City of Dallas' "Drainage Design Manual" (May 1993) and the "Dallas Development Code" require a 100-year frequency (0.01 probability of exceedance) design level for these types of facilities.

Table 6-2
Cumulative Residual Single-Event and Annualized Damages
For Lamar Levee Sumps
(October 1998 prices, 6.875% interest, 50-year period of analysis)

% ACE Event	Sump 1	Sump 2	Sump 3	Sump 4	Sump 5	Total
<100	$0	$0	$0	$0	$0	$0
50	$0	$0	$0	$0	$0	$0
20	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0
2	$0	$0	$0	$0	$0	$0
1	$0	$0	$0	$0	$0	$0
.4	$43,396	$11,411	$223,538	$0	$0	$278,345
.2	$60,344	$119,551	$331,458	$0	$0	$511,353
Annualized *	$700	$910	$5,810	$0	$240	$7,660

** The annualized damages were derived using the risk and uncertainty program, while cumulative single-event damages were not. Damages were shown for Sump 5 only upon application of the risk and uncertainly analysis. It was estimated that there would be no residual damages for the Cadillac Heights sump areas.*

As stated previously, the sumps along the proposed Lamar Street Levee would be situated from upstream to downstream as follows, and as shown in figure 6-1. The first would be located immediately southeast of the Dallas Area Rapid Transit (DART) rail line. It would require no excavation, but would inundate 1.68 acres under the design condition. The second would be located at the southwest "dead" end of Forest Avenue. It would require some limited excavation (on the southwest side of an existing commercial activity) and would inundate 1.80 acres under the design condition. The third would straddle the Missouri-Kansas-Texas (MKT) Railway and occupy the long triangular area bounded by that railway, the Southern-Pacific (SP) Railway, and the proposed Lamar Street Levee. It would require extensive excavation and would inundate 17.10 acres under the design condition. The fourth would be located beneath the north end of the Interstate Highway 45 (Julius Schepps Freeway) bridge over the Trinity River valley. It would require no excavation, but would inundate 8.08 acres under the design condition. The fifth would be located along the northeast side of the SP Railway, behind the active commercial entities along the more southeastern end of Lamar Street. It would require substantial excavation and would inundate 12.20 acres under the design condition.

The interior drainage facilities (sluice structures) along the proposed Cadillac Heights Levee, none of which would require significant excavation or would be expected to create a significant area of inundation, would be situated from upstream to downstream as follows. The first would be located west of Martin Luther King Jr. (Cedar Crest) Boulevard. The second would be located adjacent to the west side of the MKT Railway, at the point where it crosses the northeastern leg of the proposed levee alignment. The third would be located several hundred feet east of the MKT Railway. The fourth would be located adjacent to the MKT Railway, at the point where it crosses the southern leg of the proposed levee alignment.

Those sump areas which would be excavated would have three-on-one side slopes, and generally flat bottoms (sloped very slightly to the outlet). The outlet sluice facilities are proposed as simple rectangular conduits with both a flapgate (at the outlet end) and a manually operated sluice gate. Pertinent data on the sumps and outlet sluice structures, including hydrologic effects, are presented in table A-9 of Appendix A.

RECREATION AMENITIES

The recreation plan for the proposed project was designed to meet existing needs for passive and non-structured recreational activities within the regional service area, and to address state and regional shortfalls in facilities for walking, hiking, cycling, and jogging, as identified in the TORP. Facilities proposed for this project would be necessary to provide public access, protect sensitive environmental resources and promote safe use of the area. The proposed plan would create linkages between existing recreational areas and public open space areas, both existing and necessary for the DFE project. Proposed access points would take advantage of existing facilities within local parks and preserves, to the extent possible. The plan would be consistent with locally adopted recommendations for long range development of a "Great Trinity Forest Park" within the DFE area. Facilities proposed for the recreation plan are described below. More detailed discussions and drawings of this proposed plan and the regional recreation master plan are presented in Appendix I.

Trails and Access Points

The proposed project would include 18 miles of 10-foot wide, 4-inch thick reinforced concrete on compacted subgrade. The plan would also include 8.5 miles of natural surface equestrian trails and 5 miles of natural surface nature trails. A total of seven access areas are proposed, three of which would be located at existing parks or areas with adequate existing parking areas. These areas are located at Moore Park near Cedar Creek, at Woodland Springs Park near the McCommas Bluff Preserve, and at IH-45 near the Central Wastewater Treatment Plant. Each of these areas would need an entry sign, a 30-foot by 60-foot picnic pavilion, and a trailhead with an informational kiosk. The clubhouse at the Sleepy Hollow Golf Course is included as an access point, but would require no modifications. One of the three new access areas would be located near the upstream end of the existing Rochester Park levee, with another located on the east side of the Trinity River across from Lemmon Lake, and the final one located at the southem end of the study area near IH-20. The new access areas would require concrete entry drives and parking spaces to accommodate 20 cars each, with adequate tum-around space for busses and trailers. Each area would also need an entry sign, a 30-foot by 60-foot picnic pavilion, a trailhead with an informational kiosk, security lighting, and a drinking fountain and hose bib. Typical details for the concrete hike/bike trail and access areas are shown on Plate C33 in Appendix C.

Structures

Two pedestrian bridge structures would be provided for access across the river channel. The bridges would typically consist of three 50-foot prestressed concrete beams and would be designed to support light maintenance vehicles. Plate C33 in Appendix C shows typical details for the proposed structures.

Costs for the recreation amenities, including preconstruction engineering and design and construction management were estimated at $6.8 million.

OPERATION, MAINTENANCE, REPAIR, REPLACEMENT AND REHABILITATION

The Federal Govemment and the city of Dallas will enter into a local cooperation agreement under which the city will accept the project after completion of construction, and insure operation and maintenance in accordance with Federal regulations. The major items of operation and maintenance include mowing of the levees and sumps, weed control along the concrete trail and nature trail, management of the open space within the project, operation and maintenance of the pumping station and inlet and outlet control structures within the chain of wetlands, and operation and maintenance of stoplog structures and floodgates throughout the project. Table 6-3 provides a breakdown of the estimated OMRR&R costs. An operation and maintenance manual will be prepared by the Fort Worth District after completion of the project, which will include specific, detailed requirements for the operation and management of the levees, chain of wetlands, and fish and wildlife mitigation areas. These requirements will be developed through coordination with state and federal resource agencies to assure that environmental attributes of the project meet regulatory and agency mandates. In addition to routine operation and maintenance, the city will be responsible for repair, replacement and/or rehabilitation of all components and features of this project. Periodic inspections will be performed to insure that all required maintenance is being performed.

Table 6-3
Breakdown of OMRR&R Costs
(October 1998 prices)

	ESTIMATED ANNUAL COST
CHAIN OF WETLANDS:	
Mowing/clearing	*$20,000*
Debris clean-up	*$18,000*
Pump replacement (once every 25 years)	*$2,000*
Inlet/outlet structure operation/maintenance	*$10,000*
Mitigation areas for chain of wetlands	*$24,000*
Total - Chain of Wetlands	***$74,000***
LEVEES (including Rochester Park & CWWTP)	
Mowing - levees	*$200,000*
Mowing - sumps	*$75,000*
Repair of maintenance road on levees	*$35,000*
Debris removal - sumps	*$75,000*
Floodgates / closure structures maintenance	*$25,000*
Sluice structure operation/maintenance	*$35,000*
Mitigation areas for levees	*$8,000*
Total - Levees	***$453,000***
RECREATION:	
Maintenance / debris clean-up at pavilions	*$4,000*
Replacement of trail at 25-years	*$50,000*
Maintenance / cleaning of trails / bridges	*$8,000*
Resurfacing / restriping of access areas at 10-year intervals	*$6,000*
Sign repair / lighting	*$5,000*
Total - Recreation	***$73,000***
TOTAL	*$600,000*

ENVIRONMENTAL COMPLIANCE

EXECUTIVE ORDER 11988 - FLOODPLAIN MANAGEMENT

The spirit and intent of Executive Order 11988 have been considered in preparation of this action. There are no feasible alternatives to conducting activities within the 100-year floodplain of the Trinity River, and measures have been considered to minimize impacts to the floodplain through project design. Additionally, the city of Dallas currently has several programs for management of the Trinity River 100-year floodplain following project implementation. The city is a participant in the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program and the Community Rating System (CRS). The city maintains a Corridor Development Certificate from the North Central Texas Council of Governments (NCTCOG), has a Flood Warning System for the Trinity River Basin and a Flood Plain Ordinance which regulates development in the floodplain.

Future floodplain impacts will be controlled through the development of a comprehensive Floodplain Management Plan (FPMP). An FPMP will be developed by the city in accordance with Section 202(c) of the Water Resources Development Act of 1996 and the guidance provided by the Secretary of the Army. The FPMP will be developed within one year after the signing of the Project Cost Sharing Agreement and implemented within one year after completion of construction of the project.

SECTION 404 CLEAN WATER ACT

The Corps of Engineers has been directed by Congress under Section 404 of the Clean Water Act (33 USC 1344) to regulate the discharge of dredged and fill material into all waters of the United States, including adjacent wetlands. The intent of Section 404 is to protect the nation's waters from indiscriminate discharge of material capable of causing pollution, and to restore and maintain the chemical, physical and biological integrity of these areas. Although the Corps of Engineers does not issue itself permits for proposed activities which would affect waters of the United States, the Corps must meet the legal requirements of the Act. Section 404 (r) of the Clean Water Act waives the requirement to obtain a State Water Quality Certificate provided information on the effects of the discharge of dredged or fill material into waters of the United States, including the application of the Section 404(b)(1) guidelines, are included in an environmental impact statement (EIS) on the proposed project, and the EIS is submitted to Congress before the actual discharge takes place and prior to authorization or appropriation of funds for project construction. A Section 404(b)(1) analysis has been completed and is presented in Appendix F.

SECTIONS 9 AND 10 RIVERS AND HARBORS ACT

Section 9 (33USC 401) and Section 10 (33USC 403) of the Rivers and Harbors Act of 1899 direct the Corps to regulate all work or structures in or affecting the course, condition, or capacity of navigable water of the United States. The mainstem of the Trinity River at Dallas is navigable; however, no commercial navigation occurs on the Upper Trinity reach. Recreational use in the form of canoeing, fishing and pleasure boating occurs, but only to a limited extent and then only during less than flood flow events. The proposed project features would have minimal affect to navigation. The footprint of the chain of wetlands lies in the floodplain adjacent to the mainstem.

The Corps of Engineers completed an Environmental Impact Statement and a Record of Decision (ROD) in 1988 that addressed the cumulative impacts of a number of unrelated independent proposed actions within the Upper Trinity River Basin. The authority for the study was based upon the Corps regulatory requirements. The results of the EIS gave strong indications that there are potential cumulative impacts associated with individual floodplain developments that are both measurable and significant. Public comment and discussion focused on the undesirability of additional regional increases in flood hazards for either the 100-year or Standard Project Flood and that floodplain management should stabilize the flood hazard at existing levels through regulation and efforts of both the Corps and local organizations. The ROD provided a framework of criteria that would become the basis for the Regulatory Program within the Regional EIS study area. The Regulatory Program includes those actions proposed by the Corps of Engineers that are subject to Section 404, Section 9 or 10 compliance.

Hydraulic criteria applicable to the Dallas Floodway Extension area include that no rise in the 100-year or SPF elevation will be allowed, the maximum allowable loss in storage capacity for the 100-year and SPF discharges will be 0% and 5% respectively, alterations of the floodplain may not create or increase an erosive water velocity on or off site, and the floodplain may be altered only to the extent permitted by equal conveyance reduction on both sides of the channel. The proposed action will also be reviewed on the assumption that adjacent projects would have an equitable chance to be built, such that the cumulative impacts of both will not exceed the common criteria. In addition, since the proposed project includes levees that protect urban development, the minimum design criterion for the top of levee is the SPF plus 4.0, unless a relief system can be designed which will prevent catastrophic failure of the levee system. Furthermore, the ROD provides criteria for mitigation of unavoidable losses to special aquatic sites including wetlands and guidelines for mitigation of other important resources.

The ROD also provided that variance from the criteria would be made only if public interest factors not accounted for in the Regional EIS overwhelmingly indicated that the "best overall public interest" is served by allowing such variance. During the review of this project proposal by the Corps, other agencies, communities and the public, it will be determined if it meets the ROD criteria or whether resolution of flooding problems of this frequency and magnitude should be deemed as an overriding concern, and if a variance from the Record of Decision should be allowed as being in "the best overall public interest."

ENVIRONMENTAL JUSTICE

Executive Order 12898 provides for review of proposed activities to assess the effect on minority populations and low income populations. The area of potential project impact was screened and it was determined that the area does contain minority and low income populations. A review of the effects of the proposed project alternatives indicate that all flood control plans, except the combination plan including a non-structural buyout of Cadillac Heights in lieu of a levee, provide significant flood protection for local residents and businesses. The economically feasible buyout of the 25-year flood zone would leave many minority and low income individuals subject to flooding. The proposed Cadillac Heights Levee would provide protection from the Standard Project Flood and would reduce adverse economic impacts of repeated flooding in the area. This levee would impact an existing meat packing facility, but the plant could be relocated immediately adjacent to the existing location, thereby minimizing loss of employment opportunities to local residents.

Should the chain of wetlands be built alone, the majority of the economic benefits would accrue upstream within the Central Business District (CBD), with the negative impacts of forest loss occurring within the floodplain adjacent to the Cadillac Heights and Lamar areas. There would be some flood damage reduction benefits within the immediate area, but not to the same level as provided to the CBD. Other economic benefits from the multi-purpose chain of wetlands project to the minority and low income populations would accrue due to the influx of recreation users of the trail system that would be constructed.

Building the river diversion at IH-45, as requested by the sponsor, to protect a major roadway bridge from catastrophic failure would benefit all people and would not be of detriment to any populations. The Recommended Plan, including the environmental restoration of emergent wetlands, environmental mitigation, and a recreational trail would also provide benefits to the local area. Another benefit of the overall project is the clean-up of accumulations of trash and debris within the projected lands and some of the hazardous and toxic wastes in the project footprint. The proposed project would not result in disproportionate impacts to minority or low income populations. Recognizing the overall balance of benefits and impacts that would occur from the proposed project, it has been determined that implementation of the Recommended Plan, along with the river realignment at IH-45, would be in compliance with the intent and spirit of Executive Order 12898.

CUMULATIVE IMPACTS

This section analyzes the proposed project in the context of current and future trends in the Upper Trinity River Basin. The purpose of this section is to assess the cumulative impacts of the proposed action to the study area, when combined with other known actions in the vicinity of the Dallas Floodway Extension area, as described in the "INTERRELATIONSHIP WITH OTHER PROPOSED ACTIONS" section in Chapter 2. The proposed action, including environmental mitigation, makes little or no contribution to regional trends that are of concern in assessing cumulative impacts.

LAND USE

Urbanization has greatly influenced land use patterns within the Dallas area. As additional runoff from upstream areas has increased the frequency of flooding within the study area, and as adjacent urbanization has continued, floodplain land use has shifted away from agriculture, except for a few areas of pasture land. The large floodplain areas adjacent to the river are zoned for industrial development, but, with or without a project it is unlikely that substantial new development will occur in flood-prone areas due to extensive flooding and regulatory prohibitions which are currently in place. Past programs for voluntary removal of some residences and other structures in the more frequently flooded areas have also influenced floodplain land uses. Most abandoned floodplain areas have re-vegetated with grasses, followed by young forests. The proposed project would significantly reduce remaining flood damages which occur within the project area. Most of the areas that would be impacted by the proposed project features are currently in private ownership and would be shifted to public open space with the project. Physical features of the project would directly impact some forest lands that have developed during the past 30 to 40 years; however, these losses would be mitigated resulting in a larger area of preserved and reestablished floodplain forests.

All lands acquired for project features including the area between the proposed levees, the footprint of all project features, and the mitigation areas would no longer be available for uses such as agricultural production or industrial use. These lands would remain in the floodplain as open space but would be available for public uses compatible with the project. The project would result in increased use of floodplain lands for recreation. Recreation trails and flood compatible day use facilities would be developed through project lands and the habitat mitigation area. Development of more intensive recreation facilities is planned by the project sponsor for certain areas within the lands required for the project, including athletic fields and a community center. Direct land use changes caused by the proposed project would be compatible with floodplain functions and should have no negative effects on floodplain uses compared to conditions without the project.

The proposed project would provide reduction in damages to areas in both the Lamar and Cadillac Heights areas that are currently susceptible to flooding. The economic stimulus associated with the project, combined with the reduction in frequency and intensity of flood damages, would result in economic development of lands which would be afforded protection or which are adjacent to the project. Redevelopment would not be expected to occur all at once but over a period of years. The most obvious changes would likely be in the form of redevelopment and reuse rather than direct change from one land use to another. Liability concerns for environmental contamination must be addressed prior to any major redevelopment. This would be largely the responsibility of the developer and would include compliance with both Environmental Protection Agency and Texas Natural Resources Conservation Service requirements, as well as consistency with such programs as the "Brownfields" initiatives administered by those agencies. Although no specific proposals have been identified, it is probable that any industrial redevelopment that may be induced will be "cleaner" than former industrial development in the study area.

With participation in the project, the City of Dallas would be required to prepare a comprehensive floodplain management plan which should address watershed land uses adjacent to and upstream of the project. A primary purpose of this comprehensive plan is to assure that future developments do not increase the potential for future flood damages. The plan would address conditions of the project as assumed to be in-place, along with any other proposals such as may be included in the Upper Trinity Feasibility Study or public or private proposals, such as highways or commercial, residential, or industrial development. Any potential zoning changes proposed by the City of Dallas in preparing this comprehensive floodplain management plan should provide opportunity for public input.

Redevelopment of adjacent neighborhoods and commercial and industrial areas would be cumulatively influenced by the portion of the Texas Department of Transportation's (TxDOT) proposed Trinity Parkway project which would extend from Hwy 175 to the existing Dallas Floodway along the Lamar Street Levee alignment. The number and location of access ramps, as well as aesthetic treatment and noise reduction measures that would be included with TxDOT's proposed extension will affect the type and extent of adjacent land use changes. Those effects will be considered by TxDOT as that agency moves forward with compliance under the National Environmental Policy Act. One certain effect of the proposed roadway project on land use in the project vicinity would be an economic stimulus resulting from construction. The economic effect of a TxDOT project on land use within the study area would occur even in the absence of the proposed flood damage reduction project. The two proposed projects together, however, would have a combined or cumulative effect on land use. The nature, location, and extent of land use changes or economic redevelopment that would occur cannot be predicted with certainty at this time. Economic development within the project study area will be greatly influenced by the City of Dallas' comprehensive floodplain management plan, and by features of TxDOT's proposal for the Trinity Parkway as they move along in the planning and public involvement process.

CULTURAL AND HISTORIC RESOURCES

Any impacts to cultural and historical resources would be mitigated, according to provisions of the National Historic Preservation Act. Therefore, the proposed action would make no contributions to cumulative impacts of the area.

NOISE

All noise impacts directly attributable to the project would be temporary in nature. Levees would tend to interfere with the distribution of some noises. Some noise associated with roadway traffic could be redistributed to the area should the Texas Department of Transportation decide to utilize existing and proposed levees for reliever roads.

CLIMATE AND AIR QUALITY

The proposed project would have only minor impacts to local temperature and air quality parameters. There would be no measurable impacts to climate. Cumulative impacts to air quality would be insignificant, since environmental mitigation would result in an overall increase in the size of preserved and restored forested areas. Should roadways be developed, by others, on or adjacent to existing or proposed levees, the additional movement of vehicles past the project area would result in an increase in ozone-forming precursors. The impacts associated with development of this or other proposals would be determined during detailed studies by the entities proposing the projects.

HYDROLOGY AND WATER RESOURCES

Hydrologic and hydraulic analysis to determine the impacts of valley storage changes resulting from implementation of the Recommended Plan was performed. Valley storage changes in the project reach would result from both the reduction of peak water surface elevations and the function of levees blocking flood water access to the areas of the floodplain that would be protected by the levees. The analysis indicates that a reduction in the valley storage in the project reach would result in an increase in the peak discharges. This increase has been computed and is expressed in terms of an increase in the peak water surface profile downstream of the project. The water surface profile elevations would be increased an average of 0.15 feet for the 1 percent chance flood and 0.3 feet for the SPF. Based on these small increases and the very limited potential for flood damages downstream of the project, a variance from the criteria requiring mitigation for reduction of valley storage and no allowable rise in the 1 percent chance flood and SPF elevations should be allowed. The variance from these requirements, as stated in the Corridor Development Certificate (CDC) Manual and the Trinity River Environmental Impact Statement Record of Decision (ROD), would be further justified in light of the very broad ranging economic benefits accruing to the residents, commercial activities and public service facilities within the project reach as well as upstream of the project reach. The proposed project would provide SPF protection to over 2,500 structures in the immediate study area, which currently have no such protection, and increase flood protection to over 10,000 structures in the reaches of the existing Dallas Floodway. Careful consideration of these factors indicate that the best overall public interest would be served by allowing such variance. The granting of variances from the CDC and ROD for this flood damage reduction project would not set a precedent that would alleviate the compliance requirements for other floodplain development alteration projects. The criteria would continue to significantly reduce cumulative impacts to hydrologic and hydraulic conditions. In addition, any future Corps project proposals would not reduce the hydrologic and hydraulic benefits which would be derived from implementation of the proposed DFE project.

ECOLOGICAL RESOURCES

The most significant resource within the proposed project area has been identified as the bottomland hardwood forest ecosystem located in an area referred to as the "Great Trinity Forest". While the proposed project would impact only a small area of the forest, the proposed environmental mitigation plan could provide a catalyst to ultimate acquisition and management of over 1,000 acres of the area which is either currently forested, or could be converted to bottomland hardwood forest through intensive management. In addition, the proposed environmental restoration project, which includes the development of emergent wetlands, would help reverse the trend of losses to this important resource.

ECONOMIC ANALYSIS

As stated in Chapter 5, equivalent annual damages (EAD) were calculated for the Recommended Plan to account for changes in urbanization and hydrology. The analysis was performed over a 50-year period from the year 2000 to 2050.

RECREATION BENEFITS

Benefits for the recreation plan developed for the final array of alternatives were derived using the unit day value method. This method of benefit calculation was selected based on the criteria set forth in ER 1105-2-100. Specifically, the regional model available is more than seven years old, annual visits are not expected to exceed 750,000, and recreation costs are not expected to exceed 25 percent of the total project costs.

A score of 40 points was assessed for the plan based on the professional judgement of both Federal and local recreation planners. Applying the current Planning Guidance Memorandum, a score of 40 points converts to $5.09 per visitor-day, at October 1998 price levels, for quantifiable features. The benefits were derived based on 31.5 miles of trails, 34 picnic tables and 6 picnic pavilions. Refer to Appendix I for complete details on the recreation master plan. Table 6-4 details the benefits calculated for the recreation plan by feature. The participation rate in the Dallas/Fort Worth area for multi-purpose trails and pavilions exceeds the facility capacity; therefore, it is assumed that participation equals capacity and a value of one was applied. Annual visitors per miles of equestrian and nature trails were adjusted by the participation rate for the local area.

Table 6-4
Dallas Floodway Extension Recreation Benefits
Unit Day Value Method
(October 1998 prices, 6.875% interest, 50-year period of analysis)

Feature	Amount	Participation Rate	Visitors	Rate	Annual Benefits
Hike\Bike Trail	18	1.0	57,662	$5.09	$5,280,500
Equestrian Trail	8.5	0.2	6,999	$5.09	$60,500
Nature Trail	5	0.6	7,402	$5.09	$113,000
Picnic Tables	34	1.0	1,575	$5.09	$272,400
Pavilion	6	1.0	1,665	$5.09	$50,800
			Total Benefits		$5,777,200

COST ANALYSIS

Project First Cost

The project first cost includes estimates for lands and damages, relocations, fish and wildlife facilities, channels (swale and chain of wetlands), levees, recreation facilities, cultural preservation, removal of hazardous and toxic waste, engineering and design, and construction management. Contingencies were added on selected items in accordance with the level of confidence associated with the item. Construction cost data were developed using material, equipment, and labor costs typical for work of this nature in the Dallas area. Real estate costs were developed after the Gross Appraisal was completed. A cost estimate summary for the Recommended Plan is found in table 6-5, and shows a total project cost of $127.2 million.

Annualized Cost

The project first cost was converted to an annual basis, using a 50-year amortization period and the current applicable Federal interest rate of 6.875 percent. Accrued interest during the construction period was calculated as described in Chapter 5 and taken into account to produce a total investment cost. The annualized costs for the plans were used for computation of the BCR.

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Table 6-5
Cost Estimate Summary for the Recommended Plan
(October 1998 prices)

Description	Construction	Contingency	Total
Lands and Damages	$20,581,600	$5,113,400	$25,695,000
Relocations	$4,655,400	$1,250,200	$5,905,600
Fish and Wildlife Facilities	$383,900	$96,000	$479,900
Channels and Canals	$24,434,300	$5,397,700	$29,832,000
Levees and Floodways	$13,865,500	$3,363,400	$17,228,900
Recreation Facilities	$4,139,400	$1,247,800	$5,387,200
Cultural Resources Preservation	$640,000	$160,000	$800,000
Planning, Engineering and Design	$10,014,900	$1,864,900	$11,879,800
Construction Management	$5,460,700	$1,365,200	$6,825,900
Sub-Totals	$84,175,700	$19,858,600	$104,034,300
Compatible Non-Federal Levees	$23,120,000	$0	$23,120,000
Total Project Costs	**$107,295,700**	**$19,858,600**	**$127,154,300**

ECONOMIC SUMMARY

Table 6-6 presents the economic summary for the combined flood control and recreation features of the Recommended Plan, while table 6-6a presents separate analyses of each of these project purposes. The outputs of the environmental restoration features are measured in non-monetary units; therefore, the costs associated with these features are not included in the economic analysis of the project. Additionally, costs for cultural resource preservation are 100 percent Federal costs, up to a limit of one percent of total Federal project costs, and are not included in the economic analysis of the project. As shown, the Recommended Plan is economically justified, with net annual benefits of $9.8 million, and a BCR of 2.06.

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Table 6-6
Economic Summary of the Recommended Plan
(October 1998 prices, 6.875% interest, 50-year period of analysis)

Project Costs	Financial Cost	Economic Cost
Lands and Damages	$21,604,800	$21,604,800
Relocation Assistance	$4,090,200	$0
Relocations (Utilities, etc.)	$5,905,600	$5,905,600
Fish and Wildlife Facilities	$479,900	$479,900
Construction (Flood Control)	$42,371,400	$42,371,400
Construction (Environmental Restoration)	$4,689,500	$0
Construction (Recreation)	$5,387,200	$5,387,200
Engineering and Design (Flood Control / Recreation)	$11,303,700	$11,303,700
Engineering and Design (Environmental Restoration)	$576,100	$0
Construction Management (Flood Control / Recreation)	$6,452,900	$6,452,900
Construction Management (Environmental Restoration)	$373,000	$0
Cultural Resources Preservation	$800,000	$0
Project First Cost	$104,034,300	$93,505,500
Interest During Construction		$4,753,000
Non-Federal Levees		$23,120,000
Total Investment		$121,378,500
Annual Costs		
Interest and Amortization		$8,656,300
OMRR&R		$600,000
Total Annual Cost		$9,256,300
Equivalent Annual Benefits		
Flood Control Benefits		$13,285,100
Recreation Benefits		$5,777,200
Total Equivalent Annual Benefits		$19,062,300
Net Equivalent Benefits		**$9,806,000**
Benefit-Cost Ratio		**2.06**

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Table 6-6a
Economic Analysis of Separate
Flood Control and Recreation Purposes
(October 1998 prices, 6.875% interest, 50-year period of analysis)

	Flood Control	Recreation
First Costs	$113,958,300	$6,757,400
Economic Costs *	$109,868,100	$6,757,400
Interest During Construction	$4,523,300	$229,700
Investment Cost	$114,391,400	$6,987,100
Interest and Amortization	$8,158,000	$498,300
OMRR&R	$527,000	$73,000
Annual Costs	$8,685,000	$571,300
Annual Benefits	$13,285,100	$5,777,200
Net Annual Benefits	$4,600,100	$5,205,900
Benefit-Cost Ratio (BCR)	1.53	10.11

** Economic costs for Flood Control do not include $4,090,200 in Relocation Assistance costs.*

PROJECT COST SHARING

The provisions of the Water Resources Development Act of 1986 (Public Law 99-662), approved November 17, 1986, and the Water Resources Development Act of 1996 (Public Law 104-303), approved October 12, 1996, stipulate cost sharing requirements which local sponsors must meet for the Federal Government to be involved with water resource projects. Cost sharing provisions for the flood control, environmental restoration, and recreational development purposes are outlined below. The costs of removing and/or preserving cultural resources which may be discovered during implementation of this project would be borne as a 100 percent Federal cost, up to a maximum of one percent of the total Federal project costs. Should the cost of cultural resource preservation exceed this one percent limit, cost sharing provisions would be implemented. An estimate of approximately $800,000 has been developed to cover the possibility of cultural resource preservation. These non-sharable costs have been shown in cost apportionment table 6-8.

FLOOD CONTROL

The identified feasible flood control project would be cost shared based on the provisions set forth in Public Law 99-662, as amended. The designated Sponsor would be required to formally approve the recommendations of the General Reevaluation Report before initiating the Preconstruction, Engineering, and Design Phase of the project.

For structural flood control projects, the non-Federal cost is to be a minimum of 25 percent and a maximum of 50 percent of total project costs. The non-Federal sponsor is responsible for 100 percent of the operation, maintenance and replacement costs of the project.

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ENVIRONMENTAL RESTORATION

Due to the requirement to obtain an amendment to the original 1965 authorization adding environmental restoration as a project purpose, environmental restoration will be cost shared in accordance with the provisions of Public Law 104-303 (WRDA 1996). Under this law, the non-Federal cost is to be 35 percent of the total environmental restoration project costs. The non-Federal sponsor is responsible for 100 percent of the operation, maintenance and replacement costs of the project.

RECREATIONAL DEVELOPMENT

Under the Federal Water Project Recreation Act of 1965 (Public Law 89-72), outdoor recreational facilities can be provided at Federal non-reservoir flood damage reduction projects. However, recreational developments must be within the lands acquired for the basic project, except for separable lands required for access, parking, potable water, sanitation and related developments for health, safety and public access. Also, the facilities for cost sharing must be accordance with the approved list in ER 1165-2-400. As stipulated in Public Law 99-662, recreational development including lands required for public access, health, and safety, are cost-shared on an equal (50/50 percent) basis between Federal and non-Federal public interests. The cost of lands provided by local interests for the basic project are not included for recreational cost sharing purposes. Operation, maintenance and replacement costs are also the responsibility of the non-Federal sponsor.

DIVISION OF PLAN RESPONSIBILITIES

COST APPORTIONMENT

Table 6-7 presents the project costs, by work item, for the Recommended Plan. Table 6-8 reflects the calculations performed to determine the Federal and non-Federal cost apportionments based on the appropriate laws and regulations, as described previously.

Table 6-9 shows the cost apportionment data for the Recommended Plan. The total cost of this plan was estimated at $127.2 million. As shown, the Federal cost would total approximately $83.6 million (65.7%), while the non-Federal cost would equal approximately $43.6 million (34.3%).

The costs shown in table 6-9 are based on standard requirements set forth in Public Law 99-662, as amended, for the flood control and recreation components of the Recommended Plan. Since environmental restoration was not a project purpose under the 1965 authorization, an amendment to the original authorization adding environmental restoration as a project purpose would necessitate the application of standard cost sharing requirements for environmental restoration set forth in Public Law 104-303. Under these laws, non-Federal interests would be required to furnish all lands, easements, rights-of-way, and disposal areas, and perform all relocations of bridges and utilities. Specifically, the non-Federal share of project costs are set at a minimum of 25 percent and a maximum of 50 percent of the total flood control costs, 35 percent of the environmental restoration costs, and 50 percent of the recreation costs. Non-Federal interests would also be responsible for the operation and maintenance of the project features after construction. The Federal Government would be responsible for a minimum of 50 percent and a maximum of 75 percent of the flood damage reduction costs, 65 percent of the environmental restoration costs, and 50 percent of the recreation costs.

In addition to the cost apportionment regulations cited above, the provisions of Section 351 of WRDA 1996 regarding credit toward the non-Federal share of the project for advanced construction of the Central Wastewater Treatment Plant Levee and the "compatible" portion of the Rochester Park Levee were incorporated into the remaining costs analysis shown in table 6-9a. The non-Federal share of project costs prior to application of the levee credit was such that all of

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the costs for the compatible non-Federal levees were applied. The only non-Federal construction not credited was the portion of Rochester Park which was incompatible with the Recommended Plan.

Table 6-7
Project Costs for the Recommended Plan
(October 1998 prices)

	PROJECT COSTS
LERRD (Non-Federal Levees)	$946,000
RELOCATIONS/UTILITIES	
- Flood Control	$5,905,600
EXCAVATION / DISPOSAL	
- Flood Control	$28,804,800
- Environmental Restoration	$4,101,100
FILL	
- Flood Control	$1,893,200
OTHER CONSTRUCTION	
- Non-Federal Levees	$22,174,000
- Flood Control	$11,673,400
- Environmental Restoration	$588,400
- Recreation	$5,387,200
MITIGATION (W/O LAND)	
- Flood Control	$479,900
REAL ESTATE	
- Flood Control	$21,433,700
- Mitigation (Flood Control)	$4,261,300
CULTURAL RESOURCE PRESERVATION	$800,000
ENGINEERING & DESIGN	
- Flood Control	$10,472,000
- Environmental Restoration	$576,100
- Recreation	$831,700
CONSTRUCTION MANAGEMENT	
- Flood Control	$5,914,400
- Environmental Restoration	$373,000
- Recreation	$538,500
TOTAL PROJECT COSTS	**$127,154,300**
Flood Control Costs Only (Without Non-Federal Levees)	$90,838,300
Non-Federal Levee Costs Deemed "Compatible"	$23,120,000
Total Flood Control Costs	$113,958,300

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Table 6-8
Cost Apportionment Calculations for the Recommended Plan
(October 1998 prices)

COST APPORTIONMENT	FLOOD CONTROL	ENVIRONMENTAL RESTORATION	RECREATION
FEDERAL COST			
Excavation/Disposal	$28,804,800	$4,101,100	$0
Fill	$1,893,200	$0	$0
Other Construction	$11,673,400	$588,400	$5,387,200
Mitigation (w/o Land)	$479,900	$0	$0
Engineering & Design	$10,472,000	$576,100	$831,700
Construction Management	$5,914,400	$373,000	$538,500
Sub-Sub-Total	$59,237,700	$5,638,600	$6,757,400
*5% Cash Reduction **	($5,697,900)	$0	$0
Additional Cash	$0	($1,973,500)	($3,378,700)
Sub-Total	$53,539,800	$3,665,100	$3,378,700
Non-Federal Levee Credit	$22,174,000	$0	$0
TOTAL	$75,713,800	$3,665,100	$3,378,700
Cultural Resource Preservation	$800,000		
TOTAL FEDERAL PROJECT COSTS	**$83,557,600**		
Percent	65.7%		
NON-FEDERAL COST			
Non-Federal Levee Construction	$22,174,000	$0	$0
LERRD (Non-Federal Levees)	$946,000	$0	$0
Relocations / Utilities	$5,905,600	$0	$0
Real Estate - Project	$21,433,700	$0	$0
Real Estate - Mitigation	$4,261,300	$0	$0
Sub-Sub-Total	$54,720,600	$0	$0
*5% Cash Contribution **	$5,697,900	$0	$0
Additional Cash	$0	$1,973,500	$3,378,700
Sub-Total	$60,418,500	$1,973,500	$3,378,700
Non-Federal Levee Credit	($22,174,000)	$0	$0
TOTAL	$38,244,500	$1,973,500	$3,378,700
TOTAL NON-FEDERAL PROJECT COSTS	**$43,596,700**		
Percent	34.3%		
TOTAL PROJECT COSTS	**$127,154,300**		

** 5% Cash Contribution applied against flood control costs of $113,958,300* **Revised: 13 August 1999**

Table 6-9
Cost Apportionment Data for the Recommended Plan
(October 1998 prices)

Purpose	Federal Cost	Non-Federal Cost	Total Cost
Flood Damage Reduction	$75,713,800	$38,244,500	$113,958,300
Environmental Restoration	$3,665,100	$1,973,500	$5,638,600
Recreation	$3,378,700	$3,378,700	$6,757,400
Additional Federal Cost - Cultural Resource Preservation	$800,000	$0	$800,000
TOTAL	**$83,557,600**	**$43,596,700**	**$127,154,300**
Percentage	65.7	34.3	100

Table 6-9A
Remaining Federal / Non-Federal Costs for the Recommended Plan
(October 1998 prices)

Purpose	Federal Cost	Non-Federal Cost	Total Cost
Cost Apportionment	$83,557,600	$43,596,700	$127,154,300
Previously Expended	$0	$23,120,000	$23,120,000
Remaining Costs	**$83,557,600**	**$20,476,700**	**$104,034,300**

NON-FEDERAL RESPONSIBILITIES

Prior to commencement of construction, local interests must agree to meet the requirements for non-Federal responsibilities as outlined below and in future legal documents.

a. Provide between 25 percent and 50 percent of the separable project costs allocated to flood control, 35 percent of the separable project costs allocated to environmental restoration, and 50 percent of the costs separable project costs allocated to recreation, as further specified below:

(1) Provide, during construction, funds needed to cover the non-Federal share of preconstruction engineering and design costs;

(2) Provide, during construction, a cash contribution equal to 5 percent of total project costs allocable to flood control;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

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(5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 25 percent of total project costs allocated to structural flood control, 35 percent of the separable project costs allocated to environmental restoration, and 50 percent of the costs separable project costs allocated to recreation.

b. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local 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.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project including mitigation features, without cost to the Government, in a manner compatible with the project's authorized purposes, and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments.

d. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, 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 the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

i. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

k. 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 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

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Conducted by the Department of the Army," and Section 402 of the Water Resources Development Act of 1986, as amended.

m. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to flood control, environmental restoration, and recreation that are in excess of one percent of the total amount authorized to be appropriated for flood control, environmental restoration, and recreation.

n. Participate in applicable flood insurance programs, and in accordance with Section 202(c) of the Water Resources Development Act of 1996, within 1 year after the date of signing a project cooperation agreement for construction of the project, prepare a floodplain management plan designed to reduce the impacts of future flood events in the project area, and implement such plan no later than 1 year after completion of construction of the project.

o. Provide and maintain necessary access roads, parking areas and other public use facilities, open and available to all on equal terms.

p. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

q. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

PUBLIC INVOLVEMENT

This section briefly summarizes the results of public involvement activities undertaken as part of these General Reevaluation Report level investigations.

PURPOSE OF PROGRAM

This study focused on the development of an economically feasible, environmentally acceptable, and publicly supported solution to the flooding problems with the Dallas Floodway Extension area. Numerous meetings and conversations have been held with the various entities and interested citizens to share the latest possible information and to focus this study toward investigating the most viable alternatives. In addition, various public workshops/meetings were held in the study area for the citizens to give input into the problems and possible solutions, as stipulated by Public Law 99-662 and Public Law 104-303.

PARTICIPANTS

Study participants worked closely over a six-year period in an effort to inform and involve the concerned citizens in the study area. The agencies involved in this effort included the Fort Worth District (Corps of Engineers), City of Dallas, Texas Parks and Wildlife Department (TPWD), United States Fish and Wildlife Service (USFWS), and Texas Department of Transportation (TxDOT). The staff and representatives of these agencies have worked tirelessly to answer citizens questions and concerns, by hosting a series of workshops or information meetings.

PUBLIC WORKSHOPS

On May 21, 1991, an Environmental Impact Statement Scoping meeting was held in Dallas (Roosevelt High School). The purpose of this meeting was to inform the public of the proposal for work along the Dallas Floodway Extension and to solicit comments and information from the public to assist the Corps of Engineers in the preparation of a proposed solution to the problems within the area. Public attendance was poor.

During 1993 and 1994, the Dallas Floodway Extension Advisory Committee held numerous meetings concerning the potential solutions for the Dallas Floodway Extension flooding problems. At these meetings, Corps of Engineers representatives briefed the advisory committee on progress of the investigations and answered questions concerning the project.

Starting in the Summer of 1994 through the Spring of 1996, numerous meetings of the Trinity River Corridor Citizens Committee (TRCCC) were held to gather citizen input as to problems and solutions in the Trinity River Corridor within the city of Dallas. The areas discussed during these meetings included: environmental issues, flood damage reduction, recreation, economic development, and transportation. These meetings were attended by representatives of the city of Dallas and Corps of Engineers to provide technical input to the various groups within the TRCCC. Approximately 400 citizens participated in these meetings, and were from all areas of the city of Dallas (i.e. neighborhoods, business, environmental interests). The TRCCC produced a document expressing their desires for efforts within the Trinity River. A final report was prepared and published in May 1996 presenting their recommendations.

On June 18, 1996, the Corps of Engineers made a presentation to the Greater Dallas Planning Council concerning the on-going Corps of Engineers efforts in the Trinity River corridor within the city of Dallas. The topics of discussion were the Dallas Floodway Extension and the Upper Trinity River Feasibility Study.

On June 29, 1996, an Environmental and Recreation Assistance Committee (ENRAC) meeting was held at Reunion Tower in the city of Dallas, to present the status of on-going studies/projects within the Trinity River Basin (Fort Worth District). These projects included a detailed discussion of the Dallas Floodway Extension project. At this meeting, questions were addressed or noted and addressed in writing to the attendees.

On July 29, 1996, The Fort Worth District made a presentation to the Trinity River Corridor Citizens Committee concerning the Dallas Floodway Extension project status and proposals. This presentation and resulting questions were addressed by Colonel Peter Madsen. According to the City of Dallas, the meeting was attended by 115 people.

On August 13, 1996, The Fort Worth District made a presentation to the Trinity River Corridor Citizens Committee concerning questions raised at the July 29 meeting on the Dallas Floodway Extension project. This presentation and resulting questions were addressed by Colonel Peter Madsen. According to the City of Dallas, the meeting was attended by 135 people. Follow-on questions were answered and distributed later in the month.

On August 21, 1996, the Dallas City Council was briefed on the proposed Chain of Wetlands Plan as the Locally Preferred Plan. Several citizens addressed the City Council on the issue. On August 28, 1996, the Dallas City Council voted unanimously to adopt the Chain of Wetlands as the Locally Preferred Plan, with the stipulation to look at adding levees to the plan.

On August 22, 1996, Mayor Ron Kirk (Dallas) asked the representatives of various state and Federal agencies to meet and work together in the pursuit of improvements within the Trinity River corridor. These agencies included: City of Dallas, U.S. Army Corps of Engineers, Texas Department of Transportation, Environmental Protection Agency, Texas Parks and Wildlife Department, Texas Natural Resource Conservation Commission, Texas Turnpike Authority, Dallas County and the Assistant Secretary of the Army for Civil Works. This group agreed to cooperate and coordinate their efforts.

On November 16, 1996, an Environmental and Recreation Assistance Committee (ENRAC) meeting was held at Roosevelt High School in the city of Dallas, to present the status of on-going studies/projects within the Trinity River Basin (Fort Worth District). These projects included a detailed discussion of the Dallas Floodway Extension project. At this meeting, questions were addressed or noted and addressed in writing to the attendees.

On December 10, 1996, a Public Scoping meeting for the Dallas Floodway Extension Environmental Impact Statement (EIS) was held in Dallas, Texas. The purpose of this meeting was to solicit comments on the proposed project. This meeting was attended by 96 people. Comments received were addressed/incorporated into the EIS.

On February 8, 1997, a workshop was held at the Sleepy Hollow Golf Course Club House. This meeting was organized by the city of Dallas to provide information on the engineering analysis and evaluation of alternatives for the modified Chain of Wetlands and potential levees to affected property owners, neighborhood representatives, and key environmental group representatives. According to the City of Dallas, this workshop was attended by approximately 65 people.

On February 11, 1997, The Fort Worth District made a presentation to the Trinity River Corridor Citizens Committee concerning the Dallas Floodway Extension project status and proposals. This presentation and resulting questions were addressed by Colonel Peter Madsen and was attended by more than 250 people. Follow-on questions were answered and distributed later in the month.

On February 27, 1997, a neighborhood meeting was held at the Martin Luther King Seniors Center in South Dallas. This meeting was organized to inform the residents of the Lamar Street & Rochester Park areas of the proposed project for flood damage reduction in the area. The City of Dallas (City Council members and staff) and Corps of Engineers representatives made presentations and answered questions by the public, numbering 100 in attendance, according to the City of Dallas.

On March 4, 1997, a neighborhood meeting was held for the Cadillac Heights and Joppa neighborhoods. According to the City of Dallas, the meeting was attended by about 70 residents, and representatives from the City of Dallas (Council members and staff) and the Corps of Engineers. This meeting was used to inform the citizens of the proposed project and solicit their comments.

On March 19, 1997, the Dallas City Council was briefed on the proposal to add the Lamar Street and Cadillac Heights levees to the Locally Preferred Plan. Several citizens addressed the City Council on the issue. Then on March 26, 1997, the Dallas City Council voted unanimously to add the Lamar Street and Cadillac Heights levees to the Locally Preferred Plan.

On August 9, 1997, a presentation was made and questions were answered concerning the Locally Preferred Plan for the Dallas Floodway Extension. This seminar was held at the Sleepy Hollow Country Club in Dallas, Texas. This seminar was put on by the American Institute of Architects and entitled "A River Runs Through Us". This seminar was designed for educators (First Grade through Twelfth Grade) and had presentations by various agencies involved in projects within the Trinity River in Dallas. Agencies represented included: Office of State Archeologist, Environmental Protection Agency, City of Dallas, Texas Department of Transportation, and U.S. Army Corps of Engineers. Approximately 50 educators were present at this seminar.

Starting in the Fall 1996 and continuing through the present, meetings of the Interagency Executive Team (IET) are held in Dallas. This IET is made up of representatives of various agencies (State and Federal) who had jurisdiction or on-going work within the Trinity River Corridor. These agencies include: City of Dallas, U.S. Army Corps of Engineers, Texas Department of Transportation, Environmental Protection Agency, Texas Parks and Wildlife Department, Texas Natural Resource Conservation Commission, North Texas Tollway Authority, Dallas County and the North Central Texas Council of Governments. This group acts as a coordinating team between all agencies to optimize the efforts within the river corridor.

On August 21, 1997, Mayor Ron Kirk (Dallas) asked the representatives of various state and Federal agencies to again meet and discuss the advancements that had been made during the previous year since the last summit. These agencies included: City of Dallas, U.S. Army Corps of Engineers, Texas Department of Transportation, Office of the Secretary of the Army, Dallas County, Environmental Protection Agency, Texas Parks and Wildlife Department, Texas Natural Resource Conservation Commission, Texas Turnpike Authority, and North Central Texas Council of Governments.

During the life of the General Reevaluation Report/Environmental Impact Statement (GRR/EIS) preparation (1991 through 1998), numerous meetings with concerned individuals, groups, and affected property owners have been held to answer their questions and receive their feed back. Additionally, numerous letters and other correspondence have been transmitted to organizations and individuals to answer their questions and receive their feed back on the proposed project.

Upon completion of the draft GRR, a public meeting was held on June 9, 1998, to present the findings contained in the report and to receive public comments. The formal public review period ended on August 14, 1998. The comments received during this review period have been compiled, with appropriate responses, and included in this report in Appendix N.

FINANCIAL ANALYSIS

SOCIO-ECONOMIC EFFECTS OF PLAN IMPLEMENTATION

The potential economic and social effects of implementation of the investigated plan on the study area comprise the value of the long-term reduction in periodic flood damages, and direct and indirect short-term income and employment impact of project construction. The permanent reduction in periodic flood damages would effectively increase the income available to flood plain property owners for other purposes, such as (for example) improvements to homes, yards or personal property. Construction of SPF levees could encourage growth of existing business and entice new business to the area. This would improve employment conditions and expand the tax base of the area.

To the extent that this additional disposable income is spent within the surrounding area, it would result in a local "multiplier effect": increases in business revenues, employment, and personal income rippling through the local economy as each new dollar brought in is spent and respent. Property values, and local tax revenues, would also be expected to increase as a general result.

Short-term impacts associated with project construction results from the temporary presence of construction workers and expenditures for construction materials and services, as well as spending by the construction work force for food and other personal needs. These expenditures would be expected to result in a positive multiplier effect on the local economy and would last for about three years. The lasting economic and social effects of project implementation would be the benefits resulting from the permanent reduction in flood damages, as described above.

FINANCIAL CAPABILITY

A financial capability analysis of the City of Dallas was conducted in accordance with ER 1105-2-100 to ascertain the community's financial condition and its ability to meet the cost sharing responsibilities for the Floodway Extension Project. The assessment involved the calculation and analysis of nine key financial indicators. A number of interrelated economic, fiscal, and management factors support a local government's capacity to finance desired capital improvement projects. Those factors include the health of the local economy, the structure of its revenue base, the management of the community's operations, and the debt history of the community.

The Municipal Fiscal Officers Association has developed a number of financial warning indicators useful in determining the financial health of a community. These indicators are used to help determine the sponsor's current debt position and financial health. Financial indicator ratings are calculated for the city of Dallas and are compared to national averages as outlined in the Environmental Protection Agency's *Financial Capability Guidebook*, dated March 1984. The financial data used to calculate these ratings were obtained from the city of Dallas Office of Budget and Management. Other relevant facts and data which play a role in the analysis include population, per capita income and property tax information. Table 6-10 shows the indicator values and rating for the city of Dallas. The indicators, calculated values and corresponding rating have been updated to reflect the city's capability as of September 1997 and are summarized in table 6-11.

Table 6-10
Current Community Financial Indicator Values
For The City Of Dallas

Indicator	Value	Rating
1. Annual rate of change in population	1.2%	Strong
2. Current surplus/deficit as a percent of total current expenditures	1.1%	Average
3. Real property tax collection rate	96.9%	Average
4. Property tax revenues as a percent of full market value of real property	0.5%	Strong
5. Overall net debt as a percent of full market value of real property	2.2%	Strong
6. Overall net debt outstanding as a percent of personal income	5.2%	Average
7. Direct net debt per capita	$609	Average
8. Overall net debt per capita	$1,267	Weak
9. Percent direct net debt outstanding due within next 5 years	77.0%	Strong

The annual rate of change in Dallas' population between 1980 and 1997 exhibits a strong 1.2 percent annual rate of change. The indicator stability in the economic base is useful because the economic base typically rises and falls with changes in the population. The proportion of surplus/deficit expenditures to total expenditures are also some significant indicators of the community's strength. Dallas is currently operating at a surplus with revenues exceeding expenditures by about 1.1 percent, which is in balance with the national average. The third indicator measures the efficiency of the city's tax collection system. The city is currently average in this area reporting a 1997 collection rate of 96.9 percent. The city's reliance on tax revenue, indicator four, shows the extensiveness of property taxation and the potential for future revenue growth from this source. A value of 0.5 percent is strong and indicates that the city does not appear to tax heavily in relation to property values in this area.

Indicators' five through nine are used to assess the community's debt capacity. Indicator five compares the amount of tax-supported debt to the full market value of real property. The city of Dallas is average with a value of 2.2 percent. Personal income can be used as a yardstick to judge the city's ability to repay debt. Per Capita income for January 1994 was $24,480. Indicator six shows net debt representing about 5.2 percent of total personal income, which is average for most cities. Indicators' seven and eight represent the per capita direct debt of almost $609 and overall net debt outstanding per capita of $1,267, which indicates a weakness in this area.

Finally, indicator nine compares the percentage of direct net debt due within five years to total outstanding direct net debt. The city's situation is strong with 77 percent of the outstanding debt being paid over the next five years. The overall net debt reported in 1997 was $1,326,830,670.

Based on the national averages the overall financial condition of the city of Dallas is currently in a healthy state. The only indicator falling within the weak range was for the amount of net debt outstanding per capita. However, the calculated value only exceeded the average limits by only $67. Based on this analysis, the city of Dallas appears to have room to expand their debt load to accommodate new capital projects.

Table 6-11
Summary of Financial Capability
Dallas Floodway Extension Dallas, Texas, General Evaluation

A. BOND RATINGS	Rating	Date
General Obligation	AAA/Aaa (S&P)	Nov-96
Revenue Bonds:		
Dallas Water Utilities	AA/Aa (S&P)	
Civic Center	A/A1	Apr-98

B. DEBT

	Outstanding	Projected	Total
General Obligation Bonds	$632,940,270	0	$632,940,270
Revenue Bonds	$1,026,993,000	0	$1,026,993,000
Gross Direct Debt	$1,659,933,270	0	$1,659,933,270
Direct Net Debt	$632,940,270	0	$632,940,270
Overlapping Net Debt 1/	$693,890,000	0	$693,890,000
Overall Net Debt	$1,326,830,270	0	$1,326,830,270

C. DEBT REPAYMENT SCHEDULE (principal only)

	Existing	This Project*	Total
Year 1: 1998	$110,829,408	0	$110,829,408
Year 2: 1999	$107,821,082	0	$107,821,082
Year 3: 2000	$100,014,486	0	$100,014,486
Year 4: 2001	$86,486,881	0	$86,486,881
Year 5: 2002	$80,955,880	0	$80,955,880
			$486,107,737

* Assumes project funding at $23.7 million and included in outstanding debts. General Obligation bonds authorized as of May 1997.

D. DEBT LIMITS

Constitutional and Charter Debt Limit: Ten percent of assessed value. Article 717K, Vernon's Annotated Texas Civil Status Constitution and Laws of the State of Texas. Approximately 16.83% of debt limit will be used.

[1] *Overlapping net debt is the sponsor's share of taxes owed to other taxing bodies within the community, ie., a flood district.*

[2] *Other debt obligations include outstanding leases, unfunded pension liabilities, and notes with a maturity.*

NON-FEDERAL FINANCIAL PLANNING

The purpose of strategic financial planning is to optimize the use of capital over time in response to long term financial goals. The three principal elements involved include cost recovery alternatives, if needed; selection of the preferred financing alternative; and implementation of the cost recovery approach. Although financing decisions are ultimately the sponsors', the Corps of Engineers can assist in the decision making through the provision of timely information on costs, benefits and cost recovery opportunities. The sponsor is responsible for making arrangements to finance the project sufficiently in advance of construction to enable the project schedule to be met.

ABILITY-TO PAY ANALYSIS

Based on ER 1165-2-121 an ability-to-pay test should be applied to all flood control projects. The test determines the eligibility of the study area to qualify for a reduction in the amount to be cost shared by the Non-Federal interest. To qualify for a reduction the results of both the benefit and income portions of the twofold ability-to-pay test must fall within the specified guidelines.

The benefits' test determines the maximum reduction, called the "benefits based floor" (BBF), in the level of non-Federal cost sharing for any project. The factor is determined by dividing the project B/C ratio by four. If the factor (expressed as a percentage) is less than the standard level of cost sharing, the project may be eligible for a reduction in the non-Federal share to this BBF. The standard level cost share for the Flood Protection project is a minimum of 25 percent. The recommended plan's B/C ratio of 2.06 was divided by four to yield a BBF of .515 or 51.5 percent.

The income test determines qualification for the reduction calculated in the benefit step. Qualification depends on a measure of the current economic resources of both the project area and the State in which the project is located.

In accordance with factors released in Economic Guidance 96-4, the income index factors for the state of Texas and Dallas County are 90.81 and 102.77, respectively. The Eligibility Factor (EF) for a flood control project is calculated according to the following formula:

$$EF = a - b_1 * (\text{State factor}) - b_2 * (\text{area factor})$$

where:

$a = 15.86794$

$b_1 = 0.06771$

$b_2 = 0.13543$

Utilizing the above formula, an EF of -4.2 was calculated for the City of Dallas. An EF less than zero indicates ineligibility for a reduction in construction cost sharing. As stated previously, a BBF factor for the investigated plan was calculated at 51.5 percent. To qualify for a reduction, the BBF factor must be less than the standard level of cost sharing. According to ER-1165-2-121 paragraph 5a(2), the City of Dallas does not meet the criteria for a reduction in construction cost because this project does not meet both of the tests; therefore, the City of Dallas must pay a minimum of 25 percent level of the total flood protection project cost.

CHAPTER 7

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 7
DISCUSSIONS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter summarizes the results of the investigations of the General Reevaluation of the water and related land resource problems and needs with the Dallas Floodway Extension study area.

DISCUSSIONS

The Dallas Floodway Extension project is one of five local flood protection projects authorized for construction in 1965. Further studies were conducted which assessed the plan in greater detail, but were never implemented. The current study was initiated in 1991 following significant flood events in 1989 and 1990.

The NED Plan identified in this reevaluation consisted of a 1,200-foot wide swale providing greater conveyance of flood waters through the area. The flood control portion of this plan had an estimated cost of $50.0 million. The vast majority of benefits for this plan were realized in the existing Dallas Floodway, upstream of the immediate study area. This plan, which was extremely controversial from an environmental resource perspective, would have directly impacted approximately 725 acres of environmental resources, including removal of approximately 504 acres of bottomland hardwoods, and would have required 3,200 acres of mitigation at an estimated cost of $13.5 million.

Because of the public input regarding the environmental impacts of the NED Plan, and due to the city's desire to provide greater protection to the immediate study area and to incorporate environmental restoration features into the project, the chain of wetlands concept was developed. The Chain of Wetlands Plan consisted of upper and lower flood control swales, divided by IH-45. These swales were reduced in width and relocated as far west as possible to avoid the higher quality forested areas. The Chain of Wetlands would require approximately 649 acres of mitigation at an estimated cost of $3.1 million. The Chain of Wetlands Plan was formally adopted as the initial Locally Preferred Plan (LPP) on August 28, 1996. In addition, due to the anticipated public acceptability issues associated with implementation of the NED Plan, the chain of wetlands was designated as the first increment of the Federally Supportable Plan, in lieu of the NED Plan. However, public and social pressure remained to provide flood protection to the study area comparable to the protection provided to the Central Business District by the existing Dallas Floodway.

The addition of SPF levees to the chain of wetlands concept was investigated. The Lamar Levee was deemed economically feasible and was, therefore, added to the chain of wetlands as part of the Federally Supportable Plan. Although the analysis of a SPF levee at Cadillac Heights showed that this levee was not incrementally justified, a 100-year levee (1.0 percent chance of exceedance in any one year) at this location proved to be feasible. However, sensitive social equity issues prompted the city to adopt a plan including SPF levees on both sides of the river. The Chain of Wetlands Plus SPF Levees Plan was formally adopted by the city as the final LPP on March 26, 1997.

In the April 1998 draft of this report, the Federally Supportable Plan (FSP) was identified as a plan that, except for the levee protecting the Cadillac Heights neighborhood, would provide a Standard Project Flood (SPF) level of protection at a high degree of reliability. In this plan, the Cadillac Heights Levee would only provide protection from the flood that would have a 1.0 percent chance of exceedance in any one year, with a 34.0 percent reliability. Upon further analysis and subsequent concurrence by the Assistant Secretary of the Army(Civil Works), it was determined that the FSP is that plan that provides SPF protection for the entire Dallas Floodway Extension project for the following reasons. First, the alternative levee for the Cadillac Heights neighborhood would not meet the Federal Emergency Management Agency standards for protecting the area from a flood that would have a 1.0 percent chance of exceedance in any one year, nor would it provide an acceptable level of reliability, particularly when compared with other project elements. Second, the alternative levee for Cadillac Heights would allow continued damages in this area from major, although infrequent floods (greater than the flood that would have a 1.0 percent chance of exceedance in any one year), due to the construction of other project levees. Finally, Congress has already authorized the project, including the Cadillac Heights Levee, at a SPF level of protection. For the reasons noted above, the project providing a consistent SPF level of protection is the Federally Supportable Plan, and is therefore the Recommended Plan.

The original Dallas Floodway Extension project, authorized in 1965, contained levee, channel, and lake features designed to provide SPF protection to both the northern and southern portions of the city of Dallas. The current Recommended Plan provides for similar outputs at a lower total project cost. The estimated cost of the authorized improvements to the Dallas Floodway Extension area, at October 1998 price levels, would be approximately $202.7 million. Total annual benefits for the authorized project were estimated at $13.2 million. Under current economic conditions, the authorized project would have negative net benefits of $3.0 million, with a BCR of 0.82. The Recommended Plan, as presented herein is estimated to cost approximately $127.2 million, including $23.1 million for compatible portions of previously constructed non-Federal levees. This plan would yield total annual benefits of approximately $19.1 million, net annual benefits of $9.8 million, and a BCR of 2.06.

CONCLUSIONS

The following conclusions are based on the results of the investigations conducted for this study.

a. A significant need exists for a project within the Dallas Floodway Extension study area providing flood damage reduction benefits, environmental restoration features and recreation amenities.

b. The Recommended Plan is a multi-objective project consisting of a flood control swale, with an incorporated chain of wetlands for environmental restoration purposes, SPF levees protecting the Lamar and Cadillac Heights neighborhoods, environmental mitigation, and recreation facilities compatible with a larger, regional recreation master plan. Also included in this plan would be a proposed realignment of the existing river channel at the IH-45 bridge to prevent catastrophic failure of this designated national defense route, and to reduce significant annual maintenance costs due to debris accumulations at the bridge.

c. The City of Dallas has been identified as the local sponsor for the construction of the project. The Federal and non-Federal cost apportionments for the Recommended Plan are estimated at $83.6 million (65.7%) and $43.6 million (34.3%), respectively. A credit in the amount of approximately $22.2 million was applied toward the non-Federal share of the flood control project costs, in accordance with Section 351 of WRDA 1996.

d. It is noted that certain costs have been estimated which are not included as project costs, and which are not allowed to be cost shared. These costs include removal and/or preservation of cultural resources which may be discovered during implementation of this project, and which would be borne as a 100 percent Federal cost, up to a maximum of one percent of the total Federal project costs. Should the cost of cultural resource preservation exceed this one percent limit, cost sharing provisions would be implemented. An estimate of $800,000 has been developed to cover the possibility of cultural resource preservation. These costs have been included in the cost apportionments noted above.

e. Environmental restoration is not included as a project purpose in the original language of the 1965 authorization for this project. An amendment to the authorization, adding environmental restoration as a purpose for all Upper Trinity River studies, is required

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f. Cultural investigations undertaken to provide basic information on the project have identified fourteen archaeological and architectural sites eligible for inclusion on the National Register of Historic Places. Although additional investigations will be necessary for a definitive determination of eligibility, the archaeological sites appear to retain intact deposits valuable in scientific research and are, therefore, being treated as eligible for the purposes of this project. The potential for additional intact historic sites and in situ buried prehistoric cultural deposits in the project footprint impact zone is very high. All efforts will be needed to locate and identify all significant heritage resources to be impacted by the proposed project and to develop contingencies to minimize or mitigate their loss. A Programmatic Agreement with the Advisory Council on Historic Preservation, Texas Historic Preservation Officer, and other interested parties has been developed to address cultural resources with due diligence. This agreement has been included in Appendix L of this report.

g. The Recommended Plan, as proposed, would provide completion of a significant portion of the Authorized Plan for the Dallas Floodway Extension. The plan is located within the originally chosen site, and includes smaller scale features of the authorized flood damage reduction plan. Future work efforts to more fully fulfill the scope of the authorized plan would not be adversely affected by the Recommended Plan.

RECOMMENDATIONS

I recommend that the original authorization for the Trinity River and Tributaries Basinwide Study be amended to include Environmental Restoration as a project purpose, and that the Recommended Plan, as described in this report, for flood damage reduction, environmental restoration and recreation development along the Trinity River within the city of Dallas, Texas, be constructed as a Federal project with such modifications thereof as in the discretion of the Commander, HQUSACE, may be advisable.

I also recommend that the non-Federal sponsor be authorized credit for the advanced non-Federal construction of the Central Wastewater Treatment Plant Levee upgrade and the portion of the Rochester Park Levee compatible with the Recommended Plan. The preliminary estimate for this compatible construction, subject to an audit for reasonableness, allocability, and allowability, is approximately $22,174,000.

The above recommendations are made with the provision that prior to project implementation, the non-Federal sponsor shall enter into a binding agreement with the Secretary of the Army to perform the following items of local cooperation:

a. Provide between 25 percent and 50 percent of the separable project costs allocated to flood control, 35 percent of the separable project costs allocated to environmental restoration, and 50 percent of the costs separable project costs allocated to recreation, as further specified below:

(1) Provide, during construction, funds needed to cover the non-Federal share of preconstruction engineering and design costs;

(2) Provide, during construction, a cash contribution equal to 5 percent of total project costs allocable to flood control;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring

features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 25 percent of total project costs allocated to structural flood control, 35 percent of the separable project costs allocated to environmental restoration, and 50 percent of the costs separable project costs allocated to recreation.

b. Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the local 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.

c. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project including mitigation features, without cost to the Government, in a manner compatible with the project's authorized purposes, and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments.

d. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

e. Hold and save the Government free from all damages arising for the construction, 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 the Government's contractors.

f. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs.

g. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

h. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

I. To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

j. Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project.

k. 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 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

l. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as 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 Section 402 of the Water Resources Development Act of 1986, as amended.

m. Provide the non-Federal share of that portion of total cultural resource preservation mitigation and data recovery costs attributable to flood control, environmental restoration, and recreation that are in excess of one percent of the total amount authorized to be appropriated for flood control, environmental restoration, and recreation.

n. Participate in applicable flood insurance programs, and in accordance with Section 202(c) of the Water Resources Development Act of 1996, within 1 year after the date of signing a project cooperation agreement for construction of the project, prepare a floodplain management plan designed to reduce the impacts of future flood events in the project area, and implement such plan no later than 1 year after completion of construction of the project.

o. Provide and maintain necessary access roads, parking areas and other public use facilities, open and available to all on equal terms.

p. Prescribe and enforce regulations to prevent obstruction of or encroachment on the Project that would reduce the level of protection it affords or that would hinder operation or maintenance of the Project.

q. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized by statute.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent to the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

James S. Weller
Colonel, Corps of Engineers
District Engineer

DEPARTMENT OF THE ARMY
SOUTHWESTERN DIVISION, CORPS OF ENGINEERS
1114 COMMERCE STREET
DALLAS, TEXAS 75242-0216

REPLY TO
ATTENTION OF

February 12, 1999

Engineering and Technical
Services Directorate

Lieutenant General Joe N. Ballard
Commander
U.S. Army Corps of Engineers
20 Massachusetts Avenue, NW
Washington, DC 20314-1000

Dear General Ballard:

I concur in the conclusions and recommendations of the District Engineer.

Sincerely,

12Feb99

Edwin J. Arnold, Jr.
Brigadier General, U.S. Army
Commanding General

LIST OF PREPARERS

The people who were primarily responsible for contributing to preparing this General Reevaluation Report and Integrated Environmental Impact Statement are listed in table 7-1.

Table 7-1
Dallas Floodway Extension
List of Preparers

NAME	DISCIPLINE/ EXPERTISE	EXPERIENCE	ROLE IN DOCUMENT
Gene T. Rice, Jr.	Civil Engineer	16 years, Corps of Engineers	Project Management
Kevin Craig	Civil Engineer	5 years, private sector; 2 years, TxDOT; 4 years, Corps of Engineers	Technical Management; Report Preparation
Paul M. Hathorn	Supervisory Environmental Resources Planner (Biology)	23 years, water resource planning, Corps of Engineers	Review and Supervision - EIS Preparation
Billy K. Colbert	Environmental Resource Planner	9 years, Corps of Engineers; 15 years, U.S. Fish and Wildlife Service	Report - EIS Preparation
Hank Jarboe	Environmental Biology	19 years, natural resource management	EIS - Data review, evaluation and Document preparation
Marcia Hackett	Biology	6 years, wetland and landscape ecology	EIS preparation
Linda Lopez	Environmental Specialist	2 years, Corps of Engineers	Section 404 (b) (1) for DFE
Mark Simmons	Chief; Environmental Design	19 years, Corps of Engineers	Supervised preparation of the HTRW Appendix
Jim Drysdale	Environmental Design	11 years, Corps of Engineers	HTRW analysis
A. Frank Servello	Cultural Resources	2 years, Corps of Engineers; 9 years, University; 16 years, private sector	Report - EIS Preparation;SHPO Concurrence; ACHP, COE and SHPO coordination
Jeffrey Comer	Civil Engineer	18 years, Corps of Engineers	Preparation of preliminary design of relocations

NAME	DISCIPLINE EXPERTISE	EXPERIENCE	ROLE IN DOCUMENT
Lisa Eskew	Civil Engineer	3 years, Corps of Engineers	Utility Relocations
Elston Eckhardt	Chief; Hydrology & Hydraulics	17 years, Corps of Engineers	Review - H&H; Risk-Based Analysis
David Wilson	Hydraulic Engineer	16 years, Corps of Engineers	Hydraulic analysis
Craig Loftin	Hydraulic Engineer	18 years, Corps of Engineers	Hydrologic and hydraulic analysis
Efren Martinez	Civil Engineer	15 years, Corps of Engineers	Civil Design
Gayla Gurley	Civil Engineer	16 years, Corps of Engineers	Civil Design
Charles Peter Matar	Civil Engineer	3 years, TxDOT; 6 years, Corps of Engineers	Civil Design
Lanora Wright	Economist	13 years, Corps of Engineers	Economics
Randy Roberts	Realty Specialist	15 years, real estate management and planning, Corps of Engineers	Real Estate
Warren Shaver	Structural Engineer	30 years, Corps of Engineers	Structural Design
Mark Sissoms	Structural Engineer	19 years, Corps of Engineers	Structural Design
Janet Hall	Geotechnical Engineer	7 years, Corps of Engineers	Geotechnical Design
Bill Cotten	Landscape Architect	11 years, Corps of Engineers	Recreation Planner
Jim Sears	Cost Estimating	43 years, Corps of Engineers	Cost estimating
Richard Keene	Cost Estimating	24 years, Corps of Engineers	Preparation - MCACES cost estimate

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APPENDIX A

HYDROLOGY AND HYDRAULICS

APPENDIX A

HYDROLOGIC AND HYDRAULIC ANALYSES

PART 1 - HYDROLOGIC ANALYSIS

WATERSHED DESCRIPTION

The drainage area of the Trinity River, from its headwaters to the confluence of Five Mile Creek, near the Interstate Highway 20 bridge in south Dallas, was evaluated during this study. This area, which is commonly referred to as the "Upper Trinity" watershed, covers about 6,275 square miles. It includes the majority of the Dallas-Fort Worth (DFW) Metroplex. Terrain in this watershed varies in elevation from about 1,200 feet National Geodetic Vertical Datum (NGVD) at the headwaters of the West Fork of the Trinity River just northeast of Olney, Texas, to about 380 feet NGVD at the confluence of Five Mile Creek. A general watershed map is included as Plate A-1.

Of the five US Army Corps of Engineers (USACE) flood control reservoirs in the study area, three (Lakes Benbrook, Lewisville, and Grapevine) were impounded in the early 1950's. Impoundments in the other two USACE reservoirs (Lakes Joe Pool and Ray Roberts) were initiated in January 1986 and June 1987, respectively. Additional major USACE flood control projects in the study area include the Fort Worth Floodway and Dallas Floodway levee/channel improvement systems.

The two largest non-Federal lakes in the study area, both of which are situated on the West Fork of the Trinity River, are Lake Bridgeport and Eagle Mountain Lake. Lake Bridgeport is located just west of Bridgeport in Wise County. Eagle Mountain Lake is located in northwestern Tarrant County, just upstream from the much smaller Lake Worth, which is owned by the City of Fort Worth. Eagle Mountain Lake has two sets of outlet gates and an emergency spillway, but since it has no dedicated flood control storage, large releases are required during flooding periods. Smaller lakes within the Upper Trinity watershed include: Lake Amon Carter, located on Big Sandy Creek south of Bowie in southwestern Montague County; Lake Weatherford, located on the Clear Fork of the Trinity River northeast of Weatherford in Parker County; Lake Arlington, located on Village Creek in western Arlington in Tarrant County; and Mountain Creek Lake, located on its namesake in Grand Prairie in western Dallas County.

CLIMATOLOGY

The climate in the Upper Trinity watershed is humid subtropical with hot summers and mild winters. Snowfall and subfreezing temperatures are experienced occasionally during the winter season. Generally, the winter temperatures are mild with occasional cold periods of short duration resulting from the rapid movement of cold pressure air masses from the Northwestern polar regions and the continental western highlands.

Recorded temperatures at the DFW International Airport have ranged from a high of 113°F in June 1980 to a low of -1°F in December 1989. The average annual temperature over the watershed varies from 64°F at Bridgeport in the northwestern extremity of the watershed to 66°F at DFW International Airport. The mean annual relative humidity for the DFW Metroplex is about 65 percent. The average annual precipitation over the watershed varies from about 30 inches at Jacksboro, in the northwestern extremity of the watershed, to about 32 inches in the DFW Metroplex. The extreme annual precipitation amounts since 1887 include a maximum of 53.54 inches in 1991 at the DFW International Airport and a minimum of 17.91 inches in 1921 at Fort Worth. The maximum recorded precipitation in a 24 hour period was 9.57 inches, at Fort Worth on the 4th and 5th of September 1932. A large part of the annual precipitation results from thunderstorm activity, with occasional very heavy rainfall over brief periods of time. Thunderstorms occur throughout the year, but are more frequent in the late spring and early summer.

The average length of the warm season (freeze-free period) in the DFW Metroplex is about 249 days, extending from mid-March to mid-November.

MODEL DEVELOPMENT

A watershed runoff model for the area was developed utilizing the USACE computer program "HEC-1". The drainage area was divided into 110 subareas in order to be responsive to the timing of each major tributary's runoff contribution to the total flood hydrograph and also to obtain detailed flow information (flood hydrographs) at all major points of interest on the Clear, West, and Elm Forks, as well as the mainstem of the Trinity River. Plate A-1 shows the subarea arrangement. A one-hour computation time interval was used in the model. Each reservoir having flood control storage was assumed to be at conservation pool level at the start of the hypothetical, frequency related storms/floods and at a level corresponding to that at which one-third of the full flood control pool (except at Lewisville Lake which was started at 89 percent full) would already be occupied at the start of the USACE" Standard Project Flood (SPF). All reservoirs without flood control storage were assumed to be at normal (conservation pool) levels at the start of all storm/flood events. Lake Bridgeport, Eagle Mountain Lake, Lake Worth, and Lake Arlington were assumed to reside at a level corresponding to 2, 3, 2, and 3, feet, respectively, above normal (conservation pool) level at the start of the SPF event.

MODEL CALIBRATION

The Upper Trinity River "HEC-1" model was calibrated by reproducing the significant historical flood hydrographs of May-June 1989, April-May 1990, and December 1991. Initial abstractions, infiltration rates, and Snyder"s unit hydrograph parameters (lag time and peaking coefficient) were adjusted in order to generate computed hydrographs that would reasonably match the observed flood hydrographs at the streamflow gages and lakes (inflow) throughout the basin. Additionally, the Muskingum "X", "K", and number of routing steps (in both the Muskingum and modified Puls routing methods) were adjusted during the calibration efforts. The results of the flood hydrograph reproductions for the May-June 1989, April-May 1990, and December 1991 events were tabulated and compared with the results of hydrograph reproductions for the October 1974, March 1977, October-November 1981, and May 1982 events, as published in the "Upper Trinity Reconnaissance Study", dated May 1990. The results of these analyses, for the seven storm/flood reproductions, were used to assign each of the specific parameters noted above.

The model was further calibrated by adjusting infiltration rates, within reasonable limits, in order to match as closely as possible the peak values of eight different frequency related flood peaks, based on analyses of historical peaks at six streamflow gaging stations. These streamflow gaging sites include the Clear Fork of the Trinity River at Fort Worth, the West Fork of the Trinity River at Fort Worth, the West Fork of the Trinity River at Grand Prairie, the Elm Fork of the Trinity River near Carrolton, the Trinity River at Dallas, and the Trinity River below Dallas. The target values of the peak flows for hypothetical frequency related floods at any particular gage were determined by performing a flood flow frequency analysis from the record of flows at that gage. The time period covered by the gage record of flows was selected to extend from water year 1953 through water year 1992. Water year 1953 was used as the starting point since all of the major flood control reservoirs, except Lakes Joe Pool and Ray Roberts, were in place by 1952. Water year 1992 was used as the "cut-off" point for the statistical analyses since the last significant flood events on the major branches and the main stem of the Trinity River occurred in December 1991 (water year 1992). It should be noted that the degree of urbanization and conditions of available valley storage changed gradually, but significantly throughout this gaging period; therefore, a direct (perfect) calibration would not necessarily represent present day or projected baseline conditions. The flood flow frequency analysis was performed using the procedures described in "Guidelines for

Determining Flood Flow Frequency, Bulletin No. 17B, Revised September 1981", and using USACE" Southwestern Division's skew criteria. The USACE computer program "HEC-FFA" (dated May 1992) was used to statistically estimate the frequency versus discharge relationship at each of the investigated gaging sites. A graphical representation of these statistical frequency curves is presented on Plates A-2 through A-7. Plates A-7A and A-7B provide samples of the flood hydrograph reproductions.

MODEL RAINFALL

The hypothetical precipitation for the 1-, 2-, 5-, 10-, 25-, 50-, and 100-year frequency storms was developed using data from the National Weather Service (NWS) "Technical Paper 40 (TP40)" and the National Oceanic and Atmospheric Administration (NOAA) Memorandum "NWS Hydro-35". Precipitation for the 500-year frequency storm was computed by extrapolation. Figure 15 of TP40, "Depth-Area-Duration" curves, was used to adjust the point rainfall to representative average values over the contributing watershed size at each point of interest. One-hour computation time intervals were used with a 24-hour storm duration for each of the frequency related storm events. As an example, the point rainfall amounts for the 24-hour duration storms, with the storm center positioned approximately at the streamflow gage for the West Fork of the Trinity River at Grand Prairie, are as follows: 1-year, 3.20 inches; 2-year, 4.00 inches; 5-year, 5.38 inches; 10-year, 6.43 inches; 25-year, 7.54 inches; 50-year, 8.55 inches; 100-year, 9.55 inches; and 500-year, 13.10 inches. The area-adjusted 100-year frequency storm rainfall distribution is presented in Table A-1.

The Standard Project Storm (SPS) was assumed to have a total rainfall amount equal to 50 percent of the Probable Maximum Storm (PMS) rainfall amount, as adjusted in accordance with USACE" Hydrometeorological Report Number 52 (HMR 52). The PMS precipitation (commonly referred to as the PMP) was determined in accordance with the method described in "HMR 51", dated June 1978, Subject: "Probable Maximum Precipitation Estimates, United States East of the 105th Meridian," and "HMR 52", dated August 1982, Subject: "Application of Probable Maximum Precipitation Estimates - United States East of the 105th Meridian." The computer program used to develop the SPS was the USACE" "HMR52". The SPS duration was 72 hours. Four separate elliptical storm positions were used to obtain "critical-centerings" on the West, Clear, and Elm Forks, and on the main stem of the Trinity River. One of these storm centers was critically centered for the "Trinity River at Dallas" streamflow gage, for which the dominant major storm axis orientation from "HMR52" is 220 degrees bearing and the critical storm orientation angle is 246 degrees bearing. The average SPS precipitation over the 6,275 square miles of drainage area is 5.64 inches. This average precipitation is based on a critical centering of the hypothetical elliptical SPS at Hurst, in northeastern Tarrant County. As an example, the SPS rainfall amount for Subarea 50, located near the storm center, is 19.52 inches. The SPS rainfall distribution for that subarea is presented in Table A-2.

INITIAL ABSTRACTIONS AND INFILTRATION RATES

The rainfall loss values were assumed to vary with the frequency of each storm event and the nature of the soil surface. The USACE, Fort Worth District (FWD) standard values are presented in Table A-3. Data on soils was obtained using generalized soils maps from the USDA Natural Resources Conservation Service, formerly the Soil Conservation Service (SCS), which had been linked electronically with the detailed subbasin layout mapping in a geographic information system (GIS). The "percent sand" for each subarea was determined by first assigning a value to each soil type and then weighting the value for each applicable soil type in proportion to the area of each soil type in a particular subarea. Engineering judgment was used for some subareas to override the "percent sand" values obtained by the GIS. The initial abstraction and infiltration rate for each subarea was weighted in accordance with the previously tabulated values for clayey (zero "percent sand") and sandy (100 "percent sand") soils.

Comparisons were made between the frequency versus discharge relationships determined based on the statistical analysis of historical data at the major streamflow gages and those based on results of the "HEC-1" modeling. Adjustments were made to the rainfall losses at some subareas in order to produce a better correlation. The adjusted values were then used in this study. The loss rates for the SPF event varied regionally and were identical to those used in the "Upper Trinity Reconnaissance Study".

DEVELOPMENT OF UNIT HYDROGRAPHS

Unit hydrographs for the subareas above Eagle Mountain, Benbrook, Grapevine, and Lewisville Lakes were based on the adopted Snyders lag times and peaking coefficients obtained through the historical flood hydrograph reproductions of the May-June 1989, April-May 1990, and December 1991 events. Previously developed relationships between measurable subbasin parameters and Snyders unit hydrograph lag time, for both clayey and sandy soils, with consideration for the degree of urbanization, were used for the smaller, more urban subareas within the "HEC-1" model , downstream of the lakes.

Land use data for baseline conditions (year 2000) were obtained from the North Central Texas Council of Governments (NCTCOG). This data and a table correlating land use to "percent urbanization" and "percent imperviousness" was input into the GIS. Net values of these parameters at each subarea were derived from the GIS by weighting the land uses within each subarea by the default values associated with each land use.

The Snyders unit hydrograph lag time ("time-to-peak") was developed for each small, urban subarea using methodology described in "Synthetic Hydrograph Relationships, Trinity River Tributaries, Fort Worth-Dallas Urban Area" by T. L. Nelson, 1970. These mathematical relationships, which are referred to as "Urbanization Curves", are available for both Cross Timbers sandy loam- and Blackland Prairie clay- dominated watersheds in the general vicinity of the DFW Metroplex. The geographical characteristics of each subarea, including the length of the major stream (L), the distance from the subarea outflow point to the location of the subarea centroid (L_{ca}), the weighted slope (S_{st}) of the major stream, and the "percent urbanization" are the data used in the equations to determine the Snyders lag time for the two general extremes of soil type. The Snyders lag for each subarea was then generated mathematically from the "Cross Timbers Sandy Loam" and "Blackland Prairie Clay" Urbanization Curves through direct interpolation, based on the percentage of each soil type within that subarea. These urbanization curves are shown on Plates A-8 and A-9.

The subbasin parameters (both measured and computed) for baseline conditions (year 2000) are presented in Table A-4.

ROUTING PROCEDURES

The modified Puls routing method was used along the reaches downstream of Lake Worth and Benbrook, Grapevine, and Lewisville Lakes. The valley storage versus discharge relationships were based on USACE "HEC-2" backwater analyses, using the latest (February 1991) 2-foot contour interval topography along the Clear, West, and Elm Forks and the mainstem of the Trinity River. The modified Puls routing method was also used along the reach of Denton Creek below Grapevine Lake, but in this particular case, the valley storage versus discharge relationships were based on "HEC-2" backwater analyses used in the Denton County Flood Insurance Study of 1985.

The Muskingum routing method was generally used along the reaches upstream from Lake Worth, Benbrook Lake, and Lewisville Lake. The Muskingum "X", "K", and number of routing steps (in both the Muskingum and modified Puls routing methods) were calibrated by reproducing the historical flood hydrographs of May-June 1989, April-May 1990, and December 1991.

BASELINE CONDITIONS

Baseline conditions represent estimated watershed development for the year 2000, based on land use data obtained from NCTCOG. The "percent urbanization" and "percent imperviousness" values for each subarea were derived from the GIS as previously mentioned. Unit hydrographs for each subarea in the DFW metropolitan area were adjusted for this "baseline" urbanization. Rainfall losses for each subarea were also adjusted for "baseline" imperviousness.

The valley storage versus discharge relationships for the Clear, West, and Elm Forks, and the mainstem of the Trinity River, within the DFW metropolitan area, were based on "HEC-2" backwater analyses which had been adjusted to account for any known and/or anticipated future projects, and/or those which were under construction since the development of the February 1991 aerial photography and subsequent topographic mapping.

A summary of the computed probability peak discharges for baseline conditions is presented in Table A-5.

FLOOD CONTROL ALTERNATIVES

Many flood control alternatives were considered in this study. They are described in detail in Part 2 of this appendix ("Hydraulic Analysis"), and in the main report and other appendices. The two structural alternatives on the main stem of the Trinity River which were analyzed with hydrologic models were: the National Economic Development (N.E.D.) Plan, which is a 1,200-foot long overflow swale in the vicinity of the confluence of White Rock Creek; and the Recommended Plan, which is a combination of a proposed Chain of Wetlands Plan and the implementation of both the Lamar Street and Cadillac Heights Levee projects. Summaries of the computed probability peak discharges for baseline conditions on these two scenarios are presented in Tables A-6 and A-7, respectively.

RISK ANALYSIS

In accordance with recent USACE study criteria, a risk-based economic analysis was performed in this study. From a hydrologic standpoint, the three key locations along the Trinity River which were assessed for this purpose are: the downstream end of the existing Dallas Floodway (i.e. at the abandoned Atchison,Topeka, & SanteFe Railroad crossing); the Central Wastewater Treatment Plant Levee; and the "Below Dallas" streamflow gage site (at State Highway Loop 12). This analysis was performed in accordance with the procedure described in USACE Engineering Circular "EC 1105-2-205", dated 25 February 1994, entitled "Risk-Based Analysis for Evaluation of Hydrology/Hydraulics and Economics in Flood Damage Reduction Studies."

Computed probability discharge versus frequency curves for baseline conditions were developed for the Trinity River at these three locations using the "HEC-1" model as previously described. The log-transformed statistics of mean, standard deviation, and skew were then developed by trial-and-error to reasonably reproduce the discharge versus frequency curve at each location. The "HEC-FFA" program was used in this process, with 40 years assigned as an equivalent gaging record length. A summary of the calibrated statistics at each location, for each analysis condition, is presented in Table A-8. These statistical parameters were supplied as a part of the input to the "HEC Risk Analysis Program" which was then used to crudely simulate the long-term average annual equivalent flood damages under baseline conditions. Graphical representations of the resulting frequency curves are presented on Plates A-10 through A-18.

INTERIOR DRAINAGE ANALYSES

While providing a substantial degree of riverine flood damage reduction to existing properties in the reach downstream from the present end of the Dallas Floodway (at the Dallas Area Rapid Transit crossing), the proposed Lamar Street and Cadillac Heights Levees would trap a major portion of the surface runoff from about 1,264 and 337 acres of localized subbasin area, respectively. Interior drainage facilities (sumps and sluice outlets) would be required to insure that this runoff does not contribute to any "induced" flood damage. Since the levee alternatives have been intentionally designed to provide at least a 100-year frequency level of Trinity River flood containment, it was deemed inappropriate, by the local sponsor (the City of Dallas), to propose anything less than a 100-year frequency level of protection from potential interior drainage flood damage. This design level was thus necessary to meet the City"s criteria for the Recommended Plan. Developing at least a 100-year frequency level of protection from interior drainage also fits well within the City"s goals and incentives relative to their participation in the National Flood Insurance Program (NFIP).

Interior Runoff

A combination of the previously mentioned February 1991, 2-foot contour interval topographic mapping, older and less detailed City of Dallas topographic mapping, and the standard 7.5-minute US Geological Survey (USGS) 10-foot contour interval topographic mapping was used to delineate the subbasins which would contribute to interior drainage behind the proposed Lamar Street and Cadillac Heights Levee alignments. In cases where the topographic detail was too limited, the City"s storm sewer plans were used to further define the boundaries of the contributing drainage areas. A generalized watershed layout map for the interior drainage areas is presented on Plate A-19.

Subbasin runoff models, including both USACE"s "HEC-1" and the USACE-FWD"s "SWFHYD" (Southwestern Division, Fort Worth District, Hydrologic Analysis Package) were developed for these areas. Point rainfall, and its adjustment to represent basin average precipitation, was developed as previously mentioned, using a combination of the NWS "TP-40" and NOAA "Hydro. 35" data sources. Since the overwhelming majority of the localized basins are already fully developed, with a more intensive degree of urbanization expected to prevail once the levee projects are implemented, both the unit hydrograph lag times and rainfall losses were assumed to be minimized. In this particular case, the Snyder"s unit hydrographs were uniformly assigned a lag time of 5 minutes and a peaking coefficient of 0.71875 (which relates to a 640 Cp value of 460). This peaking coefficient matches the general value determined appropriate for the DFW vicinity, based on extensive flood hydrograph reproductions performed by USACE- FWD in the late 1970's. For design purposes, each subbasin was assumed to be fully covered with impervious surface material.

Riverine Tailwater Assessment

An extensive statistical evaluation was made of Trinity River flows (mean daily values) and their correlation with localized precipitation at Dallas. The analysis period of May 1957 to present (actually September 1994, due to limits of available electronic data) was used since most of the major USACE flood control reservoirs which affect flows along this reach of the river were in full operation beginning with the major inflows resulting from the April-May 1957 flood events. Ray Roberts and Joe Pool Lakes, which were implemented in the 1980's, have a fairly limited impact at this point in the river system. A generally weak correlation between localized storms and high mean flows in the river was noted. This is due to the fact that substantial rainfall upon the central and upper portions of the Clear, West, and Elm Forks of the Trinity River watershed, runoff from which is gradually routed through the long stream reaches and assorted reservoirs, is necessary to produce large, sustained flows at the proposed project reach. The runoff from the small localized interior basin watersheds at Dallas is often fully evacuated prior to the arrival significant flows on the river itself. For design purposes however, it is reasonable to assume that a closer coincidence will occur occasionally over the project life. Therefore, the prevailing (limited) steady state release rate used in evacuating water from the flood control pools of the upstream USACE reservoirs was used as a basis for the Trinity River conditions at the time of potentially intense localized precipitation. This flow value, 15,000 cubic feet per second (cfs), was assumed to be supplemented with 5,000 cfs from uncontrolled Trinity River inflows, downstream from the USACE reservoirs, for a total design tailwater flowrate of 20,000 cfs. Such a mean daily streamflow has been exceeded 110 times over the 37.3-year analysis period. Even though this amounts to only about 0.81 percent of the overall time, it must be understood that the lengthy periods during which the flood control storage in the USACE reservoirs is being evacuated offer prime opportunities for small localized thunderstorms to produce interior runoff at the proposed project.

The 20,000 cfs flowrate on the Trinity River relates to slightly less than the 2-year frequency peak discharge under the proposed project(s) conditions. It was applied within the "HEC-2" model being used concurrently for the hydraulic analysis, in order to establish design-condition tailwater elevations at potential outlet sluice locations along both levee reaches. These tailwater elevations range from about 400 to 404 feet NGVD along the Lamar Street Levee alignment and from about 397 to 400 feet NGVD along the Cadillac Heights Levee alignment. Due to the fact that the existing terrain (and improved properties) behind the Lamar Street Levee is generally lower than its counterpart behind the Cadillac Heights Levee alignment, the outlet sluices at the two projects would operate quite differently, from an hydraulic standpoint. The outlets along the Lamar Street Levee would experience a more significant tailwater and would have a generally limited conveyance while operating under "full pipe" flow conditions. Those along the Cadillac Heights Levee would not be impacted by the design condition tailwater and would have a generally higher conveyance while operating under "inlet control" flow conditions. This disparity has a dramatic impact upon the amount of required sump storage along each project.

Existing Storm Sewers

For purposes of this preliminary design, it was assumed that each of the major storm sewers that pass beneath the areas proposed for levee protection would be retained during implementation of the levee projects. This would allow for a considerable volume of otherwise "trapped" local runoff to be passed directly into the Trinity River. These storm sewers would be realigned, where necessary to avoid excavated sumps, etc. and would have their outlets modified to include flapgates, to prevent high river stages from forcing floodwaters to spill from any low gutter inlets in the areas proposed for the levee protection. Consideration was given to omitting the flapgates and sealing-off any relatively low access points (gutter inlets, manholes, etc.), but there was simply too low of a degree of confidence that these older and possibly poorly maintained sewer lines could sustain under the pressure created during high river stages.

Information on the storm sewer alignments and sizes were generally obtained from older City of Dallas plans. These systems appear to be fairly complex, with numerous interceptors and cross connections, making it difficult to clearly establish their capacities and reliabilities. During a site visit, one major storm sewer outlet as shown on the older plans was nonexistent on the ground. The uncertainties regarding these facilities will have to be significantly reduced, and preferably eliminated, prior to actual implementation of the two levee projects. Further research will be undertaken during the Plans and Specifications stage. If the decision is made to allow the existing storm sewers to drain directly into the proposed sumps, considerable enlargements and/or deepening of those sumps, or significantly increased outlet sluice capacities, would be required to insure the desired degree of interior flood damage protection.

Potential capacities of the existing storm sewers were computed based on direct application of the Bernoulli Equation to the reach of each sewer line between its lowest curb/gutter inlet and its outlet, near the Trinity River.

Sump and Outlet Sluice Design

Localized (interior) runoff was evaluated using the "HEC-1" program as previously described, except that the potential storm sewer capacities were deducted as simple "diversions". Emphasis was placed on the evaluation of the 100-year frequency flood event, i.e. the design flood for the interior drainage facilities. The inflow flood hydrographs at each of the sump locations were stored electronically using USACE"s Data Storage System (DSS). USACE"s Interior Flood Hydrology Package "HEC-IFH" was used to perform the actual routings through the alternative sump/outlet sluice configurations. This was accomplished by importing the inflow hydrograph (from "HEC-1" and "DSS") at each sump location and applying the design condition riverine tailwater stage against the outlet sluice(s). Each sump was assumed to be one third full at the onset of the 100-year frequency inflow. Target values for the resulting peak flood stages around the sumps were initially determined based on providing flood protection to the lowest improved property (buildings, etc.); however, later in this process the local sponsor requested that the design insure that the 100-year frequency flood pool at each sump be fully contained within its excavated, or otherwise topographically defined, boundary.

Storage volumes in each potential sump were computed based on discrete mathematical integration of thin horizontal slices (surface areas) for each associated elevation. The side slopes for excavation were limited to 3:1 (horizontal:vertical) ratios, while those along the levee faces were held to 5:1 ratios. Since the sumps were arranged to fit the existing alignments of railway and/or roadway embankments, property lines, and the proposed levees themselves, etc., it was not possible to apply simple volumetric equations for common prismatic shapes. Instead, the alternative configurations were mapped and the excavations contoured, providing a measurable surface area at each interval of elevation. The actual volumetric integration was performed within the "HEC-IFH" program based on the assigned area versus depth values.

Repetitive runs were required in order to establish a series of cross combinations of sump storage and outlet sluice capacities that would meet the design requirements. The recommended scenario at each sump was based on consideration of real estate, excavation, and outlet sluice costs. The number and sizes of sluice pipes at each outlet were adjusted to allow for a predominance of shapes that have been successfully applied at the existing Fort Worth and Dallas Floodways. These are simple rectangular conduits with both a flapgate (at the outlet end) and a manually operated sluice gate (positioned beneath the levee crown). Pertinent data on the sumps and outlet sluice structures, including hydrologic effects, are presented in Table A-9. Detailed drawings, including the plan view of each sump and the plan/profile views of the outlet sluice structures are presented in Appendix C - Civil, Relocations, and Structural Engineering.

General Considerations

The location of each sump is primarily based upon the availability of segments of the most low-lying terrain along the landward side of the proposed levees. Specific care was taken to avoid the use of any lands with existing improvements, active commercial/industrial land uses, or the likelihood of signifcant hazardous, toxic, or radioactive waste (HTRW) problems. Anticipated flood inflows at each site were determined based upon standard rainfall-runoff (hydrologic) modeling, using the available 2-foot contour detailed topographic mapping as the basis for delineating each of the applicable runoff subbasins.

In the case of the Lamar Street Levee, all existing storm sewers which provide drainage to or beyond Lamar Street are proposed to be extended (where necessary) beyond the levee, and to be backflow-controlled via sluice gate and flap gate devices. The total inflow hydrograph at each sump site is based upon the difference between the total inflow hydrograph and the total capacity of the applicable storm sewers. By allowing for the continued use of these storm sewers, substantial portions of the total runoff volume can be diverted past the proposed sumps. Two of the five sump sites already provide plenty of existing storage capacity to be combined with minimally sized sluices for interior drainage facilities. A third already provides an overwhelming majority of the necessary storage. The remaining two sump sites would require extensive excavation. In summary, optimization of facilities was only required for the two sites requiring excavation, if minimally sized facilities are used. "Minimally sized" is that size which is cost effective from a construction standpoint, but can still be maintained with relative ease.

In the case of the Cadillac Heights Levee, flood runoff from the upper portion of the primary contributing drainage area is proposed to be diverted around the south end of the levee system, thereby eliminating the need for an otherwise substantial sump storage capacity. The remaining (contributing) portion of the watershed is proposed to be handled via interior drainage facilities at four existing ditch locations. Due to the fact that the existing terrain in the Cadillac Heights area is situated several feet higher in elevation than its counterpart along the Lamar Street Levee, the anticipated tailwater effects from the Trinity River are virtually negligible. This results in a prevalent condition whereby the interior drainage can be sufficiently passed through minimally sized outlet sluice structures, without the need for temporary storage of floodwaters in sumps.

In keeping with the City of Dallas' local drainage ordinance, each interior drainage facility was designed to prevent inundation of "non-sump" lands, during the passage of a "100-year" frequency flood runoff event. In practice, an acceptable design elevation (a target) was selected around the periphery of each sump area, and the combination of sump storage capacity and outlet sluice capacity was varied, until the design conditions could be satisfied. The sump capacities were allowed to vary from that provided by the existing terrain to that necessary to store virtually the entire flood runoff volume. The outlet sluice capacities (both size and number of conduits) was allowed to vary upwards from that provided by a simple 4-foot by 4-foot box culvert, deemed as minimally sized. This is also the smallest structure size of this type to have been applied along the existing reaches of the Dallas and the Fort Worth Floodways.

Alternative Solution Scenarios

Optimization of the two sumps requiring excavation and/or larger than minimal facilities was performed by (1) holding the 100-year target elevation constant, and (2) varying the size and number of outlets inversely to the excavation required to obtain the target elevation. Corresponding costs were developed for these scenarios, and can be found in the Table 9A. The scheme selected for the recommended plan corresponds to the lowest cost of the combined variables, and thus is considered as being optimized.

PART 2 - HYDRAULIC ANALYSIS

GENERAL

Hydraulic analysis was performed on the reach of the Trinity River in Dallas, Texas, that extends from the Interstate Highway 20 (I.H. 635) bridge upstream to the confluence of the West Fork and the Elm Fork of the Trinity River at the upstream end of the Dallas Floodway Levee System. The primary focus of the study has been on the reach between the Loop 12 bridge and the abandoned Atchison, Topeka, and Santa Fe Railroad bridge at the downstream end of the Dallas Floodway Levees in which various plans of improvement were found to be feasible. Analysis was performed to determine the hydraulic characteristics of the existing river and to develop plans for reducing flood damages within the city. All references to elevation are given in feet above the National Geodetic Vertical Datum (NGVD).

The HEC-2 Water Surface Profiles computer program was used to hydraulically model and compute water surface profiles for a broad range of flood events. Traditional expression of the frequency of flood events has been in terms of the recurrence interval in years, such as, the "100-Year Flood". The more appropriate expression of the probability of a particular flood magnitude is in terms of "percent chance exceedance", especially as it relates to a risk-based analysis. Therefore, the "100-Year Flood", which is defined as "the magnitude of flooding which has a 1 percent probability of being equaled or exceeded in any given year", is expressed as, the "1 percent chance flood". The nine flood events computed for this study that were traditionally referred to as the 1-year, 2-year, 5-year, 10-year, 25-year, 50-year, 100-year, 500-year, and the Standard Project Flood (SPF) are now referred to respectively as the 99 percent, 50 percent, 20 percent, 10 percent, 4 percent, 2 percent, 1 percent, 0.2 percent chance flood, and the SPF.

The Standard Project Flood is defined as the flood that may be expected from the most severe combination of meteorological and hydrologic conditions that are considered to be reasonably characteristic of the geographical region involved, excluding extremely rare combinations. The SPF usually has a 0.3 to 0.08 percent probability of being equaled or exceeded in any year, and is usually between 40 and 60 percent of a Probable Maximum Flood (PMF). The SPF represents a "standard" against which the degree of protection for a project may be judged and compared with protection provided at similar projects in other localities. The SPF for purposes of this study has been estimated to have a 0.125 percent probability of being exceeded in any year.

EXISTING CONDITIONS

Trinity River

The Trinity River channel within the study reach has an average depth of about 30 feet and a top width of about 200 feet. The river historically has an average discharge of about 2,000 cubic feet per second (cfs) over the period of record from 1958 to 1990. The overbanks are generally very wide and flat. The river channel has an average bottom slope of about 0.05 percent or about 2.6 feet per mile and has historically been very stable. Analysis of aerial photographs taken periodically over the past 47 years as well as historical topographic data has shown no channel migration. There have been no known bank stability problems within the study reach. The overbank areas in the floodplain are generally covered with heavy vegetation with some areas having been disturbed by mining operations or landfills. The areas of the floodplain that have the greatest density of vegetation are covered with mature trees of sufficient height to extend above the water surface of the highest flows considered in this analysis. Therefore, a consistent hydraulic roughness value has been used for all depths of flows considered in this study. Examination of historical aerial photographs revealed that a gradual increase in the density of the vegetative cover on the floodplain has occurred and increased the hydraulic roughness of the floodplain over time. This has resulted in the computation of higher flood levels within the study reach than in previous studies. Several landfills placed within the floodplain in the study reach have also raised flood levels due to the reduction of flow conveyance area and the reduction of available valley storage of floodwater.

Landfills

Four significant landfill areas are located within the floodplain of the study reach. The McCommas Bluff Landfill is located just upstream of Interstate Highway 20 (I.H. 635) and is currently operated by the City of Dallas. This landfill is a primary site for solid waste disposal for the City of Dallas. The South Loop Landfill is located immediately downstream of Loop 12 on the left overbank looking downstream and was closed in 1983. The Elam Landfill is located immediately upstream of Loop 12 on the left overbank and was closed in 1980. The Linfield Landfill located on Linfield Road on the right bank of the Trinity River was closed in 1975. The Linfield Landfill is a significant influence to flood water surface elevations due to its close proximity to the river channel as well as fill extending above the 1 percent chance flood water surface. The landfill is located opposite the river channel from a natural narrowing of the left overbank. These conditions combine to create a significant encroachment of the floodplain at this location. The locations of the South Loop Landfill, the Elam Landfill, and the Linfield Landfill and their relationship to the limits of the 1 percent chance flood and the SPF floodplain are shown on Plates A-37 and A-38.

Sleepy Hollow Country Club Levee

The Sleepy Hollow Country Club Golf Course is located between the Linfield Landfill and the Loop 12 bridge on the right bank of Trinity River. A small levee approximately 10 feet in height is located along the right bank of the river channel and protects the golf course from approximately the 10 percent chance flood event based on observance of recent floods. For flows less than the 10 percent chance flood, the levee encroaches upon the main bridge opening of the Loop 12 bridge for about 50 percent of its length. The Loop 12 highway crossing of the floodplain consists of two additional relief bridges that are not effected by the golf course levee.

Dallas Floodway Levees

The Dallas Floodway Levee System is a federally sponsored project currently maintained by the City of Dallas. The Dallas Floodway Extension Study initially had a primary focus to evaluate current conditions and proposed improvements for those areas downstream of the Dallas Floodway that are susceptible to flood damages up to and including the SPF event. However, due to changes in the floodplain and the backwater effects on the downstream end of the Dallas Floodway Levees, the risk of overtopping of the Dallas Floodway Levees has become a major consideration. The design of the Dallas Floodway Levees was based on construction of the levee crest to the SPF water surface elevation plus four feet of freeboard. The SPF flood elevations used to establish the original design grade of the Dallas Floodway Levees were computed using hand backwater calculations. Subsequent studies have confirmed the original SPF flood elevations using an LRD-1 hydraulic model to compute water surface profiles. The most recent LRD-1 model was based on U.S.G.S. quadrangle map topography combined with surveyed cross-section data and estimated hydraulic roughness values from the 1960's. As a result, the hydraulic model compiled for this study, which has been updated for current conditions as accurately as possible, computes significantly higher water surfaces than those computed with the earlier model downstream of the Dallas Floodway.

The downstream end of the Dallas Floodway East and West Levees is located near the abandoned Atchison, Topeka, and Santa Fe Railroad Bridge. The East Levee has a terminal section that extends perpendicular to the river along the abandoned A.T. & S.F Railroad and directly beneath the newly constructed DART Rail Line Bridge to high ground. A portion of this extension of the East Levee is an earthen embankment with a design crest elevation of 425.2 feet and the remainder is a concrete flood wall up to 7 feet in height that extends the levee to high ground. The concrete flood wall portion of the levee has a design crest elevation of 423.0 feet and has two integral stop log closure sections. One stop log structure provides passage for a double track Union Pacific Railroad line. The other stop log structure formerly served the same purpose but the tracks have been removed as part of the construction of the DART Rail Line Bridge. For the purposes of this study the stop log structures have been assumed to be in place prior to the occurrence of a major flood event and reliable up to the flood wall design crest elevation of 423.0 feet.

The most recent topographic survey of the region was compiled from aerial photographs taken in February of 1991 and indicates that portions of both the East and West Levee crests have degraded below the design grade. However, the original design grade of the levees has been used to evaluate the frequency of overtopping based on the fact that, maintaining the levee crest height is a City of Dallas responsibility and the City was already implementing projects to address the problem of the degraded crest heights. The overtopping elevation chosen for the Dallas Floodway East Levee and used in the risk based analysis was based on the crest elevation of the concrete flood wall portion for plans without new levees. The current hydraulic study has computed a baseline condition SPF water surface elevation at the DART Rail Line Bridge of 426.0 feet and a 0.2 percent chance (500-year) water surface elevation of 422.4 feet.

A project undertaken by the City Of Dallas to improve the flow conditions for low flows within the Trinity River channel in the Dallas Floodway has been initiated. The project design provides for excavation (dredging) of the river channel and placement of the excavated material on the East and West Levees. The placement of the fill on the levees provides for restoration of the crest height to the original design grade plus two feet of overbuild. Additionally, it provides for greater side slope stability on the riverside by placing fill on a flatter slope. Phase 1 of the project, beginning downstream of the A.T. & S.F. Railroad bridge and extending upstream to the Houston Street bridge, has been funded and thus has been hydraulically modeled in the baseline conditions hydraulic model. The design does not provide for the raising of the extension of the East Levee under the DART Rail line bridge described above for either the embankment portion or the concrete flood wall portion. Therefore, under current conditions, the crest of the flood wall extension of the East Levee remains the critical overtopping point.

Computation of water surface profiles through the Dallas Floodway reflecting the backwater effect of the changed downstream conditions was performed to evaluate the existing levees risk of overtopping. When comparing the original design grade of the East and West Levees to the water surface profiles, a gradual increase in the levees height above the computed water surface profiles from the downstream end to the upstream end of the floodway was observed. This observation is the result of the assumption that within the floodway periodic maintenance has been performed as designed to maintain a consistent hydraulic roughness and no encroachments or other hydraulic changes have occurred within the floodway. The hydraulic analysis also reveals that conditions within the floodplain downstream of the Dallas Floodway have a strong influence on the performance of the floodway.

Rochester Park Levee

The Rochester Park Levee was designed and constructed prior to the completion of the current hydrologic and hydraulic analysis. The levee has been hydraulically modeled in the current Baseline Conditions hydraulic model but not included in the Existing Conditions Model as discussed under "Hydraulic Models" in Appendix A. The design of the levee was based on the SPF water surface computed from the previous LRD-1 hydraulic analysis discussed above plus four feet of freeboard. The LRD-1 hydraulic analysis was, at the time the levee was being designed, the most up to date hydraulic analysis available. The SPF water surface elevation at the upstream end of the levee yielded a design crest elevation of 417.0 feet. This design crest elevation was used for the entire levee crest. However, the upstream end of the Rochester Park Levee terminates at a natural ground elevation of approximately 415.5 feet. Based on the earlier hydraulic study this allowed for about two feet of freeboard above the SPF water surface at that location. The levee includes floodgate structures at the Central Expressway Service Road , the Bexar Street underpass at the C.F. Hawn Freeway, the Union Pacific Railroad underpass at the C.F. Hawn Freeway, and two levee crossings of the Union Pacific Railroad.

As originally designed, flood discharges exceeding the capacity of the levee system would initially enter the levee protected area upstream of the end of the levee across broad natural ground areas prior to a levee overtopping. Because no floodgate structure was constructed at the underpass of Hatcher Street and South Central Expressway, floodwater would enter the areas protected by the Rochester Park Levee at an elevation lower than the upstream end of the levee. The elevation at the underpass above which floodwater would begin to inundate those areas protected by the Rochester Park Levee north of the C.F. Hawn Freeway is estimated to be 413.0 feet. The elevation above which floodwaters would begin to inundate those areas south of the C.F. Hawn Freeway after floodwater had entered through the Hatcher Street underpass is estimated to be elevation 414.5 feet. A portion of the C.F. Hawn Freeway located north of the Rochester Park area forms a ridge that causes this difference in initial inundation levels for the two areas. The ground elevation of 413.0 feet at the Hatcher Street underpass was used as the critical overtopping elevation for evaluation of the existing Rochester Park Levee and used as input to the risk based analysis for determination of the residual damages and relative levee performance for baseline conditions. The current hydraulic study has computed a 1 percent chance (100-year) water surface elevation at Hatcher Street for baseline conditions of 412.0 feet and a 0.2 percent chance (500-year) water surface elevation of 418.1 feet.

Central Wastewater Treatment Plant Levee

The Central Wastewater Treatment Plant (CWWTP) is located on the right overbank of the Trinity River between the Missouri-Kansas-Texas Railroad bridge and the Interstate Highway 45 bridge. It is protected from flooding by a ring levee system that surrounds the treatment plant. The levee survived the flood of 1990 without overtopping but required emergency repairs during the flood. The City of Dallas has since implemented a plan to upgrade the CWWTP Levee and other plant facilities to comply with the Texas Water Commission requirements to provide 1 percent chance (100-year) flood protection plus three feet of freeboard. The levee improvement plan was designed by the engineering firm of Halff Associates, Inc., of Dallas. The results of the hydraulic analysis used to establish the design levee crest grade of elevation 415.0 feet compares very closely with the current baseline water surface profiles presented in this report. Elevation 415.0 feet was used as input to the risk based analysis for determination of the residual damages and relative levee performance for baseline conditions.

HYDRAULIC MODELS

General

The PC version 4.6 of the HEC-2 Water Surface Profiles computer program was used to hydraulically model and compute water surface profiles for this study. Several HEC-2 backwater models with differing input data sets have been used for this study. Initially HEC-2 models were produced using cross-sections obtained from the City of Dallas topographic maps developed in 1977 and was the most recent topographic information available at the time the model was prepared. When the topographic mapping used for the Upper Trinity River Feasibility Study became available later in the study, the decision was made to update the models with the more recent topographic data. Therefore, models for this study would be consistent with the HEC-2 models used for the Upper Trinity Feasibility Studies.

The City of Dallas topographic maps used for the "existing conditions" HEC-2 models developed initially were updated as much as possible to represent current conditions. The City of Dallas topographic maps were compiled from aerial photography flown in March 1977, and have a contour interval of two feet and a scale of one inch equals two hundred feet. Cross-sections for the model were taken directly from the topographic maps on average every 1,000 feet of river distance. Channel geometry was input from surveyed cross-sections used in previous Trinity River LRD-1 hydraulic models. The 1977 topographic maps were updated to reflect the contours of two City of Dallas landfills located in the floodplain of the Trinity River that were completed after 1977. One of these is the Elam Landfill located immediately upstream of the Loop 12 bridge on the left overbank and the other is the South Loop Landfill located immediately downstream of the Loop 12 bridge on the left overbank. Another landfill is located on Linfield Road and was completed prior to 1977 and was reflected in the City of Dallas topographic maps. Information relating to current conditions for the McCommas Bluff Landfill located near I.H. 20 was not available to update the 1977 topography. a calibration of this model was accomplished by the methods described under "Calibration Model" to closely match the May 1990 Flood. This model was used for initial plan formulation and the initial determination of the National Economic Development (N.E.D.) Plan.

In 1994, the existing conditions model discussed above was abandoned and a new model was created which was based on mapping made available as a result of the concurrent Upper Trinity Feasibility Study. Basic input data for the current model was obtained from cross-sections taken from digitized topographic mapping produced by photogrammetry. The cross-sections were taken electronically from the digitized mapping data rather than from topographic maps and contain ground points having elevations mapped to one tenth of one foot. The cross-section locations are identical to those used in the initial HEC-2 models. The mapping was compiled from aerial photography flown in February 1991. The mapping complies with National Map Accuracy Standards and has a vertical accuracy of plus or minus 0.5 ft.

The following description applies to the development of HEC-2 models derived from both sets of topographic data described above. Four highway bridges and three railroad bridges were modeled by the HEC-2 Normal Bridge method using the best available as-built bridge plans. The I-45 bridge was not modeled in the normal manner because of several factors. First, the bridge crosses the entire floodplain with no contraction of flows caused by the bridge abutments. Secondly, the bridge crosses the floodplain on an extreme skew making it impractical to model by usual methods. Thirdly, the low steel of the bridge is sufficiently high that it would not influence the highest flood flow that would be analyzed. Therefore, the pier losses were accounted for by the use of the Manning's roughness coefficient in each successive cross-section. Due to the broad and varied nature of the floodplain, "NH" records were used in the models to vary the Manning's roughness coefficients horizontally, to more accurately model the floodplain roughness.

The White Rock Creek confluence to the Trinity River and the low lying residential areas north of the Rochester Park Levee store significant volumes of flood water during major flood events. This created a need to compile separate HEC-2 models to calculate flood volumes. One model was used to compute water surface profiles by representing only conveyance areas of the floodplain. Another was used to compute storage volumes for the various floods under consideration so that peak discharges would be more accurately computed. This was done for both the initial HEC-2 model and the current one. The stage-discharge relationship of the conveyance model was retained during computation of the storage volumes by use of rating curve input to the model cross-sections.

Calibration Model

A recent major flood event occurring in May 1990 provided a reasonable basis for calibrating the HEC-2 backwater models because the flood was estimated to be the highest magnitude since 1942 and high watermarks were established for the study reach following the flood. When the Upper Trinity Feasibility Study topographic data became available, development of a common HEC-2 model to be used for each of the two concurrent studies was needed. Therefore, another model calibration was needed to establish the hydraulic roughness values in the floodplain consistent with the new topographic data. The 1991 topographic data represented hydraulic conditions at the time of the May 1990 flood sufficiently to be used without revision for the calibration. The following description of the model calibration applies to both the model derived from the 1977 topographic data and the model derived from the 1991 topographic data. The data given for Manning"s roughness coefficients and flow velocities are for the current model.

Initial Manning's roughness coefficients were estimated by field surveys, aerial photographs, and using the "Guide for Selecting Manning"s Roughness Coefficients for Natural Channels and Flood Plains" by Arcement and Schneider. Calibration of the hydraulic model was accomplished by using the U.S.G.S. gage data at both the Below Dallas Gage and the Dallas Gage. The Dallas Gage is located 90 feet downstream of the Commerce Street Bridge and the Below Dallas Gage is located at the downstream side of the Loop 12 bridge. Calibration of the model by adjusting the Manning's roughness coefficients resulted in a reasonable reproduction of the most recent major flood for the study area which occurred in May of 1990. Measured peak discharges and corresponding gage readings published by the U.S.G.S. were used as reference points. High watermarks for the May 1990 flood established by the Corps of Engineers and Halff Associates, Inc., at various locations in the study area were also used in the calibration of the model. The measured peak discharges published by the U.S.G.S for the May 1990 flood were 82,300 cfs at the Below Dallas Gage and 87,000 cfs at the Dallas Gage. Manning's roughness coefficients used in the study for the channel vary from 0.035 to 0.063 and range from 0.084 for open grassy areas to 0.210 for densely wooded areas in the overbanks. The channel flow capacity is approximately 6000 cfs. Computed channel flow velocities are in the range of 0.7 to 4.0 feet per second (fps) for the 50 percent chance event, 0.3 to 6.0 fps for the 10 percent chance event, 0.4 to 9.0 fps for the 2 percent chance event, and 0.5 to 10.0 fps for the 1 percent chance event. The calibration model water surface profiles and the high watermark locations are shown on Plates A-25 and A-26. Stage-Discharge rating curves for the Below Dallas Gage, the calibration model, and baseline conditions are shown on Plate A-21.

Baseline Model

The development of the Baseline model was based on the requirements of the Upper Trinity River Feasibility Study to have certain projects that influence the hydraulic and hydrologic conditions within the floodplain incorporated into the HEC-2 model to form a basis for future hydraulic studies within the Trinity River corridor. The following projects have been incorporated into the approved Upper Trinity River Feasibility Study Baseline Conditions HEC-2 models and modeled as completed per the design plans for each project.

Southside Sewage Treatment Plant Levee modification
McCommas Bluff Landfill and Swale
Rochester Park Levee
Central Wastewater Treatment Plant Levee modification
DART OC-2 Rail Line bridge
Dixie Metals Company Landfill
Dallas Floodway channel and levee modification (A.T. & S.F. Railroad bridge to Houston St. bridge)
Various small permitted fill areas

These projects are permitted fills or projects constructed or under construction following the development of the 1991 aerial photography and mapping which was the basic input for the baseline model. All landfills have been represented as completed. Water surface profiles for baseline conditions are shown on Plates A-29 and A-30.

Existing Conditions Model

Due to the configuration of proposed levees in the Recommended Plan, economic analysis of conditions prior to the construction of the Rochester Park Levee and the Central Wastewater Treatment Plant Levee Modification was necessary. Therefore, an "Existing Conditions" hydraulic model was compiled representing floodplain conditions prior to 1991 before either project was constructed. This model is essentially the same as the baseline model without the effects of the Rochester Park Levee and the CWWTP Levee Modification. Water surface profiles for existing conditions are presented on Plates A-27 and A-28.

NATIONAL ECONOMIC DEVELOPMENT PLAN

General

The N.E.D. Plan for the reduction of flood damages within the study reach calls for excavation of overbank swales within two sections along the Trinity River. The lower swale is located on the left overbank looking downstream and extends from about 2,000 feet downstream of Loop 12 to the oxbow river bend near the State Highway 310 (Central Expressway) bridge. The upper swale is located on the right overbank and extends from the upstream side of the Central Mitigation Swale adjacent to the Central Wastewater Treatment Plant to the confluence with Cedar Creek. The swale is designed to function as a grass-lined floodway to be maintained free of woody vegetation to provide an efficient means of conveying flood water. The swale design provides for ease of maintenance and to minimize negative impacts to the existing river channel and the local environment.

Both the upper and lower swales are designed to function similarly to a bypass channel with a very wide and shallow trapezoidal cross-section with low hydraulic roughness characteristics. The trapezoidal swale cross-section has a flat bottom with side slopes of a minimum four horizontal to one vertical (4H:1V). Excavation depth of both the upper and lower swales ranges from zero to 14 feet with the average depth at about three feet. Both the upper and lower swales are designed on a longitudinal slope of 0.05 percent for most of their length. This slope is consistent with both the average slope of the natural channel bottom and the average downstream slope of the overbanks. Hydraulic efficiency of the floodplain is improved primarily by the reduction of the existing hydraulic roughness in the areas where the swale is located. The swale also increases hydraulic efficiency by the addition of floodplain conveyance area. Additionally, the swales increase hydraulic efficiency by providing for more uniform flow due to the removal of floodplain ridges and filling of low areas. The uniform slope of the excavated swale is designed to be free draining for efficient conveyance of local runoff and receding flood waters as an aid to providing effective seasonal maintenance. Water surface profiles for the N.E.D. Plan are shown on Plates A-31 and A-32. Average flow velocities for the N.E.D. Plan for the 1 percent chance and SPF floods are provided in Table A-10.

Lower N.E.D. Swale

The downstream limit of the lower swale at the centerline is located about 2,200 feet downstream of the Loop 12 bridge. The downstream end terminates at an approximate elevation of 386.0 feet. The downstream limit of the swale is along an existing tree line break adjacent to an existing dirt road. The tree line break is skewed 45 degrees to the swale centerline. Dense cover of mature trees exists downstream and less dense vegetation is located upstream of the dirt road. The swale excavation and clearing was limited to this downstream location because very little additional benefits would be achieved by continuing the swale farther downstream. Significant impacts to the higher quality habitat areas downstream was also reduced by limiting the swale at this location.

From the downstream end, the swale has a bottom width of 800 feet and extends upstream on a 0.14 percent adverse down slope approximately 1,100 feet to a natural tributary crossing. The tributary conveys local runoff to the main Trinity River channel. The slope of this portion of the swale is adverse to the flow of the river at flood stage and serves to provide good drainage for local runoff without negatively effecting the performance of the swale during a flood event. From this tributary crossing, the 800 foot bottom width swale extends upstream on a slope of 0.05 percent through the largest of two relief bridges for the Loop 12 highway crossing to a point about 4,500 feet from the downstream end of the swale. The extension of the swale downstream of Loop 12 is designed to significantly increase flow through the relief bridge. Loop 12 crosses the Trinity River floodplain and conveys flood water by means of three bridge structures. The main bridge structure crosses the river channel and is approximately 1,340 feet in length. Its flow capacity is reduced for the more frequent flood events by the Sleepy Hollow Country Club levee located immediately upstream from the bridge. The largest of the two relief bridges is located 470 feet from the main bridge eastward along Loop 12 and is 800 feet in length. Dense vegetation exists immediately upstream and downstream of this relief bridge. Another relief bridge is located eastward along the highway about 1,200 feet from the 800 foot relief bridge and is 200 feet in length.

Several ponds of water are located in the area upstream of Loop 12 near the Elam Landfill within the proposed boundaries of the lower swale. The portions of these ponded areas that lie within the swale are to be filled to the design grade of the swale bottom and turfed in like manner as the excavated areas of the swale. The portions of the ponded areas that lie outside the boundaries of the swale are to remain.

From a location about 4,500 feet from the downstream end of the lower swale, the swale extends upstream on a 0.05 percent slope and begins the transition from 800 foot bottom width to 1,200 foot bottom width over a distance of 2,000 feet. The 800 foot bottom width portion of the swale has been designed to extend upstream sufficiently to avoid excavation of the documented landfill areas located upstream of the Loop 12 bridge. From the upstream end of the 800 foot to 1,200 foot transition, the swale extends upstream on a 0.05 percent slope and has a 1,200 foot bottom width to its upstream limit at the oxbow river bend near the S.H. 310 bridge. The White Rock Creek channel crosses the proposed swale at about 10,000 feet upstream from the downstream end of the swale. Excavation of the swale on the design grade is continuous through the creek banks on both sides. Otherwise, the creek is to remain in its natural meandering condition across the swale. Erosion resistant grasses are to be maintained on the creek bank slopes and Willow trees and other woody type vegetation are to be removed from the upper creek banks at least annually.

The design requires excavation in the vicinity of the bridge piers that are located within the swale for the three bridges that cross the lower swale. Excavation at the Loop 12 relief bridge piers is required to a depth of about 3 feet. The Southern Pacific Railroad bridge crosses the lower swale near the upper end of the swale and excavation around the bridge trestle pilings is required to a depth of about 2 to 3 feet. Excavation around the bridge piers within the swale for the S.H. 310 bridge is required to a depth of 3 to 5 feet. Bridge piers or pilings located within the swales are protected from possible increased risk of scour damage or strengthened where it is deemed necessary.

The upstream limit of the lower swale is excavated on the design grade through the left bank of the Trinity River at the centerline elevation of 392.7 feet. Total centerline length of the lower swale is about 17,500 feet. Channel flow would initially divert to the upstream end of the lower swale at the approximate bank full capacity of 6,000 cfs.

Upper N.E.D. Swale

The downstream limit of the upper swale is located along the upstream bank line of the existing Central Mitigation Swale adjacent to the Central Wastewater Treatment Plant. The downstream end of the swale at the centerline is at elevation 392.5 feet and meets the approximate natural ground surface at that location. The design of the downstream limit of the upper swale and the discontinuity of the upper and lower swale is based on several factors. The area immediately downstream of the I.H. 45 bridge to the right bank of the river has a dense mature tree cover consisting mostly of hardwood trees. This overbank area between the upper and lower swale has been determined to have a high value in terms of natural habitat and aesthetics. Even though this area creates a significant resistance to the flow under flood conditions, its natural condition should be preserved. In addition, the presence of the dense vegetation in this area may have some benefit to preserving the natural condition of the channel under flood conditions by acting as a buffer for flows crossing the river channel at a right angle to the channel at the oxbow bend. The lower swale has been designed to extend upstream through the Southern Pacific Railroad Bridge and the State Highway 310 bridge to the river bank to improve flow capacity through the bridges and to compensate for the high floodplain roughness created by the dense vegetation in the river oxbow area. The ground surface beneath the I.H. 45 bridge has been maintained clear of vegetation and provides for adequate access to the area for maintenance.

The downstream end of the upper swale has a bottom width of about 1,100 feet and extends upstream on a slope of 0.05 percent to the upstream limit of the upper swale at the confluence of Cedar Creek and the Trinity River. The portion of the swale extending from the upstream bank line of the existing Central Mitigation Swale to about 1,400 feet from the downstream end varies in bottom width from 1,000 feet to 1,200 feet due to space limitations between the CWWTP levee and the river channel. Another portion of the upper swale located about 3,200 feet from the downstream end is reduced in bottom width to about 900 feet due to the sharp river channel bend extending southwesterly into the swale.

The Missouri-Kansas-Texas Railroad trestle bridge crosses the upper swale at about 4,000 feet upstream from the downstream end of the swale. Excavation required beneath the trestle is estimated to be a depth of less than one foot for the entire length of the trestle. This trestle crosses the right overbank of the Trinity River floodplain and is approximately 1,200 feet in length. Another M-K-T Railroad Bridge spanning the river channel is approximately 320 feet in length is not effected by the swale. Excavation beneath the Martin Luther King Boulevard Bridge is estimated to be a depth ranging between zero and 2.5 feet. This bridge crosses the upper swale at about 5,900 feet upstream of the downstream end of the swale.

The bottom elevation at the upstream limit of the upper swale is 396.0 feet at the centerline of the swale. The upstream limit will intersect the banks of both the Trinity River and Cedar Creek near the confluence. The natural alignment of either of the two channels in the confluence area will not be changed by construction of the swale. The total centerline length of the upper swale is about 7,000 feet. Channel flow would initially divert to the upstream end of the upper swale at the approximate bank full capacity of about 7,000 cfs.

Local Drainage

The upper and lower swales are in a trapezoidal shape and are designed to a grade generally lower than the natural ground. This creates side bank slopes that potentially are at risk from erosion damage if significant concentrations of flows from local runoff are allowed to flow over the top of the banks. The side slopes of the swale are designed with four horizontal to one vertical (4H:1V) side slopes. An analysis of upland drainage areas on the sides of the proposed swale has produced the following observations and recommendations.

Two conditions where local runoff could flow over the banks of the swale are at the beginning of a rainfall event and when the flood water recedes from the floodplain. At the beginning of a flood event, the inundation of the swale to a depth of several feet would be expected before there would be significant local runoff over the swales banks. This is due to the location of the swales bottom grade at near the top of bank elevation along the natural channel and the very large drainage area upstream of the project reach. The design grades of the upper and lower swales are such that excavation of the swales will result in side bank heights for most of the swales length ranging from zero to four feet. This would result in a head differential of flow from the overbanks of the swale to the water surface in the swale that is negligible for most of the swales length.

An area of the lower swale with a side bank height significantly higher is located on the left bank of the lower swale between 4,500 feet and 7,200 feet from the downstream end. This area has a bank height varying from 11 to 15 feet. To prevent possible overbank flow from local drainage areas above the top of bank in this reach of the lower swale, the side slope will be extended above the natural ground to create a small berm. The reach of the lower swale located between 4,500 feet and 6,200 feet from the downstream end will have a left top of bank minimum elevation of 398.0 feet. The reach of the lower swale located between 6,500 feet and 7,200 feet from the downstream end has a left top of bank minimum elevation of 403.0 feet.

The natural channels crossing the swales such as the White Rock Creek channel provide for complete drainage of the swales following a flood event. Floodwaters recede very gradually within the floodplain following a flood event; therefore, no significant erosion of cross channel banks or swale banks is expected.

RECOMMENDED PLAN

General

The Recommended Plan for reduction of flood damages within the study reach is for excavation of wetland swales in a longitudinal configuration paralleling the Trinity River on the right overbank extending from Loop 12 upstream to the confluence of Cedar Creek and the Trinity River. The wetland swales are comprised of a series of wetland cells linked closely together and referred to as the Chain of Wetlands. The Recommended Plan also includes construction of earthen levees and/or flood walls on both sides of the Trinity River. The proposed Lamar Street Levee is designed to provide SPF flood protection for portions of the industrial and residential development downstream of the existing Dallas Floodway Levees. The Lamar Street Levee will be located on the left bank of the Trinity River between the Dallas Area Rapid Transit (DART) Rail Line Trinity River bridge and the Southern Pacific Railroad Trinity River bridge. The proposed Cadillac Heights Levee is designed to provide SPF flood protection for the industrial and residential areas located on the right bank of the Trinity River from the confluence of Cedar Creek to the Central Wastewater Treatment Plant and to high ground near Kiest Boulevard. Water surface profiles for the Recommended Plan are shown on Plates A-33 and A-34. Water surface profiles comparing the Recommended Plan to the Baseline Conditions are shown on Plates A-35 and A-36. The floodplain areas for the 1 percent chance flood and the SPF comparing the Baseline Conditions with the Recommended Plan are shown on Plates A-37 and A-38. A plan view of the Recommended Plan may be found in Appendix C - Civil, Structural, and Relocations Engineering.

Chain of Wetlands

The Chain of Wetlands portion of the Recommended Plan has been designed to reduce flood damages by increasing the overall hydraulic efficiency of the floodplain. The Chain of Wetlands swales function as a "floodway" by performing two primary functions relating to the conveyance of flood water. First, the design of the Chain of Wetlands swales provides a flow zone where areas of dense vegetation having high hydraulic roughness characteristics are replaced with vegetation having a much lower resistance to the flow. Secondly, the excavation of the swales provides for increased flowage area by the removal of soil from the floodplain. The swales have been designed to be generally continuous and aligned along the flowline of the river to enhance both hydraulic functions. The effect of the increased efficiency is that flood water moves through the project area at a slightly faster rate as the flood wave passes, thereby lowering the maximum water surface at the peak of the flood. The term "swale" is used to describe an excavated flow path having a very low depth to width ratio. A typical channel has a much higher depth to width ratio. The wetlands, which have been designed to have consistent water levels for long periods, are generally only 2 to 3 feet below the natural ground surface and several hundred feet in width. Therefore, the wetland swales will have the appearance of a slight depression rather than the appearance of a typical channel.

The Chain of Wetlands is divided into upper and lower reaches within the study area by the oxbow river bend between S.H. 310 and I.H. 45. The lower portion of the Chain of Wetlands extends from the upstream side of the Loop 12 bridge to the downstream side of the I.H. 45 bridge on the right overbank looking downstream. The lower portion of the Chain of Wetlands has been aligned through the Linfield Landfill and the Sleepy Hollow Country Club Golf Course to provide for a shorter and more efficient flow path for floodwater. The Linfield Landfill is located on the inside of a natural river bend where flood water is currently forced to follow a long path around the landfill through dense vegetation on the opposite side of the river. The excavation of the swale through the landfill results in excavation depths of up to 30 feet, but elsewhere the maximum excavation depth is 10 to 13 feet. The excavation through the Linfield Landfill has been designed with a swale width of about 500 feet at elevations consistent with the natural ground surface upstream and downstream of the landfill. Grass-lined side slopes on a 4H:1V slope will be utilized through the landfill to facilitate maintenance. The portion of the proposed lower Chain of Wetlands swales located upstream of the Linfield Landfill and downstream of the Southern Pacific Railroad bridge will be adjacent to an existing wetland swale previously constructed for mitigation of the Central Wastewater Treatment Plant Levee Improvement Project. This proposed swale and the existing swale will be separated by an approximate 120-foot wide strip of existing forested land. Another existing wetland swale lies between the S.H. 310 bridge and the I.H. 45 bridge on the right bank of the river. Neither of these existing wetland swales will be modified or included in the management scheme for the proposed wetlands. The most upstream wetland cell of the lower Chain of Wetlands is approximately 300 feet in width and 1,100 feet in length. This wetland cell is located along the downstream right-of way line of the I.H. 45 bridge on the right bank of the river. This cell is separated from the remainder of the lower Chain of Wetlands by the oxbow river bend of the Trinity River.

The upper portion of the Chain of Wetlands extends from the upstream side of the I.H. 45 bridge to the confluence of Cedar Creek and the Trinity River. The proposed upper wetland swales extend from the upstream bank line of the Central Mitigation Swale to the bank of Cedar Creek. The CWWTP effluent discharges into the Central Mitigation Swale and outflows to the river channel beneath the I.H. 45 bridge. Water from the CWWTP in the Central Mitigation Swale will be used to periodically supply water to the wetlands by means of a pumping facility. The normal water level of the Central Mitigation Swale is elevation 382.5 feet. The discharge of water from the pumping facility to the upper wetlands will be at elevation 392.0 feet to the wetland cell at the downstream side of the I.H. 45 bridge and at elevation 394.0 feet to the wetland cell that is upstream of the Central Mitigation Swale. The pumping facility will be used to re-supply the wetland cells during dry periods and following periodic draw down of the wetlands for maintenance and management.

The wetland swales are divided into wetland cells to allow management of the water levels in the wetlands in order to maximize the environmental functions of the wetlands. Wetland cells are divided at each location where the swale intersects a bridge structure so that no excavation in the vicinity of the bridge piers will be required. However, the area beneath the bridge in the vicinity of the swale is considered a functional part of the swale and is to be maintained clear of woody vegetation. Each wetland cell is excavated to create a variety of water depths for desirable wetland vegetation. A typical cross section of the wetland swales and the design Manning"s hydraulic roughness values for the various zones within the wetland swale is shown on Plate A-20. The Manning"s hydraulic roughness values shown for the various swale zones are used in the Recommended Plan HEC-2 hydraulic model and are based on the varying types of vegetation in the swale. Each wetland cell has a specified design water surface elevation and is controlled by a small outlet structure with a simple stoplog weir. The stoplog weir design allows for the draw down of each cell up to 3 vertical feet below the design water level and allows the option of controlling the water levels at increments between 0 and 3 feet below the design water level. The stoplog weir structure also provides for energy dissipation for flow into or out of the wetland cell. Transfer of water from cell to cell will be by means of a subsurface 36 inch diameter reinforced concrete pipe (RCP). The outflow pipe from each wetland cell will discharge to either the next downstream wetland cell or existing creeks depending on the cell location. There are no direct flow connections between the proposed wetland cells and the Trinity River channel. Distribution of water at low river conditions for the upper Chain of Wetlands from the pumping facility will be downstream to the wetland cell located adjacent to the I.H. 45 bridge and upstream to the wetland cell located upstream of the Central Mitigation Swale. Water supplied to the wetland cell adjacent to the I.H. 45 bridge will flow downstream to the other wetland cells in the Lower Chain of Wetlands by means of a 36-inch RCP. Outflow from the lower Chain of Wetlands at low river conditions will be directly into Honey Springs Branch. Water supplied to the wetland cell upstream of the Central Mitigation Swale will flow in the upstream river direction to the other wetland cells extending to Cedar Creek. Outflow from the upper Chain of Wetlands at low river conditions will be directly into Cedar Creek. The wetlands cells in the upper portion of the Chain of Wetlands between the Central Mitigation Swale and Cedar Creek have been designed with descending water levels in the upstream river direction in order to take advantage of the consistent water source available at the Central Mitigation Swale.

Lamar Street Levee

The Lamar Street Levee will extend from the existing Rochester Park Levee at the downstream side of the Southern Pacific Railroad bridge to the existing Dallas Floodway East Levee at the DART Rail Line Bridge. The Lamar Street Levee will become an extension of each of the existing levees at the points of juncture and become an integral part of both existing earthen levees to provide SPF flood protection for residences and business along Lamar Street and the Rochester Park area. The alignment of the Lamar Street Levee has been designed to preserve as much of the natural forest along the river channel as possible and provide flood protection for most of the businesses located along the riverside of the Southern Pacific Railroad. Floodgates will be required at the levee intersection of the Southern Pacific Railroad and the M.K.T. Railroad. The levee has been designed with turn-back sections at the Martin Luther King Boulevard intersection in order to tie the levee crest to the highway embankment at the levee design grade. This alignment eliminates the need for an additional floodgate at the M.L.K. Blvd. bridge abutment. The levee crosses S.H. 310 near the Trinity River bridge north abutment where there is currently a grade separation of about 4 feet between the south bound lanes and the northbound lanes. The southbound lanes are at an elevation approximately 1 foot higher than the design levee crest elevation at that point. Therefore, the levee crest has been designed to tie into the highway embankment on the upstream side of the bridge abutment. The northbound lanes are currently about 3 feet below the crest design grade of the levee. The Texas Department of Transportation (TXDOT) has indicated that a replacement of the older northbound S.H. 310 Trinity River bridge is in the planning stages. The northbound bridge and approaches to the bridge are to be replaced at approximately the same elevation as the southbound bridge. The current design for the northbound bridge approach closure to the levee design grade is by emergency flood fighting methods, such as sandbagging, pending further development of the bridge replacement by TXDOT.

The Lamar Street Levee crest design grade has been set at 2 feet above the SPF water surface for "Baseline" conditions with the Lamar Street Levee, the Cadillac Heights Levee, and the Chain of Wetlands in place. The design crest height of the Lamar Street Levee was not based on a particular "freeboard" requirement. However, the levee height is reasonably optimized because the design satisfies the basic requirements of providing a reasonably low risk of overtopping by the SPF while taking advantage of the full protection potential of existing levees without incurring significant costs to raise or modify them. It should be noted that, while the computed design water surface profile must be used as a guide for establishing the design crest profile for the levee, the design water surface is not an absolute. The design water surface profile is regarded as a "most likely" value derived from best estimates of key factors, parameters and data components that have some inherent variability or uncertainty. This most likely value of the flooding level is used in the risk based analysis along with probability distributions of the key parameters and data components which may take on a range of values. Information relating to performance and probability of overtopping for this levee height is presented in Appendix D - Economic Analysis. The design grade of the Lamar Street Levee at the juncture with the existing Rochester Park Levee is elevation 417.0

feet. The design grade of the proposed levee at the juncture with the existing Dallas Floodway East Levee is elevation 426.5 feet. The Lamar Street Levee will be constructed of earth fill with the exception of the floodgate structures at the two railroad crossings. Compacted impervious fill will be placed to the height of the design grade of the levee and a minimum 8 inches of road base material will be placed above this level. The levee design crest is defined as the top of the road base material. The proposed levee has a crest width of 20 feet and side slopes of 4 horizontal to 1 vertical (4H:1V).

The Recommended Plan floodplain area for the 1 percent chance flood and the SPF is shown on Plates A-37 and A-39. The floodplain area located north of U.S. Highway 175 (Central Expressway and C.F. Hawn Freeway) receives significant flood damage reduction benefits by the Recommended Plan in terms of frequency of flooding. However, some of this area will remain subject to the SPF at elevation 414.8 feet because Trinity River flood water will pond back into this area from the lower portion of the White Rock Creek drainage basin. This is due to the present alignment of the downstream end of the Rochester Park Levee. The levee extends westward along the C.F. Hawn Freeway and ties to high ground at the floodgate at Bexar Street and the C.F. Hawn Freeway. The Trinity River SPF water surface elevation of 414.8 feet is the computed Recommended Plan water surface elevation at the downstream limit of the existing Rochester Park Levee. Because low lying areas north of the Central Expressway and the C.F. Hawn Freeway are below the 414.8 feet elevation, the Hatcher Street underpass at Central Expressway would be subject to the SPF with the Recommended Plan. The approximate street level at the Hatcher Street underpass is elevation 413.0 feet. Therefore, some method of closure of the underpass up to the SPF water surface of 414.8 feet is required to prevent floodwater from entering the Lamar Street Levee protected area. The most appropriate method of closure for the underpass is sandbagging because of the relatively low height of about 2 to 3 feet needed to contain the SPF. The length of closure required across the underpass would be approximately 160 feet making the use of permanent floodgates impractical. The sandbagging effort would be a rare occurrence since the flood event required to reach the underpass from backup flooding would be greater than a 500-year event. Consideration was given to extending the downstream end of the Rochester Park Levee to high ground to provide SPF flood protection to the predominately residential structures remaining in the SPF floodplain. Preliminary investigation of potential levee extension alternatives for this area has indicated that these alternatives would not be economically feasible. This conclusion is based on the low number of structures remaining in the more frequent flood zones, the length of levee required to tie to high ground, the high cost of providing for relocation of structures along the levee alignments and interior flood protection requirements.

A preliminary plan to provide for initial overtopping of the Lamar Street Levee in the least hazardous location has been developed. The Plan complies with the guidelines of Engineer Technical Letter No. 1110-2-299 titled, "Overtopping of Flood Control Levees and Floodwalls". The plan is designed to prevent a sudden failure or washout of the earth embankment due to overtopping of the levee in a particularly hazardous location if a levee overtopping is determined to be unavoidable due to a flood event greater than the SPF. The plan provides for controlled inundation of the levee-protected area in the event of an imminent overtopping. The design of the levee requires a low level flood protection effort in the form of sandbagging at the Hatcher Street underpass as described above to allow the SPF to pass without damaging the levee protected area. The sandbagging effort would be used to provide an easily controlled initial access point for flood water into the levee protected area if a levee overtopping is determined to be unavoidable. The Hatcher Street underpass will serve to localize flow into the levee-protected area and the street surfaces will minimize erosion potential at the sandbagged release point. Since floodwater access to the levee protected area through the Hatcher Street underpass is backup flooding from the downstream end of the levee, the flood level could potentially pond up to elevation 417.0 feet prior to overtopping of the earth embankment at some upstream point. A potential levee overtopping head differential between the interior ponded level of elevation 417.0 feet and the crest of the levee at the upstream end of the Lamar Street Levee near the DART Rail Line bridge is nine feet. Therefore, a notch 1 foot lower than the design crest of the Lamar Street Levee will be constructed at approximately 600 feet downstream of the DART Rail Line bridge in order to force overtopping at the least damaging point near the upstream end of the levee. The weir notch will have a concrete crest and a mildly sloping riprap chute on the upland side of the levee to allow flood water to enter the protected area gradually, thus preventing a sudden washout of the levee. The notch and the chute will be located at the point of the highest natural ground elevation of approximately 420.0 feet to minimize erosion potential.

Cadillac Heights Levee

The Recommended Plan Cadillac Heights Levee extends easterly from the intersection of Kiest Boulevard and McGowan Street to the existing Central Wastewater Treatment Plant Levee. The levee also extends from the northwestern end of the CWWTP Levee and along the Texas Utilities power line easement to high ground near the intersection of 11th Street and Avenue J. The levee will require floodgate structures at two crossing locations on the M.K.T. Railroad, the railroad spur service track to the CWWTP, and at Martin Luther King Boulevard. A portion of the Recommended Plan Cadillac Heights levee alignment coincides with a portion of the existing alignment of the CWWTP levee. This portion of the proposed levee will raise the existing levee to the design height and the widening of the base of the levee will be on the outside of the existing CWWTP ring levee. The CWWTP entrance roads will be relocated to convey traffic over the design crest of the levee.

The Recommended Plan Cadillac Heights Levee crest design grade has been set at 2 feet above the same SPF water surface elevations as described above for the Lamar Street Levee. The levee height was based on, requests by the local sponsor and the public to provide equal flood protection on both sides of the river. Information relating to performance and risk of overtopping for this levee height is presented in Appendix D - Economic Analysis. The design grade of the Recommended Plan Cadillac Heights Levee, extending from the south end of the levee at the intersection of Kiest Boulevard and McGowan Street to the northeast corner of the CWWTP levee is elevation 421.5 feet. The design grade of the levee at the upstream end near the intersection of 11th Street and Avenue J is elevation 426.0 feet. The Cadillac Heights Levee will be constructed of earth fill with the exception of the floodgate structures. Compacted impervious fill will be placed to the height of the design grade and a minimum 8 inches of road base material will be placed above this level. The levee design crest is defined as the top of the road base material. The proposed levee has a crest width of 20 feet and side slopes of 4 horizontal to 1 vertical (4H:1V).

A preliminary plan to provide for initial overtopping of the Cadillac Heights Levee in the least hazardous location has been developed. A weir notch 1 foot lower than the design crest of the levee will be located at the terminal end of the levee near the intersection of Kiest Boulevard and McGowan Street. The notch will be 200 feet in length and will allow flood water to enter the levee protected area gradually to prevent a sudden washout of the levee if it is determined that a levee overtopping is unavoidable due to a flood event greater than the SPF. Early warning of an eminent inundation of the protected area will be sufficient to facilitate a complete evacuation of the protected area.

Local Drainage

The local drainage design features related to the Chain of Wetlands are minimal since most of the excavated slopes are very gradual. The exception to this is the excavation through the Linfield Landfill which has 4H:1V side slopes extending out from the swale. Concentration of local runoff to the top of the 4H:1V side slopes is expected to be minimal; therefore, no collector ditches at the top of the slopes through the landfill are required. Local runoff from the interior of the Cadillac Heights Levee will be conveyed by means of short grass-lined channels from the sluicegate outlet locations in the levee to the wetland cells adjacent to the levee. Local runoff from the interior of the Lamar Street Levee will be conveyed to the river channel by utilizing existing runoff drainage channels.

Sedimentation

There has been no significant channel migration, bank stability problems, or erosion documented in the last fifty years within the project reach that would indicate that there has been a net loss of sediment from the project reach transported either by normal daily flows or by flood events. The apparent stability of the channel in the project reach and minor changes in the overbank topography in undisturbed areas also indicate that any sediment being supplied from the Dallas Floodway area or from the White Rock Creek drainage area is being transported through the project reach without significant deposition. The upper and lower Chain of Wetlands swales have been designed to function only when the river is at flood stage, and therefore will have a very minor effect on the hydraulic characteristics of the natural river channel at flows less than the 50 percent chance (2-year) flood. Flows through the swales during a flood event will have higher velocities than under existing conditions and will reduce the chance of deposition of suspended sediments. However, flow velocities are not high enough to cause an increased risk of erosion. Average flow velocities for the 1 percent chance flood and the SPF are provided in Table A-11.

Risk and Uncertainty Analysis

Risk and Uncertainty Analysis was performed for the three existing major levee systems and the proposed Recommended Plan Levees discussed above. The purpose of the analysis is to provide a measure of the uncertainty of the performance of the levees as they relate to various alternatives that have been considered. This information is used to aid in the determination of acceptable risk and selection of a plan.

A component of this analysis is the stage-discharge uncertainty and is represented in the analysis by the stage-discharge rating and the standard deviation of the computed water surface elevations. The stage-discharge ratings used in the analysis were computed at the selected index points for the three levees under consideration. The index locations used in the risk analysis are at river station 998+00 for the Rochester Park Levee, at river station 1,011+38 for the Central Wastewater Treatment Plant Levee and the Cadillac Heights Levee, and at river station 1,083+80 for the Dallas Floodway East Levee. Plates A-22, A-23, and A-24 show the stage-discharge rating curves for existing conditions, baseline conditions, and the Recommended Plan at these respective locations.

The water surface profile analysis was performed using cross-sectional data taken from topographic data having an estimated accuracy of plus or minus 0.5 feet. The model was calibrated to the Trinity River Below Dallas Gage and to high watermarks for the 1990 flood event. The calibration results indicated that all of the high watermarks are within 0.7 feet of the 2 percent chance flood profile and the majority of them are within 0.3 feet, as shown on Plates A-25 and A-26. The calibration of the model for the range of frequencies from the 50 percent chance (2-year) flood to the 2 percent chance (50-year) flood at the gage was considered to be good. A comparison of the computed rating curve with the Below Dallas Gage rating curve is shown on Plate A-21. A minimum standard deviation from Appendix A, Stage-Discharge Uncertainty Section, Table 1, of the draft engineering circular "Risk Analysis Framework for Evaluation of Hydrology/Hydraulics and Economics in Flood Reduction Studies" is estimated to be 0.6 feet. A sensitivity analysis to estimate upper and lower limits for a range of flood events was performed by adjusting the Manning's roughness coefficients. The result was about 1 foot difference between the limits and the computed profile for flood events of the 2 percent chance flood and below. This range was estimated to encompass 95 percent of the entire population of measured gage reading data points that could be expected for the Below Dallas Gage at Loop 12. The maximum discharge recorded at the gage is about a 2 percent chance flood discharge. The difference between the upper and lower limits and the computed profile for the 1 percent chance flood, the 0.2 percent chance flood, and the SPF through the project reach ranges from 1.5 to 2.0 feet. Based on these results, a standard deviation of one foot for the SPF frequency stage was adopted, since this frequency was of primary interest in the analysis.

Care of Water During Construction

Excavation of the swales should proceed from downstream to upstream relative to the design flow of water from cell to cell following completion of the outlet control structure at the discharge point to the tributary creeks. This will provide for efficient drainage of the work site following a local rainfall event or high river conditions to minimize construction delays and costs to dewater the site. Temporary flow control devices on the outlet structures discharging to the tributary creeks shall be used to prevent backflow into the swales in the event of high river conditions during construction. Turfing and planting of wetland vegetation on the excavated swale shall be established as soon as practical within seasonal limits following completed excavation of each wetland cell. Construction of each wetland cell shall be completed prior to commencing construction of the next upstream wetland cell. Downed trees, cleared brush, or other debris loosened from the floodplain will not be stored within the floodplain. These materials will be removed from the floodplain as soon as practical following clearing and grubbing operations to prevent the possible blockage of bridge structures during a flood event. Any suspected hazardous or toxic materials discovered during the excavation and construction of the project will be reported to the Corps of Engineers District Office personnel to ensure proper removal and disposal of such materials.

Surveillance Plan

The local sponsor will be furnished an Operation and Maintenance (O&M) manual. This manual will provide information showing the requirements of CFR Section 208.10, and will also contain copies of the construction plans which show the features along the project such as bridges and roadway surfaces. The plan and profile sheets show the horizontal and vertical control with reference bench marks. The O&M manual will also specify that the local sponsor will appoint a superintendent who will have responsibility for maintenance of the project. The manual will provide that annual maintenance inspections will be performed which will include participation by a representative from the Corps of Engineers District Office. This inspection will include evaluation of such items as mowing requirements and repair of damages experienced by the project in recent flood events. In addition to the annual inspections, inspections will be made after each significant flow event, and eroded reaches of the project will be repaired. CFR 208.10 also requires that any improvement passing over, through, or under the floodway must be given prior approval by the District Engineer.

Plan for Relocation of the Trinity River Channel at I.H. 45

The Interstate Highway 45 bridge over the Trinity River was constructed following the Authorized Plan of improvement which provided for a 250-foot bottom width navigation channel to be constructed on the right overbank of the river near the point where the bridge would cross the river. In order to accommodate the requirements for the navigation channel, the bridge was designed with three continuous steel girder spans of 320 feet, 480 feet, and 320 feet measured along the centerline of the bridge and centered over the proposed navigation channel. The pier bents are skewed 50 degrees to the centerline of the bridge so that the piers would be parallel with the navigation channel and the flow of the river. The resulting pier bent spacing for the 480-foot span and the 320-foot outside spans normal to the flow are respectively 308 feet and 205 feet. The bridge beam spans over the existing river channel are 78 feet in length and have the same 50 degree skew to the centerline of the bridge. The resulting pier bent spacing for the bridge over the existing river channel normal to the flow is about 50 feet. The bridge was designed to accommodate construction of the large navigation channel and also retain the existing river channel. However, most of the river flow would have been carried through the navigation channel and a significantly reduced amount of flow would have been carried through the existing channel. The navigation channel was never approved for construction, but since the completion of the bridge, the Texas Department of Public Transportation (TXDOT) has experienced significant maintenance and repair costs due to floating debris accumulation and large trees striking the piers in the existing channel. The pier bent spacing at the current channel location was not designed to accommodate all of the normal river flows in the existing channel. The top width of the existing river channel is about 200 feet and several pier bents are located within the channel.

Interstate Highway 45 has been designated as a major transportation corridor for national defense, and TXDOT has considered replacement of the bridge spans over the existing channel as a solution to the ongoing maintenance costs and to provide long-term integrity of the structure. Alternatively, TXDOT has proposed a plan to relocate the existing river channel to pass normal river flow beneath the existing 320-foot bridge span that is located nearest the existing river channel. A plan to relocate a portion of the existing river channel has been designed to accomplish these goals at a significantly lower cost than replacement of the short bridge spans. The plan calls for realignment of about 3,300 feet of the existing river channel. The proposed channel has a trapezoidal cross section with a 30-foot bottom width, 3H:1V side slopes, and a top width of approximately 180 feet. The existing river channel in the reach where the realignment is proposed has an average bottom slope that is nearly zero. Therefore, the proposed channel realignment section has been designed with a zero bottom slope from beginning to end. The proposed channel has an average depth of 15 feet and has been designed to closely approximate the channel flow capacity and the flow velocities of the existing river channel. The proposed channel alignment will be centered between the nearest 320-foot span of the I.H. 45 bridge which has a face to face clearance distance between the piers of about 200 feet normal to the flow. Excavation around the piers will not be required. The proposed realignment will result in the channel being moved laterally a maximum distance of about 350 feet. The existing channel will be filled to the existing top of bank elevation 396.0 feet, to prevent further collection of debris. Relocation of the channel will result in modifications to the existing Central Mitigation Swale. The Central Mitigation Swale will be reduced in size by filling of the portion of the swale near the proposed channel realignment. A minimum of 150 feet from the top of bank of the proposed river channel realignment to the top of the bank of the Central Mitigation Swale, will be required.

Several alternatives regarding filling of the old river channel have been investigated. The investigated alternatives accomplish the primary goals of the I-45 bridge channel realignment project to some degree, but the proposed plan for the channel realignment accomplishes these goals with a minimal risk to the bridge structure and a minimal filling of the old channel. The primary objective of the project is to reduce the risk of damage to the bridge piers from floating debris and reduce or eliminate the cost of continual maintenance to remove the debris and periodically repair the structure. The proposed plan to fill the old channel is to fill from the upstream diversion of the river channel to the downstream side of the bridge. The fill will be placed up to the level of the existing overbank areas at the approximate elevation of 396.0 feet and will be placed around the existing bridge piers located within the old channel. This is the only partial channel fill plan that will ensure complete diversion of channel confined flows and minimize the risk to the existing bridge piers. The channel fill will terminate at the downstream end with a very gradual slope of the fill to the streambed of the old channel just downstream of the bridge piers. A portion of the old channel downstream of the I-45 bridge is to remain unfilled as existing. This unfilled portion of the old channel will provide a slack water area for use as a possible river access point and may provide some habitat diversity near the river. However, slack water areas such as this have a tendency to collect trash and debris both from flood events and from the ease of public access. Therefore, additional maintenance to remove trash may be required for the unfilled portion of the old river channel. The filled portion of the old river channel will maximize the diversion of channel confined river flows to the new channel alignment, stabilize the bridge piers in the old channel, and minimize the risk of floating debris collecting on the bridge piers. The Texas Department of Transportation (TXDOT) maintains an access road directly beneath the I-45 bridge which provides access to the river channel from either side of the river. Filling of the old river channel beneath the bridge as proposed will provide continued access to the river channel within the TXDOT right-of-way for inspection and maintenance. A plan view of the proposed relocation of the Trinity River channel at I.H. 45 may be found in Appendix C - Civil, Structural, and Relocations Engineering.

Table A-1
100-Year Frequency Storm Rainfall Distribution

Time (hour)	Rainfall (inches)
1	0.09
2	0.10
3	0.11
4	0.12
5	0.13
6	0.14
7	0.21
8	0.24
9	0.28
10	0.38
11	0.50
12	1.04
13	2.79
14	0.62
15	0.43
16	0.31
17	0.26
18	0.23
19	0.15
20	0.13
21	0.12
22	0.11
23	0.10
24	0.10
Total	8.69

Table A-2
Standard Project Storm (SPS) Rainfall Distribution
For Subarea 50

Time (hour)	Rainfall (inches)	Time (hour)	Rainfall (inches)	Time (hour)	Rainfall (inches)
1	0.05	25	0.07	49	0.89
2	0.05	26	0.07	50	1.42
3	0.05	27	0.07	51	2.00
4	0.05	28	0.07	52	3.64
5	0.05	29	0.07	53	1.78
6	0.05	30	0.07	54	1.26
7	0.05	31	0.10	55	0.29
8	0.05	32	0.10	56	0.26
9	0.05	33	0.10	57	0.23
10	0.05	34	0.10	57	0.22
11	0.05	35	0.10	59	0.20
12	0.05	36	0.10	60	0.19
13	0.06	37	0.14	61	0.12
14	0.06	38	0.14	62	0.12
15	0.06	39	0.15	63	0.12
16	0.06	40	0.16	64	0.12
17	0.06	41	0.17	65	0.12
18	0.06	42	0.18	66	0.12
19	0.06	43	0.32	67	0.08
20	0.06	44	0.35	68	0.08
21	0.06	45	0.39	69	0.08
22	0.06	46	0.45	70	0.08
23	0.06	47	0.52	71	0.08
24	0.06	48	0.60	72	0.08
				Total	19.52

Table A-3
Standard Rainfall Losses

Recurrence Interval (years)	Annual Exceedance Probability (%)	Clayey Soil		Sandy Soil	
		Initial Abstraction (inches)	Infiltration Rate (inches/hour)	Initial Abstraction (inches)	Infiltration Rate (inches/hour)
1	NA	1.35	0.18	1.89	0.23
2	50	1.20	0.16	1.68	0.21
5	20	1.30	0.16	1.80	0.21
10	10	1.12	0.14	1.50	0.18
25	4	0.95	0.12	1.30	0.15
50	2	0.84	0.10	1.10	0.13
100	1	0.75	0.07	0.90	0.10
500	0.2	0.50	0.05	0.60	0.08

Table A-4
Subbasin Parameters for Baseline Conditions

Subarea Number	Drainage Area (sq. mi.)	C_t	t_{pR} (hours)	C_p	Q_{pR} (cfs)	Percent Sand (%)	Urbanization (%)	Imperviousness (%)
1	683.00	2.3	18.00	.35	8785	100	<1	<1
2	149.25	1.7	9.00	.35	3805	100	2	1
3	97.78	1.4	8.00	.35	2785	100	7	4
4	160.97	1.3	6.00	.35	6047	100	4	2
5	20.00		**		12907			
6	71.17	1.6	7.00	.66	4370	100	8	4
7	97.46	1.6	6.00	.66	6927	100	5	3
8	2.34		**		1510			
9	69.90	2.0	10.00	.66	3045	100	2	1
10	90.10	1.8	9.00	.66	4346	100	5	3
11	73.20	1.8	7.00	.66	4495	100	2	<1
12	209.83	1.7	9.00	.66	10120	97	2	<1
13	55.65	1.5	5.00	.66	4734	75	3	2
14	47.52	1.2	3.00	.66	6567	20	8	6
15	127.45	1.6	8.00	.66	6885	100	7	5
16	14.38		**		9280			
17	13.60	***	0.82	.70	4170	30	22	15
18	74.84	***	4.82	.70	6970	50	9	7
19	5.56		**		3588			
20	20.99	***	3.55	.70	2609	60	57	36
21	107.11	1.6	8.00	.70	6155	100	1	1
22	1.89		**		1220			
23	142.38	1.8	13.00	.70	5056	100	3	2
24	62.47	1.3	6.00	.70	4719	89	2	1
25	33.61	1.2	5.00	.70	3023	80	2	<1
26	33.94	0.9	3.00	.70	4963	24	5	3
27	39.11	***	2.37	.70	7548	80	3	2

Subarea Number	Drainage Area (sq. mi.)	C_t	t_{pR} (hours)	C_p	Q_{pR} (cfs)	Percent Sand (%)	Urbanization (%)	Imperviousness (%)
28	5.89		**		3801			
29	8.45	***	1.63	.70	2121	50	30	17
30	54.70	***	3.90	.60	5365	10	14	8
31	24.56	***	1.70	.70	5920	40	69	42
32	3.96	***	0.94	.70	1278	40	70	56
33	0.40	***	0.87	.70	129	40	70	54
34	8.91	***	1.16	.70	2875	5	10	6
35	0.38		**		245			
36	13.71	***	1.24	.70	4321	0	53	34
37	10.89	***	1.85	.70	2440	40	67	47
38	37.33	***	2.53	.70	6375	10	59	37
39	18.25	***	1.86	.70	4082	40	60	39
40	18.45	***	2.35	.70	3384	5	42	30
41	54.70	***	3.97	.70	6111	1	24	15
42	11.30	***	3.39	.70	1484	30	29	20
43	114.76	***	6.73	.70	7715	50	16	10
44	14.42	***	1.36	.70	4197	60	62	40
45	10.38	***	1.64	.70	2589	100	73	42
46	3.44		**		2220			
47	48.63	***	5.51	.70	3981	90	48	29
49	1.79	***	1.53	.70	474	30	36	23
50	27.29	***	3.05	.70	3936	60	59	38
51	29.47	***	4.97	.70	2660	70	48	35
52	21.60	***	3.47	.70	2756	65	69	51
53	2.85	***	0.78	.70	920	10	60	39
54	4.12	***	1.40	.70	1172	5	46	31
55	83.16	***	9.10	.70	4200	90	37	20
56	9.64	***	3.44	.70	1243	80	37	27
57	8.85	***	2.33	.70	1636	5	30	23

Subarea Number	Drainage Area (sq. mi.)	C_t	t_{pR} (hours)	C_p	Q_{pR} (cfs)	Percent Sand (%)	Urbanization (%)	Imperviousness (%)
58	33.00	***	3.08	.70	4745	0	9	7
59	68.00	***	6.51	.70	4742	85	11	7
60	77.08	***	2.72	.70	12257	7	9	6
61	42.25	***	1.62	.70	10663	8	9	6
62	11.67		**		7531			
63	30.58	***	2.49	.70	5301	5	34	20
64	17.84	***	1.39	.70	5104	5	57	40
65	10.35	***	1.13	.70	3340	5	24	14
66	4.23		**		2730			
67	9.00	***	1.32	.70	2697	5	36	26
68	9.23	***	2.38	.70	1663	75	75	47
69	110.00	1.5	7.00	.70	7157	100	1	<1
70	164.00	1.2	7.00	.70	10670	91	1	<1
71	58.00	1.0	4.00	.70	6453	54	2	2
72	68.00	.94	4.00	.70	7565	12	<1	<1
73	61.32	1.0	5.00	.70	5516	23	1	<1
74	36.86	1.4	5.00	.70	3316	5	6	4
75	102.44	1.6	7.00	.70	6665	0	4	3
76	83.01	1.45	4.00	.70	9235	80	14	9
77	11.37		**		7337			
78	23.63	***	4.02	.70	2625	25	24	15
79	295.00	1.95	16.00	.794	9717	74	2	2
80	55.34	1.95	9.50	.794	3032	24	4	3
81	275.10	1.95	14.28	.794	10105	50	3	3
82	92.80	1.95	*	.794	15714	25	2	1
83	145.60	1.95	8.04	.794	9373	86	2	2
84	45.86		**		29595			
85	37.60	1.95	7.00	.794	2767	80	1	<1
86	221.61	1.95	*	.794	18397	50	11	8

Subarea Number	Drainage Area (sq. mi.)	C_t	t_{pR} (hours)	C_p	Q_{pR} (cfs)	Percent Sand (%)	Urbanization (%)	Imperviousness (%)
87	75.50	1.45	9.00	.794	4371	21	2	1
88	236.71	1.95	*	.794	37998	50	5	3
89	46.24		**		29840			
90	19.95	***	3.33	.70	2639	15	24	16
91	15.93	***	2.43	.70	2826	0	19	12
92	24.98	***	5.24	.70	2155	80	26	16
93	19.51	***	1.76	.70	4567	0	45	29
94	12.81	***	1.37	.70	3707	0	52	37
95	15.22	***	2.27	.70	2885	5	42	28
96	13.70	***	1.21	.70	4403	0	68	51
97	24.12	***	1.88	.70	5346	0	48	30
98	21.62	***	1.09	.70	6976	0	67	48
99	12.59	***	1.01	.70	4062	0	87	49
100	5.12	***	0.74	.70	1652	40	55	42
101	2.95	***	1.12	.70	592	0	76	56
102	6.03	***	0.81	.70	1946	0	75	52
103	98.25	***	3.67	.70	11794	0	62	40
104	1.75		**		1129			
105	32.99	***	2.39	.70	5921	0	63	39
106	22.43	***	1.98	.70	4796	5	66	41
107	12.10	***	1.62	.70	3054	5	37	27
108	60.72	***	2.79	.70	9420	0	42	27
109	45.56	1.95	*	.794	18637	100	3	3
110	33.80	1.95	7.67	.794	2282	100	5	5
111	53.28	1.95	*	.794	24782	74	2	2

* a composite unit hydrograph was made from combining numerous subarea unit hydrographs.
** a 1-hour instantaneous unit hydrograph was used for the lake surface area.
*** a "C_t" value was not required. Urbanization curve methodology was used.

Table A-5

Peak Discharges on the Trinity River for Baseline Conditions

Location along the Trinity River	Computed Probability Peak Discharges (cfs) for:								
	Recurrence Interval (years)								SPF Event
	1	2	5	10	25	50	100	500	
	Annual Exceedance Probability (percent)								
	NA	50	20	10	4	2	1	0.2	NA
Below the confluence of the West and Elm Forks	18300	24500	38700	51500	73400	95100	115800	202700	270100
At the "Dallas" Streamflow Gage	18000	24100	38100	50800	72500	94600	115200	201400	269200
Above the confluence of White Rock Creek	14100	20900	35200	48400	69100	90200	111800	188500	251100
Below the confluence of White Rock Creek	15700	22400	37900	55200	74200	96700	119400	200300	268300
At the "Below Dallas" Streamflow Gage	15700	22300	37700	54700	74100	96500	119300	200100	267700
Above the confluence of Five Mile Creek	15300	21900	37300	53200	73700	95700	118800	197800	264700
Below the confluence of Five Mile Creek	15300	21900	37300	53200	73700	95700	118800	197800	264700

Table A-6

Peak Discharges on the Trinity River for Baseline Conditions plus a 1,200-foot Swale

Location along the Trinity River	Computed Probability Peak Discharges (cfs) for:								
	Recurrence Interval (years)								SPF Event
	1	2	5	10	25	50	100	500	
	Annual Exceedance Probability (percent)								
	NA	50	20	10	4	2	1	0.2	NA
Below the confluence of the West and Elm Forks	18300	24500	38700	51500	73400	95100	115800	202700	270100
At the "Dallas" Streamflow Gage	18000	24100	38200	51000	72600	94600	115300	201500	269300
Above the confluence of White Rock Creek	16800	23100	36000	48800	70300	91700	112900	192500	255000
Below the confluence of White Rock Creek	19800	26900	42600	57700	76400	99000	122100	205900	273600
At the "Below Dallas" Streamflow Gage	19800	26900	42500	57500	76300	99000	122000	205700	273400
Above the confluence of Five Mile Creek	18900	26100	41600	56300	76000	98400	121700	203700	270000
Below the confluence of Five Mile Creek	18900	26100	41600	56300	76000	98400	121700	203700	270200

Table A-7

Peak Discharges on the Trinity River for Baseline Conditions, plus "Chain of Wetlands", and with Lamar Street and Cadillac Heights Levees in place

Location along the Trinity River	Computed Probability Peak Discharges (cfs) for:								
	Recurrence Interval (years)								SPF Event
	1	2	5	10	25	50	100	500	
	Annual Exceedance Probability (percent)								
	NA	50	20	10	4	2	1	0.2	NA
Below the confluence of the West and Elm Forks	18300	24500	38700	51500	73400	95100	115800	202700	270100
At the "Dallas" Streamflow Gage	18000	24200	38200	51000	72500	94500	115200	201300	269300
Above the confluence of White Rock Creek	16500	22800	35700	48200	69700	91200	112900	192200	256800
Below the confluence of White Rock Creek	19200	26300	41400	55700	75200	97900	121700	205500	275700
At the "Below Dallas" Streamflow Gage	19200	26200	41300	55600	75100	97800	121600	205200	275300
Above the confluence of Five Mile Creek	18500	25600	40500	54700	74700	97100	121100	203000	271700
Below the confluence of Five Mile Creek	18500	25600	40500	54700	74700	97100	121100	203000	271800

Table A-8
Calibrated Statistics for Risk Analysis

Condition	Trinity River Location	Equivalent Record Length (years)	Log-transformed Values of:		
			Mean	Standard Deviation	Skew
Baseline	At the Downstream End of the Dallas Floodway	40	4.2779	0.3341	0.13
Baseline	At the Central Wastewater Treatment Plant Levee	40	4.2770	0.3300	0.13
Baseline	At the "Below Dallas" Streamflow Gage (Loop 12)	40	4.2779	0.3341	0.13
N.E.D Plan	At the Downstream End of the Dallas Floodway	40	4.2779	0.3341	0.13
N.E.D Plan	At the Central Wastewater Treatment Plant Levee	40	4.2800	0.3335	0.14
N.E.D Plan	At the "Below Dallas" Streamflow Gage (Loop 12)	40	4.2779	0.3390	0.14
Recommended Plan	At the Downstream End of the Dallas Floodway	40	4.2779	0.3341	0.13
Recommended Plan	At the Central Wastewater Treatment Plant Levee	40	4.2770	0.3300	0.14
Recommended Plan	At the "Below Dallas" Streamflow Gage (Loop 12)	40	4.2779	0.3390	0.14

Table A-9
Pertinent Data on Sumps and Outlet Sluices

Sump #		100-year Frequency Flood Event				Excavation				Outlet Sluices				
	Drainage Area	Peak Inflow	Peak Outflow	Peak Pool Elevation	Peak Surface Area	Surface Area	Top-of-Cut Elevation	Toe-of-Cut Elevation	Invert Elevation	# of Conduits	Size	Inlet Elevation	Outlet Elevation	Levee Station
	(acres)	(cfs)	(cfs)	(feet)	(acres)	(acres)	(feet)	(feet)	(feet)		(feet)	(feet)	(feet)	(feet)
LS-1	32	258	133	402.7	1.68	0.00	NA	NA	388	1	4 x 4	393	391	40+10
LS-2	28	226	111	402.0	1.80	1.80	409	393	392	1	4 x 4	392	390	24+90
LS-3	795	3483	1614	402.5	17.10	17.10	407	393	392	4	6 x 6	392	390	118+60
LS-4	141	837	187	403.8	8.08	0.00	NA	NA	398	1	4 x 4	395	393	92+30
LS-5	268	1809	713	400.0	12.20	12.20	412	393	392	3	5 x 5	392	390	50+60
CH-1	102	798	798	412.0	NA	NA	NA	406	405	3	5 x 5	405	404	118+00
CH-2	140	1025	1025	405.6	NA	NA	NA	398	397	3	5 x 5	397	396	90+80
CH-3	34	280	280	400.6	NA	NA	NA	398	397	3	5 x 5	397	396	82+00
CH-4	61	469	469	400.0	NA	NA	NA	396	395	3	5 x 5	395	394	43+70

Notes: "LS" refers to the Lamar Street Levee segment and "CH" refers to the Cadillac Heights Levee segment.
All elevations are referenced to the National Geodetic Vertical Datum (NGVD).

Table A-9A
Incremental Cost Items for Alternative Solution Scenarios
Sumps LS-3 and LS-5

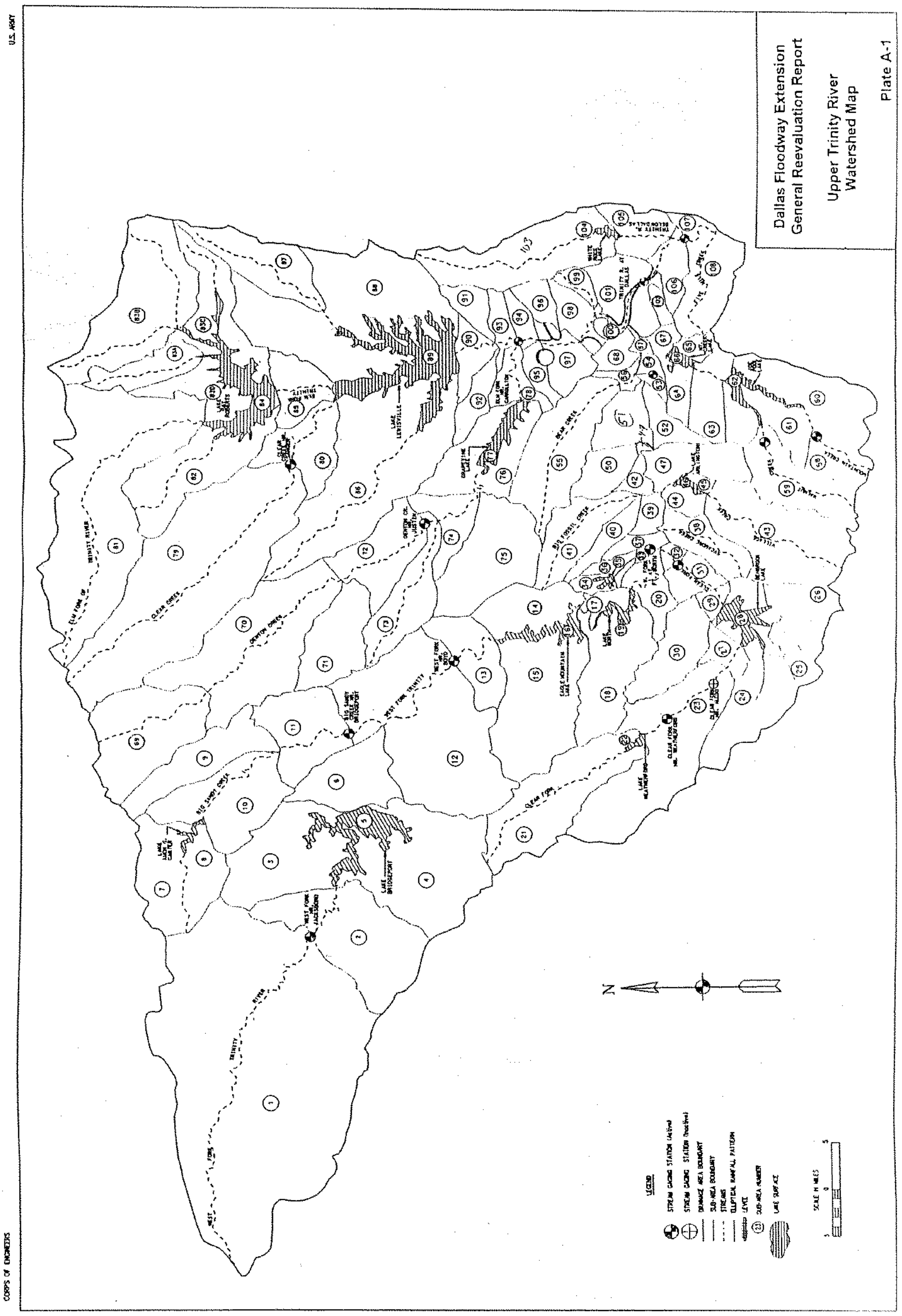
Sump #	Alternative #1 (1 – 4' x 4' outlet)			Alternative #2 (Recommended Plan)			Alternative #3 (no excavation)		
	Outlet Sluices	Excavation (cu.yds)	Cost of items	Outlet Sluices	Excavation (cu. yds.)	Cost of items	Outlet Sluices	Excavation (cu.yds)	Cost of items
L.S.-3	1 – 4 x 4	543,300	$2.95 million	4 - 6 x 6	317,300	$2.08 million	9 – 6 x 6	0	$2.30 million
L.S.-5	1 – 4 x 4	400,500	$2.24 million	3 – 5 x 5	232,500	$1.38 million	7 – 5 x 5	0	$1.43 million

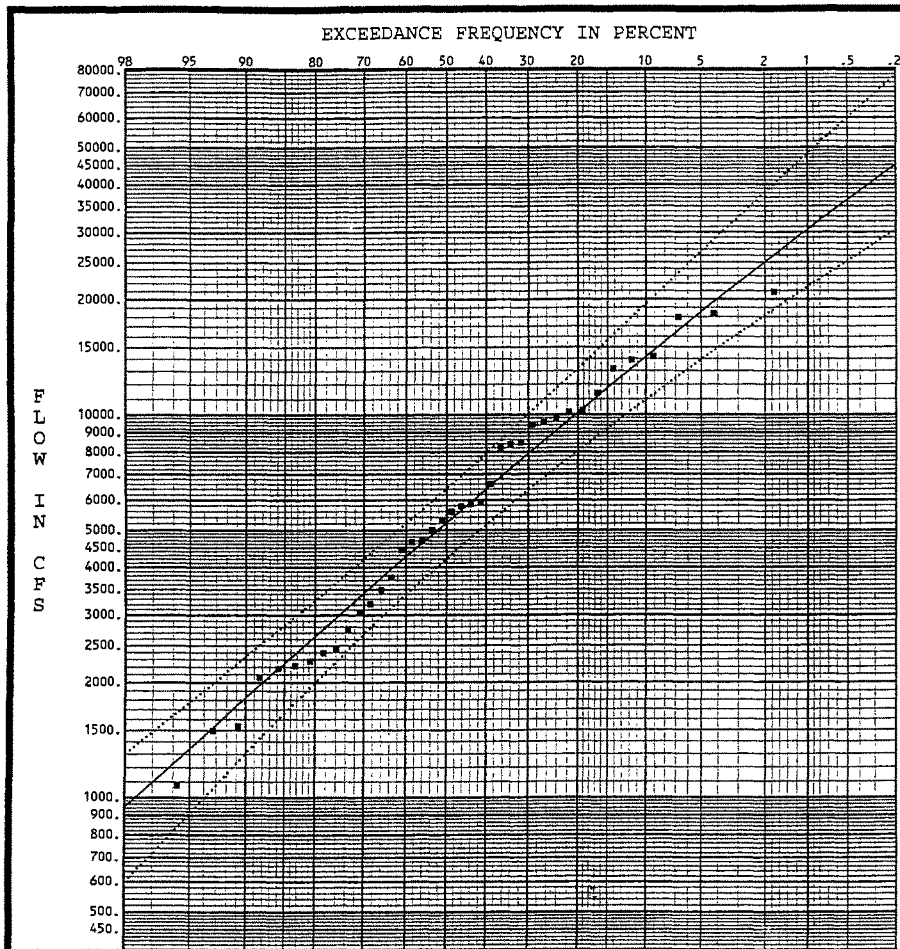
Table A-10
Average Flow Velocities (feet per second)
for Baseline Conditions versus N.E.D. Plan

Reach	Event	Baseline Conditions			N.E.D. Plan		
		LOB	CHAN	ROB	LOB	CHAN	ROB
Downstream limit of N.E.D. Swale to Loop 12 Bridge	1 %	0.9	3.0	2.5	3.4	2.2	2.0
	SPF	1.1	3.5	3.5	4.4	2.6	2.9
Through Loop 12 bridge	1 %	2.4	10.1	2.5	3.0	7.6	1.9
	SPF	3.2	12.0	3.6	4.2	9.1	2.8
Loop 12 to White Rock Creek	1 %	1.0	2.5	1.7	2.8	1.8	0.6
	SPF	1.4	2.9	2.3	2.7	1.9	1.5
White Rock Creek to Southern Pacific RR	1 %	1.0	3.3	0.9	1.5	2.2	0.5
	SPF	1.4	4.3	1.1	2.1	2.9	0.8
Through Southern Pacific RR Bridge	1 %	1.4	7.2	1.8	3.9	4.5	1.1
	SPF	2.3	10.5	2.6	6.1	6.5	1.6
Southern Pacific RR to State Highway 310 bridge	1 %	1.3	5.0	2.3	3.5	3.8	1.6
	SPF	1.9	6.7	3.2	4.9	4.9	2.3
Through State Highway 310 bridge	1 %	1.5	6.7	2.8	3.5	4.6	1.8
	SPF	2.0	9.9	3.9	5.2	6.3	2.7
State Highway 310 to I.H. 45 bridge	1 %	0.9	3.6	1.6	1.7	4.0	1.8
	SPF	1.2	3.9	2.0	1.9	4.6	2.3
I.H. 45 bridge to M-K-T RR	1 %	1.2	4.6	1.7	1.0	4.3	3.1
	SPF	1.4	4.4	1.8	1.3	4.8	3.3
Through M-K-T RR bridge	1 %	1.6	8.3	1.7	0.9	5.4	5.3
	SPF	2.4	7.1	2.0	1.6	6.0	4.6
M-K-T RR to Martin Luther King Boulevard	1 %	1.3	7.3	1.4	0.8	5.1	3.8
	SPF	2.0	8.7	1.8	1.2	6.3	4.7
Through Martin Luther King Boulevard Bridge	1 %	1.4	7.4	1.9	0.6	3.9	4.2
	SPF	2.4	8.4	2.5	1.0	5.0	5.6
Martin Luther King Boulevard to Cedar Creek	1 %	1.6	3.8	1.9	1.9	6.5	3.9
	SPF	2.2	4.4	2.3	2.3	7.5	5.0

Table A-11
Average Flow Velocities (feet per second)
for Baseline Conditions versus Recommended Plan

Reach	Event	Baseline Conditions			Recommended Plan		
		LOB	CHAN	ROB	LOB	CHAN	ROB
Downstream limit of N.E.D. Swale to Loop 12 Bridge	1 %	0.9	3.0	2.5	0.9	5.3	2.9
	SPF	1.1	3.5	3.5	1.3	6.4	3.8
Through Loop 12 bridge	1 %	2.4	10.1	2.5	2.2	8.1	2.3
	SPF	3.2	12.0	3.6	2.7	10.6	2.9
Loop 12 to White Rock Creek	1 %	1.0	2.5	1.7	0.8	3.3	2.9
	SPF	1.4	2.9	2.3	1.1	4.1	3.3
White Rock Creek to Southern Pacific RR	1 %	1.0	3.3	0.9	0.6	2.5	3.0
	SPF	1.4	4.3	1.1	0.9	3.3	3.2
Through Southern Pacific RR Bridge	1 %	1.4	7.2	1.8	1.0	4.9	4.2
	SPF	2.3	10.5	2.6	1.6	6.7	5.7
Southern Pacific RR to State Highway 310 bridge	1 %	1.3	5.0	2.3	0.6	2.7	4.1
	SPF	1.9	6.7	3.2	1.0	3.9	5.5
Through State Highway 310 bridge	1 %	1.5	6.7	2.8	1.9	5.4	4.2
	SPF	2.0	9.9	3.9	3.0	7.4	6.0
State Highway 310 to I.H. 45 bridge	1 %	0.9	3.6	1.6	1.3	4.4	2.8
	SPF	1.2	3.9	2.0	2.0	5.5	3.3
I.H. 45 bridge to M-K-T RR	1 %	1.2	4.6	1.7	1.3	4.9	3.8
	SPF	1.4	4.4	1.8	2.0	6.3	4.7
Through M-K-T RR bridge	1 %	1.6	8.3	1.7	3.0	11.2	3.6
	SPF	2.4	7.1	2.0	3.9	11.3	4.6
M-K-T RR to Martin Luther King Boulevard	1 %	1.3	7.3	1.4	0.9	4.5	2.8
	SPF	2.0	8.7	1.8	1.6	6.6	4.4
Through Martin Luther King Boulevard Bridge	1 %	1.4	7.4	1.9	1.4	7.0	2.7
	SPF	2.4	8.4	2.5	2.7	9.5	4.2
Martin Luther King Boulevard to Cedar Creek	1 %	1.6	3.8	1.9	1.7	4.5	2.7
	SPF	2.2	4.4	2.3	2.7	6.5	4.0


Dallas Floodway Extension
General Reevaluation Report
Upper Trinity River
Watershed Map
Plate A-1



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
.... 5% and 95% Confidence Limits

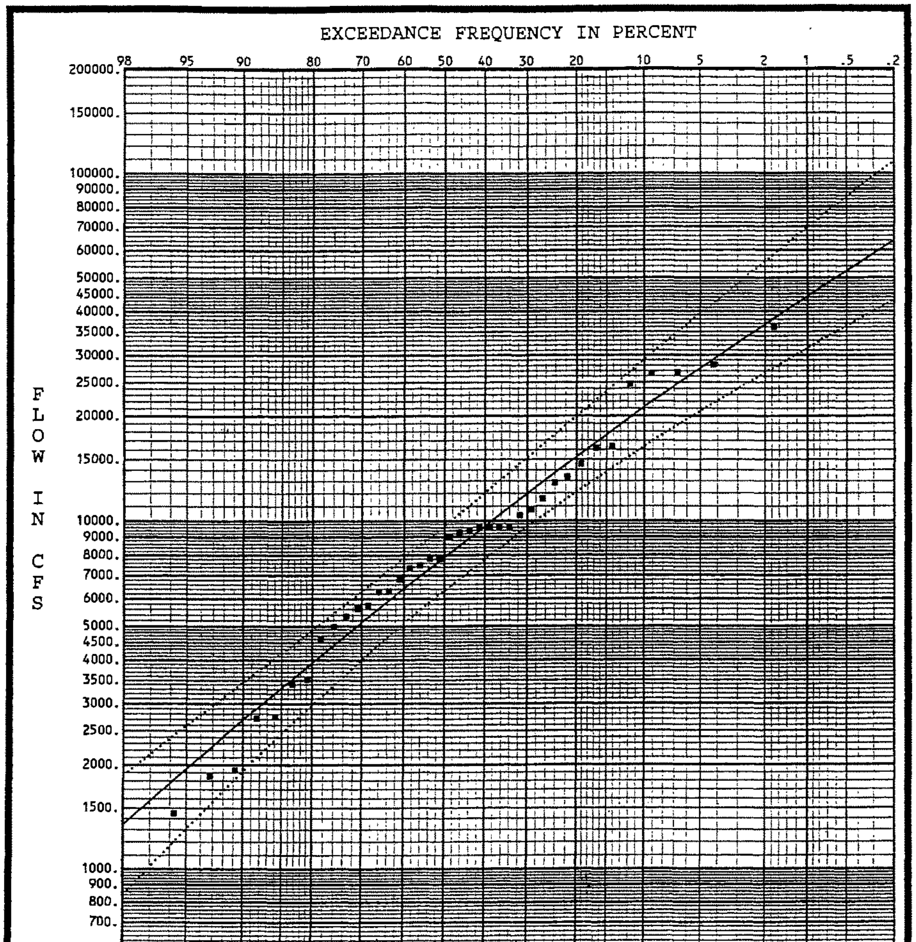
FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

		NUMBER OF EVENTS	
MEAN	3.7110	HISTORIC EVENTS	0
STANDARD DEV	.3466	HIGH OUTLIERS	0
SKEW	-.1846	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.1289	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Clear Fork of the Trinity
River at Fort Worth
for Water Years 1953-1992

Plate A-2



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
.... 5% and 95% Confidence Limits

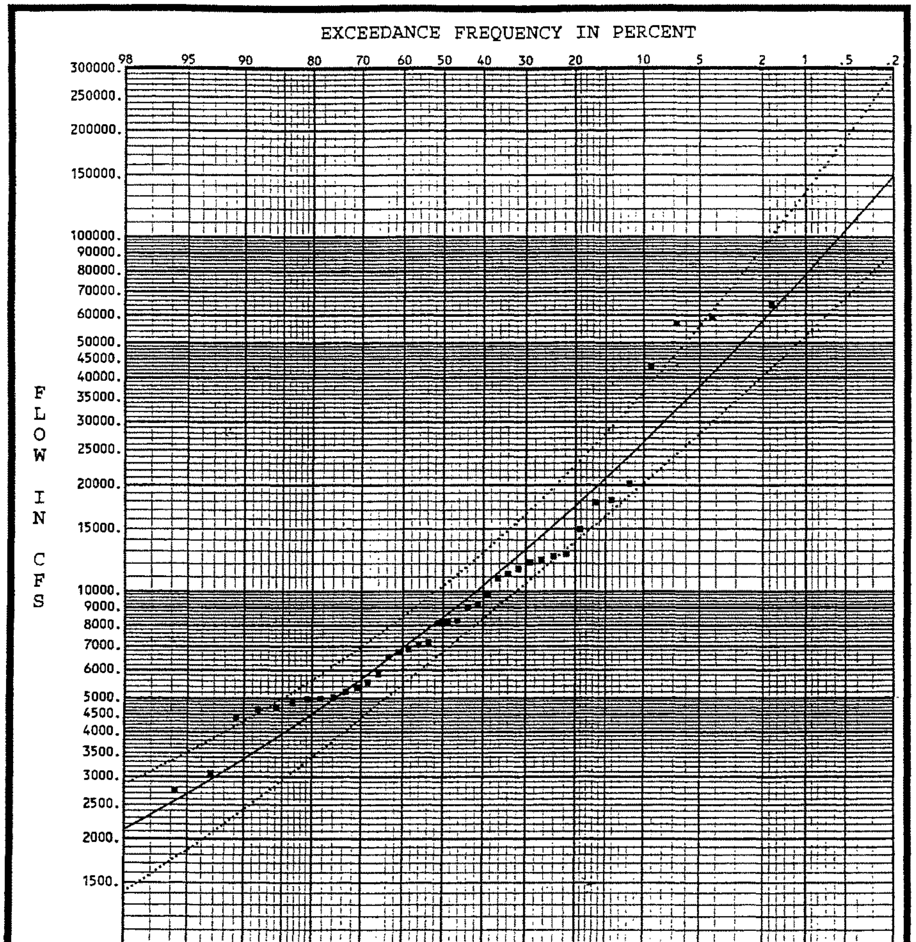
FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

		NUMBER OF EVENTS	
MEAN	3.8852	HISTORIC EVENTS	0
STANDARD DEV	.3498	HIGH OUTLIERS	0
SKEW	-.2964	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.2031	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
West Fork of the Trinity
River at Fort Worth
for Water Years 1953-1992

Plate A-3



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

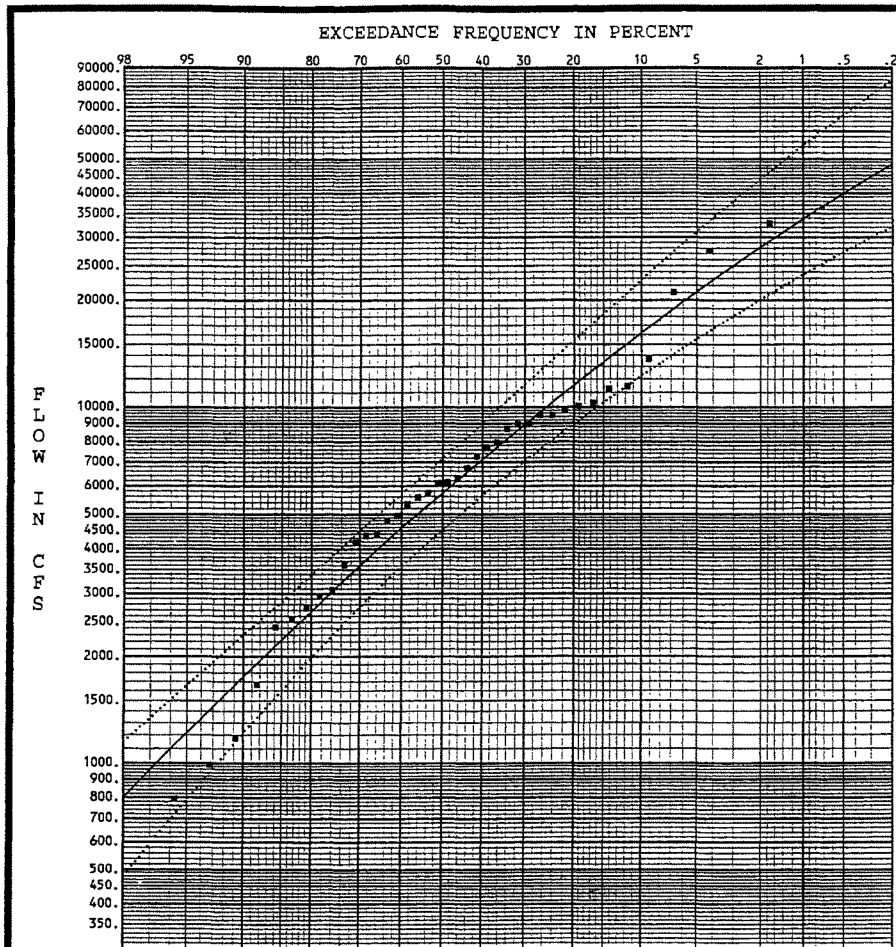
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.9551	HISTORIC EVENTS	0
STANDARD DEV	.3514	HIGH OUTLIERS	0
SKEW	.7718	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.4838	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
West Fork of the Trinity
River at Grand Prairie
for Water Years 1953-1992

Plate A-4



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

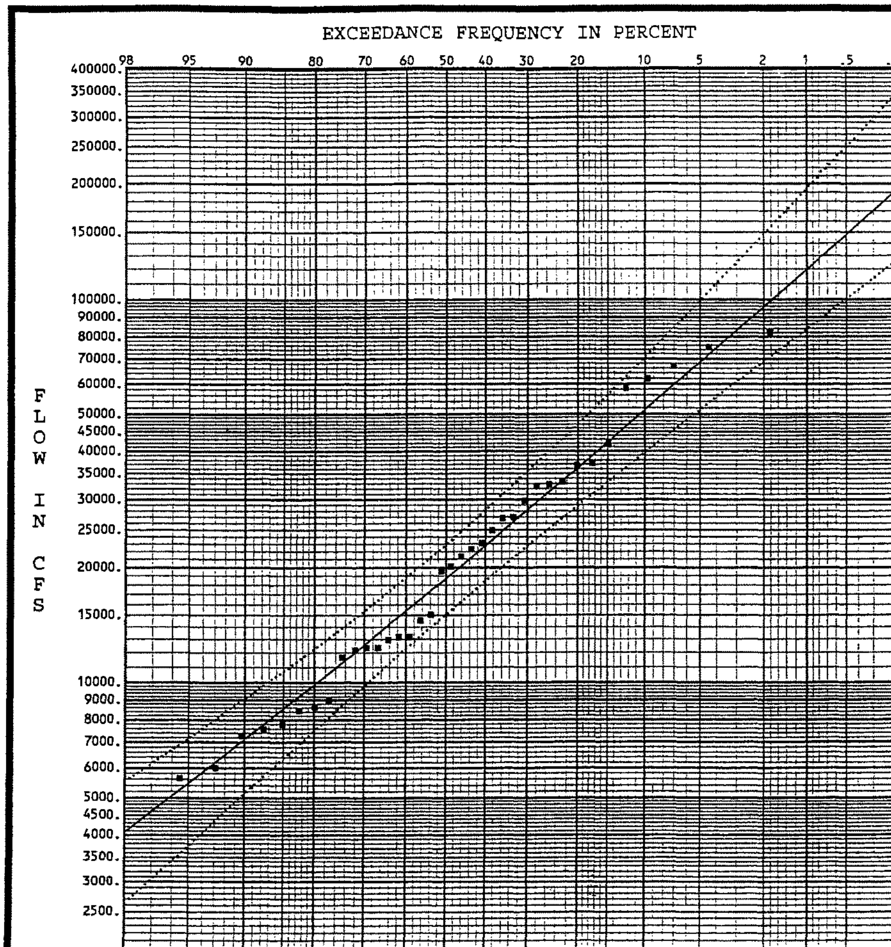
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	3.7390	HISTORIC EVENTS	0
STANDARD DEV	.3775	HIGH OUTLIERS	0
SKEW	-.4652	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	-.3094	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Elm Fork of the Trinity
River near Carrolton
for Water Years 1953-1992

Plate A-5



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

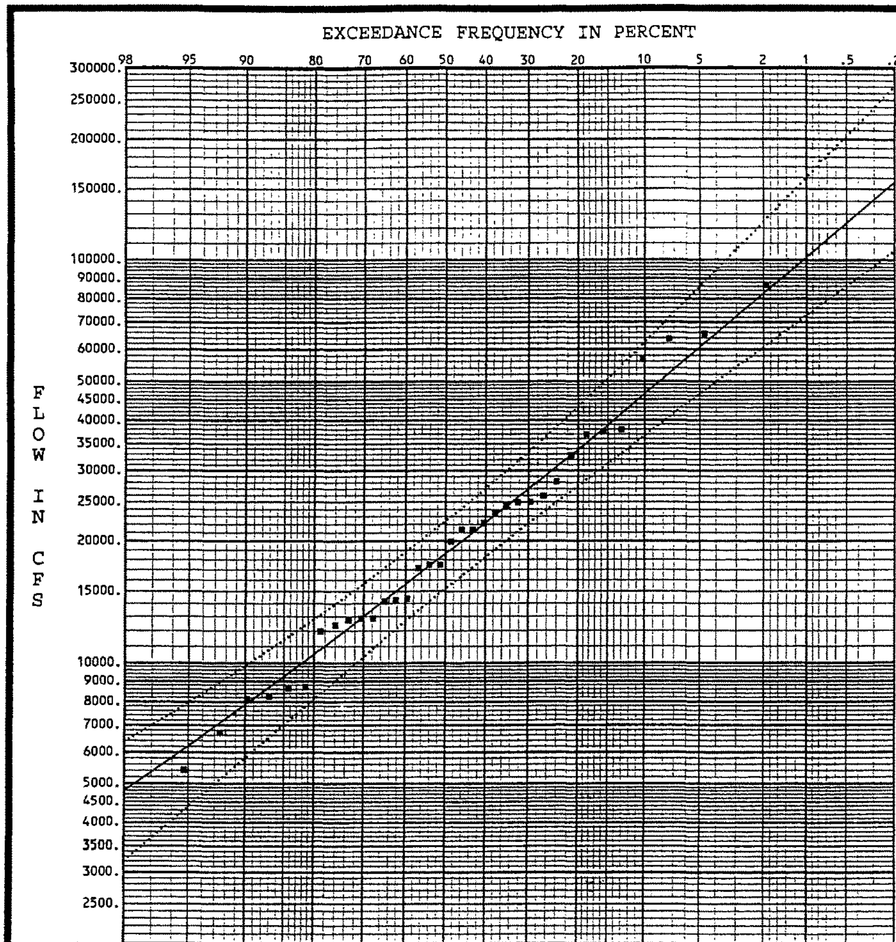
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3341	HIGH OUTLIERS	0
SKEW	.1416	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.0982	SYSTEMATIC EVENTS	38

(NUMBER OF EVENTS)

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at Dallas
for Water Years 1953-1992

Plate A-6



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
········ 5% and 95% Confidence Limits

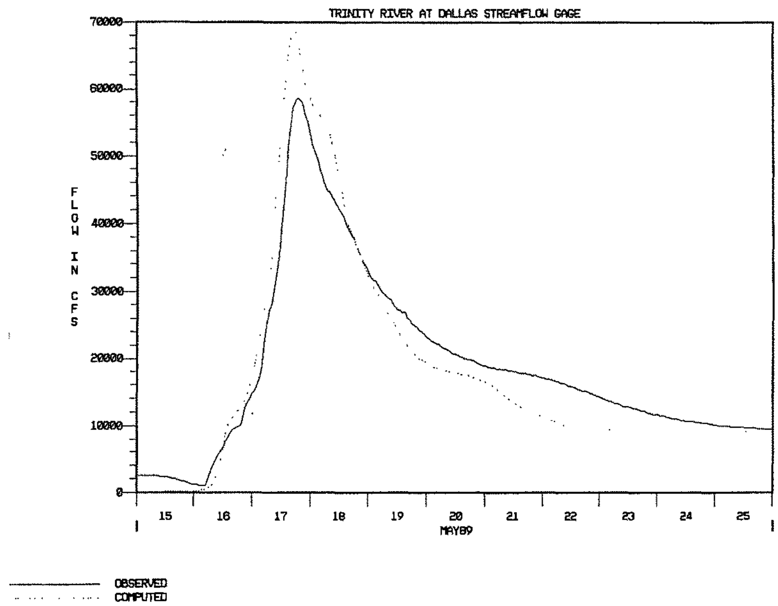
FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

		NUMBER OF EVENTS	
MEAN	4.2770	HISTORIC EVENTS	0
STANDARD DEV	.3010	HIGH OUTLIERS	0
SKEW	.2070	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1398	SYSTEMATIC EVENTS	36

. Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River below Dallas
for Water Years 1953-1992

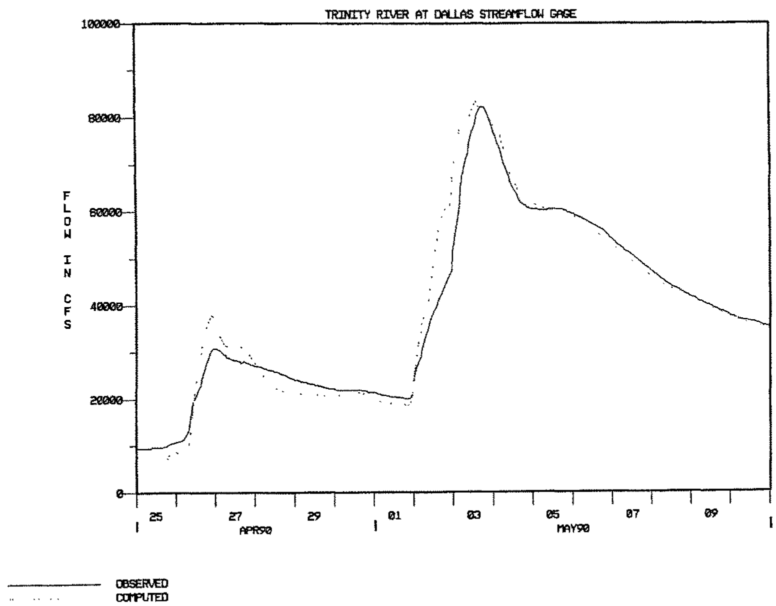
Plate A-7



Dallas Floodway Extension
General Reevaluation Report

Flood Hydrograph Reproduction
May 1989 Event

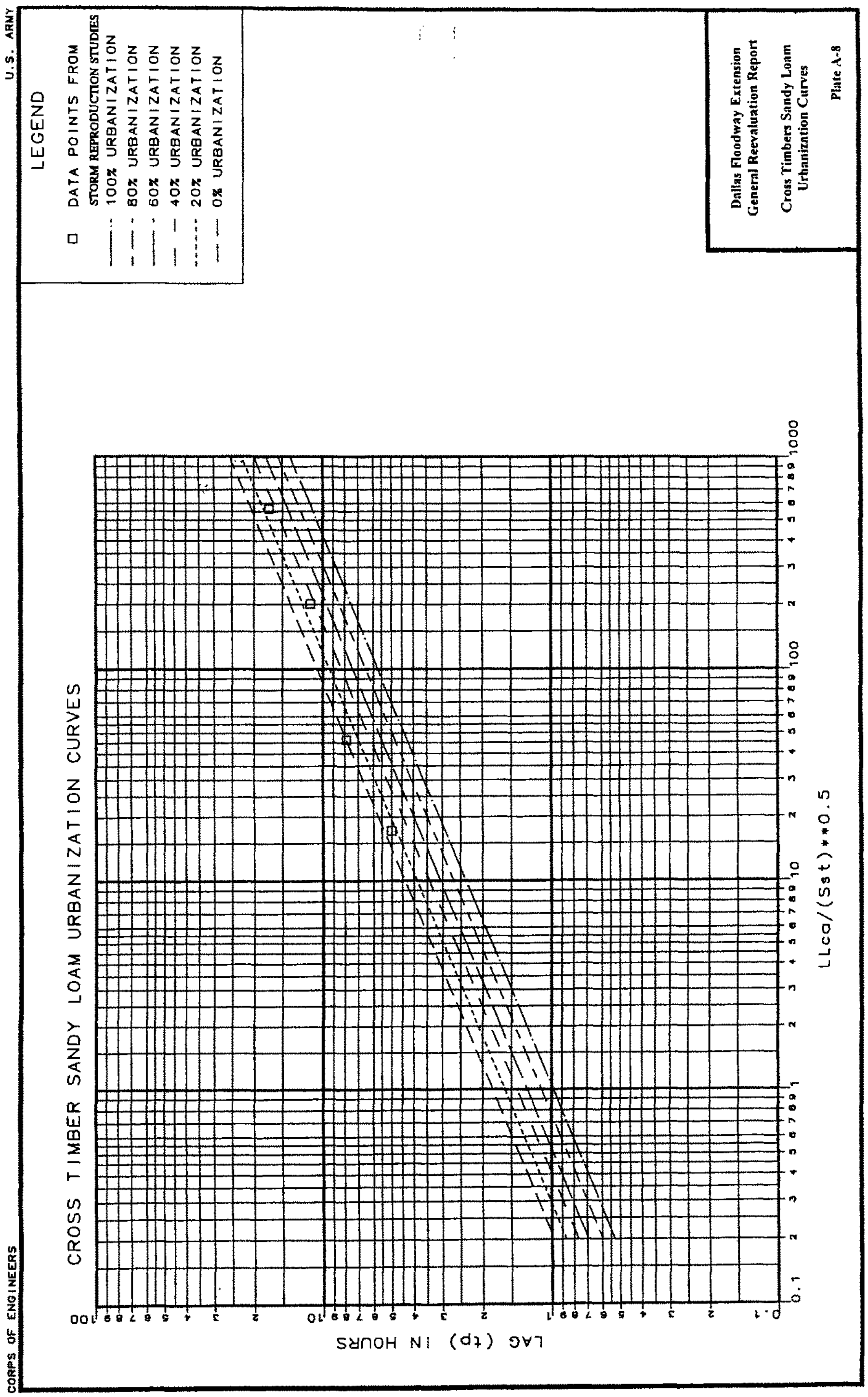
Plate A-7A

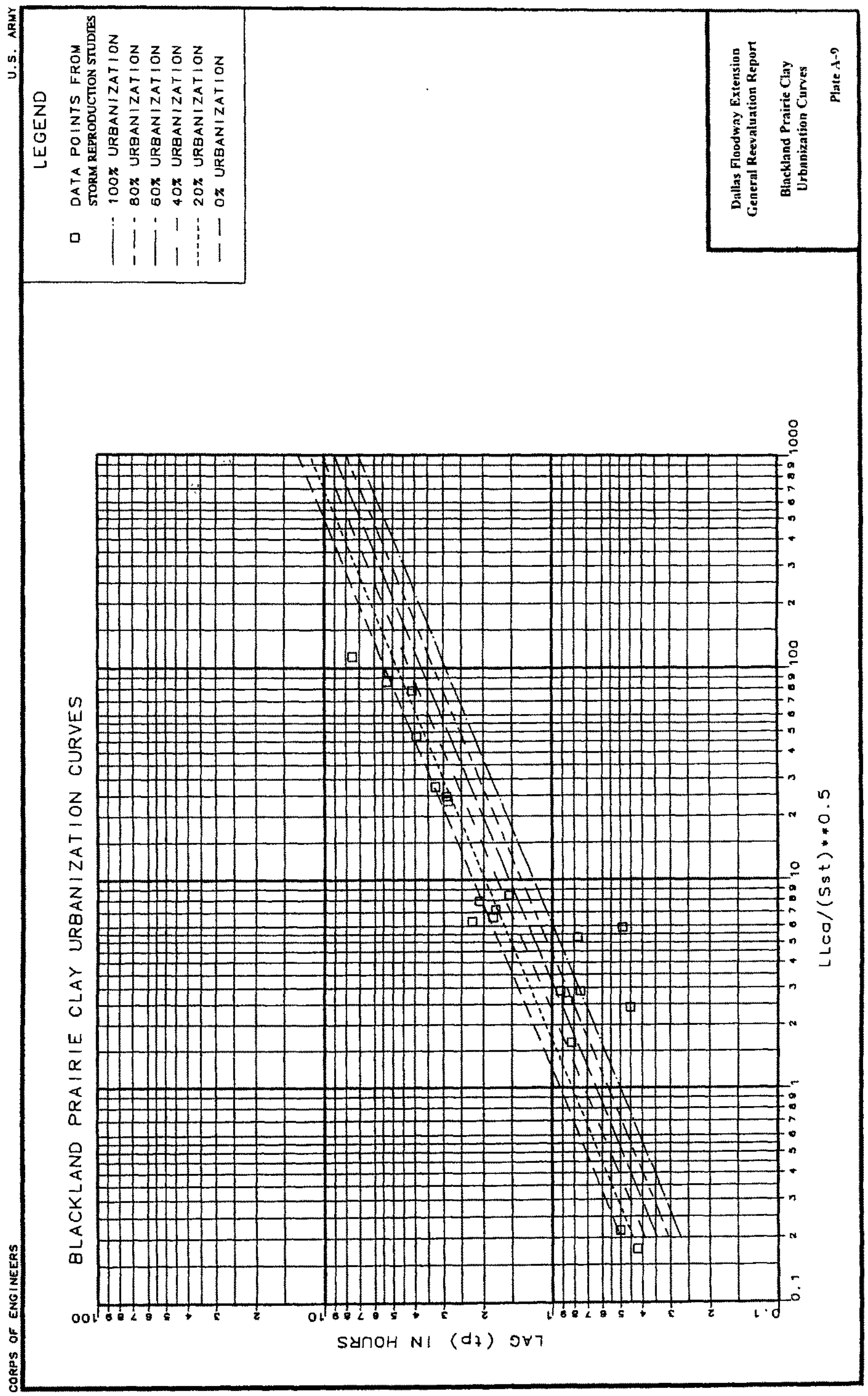


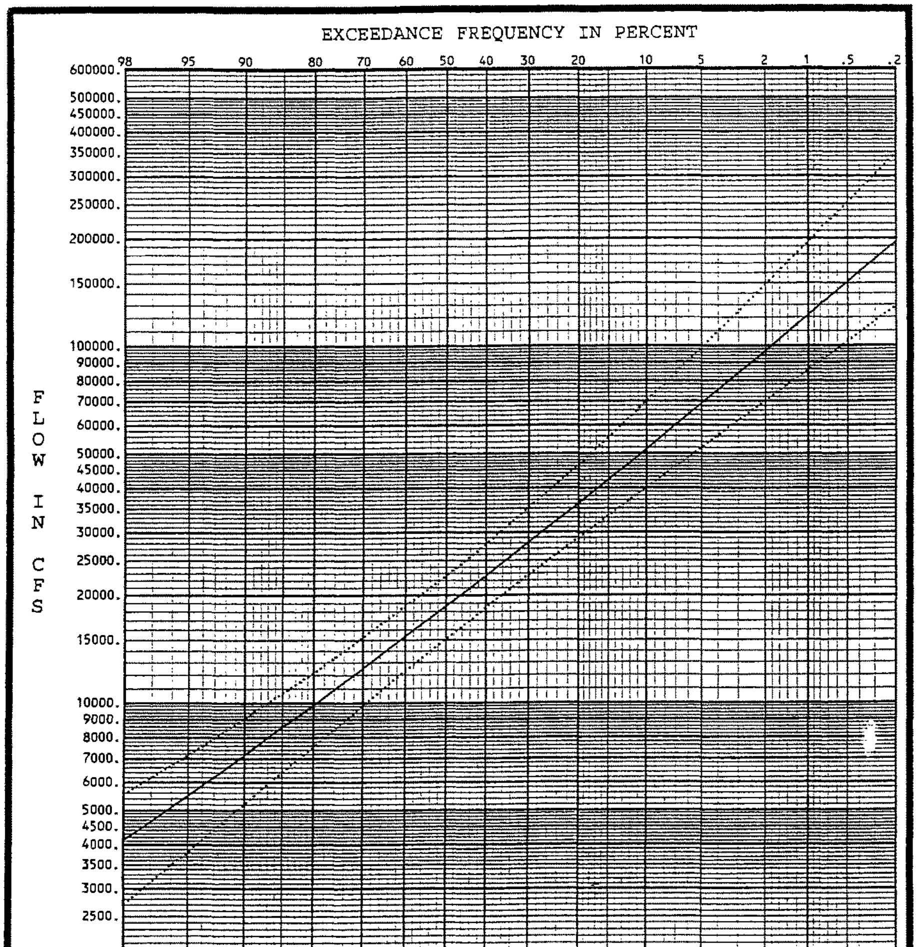
Dallas Floodway Extension
General Reevaluation Report

Flood Hydrograph Reproduction
May 1990 Event

Plate A-7B


CORPS OF ENGINEERS
U.S. ARMY
CROSS TIMBER SANDY LOAM URBANIZATION CURVES
LEGEND
DATA POINTS FROM STORM REPRODUCTION STUDIES
100% URBANIZATION
80% URBANIZATION
60% URBANIZATION
40% URBANIZATION
20% URBANIZATION
0% URBANIZATION
LAG (tp) IN HOURS
LLca/(Sst)**0.5
Dallas Floodway Extension
General Reevaluation Report
Cross Timbers Sandy Loam
Urbanization Curves
Plate A-8


U.S. ARMY
LEGEND
DATA POINTS FROM STORM REPRODUCTION STUDIES
100% URBANIZATION
80% URBANIZATION
60% URBANIZATION
40% URBANIZATION
20% URBANIZATION
0% URBANIZATION
BLACKLAND PRAIRIE CLAY URBANIZATION CURVES
LAG (tp) IN HOURS
LLca/(Sst)**0.5
Dallas Floodway Extension
General Reevaluation Report
Blackland Prairie Clay
Urbanization Curves
Plate A-9
CORPS OF ENGINEERS



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

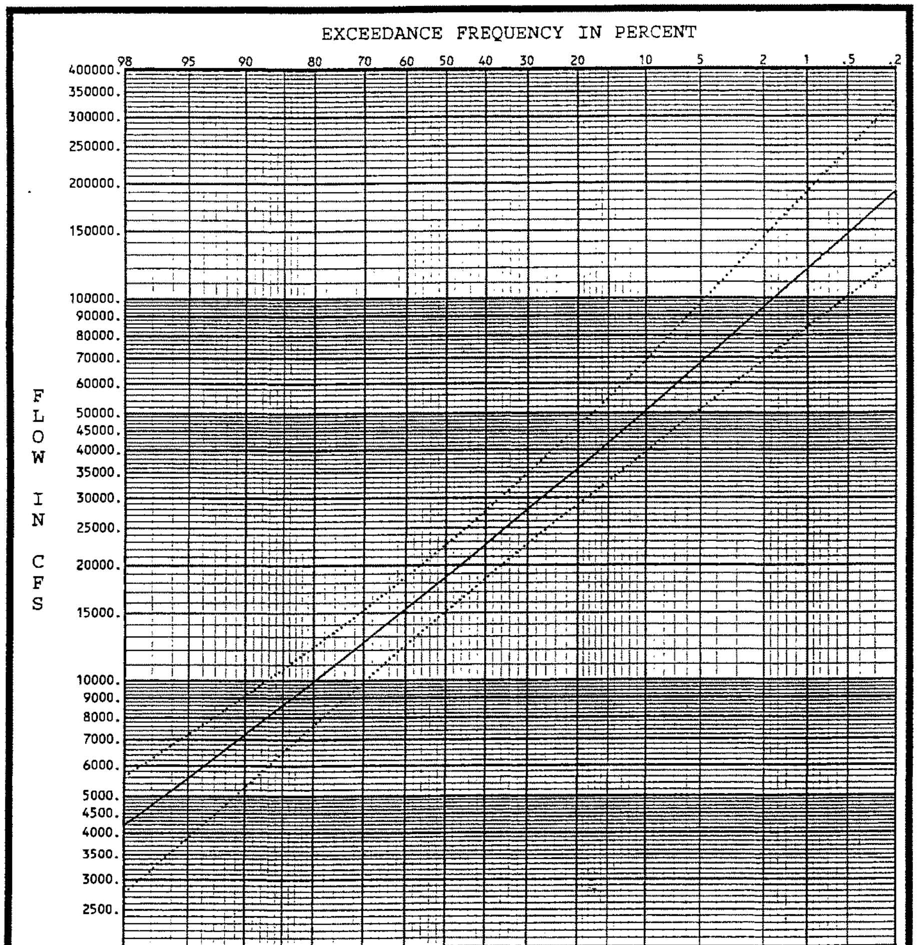
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3341	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1300	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at Downstream
End of the Dallas Floodway
For Baseline Conditions

Plate A-10



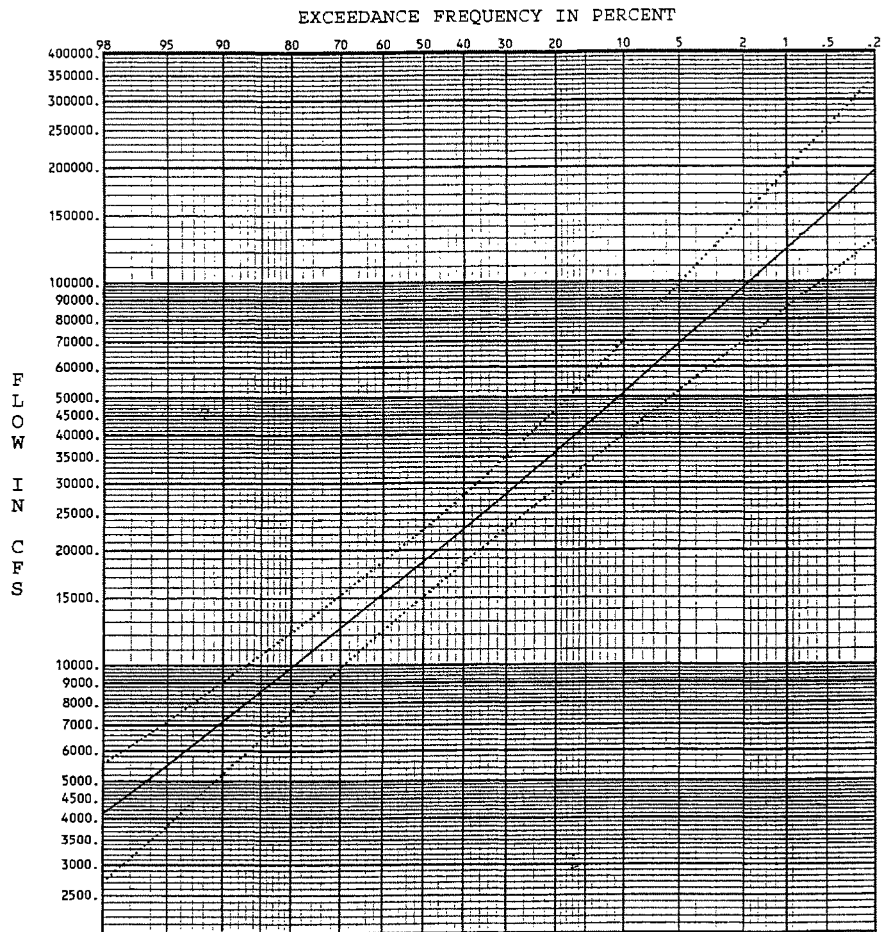
—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

FREQUENCY STATISTICS LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2770	HISTORIC EVENTS	0
STANDARD DEV	.3300	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1300	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the Central
Wastewater Treat. Plant Levee
For Baseline Conditions

Plate A-11



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

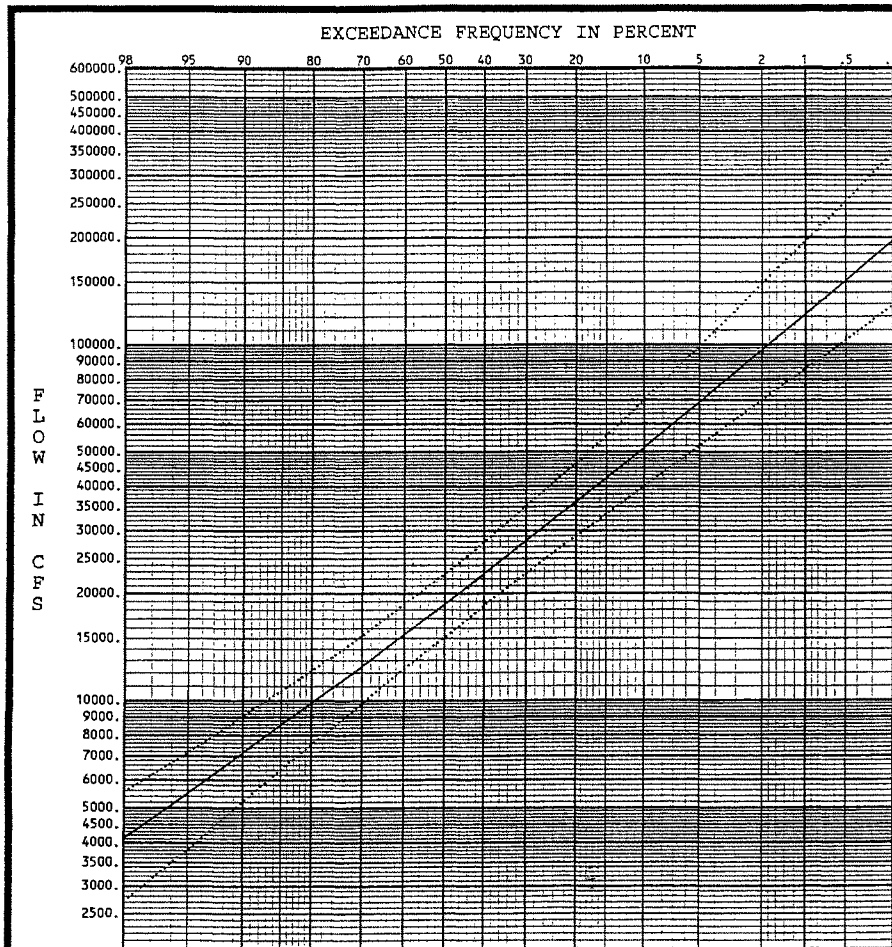
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3341	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1300	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the "Below
Dallas" Gage (Loop 12)
For Baseline Conditions

Plate A-12



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

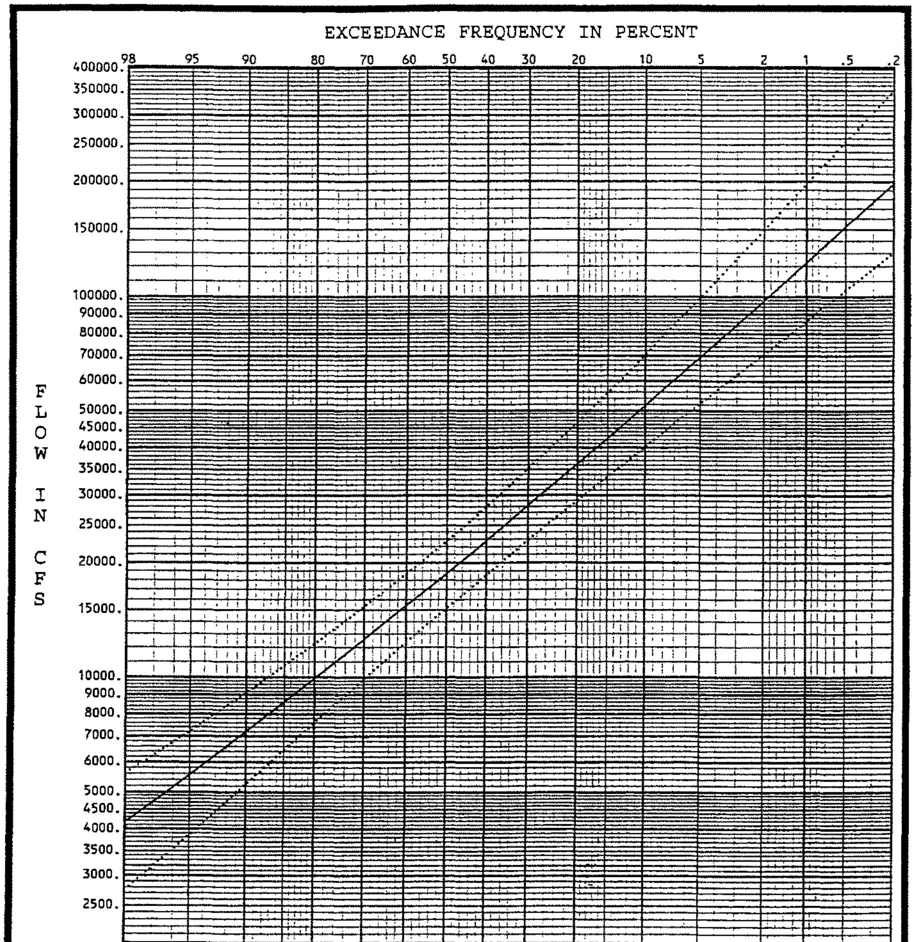
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3341	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1300	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at Downstream
End of Dallas Floodway for
1,200-Foot Swale (NED) Plan

Plate A-13



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

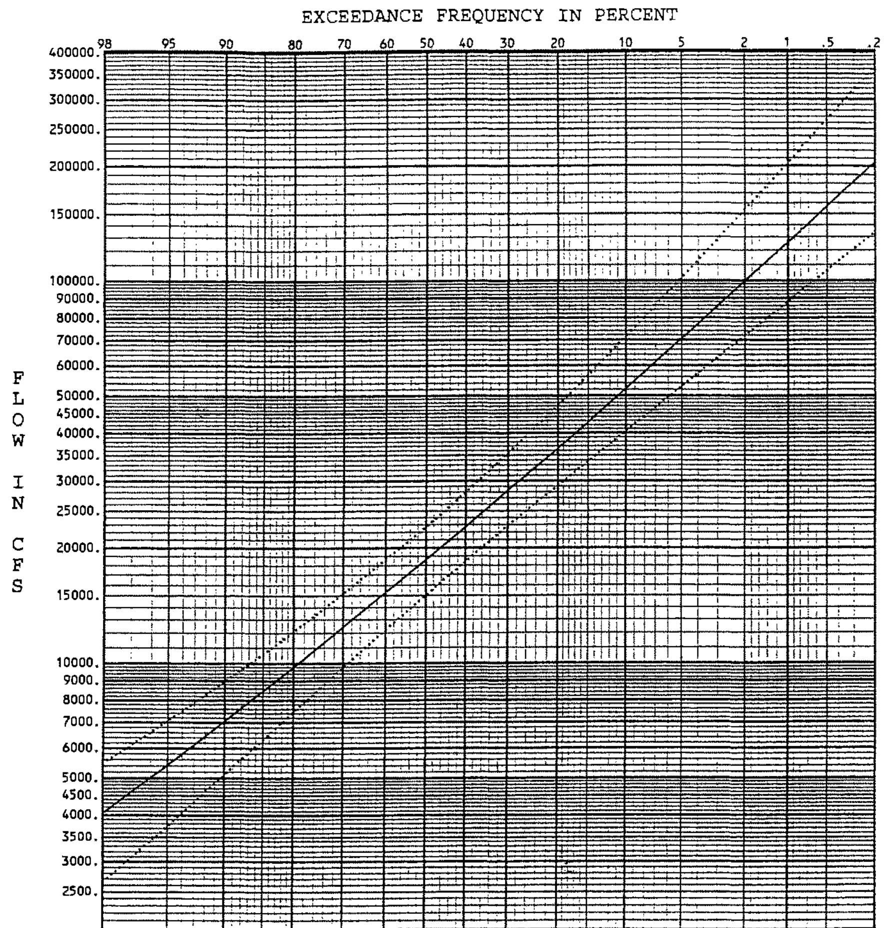
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2800	HISTORIC EVENTS	0
STANDARD DEV	.3335	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1400	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the Central
Wastewater Treat. Plant Levee
1,200-Foot Swale (NED) Plan

Plate A-14



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
.... 5% and 95% Confidence Limits

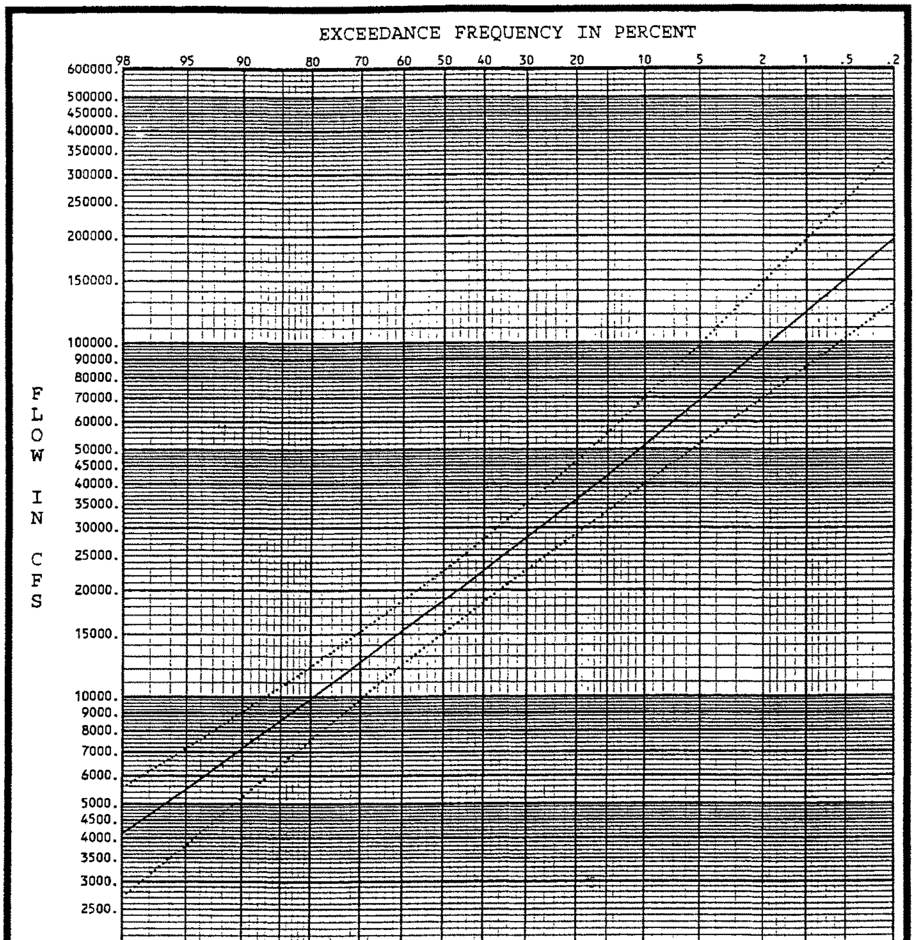
FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

		NUMBER OF EVENTS	
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3390	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1400	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the "Below Dallas" Gage (Loop 12) For 1,200-Foot Swale (NED) Plan

Plate A-15



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
.... 5% and 95% Confidence Limits

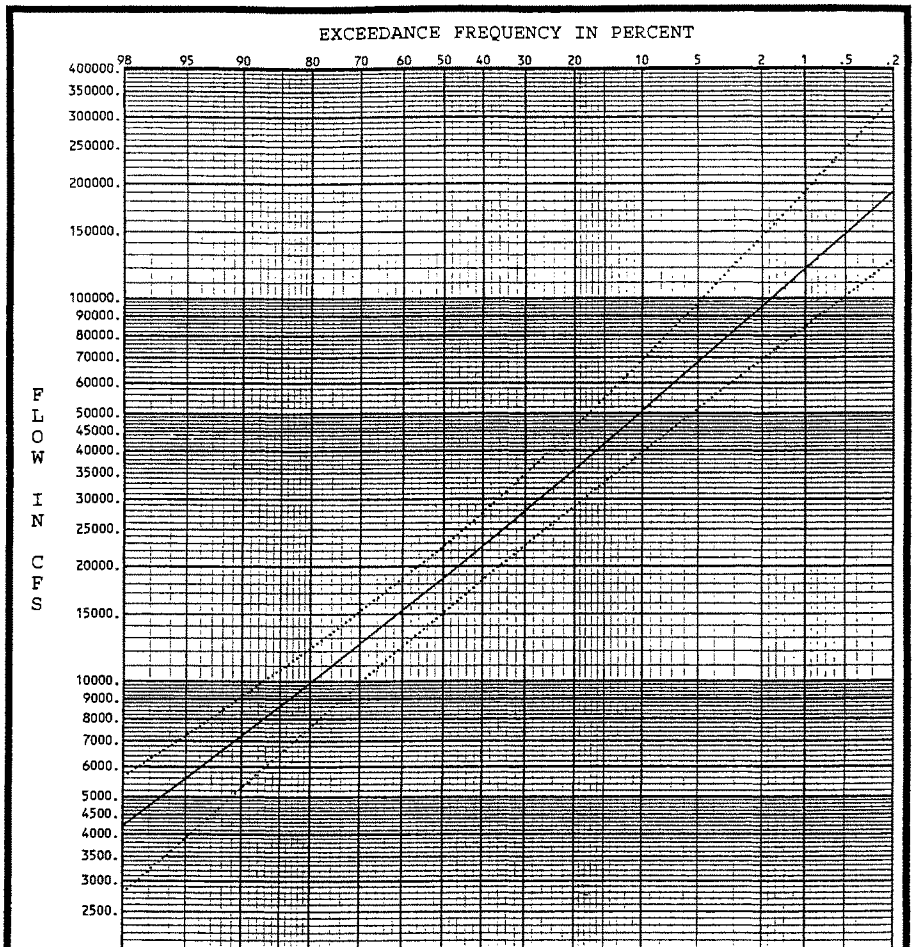
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3341	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1300	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at Downstream
End of the Dallas Floodway
For Recommended Plan

Plate A-16



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

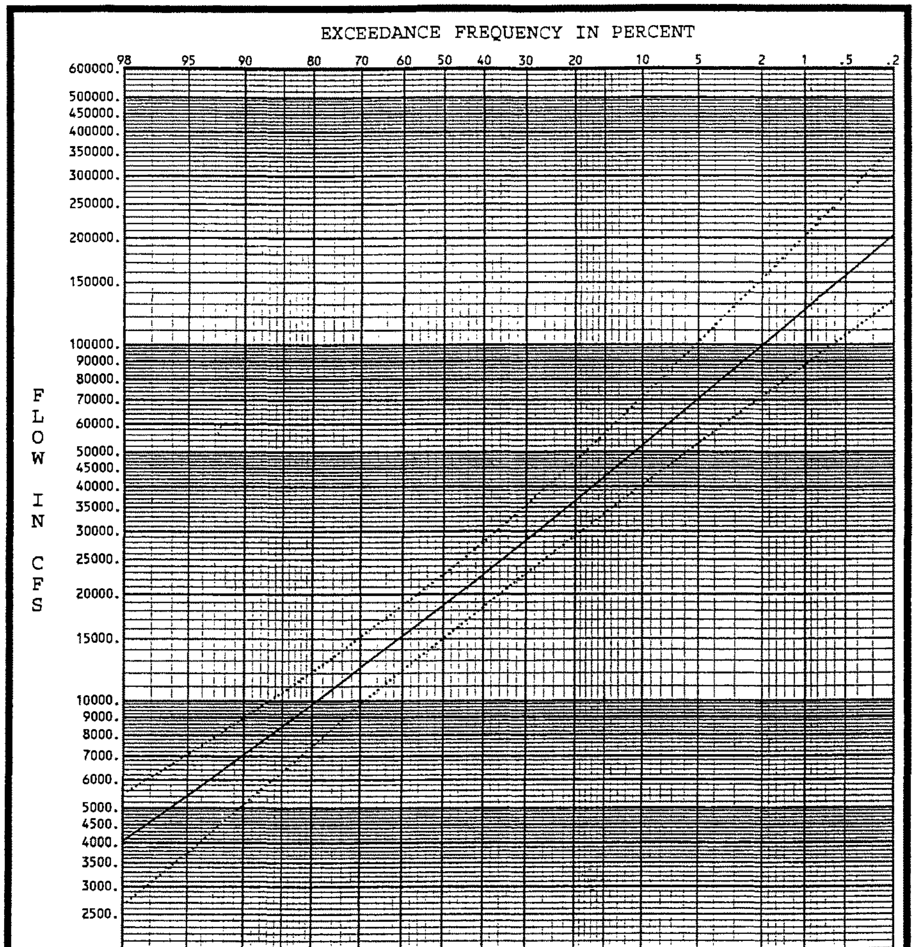
FREQUENCY STATISTICS

LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	4.2770	HISTORIC EVENTS	0
STANDARD DEV	.3300	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1400	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the Central
Wastewater Treat. Plant Levee
For Recommended Plan

Plate A-17



—— FLOW Frequency (without Exp. Prob.)
▪ Median Plotting Positions
······· 5% and 95% Confidence Limits

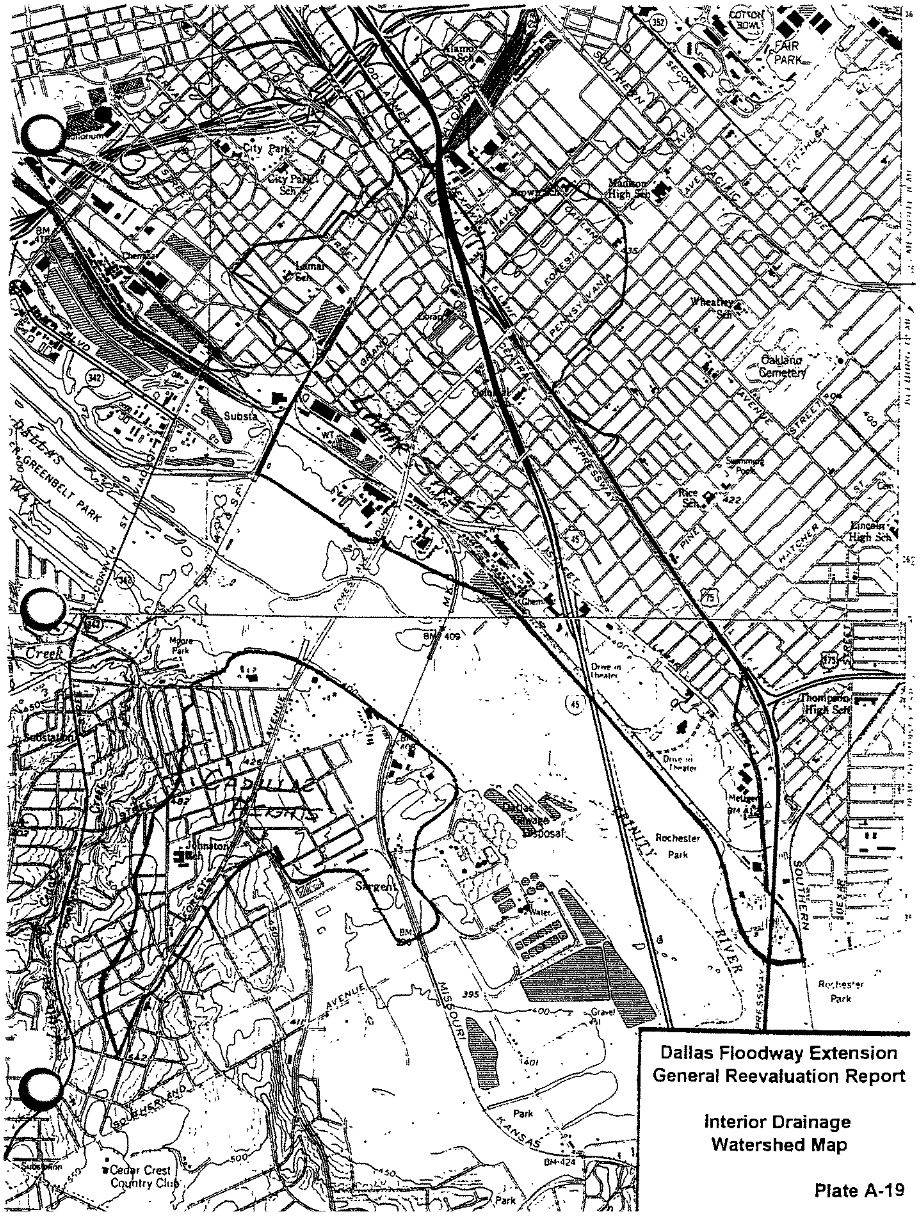
FREQUENCY STATISTICS
LOG TRANSFORM OF FLOW, CFS

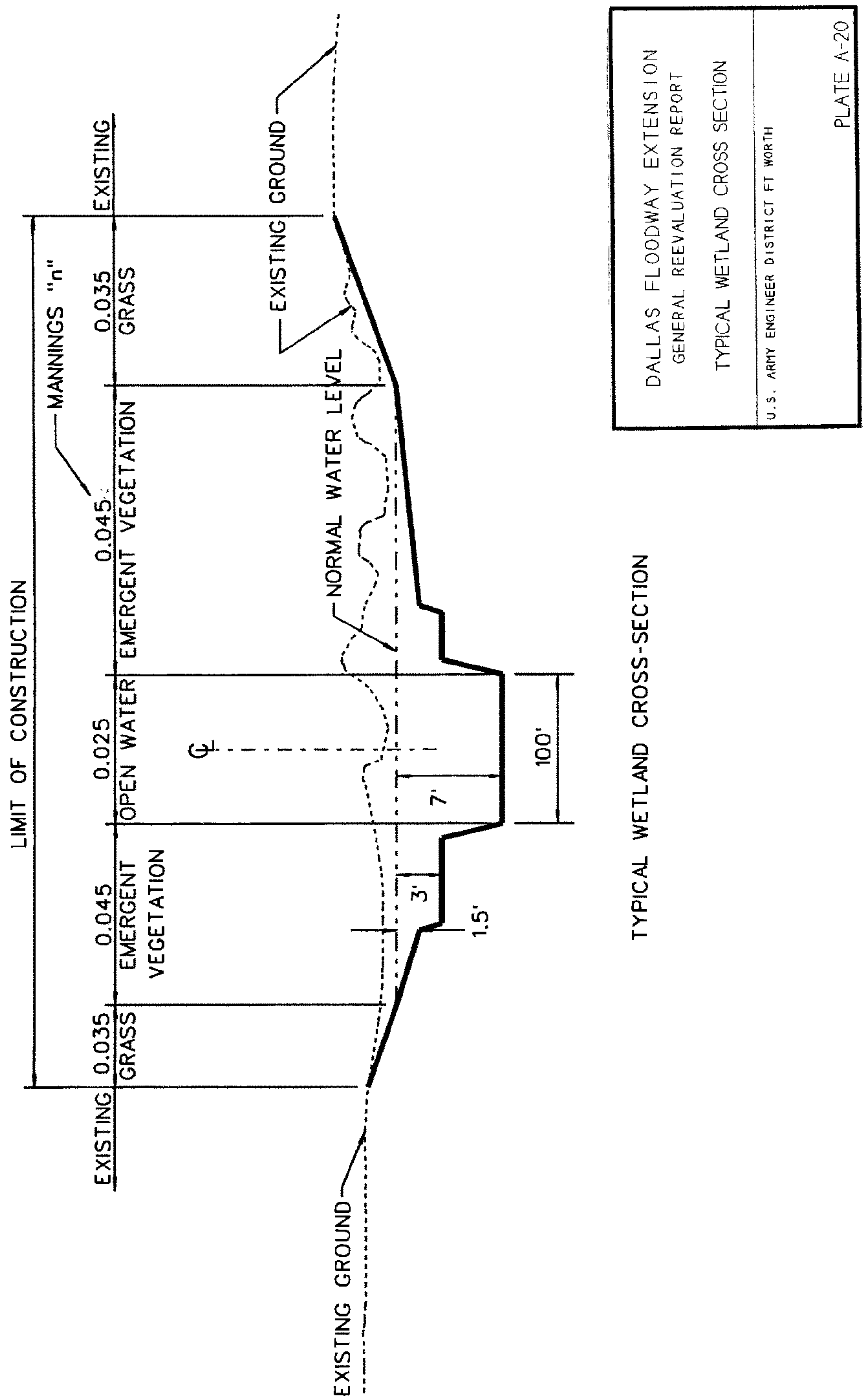
			NUMBER OF EVENTS
MEAN	4.2779	HISTORIC EVENTS	0
STANDARD DEV	.3390	HIGH OUTLIERS	0
SKEW	.0000	LOW OUTLIERS	0
REGIONAL SKEW	.0000	ZERO OR MISSING	0
ADOPTED SKEW	.1400	SYSTEMATIC EVENTS	40

Dallas Floodway Extension
General Reevaluation Report

Discharge vs. Frequency Curve
Trinity River at the "Below
Dallas" Gage (Loop 12)
For Recommended Plan

Plate A-18


Dallas Floodway Extension
General Reevaluation Report
Interior Drainage
Watershed Map
Plate A-19
COTTON BOWL
FAIR PARK
City Park
Lamar Sch
Madison High Sch
Wheatley Sch
Oakland Cemetery
Rice Sch
Lincoln High Sch
Moore Park
Thompson High Sch
Dallas Sewage Disposal
Rochester Park
Sargent
Cedar Crest Country Club
Substation
PENNSYLVANIA
EXPRESSWAY
RIVER
SOUTHERN
MISSOURI
AVENUE
KANSAS
Park
Drive in Theater


LIMIT OF CONSTRUCTION
MANNINGS "n"
EXISTING
0.035 GRASS
0.045 EMERGENT VEGETATION
0.025 OPEN WATER
0.045 EMERGENT VEGETATION
0.035 GRASS
EXISTING
EXISTING GROUND
EXISTING GROUND
NORMAL WATER LEVEL
7'
3'
1.5'
100'
TYPICAL WETLAND CROSS-SECTION
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
TYPICAL WETLAND CROSS SECTION
U.S. ARMY ENGINEER DISTRICT FT WORTH
PLATE A-20

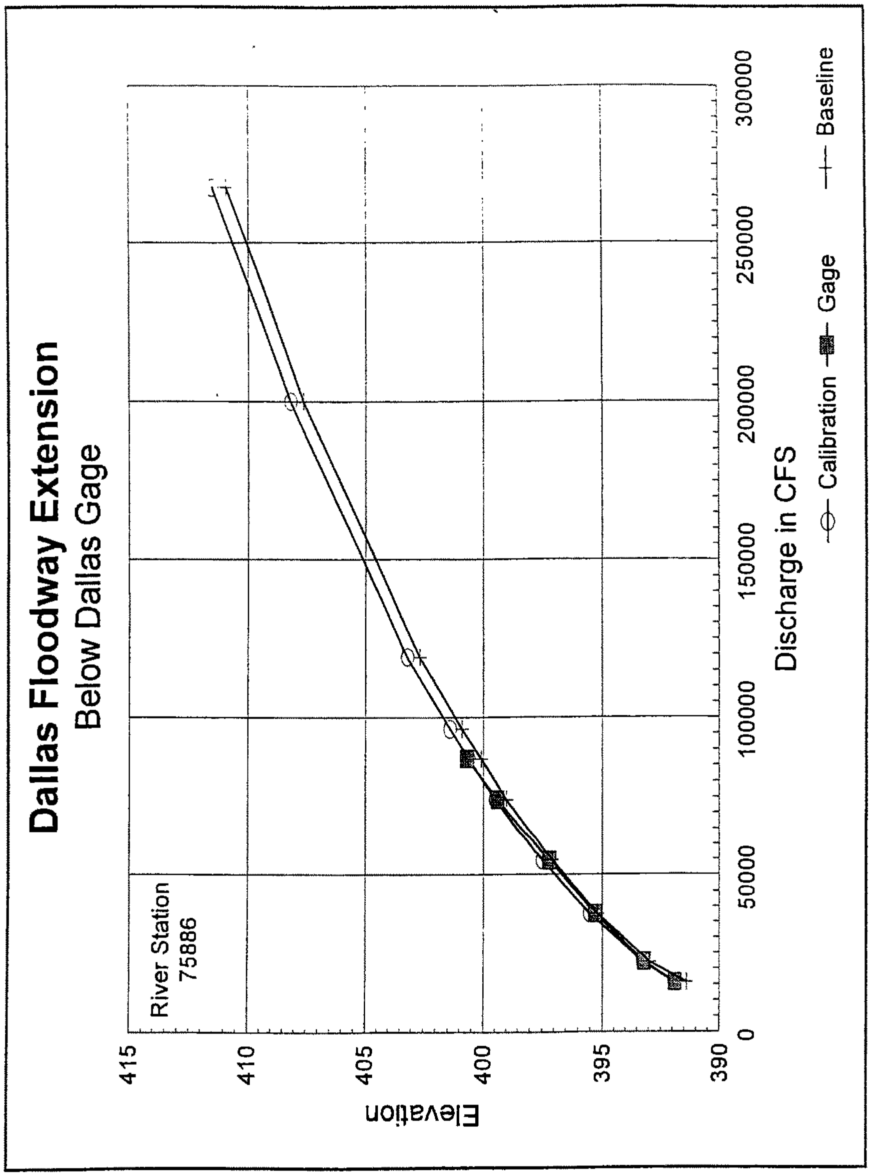

Dallas Floodway Extension
Below Dallas Gage
River Station
75886
Elevation
415
410
405
400
395
390
0
50000
100000
150000
200000
250000
300000
Discharge in CFS
Calibration
Gage
Baseline

PLATE A-21

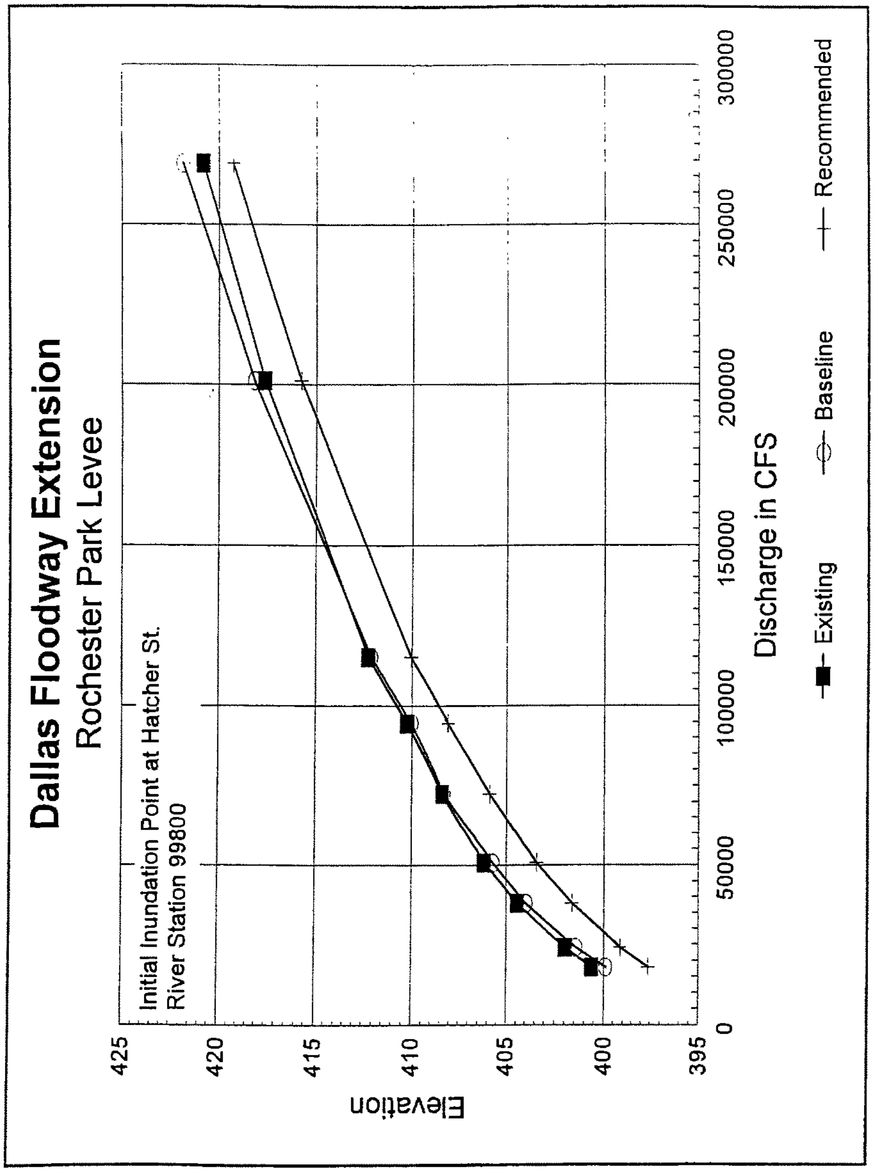

Dallas Floodway Extension
Rochester Park Levee
Initial Inundation Point at Hatcher St.
River Station 99800
Elevation
425
420
415
410
405
400
395
0
50000
100000
150000
200000
250000
300000
Discharge in CFS
Existing
Baseline
Recommended

PLATE A-22

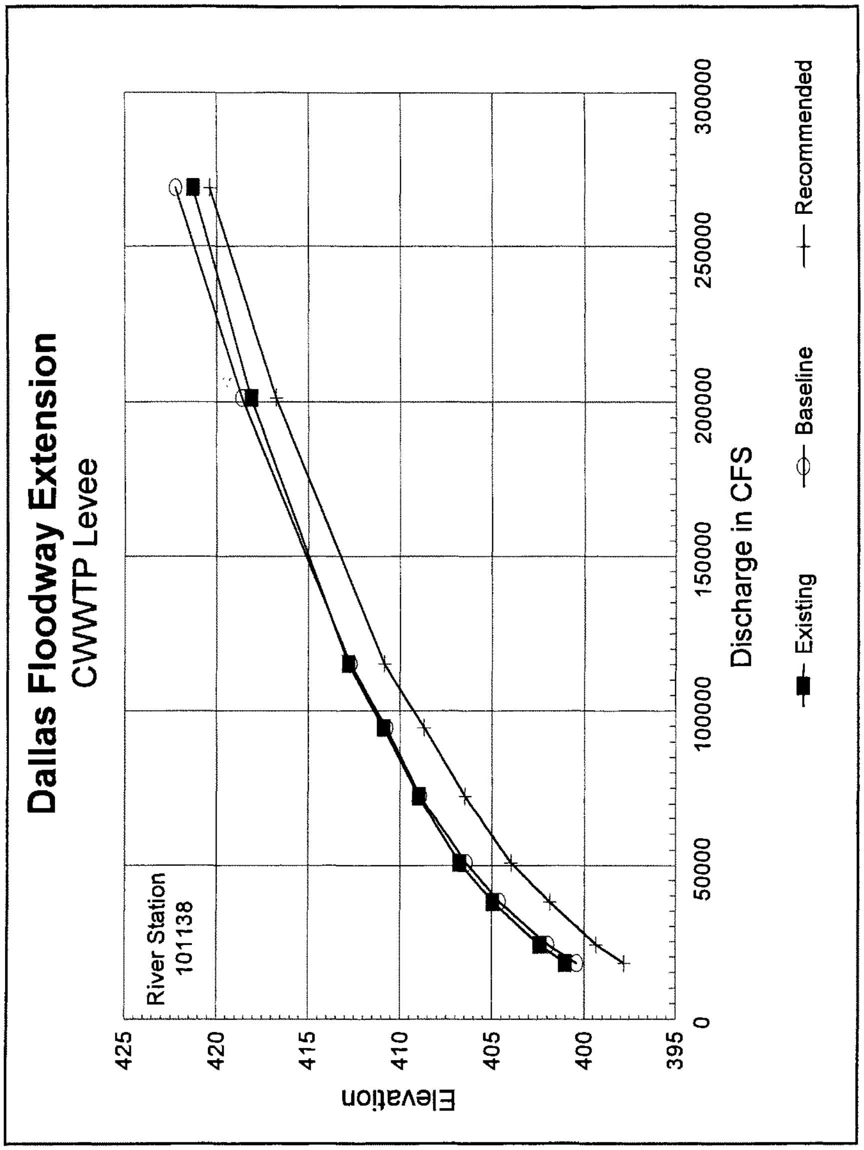
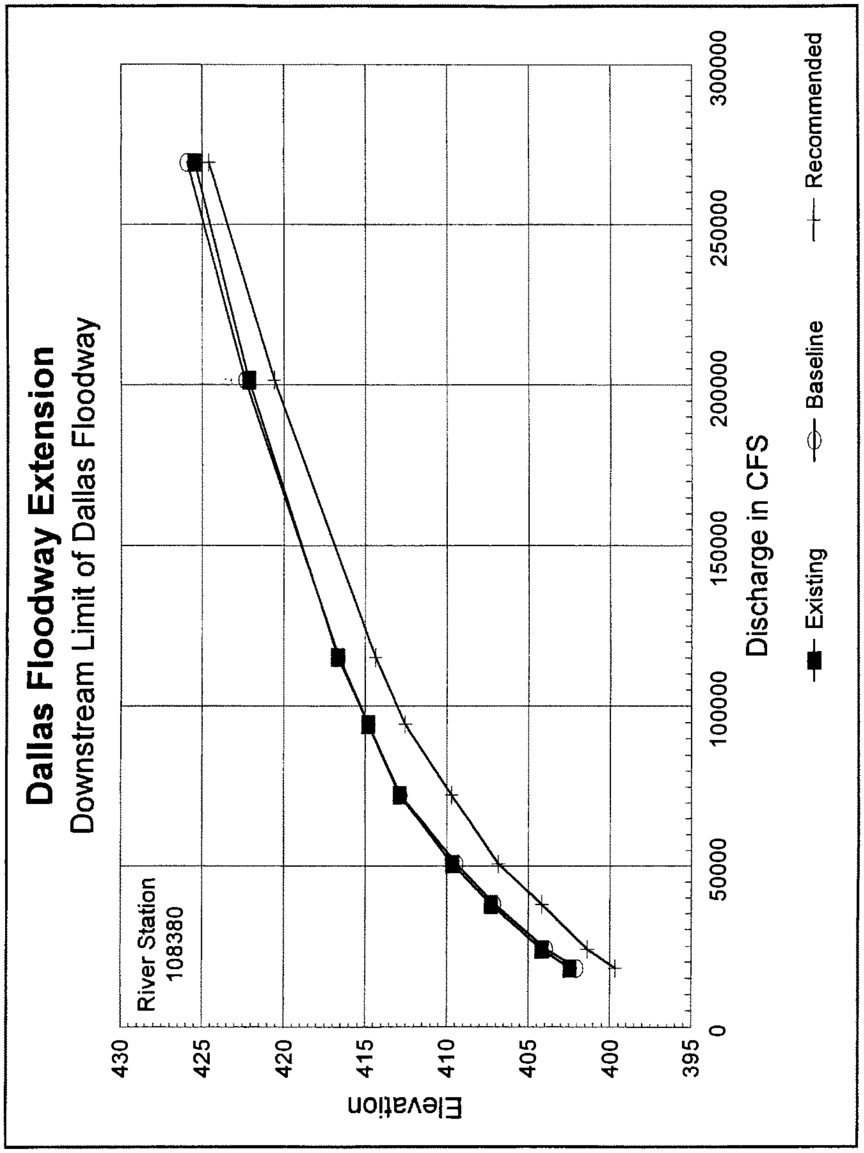
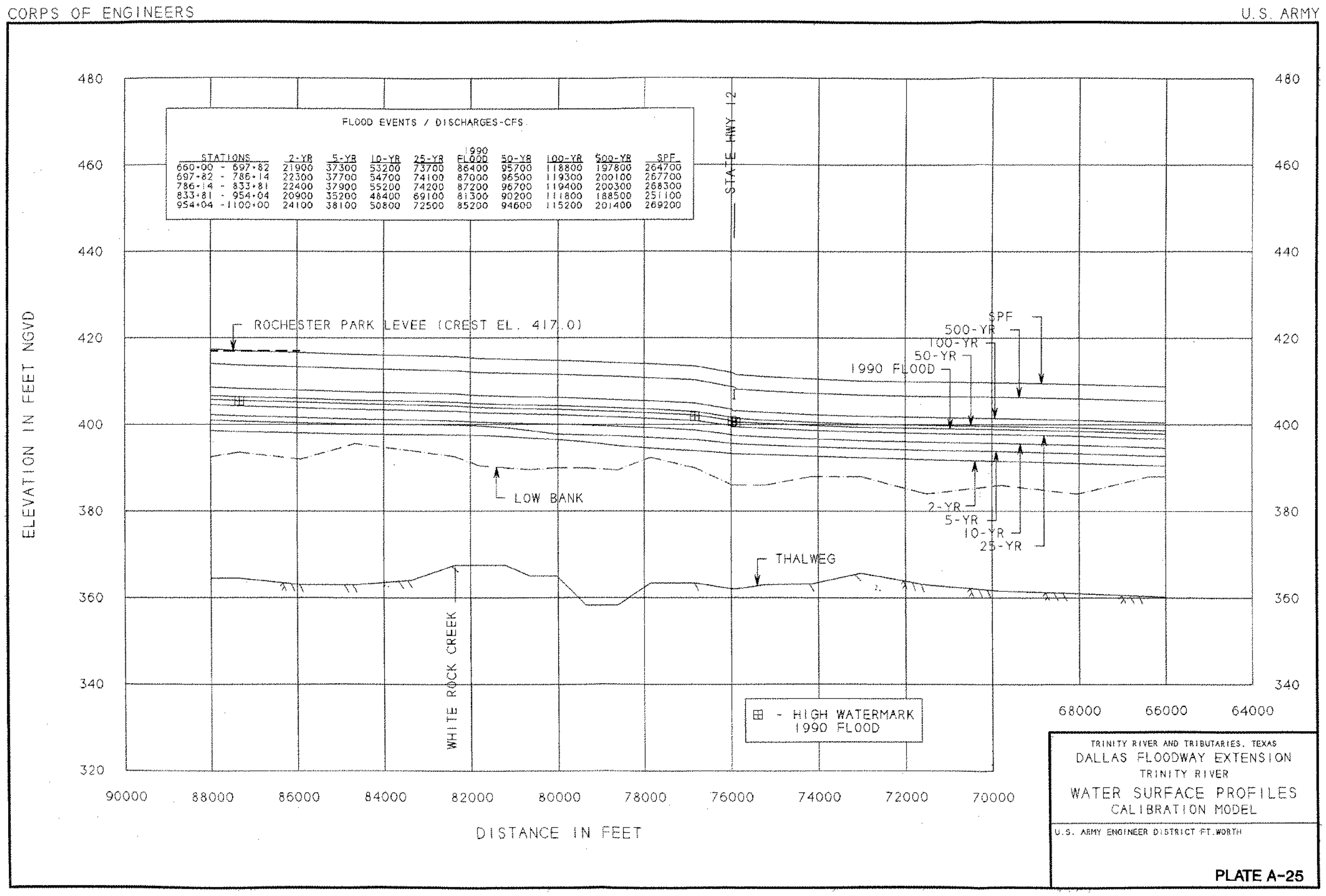

Dallas Floodway Extension
CWWTP Levee
River Station
101138
Elevation
425
420
415
410
405
400
395
0
50000
100000
150000
200000
250000
300000
Discharge in CFS
Existing
Baseline
Recommended

PLATE A-23



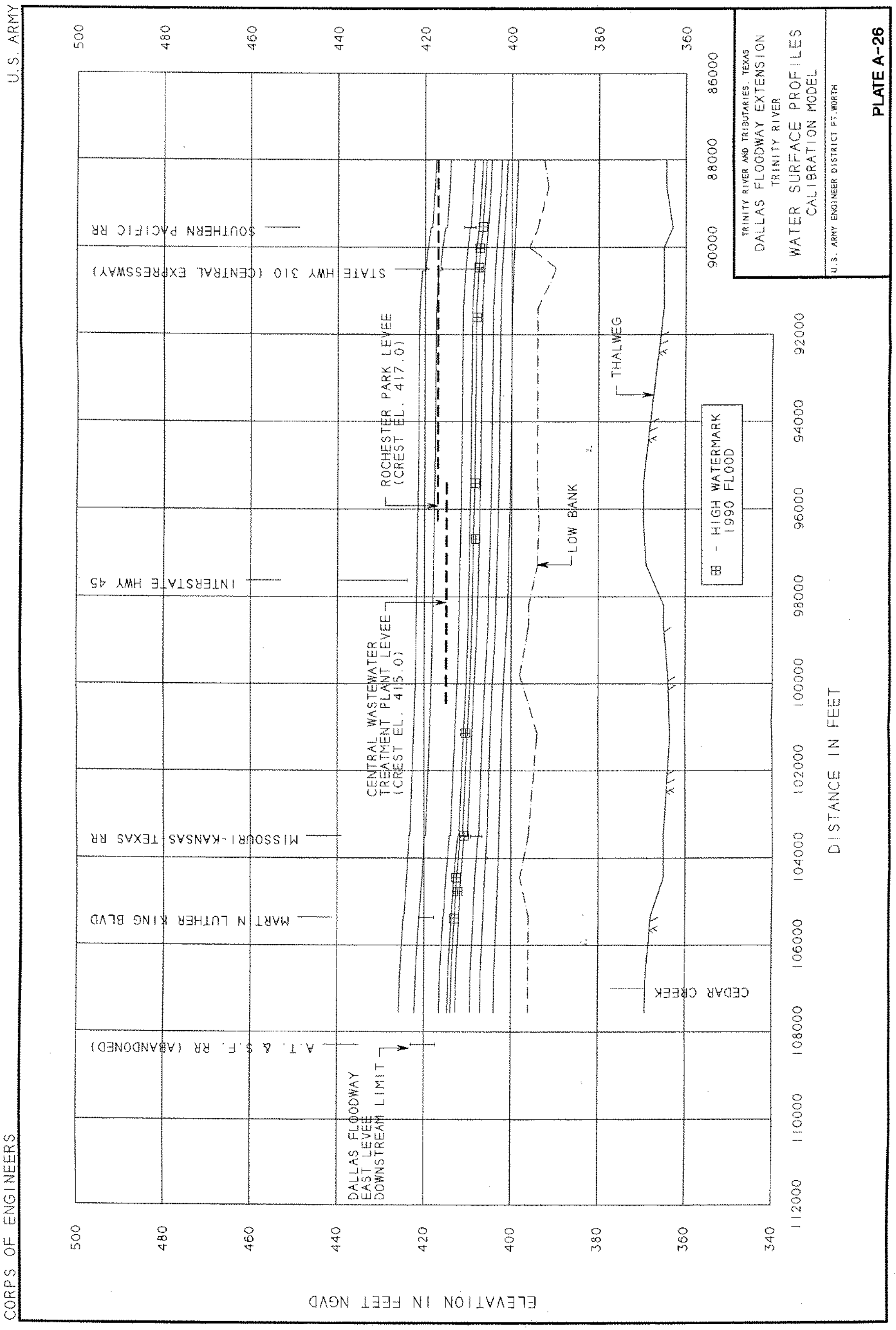
Dallas Floodway Extension
Downstream Limit of Dallas Floodway
River Station
108380
Elevation
430
425
420
415
410
405
400
395
0
50000
100000
150000
200000
250000
300000
Discharge in CFS
Existing
Baseline
Recommended

PLATE A-24

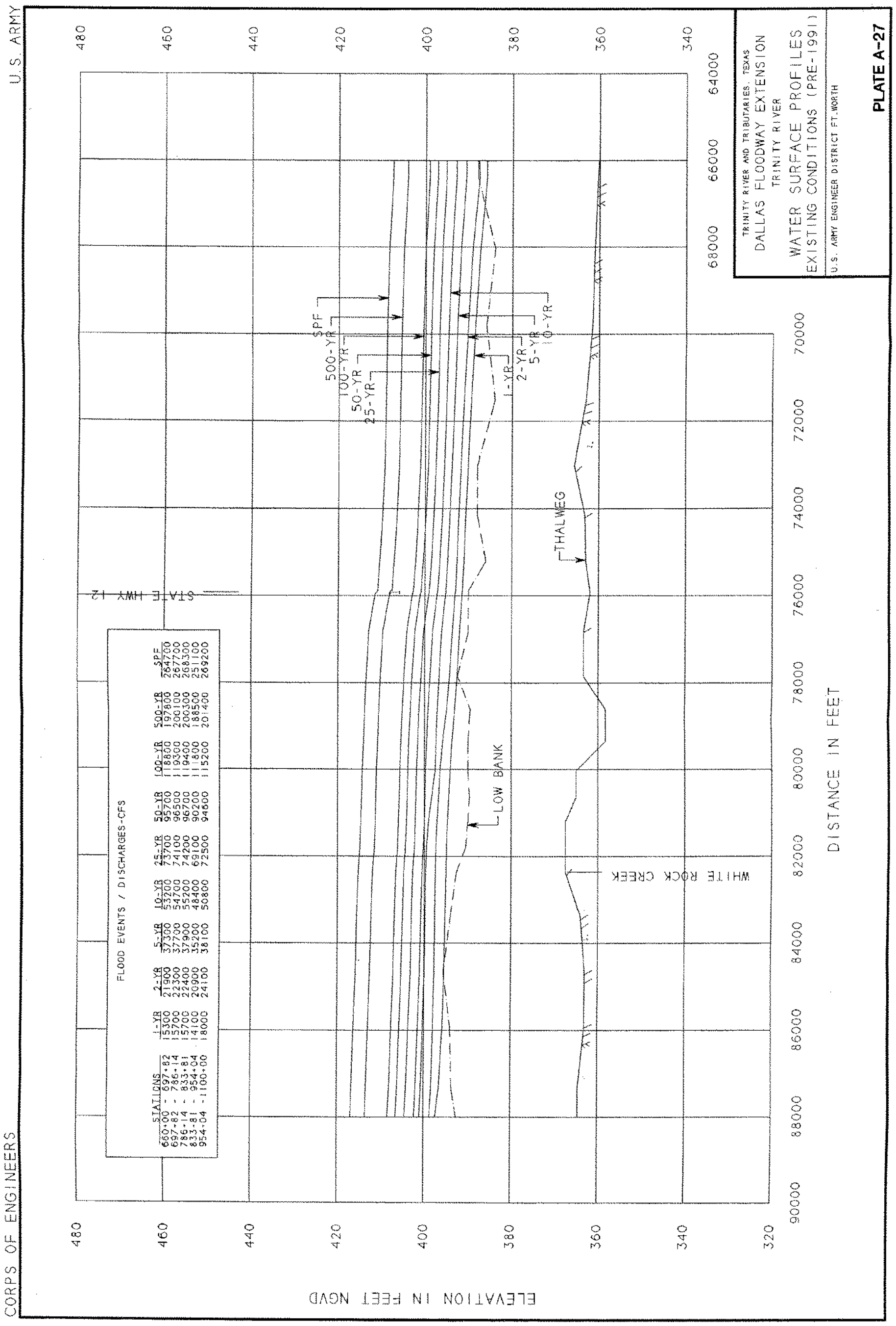


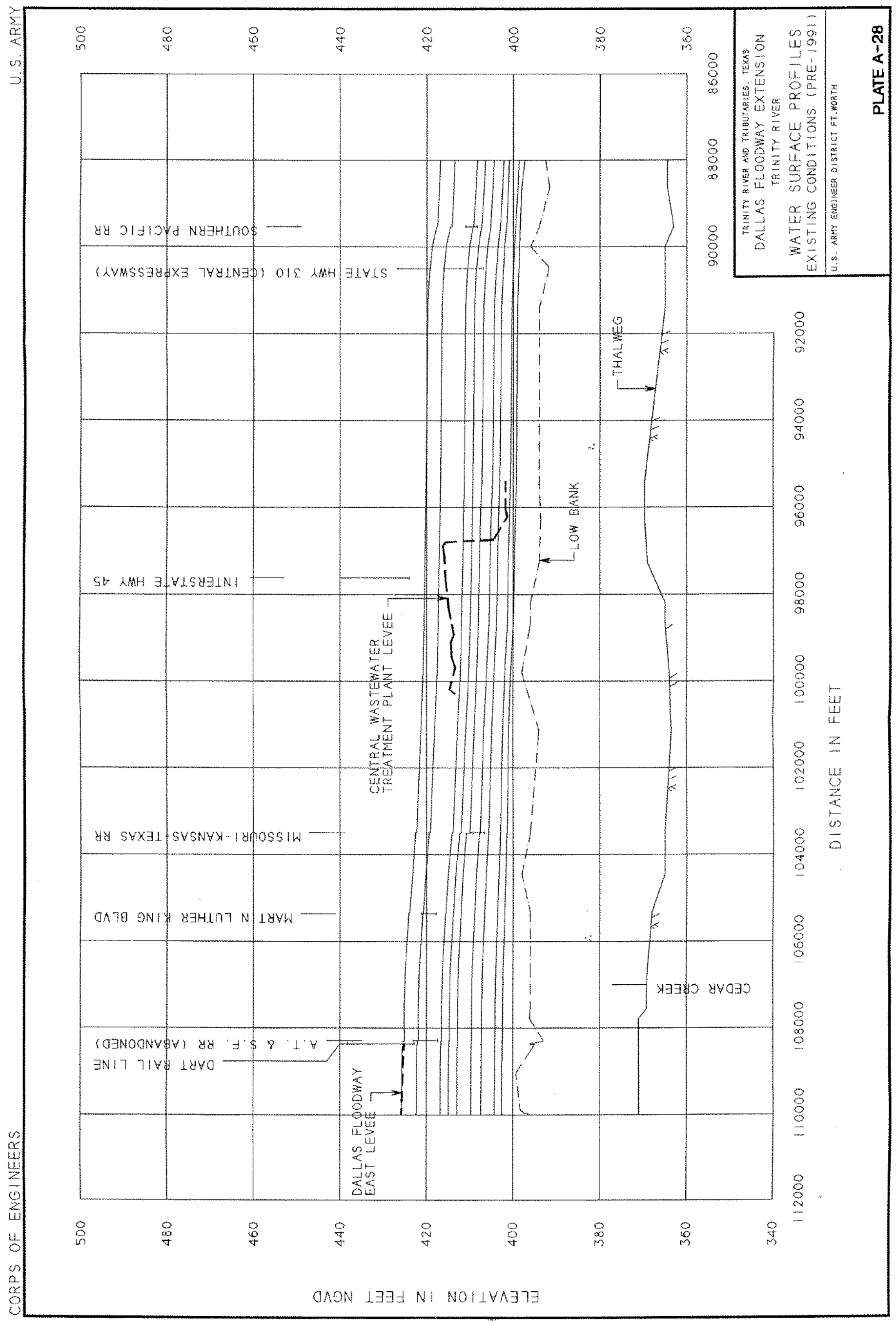
FLOOD EVENTS / DISCHARGES-CFS

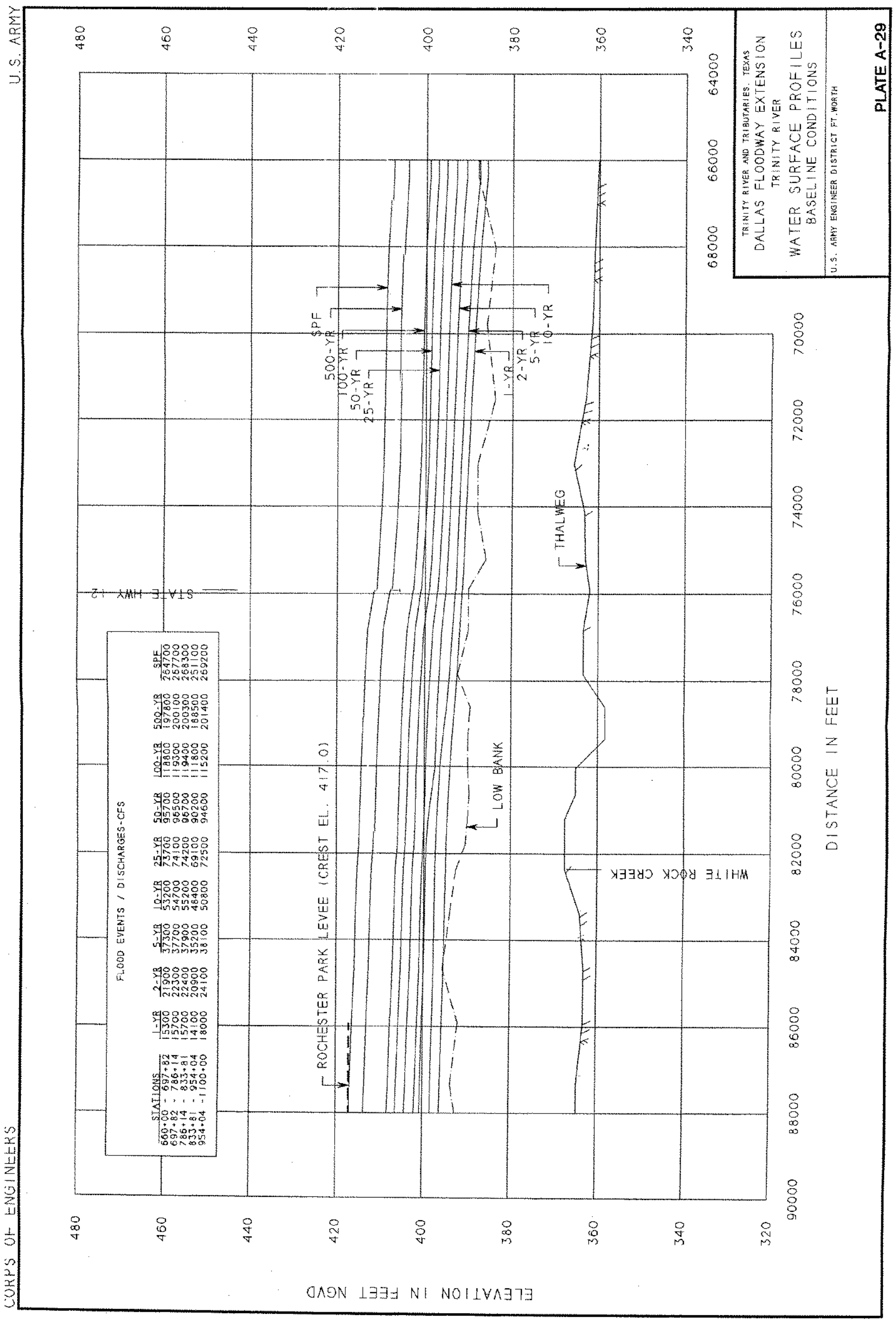
STATIONS	2-YR	5-YR	10-YR	25-YR	1990 FLOOD	50-YR	100-YR	500-YR	SPF
660+00 - 697+82	21900	37300	53200	73700	86400	95700	118800	197800	264700
697+82 - 786+14	22300	37700	54700	74100	87000	96500	119300	200100	267700
786+14 - 833+81	22400	37900	55200	74200	87200	96700	119400	200300	268300
833+81 - 954+04	20900	35200	48400	69100	81300	90200	111800	188500	251100
954+04 - 1100+00	24100	38100	50800	72500	85200	94600	115200	201400	269200

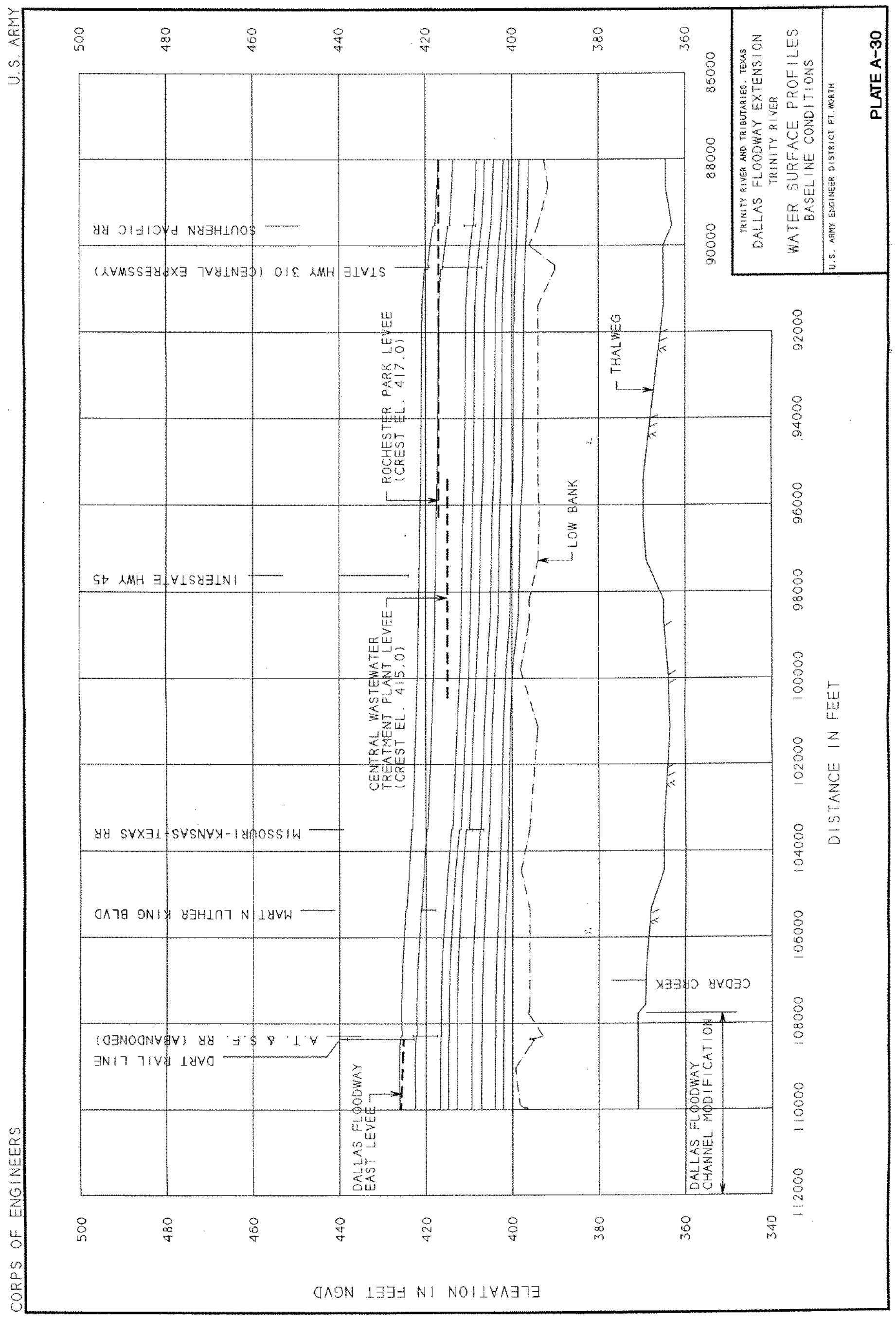


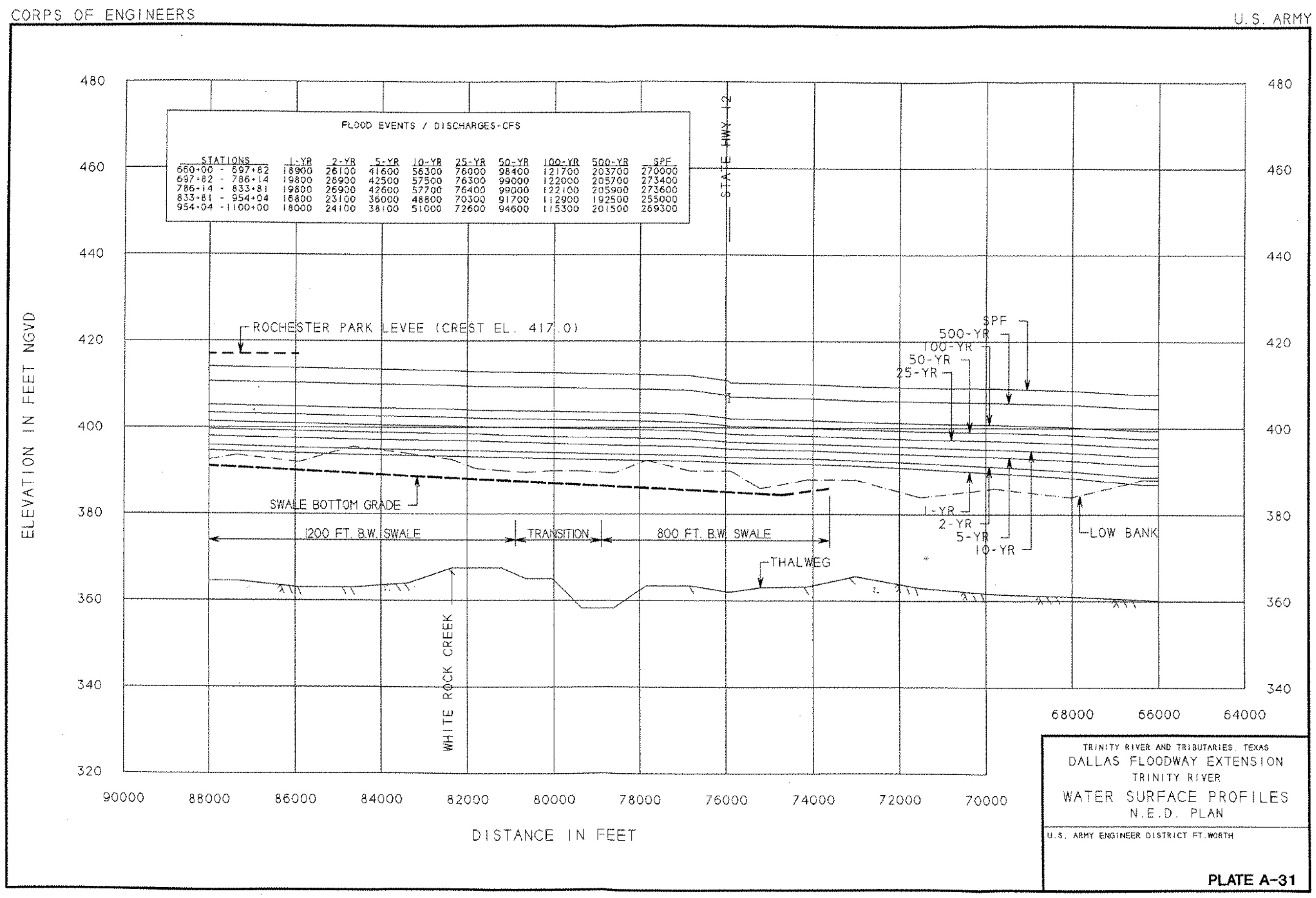
U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
CALIBRATION MODEL
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-26
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
ROCHESTER PARK LEVEE (CREST EL. 417.0)
THALWEG
HIGH WATERMARK 1990 FLOOD
LOW BANK
INTERSTATE HWY 45
CENTRAL WASTEWATER TREATMENT PLANT LEVEE (CREST EL. 415.0)
MISSOURI-KANSAS-TEXAS RR
MARTIN LUTHER KING BLVD
CEDAR CREEK
A.T. & S.F. RR (ABANDONED)
DALLAS FLOODWAY EAST LEVEE DOWNSTREAM LIMIT
DISTANCE IN FEET
ELEVATION IN FEET NGVD
86000
88000
90000
92000
94000
96000
98000
100000
102000
104000
106000
108000
110000
112000
500
480
460
440
420
400
380
360
340


U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
EXISTING CONDITIONS (PRE-1991)
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-27
FLOOD EVENTS / DISCHARGES-CFS
STATIONS 1-YR 2-YR 5-YR 10-YR 25-YR 50-YR 100-YR 500-YR SPF
660+00 - 697+82 15300 21900 37300 53200 73700 95700 118800 197800 264700
697+82 - 786+14 15700 22300 37700 54700 74100 96500 119300 200100 267700
786+14 - 833+81 15700 22400 37900 55200 74200 96700 119400 200300 268300
833+81 - 954+04 14100 20900 35200 48400 69100 90200 111800 188500 251100
954+04 - 1100+00 18000 24100 38100 50800 72500 94600 115200 201400 269200
STATE HWY 12
SPF
500-YR
100-YR
50-YR
25-YR
1-YR
2-YR
5-YR
10-YR
THALWEG
LOW BANK
WHITE ROCK CREEK
ELEVATION IN FEET NGVD
DISTANCE IN FEET
480
460
440
420
400
380
360
340
320
90000
88000
86000
84000
82000
80000
78000
76000
74000
72000
70000
68000
66000
64000


U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
EXISTING CONDITIONS (PRE-1991)
U.S. ARMY ENGINEER DISTRICT FT.WORTH
PLATE A-28
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
THALWEG
LOW BANK
INTERSTATE HWY 45
CENTRAL WASTEWATER TREATMENT PLANT LEVEE
MISSOURI-KANSAS-TEXAS RR
MARTIN LUTHER KING BLVD
CEDAR CREEK
A.T. & S.F. RR (ABANDONED)
DART RAIL LINE
DALLAS FLOODWAY EAST LEVEE
DISTANCE IN FEET
86000 88000 90000 92000 94000 96000 98000 100000 102000 104000 106000 108000 110000 112000
ELEVATION IN FEET NGVD
340 360 380 400 420 440 460 480 500

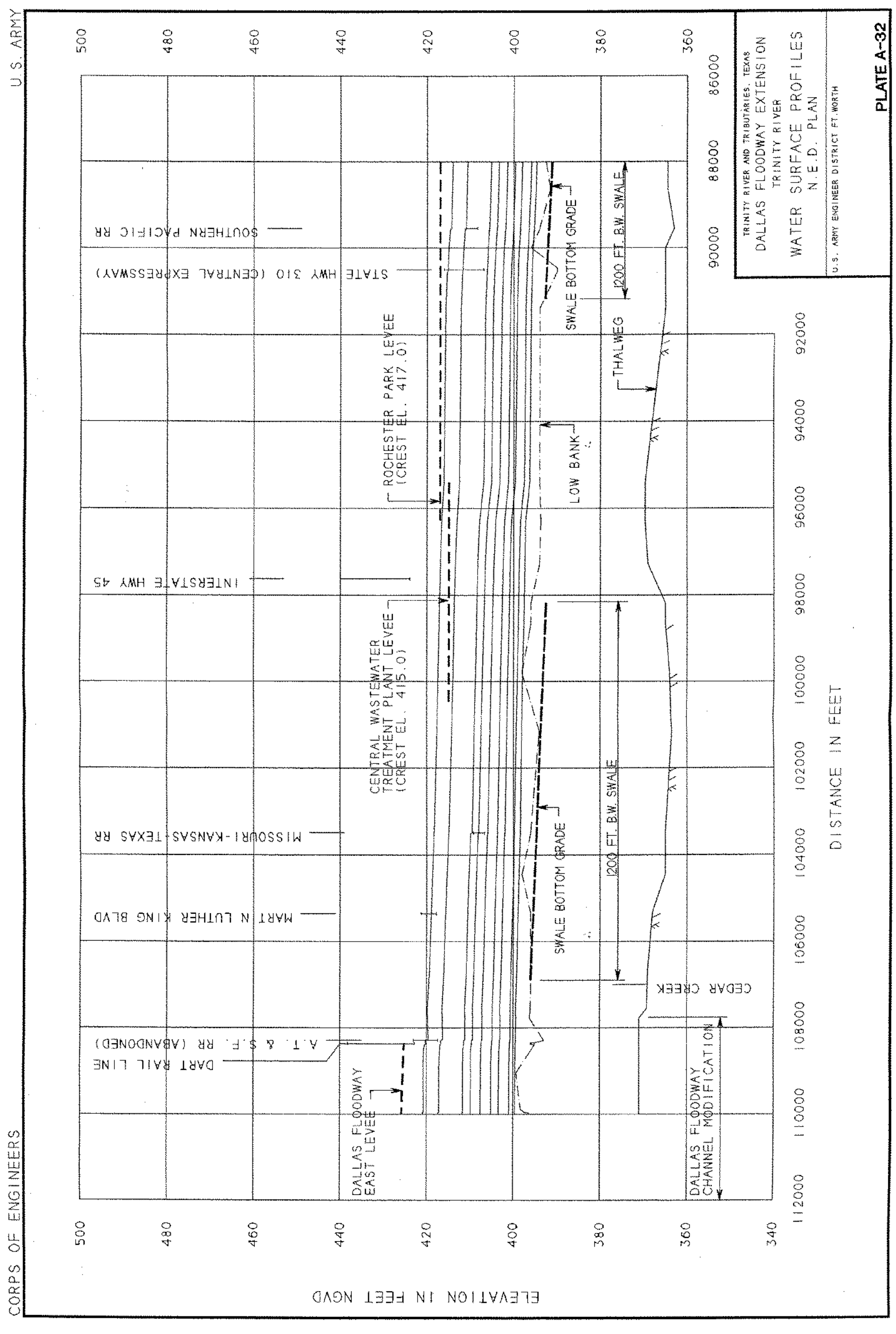

CORPS OF ENGINEERS
U.S. ARMY
FLOOD EVENTS / DISCHARGES-CFS
STATIONS 1-YR 2-YR 5-YR 10-YR 25-YR 50-YR 100-YR 500-YR SPF
660+00 - 697+82 15300 21900 37300 53200 73700 95700 118800 197800 264700
697+82 - 786+14 15700 22300 37700 54700 74100 96500 119300 200100 257700
786+14 - 833+81 15700 22400 37900 55200 74200 96700 119400 200300 268300
833+81 - 954+04 14100 20900 35200 48400 69100 90200 111800 188500 251100
954+04 -1100+00 18000 24100 38100 50800 72500 94600 115200 201400 269200
STATE HWY 12
ROCHESTER PARK LEVEE (CREST EL. 417.0)
SPF
500-YR
100-YR
50-YR
25-YR
LOW BANK
1-YR
2-YR
5-YR
10-YR
THALWEG
WHITE ROCK CREEK
ELEVATION IN FEET NGVD
DISTANCE IN FEET
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
BASELINE CONDITIONS
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-29

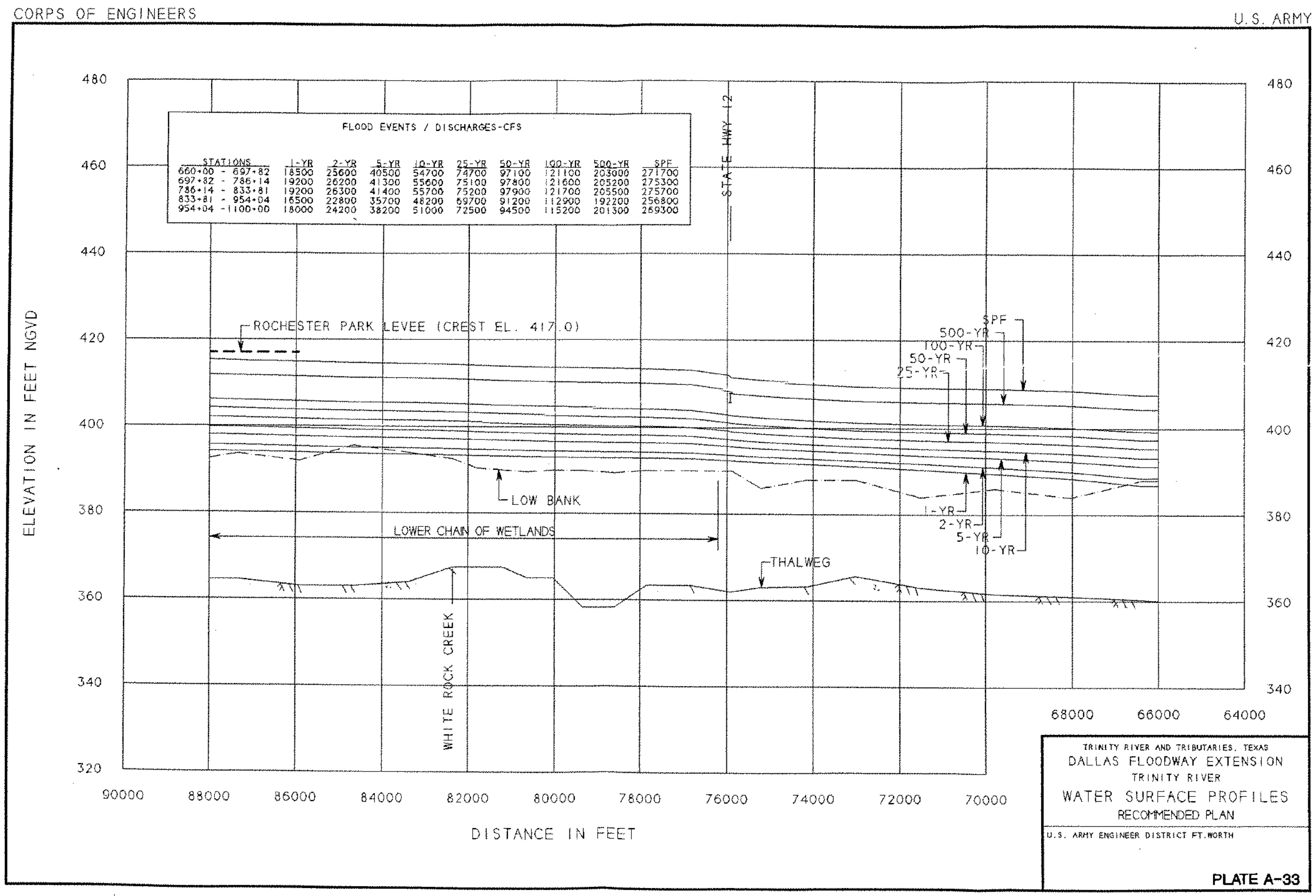

U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
BASELINE CONDITIONS
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-30
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
ROCHESTER PARK LEVEE
(CREST EL. 417.0)
THALWEG
LOW BANK
INTERSTATE HWY 45
CENTRAL WASTEWATER
TREATMENT PLANT LEVEE
(CREST EL. 415.0)
MISSOURI-KANSAS-TEXAS RR
MARTIN LUTHER KING BLVD
CEDAR CREEK
A.T. & S.F. RR (ABANDONED)
DART RAIL LINE
DALLAS FLOODWAY
EAST LEVEE
DALLAS FLOODWAY
CHANNEL MODIFICATION
DISTANCE IN FEET
ELEVATION IN FEET NGVD
86000
88000
90000
92000
94000
96000
98000
100000
102000
104000
106000
108000
110000
112000
500
480
460
440
420
400
380
360
340



FLOOD EVENTS / DISCHARGES-CFS

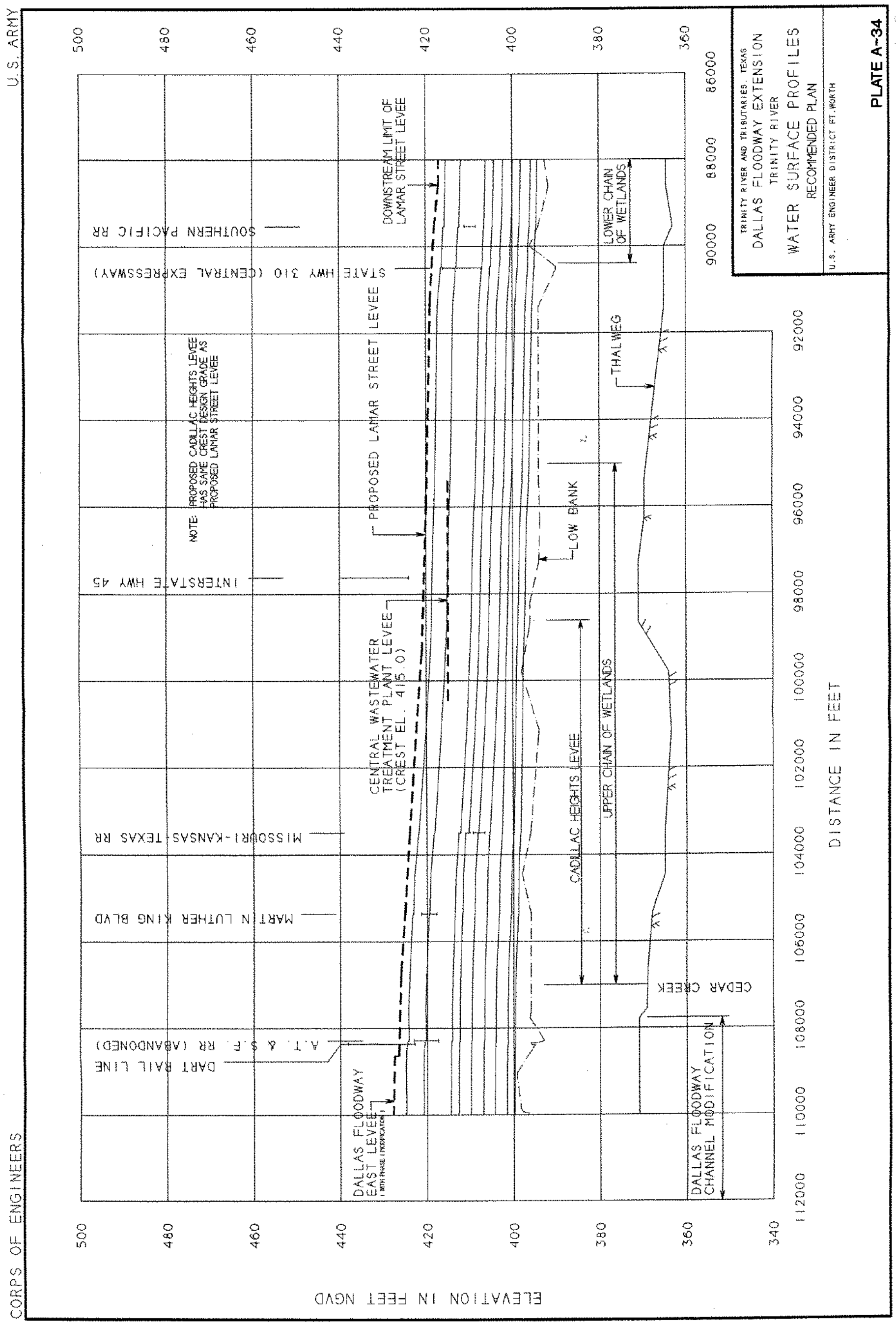
STATIONS	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	SPF
660+00 - 697+82	18900	26100	41600	56300	76000	98400	121700	203700	270000
697+82 - 786+14	19800	26900	42500	57500	76300	99000	122000	205700	273400
786+14 - 833+81	19800	26900	42600	57700	76400	99000	122100	205900	273600
833+81 - 954+04	16800	23100	36000	48800	70300	91700	112900	192500	255000
954+04 - 1100+00	18000	24100	38100	51000	72600	94600	115300	201500	269300


U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
N.E.D. PLAN
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-32
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
ROCHESTER PARK LEVEE (CREST EL. 417.0)
INTERSTATE HWY 45
CENTRAL WASTEWATER TREATMENT PLANT LEVEE (CREST EL. 415.0)
MISSOURI-KANSAS-TEXAS RR
MART N LUTHER KING BLVD
A.T. & S.F. RR (ABANDONED)
DART RAIL LINE
DALLAS FLOODWAY EAST LEVEE
DALLAS FLOODWAY CHANNEL MODIFICATION
CEDAR CREEK
SWALE BOTTOM GRADE
1200 FT. B.W. SWALE
THALWEG
LOW BANK
ELEVATION IN FEET NGVD
DISTANCE IN FEET
500
480
460
440
420
400
380
360
340
86000
88000
90000
92000
94000
96000
98000
100000
102000
104000
106000
108000
110000
112000

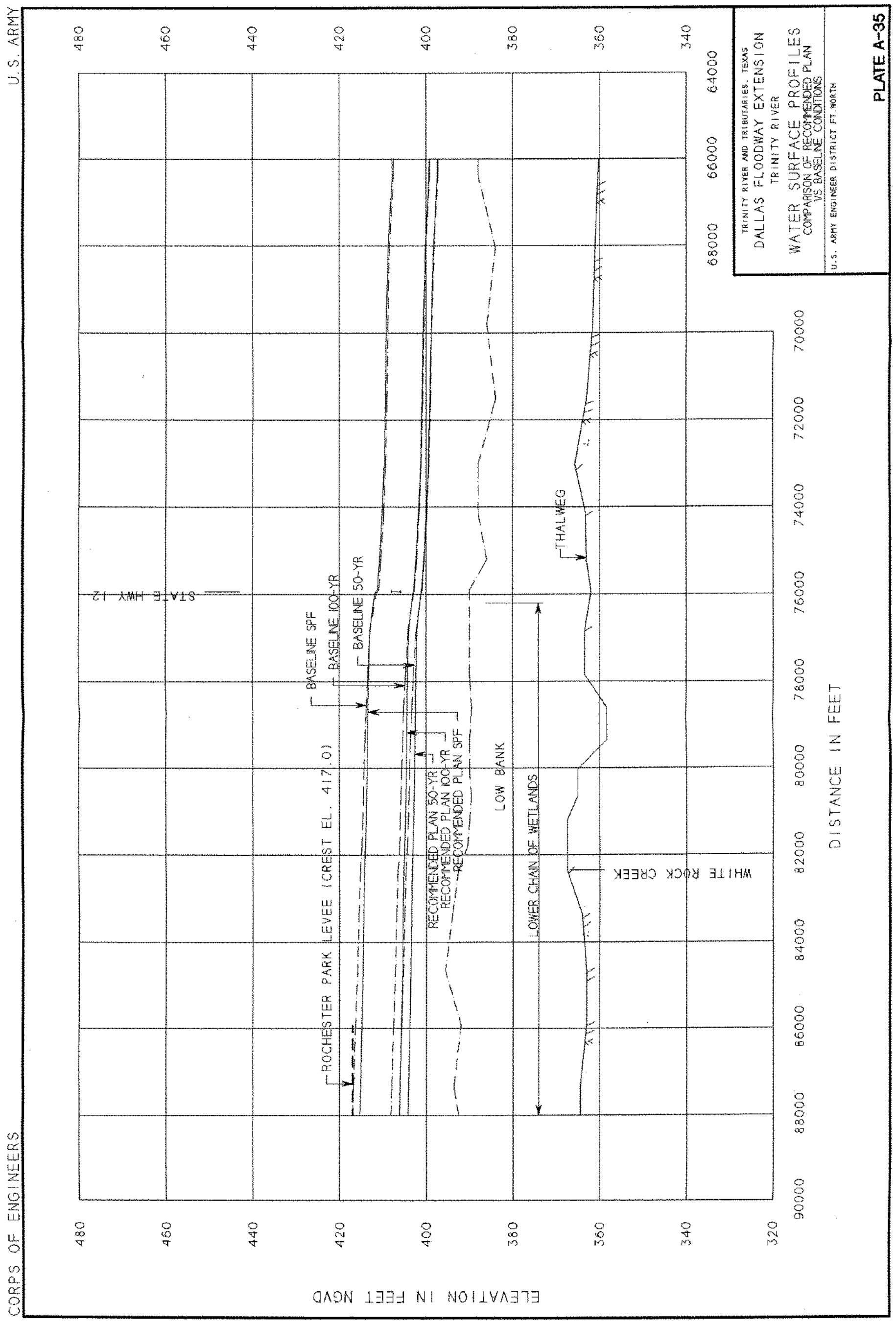


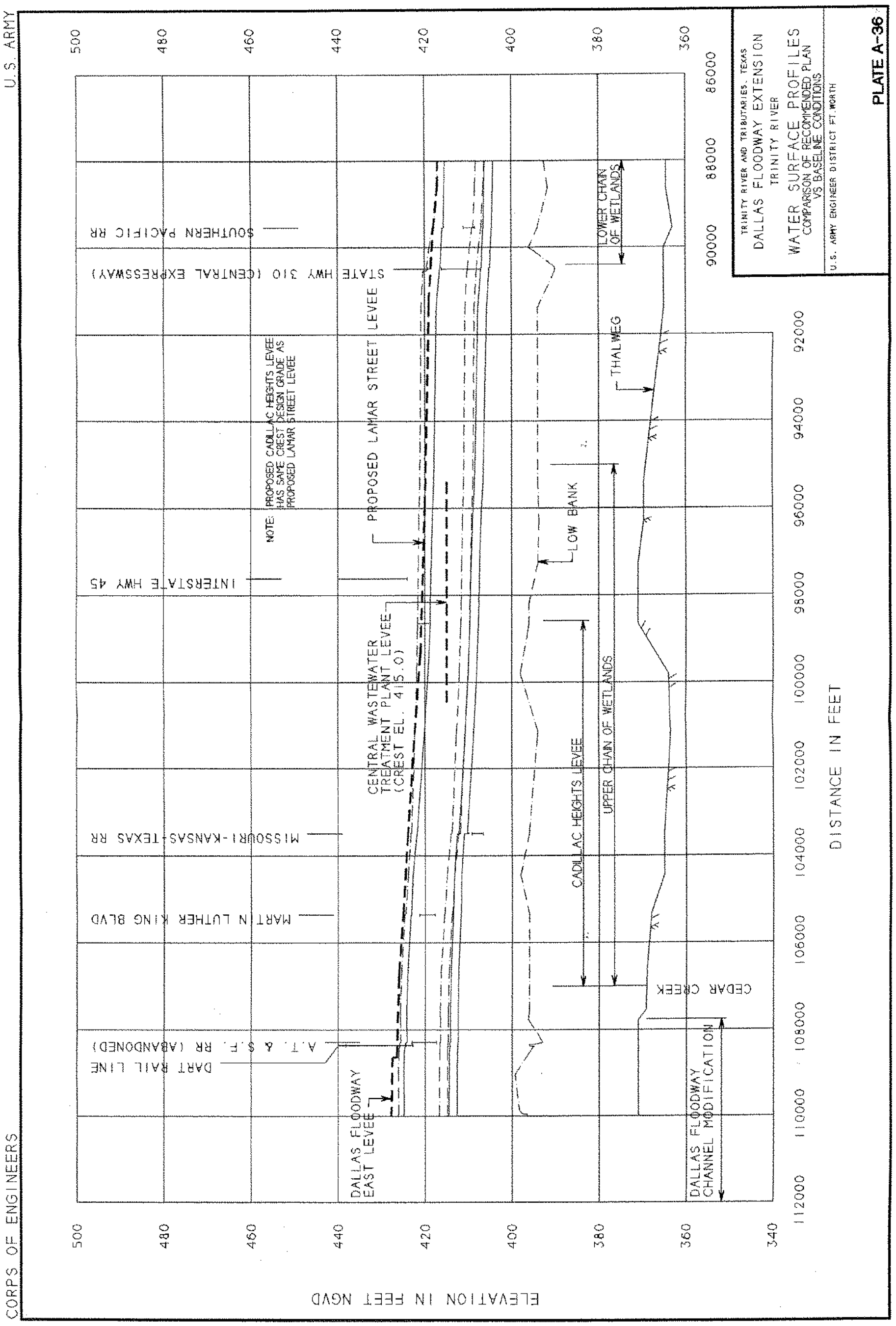
FLOOD EVENTS / DISCHARGES-CFS

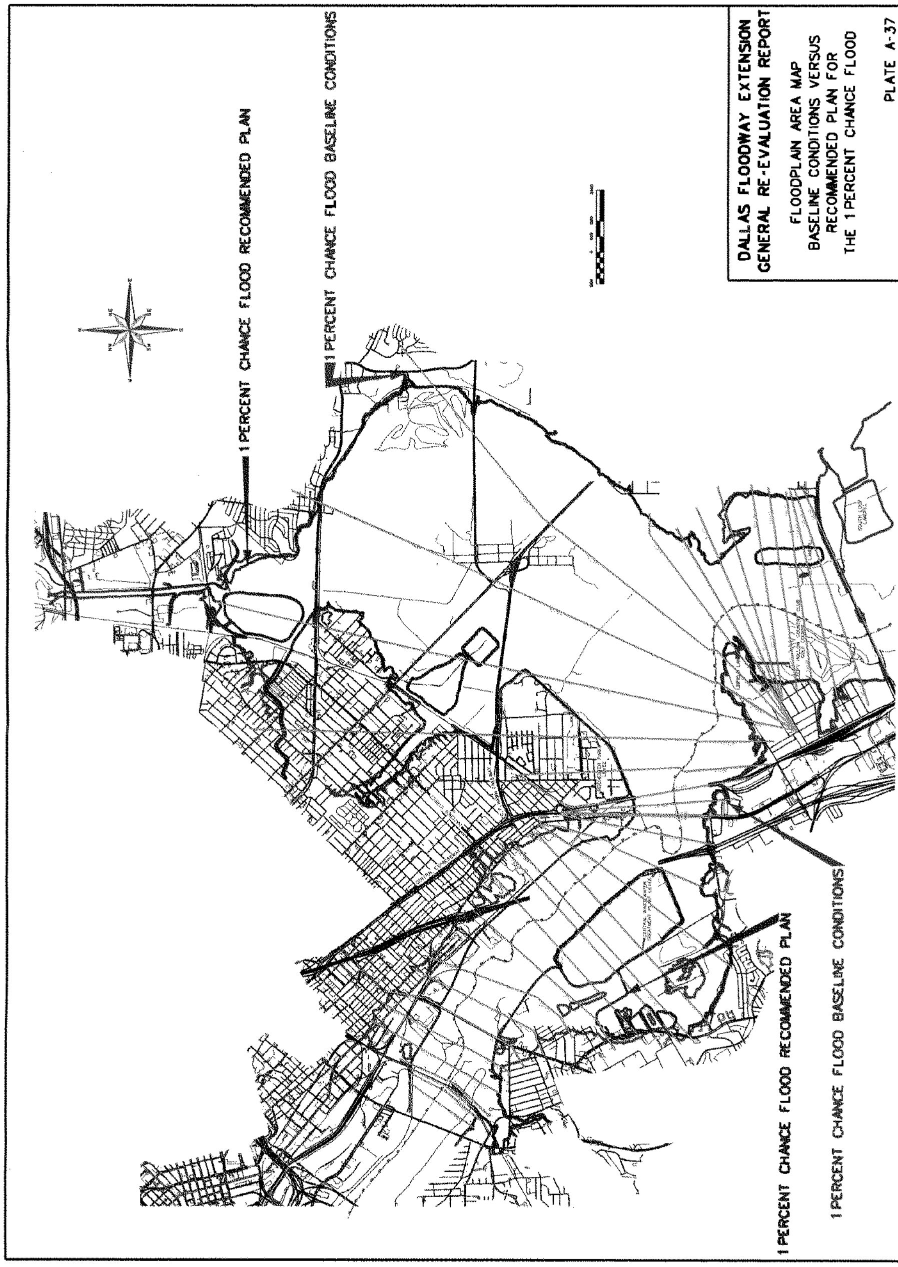
STATIONS	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR	500-YR	SPF
660+00 - 697+82	18500	25600	40500	54700	74700	97100	121100	203000	271700
697+82 - 786+14	19200	26200	41300	55600	75100	97800	121600	205200	275300
786+14 - 833+81	19200	26300	41400	55700	75200	97900	121700	205500	275700
833+81 - 954+04	16500	22800	35700	48200	69700	91200	112900	192200	256800
954+04 -1100+00	18000	24200	38200	51000	72500	94500	115200	201300	269300

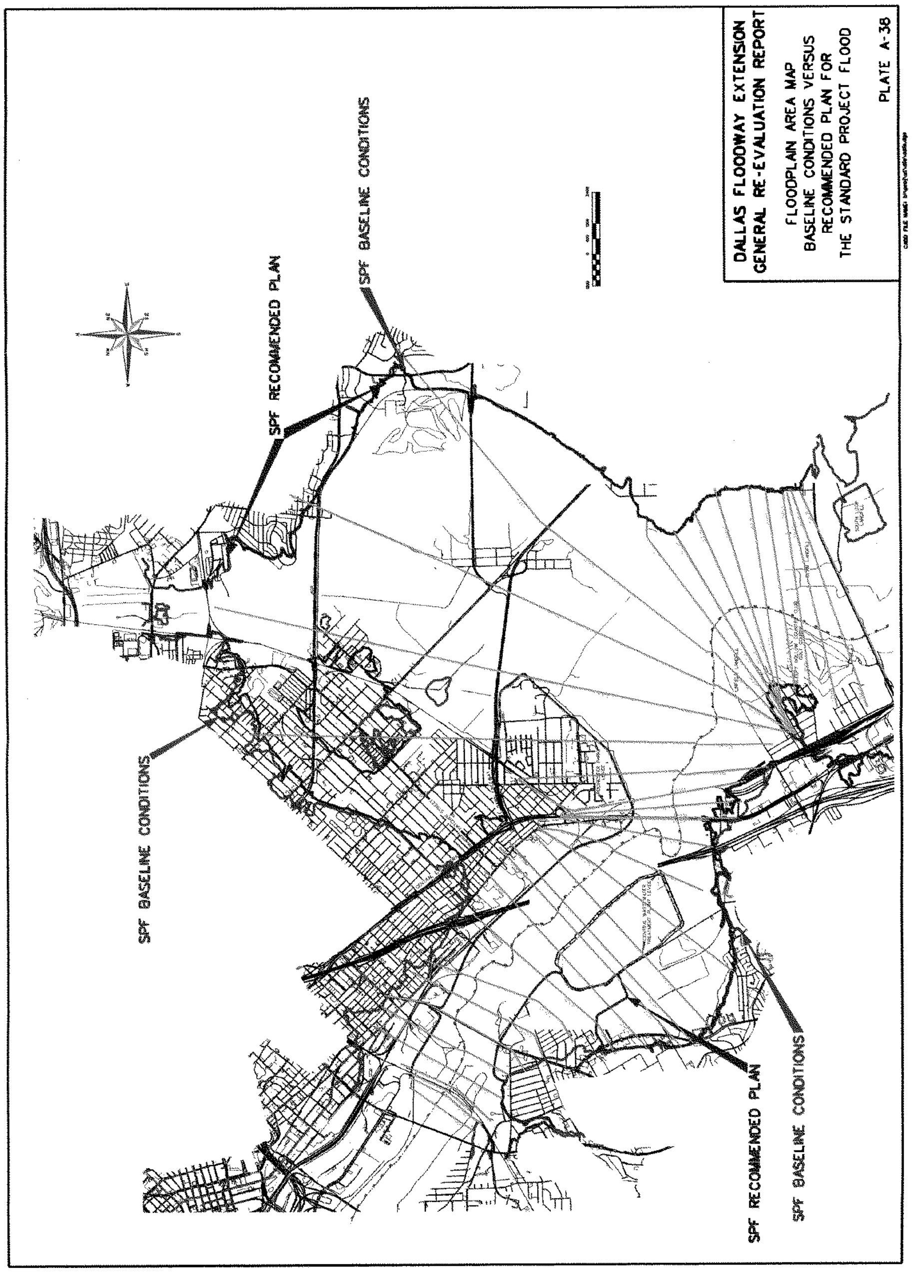


U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
RECOMMENDED PLAN
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-34
ELEVATION IN FEET NGVD
DISTANCE IN FEET
500
480
460
440
420
400
380
360
340
86000
88000
90000
92000
94000
96000
98000
100000
102000
104000
106000
108000
110000
112000
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
INTERSTATE HWY 45
MISSOURI-KANSAS-TEXAS RR
MARTIN LUTHER KING BLVD
A.T. & S.F. RR (ABANDONED)
DART RAIL LINE
DOWNSTREAM LIMIT OF LAMAR STREET LEVEE
PROPOSED LAMAR STREET LEVEE
NOTE: PROPOSED CADILLAC HEIGHTS LEVEE HAS SAME CREST DESIGN GRADE AS PROPOSED LAMAR STREET LEVEE
CENTRAL WASTEWATER TREATMENT PLANT LEVEE (CREST EL. 415.0)
DALLAS FLOODWAY EAST LEVEE
LOWER CHAIN OF WETLANDS
THALWEG
LOW BANK
CADILLAC HEIGHTS LEVEE
UPPER CHAIN OF WETLANDS
CEDAR CREEK
DALLAS FLOODWAY CHANNEL MODIFICATION


U.S. ARMY
CORPS OF ENGINEERS
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
COMPARISON OF RECOMMENDED PLAN VS BASELINE CONDITIONS
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-35
ROCHESTER PARK LEVEE (CREST EL. 417.0)
BASELINE SPF
BASELINE 100-YR
BASELINE 50-YR
RECOMMENDED PLAN 50-YR
RECOMMENDED PLAN 100-YR
RECOMMENDED PLAN SPF
LOW BANK
LOWER CHAIN OF WETLANDS
THALWEG
WHITE ROCK CREEK
STATE HWY 12
ELEVATION IN FEET NGVD
DISTANCE IN FEET


U.S. ARMY
CORPS OF ENGINEERS
SOUTHERN PACIFIC RR
STATE HWY 310 (CENTRAL EXPRESSWAY)
PROPOSED LAMAR STREET LEVEE
NOTE: PROPOSED CADILLAC HEIGHTS LEVEE HAS SAME CREST DESIGN GRADE AS PROPOSED LAMAR STREET LEVEE
INTERSTATE HWY 45
CENTRAL WASTEWATER TREATMENT PLANT LEVEE (CREST EL. 415.0)
MISSOURI-KANSAS-TEXAS RR
MARTIN LUTHER KING BLVD
A.T. & S.F. RR (ABANDONED)
DART RAIL LINE
DALLAS FLOODWAY EAST LEVEE
LOWER CHAIN OF WETLANDS
THALWEG
LOW BANK
UPPER CHAIN OF WETLANDS
CADILLAC HEIGHTS LEVEE
CEDAR CREEK
DALLAS FLOODWAY CHANNEL MODIFICATION
ELEVATION IN FEET NGVD
DISTANCE IN FEET
TRINITY RIVER AND TRIBUTARIES, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER
WATER SURFACE PROFILES
COMPARISON OF RECOMMENDED PLAN VS BASELINE CONDITIONS
U.S. ARMY ENGINEER DISTRICT FT. WORTH
PLATE A-36


1 PERCENT CHANCE FLOOD RECOMMENDED PLAN
1 PERCENT CHANCE FLOOD BASELINE CONDITIONS
DALLAS FLOODWAY EXTENSION
GENERAL RE-EVALUATION REPORT
FLOODPLAIN AREA MAP
BASELINE CONDITIONS VERSUS
RECOMMENDED PLAN FOR
THE 1 PERCENT CHANCE FLOOD
PLATE A-37


DALLAS FLOODWAY EXTENSION
GENERAL RE-EVALUATION REPORT
FLOODPLAIN AREA MAP
BASELINE CONDITIONS VERSUS
RECOMMENDED PLAN FOR
THE STANDARD PROJECT FLOOD
PLATE A-38
SPF RECOMMENDED PLAN
SPF BASELINE CONDITIONS
SPF BASELINE CONDITIONS
SPF RECOMMENDED PLAN
SPF BASELINE CONDITIONS

APPENDIX B

GEOTECHNICAL ENGINEERING

APPENDIX B

GEOTECHNICAL ENGINEERING

GENERAL

The proposed flood control plans include elements to enhance the channel conveyance (overflow swales) and levee elements. The overflow swales are referred to as the Chain of Wetlands, and the levee elements include the Lamar Street Levee and the Cadillac Heights Levee.

The Chain of Wetlands consists of an upper and lower swale separated at the IH-45 bridge. The upper swale alignment would have an approximate 400-foot average bottom width and would extend from the Cedar Creek confluence downstream to the oxbow at IH-45, a distance of approximately 1.5 miles. The upper swale would be aligned as far west of the Trinity River as possible to avoid adverse impacts to woodlands. The lower swale would have a 600-foot average bottom width between IH-45 and Loop 12, a distance of approximately 2.2 miles, and would be aligned through the Linfield Landfill and Sleepy Hollow Golf Course at the lower end.

The east, or Lamar Street, levee extension would connect the downstream end of the existing Dallas Floodway East Levee, at the east abutment of the old AT&SF RR bridge, with the existing Rochester Park Levee, at the east abutment of the Southern Pacific RR bridge. This levee extension would have an approximate average height of 20 feet and would be about 3 miles long. This extension would not require raising any portion of the existing Floodway East Levee. Approximately 1,000 feet of the Rochester Park Levee would be raised by an amount less than one foot. About 4,500 feet of the existing Rochester Park levee would be made unnecessary by the Lamar Street levee. Although the alignment of this levee extension would be adjacent to several commercial businesses, the majority of these businesses would not require relocation. The Proctor and Gamble storage facility and some smaller commercial structures at the downstream end of the Lamar Levee extension, near State Highway 310, would, however, require relocation.

The west, or Cadillac Heights, levee would begin upstream near Cedar Creek and extend downstream to the existing Central Wastewater Treatment Plant (CWWTP) Levee, would utilize a portion of the existing CWWTP Levee along the northwest corner at the plant entrance and then extend from the west side of the CWWTP Levee to high ground near the intersection of Kiest Boulevard and McGowan Avenue. The average height of this levee would be about 15 feet and the length from the Cedar Creek end to the downstream end near Kiest and McGowan would be approximately 2.3 miles. Construction of this levee may affect a number of commercial structures. Plate C-01, Sequence No. 2, presents a project location map.

GEOLOGIC DESCRIPTION

The area encompassed by the proposed Dallas Floodway Extension is underlain by limestone, marl (defined as halfway between limestone and shale), and shale representing the Austin Chalk Formation of Cretaceous age. More specifically, the project area is underlain by the Middle unit of the Austin Formation. The Middle unit is composed mainly of thinly bedded, laminated marl and shale, often indurated. The Austin Chalk Formation is, in turn, overlain by a thick mantle of alluvial water-bearing sediments which have been deposited by the Trinity River. The soft limestone and calcareous shales of the Austin Chalk outcrop can be found immediately beneath the overburden, beyond the floodplain on either side of the river. Seismic risk is insignificant at the project site.

The alluvial sediments encountered consisted variably of silty and sandy clays. Occasionally, significant lenses of water-bearing sands or gravelly sands were penetrated by exploratory borings. Extremely wet material with high humus content, was encountered near the surface in some areas.

SUBSURFACE INVESTIGATIONS

Subsurface investigations for the Dallas Floodway Extension consisted of a total of 138 borings, 115 completed in 1982, and 23 completed in 1997. The borings completed in 1997 are as follows: 400-410, 412-418, 427, 429, 430, 432 and 437. All other borings shown on the drawings were advanced in 1982. The 1982 borings were along the plan alignments investigated for the 1982 General Design Memorandum, consisting of levees along both sides of the Trinity River channel, as well as channelization of the Trinity River, Five Mile Creek and White Rock Creek. The total number of borings advanced in 1982 was actually greater than 115, but many of the borings were in areas outside the scope of the current plan (1998 General Reevaluation Report). In order to fully maximize drilling resources, subsurface data gained from the borings advanced in 1982 was used extensively in the current design. Additional subsurface investigations should be conducted in order to sample and test soils where information is needed to design a specific structural feature.

A boring location plan is presented on plates B-1 through B-3. The borings provided undisturbed samples from core barrels, Denison barrels, and Shelby tubes. Jar samples and bag samples were obtained from auger cuttings.

SUBSURFACE CONDITIONS

Subsurface soil profiles are presented on plates B-4 through B-14. The profile for the Lamar Levee is on plates B-4 through B-9, and the profile for the Cadillac Heights Levee is on plates B-10 and B-11. The profile for the downstream swale is on plates B-12 and B-13, and the profile for the upstream swale is on plates B-14 and B-15. The profile for the slurry trench is on plate B-16. Please note that many of the boring logs used to construct these profiles are offset from the centerline of the feature. Subsurface conditions encountered consist of the following:

Overburden

The overburden soils along the project alignment consist of undisturbed and disturbed alluvial and residual soils. The project site extends through highly developed urban lands which have undergone reshaping of terrain and quarrying of sands and gravels on a commercial scale. The overburden thickness as encountered in the borings varied considerably. It was less than ten feet thick in some places and more than twenty feet thick in others. Overburden thickness in the floodplain areas was generally in excess of twenty-five feet. For this project, these soils are segregated into three distinct soils groups:

Floodplain. This group is located within the distinct floodplain of the Trinity River and consists of clay of moderate to high plasticity. In general, disturbance of soils within this group has been minimal. Most of the features of the plan are located within the floodplain, and thus will encounter clays and sandy clays characteristic of floodplain deposits. Laboratory testing of these soils confirmed some extremely plastic soils, as shown by high liquid limits (99 in Boring 64), and high plasticity indices (59, also in Boring 64). Soil classifications consisted of CL, CH, SC, SM, with the occasional GC encountered.

Terrace. This group is located out of the floodplain, and forms the naturally occurring gentle bluff found on both sides of the Trinity River. This bluff is more prominent on the north side than the south side, where there isn't a well-defined boundary. The soils are predominantly clayey sands with occasional gravels. Some reshaping and disturbance has occurred. The only portion of the project located near the terrace is the extreme southern end of the Cadillac Heights levee. This is to be expected, as terrace deposits are by definition the higher boundaries of the floodplain, and form the high ground that the project levees tie into. Laboratory testing of these soils revealed CL, CH, SC, SM and GC soils present. The proportion of coarse-grained soils encountered was higher than encountered in the floodplain. Plasticity of the clays ranged from low to high.

Urban. This group is located out of the floodplain along the south side of the Trinity River, and consists of man-made fills. The soils are intermixed clays, sandy clays, clayey sands, sands, and gravels, and, in the case of the Linfield Landfill, man-made construction debris and garbage such as tires, sheet metal, concrete blocks, ceramic tiles and steel I-beams. No laboratory testing was done on samples taken from the landfill.

Primary

Primary strata consist of weathered and unweathered limestone and shale.

GROUNDWATER

The water table was encountered in numerous borings with considerable variance in depth. Because of this variance, the subsurface profile should be viewed for the respective groundwater levels at each area. Alluvial deposits, as encountered during the borings and as described in the preceding paragraphs, located below the water table will necessitate shoring during excavation operations. Dewatering will be required during construction of the proposed project components. The excavations for the construction of some of the stoplog structures may encounter ground water and may require a dewatering system for construction in the dry. Care of water should also address control of storm runoff.

EXCAVATION EFFORT

The weathered shale and limestone will present no significant excavating problems. Furthermore, the overburden materials are of sufficient thickness over most of the project area that the primary will not be encountered during excavation. Standard excavation equipment should prove adequate for this project. More rigorous excavation equipment (e.g. heavy rippers) should not be needed.

LABORATORY TESTING

Conventional geotechnical testing of selected samples was conducted by the Southwestern Division Laboratory (CESWD) in Dallas, Texas and by the Materials Testing Center at Waterways Experiment Station. Tests for identification included tests for moisture content, grain size analyses, and Atterberg limits. Strength tests included triaxial (Q) tests, direct shear (S) tests, and unconfined compression tests. Testing results, as available in time for publication, are presented on the plates.

LEVEE MATERIAL

Material for construction of the levee embankments will come from required excavation of the overflow swales and, to a lesser extent, from required excavation of the stoplog structures and from the sumps. Subsurface explorations have encountered clays and sandy clays, which are suitable for levee construction. Some materials may require "drying back" prior to compaction. It is estimated that the volume of excavated material will exceed the levee fill requirements by approximately 600,000 cubic yards.

LEVEES

Embankments

The recommended levee section is presented on Plate C-03, Seq No. 4. The crest width of the levees will be 20 feet, and the side slopes of the levee embankments are recommended to be 1V:4H. This side slope configuration is required in order to prevent skin failures common on steeper embankments in the area. On the existing Dallas Floodway, surface failures on the 1V:3H side slopes are quite common, with approximately six occurring per year. The levees surrounding the Central Wastewater Treatment Plant (CWWTP) were originally constructed with slopes ranging from 1V:2.5H to 1V:3.3H. Numerous surface failures of the levees (approximately two per year), prompted the CWWTP to regrade their levee slopes to a 1V:4H slope during 1993-1994. The material used to regrade the CWWTP slopes was excavated from a nearby wetland mitigation area, and consisted mainly of CH soils, but also included CL soils. Since this regrading, there have been no slides on these levees. Preliminary stability analyses, using the Corps' UTEXAS3 program, showed a factor of safety against skin slides less than unity for a 1V:3H side slope, but indicated an adequate factor of safety for a 1V:4H side slope. More detailed slope-stability analyses will be conducted during the detailed design of this project. The UTEXAS 3 analysis used the following data:

Shear Strength	c = 0, phi = 18 deg
Unit weight	Moist: 105 pcf, sat'd: 114 pcf
Type of case analyzed	Steady seepage, no floodwater loading
Type of failure	non-circular
Procedure used	Spencer's

The maximum height of the Lamar Street levee will be 31 feet (at station 67+00), but will generally be less than 20 feet along the remainder of the levee alignment. The maximum height of the Cadillac Heights levee will be less than 26 feet, with an average height of less than 15 feet.

The levee embankments will be constructed of suitable clays (CL and CH) and suitable clayey sands (SC) from the required excavation. The embankment fill should be compacted to a minimum relative compaction of 95 percent standard Proctor density (ASTM 698) at, or slightly above, optimum moisture content.

Underseepage

It is recommended that an inspection trench be excavated along the levee alignments. The purpose of the trench is to disclose undetected utilities or other foundation problems and to reduce potential seepage problems. The inspection trench should be excavated to a depth of 5 feet, with a bottom width of 10 feet. Side slopes on the inspection trench will be 1V:1H. Underseepage is not foreseen to be a problem, due to the generally impervious nature of the alluvial riverbed sediments. However, in order to lengthen the seepage path, the inspection trench will be backfilled with impervious fill material. Alluvial riverbed sediments typically are lensatic in nature; that is, pockets of sandy, permeable material that would readily convey seepage are discontinuous, and can grade both horizontally and vertically into impermeable clay or clayey sand over short distances. Therefore, problem seepage areas are not expected to occur over large, continuous areas.

GEOTECHNICAL PARAMETERS FOR STRUCTURES

The geotechnical parameters for design of structures are as follow:

Floodplain (Clay as CL and CH)

MKT Railroad (Lamar Street Levee)
Martin Luther King, Jr. Boulevard

Above Normal Water Table

Unit weight, moist: 118 pcf (MC = 23%)
Unit weight, dry: 94 pcf

Allowable bearing capacity = 2500 psf

Shear strength (S): c = 0, phi = 18°
Sliding on concrete: c = 0, phi = 12°

At rest, k_o = 0.5
Active, k_a = 0.5
Passive, k_p = 2.0

Below Normal Water Table

Unit weight, moist: 105 pcf, MC = 20%
Unit weight, dry: 88 pcf
Unit weight, saturated: 114 pcf, MC = 30%

Shear strength (S): c = 0, phi = 18°
Sliding on concrete: c = 0, phi = 12°

At rest, k_o = 0.8
Active, k_a = 0.8
Passive, k_p = 2.0

Terrace (Clayey Sand as SC)

Southern Pacific Railroad
Central Expressway

Unit weight, moist: 128 pcf, MC = 13%
Unit weight, dry: 113 pcf
Unit weight, saturated: 135 pcf, MC = 18%

Allowable bearing capacity = 2500 psf

Shear strength (S): c = 0, phi = 28°
Sliding on concrete: c = 0, phi = 19°

At rest, k_o = 0.4
Active, k_a = 0.5
Passive, k_p = 2.6

Urban (Clayey Sand and Sandy Clay as SC and CL-CH)

Sargent Road (Cadillac Heights)

Unit weight, moist: 122 pcf, MC = 18%
Unit weight, dry: 108 pcf
Unit weight, saturated: 130 pcf, MC = 20%

Allowable bearing capacity = 2000 psf

Shear strength (S): c = 0, phi = 25°
Sliding on concrete: c = 0, phi = 17°

At rest, k_o = 0.4
Active, k_a = 0.5
Passive, k_p = 2.4

SLURRY TRENCH

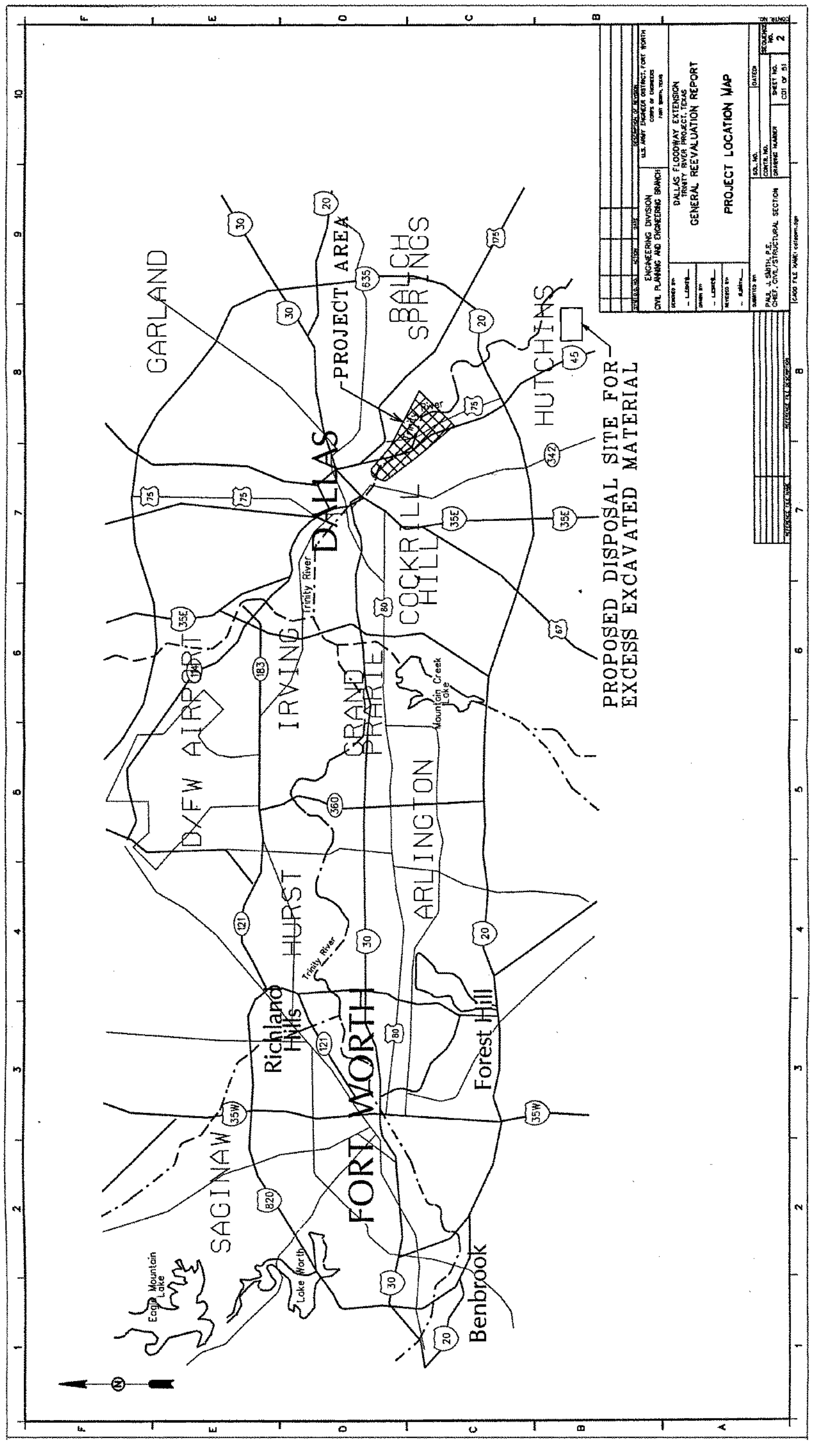
The slurry trench should be constructed between the Linfield Landfill and the downstream swale in order to prevent water migration and thus possible contamination of flood waters. Additionally, the slurry trench will aid in the dewatering of the excavation and construction of the swale in the dry. The slurry trench will be constructed roughly in an L-shape in plan, and will be approximately twenty-five feet deep and two feet wide (minimum). The base of the slurry trench will be excavated into undisturbed clays, or primary strata (shale or limestone). See Plate C-03, Seq. No. 4 for a typical cross section. The fill material for the trench will be a cement-bentonite mixture, with a bentonite-water slurry used to hold the trench open during construction. Table B-1 presents a breakdown of estimated quantities for the slurry trench.

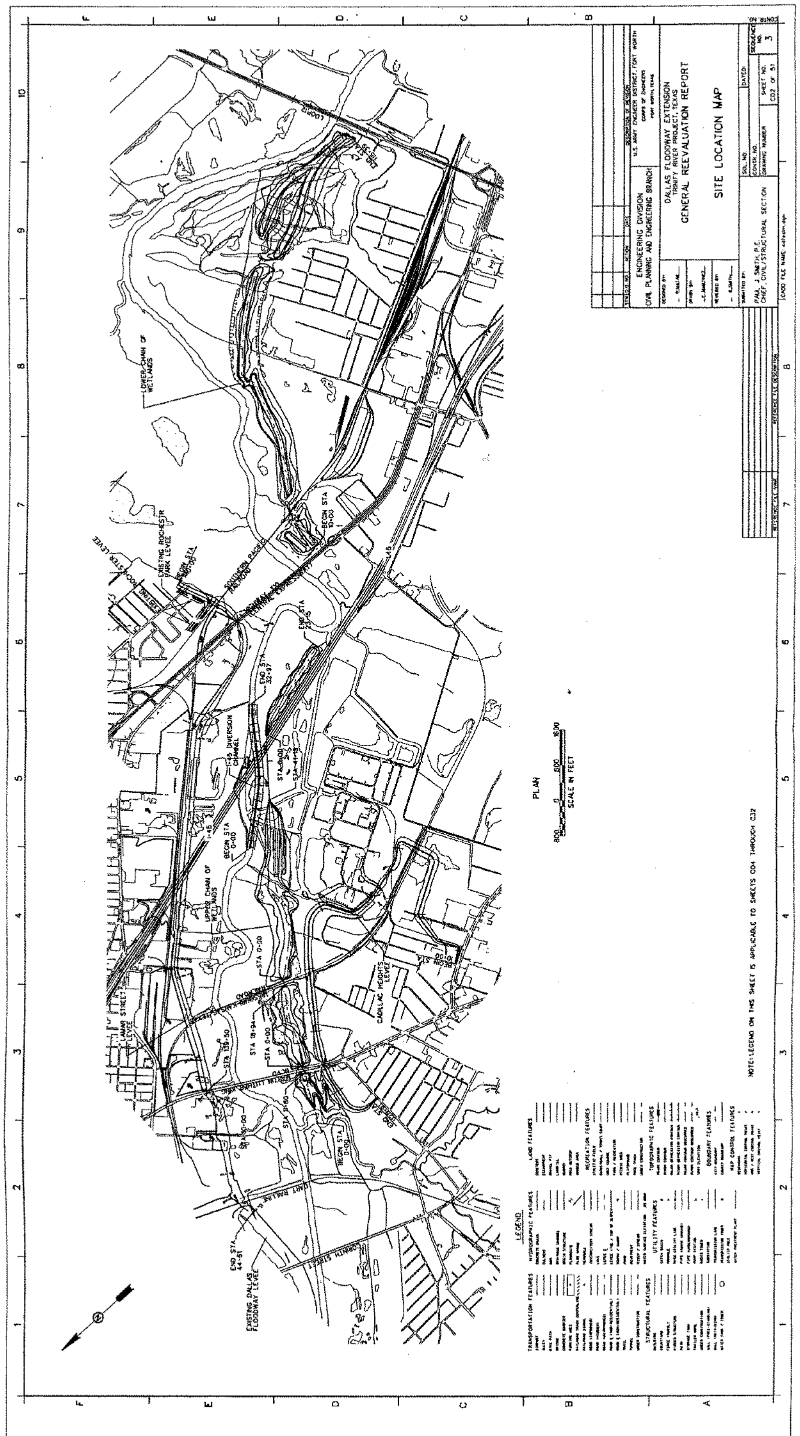
Table B-1
Slurry Trench Quantities

Item	Quantity
Excavation (Class I Non-Hazardous Material)	5,674 cubic yards
Slurry: Bentonite (10% by weight)	996 tons
Backfill: Cement* (6% by weight)	552 tons
Backfill: Soil **	5,334 cubic yards

** Portland cement to be used, in compliance with requirements of ASTM C150.*
*** Typical gradation requirements are as follows:*

Sieve Size	*% Passing, by weight*
3"	*100*
1-1/2"	*95-100*
3/4"	*80-100*
No. 4	*55-100*
No. 10	*40-80*
No. 40	*18-45*
No. 200	*10-25*


GARLAND
PROJECT AREA
BALCH SPRINGS
HUTCHINS
DALLAS
COCKRELL HILL
PROPOSED DISPOSAL SITE FOR EXCESS EXCAVATED MATERIAL
D/FW AIRPORT
IRVING
GRAND PRAIRIE
ARLINGTON
HURST
Richland Hills
FORT WORTH
Forest Hill
SAGINAW
Benbrook
Trinity River
Mountain Creek Lake
Eagle Mountain Lake
Lake Worth
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PROJECT LOCATION MAP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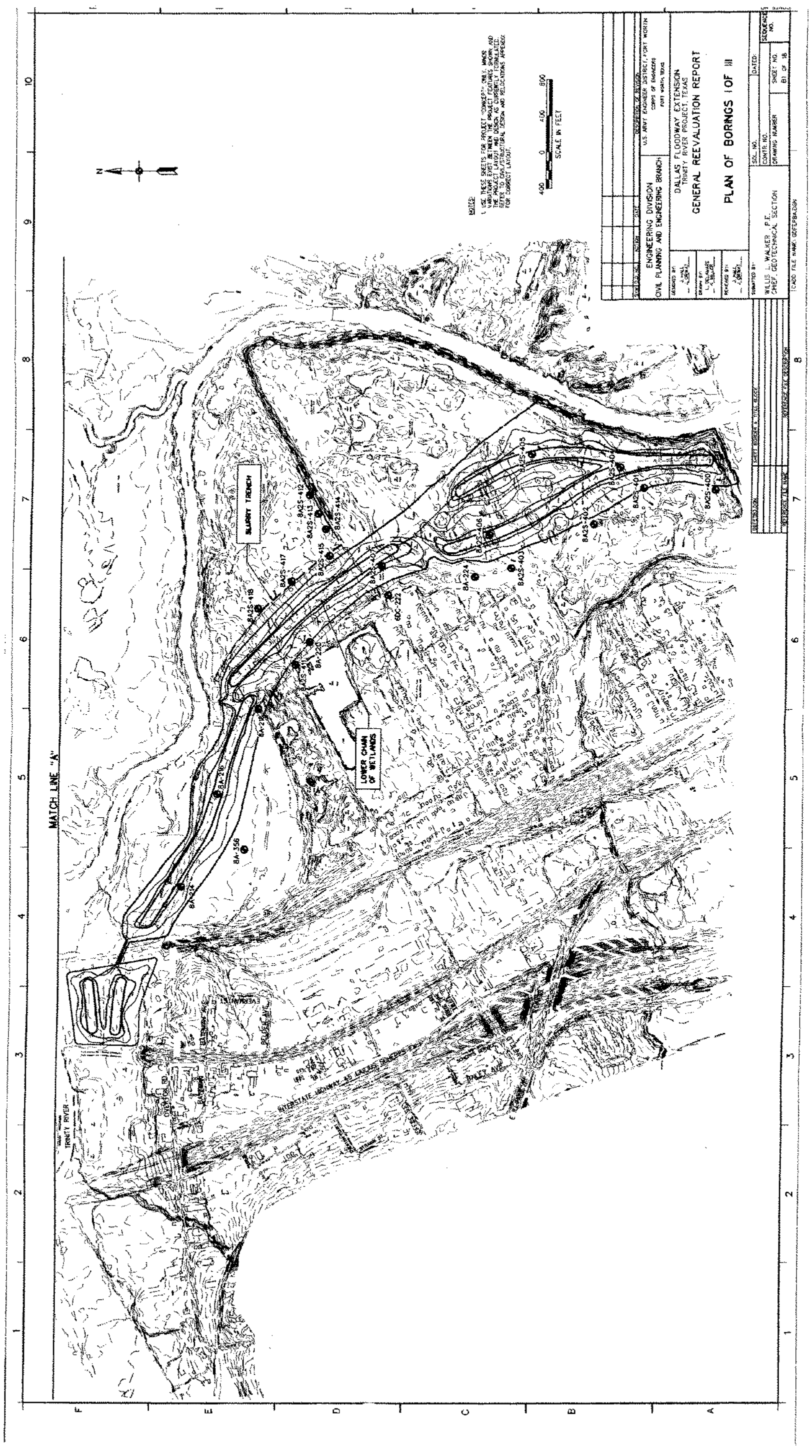
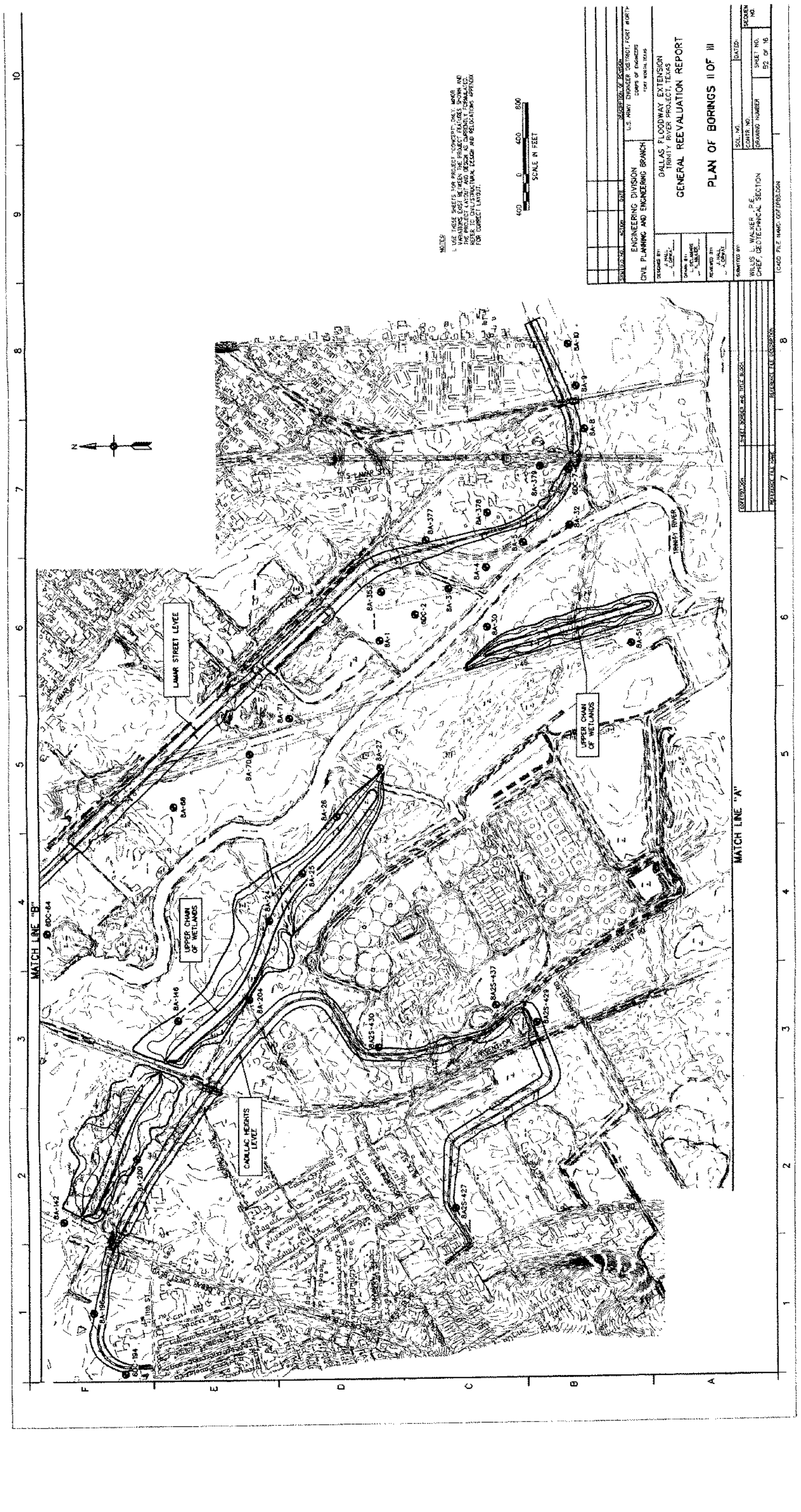
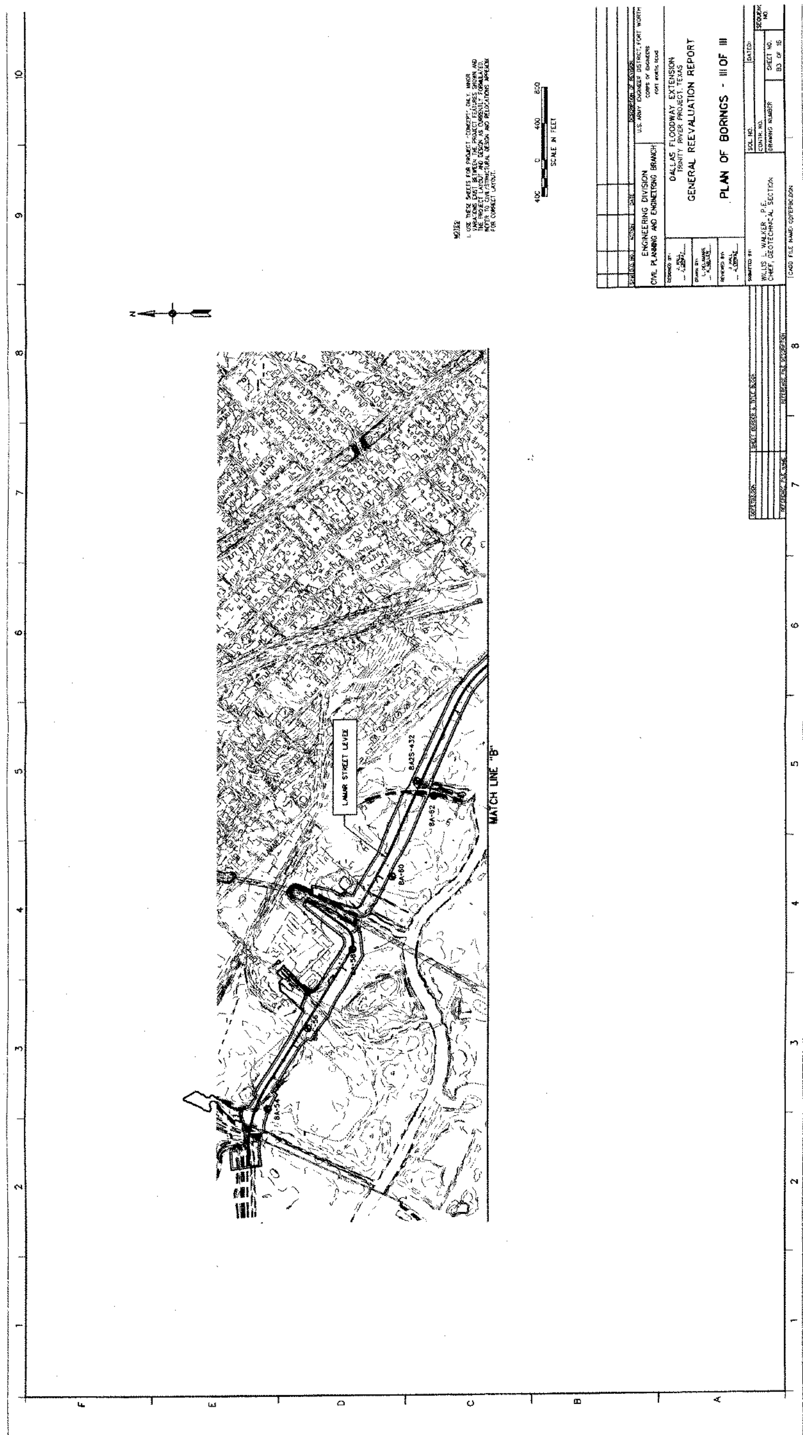
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
SITE LOCATION MAP
PLAN
SCALE IN FEET
LEGEND
NOTE: LEGEND ON THIS SHEET IS APPLICABLE TO SHEETS C04 THROUGH C32


MATCH LINE "A"
SLURRY TRENCH
LOWER CHAIN OF WETLANDS
SCALE IN FEET
ENGINEERING DIVISION
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT


MATCH LINE "B"
MATCH LINE "A"
LAMAR STREET LEVEE
CADILLAC HEIGHTS LEVEE
UPPER CHAIN OF WETLANDS
ENGINEERING DIVISION
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT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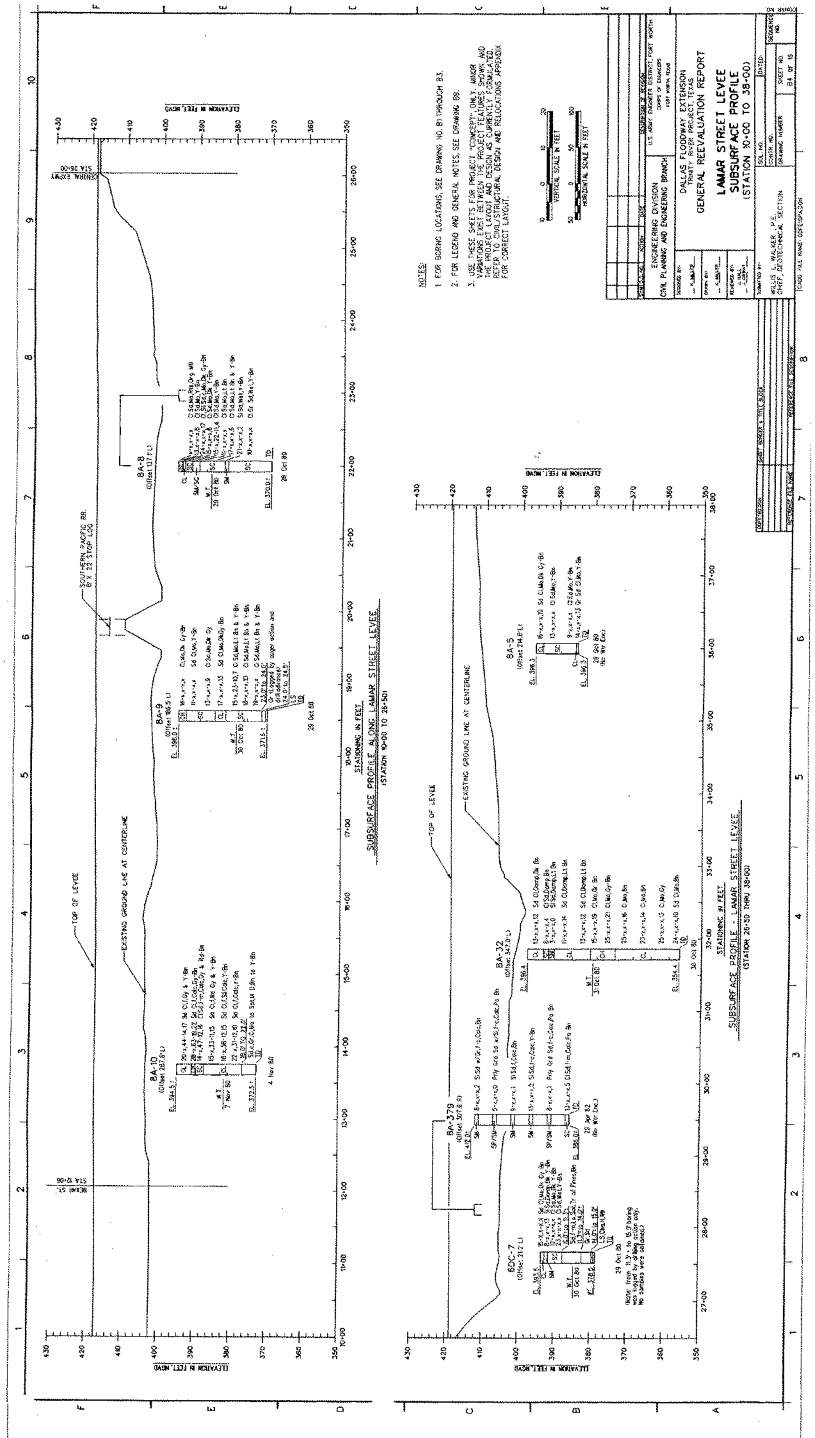
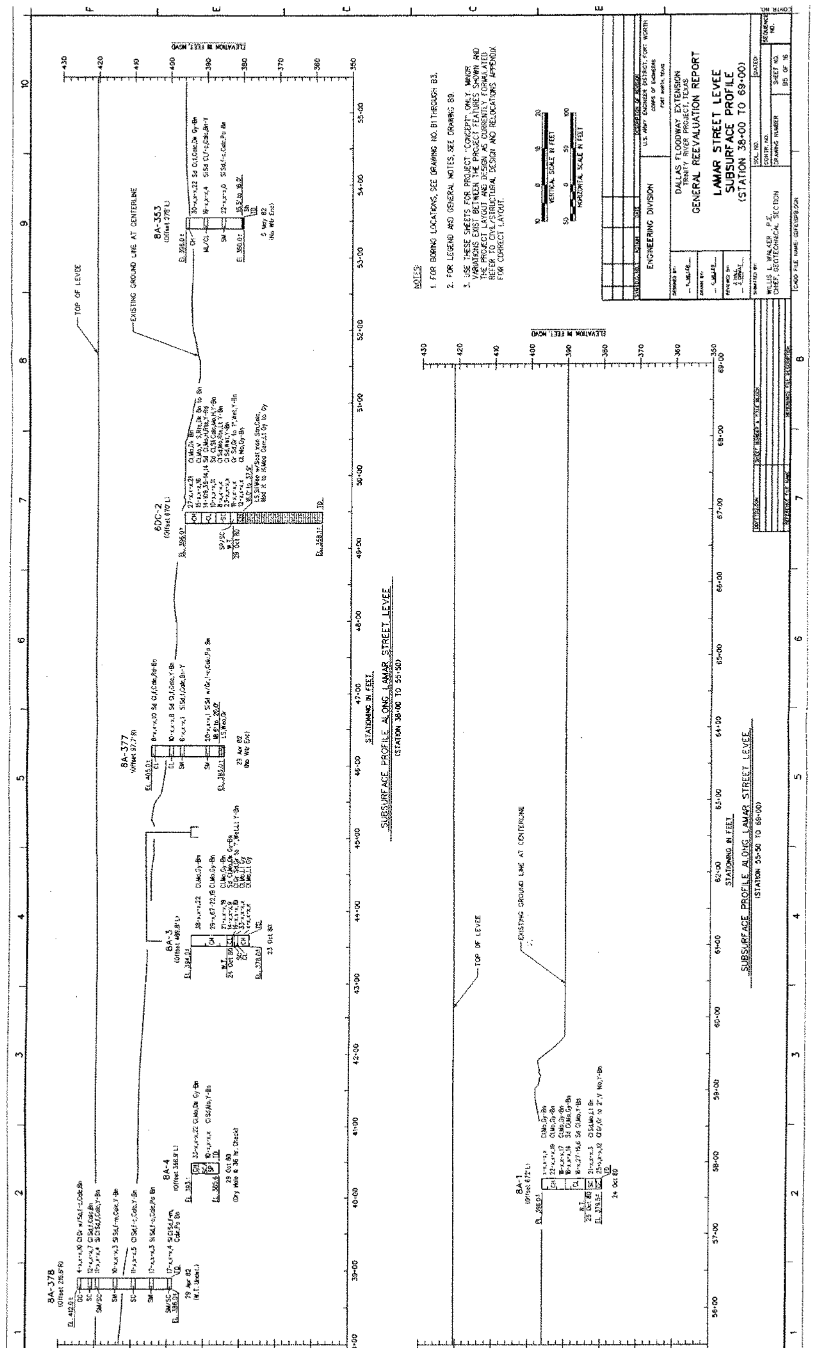
CORPS OF ENGINEERS
FORT WORTH TEXAS
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PLAN OF BORINGS - III OF III
WILLIS L. WALKER, P.E.
CHIEF, GEOTECHNICAL SECTION
SHEET NO.
93 OF 16
LAMAR STREET LEVEE
MATCH LINE "B"
SCALE IN FEET


DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 10+00 TO 38+00)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
SUBSURFACE PROFILE - LAMAR STREET LEVEE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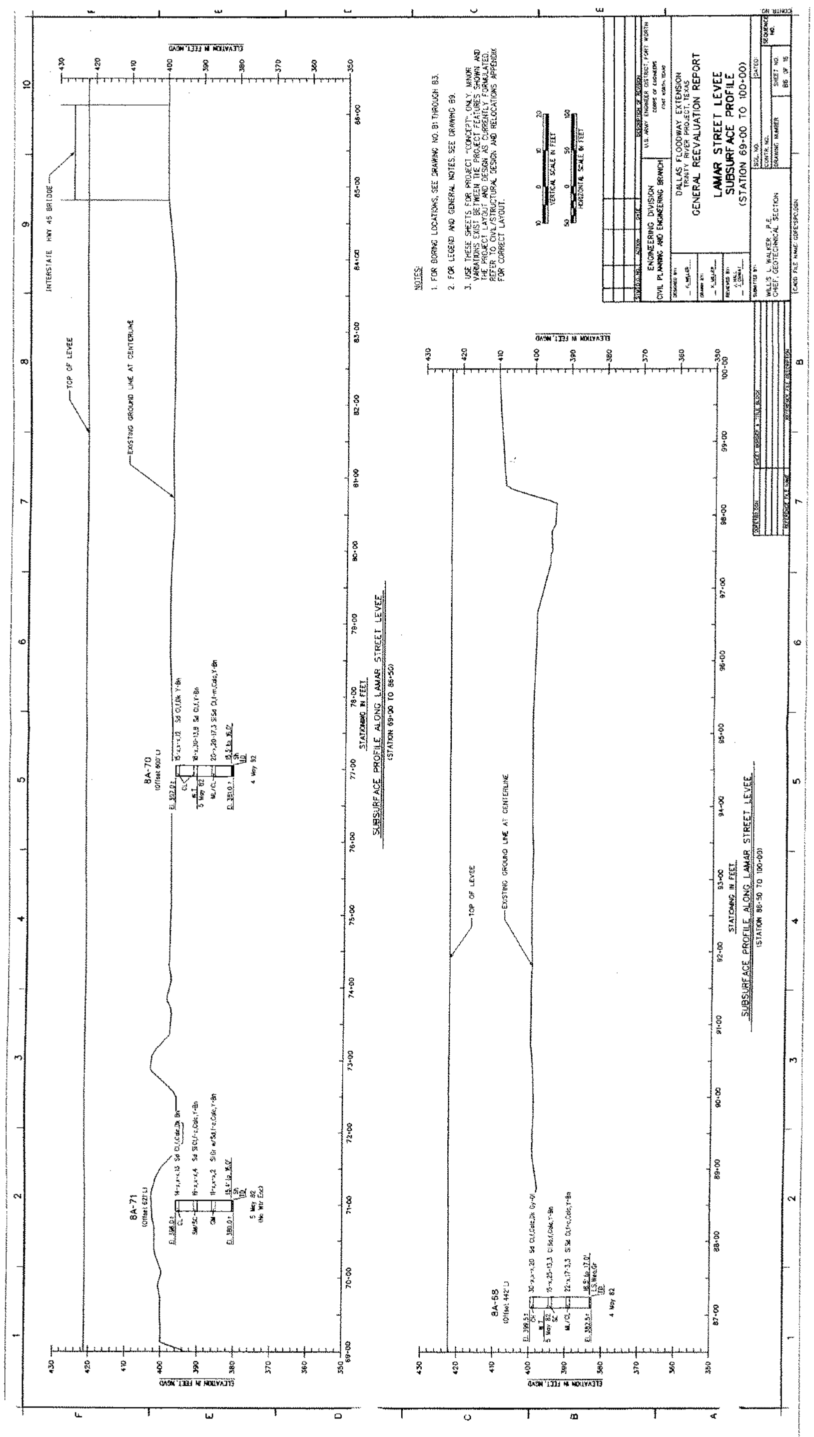
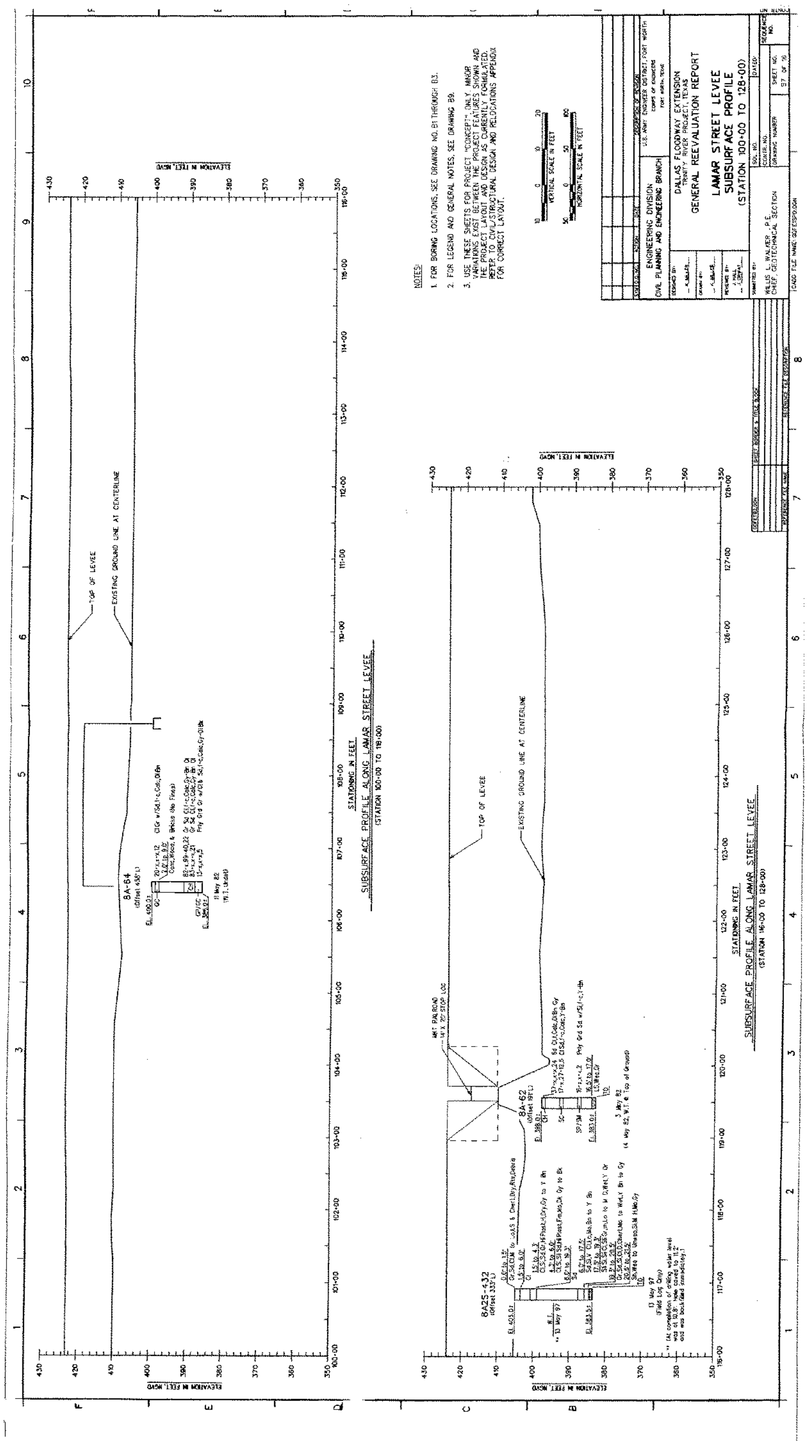
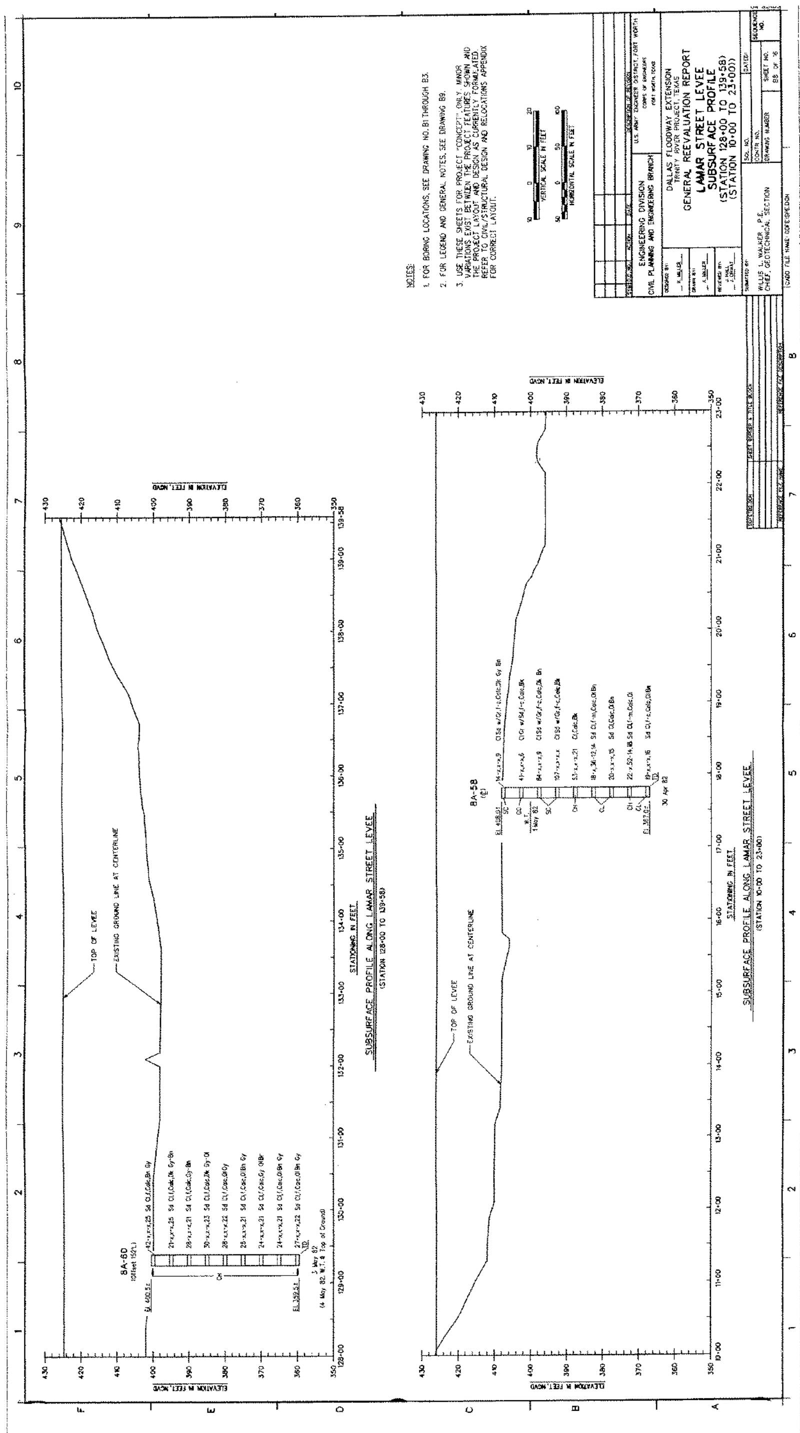
(STATION 38+00 TO 55+50)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 55+50 TO 69+00)
STATIONING IN FEET
ELEVATION IN FEET, NGVD
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
NOTES:
ENGINEERING DIVISION
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 38+00 TO 69+00)

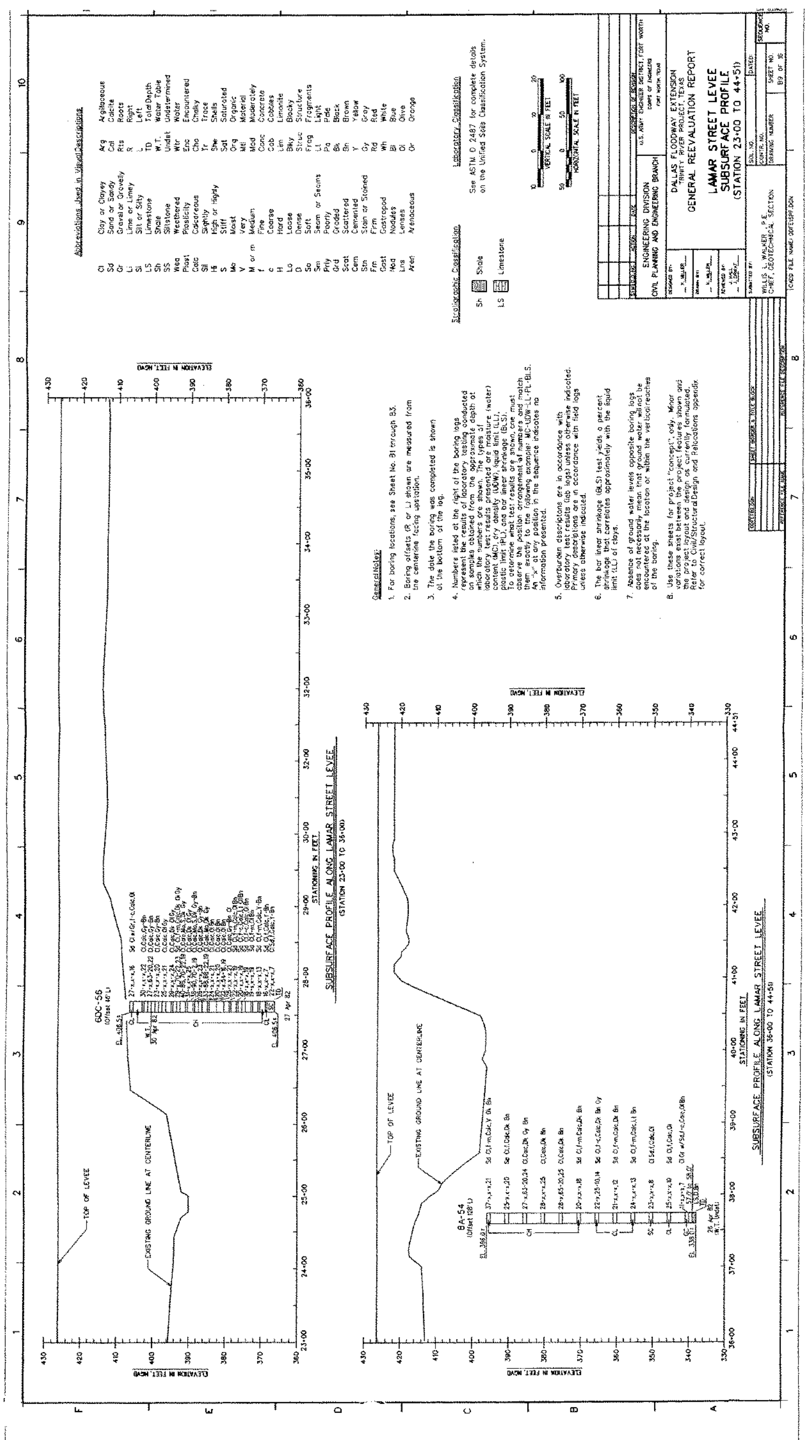


NOTES:
1. FOR BORING LOCATIONS, SEE DRAWING NO. B1 THROUGH B3.
2. FOR LEGEND AND GENERAL NOTES, SEE DRAWING B9.
3. USE THESE SHEETS FOR PROJECT "CONCEPT" ONLY. MINOR VARIATIONS EXIST BETWEEN THE PROJECT FEATURES SHOWN AND THE PROJECT LAYOUT AND DESIGN AS CURRENTLY FORMULATED. REFER TO CIVIL/STRUCTURAL DESIGN AND RELOCATIONS APPENDIX FOR CORRECT LAYOUT.
VERTICAL SCALE IN FEET
HORIZONTAL SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 69+00 TO 100+00)
WILLIS L. WALKER, P.E.
CHIEF, GEOTECHNICAL SECTION
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 69+00 TO 86+50)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 86+50 TO 100+00)
STATIONING IN FEET
ELEVATION IN FEET, NGVD
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
INTERSTATE HWY 45 BRIDGE
BA-71
BA-70
BA-58



SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 100+00 TO 118+00)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 116+00 TO 128+00)
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 100+00 TO 128+00)


NOTES:
1. FOR BORING LOCATIONS, SEE DRAWING NO. B1 THROUGH B3.
2. FOR LEGEND AND GENERAL NOTES, SEE DRAWING B9.
3. USE THESE SHEETS FOR PROJECT "CONCEPT" ONLY. MINOR VARIATIONS EXIST BETWEEN THE PROJECT FEATURES SHOWN AND THE PROJECT LAYOUT AND DESIGN AS CURRENTLY FORMULATED. REFER TO CIVIL/STRUCTURAL DESIGN AND RELOCATIONS APPENDIX FOR CORRECT LAYOUT.
VERTICAL SCALE IN FEET
HORIZONTAL SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 128+00 TO 139+58)
(STATION 10+00 TO 23+00)
WILLIS L. WALKER, P.E.
CHIEF, GEOTECHNICAL SECTION
SHEET NO. B8 OF 16
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
8A-6D
8A-5B
ELEVATION IN FEET, NGVD
STATIONING IN FEET
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 128+00 TO 139+58)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 10+00 TO 23+00)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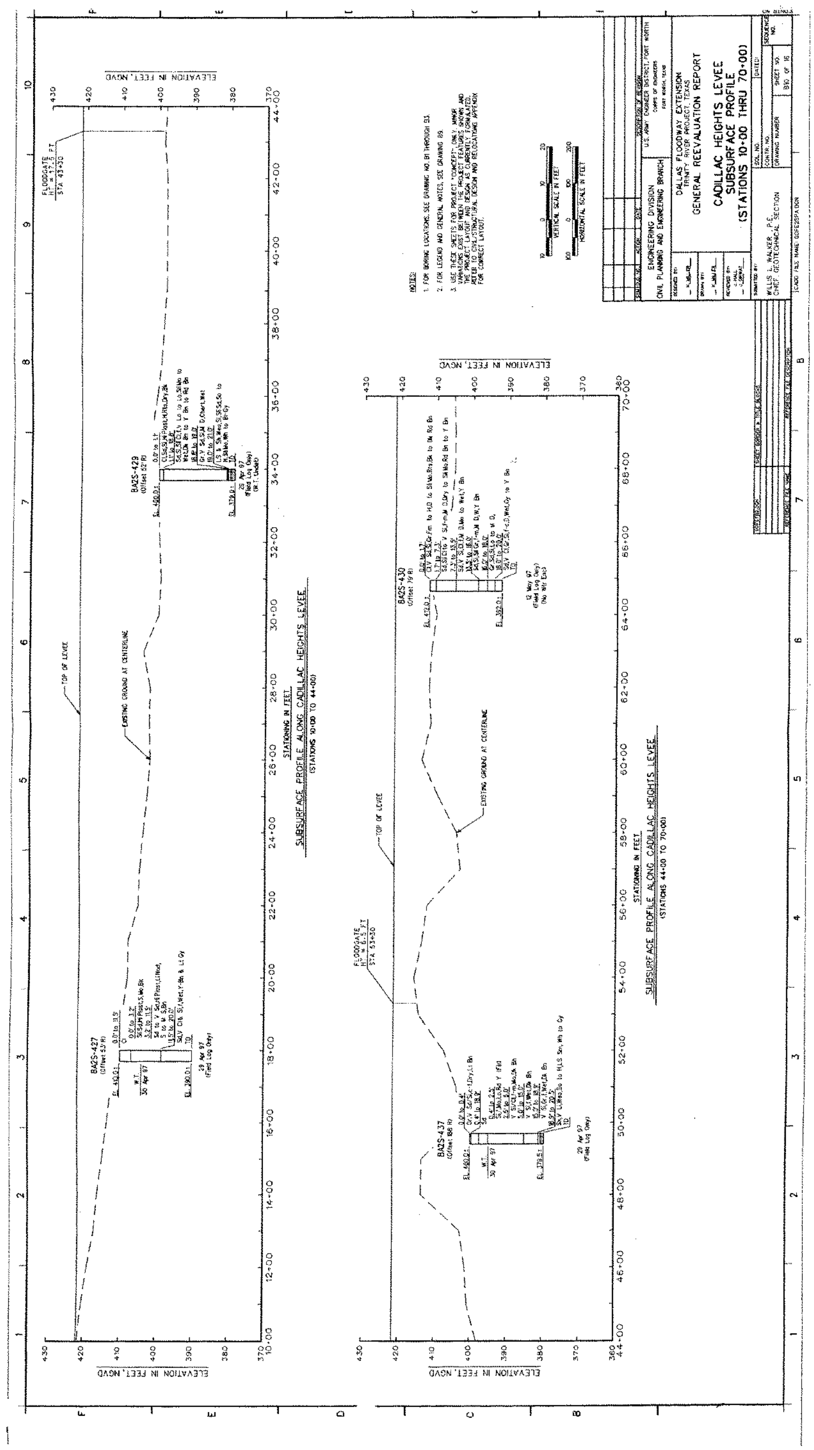
(STATION 23+00 TO 36+00)
SUBSURFACE PROFILE ALONG LAMAR STREET LEVEE
(STATION 36+00 TO 44+51)
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUBSURFACE PROFILE
(STATION 23+00 TO 44+51)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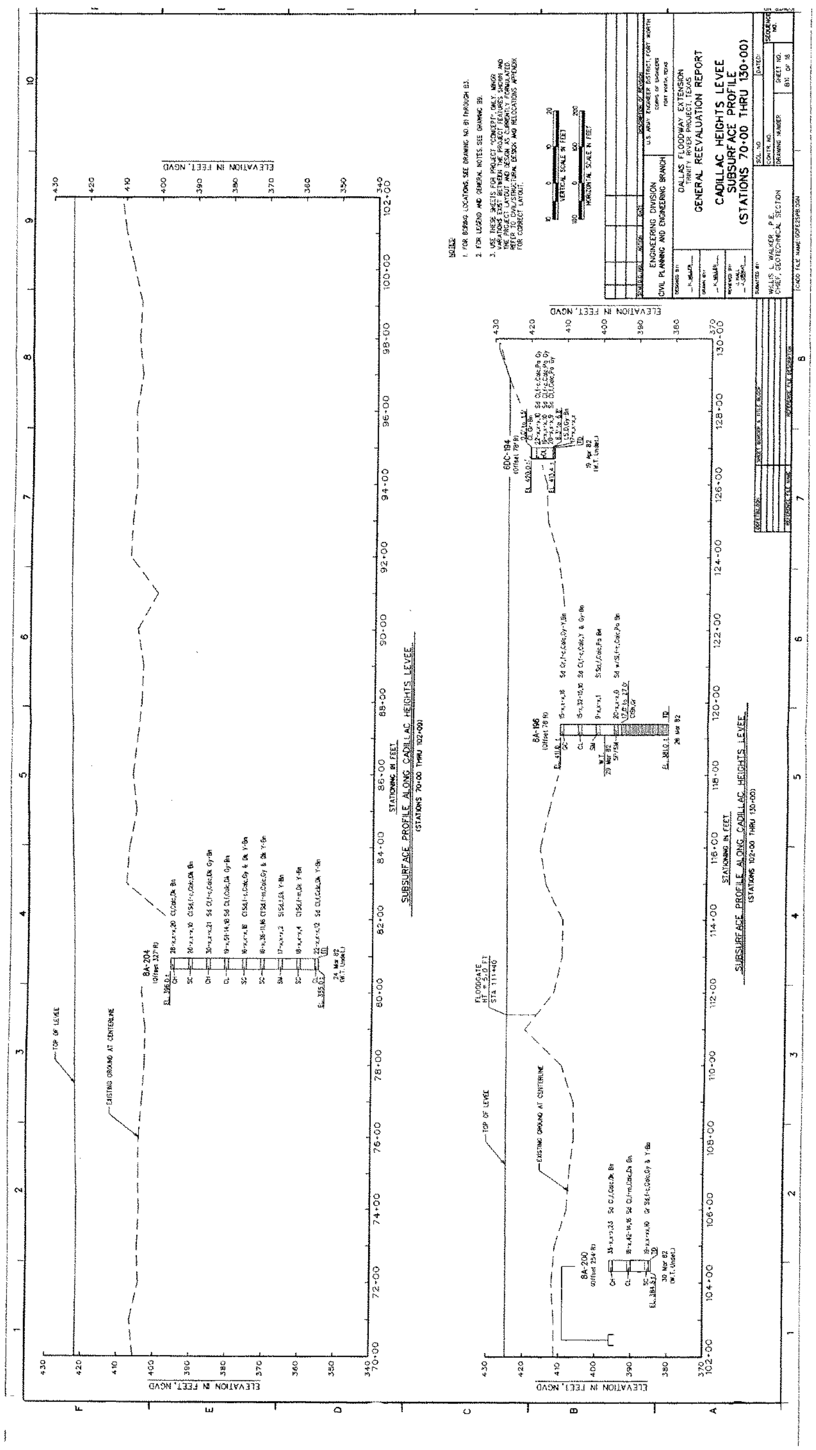
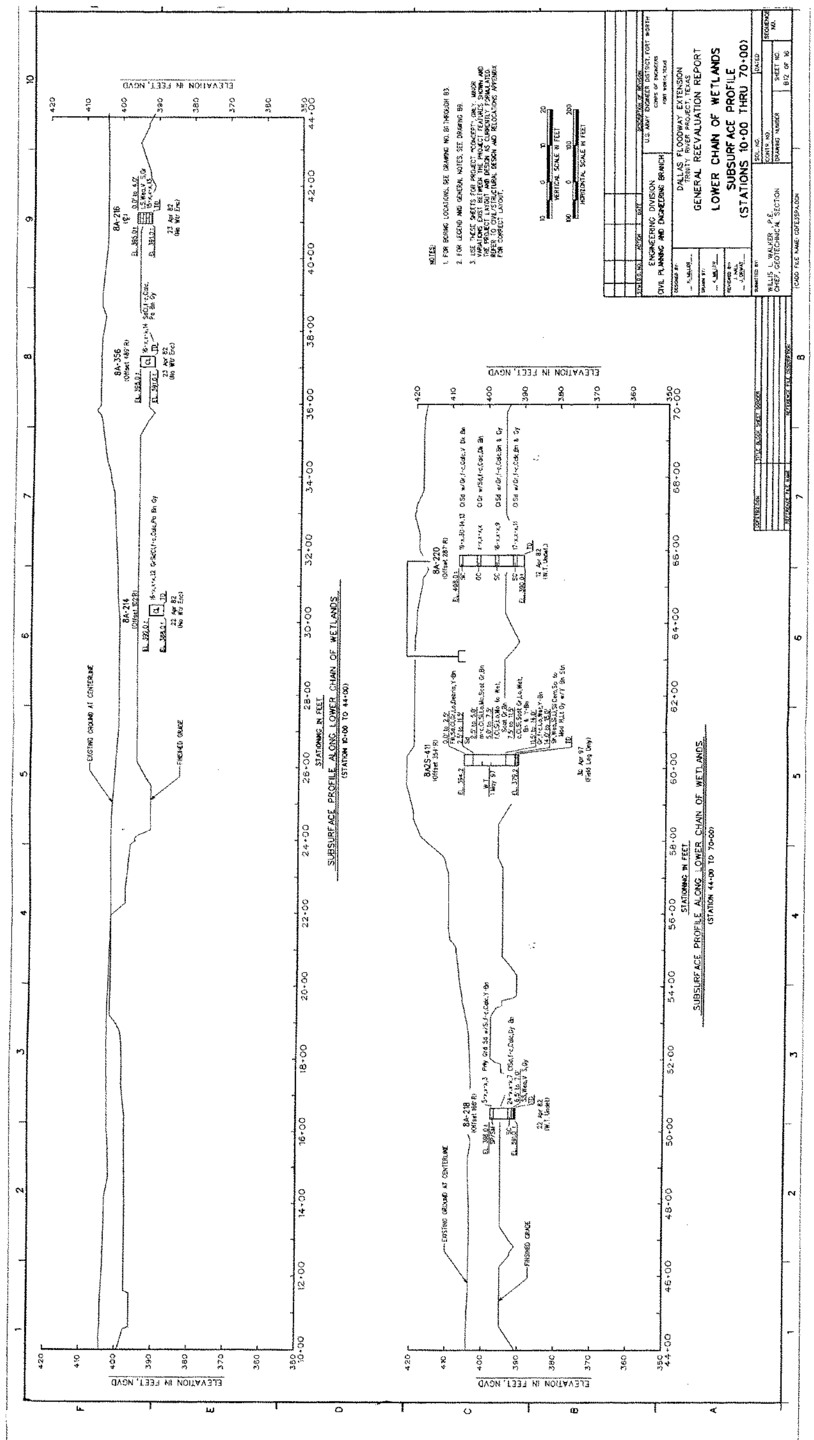
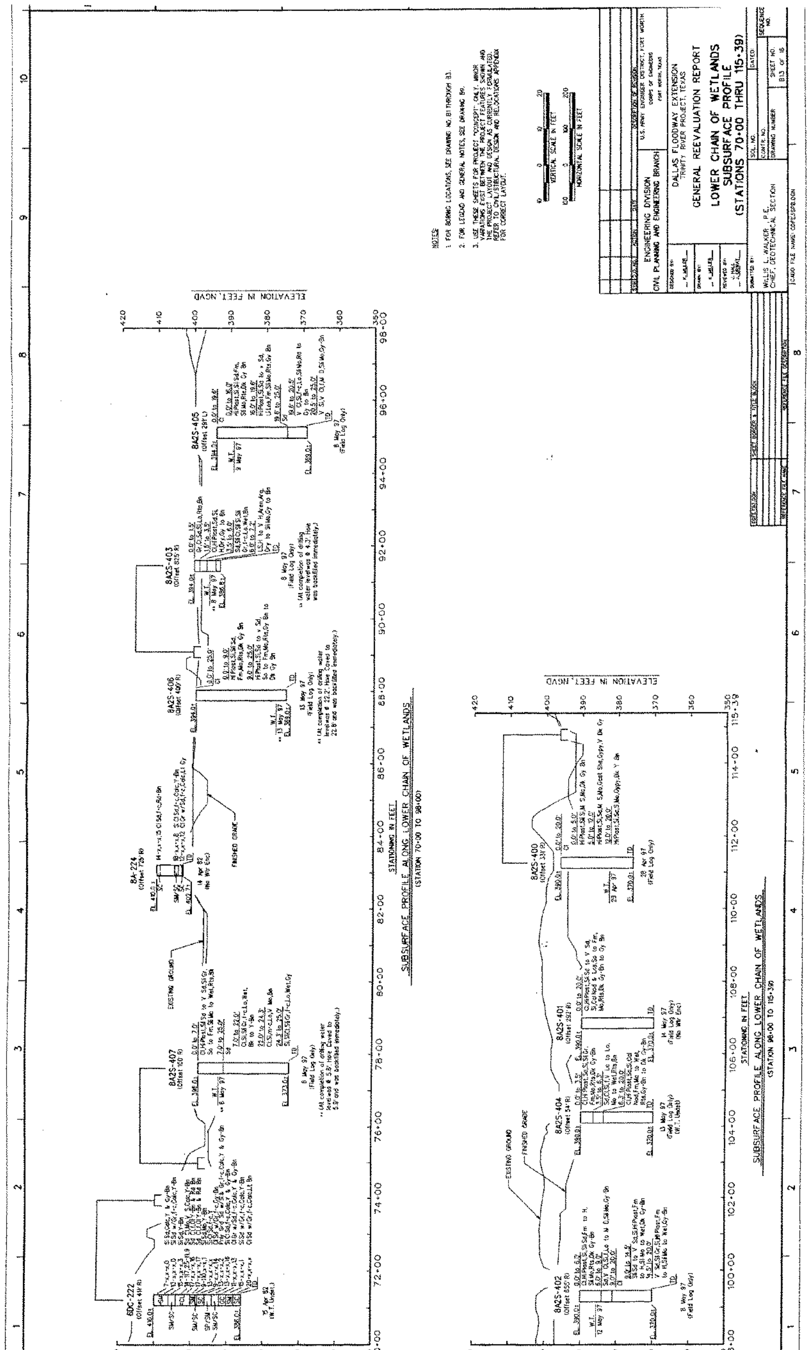
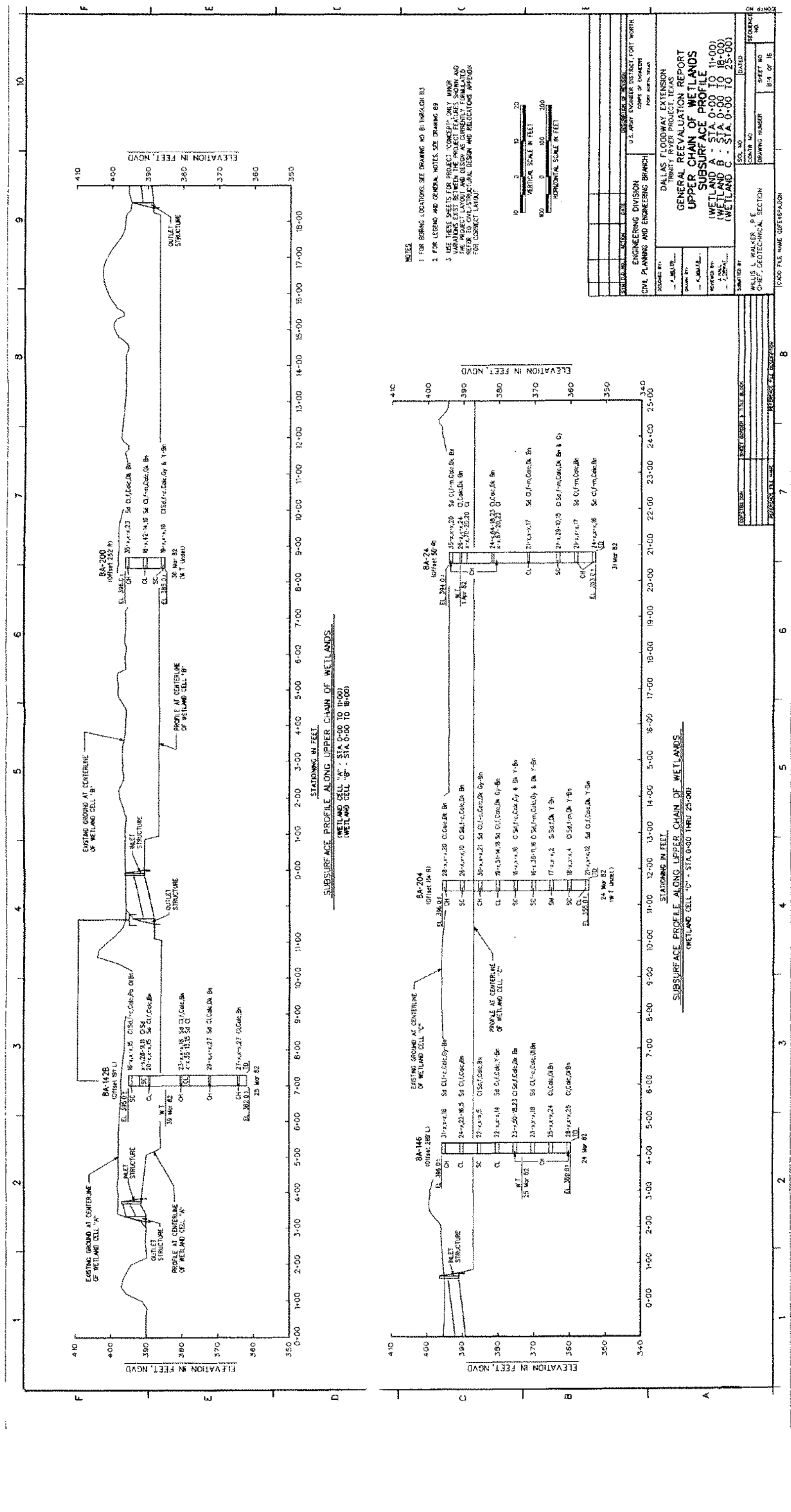
(STATIONS 10+00 TO 44+00)
SUBSURFACE PROFILE ALONG CADILLAC HEIGHTS LEVEE
(STATIONS 44+00 TO 70+00)
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
CADILLAC HEIGHTS LEVEE
SUBSURFACE PROFILE
(STATIONS 10+00 THRU 70+00)
ELEVATION IN FEET, NGVD
STATIONING IN FEET



DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
CADILLAC HEIGHTS LEVEE
SUBSURFACE PROFILE
(STATIONS 70-00 THRU 130-00)
SUBSURFACE PROFILE ALONG CADILLAC HEIGHTS LEVEE
(STATIONS 70-00 THRU 102-00)
SUBSURFACE PROFILE ALONG CADILLAC HEIGHTS LEVEE
(STATIONS 102-00 THRU 130-00)
STATIONING IN FEET
ELEVATION IN FEET, NGVD
TOP OF LEVEE
EXISTING GROUND AT CENTERLINE
BA-204
BA-200
BA-196
6DC-194
FLOODGATE
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH


DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LOWER CHAIN OF WETLANDS
SUBSURFACE PROFILE
(STATIONS 10+00 THRU 70+00)
SUBSURFACE PROFILE ALONG LOWER CHAIN OF WETLANDS
SUBSURFACE PROFILE ALONG LOWER CHAIN OF WETLANDS


DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LOWER CHAIN OF WETLANDS
SUBSURFACE PROFILE
(STATIONS 70+00 THRU 115+39)
SUBSURFACE PROFILE ALONG LOWER CHAIN OF WETLANDS
ELEVATION IN FEET, NGVD
STATIONING IN FEET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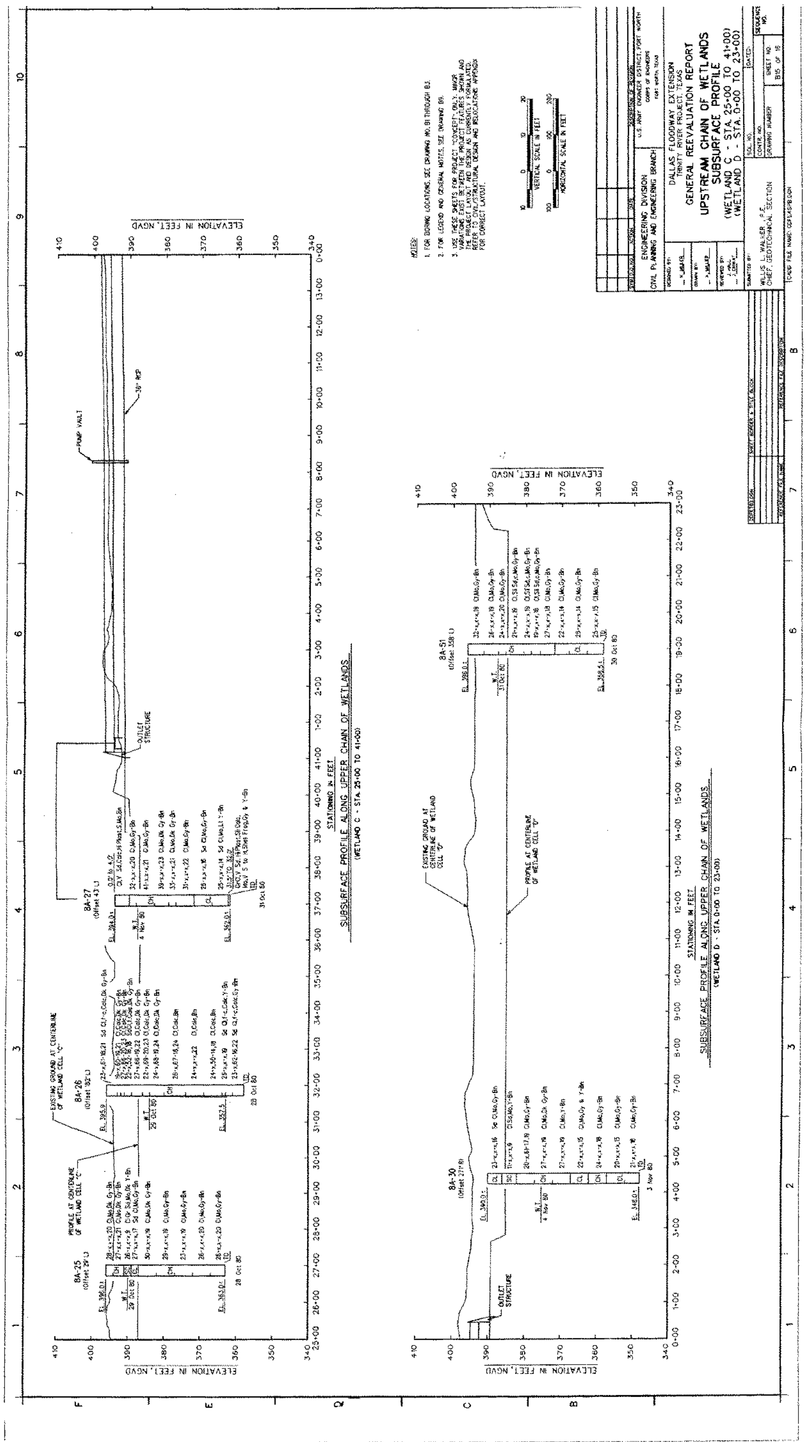
SUBSURFACE PROFILE ALONG UPPER CHAIN OF WETLANDS
ELEVATION IN FEET, NGVD
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
UPPER CHAIN OF WETLANDS
SUBSURFACE PROFILE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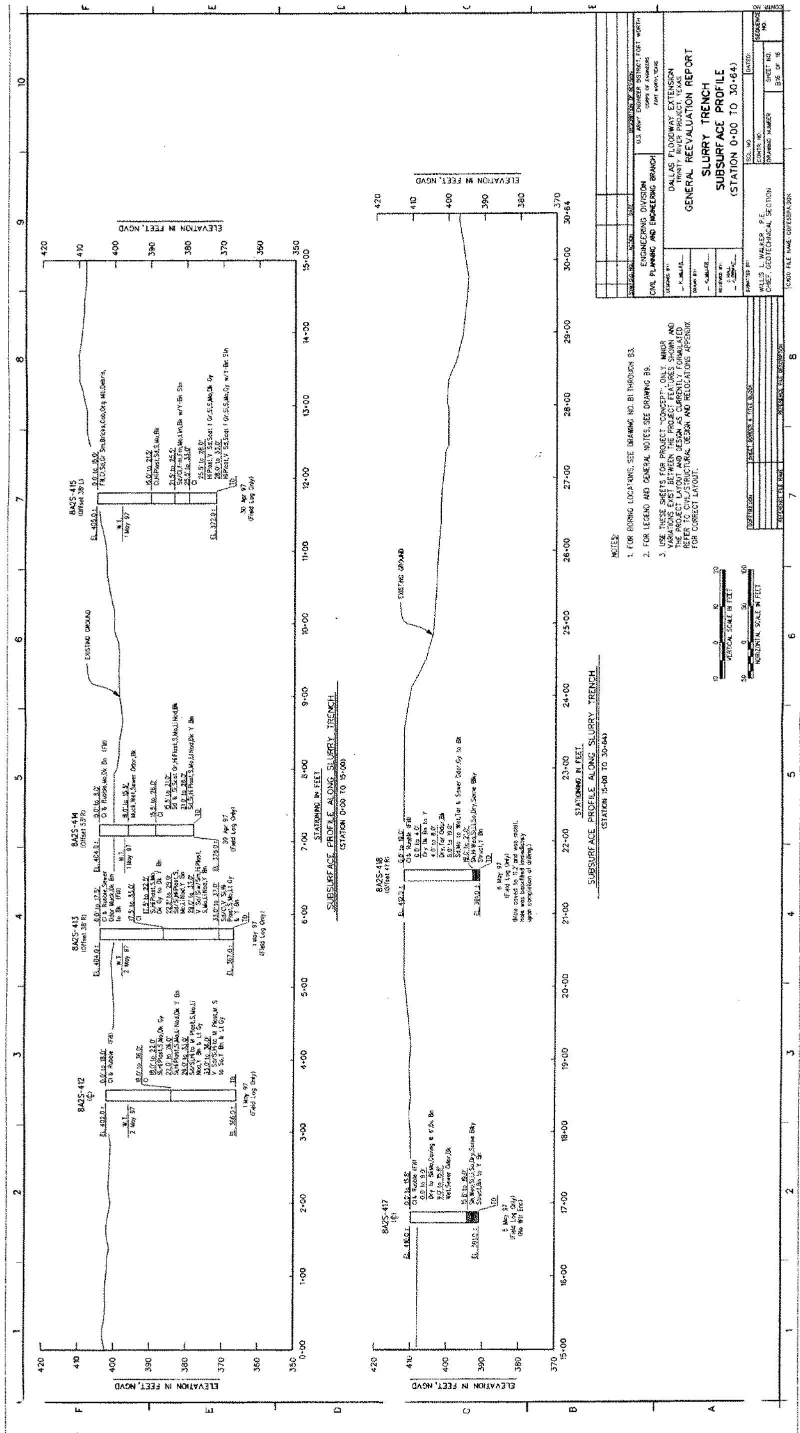
(WETLAND C - STA. 25+00 TO 41+00)
SUBSURFACE PROFILE ALONG UPPER CHAIN OF WETLANDS
(WETLAND D - STA. 0+00 TO 23+00)
ELEVATION IN FEET, NGVD
STATIONING IN FEET
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
UPSTREAM CHAIN OF WETLANDS
SUBSURFACE PROFILE
(WETLAND C - STA. 25+00 TO 41+00)
(WETLAND D - STA. 0+00 TO 23+00)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(STATION 0+00 TO 15+00)
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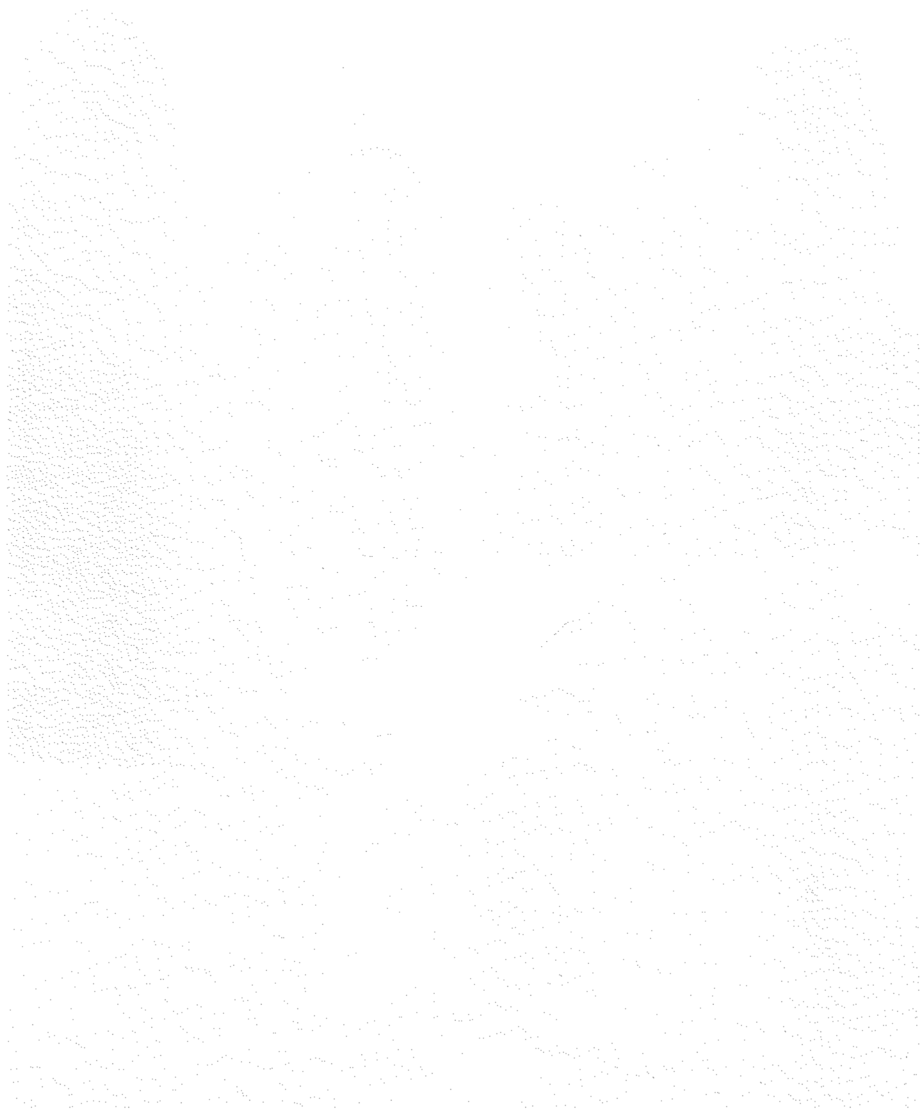
(STATION 15+00 TO 30+64)
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
SLURRY TRENCH
SUBSURFACE PROFILE
(STATION 0+00 TO 30+64)

APPENDIX C

CIVIL/STRUCTURAL DESIGN AND RELOCATIONS



APPENDIX C

CIVIL/STRUCTURAL DESIGN AND RELOCATIONS

CIVIL DESIGN

LEVEES

GENERAL

The purpose of this section is to discuss the alignment and design of levees for the Recommended Plan. Levees providing SPF levels of protection will be placed on each side of the Trinity River, starting at the downstream end, where Central Expressway (U.S. Highway 75) crosses the Trinity River and ending at the upstream end bordered by the Dallas Area Rapid Transit (DART) line. The levee to the east of the Trinity River has been designated as the Lamar Street Levee, and the levee to the west as the Cadillac Heights Levee. Both levees cross various major roads and railroad lines. In lieu of doing major relocations to these transportation facilities, gate closure structures will be installed at these crossings.

EXISTING CONDITIONS

Cadillac Heights Levee

Alignment of the new levee will impact the Missouri-Kansas-Texas Railroad (M.K.T.) at two main line locations and one spur line, and will also impact Martin Luther King Blvd. An existing levee surrounding the Central Wastewater Treatment Plant (CWWTP) provides an approximate 140-year level of flood protection. Placement of the new levee will incorporate the existing levee as it runs parallel to it and will impact the service entrance roads. Several buildings, which are primarily commercial facilities, will be have to be removed or relocated due to the new levee location. A major structure to be affected is the Dallas City Packing plant.

Lamar Street Levee

Alignment of the new levee will impact the Southern Pacific Railroad (S.P.) at one location and the M.K.T. at one location. No major roads will be impacted by gated structures; however, minor adjustments may be required at Martin Luther King Blvd. At this junction, the levee was realigned in order to reach a higher ground tie-in point. At the downstream end, this new levee will tie into the existing Rochester Park levee. Major road bridges which cross the new levee will not require any modifications since the low chord beam is well above the top of levee elevation.

EFFECTS OF THE PROJECT

General

Both the Lamar levee and the Cadillac Heights levee will be designed to the Standard Project Flood for the LPP design. The levees shall be made from the suitable material excavated from the proposed chain of wetlands area. Preparation of right-of-way for construction of both levees shall consist of removal of some building structures, clearing and grubbing of trees and brush vegetation, and excavation of some contaminated soils. The majority of the site preparation shall consist of removing grass type vegetation and stripping of the topsoil which can be salvaged for use on turfing the side slopes of the new levees. All building and site demolition debris shall be salvaged and recycled to the maximum extent possible. Unsalvageable debris and contaminated soil shall be disposed in the appropriate landfill site that complies with all Federal, State, and local regulations and ordinances. See Appendix J for additional information on these sites. Cutting, trimming, or converting to mulch can be done on site; however, all material shall be removed from the project site in compliance with all Federal, State, and local regulations and ordinances.

A typical cross section will consist of a 20-foot crown width with side slopes of 1 vertical to 4 horizontal. The use of steeper slopes for the levees was considered, but not used, since the soil has a history of slides at other levees in the area, plus maintenance mowing of the slope is much easier and safer at this slope. See Appendix B, Geotechnical Engineering, for more information on the stability of the material being used. A trapezoidal inspection trench, 5 feet deep with side slopes of 1 vertical to 1 horizontal shall be excavated along the centerline of the levee alignment. The purpose of the inspection trench is to locate any unsuitable levee foundation materials and any pipe or conduits not otherwise found. An access/maintenance road shall be added to the top of the levee which consists of an eight inch thick gravel base. Other than the access road, all exposed and disturbed areas within the construction limits will be turfed for prevention of erosion.

Cadillac Heights Levee

This levee extends over a total length of 11,891 feet. The top of levee varies in elevation from 421.5 at the downstream end to elevation 426.0 at the upstream end. The initial elevation of 421.5 is constant from station 10+00 to 74+50 then has a gradual slope increase to elevation 426.0. The average height is 14.9 feet, with a maximum height of 25.75 feet. Four flood control closure structures are required due to railroads and streets crossing the levee. One major railroad, M.K.T., crosses the levee three times, thereby requiring stoplog structures. These structures are located at levee centerline stations 43+30, 53+30, and 90+30. One street crossing at Martin Luther King Blvd. will require a floodgate at levee centerline station 111+40. See the Structural section of this appendix for descriptions and operation of these structures. There is an existing levee that surrounds the Central Wastewater Treatment Plant, which has a top of levee elevation of only 415.0. Therefore, the new levee between station 67+00 and 73+00 shall be constructed a raising the existing levee by 6 feet. Various utilities exist along the alignment of the new levee, and some relocation procedures will be required prior to construction of the new levee. See the Relocations section of this appendix for a description of such actions. Plan and profiles drawings of this levee are shown on Plates C04 to C12 of this appendix.

Lamar Street Levee

This levee extends over a total length of 16,419 feet. The top of levee varies in elevation from 417.0 at the downstream end to elevation 426.0 at the upstream end. The initial downstream elevation of 417.0 is gradually increased with a varying slope to elevation 426.0. The average height is 17.6 feet, with a maximum height of 31.0 feet. Two stoplog structures are required due to railroad crossings through the levee. Two major railroads, the S.P. and the M.K.T., cross the levee at levee centerline stations 19+80 and 119+60, respectively. See the Structures section and Plates S06 and S07 of this appendix for descriptions and operation of these structures. There is an existing Rochester Park levee at the downstream end, with a top of levee elevation of only 415.0, thereby requiring that the new levee be constructed with a transition slope to meet the initial elevation of 417.0 at the beginning station 10+00. Various utilities exist along the alignment of the new levee, and relocation procedures will be required prior to construction of the new levee. To avoid major relocation construction at Martin Luther King Blvd, the levee will parallel the road until a ground tie-in elevation of 426.0 is encountered, thus eliminating the need for a flood control structure at this road crossing. Two major freeway bridges cross the levee at levee centerline stations 26+00 and 80+50; however, the low chord beam elevations are well above the top of levee elevations and no modification to the bridges will be required. See the Relocations section of this appendix for a description of above actions. Plan and profiles drawings of this levee are shown on Plates C13 to C20 of this appendix.

CHAIN OF WETLANDS

GENERAL

This section will discuss the proposed design and function of the upstream and downstream chain of wetlands portion of the Dallas Floodway Extension project. The upper wetland chain consists of four separate wetland cells and the lower chain consists of three separate wetland cells. Both chains have a primary purpose of flood water conveyance.

FUNCTION

During flooding, the upper and lower chain of wetlands acts as flood control channels to convey flood water to outfalls east of IH-45 and north of Loop 12, respectively. During non-flood events, the chains serve as wetland areas for various wildlife and aquatic growth.

DESIGN CRITERIA

The upper wetland chain begins on the west side of Martin Luther King Jr. Blvd and ends at the southeast corner of the Central Wastewater Treatment Plant on the east side of IH-45. The chain consists of four separate wetland cells, each of varied lengths and shapes (See Plates C25 to C31). Wetland cells "A", "B" and "C" flow conversely to the Trinity River. Wetland cell "D" flows downstream with the river and outfalls into the Trinity on the east side of IH-45. Each cell has an inlet and outlet control structure. The inlet structure consists of a concrete stoplog structure with an attached trashrack. The outlet structure consists of a standard TxDOT concrete headwall (See Plate C32). The inlet and outlet structures are connected by 36" reinforced concrete pipe.

The lower wetland chain begins south of Central Expressway and ends just north of Loop 12. The chain consists of three separate wetland cells, each of varied lengths and shapes (See Plates C21 to C24). Wetland cells "E", "F" and "G" flow downstream with the river and outfall into Honey Springs Branch. The cells are connected by the same type of inlet and outlet control structures as in the upper chain.

Flooding from the river will be the main source of water to the upper wetland chain. In times of low flows or drought the cells will be fed from an existing wetland on the north side of the Central Wastewater Treatment Plant. Water will be pumped from the existing wetland to a pump vault which is located between proposed wetland cells "C" and "D". The flow will be split at the vault with partial flow feeding the three upper cells "A", "B" and "C" and the other feeding cell "D" (See Plates C28 and C30).

The typical section of a wetland cell varies in depth from 1.5' to 7' with various slopes and shelves to support an array of aquatic life and vegetation (See Plate C03).

Preparation of right-of-way for the wetland cell construction includes clearing of some trees and brush vegetation, and excavation of some contaminated soils. The majority of the site preparation shall consist of removing grass type vegetation and stripping of the topsoil which can be salvaged for use on the area to be turfed. All felled trees and brush may be disposed of as salvageable timber. Cutting, trimming, or converting to mulch can be done on site; however, all material shall be removed from the project site in compliance with all Federal, State, and local regulations and ordinances. Excavated material generated from the construction of these wetland cells shall be inspected and tested to obtain suitable material to be used as fill to build the Cadillac Heights and Lamar Levees. Excess excavated material both suitable and unsuitable shall be disposed of at a designated site located approximately 10 miles south of the project area in Hutchins, Texas. Contaminated soils shall be disposed in the appropriate landfill site that complies with all Federal, State, and local regulations and ordinances. See Appendix J for additional information on these sites.

IH-45 DIVERSION CHANNEL

GENERAL

This section will discuss the proposed design and function of the IH-45 diversion channel within the Dallas Floodway Extension project. The IH-45 diversion channel consists of a 3,300-foot bypass of the Trinity River on the east and west side of IH-45 for the purpose of improving the efficency of flow through the bridge. The IH-45 diversion channel consists of the realignment of the Trinity River 2,000 feet west and 1,300 feet east of IH-45. This phase of the project consists mainly of excavation of the bypass channel and filling the existing channel (See Plates C30 to C31).

RECREATION FEATURES

GENERAL

The proposed project includes construction of an extensive network of recreation trails with numerous access areas. Other features of the plan include pedestrian bridges, and picnic pavilions. Refer to Appendix I, Recreation, and the drawing entitled Recreation and Open Space Plan for a complete description of the recreation plan.

Trails and Access Points

The proposed project includes 18 miles of 10-foot wide, 4-inch thick reinforced concrete on compacted subgrade. The plan also includes 8.5 miles of natural surface equestrian trails and 5 miles of natural surface nature trails. In addition, seven access areas are proposed with parking available for a minimum of 20 vehicles at each area. One of these areas, located at the Sleepy Hollow Golf Course, will require no modifications. Plate C33 shows typical details for the concrete hike/bike trail and access areas.

Structures

Two pedestrian bridge structures will be provided for access across the river channel. The bridges will typically consist of three 50-foot prestressed concrete beam spans and will be designed to support light maintenance vehicles. Plate C33 shows typical details for the proposed structures.

RELOCATIONS

GENERAL

The purpose of this section is to discuss the existing transportation and utility infrastructure which would be affected by the proposed project and the remedial measures proposed to accommodate the project. In accordance with the Water Resources Development Act of 1986 (Public Law 99-662), the relocation or alteration of roads, bridges and utilities for this project will be the responsibility of the non-Federal sponsor. However, relocation of railroad bridges, and approaches thereto, are project construction costs to be cost shared by Federal government and the non-Federal sponsor. Gated sewer outlets, gate well structures, and any closure structures required where the levee crosses a transportation facility are also project construction costs to be cost shared.

EXISTING CONDITIONS

The project area is traversed by several existing roads, railroads, and utility lines. The Dallas Central Waste Water Treatment Plant is also located in the area. The existing transportation and utility facilities are shown on Plates C04 to C31 of this appendix. The facilities which are affected by the project have been maintained in good condition.

EFFECTS OF THE PROJECT

The project will adversely affect existing roads, railroads, and utilities in the project area. The affected facilities are listed in Table C-1. Proposed remedial measures are shown on Plates C04 to C31, and are discussed below.

Roads

Martin Luther King Boulevard

This facility, which is owned by the City of Dallas, consists of a 4-lane divided roadway with sidewalks. The west levee will cross the roadway at the west bridge abutment. Ramping the roadway over the levee is impractical due to its close proximity to the bridge. The top of levee will be approximately 4 feet above the bridge grade. A closure structure approximately 4 feet high and 60 feet long is proposed for the west levee at this location. The proposed structure will maintain the clear width of the existing bridge. The proposed structure has been discussed with representatives of the City of Dallas who have expressed their tentative agreement with the plan. Refer to the Structures section of this appendix for additional discussion and see Plate S01 for details. The east levee will intersect the embankment of the east bridge approach, the elevation of which is sufficient to avoid the need for a closure structure.

Central Expressway (U.S. Highway 75)

This facility, which is owned by the State of Texas, consists of a 4-lane divided highway. This facility is not affected by the west levee. The east levee will intersect the embankment of the east bridge approach. Although the existing east abutment is approximately 4 feet lower than the proposed levee, the owner has plans to raise the abutment to levee height in the near future. A closure structure at this location is not proposed.

Interstate Highway 45

This facility, which is owned by the State of Texas, will not be affected by the west levee. The east levee will cross beneath the IH-45 bridge and will not affect the bridge. The State's maintenance road will be ramped over the levee to maintain the State's access to it's right of way. The existing low flow channel of the Trinity River will be realigned thru the IH-45 bridge to eliminate the current maintenance problems with erosion around the bridge pier. No alteration to the bridge structure will be required. Refer to Plates C30 and C31 for drawings of the channel realignment.

Sargent Road

This 2-lane roadway is owned by the City of Dallas. A short section of this roadway on the north side of the CWWTP will require minor realignment to accommodate the west levee alignment. The west levee will cross the southern end of Sargent Road near Kiest Blvd. Due to the close proximity of the railroad and the intersection at Kiest Blvd. in this area, ramping Sargent Road over the levee would be impractical. The sponsor has expressed approval of the current plan to abandon the southern end of Sargent Road in this area and reroute traffic around existing roads.

Rector Road

This 2-lane roadway is owned by the City of Dallas. This roadway currently terminates approximately 200 feet northeast of the proposed Cadillac levee alignment at station 26+00. The proposed plan is to move the termination point to the southwest side of the levee and remove that portion of the road within the levee footprint.

Railroads

The SPF project levees and wetlands cross three active railroad lines and one inactive line. Each facility is discussed below. Refer to the Structures section of this appendix and Plates S02 to S07 for drawings and analyses of the proposed structures.

Dallas Area Rapid Transit

The east levee will cross under an active Dallas Area Rapid Transit (DART) bridge at the upstream end of the project. The levee will pass under the elevated bridge and will not affect the structure. The east levee will cross an inactive railroad embankment, which is also owned by DART, (previously owned by Atchison, Topeka and Santa Fe Railway.) The inactive line is immediately downstream of the active railroad and is several feet lower than the proposed east levee. The proposal is to build the levee across the old railroad embankment with no closure structure. This would effectively require abandonment of the inactive line, although, it could potentially be upgraded for use as a hiking/biking trail. The DART facilities will not be crossed by the wetlands or the west levee. A relocation agreement is proposed between the Federal Government and DART to accommodate the design and construction of the alterations described above.

Union Pacific Railroad

The Union Pacific Railroad (U.P.) owns two active lines which cross the project area. One line was formerly owned by Missouri-Kansas-Texas Railroad Company (MKT). This facility is located between Martin Luther King Blvd. and Interstate 45. The other line was formerly owned by Southern Pacific Railroad (S.P.) and is located south of Central Expressway. Both active lines will be crossed by the proposed levees. The proposal is to stage work on the railroad facilities and shift traffic between the two active lines to avoid the necessity to build a railroad detour. A description of the proposed structures is presented below.

The east levee will cross the existing embankment of the old MKT line, and a 20' x 14' stoplog structure is proposed at this location. The west levee will cross the same line at two separate locations. One crossing will be on the north side of the wastewater treatment plant and the other crossing will be west of the treatment plant. Twenty-foot wide stoplog structures are proposed for both the north and west locations, at heights of approximately 15 feet and 17.5 feet, respectively. The west levee will also cross an active railroad spur that serves the wastewater treatment plant. A 20' x 6.5' stoplog structure is proposed for the spur crossing. An inactive railroad spur, which the west levee alignment crosses near Kiest Blvd., will be removed within the footprint of the levee and the remainder of the spur will be abandoned.

The east levee will cross the embankment of the old S.P. railroad and will be approximately 8 feet higher than the existing trackage. A 20' x 8' stoplog structure is proposed for this crossing.

The proposed wetlands will require only minimal excavation under the existing railroad bridges for the purpose of hydraulically connecting the upstream and downstream wetland cells. The wetlands should not adversely affect the railroad facility.

A relocation agreement is proposed between the Federal Government and Union Pacific to accommodate the design and construction of the alterations described above. Refer to the Structures section of this appendix for additional discussion and Plates S02 to S07 for drawings of the proposed structures.

Utilities

Sanitary Sewer

Numerous sanitary sewer lines will be crossed by the east and west levees, as indicated on Plates C04 to C21 and Table C-1. The pipes mostly consist of relatively small diameter laterals and collectors. The pipes are various ages and consist of various materials. Since the existing pipes are unlikely to accommodate the anticipated loading and settlement imposed by the proposed levee, reconstruction of the sewer lines under the levees is proposed. A closure valve is also proposed for each pipe that is reconstructed under the levee. The inclusion of a valve on sanitary sewer lines is a decision which must be based on judgements of risk versus cost. The additional cost of valves is considered to be justified based on the risk of a rupture one or more of the numerous pipes which cross the levee.

One existing sewer line, which will be crossed at the upstream end of the east levee, will be left in place without reconstruction. The 60-inch diameter Cadiz Force Main was constructed in 1986, and consists of a prestressed concrete embedded cylinder pipe (75 p.s.i. internal pressure). Most of the pipe in the area is placed in a 96-inch diameter tunnel liner approximately 28 feet below natural ground. The void between tunnel liner and pipe is filled with grout. An existing valve with valve box is also located in the area. The proposal is to place the levee over the existing pipe and extend the valve box to the top of levee. An analysis will be required during final design to verify that the pipe has sufficient strength and joint flexibility to accommodate the levee construction.

Storm Drains

Limited availability of sump volume mandates that some existing storm drains be extended under the levee and discharged on the river side of the levee. Some collector pipes are proposed to minimize the length of new pipe required and reduce the number of levee crossings proposed. The numerous storm drain lines which will be affected by the east and west levees are indicated on Plates C04 to C21 and Table C-1. The existing storm drains range in size, age, and materials. Since the existing pipes are unlikely to accommodate the anticipated loading and settlement imposed by the proposed levee, reconstruction of the storm drains under the levees is proposed. An emergency closure valve is also required at each levee crossing to prevent flooding in the event of a malfunction of the flapgates.

Water Lines

Three water supply lines, which are owned and operated by the City of Dallas, will be affected by the west levee, as indicated on Plates C04 to C12 and Table C-1. Water lines will not be affected by the east levee or the wetlands. Since the subject lines convey pressure flows, the recommended plan consists of relocating the pipes over the levee. A minimum of 2 feet of cover material is proposed over the pipes.

Electric Transmission Towers

TU Electric owns and operates numerous large electrical transmission lines in the project area. An electric transmission tower near the electric substation on the west side of the Central Wastewater Treatment Plant will require relocation to accommodate the west levee. Discussions with representatives of TU Electric indicate their tentative approval of the proposal.

Fiber Optic Cables

Fiber optic cables, which are buried in the right-of-way of Union Pacific's rail facilities, will be affected at several locations, as indicated on Plates C04 to C1 and Table C-1. The construction of the proposed stoplog structures on the east levee will require alteration of cables owned by Qwest Communication Company and Electra Communication Company. The proposed stoplog structures on the west levee will require two alterations of the Electra cable for the LPP and one alteration for the FSP.

Table C-1

SANITARY SEWER LINES (Cadillac Heights)			
Levee Station	**Dia. (Inches)**	**Length Reloc. (LF)**	**Sluice Gate Required**
112+00	10	250	Yes
102+00	8	200	Yes
98+00	8	100 (removal)	No
94+00	15	300	Yes
79+70	12	450	Yes
75+80	12	200	Yes
66+00 - 74+00	10	950	Yes
43+00	12	240	Yes
26+00	10	220	Yes

STORM SEWER (Cadillac Heights)			
Levee Station	**Dia. (Inches)**	**Length Reloc. (LF)**	**Sluice Gate Required**
111+75	24	300	Yes
110+50	72	200	Yes
66+00 - 72+00	24	450	No
10+00	54	3200	No

WATER SUPPLY (Cadillac Heights)			
Levee Station	**Dia. (Inches)**	**Length Reloc. (LF)**	**Sluice Gate Required**
62+00	8	200	No
43+50	6	220	No
26+00	8	200	No

ELECTRICAL SUPPLY (Cadillac Heights)			
Levee Station	**Descr.**	**Size (kV)**	**Length (LF)**
45+00	Transmission Tower	138	
66+00 - 72+00	Aerial Distribution		600

ROADWAYS (Cadillac Heights)			
Levee Station	**Roadway**	**Length Reloc. (LF)**	**Rdwy Width (Ft)**
92+00 - 94+00	Sargent Road	200	18
61+00	Entrance to CWWTP	450	25
59+00	Entrance to CWWTP	550	30

FLOODGATE STRUCTURES (Cadillac Heights)			
Levee Station	**Roadway**	**Gate Width (LF)**	**Gate Height (Ft)**
111+40	Martin Luther King Blvd.	65	5

STOPLOG STRUCTURES (Cadillac Heights)			
Levee Station	**Railroad**	**Stoplog Width (Ft)**	**Stoplog Height (Ft)**
90+30	M.K.T.	20	14
53+30	M.K.T. (spur)	20	6.5
43+30	M.K.T.	20	17.5

FIBER OPTIC CABLES (Cadillac Heights)			
Levee Station	**Company**	**Reloc. Length (Ft)**	
90+30	Electra Comm. Co.	50	
43+30	Electra Comm. Co.	50	

SANITARY SEWER LINES (Lamar Levee)			
Levee Station	**Dia. (Inches)**	**Length Reloc. (LF)**	**Sluice Gate Required**
27+00	12	150	Yes
27+00 - 34+00	10	800	No
70+00	12	200	Yes
90+00	24	220	Yes
106+00	15	150	Yes
117+00	48	300	Yes

STORM SEWER (Lamar Levee)			
Levee Station	**Size**	**Length Reloc. (LF)**	**Sluice Gate Required**
24+00 (North Reach)	8' x 8' Box Culvert	300	Yes
25+00	54" Dia. Pipe	150	Yes
47+00	48" Dia. Pipe	200	Yes
76+80	24" Dia. Pipe 30" Dia. Pipe 42" Dia. Pipe 60" Dia. Pipe	450 150 950 2050	No No No Yes
119+00	66" Dia. Pipe	1200	Yes
134+00	7' x 7' Box Culvert	900	Yes

STOPLOG STRUCTURES (Lamar Levee)			
Levee Station	Railroad	Stoplog Width (Ft)	Stoplog Height (Ft)
19+80	S.P. (U.P.)	20	8
119+60	M.K.T. (U.P.)	20	14

FIBER OPTIC CABLES (Lamar Levee)			
Levee Station	Company	Reloc. Length (Ft)	
20+00	Qwest Comm. Co.	50	
120+00	Electra Comm. Co.	50	

STRUCTURES

DESCRIPTION OF STRUCTURES

General

Structural works included in the Dallas Floodway Extension project consist primarily of closure structures where the proposed levees intersect streets or railroads, and various gate-controlled sluice structures for control of sump and interior drainage. The proposed new structures are as follows: one new closure structure at the intersection of the MKT Railroad with the Lamar levee, station 119+60; one new closure structure at the intersection of the Southern Pacific Railroad with the Lamar levee, station 19+80; three (3) new closure structures at the Cadillac Heights levee - MKT Railroad intersections, stations 43+30, 53+30 and 90+30; one new closure structure at the Cadillac Heights levee - Martin Luther King Freeway intersection, station 111+40; five (5) separate gate-controlled sluice structures at sump outlets in the Lamar levee and four (4) gate-controlled sluice structures in the Cadillac Heights levee. All the closure structures will be cast-in-place reinforced concrete structures with rectangular openings controlled by single or dual-leaf steel swing gates and further categorized below for discussion as either floodwall type or retaining wall type closures. The swing gates will be fabricated from structural steel shapes and plate, with rubber J-shaped seals along the vertical and lower edges. The gates vary in height from 5 feet to 17.5 feet and are shown in detail on plates S-01 through S-07 of this appendix. The sluice structures will be conventional cast-in-place, reinforced concrete construction and will consist of a cut-and-cover conduit with single or multiple sluices, a centrally located gate control tower with cast iron slide gates and simple span service bridge. Details and locations of the sluice structures are shown on plates S-08 and S-09 of this appendix. Locations and details of the sluice controlled sanitary and storm sewers are shown in table C-1 of the Relocations section of this appendix.

Retaining Wall Type Closure Structures

The closure structures at stations 53+30 and 111+40 on the Cadillac Heights Levee, for the LPP, and at station 19+80 on the Lamar levee are categorized, for the purposes of this report, as retaining wall type structures and have swing gates that are 6.5', 5.0' and 8.0' in height, respectively. They are configured in a U-shaped arrangement, i.e., a footing with integral sill and vertical end walls. The structures provide a 20-foot (minimum) rectangular opening through the levee for the railroads and a 65-foot opening for the Martin Luther King (MLK) freeway. The end walls of the structure are cantilever retaining walls that are oriented transversely to and match the cross-section of the levee, thus retaining the levee material. A fabricated steel swing gate is mounted on hinges on a stiffened section of one of the end walls, sealing against the concrete surfaces of each wall and along the sill. In the case of the MLK structure, a reinforced concrete center post is used to support a dual leaf gate arrangement, each leaf being hinged on the end walls and swinging in to the center post. A portable winch is provided as loose equipment to operate the gates.

Floodwall Type Closure Structures

The closure structures at stations 43+30 and 90+30 on the Cadillac Heights Levee, and the structure at station 119+60 on the Lamar Levee and are categorized, for the purposes of this report, as floodwall type structures and have single leaf swing gates that are 17.5', 15.0' and 14.0' in height, respectively. They are configured as inverted-T shaped floodwalls that function as extensions of the levee, allowing the levee material to be tapered away from the railroad embankment. The stem of the floodwall is notched to provide the required opening for the railroad and the exposed vertical edges of the notch are stiffened to provide mounting and bearing points for the steel swing gate, which seals against the concrete surfaces around the perimeter of the notch. Again, a portable winch is provided to operate the swing gate at each structure.

Sluice Structures

The proposed new sluice structures will be conventional cast-in-place, reinforced concrete construction and will consist of a cut-and-cover conduit with single or multiple sluices and flap gates on the river side, a centrally located gate control tower with cast iron slide gates and simple span service bridge with cast-in-place concrete abutment. Sizes and approximate locations of the sluice structures are given in Tables C-2 and C-3 below. Details of the sluice structures are shown on Plates S-08 and S-09 of this appendix.

Table C-2
Sluice Structures - Cadillac Heights Levee

SLUICE NUMBER	LEVEE STATION (FT)	CONDUIT SIZE (FT)	INLET ELEVATION (FT. NGVD)	OUTFALL ELEVATION (FT. NGVD)
1	118+00	3- 5x5	405	404
2	91+40	3- 5x5	397	396
3	82+00	3-5x5	397	396
4	41+50	3-5x5	395	394

Note: The sluice structures are listed in order from northwest to southeast, along the proposed levee system.

Table C-3
Sluice Structures - Lamar Street Levee

SLUICE NUMBER	LEVEE STATION (FT)	CONDUIT SIZE (FT)	INLET ELEVATION (FT. NGVD)	OUTFALL ELEVATION (FT. NGVD)
1	40+10	4x4	393	391
2	24+90	4x4	392	390
3	118+60	4- 6x6	392	390
4	92+30	4x4	395	393
5	50+60	3- 5x5	392	390

Note: The sluice structures are listed in order from northwest to southeast, along the proposed levee system.

DESIGN CRITERIA

References

Allowable stresses, loading conditions, design assumptions and other criteria for structural design are in accordance with the applicable sections of the "US Army Corps of Engineers Manuals" (EM) and other publications listed below:

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

2. Engineering and Design; Design of Hydraulic Steel Structures, EM 1110-2-2105, 31 March 1993.

3. Engineering and Design; Structural Design of Closure Structures for Local Flood Protection Projects, EM 1110-2-2705, 31 March 1994.

4. Building Code Requirements for Structural Concrete (ACI318-95).

5. Corps of Engineers Structural Engineering Computer Programs:

   a. Design and/or Analysis of Composite Skinplate (SKNPLATE) - Program Number X0019.

   b. Sliding Stability Analysis of Concrete Structures (CSLIDE) - Program Number X0075

   c. Interactive Graphics 3-Dimensional Stability Analysis/Design Program (3DSAD) - Program Number X8100.

   d. Design of Reinforced Concrete Orthogonal Culverts/Conduits (CORTCUL) - Program Number X0024.

   e. Concrete Strength Investigation and Design in Accordance with ACI Code 318-83 (CASTR) - Program Number X0067.

Design Methodology

Design of the concrete structures was accomplished using the Strength Design Method, in accordance with EM1110-2-2104, referenced above. Design of the steel gates for each closure structure was accomplished using the Allowable Stress Design Method (ASD) and computer program SKNPLATE (X0019). The design flood level for all of the closure structures was taken to be the elevation of the top of the gate (top of levee), with no allowance for freeboard. The minimum acceptable sliding factor of safety for the closure structures was taken to be 1.5 and each was designed to withstand hydrostatic uplift pressures corresponding to the design flood level on the river side and to sill height on the land side, assuming a linear variation across the entire base of the structure. The project is in seismic zone zero; therefore no augmented design is required. Additionally, no significant wave action is expected.

Unit Weights and Material Properties

Reinforced Concrete = 150 pcf
Water = 62.4 pcf
Steel = 490.0 pcf
Concrete Strength = 3000. psi at 28 days

Reinforcing Steel f_y = 60,000. psi (ASTM A615, Grade 60)
Structural Steel f_y = 36,000. psi (ASTM A36)

Soil Design Parameters - Cadillac Heights Levee

Martin Luther King Freeway (CH)

Unit weight (moist, w=23%)		γ_m = 118 pcf
Unit weight (dry)		γ_{dry} = 94 pcf
Unit weight (sat, w=30%)		γ_{sat} = 122 pcf
Shear Strength (S) Cohesion (CD)		C = 0
Shear Strength (Q) Cohesion (UU)		C = 800 psf
Internal Friction Angle (Consolidated, Drained)		ϕ = 18°
Internal Friction Angle (Unconsolidated, Undrained)		ϕ = 0°
Wall Friction Angle (concrete/soil interface)		δ = 12°
Allowable Bearing Capacity:	above water table	= 2000 psf
	below water table	= 1500 psf
Earth Pressure Coefficients:	above water table	k_a = 0.5
		k_o = 0.5
		k_p = 2.0
	below water table	k_a = 0.8
		k_o = 0.8
		k_p = 2.0

MKT Railroad near Sargent Road and MKT Spur Track (SC)

Unit weight (moist, w=18%)	γ_m = 122 pcf
Unit weight (dry)	γ_{dry} = 108 pcf
Unit weight (sat, w=20%)	γ_{sat} = 130 pcf
Shear Strength (S) Cohesion (CD)	C = 0
Internal Friction Angle (Consolidated, Drained)	ϕ = 25°
Wall Friction Angle (concrete/soil interface)	δ = 17°
Allowable bearing capacity	= 2000 psf
Earth pressure coefficients:	k_a = 0.4
	k_o = 0.5
	k_p = 2.4

MKT Railroad near Meat Packing Plant (CH)

Above water table:	
Unit weight (moist, w=18%)	γ_m = 127 pcf
Unit weight (dry)	γ_{dry} = 108 pcf
Unit weight (sat, w=30%)	γ_{sat} = 132 pcf
Shear Strength (S) Cohesion (CD)	C = 0
Shear Strength (Q) Cohesion (UU)	C = 800 psf
Internal Friction Angle (Consolidated, Drained)	ϕ = 18°
Internal Friction Angle (Unconsolidated, Undrained)	ϕ = 0°
Wall Friction Angle (concrete/soil interface)	δ = 12°
Allowable bearing capacity	= 2500 psf
Earth pressure coefficients	k_a = 0.5
	k_p = 2.0
Below water table:	
Unit weight (sat., w=38%)	γ_{sat} = 110 pcf
Unit weight (dry)	γ_{dry} = 80 pcf

Shear Strength (S) Cohesion(CD)	C = 0
Shear Strength (Q) Cohesion (UU)	C = 800 psf
Internal Friction Angle (Consolidated Drained)	ϕ = 18°
Internal Friction Angle (Unconsolidated Undrained)	ϕ = 0°
Wall Friction Angle (concrete/soil interface)	δ = 12°
Allowable bearing capacity	= 1500 psf
Earth pressure coefficients	k_a = 0.8
	k_p = 2.0

Soil Design Parameters - Lamar Levee

MKT Railroad (CH, limestone at about 15 ft)

Unit weight (moist, w=23%)	γ_m = 118 pcf
Unit weight (dry)	γ_{dry} = 94 pcf
Unit weight (sat, w=30%)	γ_{sat} = 122 pcf
Shear Strength (S) Cohesion (CD)	C = 0
Shear Strength (Q) Cohesion (UU)	C = 800 psf
Internal Friction Angle (Consolidated Drained)	ϕ = 18°
Internal Friction Angle (Unconsolidated Undrained)	ϕ = 0°
Wall Friction Angle (concrete/soil interface)	δ = 12°
Allowable bearing capacity	= 2000 psf
Earth pressure coefficients	k_a = 0.5
	k_o = 0.5
	k_p = 2.0

SP Railroad (SC)

Unit weight (moist, w=13%)	γ_m = 128 pcf
Unit weight (dry)	γ_{dry} = 113 pcf
Unit weight (sat, w=18%)	γ_{sat} = 135 pcf
Shear Strength (S) Cohesion(CD)	C = 0
Internal Friction Angle (Consolidated Drained)	ϕ = 28°
Wall Friction Angle (concrete/soil interface)	δ = 19°
Allowable bearing capacity	= 2500 psf
Earth pressure coefficients	k_a = 0.4
	k_o = 0.5
	k_p = 2.6

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SYM. | D.C. NO. | ACTION | DATE | DESCRIPTION OF REVISION

ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS

DESIGNED BY: JEE COMER
DRAWN BY: ARLENE HUGHES
REVIEWED BY: JEE COMER

DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT

INDEX OF DRAWINGS

SUBMITTED BY:
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION

SOL. NO. | DATED:
CONTR. NO.
DRAWING NUMBER | SHEET NO. 001 OF 59 | SEQUENCE NO. 1

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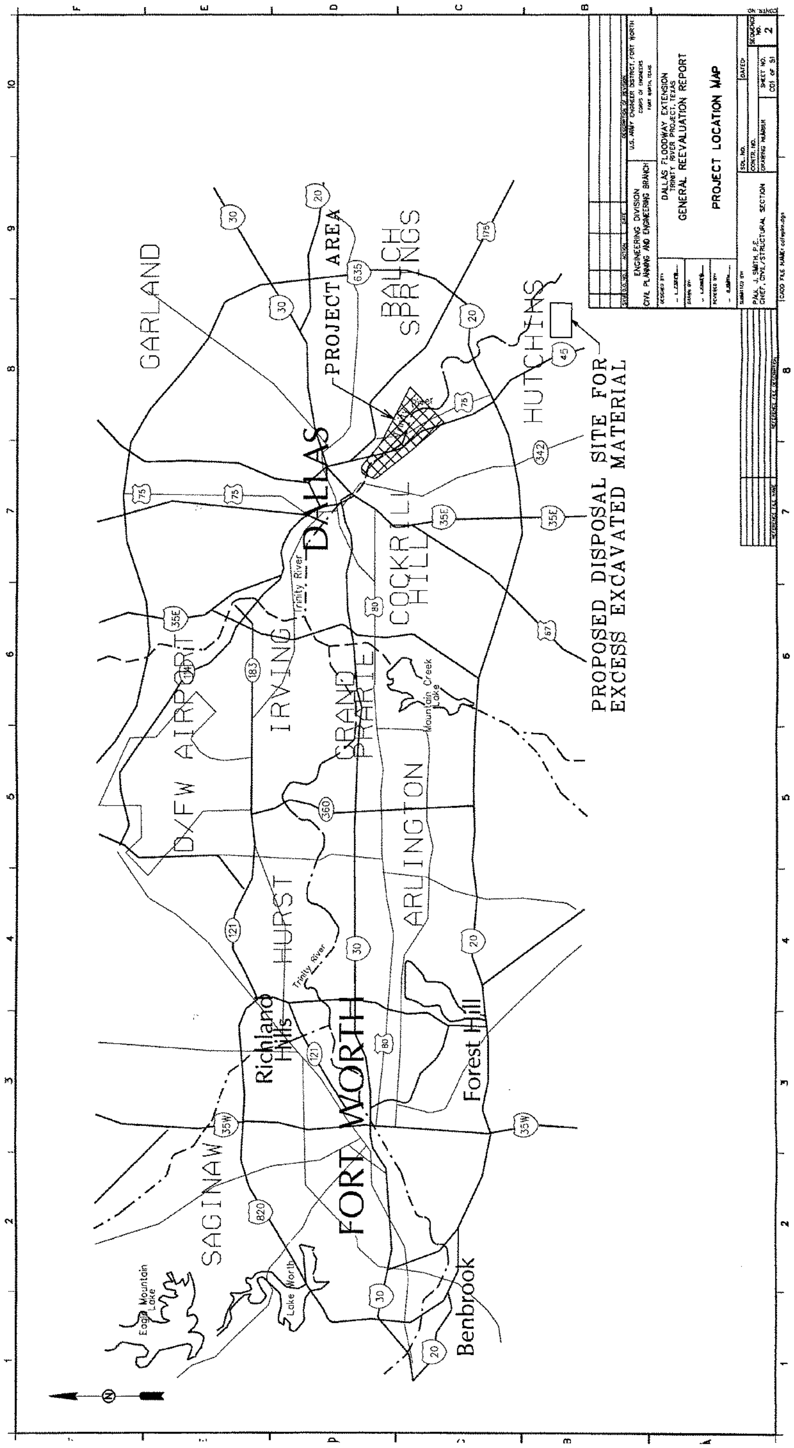
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D/FW AIRPORT
ARLINGTON
HURST
FORT WORTH
SAGINAW
Richland Hills
Forest Hill
Benbrook
Lake Worth
Eagle Mountain Lake
Mountain Creek Lake
Trinity River
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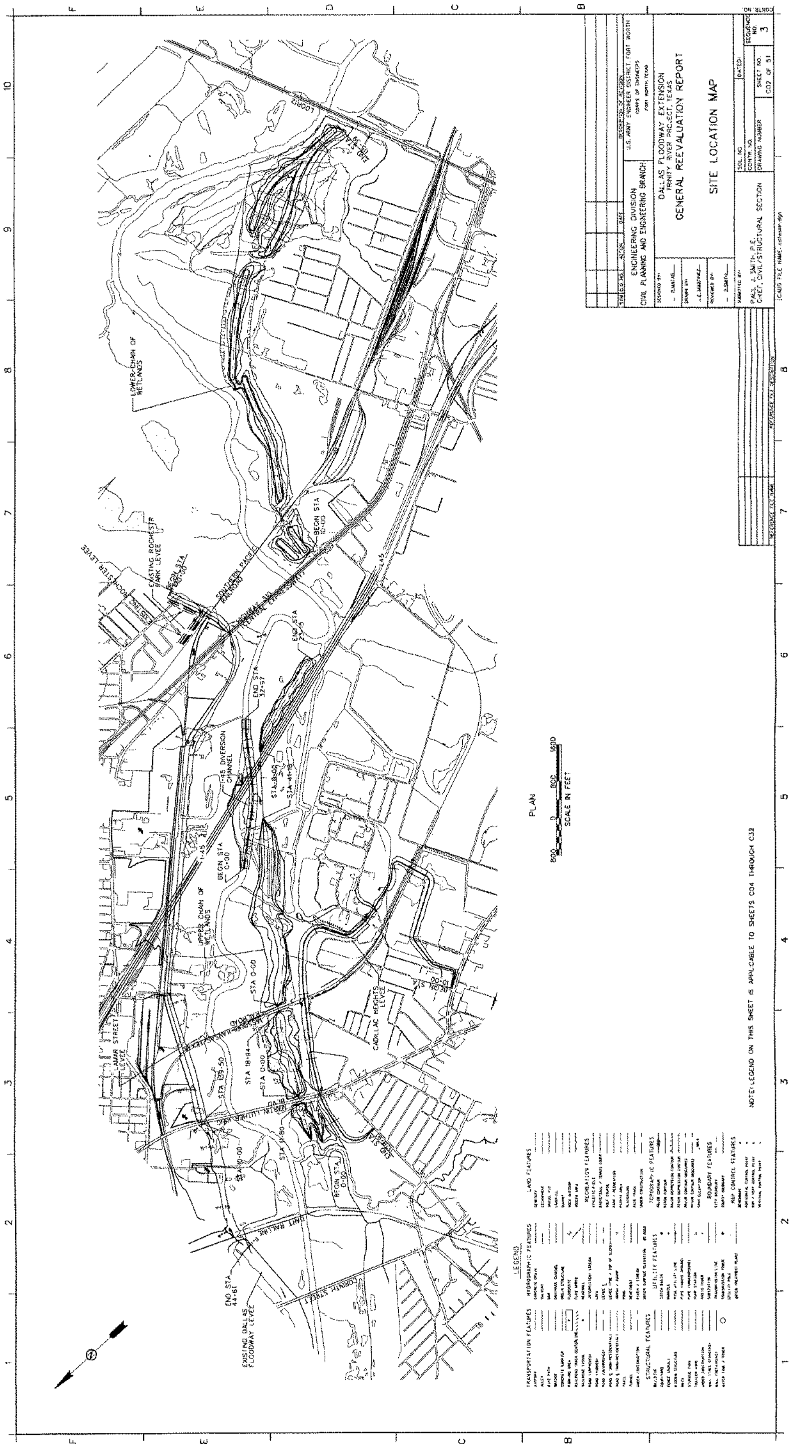
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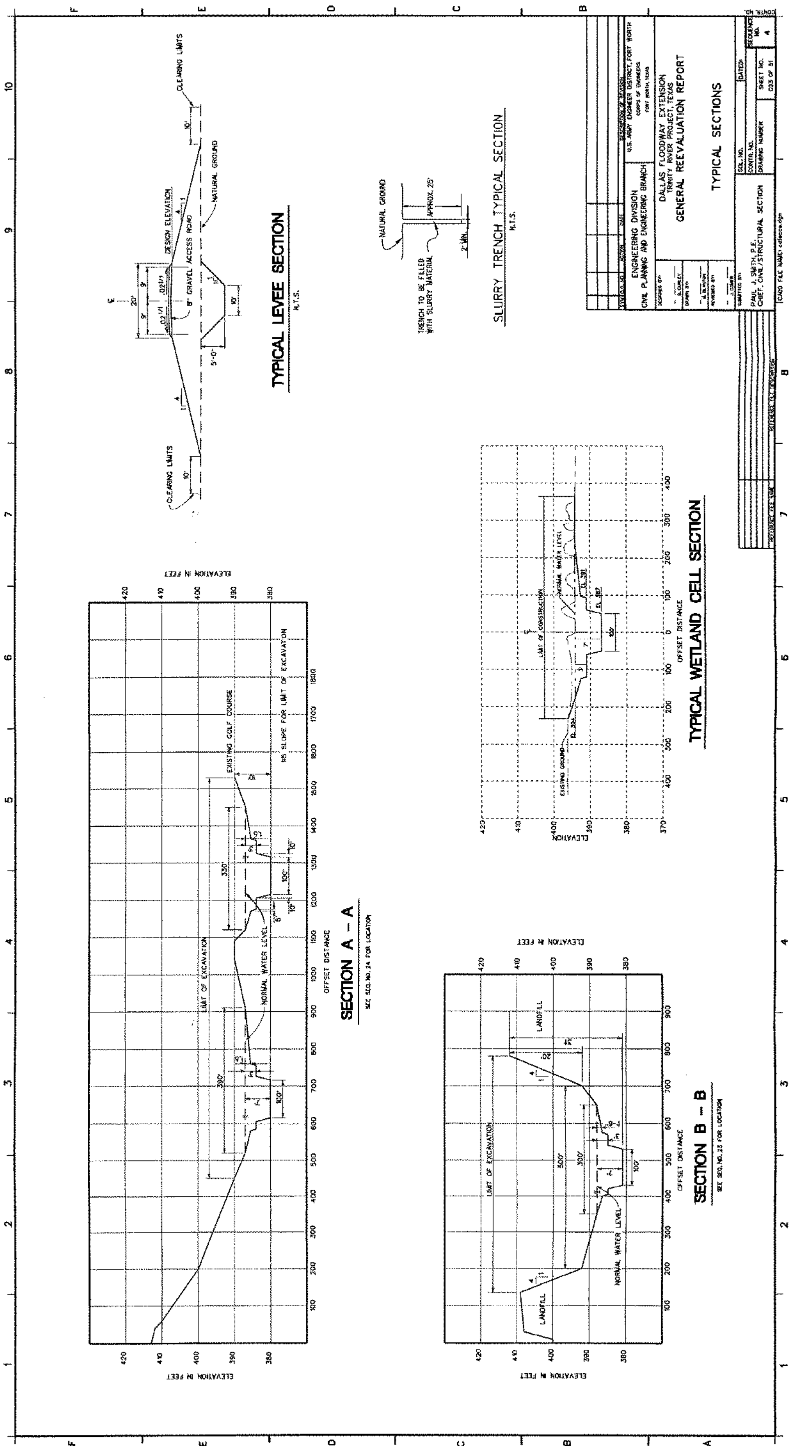
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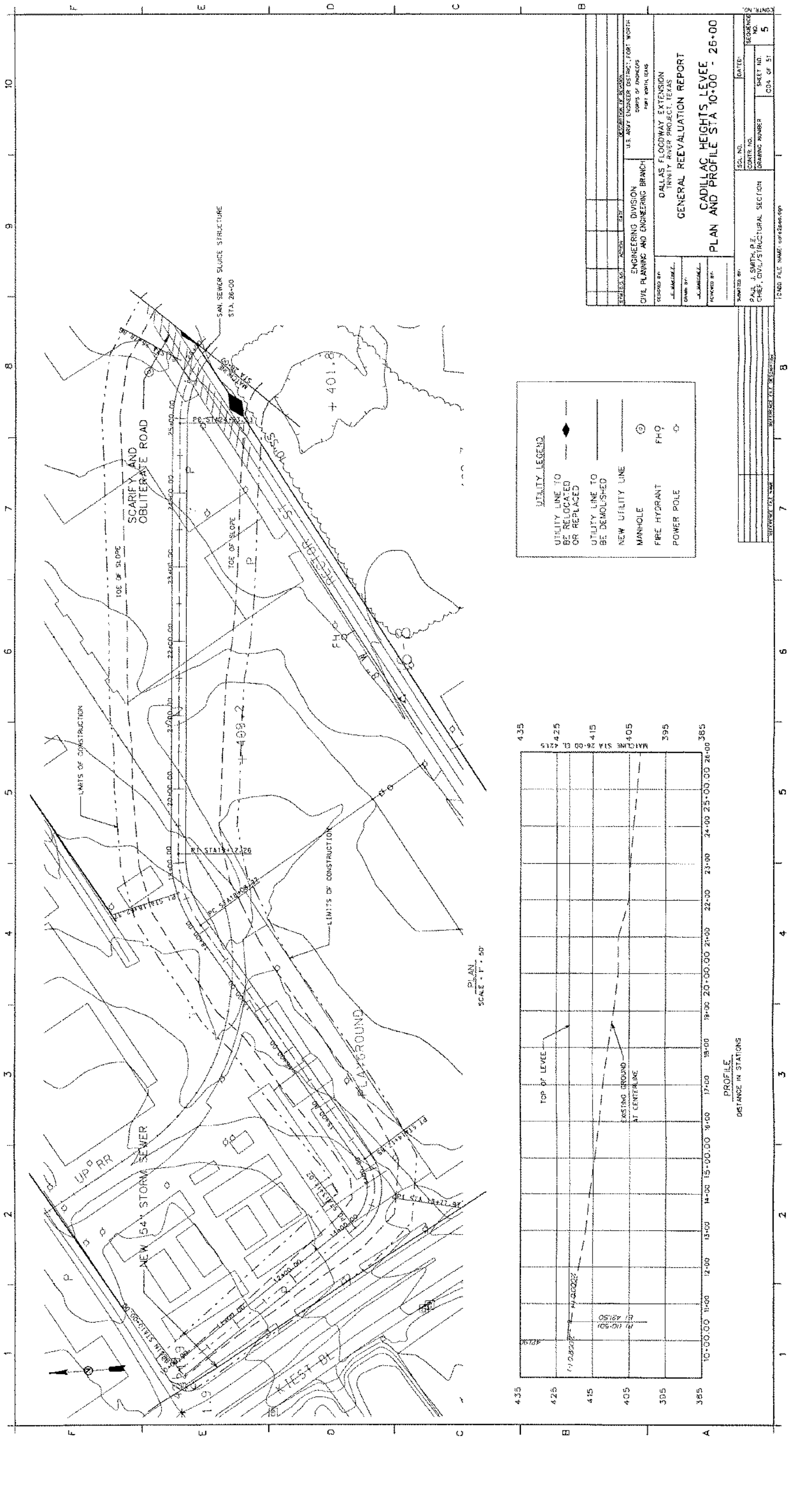
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UTILITY LINE TO BE DEMOLISHED
NEW UTILITY LINE
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FIRE HYDRANT
POWER POLE
SCARIFY AND OBLITERATE ROAD
NEW 54" STORM SEWER
UP RR
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TOP OF LEVEE
EXISTING GROUND AT CENTERLINE
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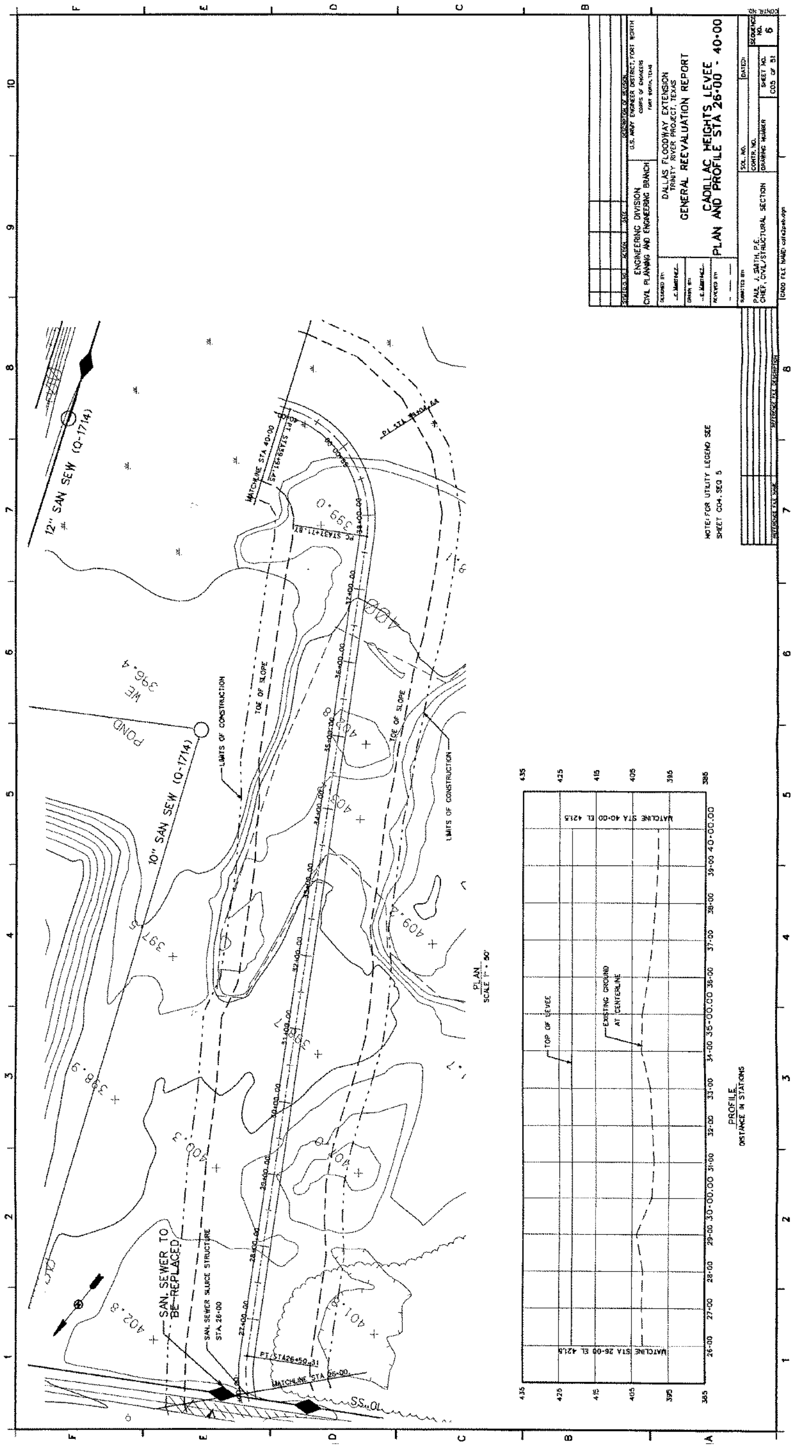
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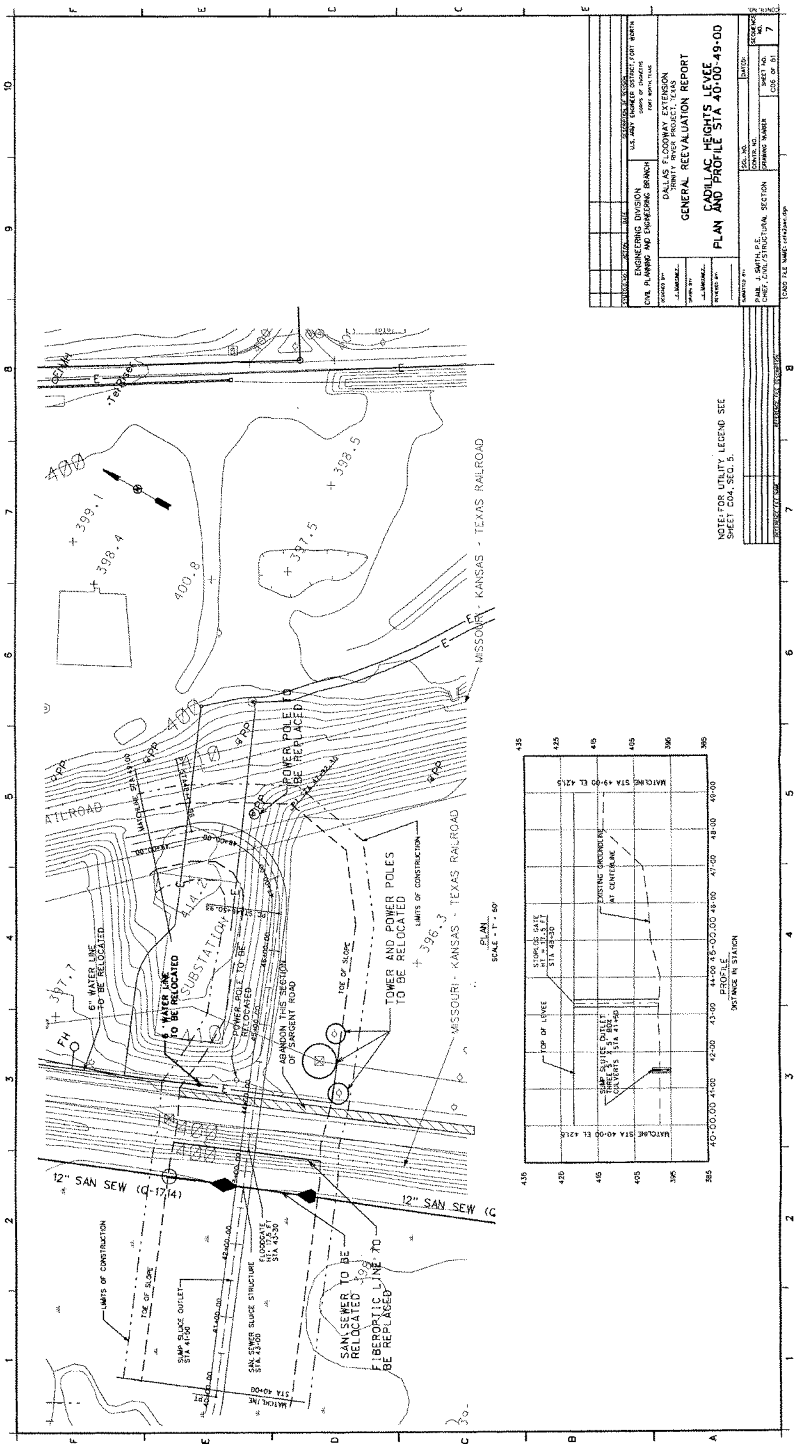
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POWER POLE TO BE REPLACED
6" WATER LINE TO BE RELOCATED
SAN. SEWER TO BE RELOCATED
FIBEROPTIC LINE TO BE REPLACED
12" SAN SEW
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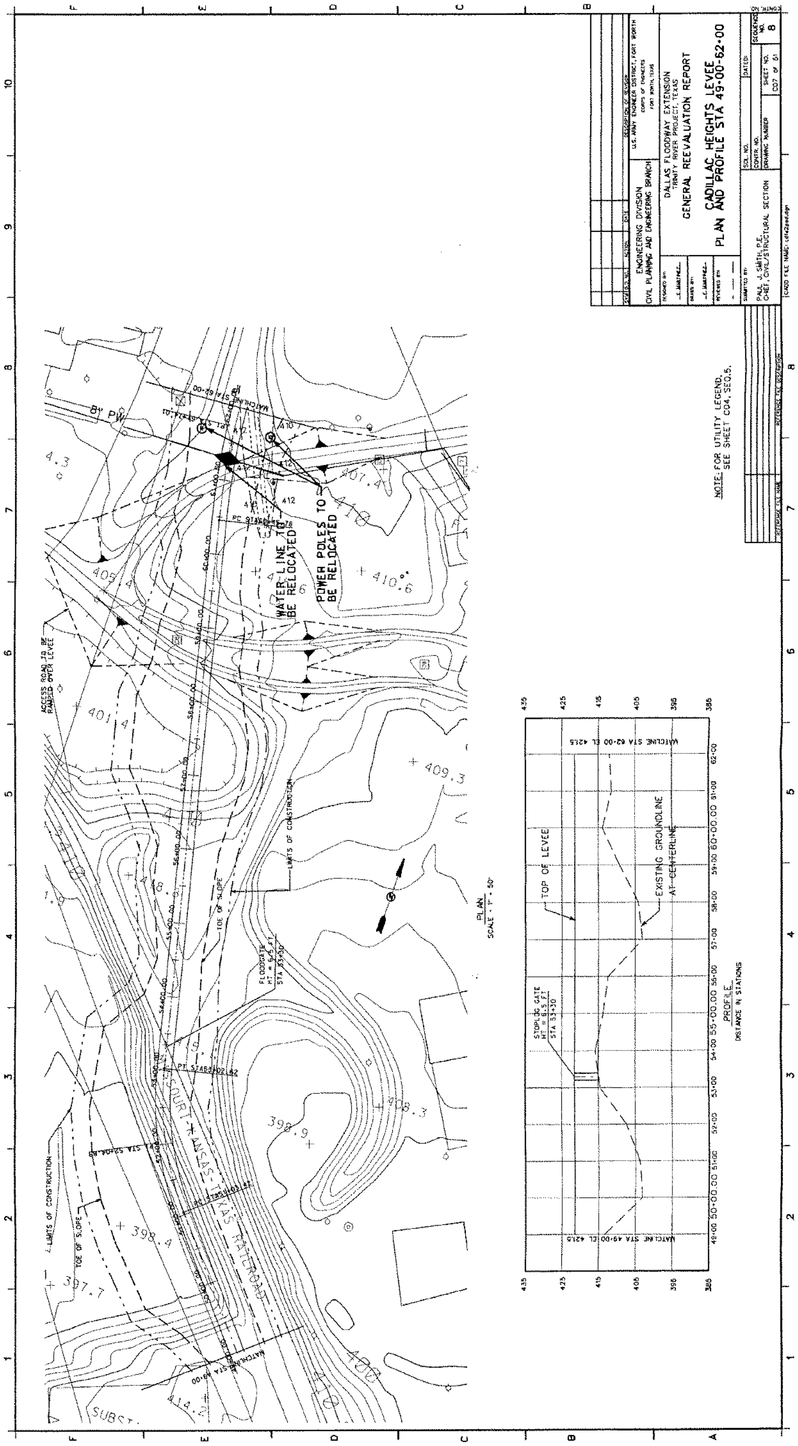
PROFILE
DISTANCE IN STATION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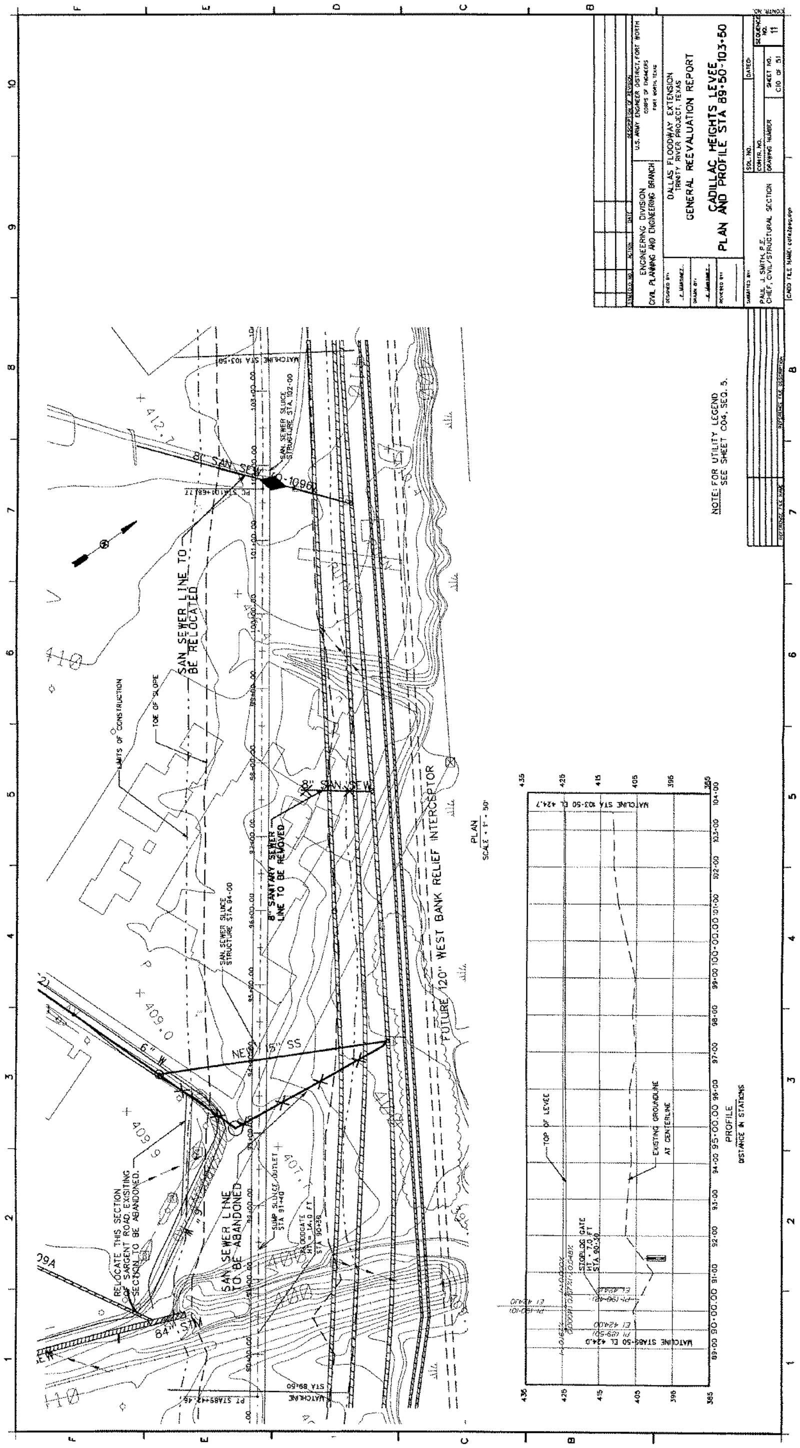

CADILLAC HEIGHTS LEVEE
PLAN AND PROFILE STA 89+50-103+50
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NOTE: FOR UTILITY LEGEND SEE SHEET C04, SEQ. 5.
FUTURE 120" WEST BANK RELIEF INTERCEPTOR
SAN SEWER LINE TO BE RELOCATED
SAN SEWER LINE TO BE ABANDONED
PLAN
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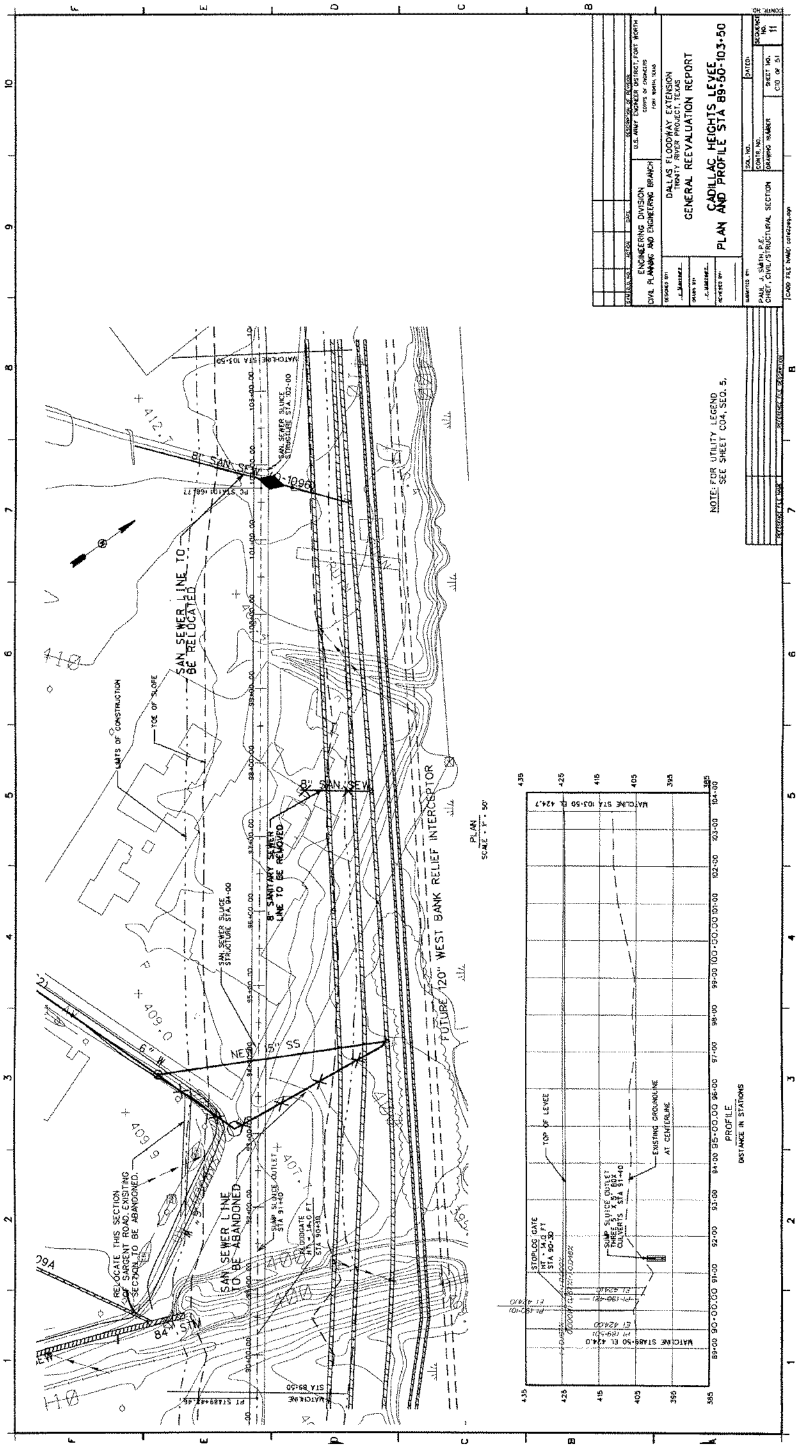
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PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
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SEQUENCE NO.
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SAN. SEWER LINE TO BE ABANDONED
8" SANITARY SEWER LINE TO BE REMOVED
FUTURE 120" WEST BANK RELIEF INTERCEPTOR
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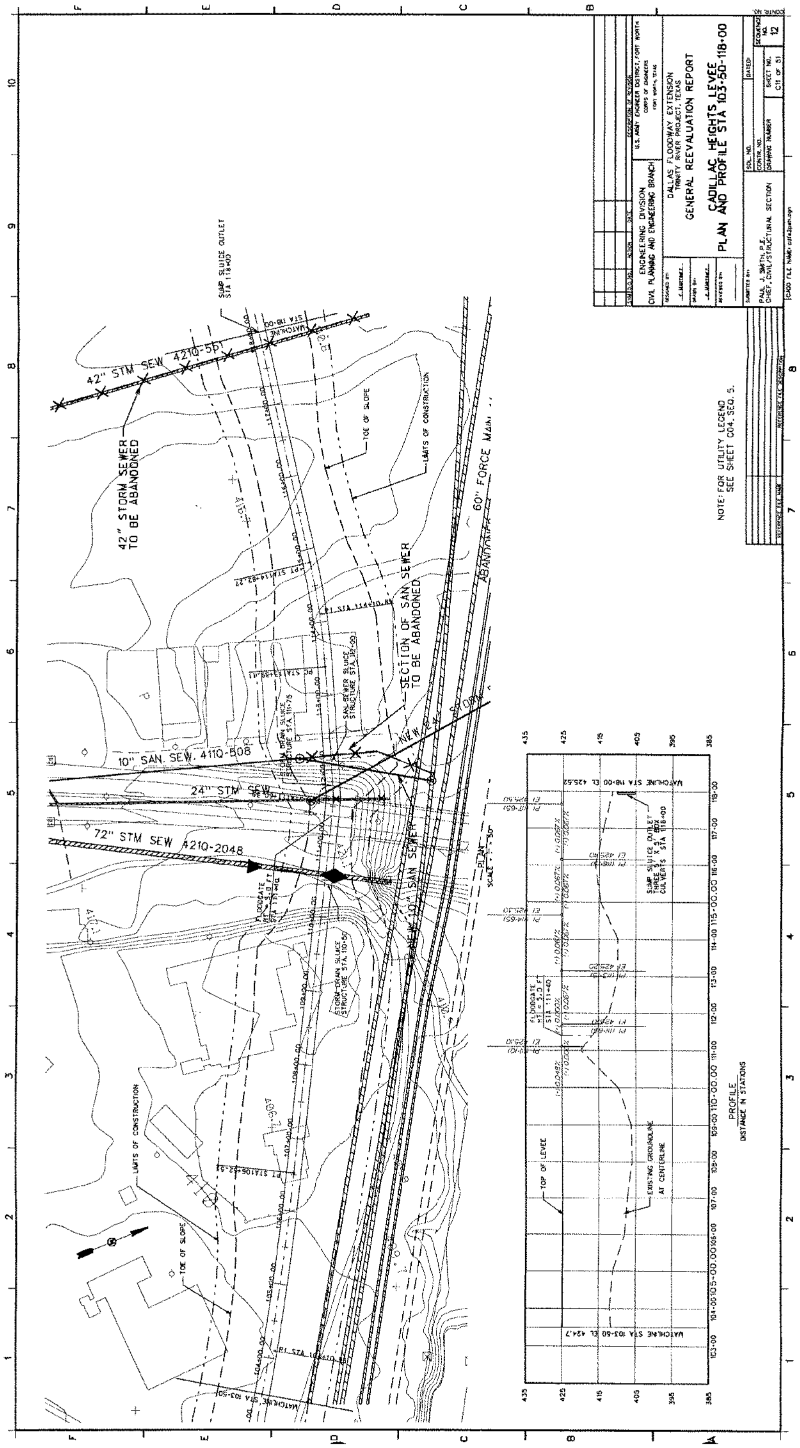
EXISTING GROUNDLINE AT CENTERLINE



CADILLAC HEIGHTS LEVEE
PLAN AND PROFILE STA 103-50-118+00
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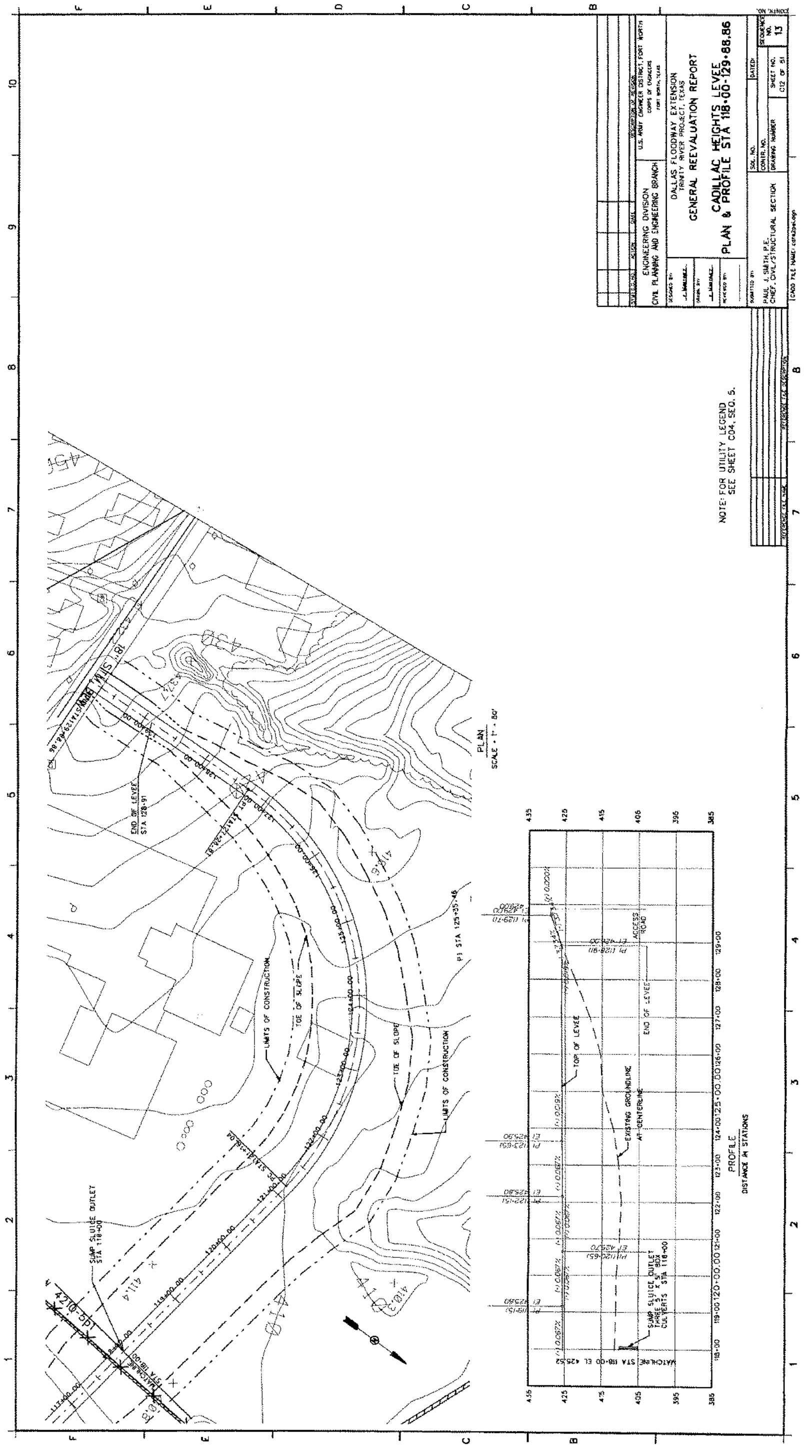
SECTION OF SAN SEWER TO BE ABANDONED
60" FORCE MAIN
72" STM SEW 4210-2048
10" SAN. SEW. 4110-508
24" STM SEW
NOTE: FOR UTILITY LEGEND SEE SHEET C04, SEQ. 5.
PROFILE
DISTANCE IN STATIONS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CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
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CADILLAC HEIGHTS LEVEE
PLAN & PROFILE STA 118+00-129+88.86
NOTE: FOR UTILITY LEGEND
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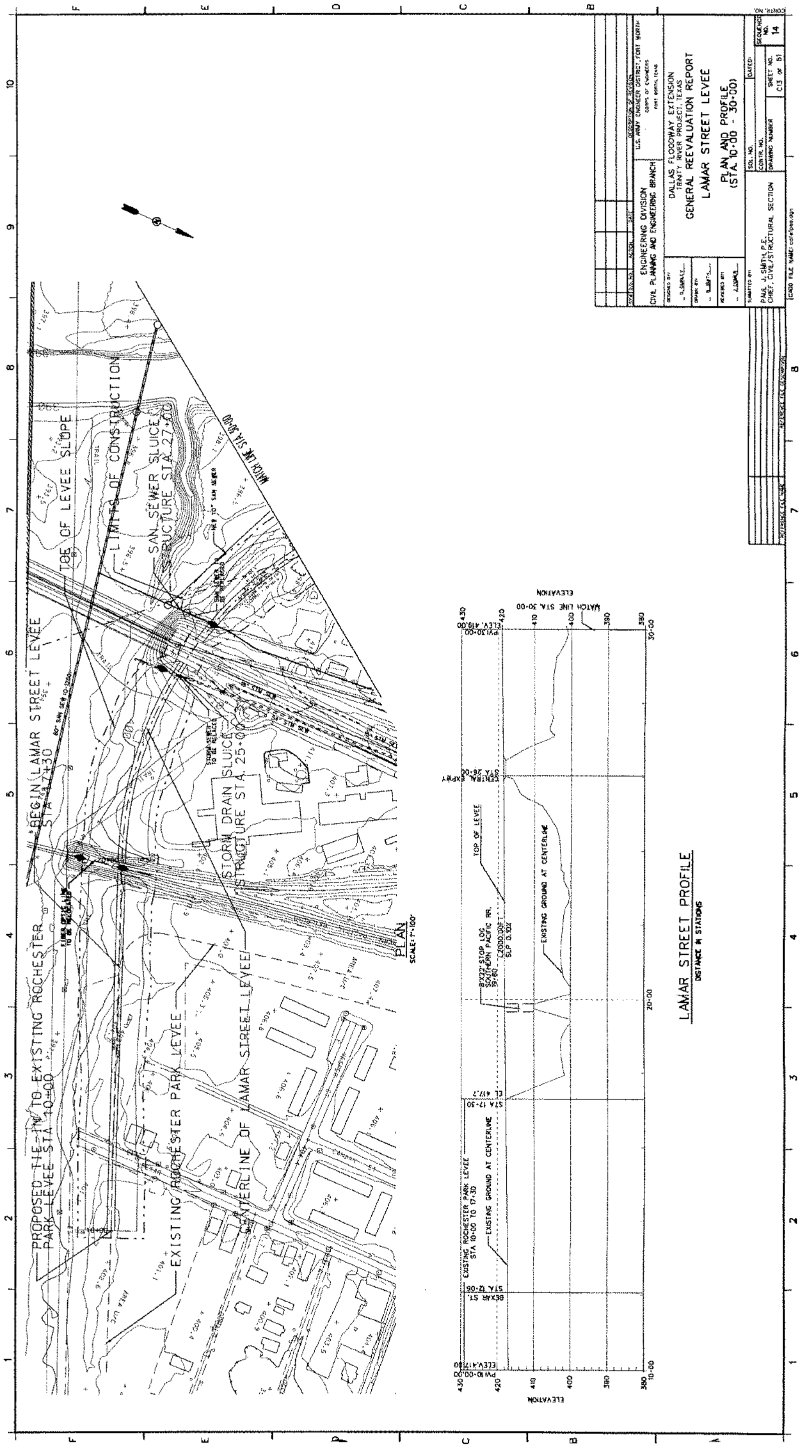
LIMITS OF CONSTRUCTION
TOE OF SLOPE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PLAN AND PROFILE
(STA 10+00 - 30+00)
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
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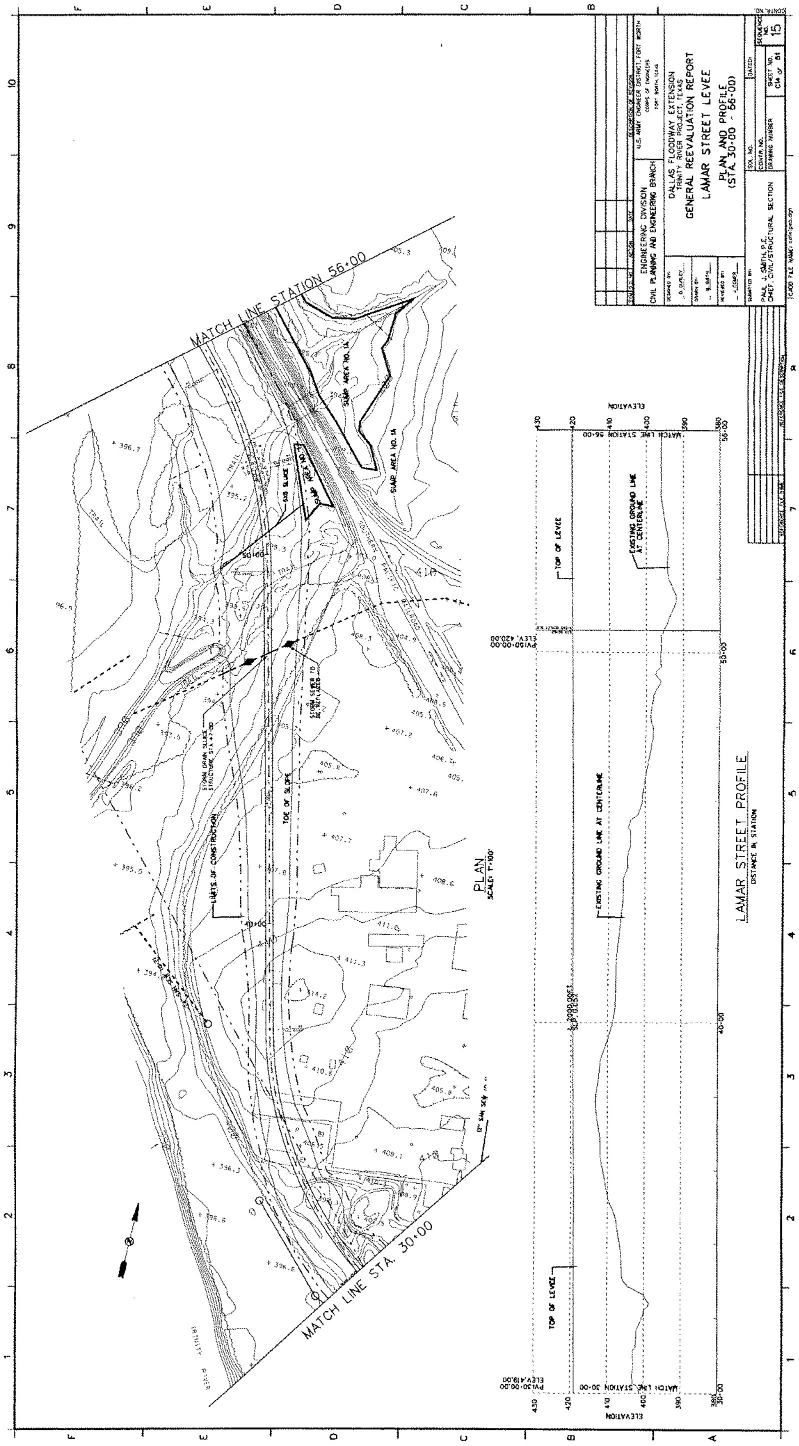
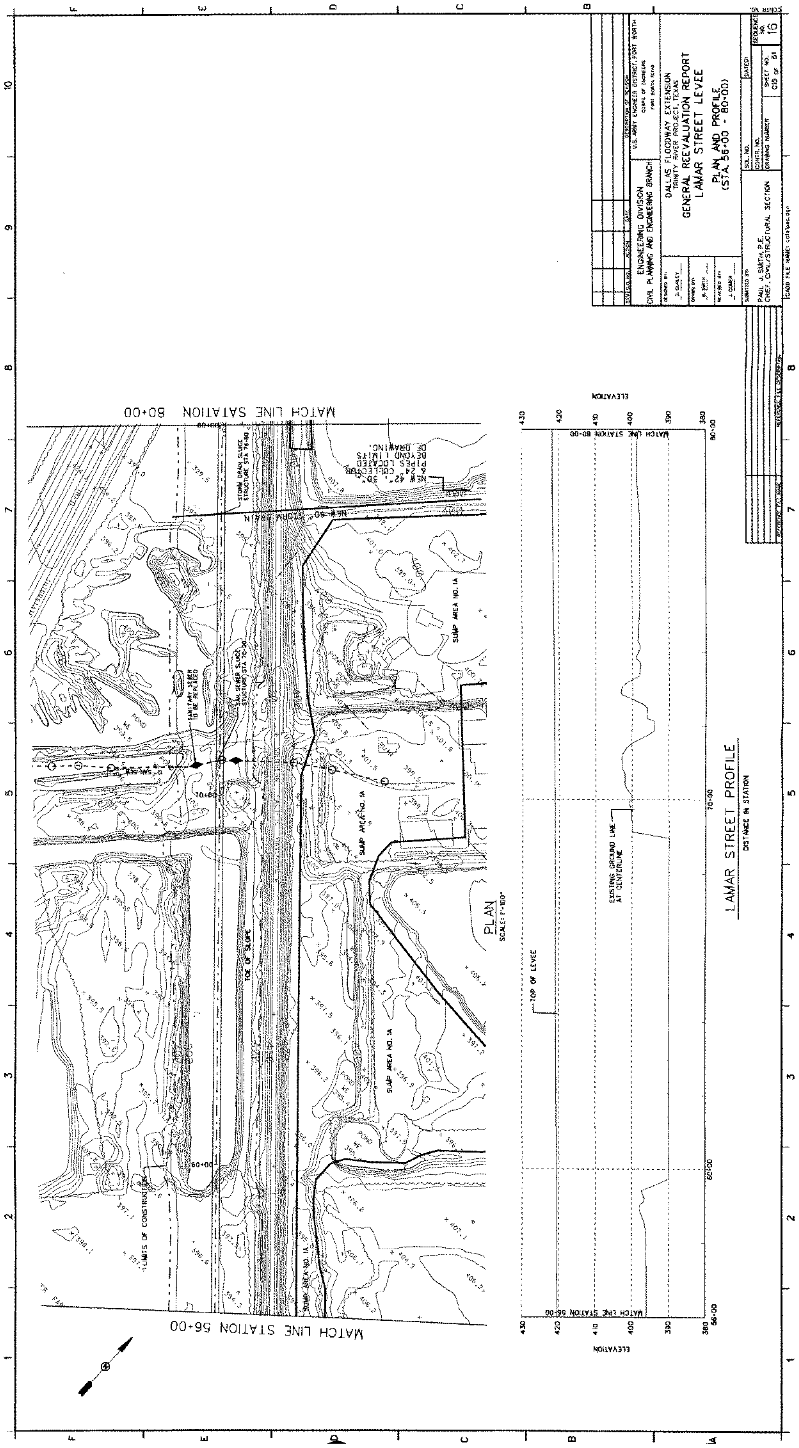
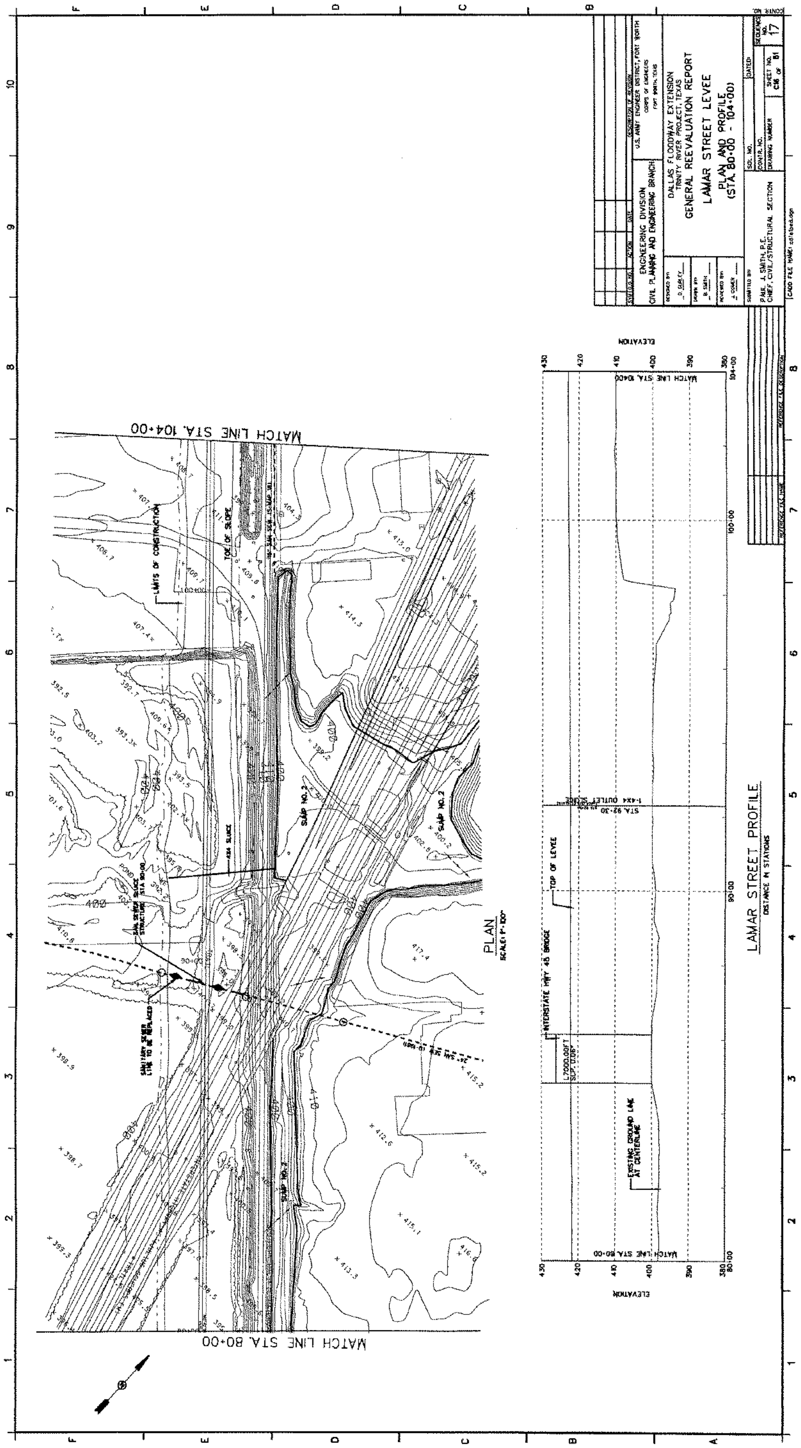
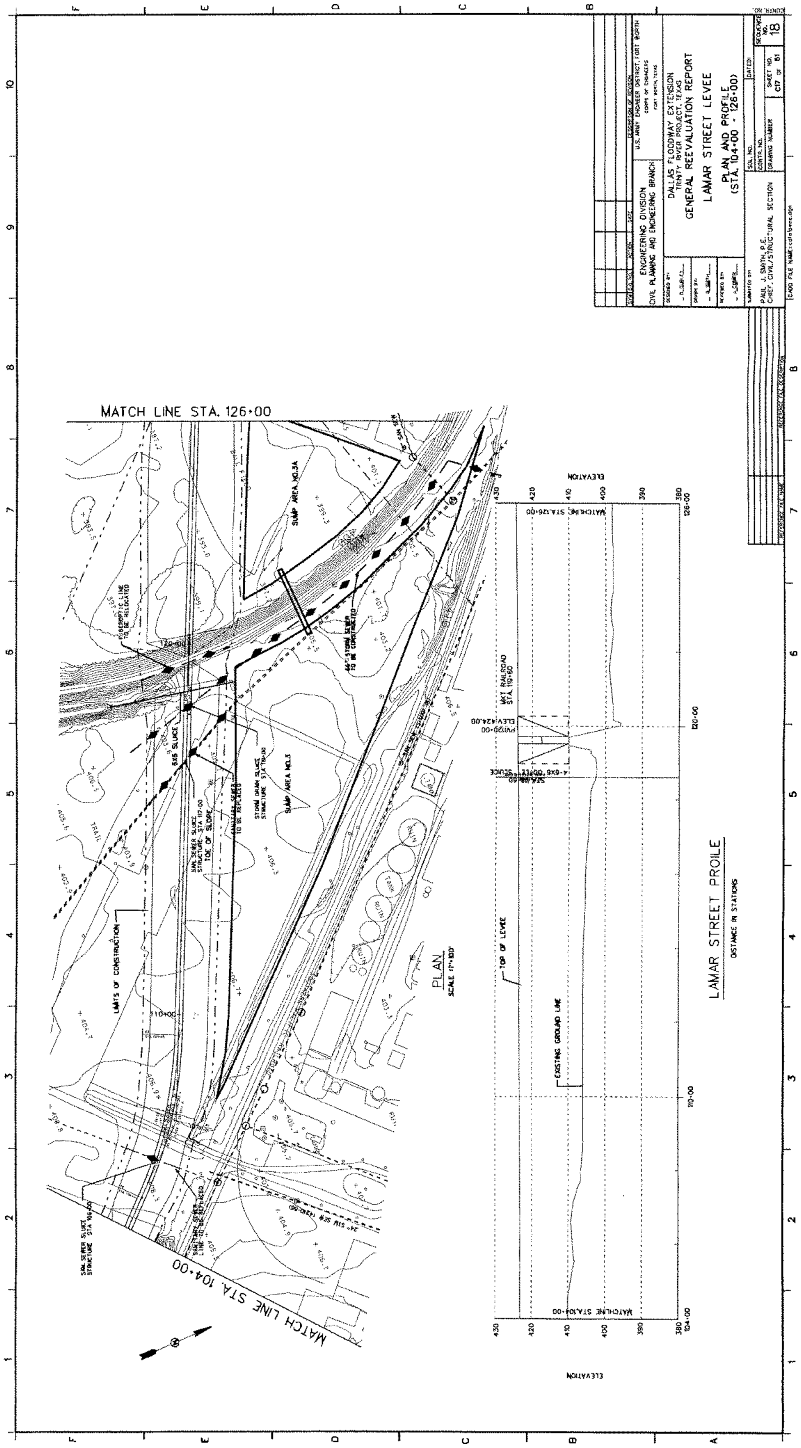
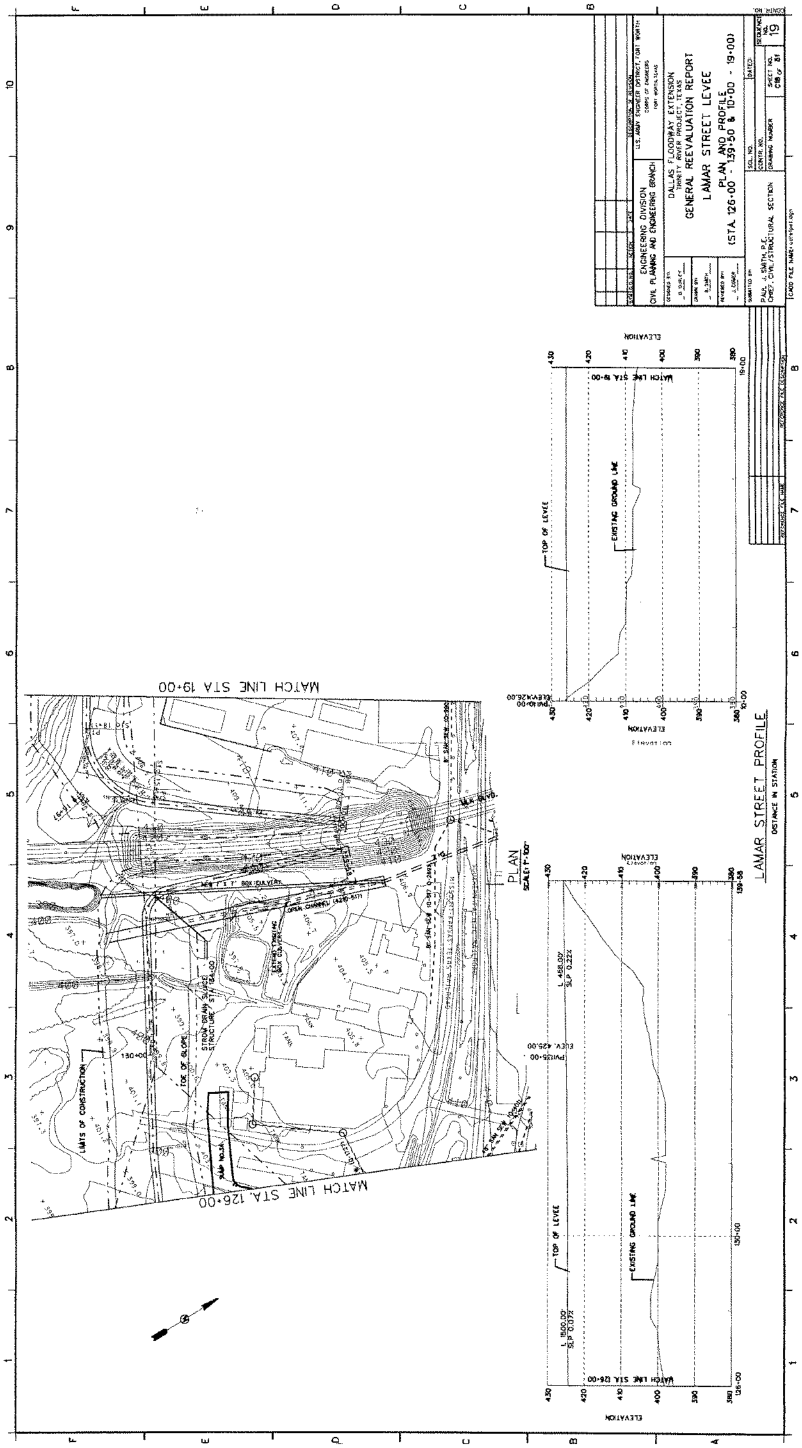
EXISTING GROUND AT CENTERLINE
ELEVATION

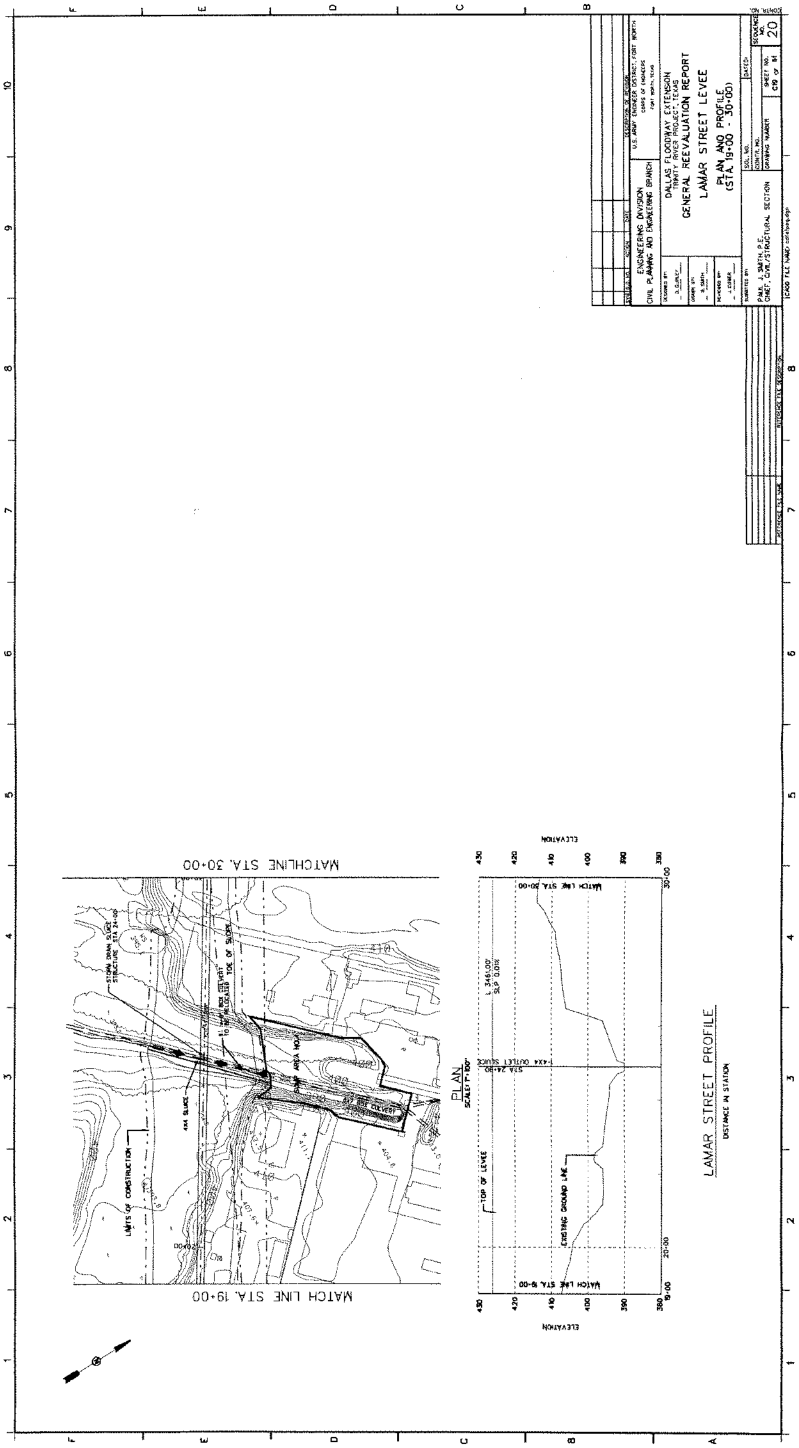

ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA. 30+00 - 56+00)
MATCH LINE STATION 56+00
MATCH LINE STA. 30+00
PLAN
LAMAR STREET PROFILE
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
ELEVATION

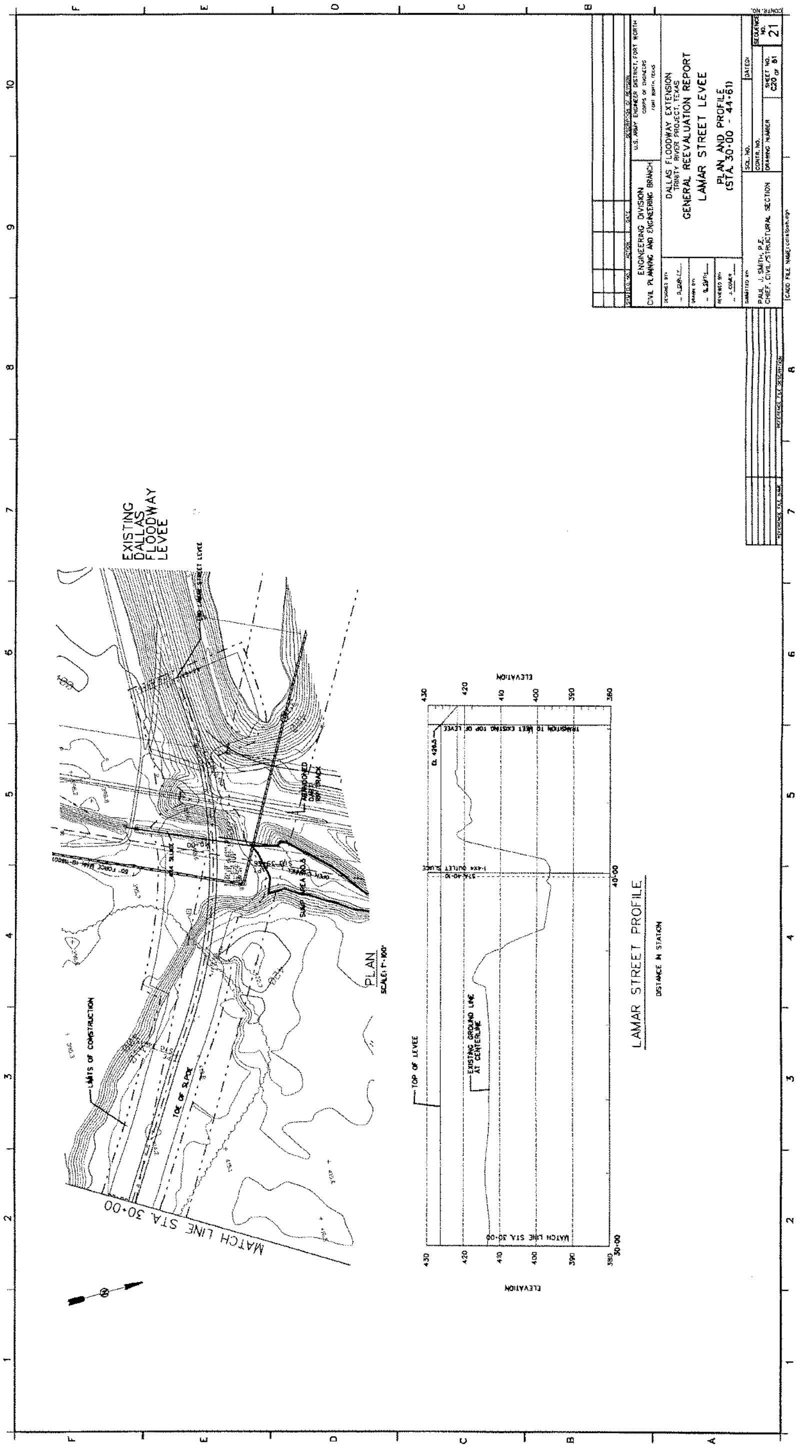

MATCH LINE STATION 80+00
MATCH LINE STATION 56+00
PLAN
TOE OF SLOPE
SUMP AREA NO. 1A
LIMITS OF CONSTRUCTION
ELEVATION
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
LAMAR STREET PROFILE
DISTANCE IN STATION
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA. 56+00 - 80+00)

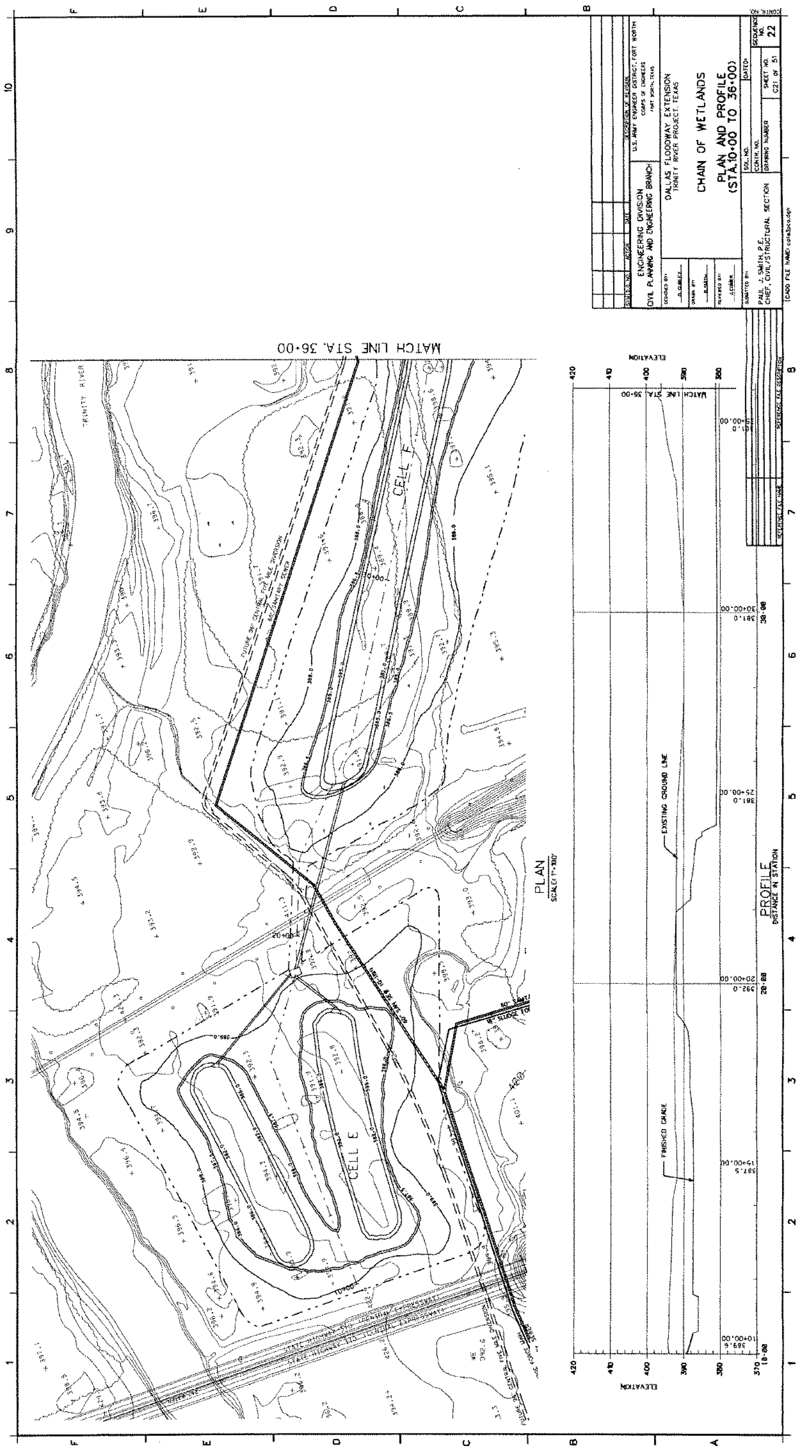

DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA 80+00 - 104+00)
MATCH LINE STA. 104+00
MATCH LINE STA. 80+00
PLAN
LAMAR STREET PROFILE

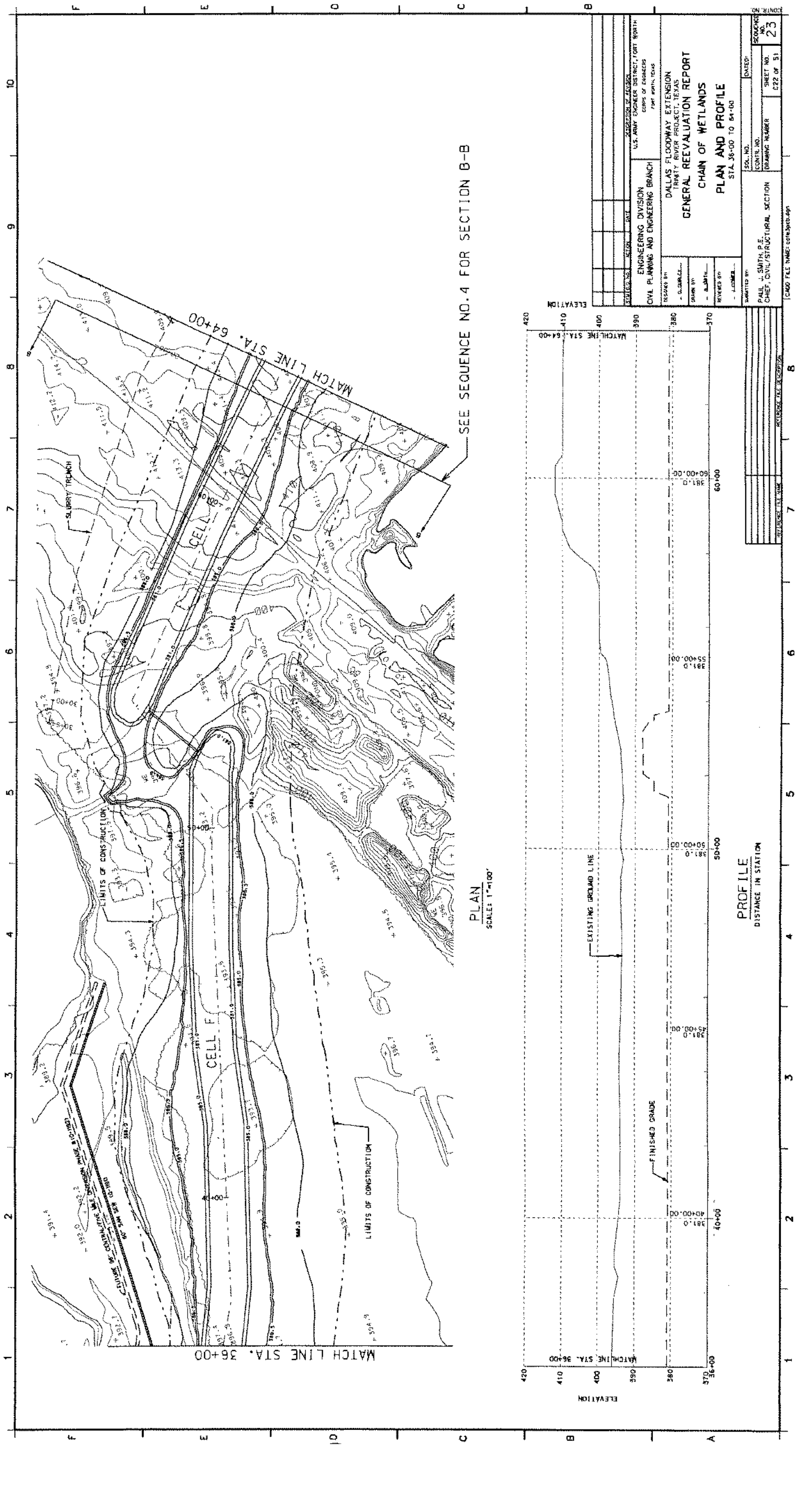

MATCH LINE STA. 126+00
MATCH LINE STA. 104+00
PLAN
LAMAR STREET PROILE
DISTANCE IN STATIONS
TOP OF LEVEE
EXISTING GROUND LINE
LIMITS OF CONSTRUCTION
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA. 104+00 - 126+00)


DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA. 126+00 - 139+50 & 10+00 - 19+00)
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
MATCH LINE STA 19+00
MATCH LINE STA. 126+00
PLAN
LIMITS OF CONSTRUCTION
TOE OF SLOPE
TOP OF LEVEE
EXISTING GROUND LINE
ELEVATION
LAMAR STREET PROFILE
DISTANCE IN STATION

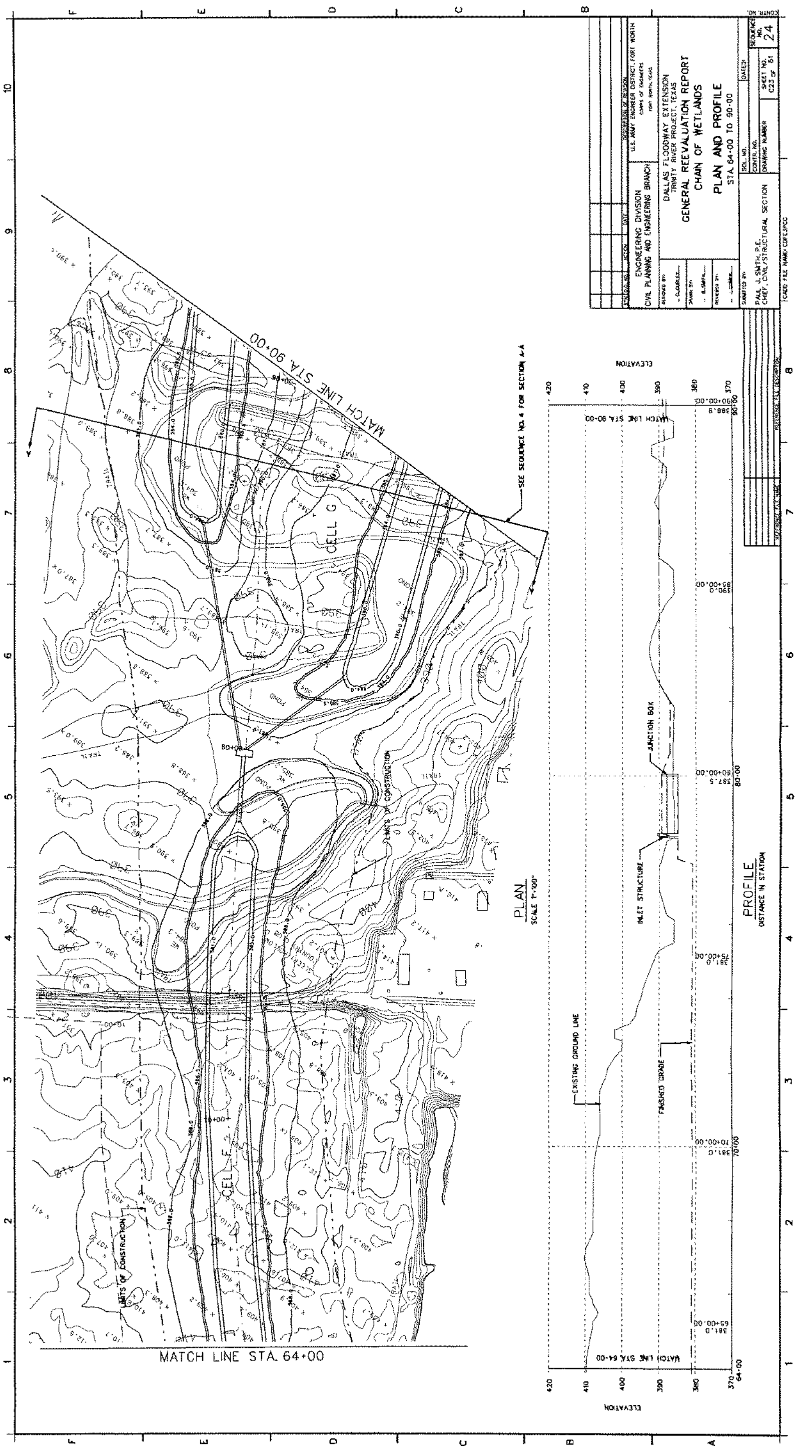

DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA 19+00 - 30+00)
MATCHLINE STA. 30+00
MATCH LINE STA. 19+00
PLAN
LAMAR STREET PROFILE

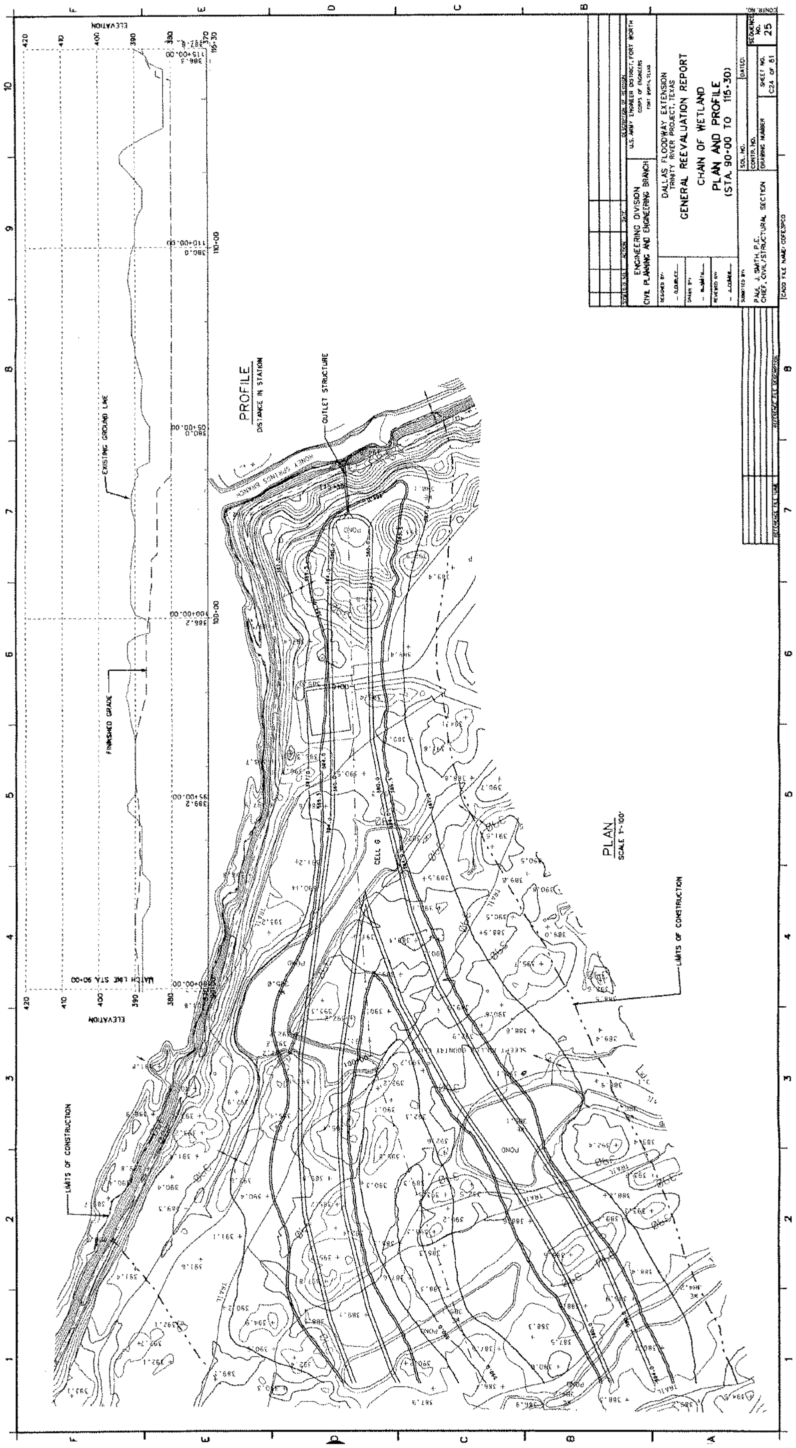

EXISTING DALLAS FLOODWAY LEVEE
LIMITS OF CONSTRUCTION
TOE OF SLOPE
MATCH LINE STA. 30+00
PLAN
SCALE: 1"=100'
TOP OF LEVEE
EXISTING GROUND LINE AT CENTERLINE
LAMAR STREET PROFILE
DISTANCE IN STATION
ELEVATION
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
PLAN AND PROFILE
(STA. 30+00 - 44+61)
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
21

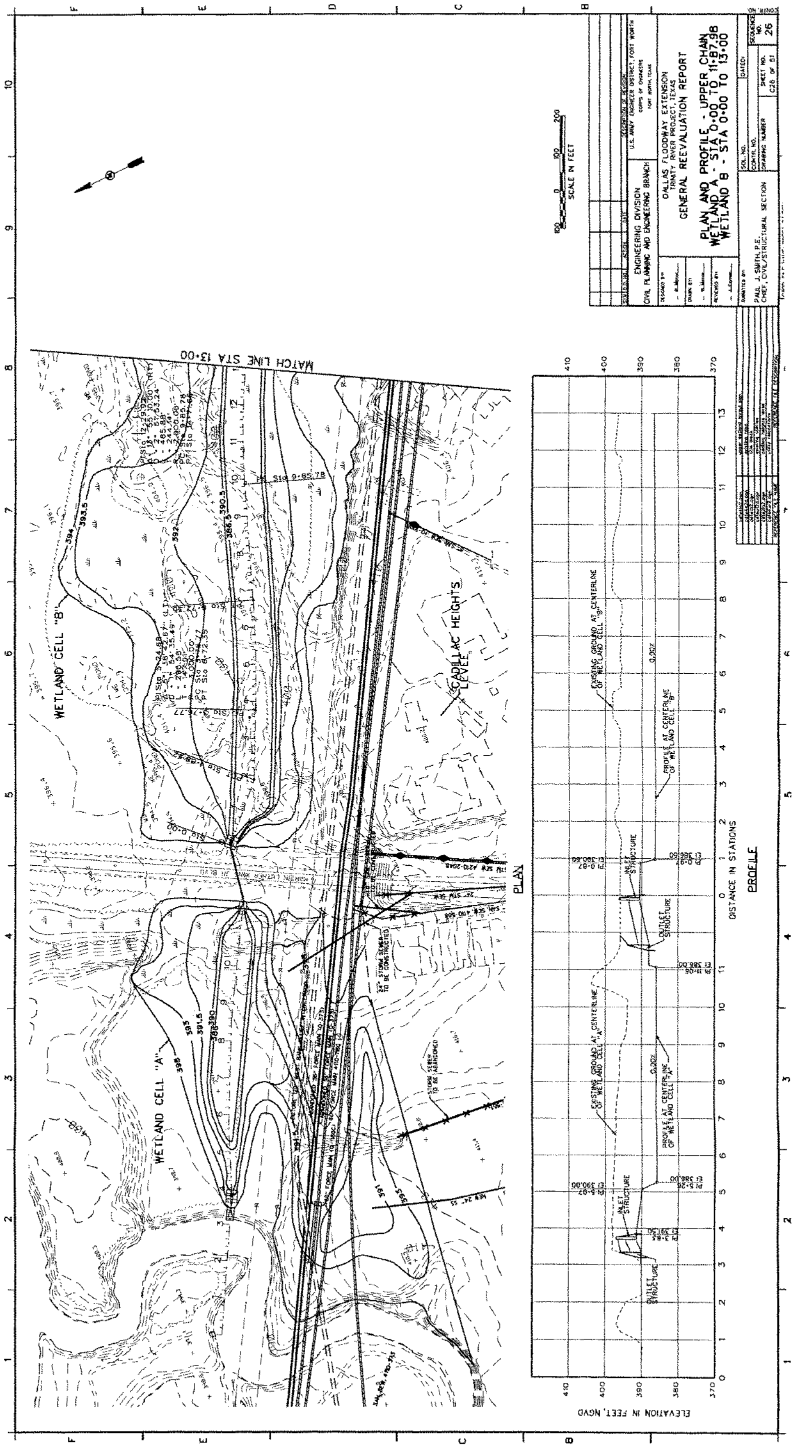

ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
CHAIN OF WETLANDS
PLAN AND PROFILE
(STA.10+00 TO 36+00)
MATCH LINE STA. 36+00
CELL E
CELL F
TRINITY RIVER
PLAN
PROFILE
EXISTING GROUND LINE
FINISHED GRADE
ELEVATION

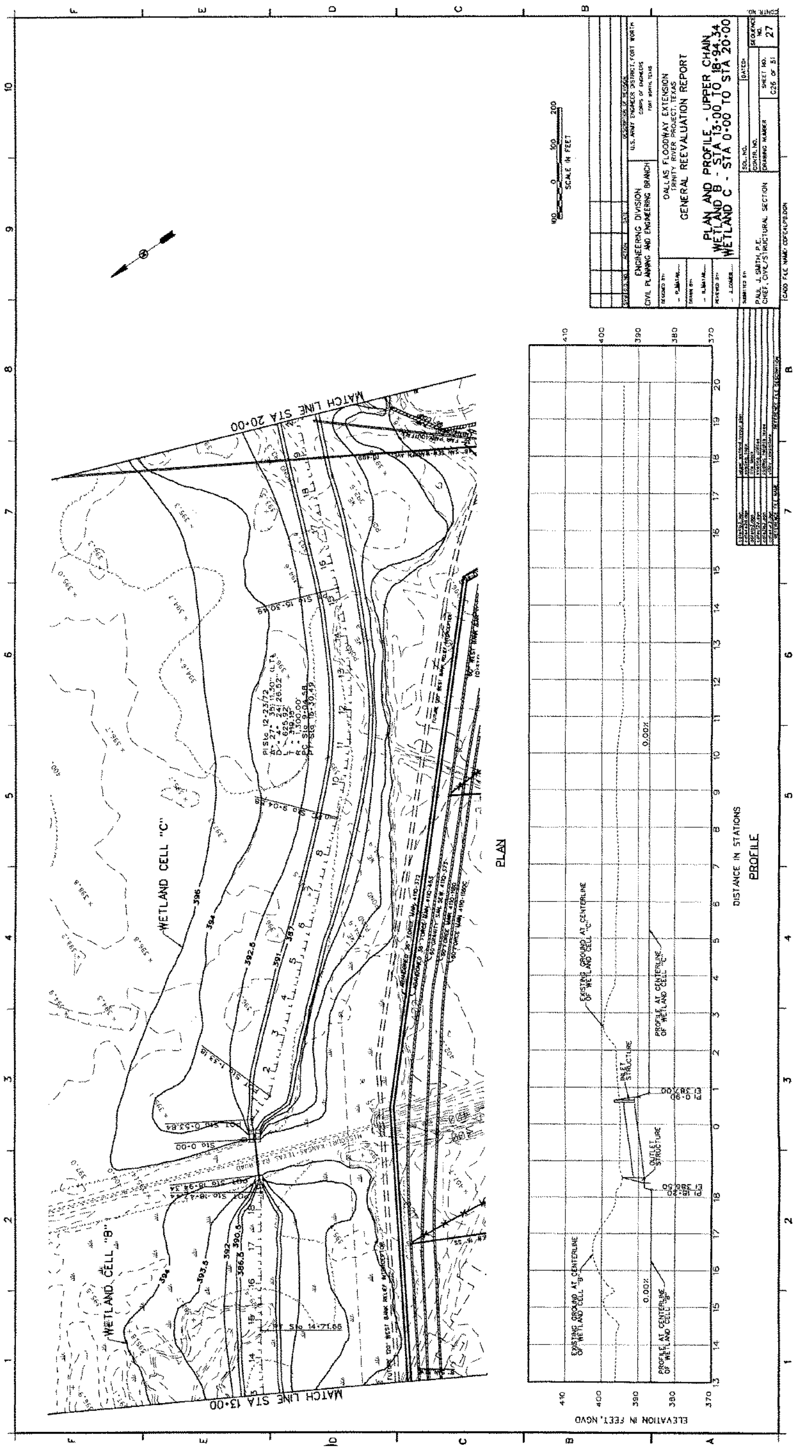

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CHAIN OF WETLANDS
PLAN AND PROFILE
STA. 36+00 TO 64+00
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
SEQUENCE NO. 23
SHEET NO. C22 OF 51
SEE SEQUENCE NO.4 FOR SECTION B-B
MATCH LINE STA. 64+00
MATCH LINE STA. 36+00
SLURRY TRENCH
CELL B
CELL F
LIMITS OF CONSTRUCTION
PLAN
SCALE: 1"=100'
EXISTING GROUND LINE
FINISHED GRADE
ELEVATION
PROFILE
DISTANCE IN STATION

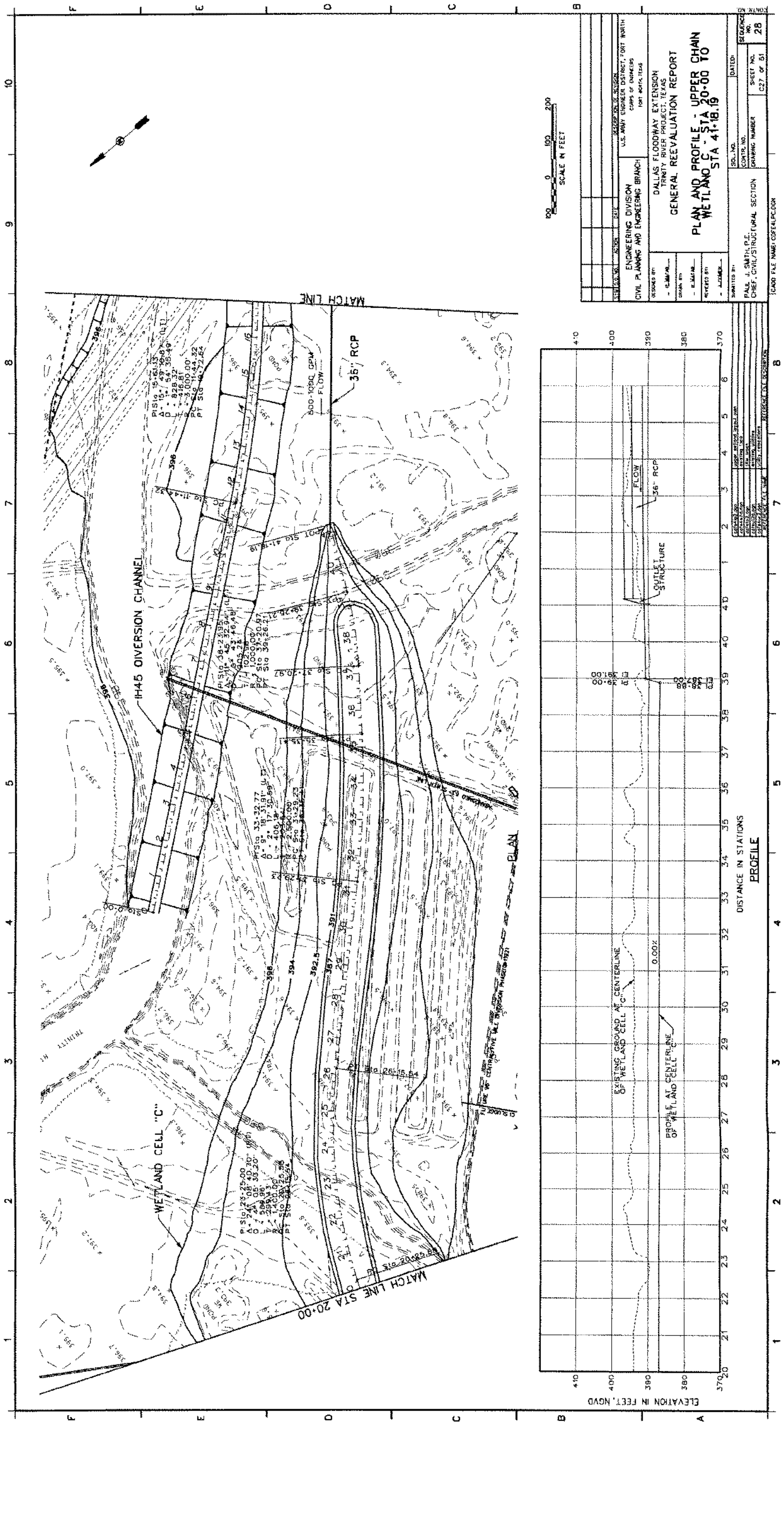
 4/30/2009

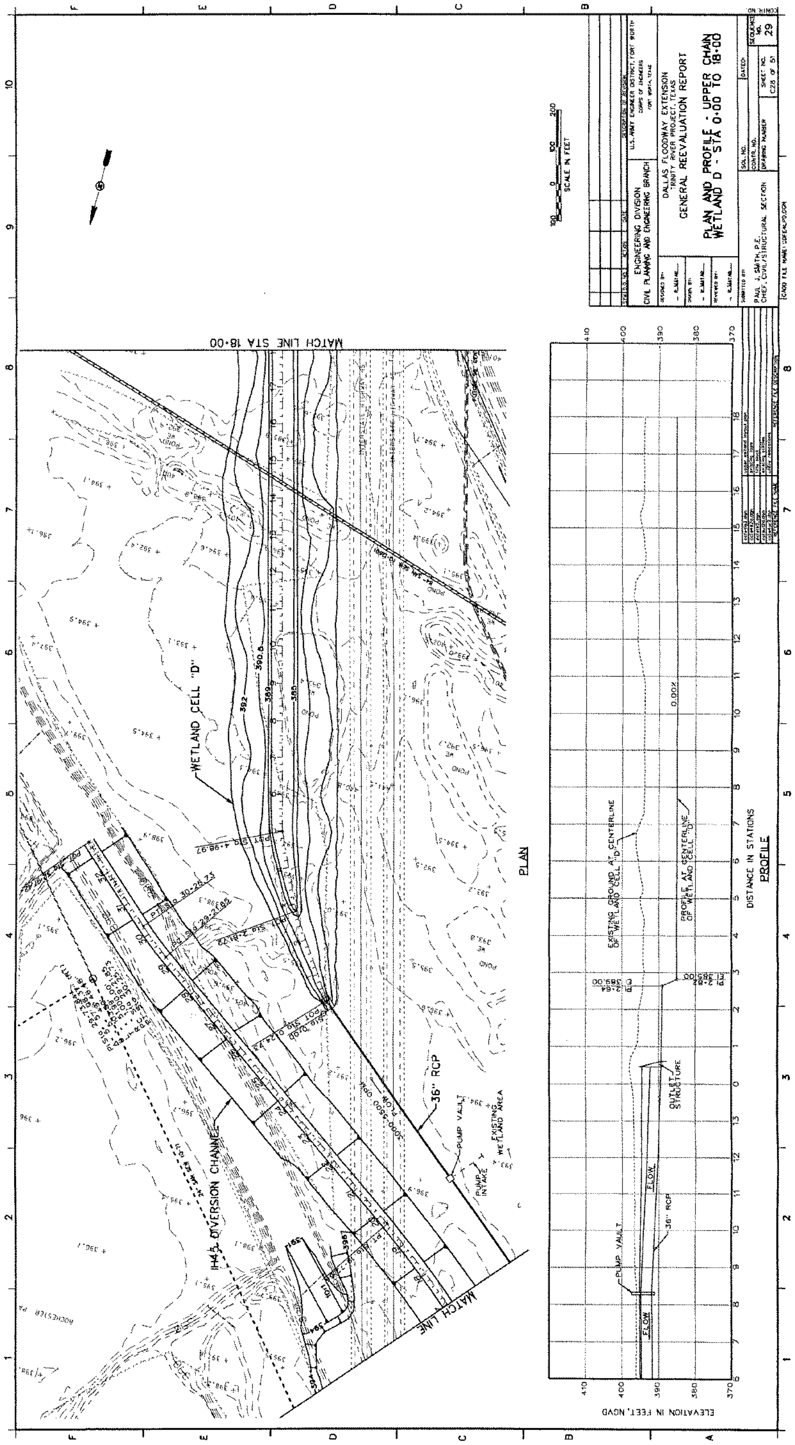

ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CHAIN OF WETLANDS
PLAN AND PROFILE
STA. 64+00 TO 90+00
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
SEQUENCE NO. 24
SHEET NO. C23 OF 51
MATCH LINE STA. 90+00
MATCH LINE STA. 64+00
SEE SEQUENCE NO. 4 FOR SECTION A-A
CELL G
CELL F
LIMITS OF CONSTRUCTION
PLAN
PROFILE
DISTANCE IN STATION
EXISTING GROUND LINE
FINISHED GRADE
INLET STRUCTURE
JUNCTION BOX
ELEVATION


PROFILE
DISTANCE IN STATION
OUTLET STRUCTURE
EXISTING GROUND LINE
FINISHED GRADE
PLAN
LIMITS OF CONSTRUCTION
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CHAIN OF WETLAND
PLAN AND PROFILE
(STA. 90+00 TO 115+30)

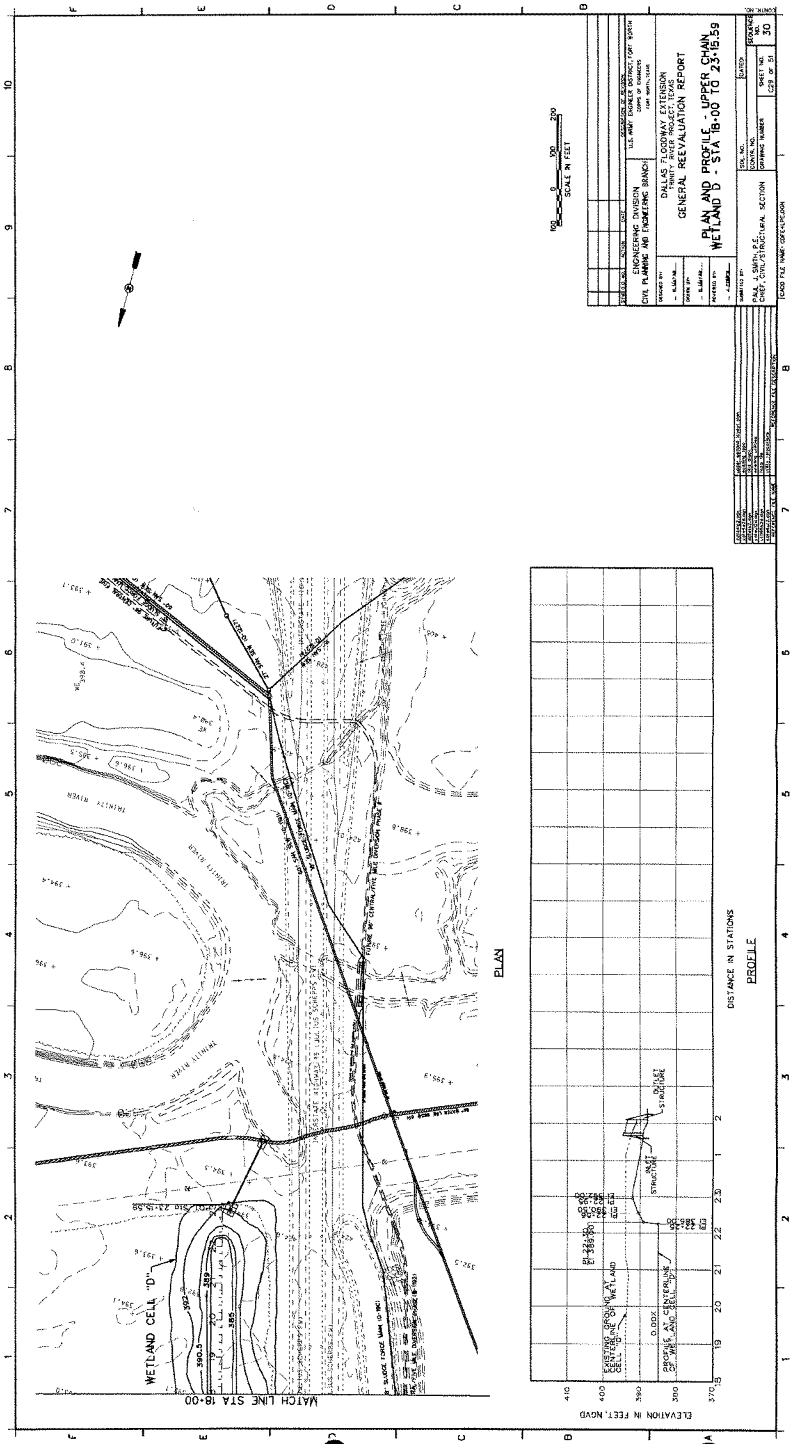

WETLAND CELL "A"
WETLAND CELL "B"
CADILLAC HEIGHTS LEVEE
MATCH LINE STA 13+00
PLAN
PROFILE
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
SCALE IN FEET
ENGINEERING DIVISION
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PLAN AND PROFILE - UPPER CHAIN
WETLAND A - STA 0+00 TO 11+87.98
WETLAND B - STA 0+00 TO 13+00

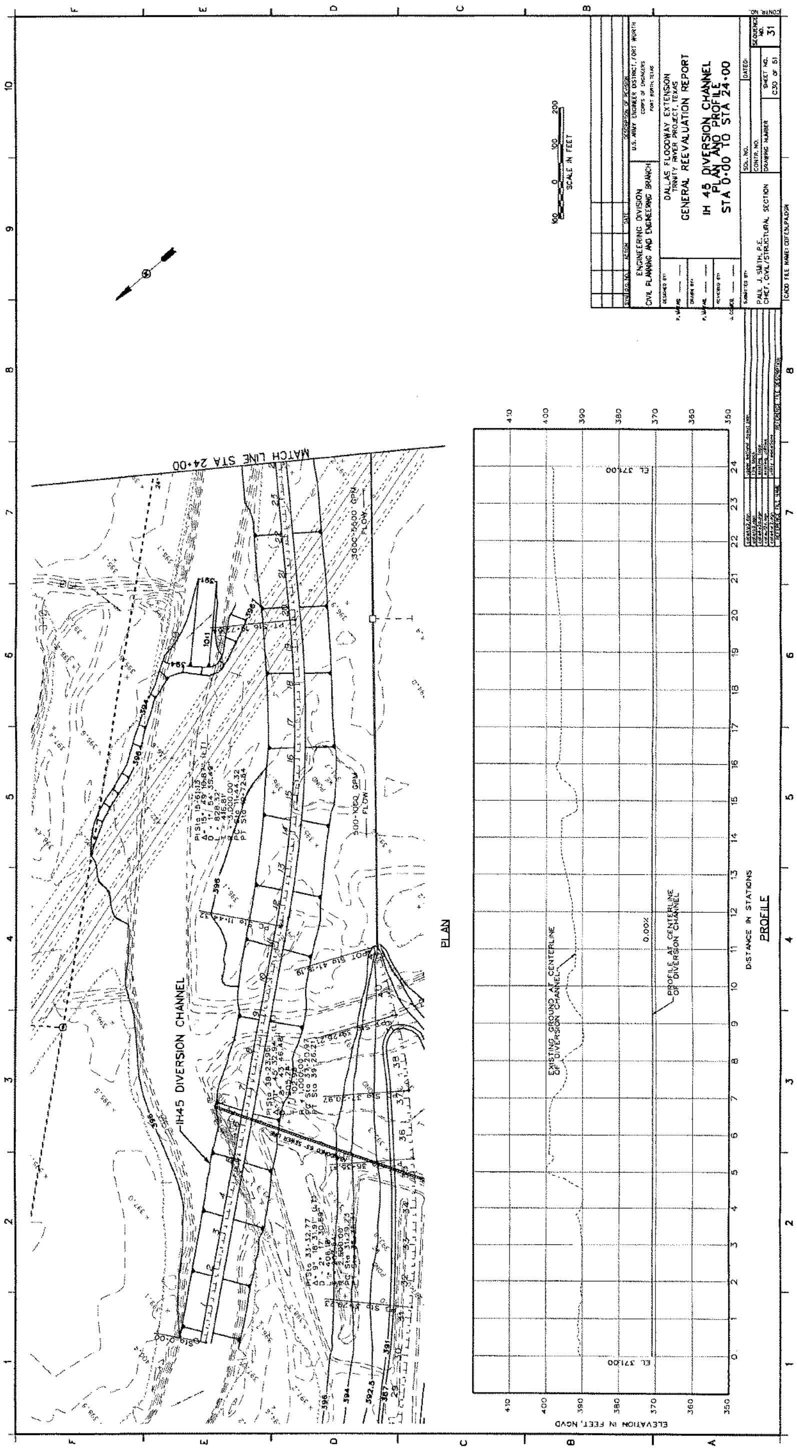

PLAN
PROFILE
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
WETLAND CELL "C"
WETLAND CELL "B"
MATCH LINE STA 20+00
MATCH LINE STA 13+00
SCALE IN FEET
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PLAN AND PROFILE - UPPER CHAN.
WETLAND B - STA 13+00 TO 18+94.34
WETLAND C - STA 0+00 TO STA 20+00

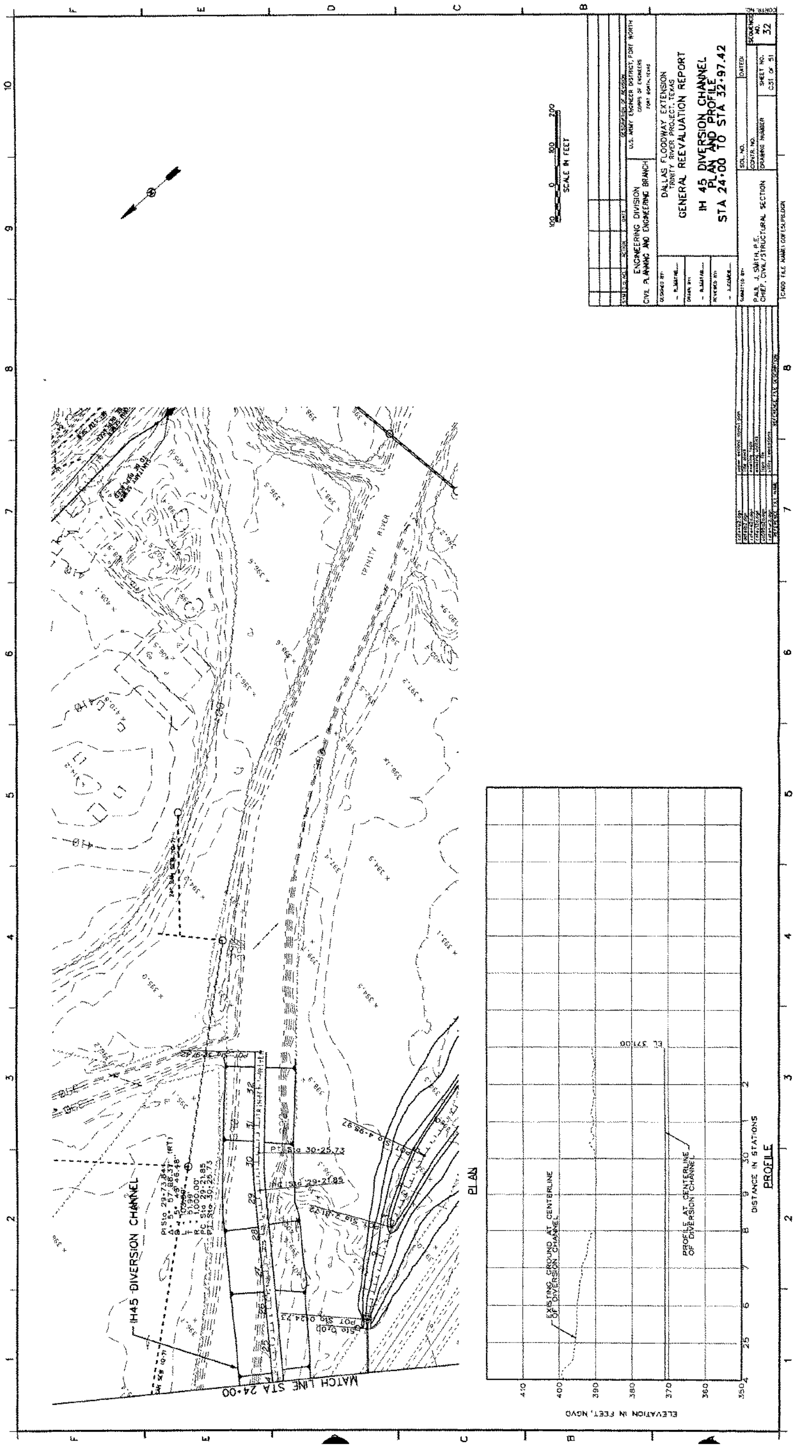

PLAN AND PROFILE - UPPER CHAIN
WETLAND "C" - STA 20+00 TO
STA 41+18.19
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
SCALE IN FEET
MATCH LINE
MATCH LINE STA 20+00
IH45 DIVERSION CHANNEL
WETLAND CELL "C"
36" RCP
FLOW
PLAN
PROFILE
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
OUTLET STRUCTURE
EXISTING GROUND AT CENTERLINE OF WETLAND CELL "C"
PROFILE AT CENTERLINE OF WETLAND CELL "C"
0.00%

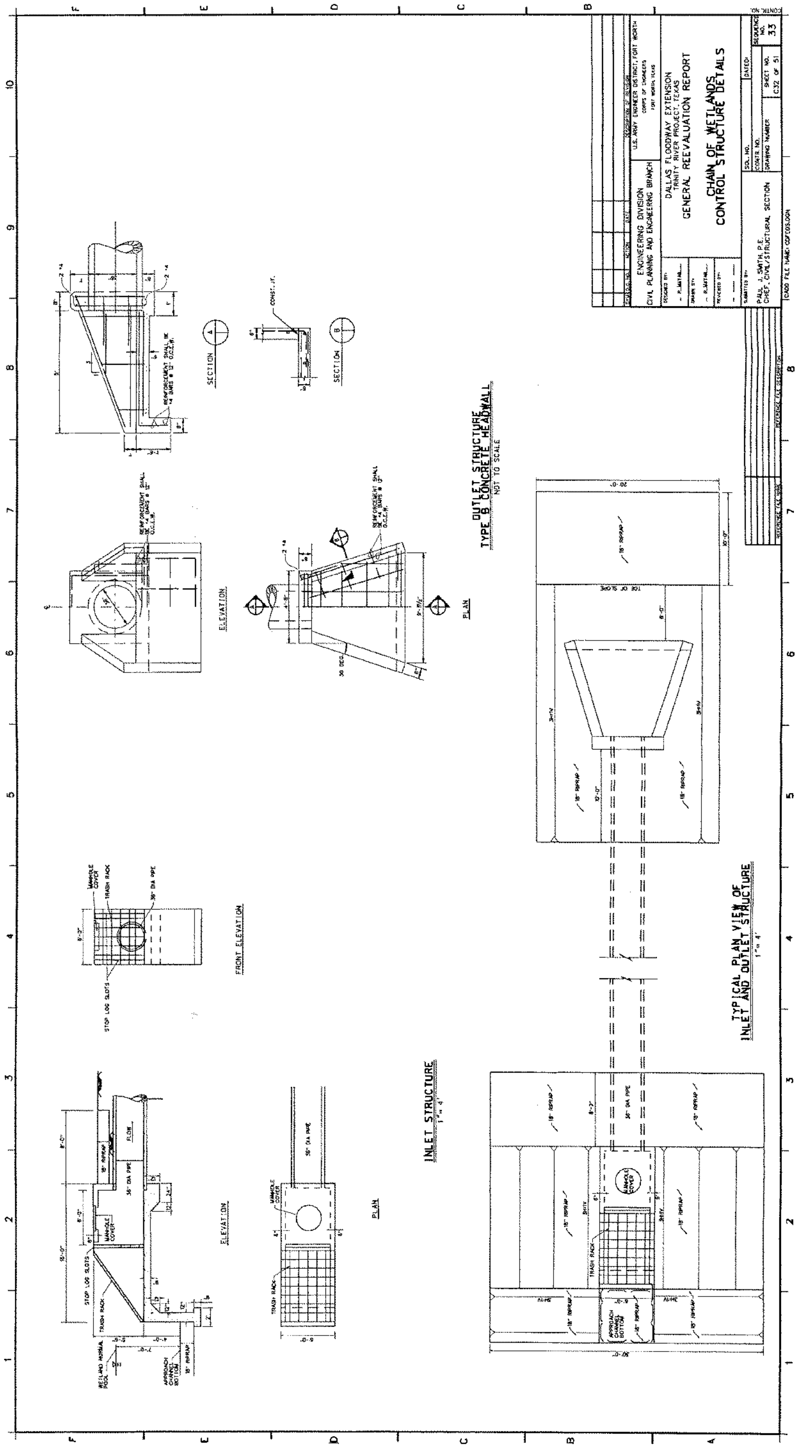


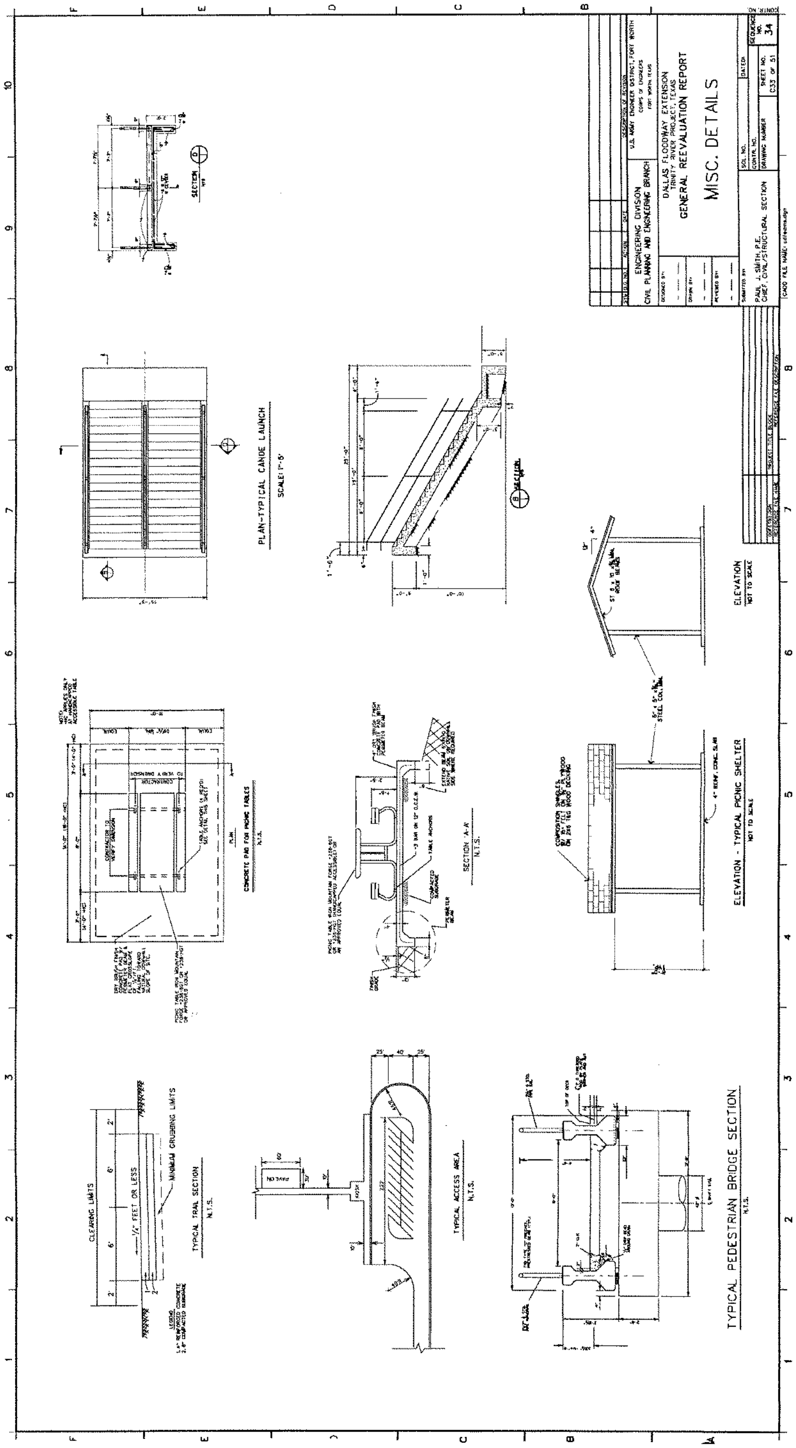
PLAN
PROFILE
WETLAND CELL "D"
MATCH LINE STA 18+00
MATCH LINE
36" RCP
IH45 DIVERSION CHANNEL
PUMP VAULT
OUTLET STRUCTURE
FLOW
EXISTING GROUND AT CENTERLINE OF WETLAND CELL "D"
PROFILE AT CENTERLINE OF WETLAND CELL "D"
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
SCALE IN FEET
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PLAN AND PROFILE - UPPER CHAIN
WETLAND D - STA 0+00 TO 18+00


ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
PLAN AND PROFILE - UPPER CHAIN
WETLAND D - STA 18+00 TO 23+15.59
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
SHEET NO.
C29 OF 51
SEQUENCE NO.
30
SCALE IN FEET
PLAN
PROFILE
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
WETLAND CELL "D"
MATCH LINE STA 18+00
TRINITY RIVER
INLET STRUCTURE
OUTLET STRUCTURE

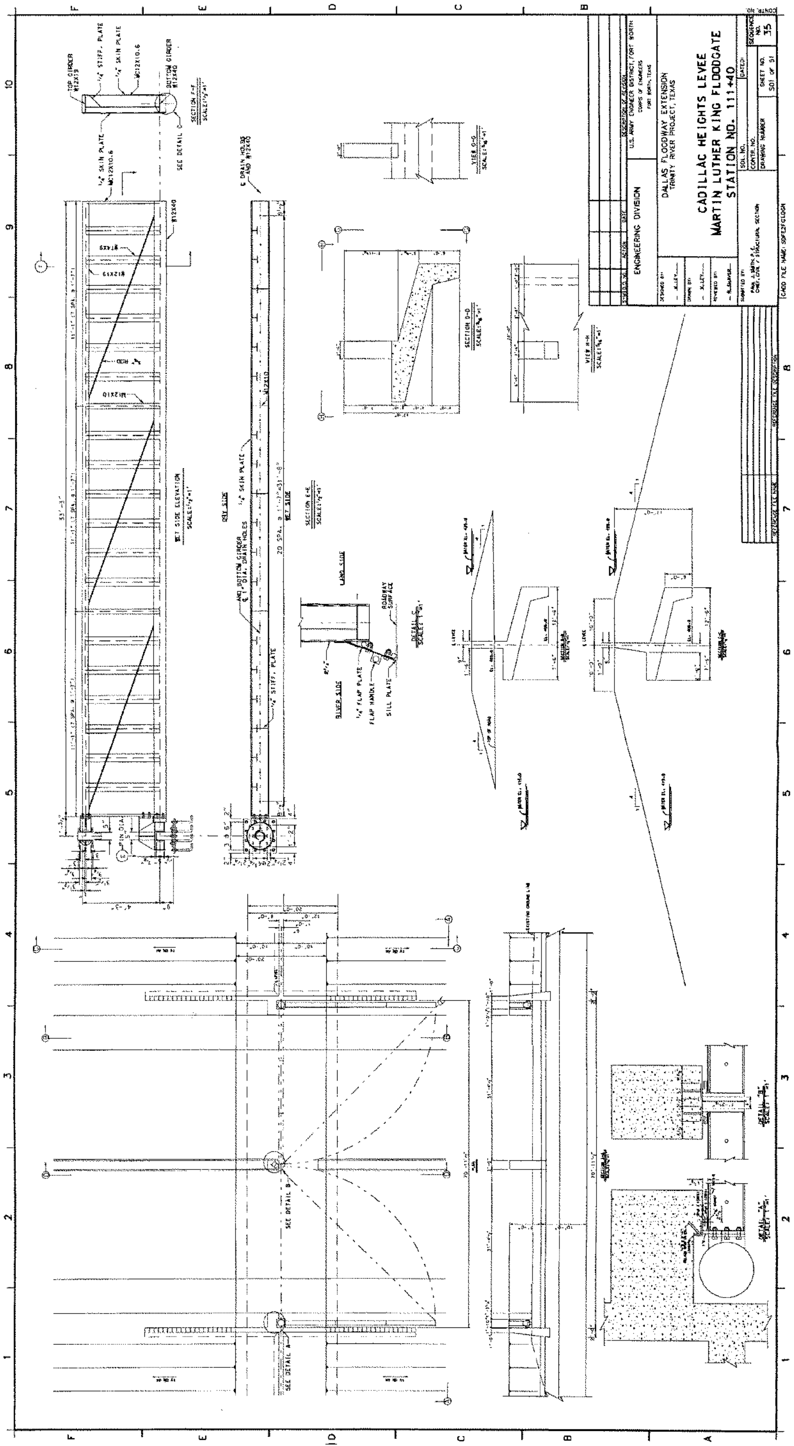

IH45 DIVERSION CHANNEL
MATCH LINE STA 24+00
PLAN
PROFILE
DISTANCE IN STATIONS
ELEVATION IN FEET, NGVD
EXISTING GROUND AT CENTERLINE OF DIVERSION CHANNEL
PROFILE AT CENTERLINE OF DIVERSION CHANNEL
SCALE IN FEET
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
IH 45 DIVERSION CHANNEL
PLAN AND PROFILE
STA 0+00 TO STA 24+00

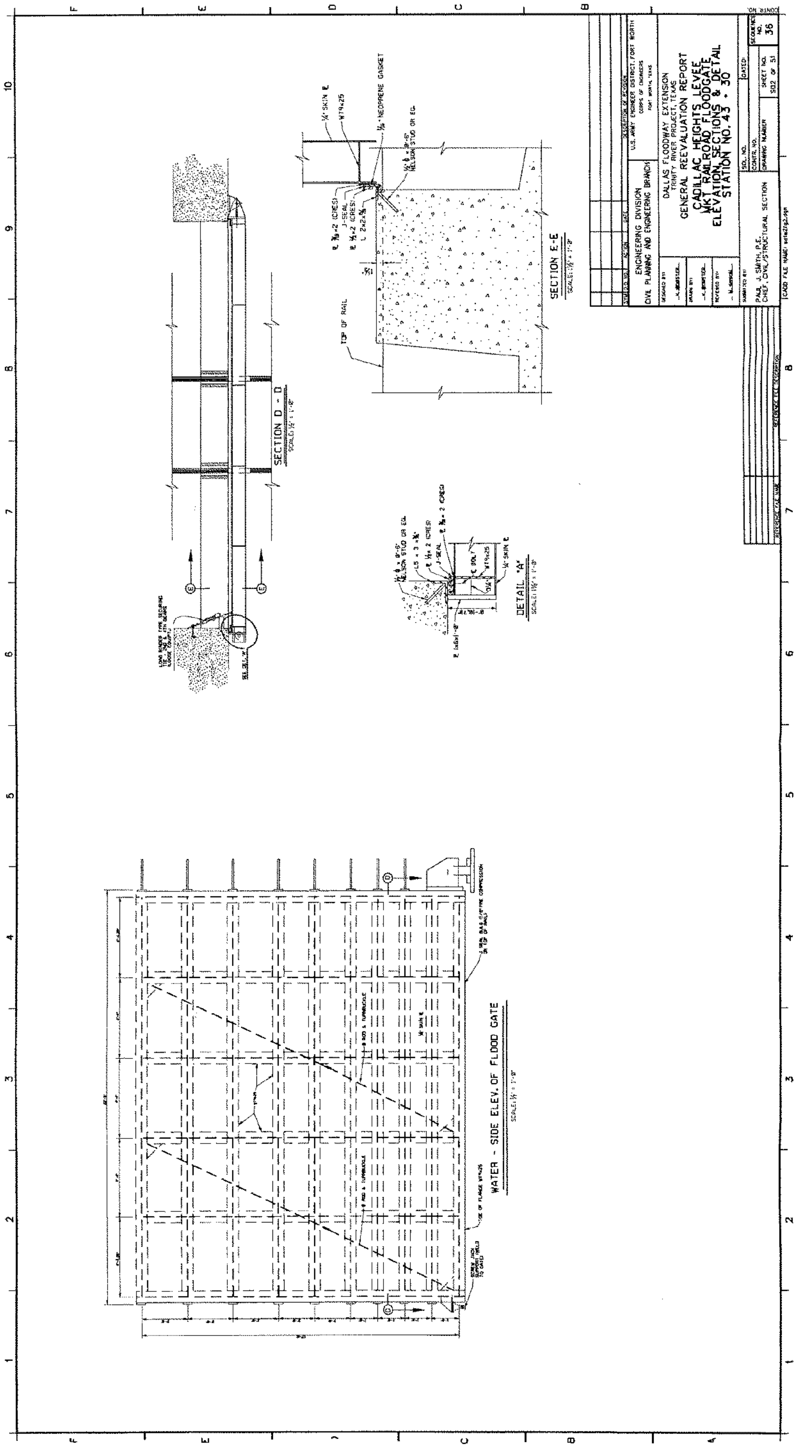

U.S. ARMY ENGINEER DISTRICT, FORT WORTH
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
IH 45 DIVERSION CHANNEL
PLAN AND PROFILE
STA 24+00 TO STA 32+97.42
SCALE IN FEET
IH45 DIVERSION CHANNEL
TRINITY RIVER
MATCH LINE STA 24+00
PLAN
EXISTING GROUND AT CENTERLINE OF DIVERSION CHANNEL
PROFILE AT CENTERLINE OF DIVERSION CHANNEL
DISTANCE IN STATIONS
PROFILE
ELEVATION IN FEET, NGVD

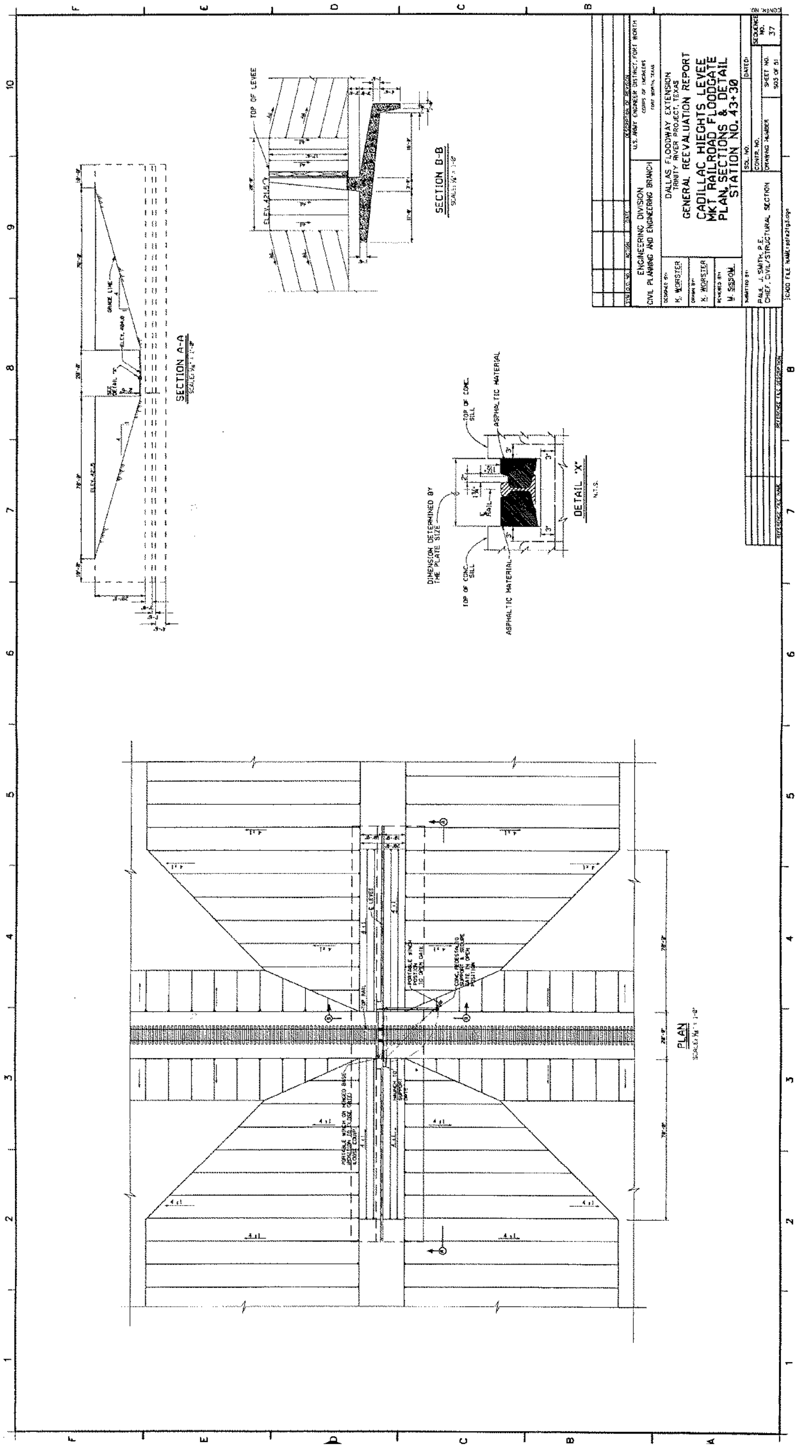

DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CHAIN OF WETLANDS
CONTROL STRUCTURE DETAILS
OUTLET STRUCTURE
TYPE B CONCRETE HEADWALL
NOT TO SCALE
TYPICAL PLAN VIEW OF
INLET AND OUTLET STRUCTURE
INLET STRUCTURE
ELEVATION
PLAN
FRONT ELEVATION
SECTION



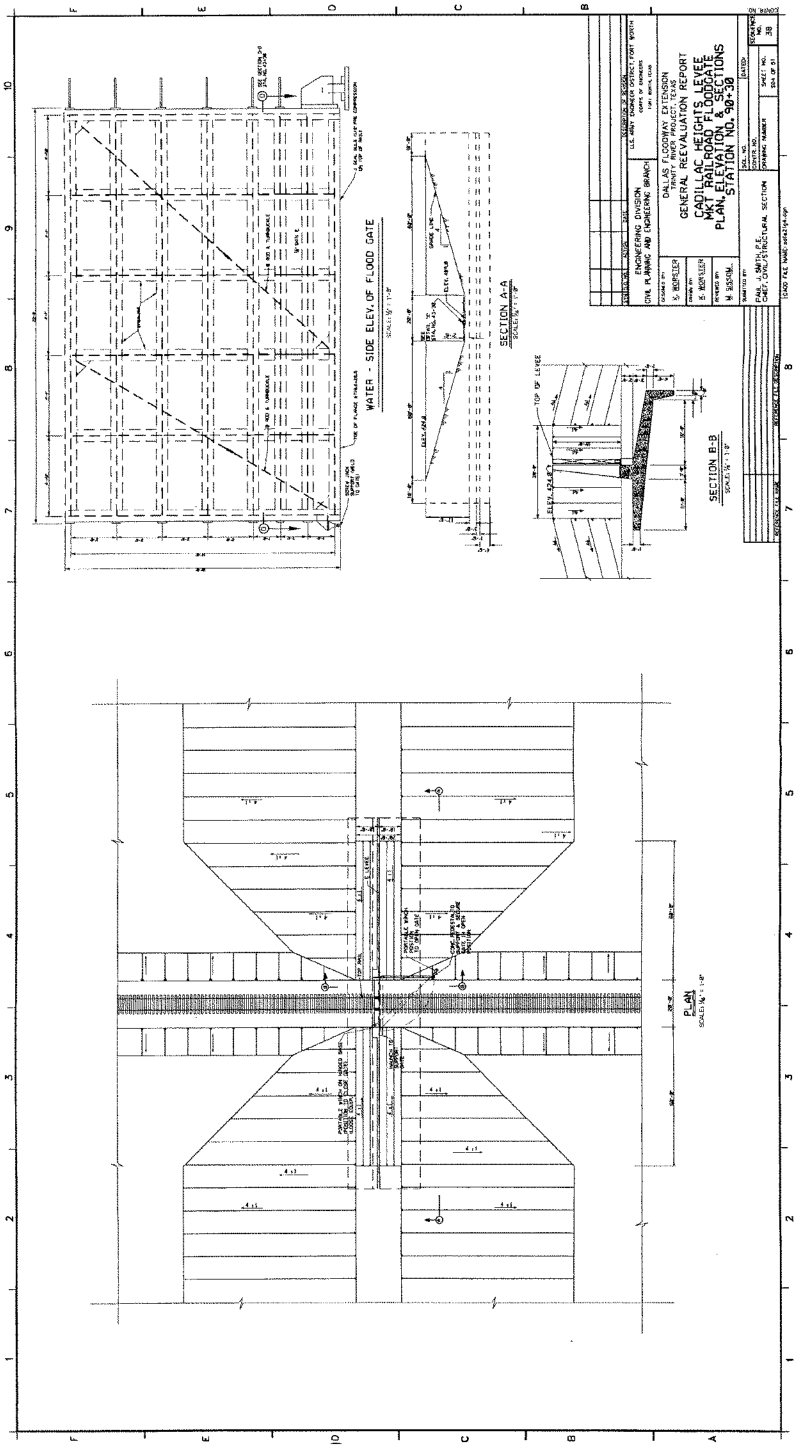
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
MISC. DETAILS
PLAN-TYPICAL CANOE LAUNCH
SECTION A-A
N.T.S.
ELEVATION
NOT TO SCALE
ELEVATION - TYPICAL PICNIC SHELTER
NOT TO SCALE
TYPICAL TRAIL SECTION
N.T.S.
TYPICAL ACCESS AREA
N.T.S.
TYPICAL PEDESTRIAN BRIDGE SECTION
N.T.S.

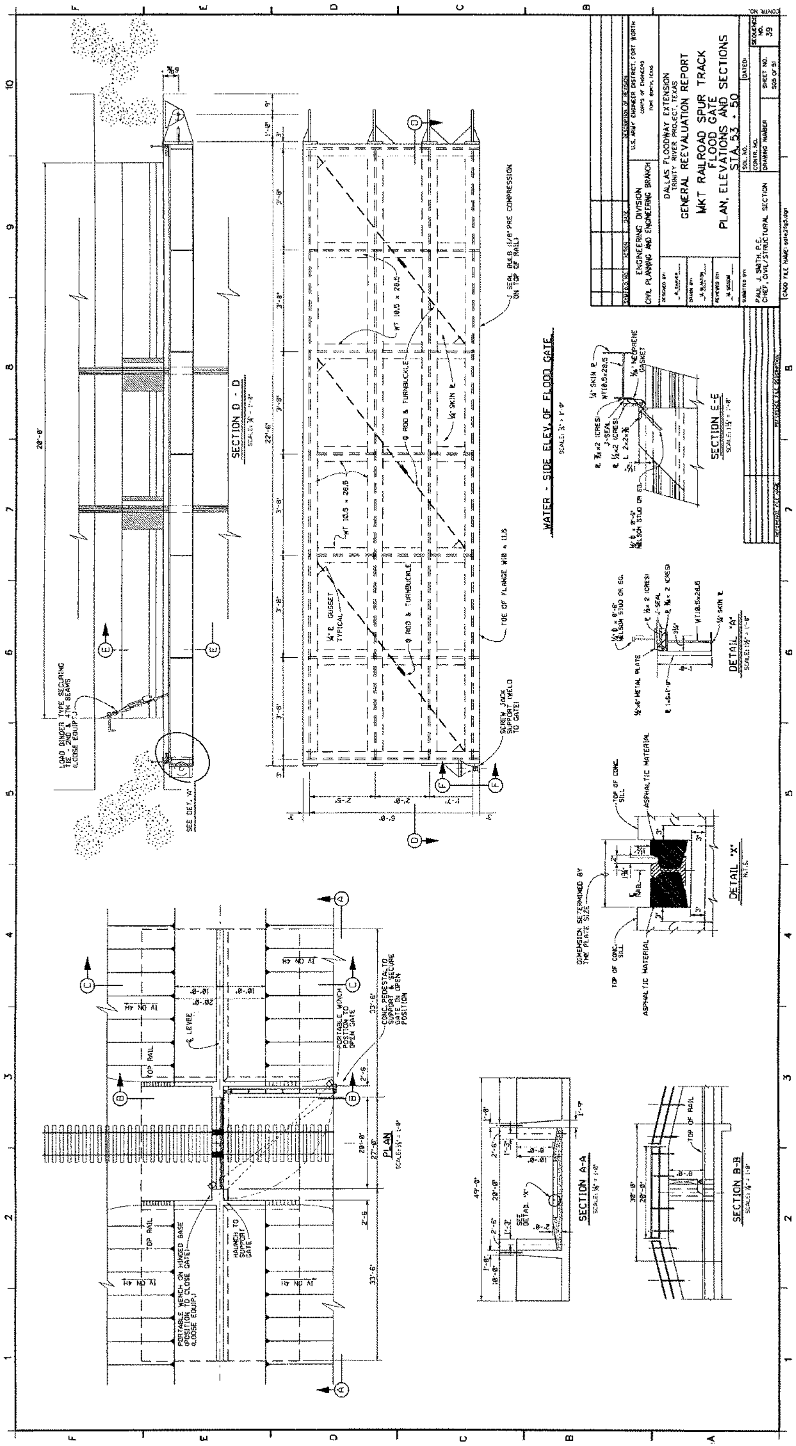

CADILLAC HEIGHTS LEVEE
MARTIN LUTHER KING FLOODGATE
STATION NO. 111+40
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
ENGINEERING DIVISION
U.S. ARMY ENGINEER DISTRICT, FORT WORTH

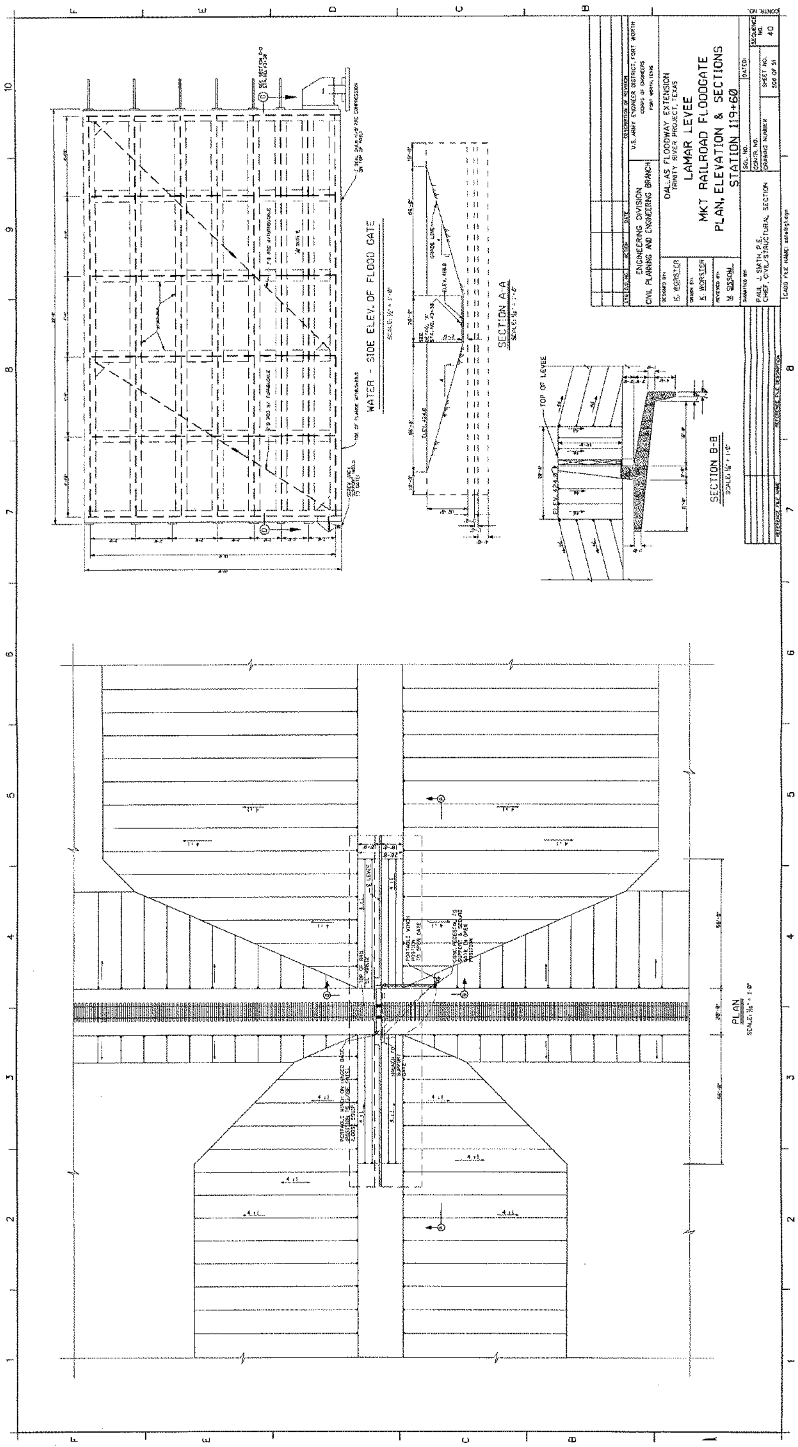

SECTION D - D
SECTION E-E
TOP OF RAIL
DETAIL "A"
WATER - SIDE ELEV. OF FLOOD GATE
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CADILLAC HEIGHTS LEVEE
ELEVATION, SECTIONS & DETAIL
STATION NO. 43 + 30
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION

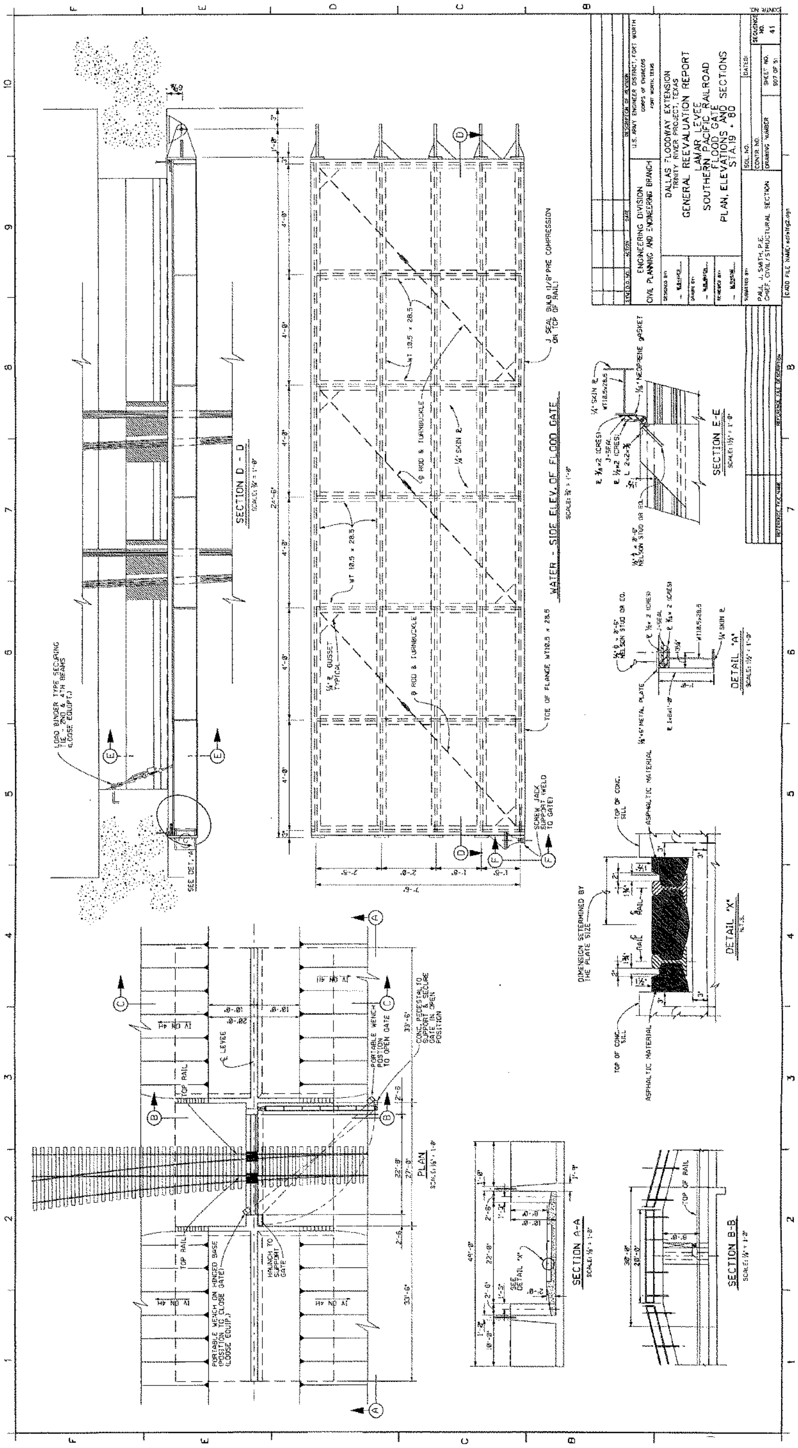


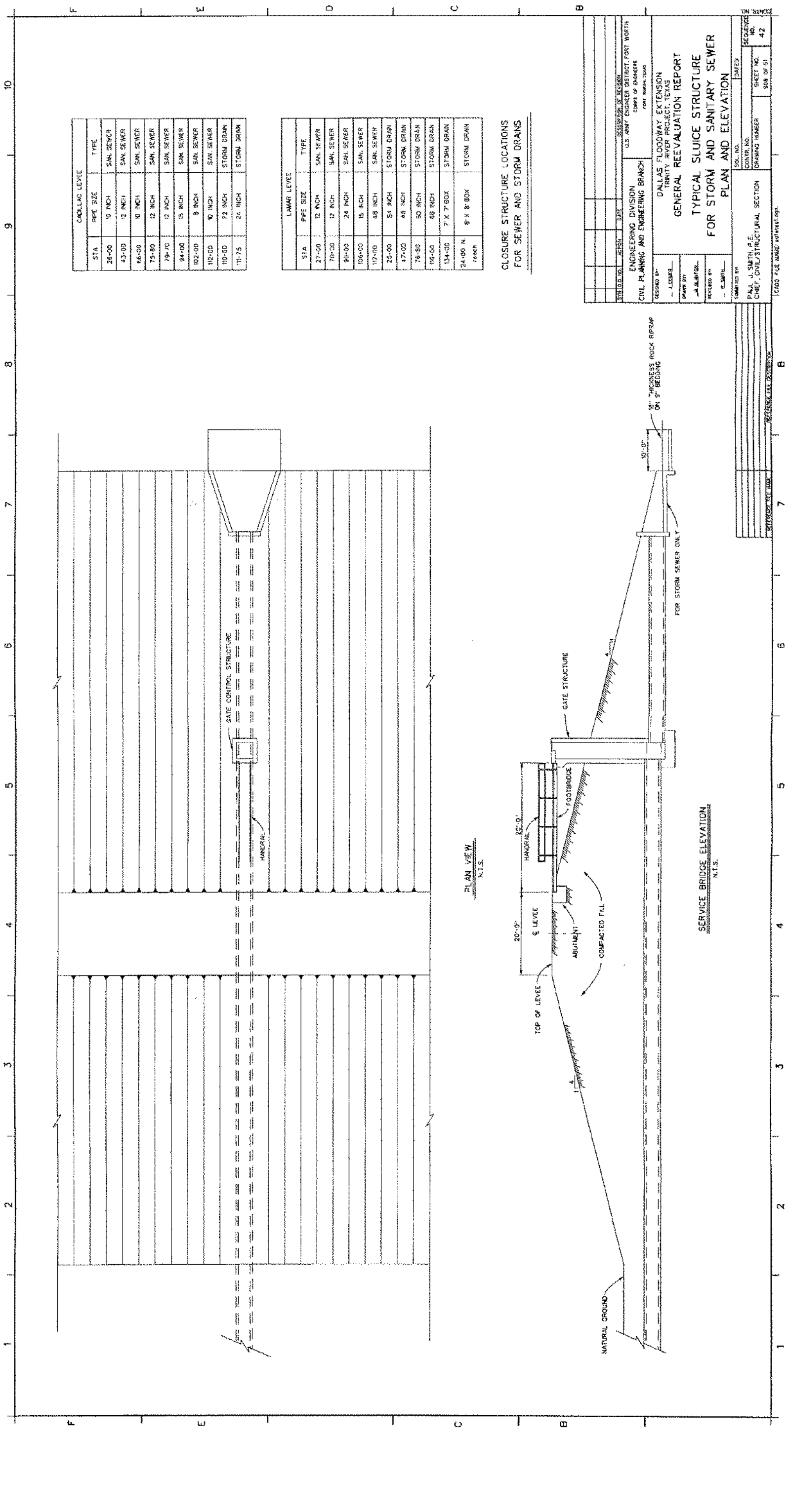
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CADILLAC HIEGHTS LEVEE
MKT RAILROAD FLOODGATE
PLAN, SECTIONS & DETAIL
STATION NO. 43+30
SECTION A-A
SECTION B-B
TOP OF LEVEE
DETAIL "X"
TOP OF CONC. SILL
ASPHALTIC MATERIAL
DIMENSION DETERMINED BY THE PLATE SIZE
PLAN


U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DESIGNED BY: K. WORSTER
DRAWN BY: K. WORSTER
REVIEWED BY: M. SUSSOM
SUBMITTED BY: PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CADILLAC HEIGHTS LEVEE
MKT RAILROAD FLOODGATE
PLAN, ELEVATION & SECTIONS
STATION NO. 90+30
SHEET NO. S04 OF 51
SEQUENCE NO. 38
WATER - SIDE ELEV. OF FLOOD GATE
SECTION A-A
SECTION B-B
TOP OF LEVEE
PLAN


SECTION D - D
WATER - SIDE ELEV. OF FLOOD GATE
SECTION E-E
DETAIL "A"
DETAIL "X"
PLAN
SECTION A-A
SECTION B-B
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
MKT RAILROAD SPUR TRACK
FLOOD GATE
PLAN, ELEVATIONS AND SECTIONS
STA 53 + 50


WATER - SIDE ELEV. OF FLOOD GATE
SECTION A-A
SECTION B-B
TOP OF LEVEE
PLAN
ENGINEERING DIVISION
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
LAMAR LEVEE
MKT RAILROAD FLOODGATE
PLAN, ELEVATION & SECTIONS
STATION 119+60

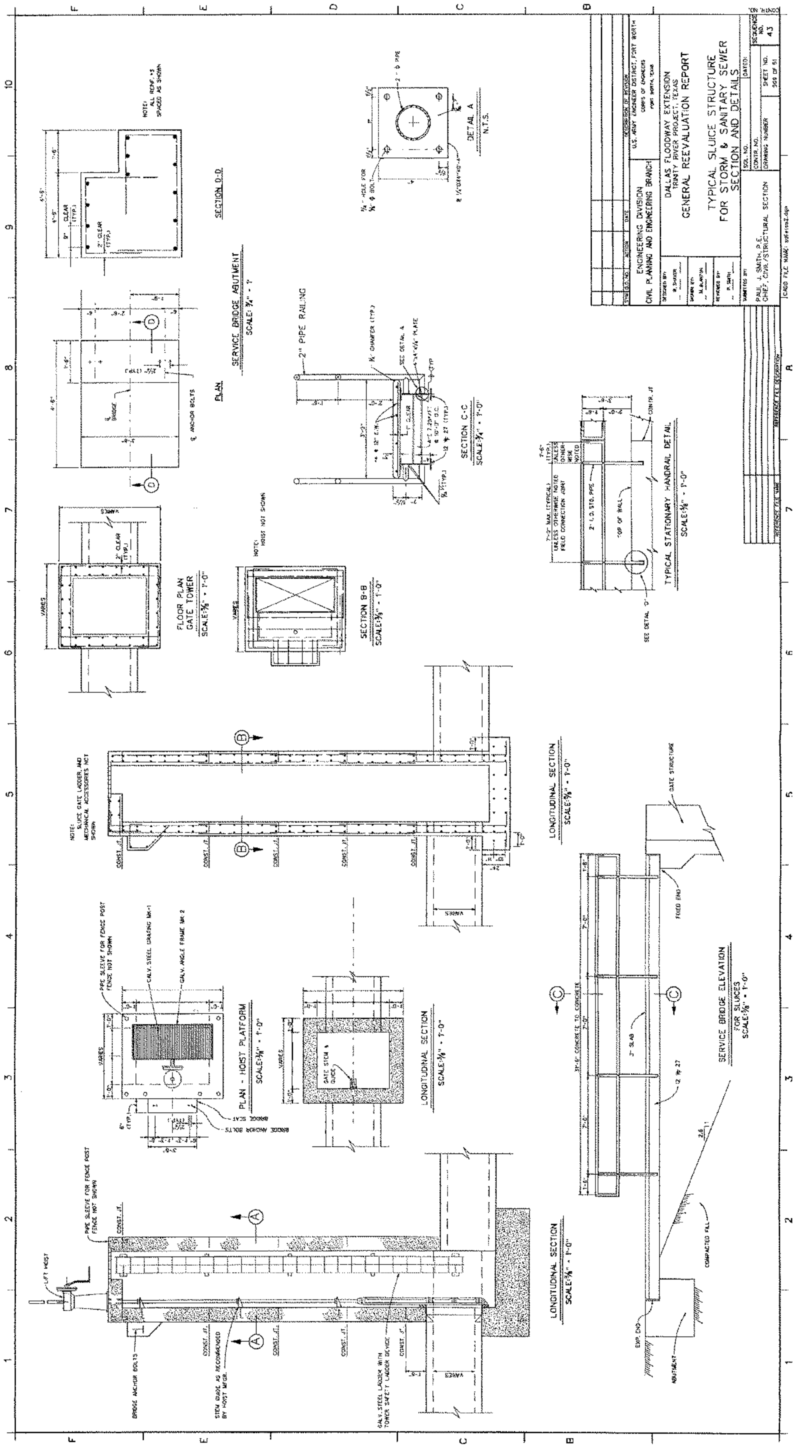

DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR LEVEE
SOUTHERN PACIFIC RAILROAD
FLOOD GATE
PLAN, ELEVATIONS AND SECTIONS
STA 19 + 80
SECTION D - D
WATER - SIDE ELEV. OF FLOOD GATE
PLAN
SECTION A-A
SECTION B-B
SECTION E-E
DETAIL "A"
DETAIL "X"

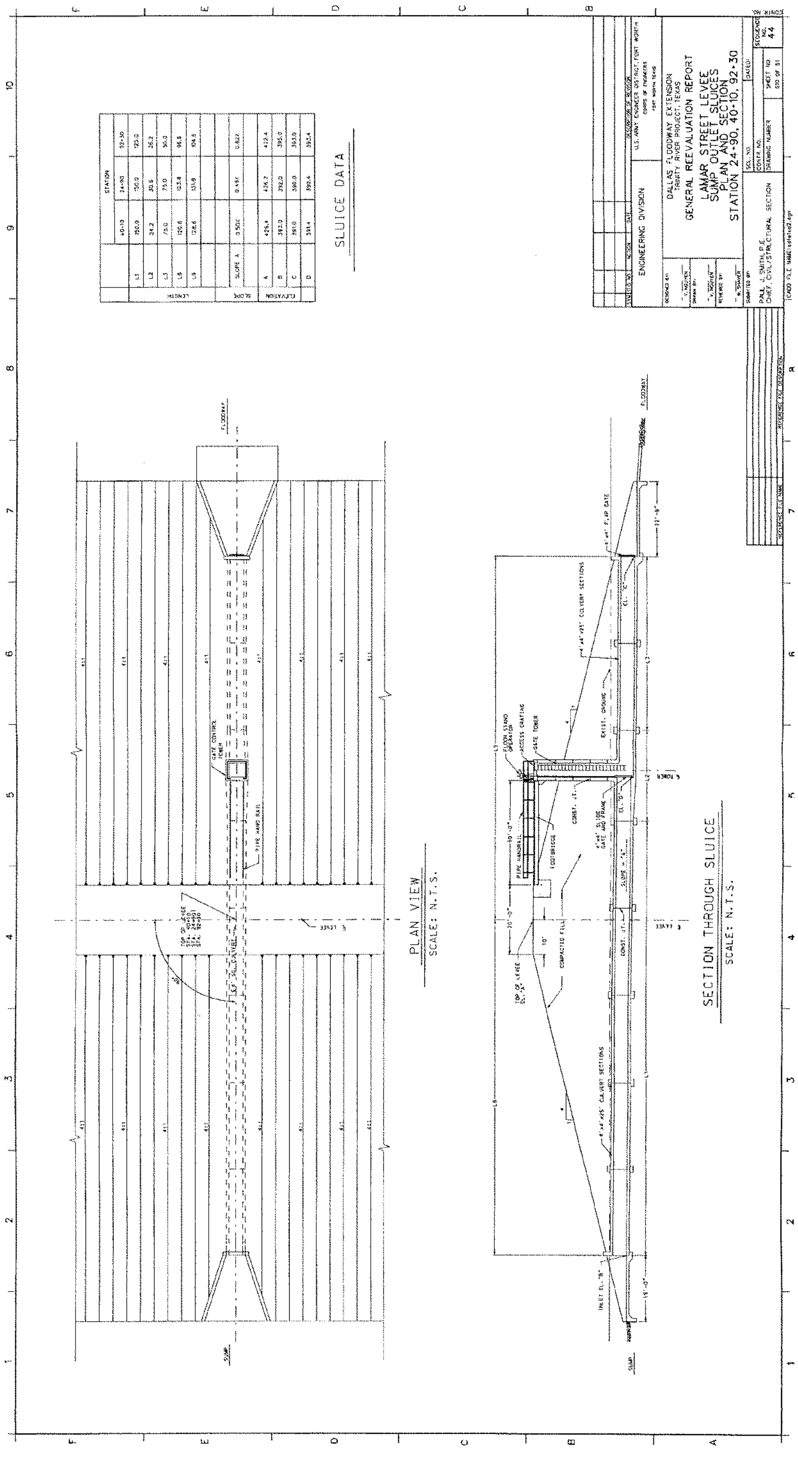


CADILLAC LEVEE		
STA	PIPE SIZE	TYPE
26+00	10 INCH	SAN. SEWER
43+00	12 INCH	SAN. SEWER
66+00	10 INCH	SAN. SEWER
75+80	12 INCH	SAN. SEWER
79+70	12 INCH	SAN. SEWER
94+00	15 INCH	SAN. SEWER
102+00	8 INCH	SAN. SEWER
112+00	10 INCH	SAN. SEWER
110+50	72 INCH	STORM DRAIN
111+75	24 INCH	STORM DRAIN

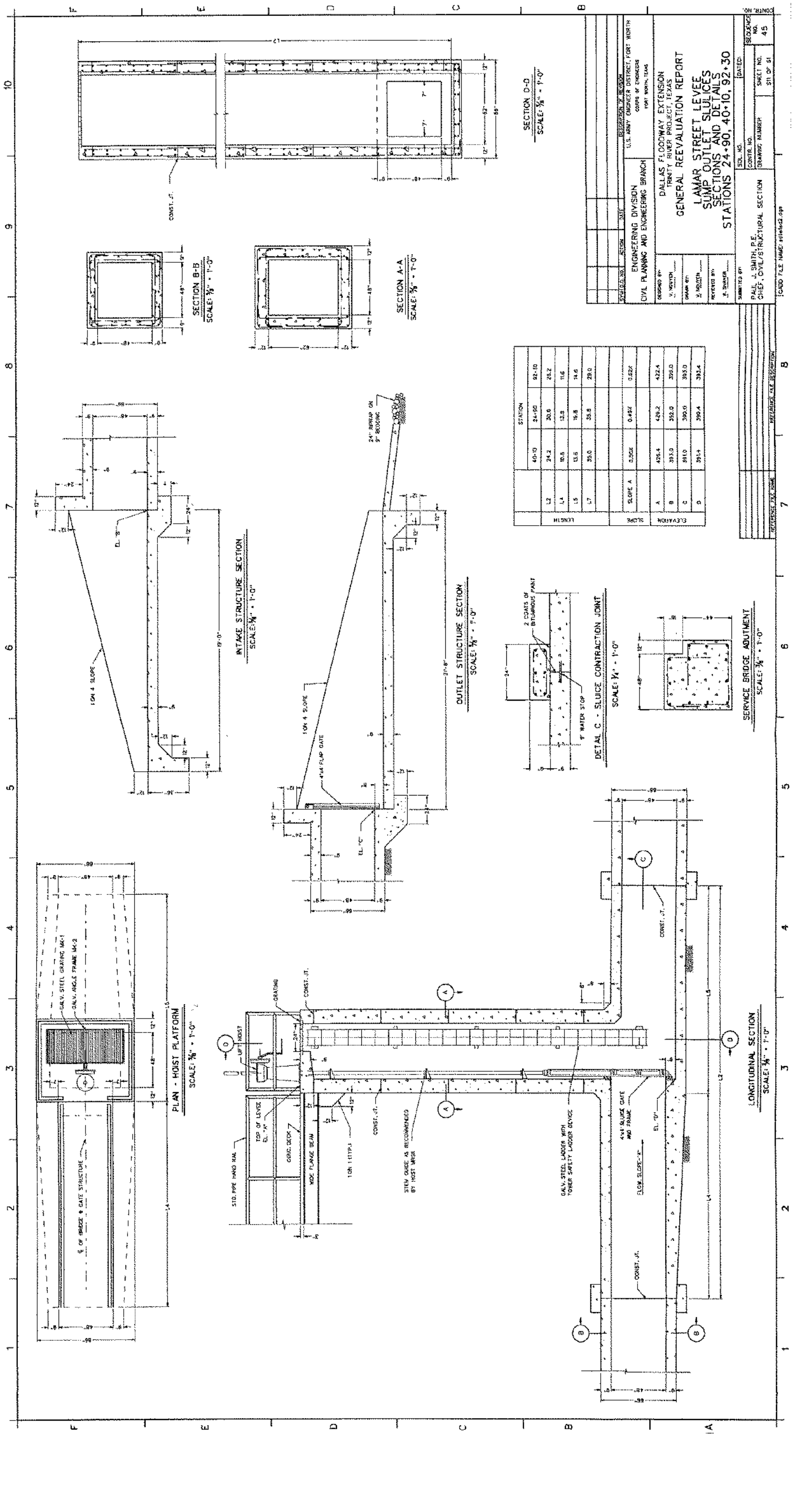
LAMAR LEVEE		
STA	PIPE SIZE	TYPE
27+00	12 INCH	SAN. SEWER
70+00	12 INCH	SAN. SEWER
90+00	24 INCH	SAN. SEWER
106+00	15 INCH	SAN. SEWER
117+00	48 INCH	SAN. SEWER
25+00	54 INCH	STORM DRAIN
47+00	48 INCH	STORM DRAIN
76+80	60 INCH	STORM DRAIN
119+00	66 INCH	STORM DRAIN
134+00	7' X 7' BOX	STORM DRAIN
24+00 N. reach	8' X 8' BOX	STORM DRAIN

CLOSURE STRUCTURE LOCATIONS FOR SEWER AND STORM DRAINS

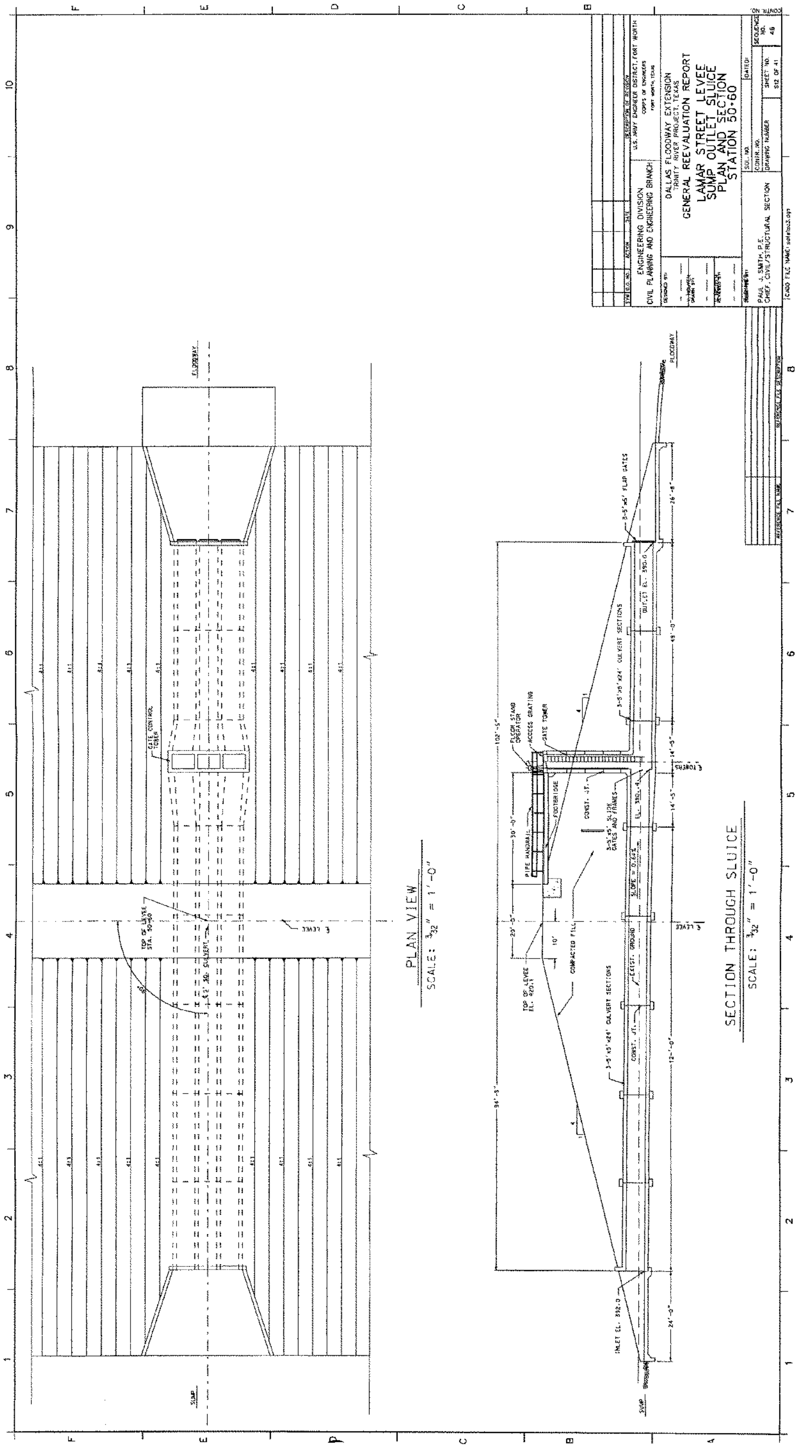

DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
TYPICAL SLUICE STRUCTURE
FOR STORM & SANITARY SEWER
SECTION AND DETAILS

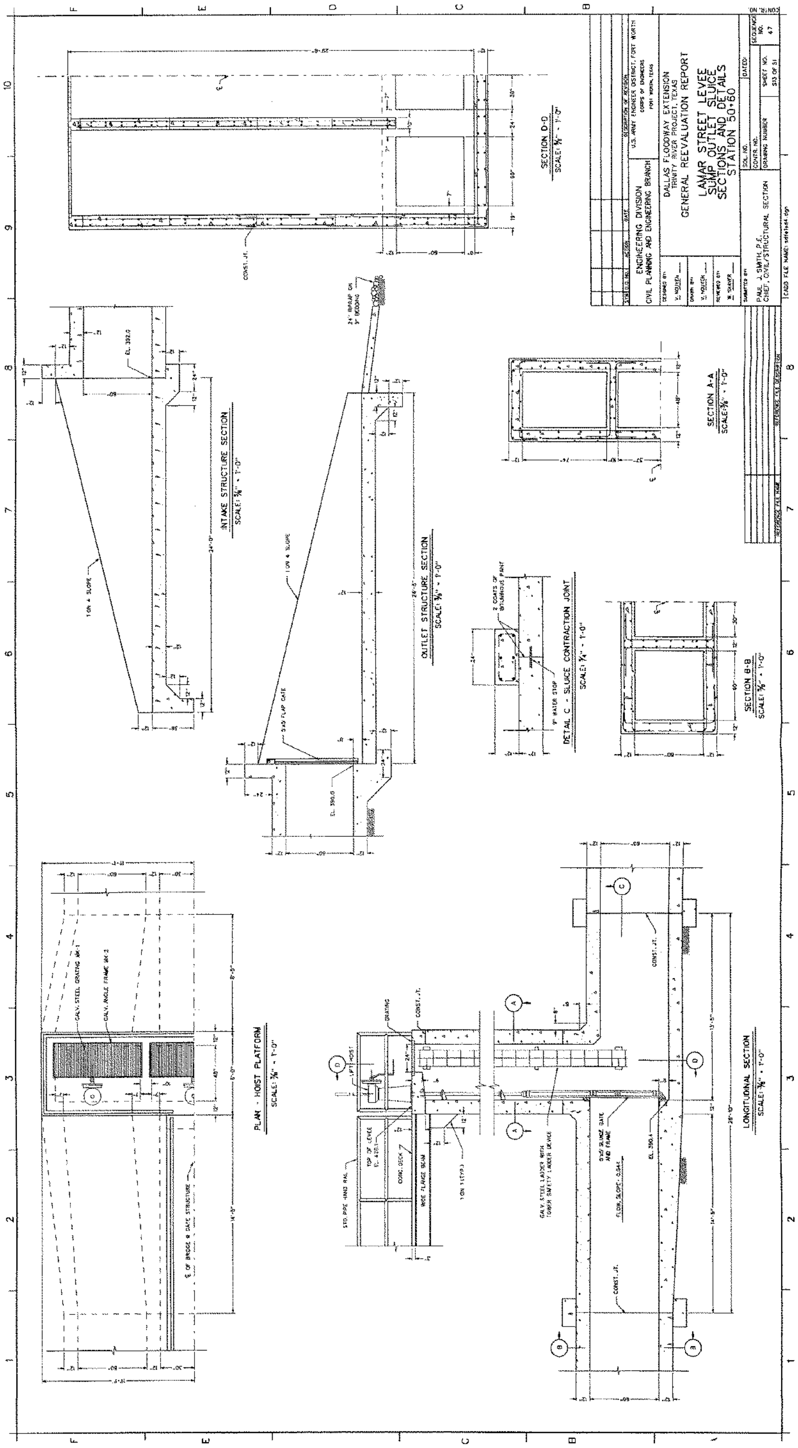


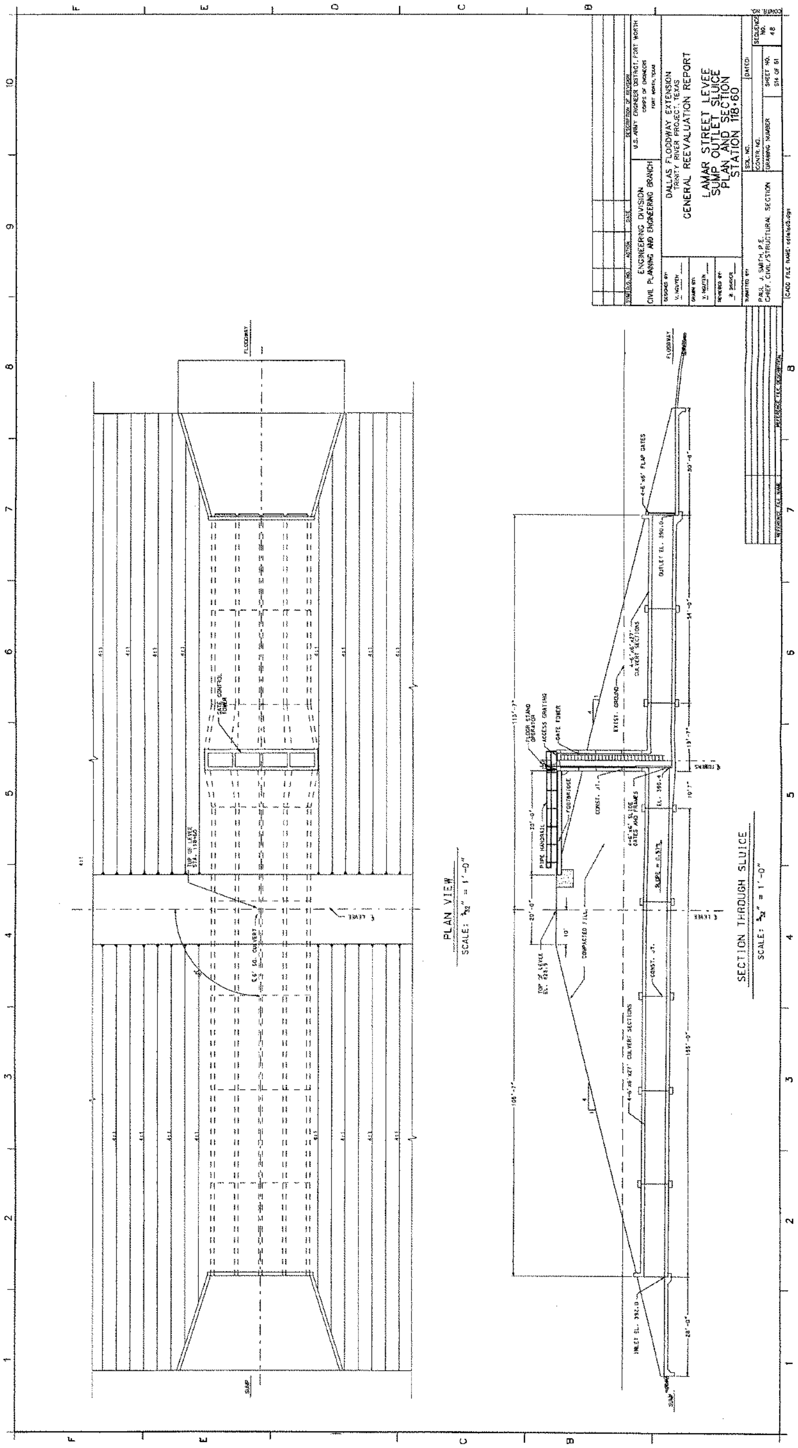
		STATION		
		40+10	24+90	92+30
LENGTH	L1	150.0	150.0	125.0
	L2	24.2	30.6	26.2
	L3	75.0	75.0	50.0
	L8	120.6	123.8	96.8
	L9	128.6	131.8	104.8
SLOPE	SLOPE A	0.50%	0.49%	0.62%
ELEVATION	A	426.4	426.2	422.4
	B	393.0	392.0	395.0
	C	391.0	390.0	393.0
	D	391.4	390.4	393.4

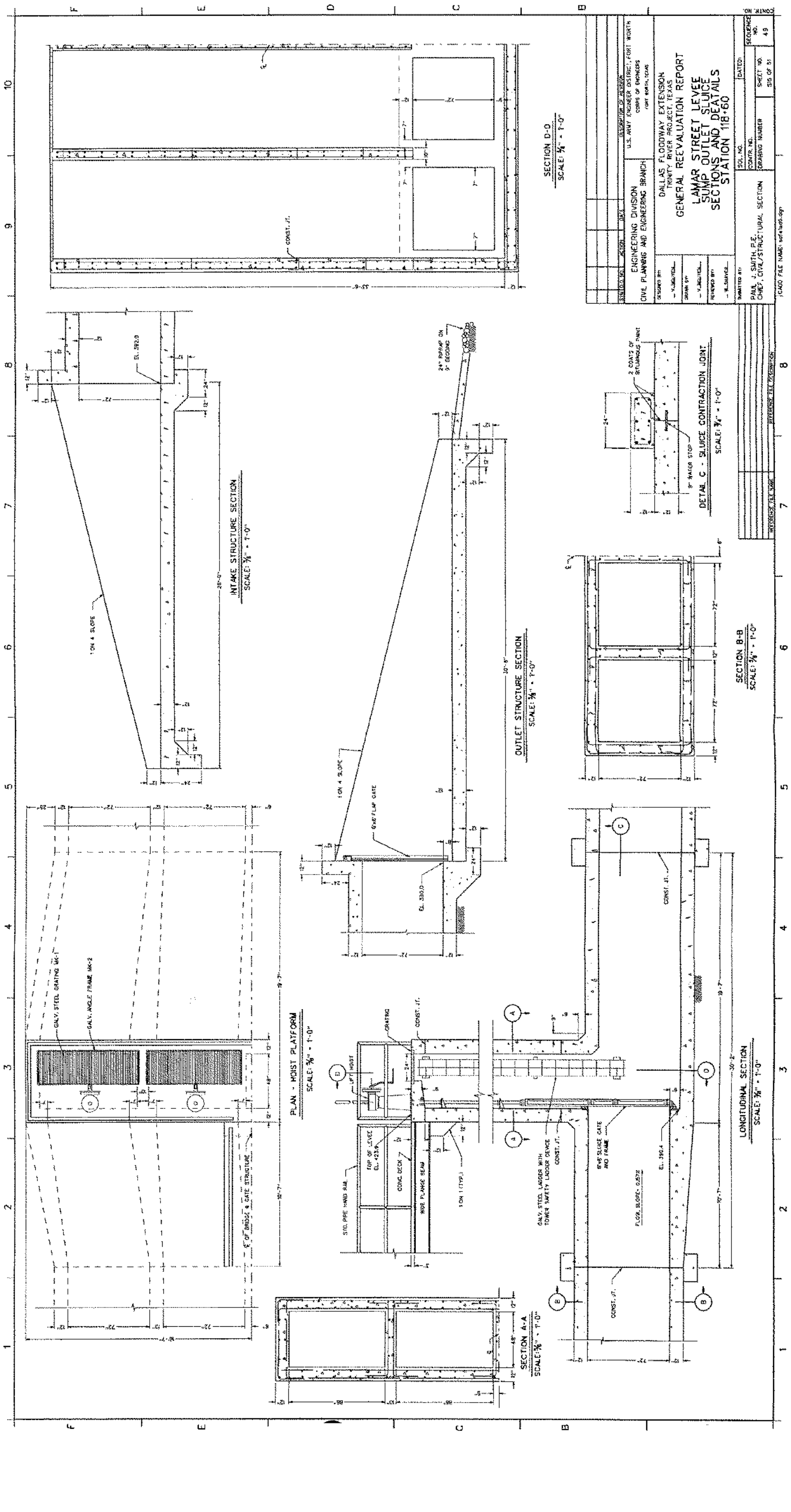


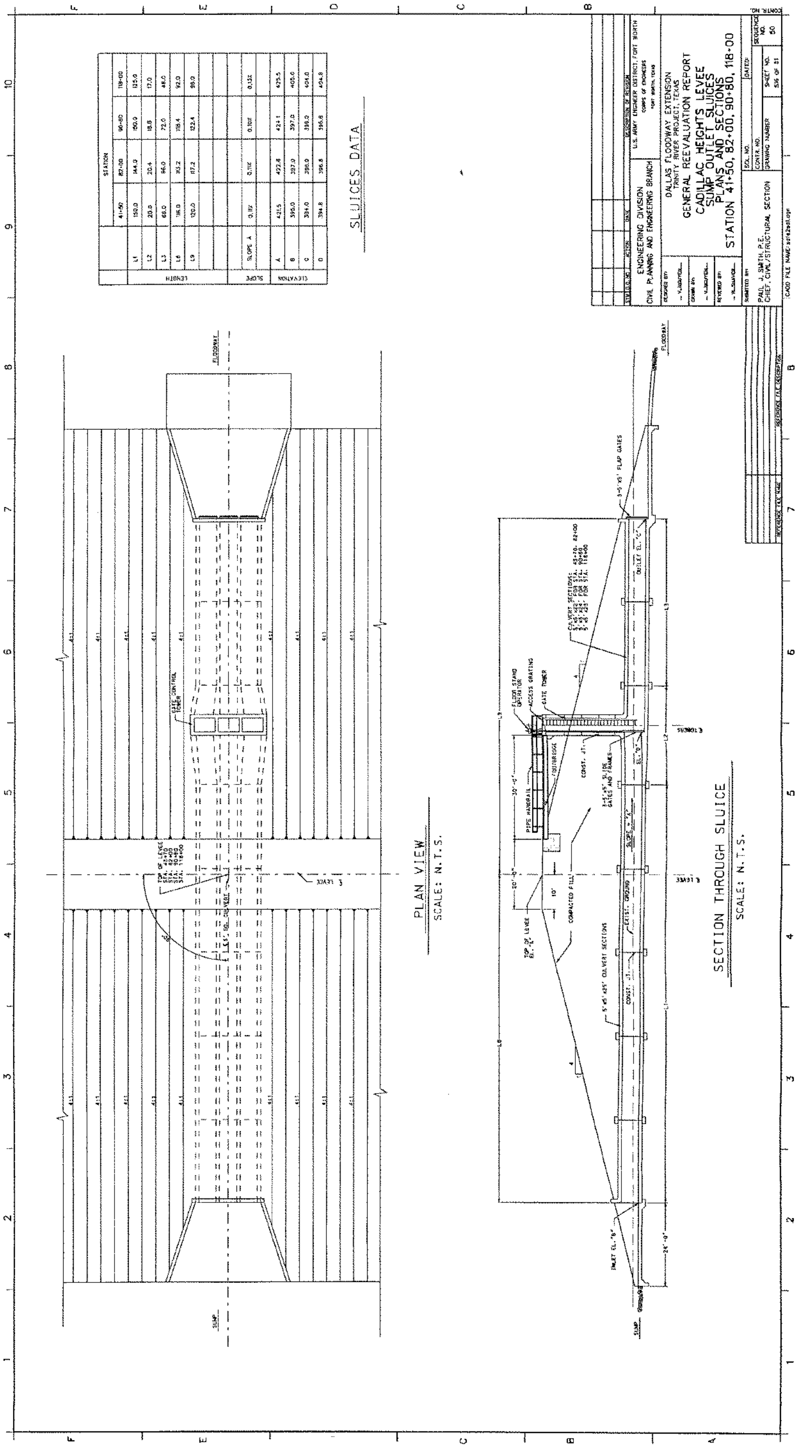
SECTION D-D
SECTION B-B
SECTION A-A
INTAKE STRUCTURE SECTION
OUTLET STRUCTURE SECTION
DETAIL C - SLUICE CONTRACTION JOINT
SERVICE BRIDGE ABUTMENT
PLAN - HOIST PLATFORM
LONGITUDINAL SECTION
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUMP OUTLET SLUICES
SECTIONS AND DETAILS
STATIONS 24+90, 40+10, 92+30


PLAN VIEW
SCALE: 3/32" = 1'-0"
SECTION THROUGH SLUICE
SCALE: 3/32" = 1'-0"
DALLAS FLOODWAY EXTENSION
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUMP OUTLET SLUICE
PLAN AND SECTION
STATION 50+60

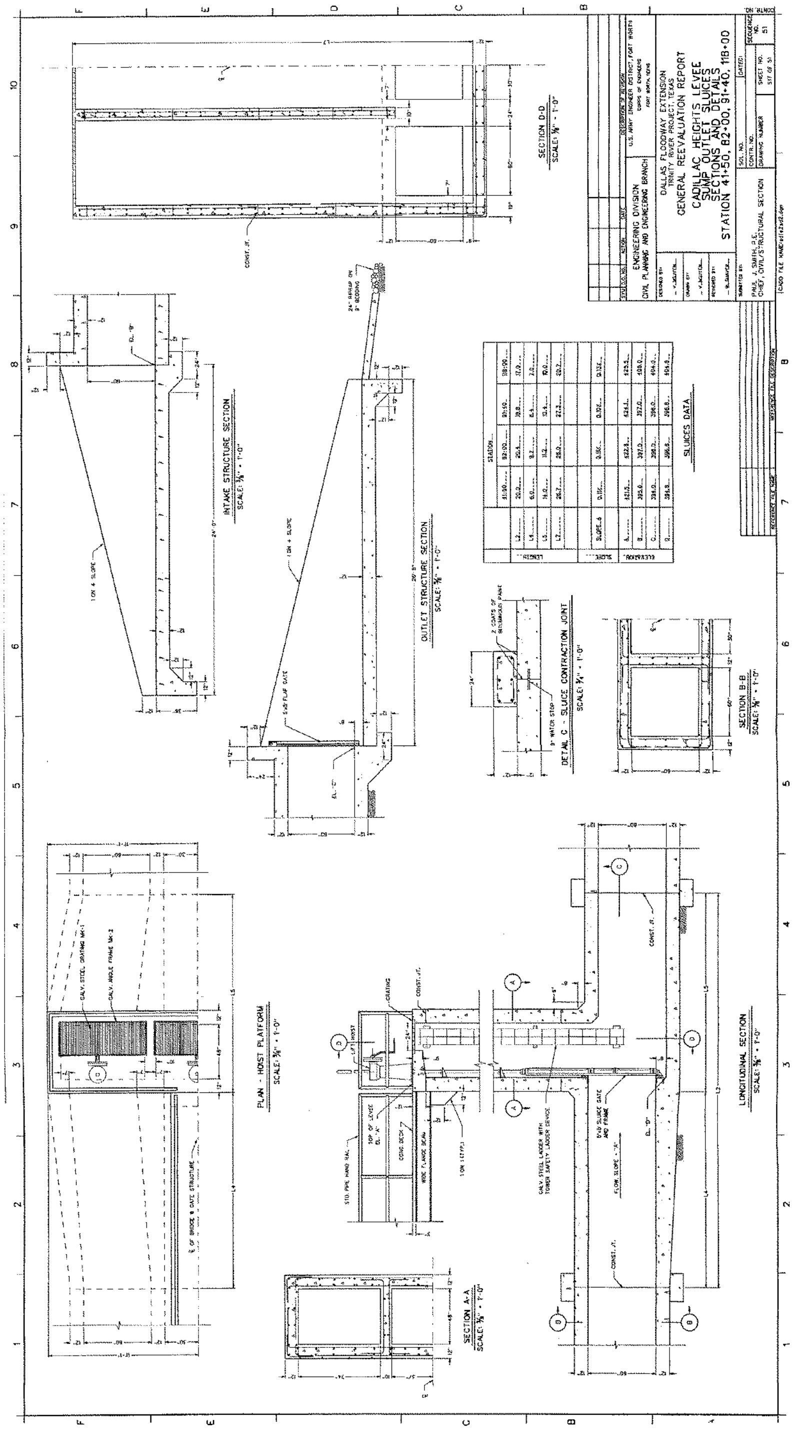

ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
FORT WORTH, TEXAS
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUMP OUTLET SLUICE
SECTIONS AND DETAILS
STATION 50+60
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION
SECTION D-D
SECTION A-A
SECTION B-B
INTAKE STRUCTURE SECTION
OUTLET STRUCTURE SECTION
DETAIL C - SLUICE CONTRACTION JOINT
PLAN - HOIST PLATFORM
LONGITUDINAL SECTION


DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUMP OUTLET SLUICE
PLAN AND SECTION
STATION 118+60
PLAN VIEW
SECTION THROUGH SLUICE


SECTION D-D
SCALE: 3/4" = 1'-0"
INTAKE STRUCTURE SECTION
SCALE: 3/4" = 1'-0"
OUTLET STRUCTURE SECTION
SCALE: 3/4" = 1'-0"
DETAIL C - SLUICE CONTRACTION JOINT
SCALE: 3/4" = 1'-0"
SECTION B-B
SCALE: 3/4" = 1'-0"
PLAN - HOIST PLATFORM
SCALE: 3/4" = 1'-0"
LONGITUDINAL SECTION
SCALE: 3/4" = 1'-0"
SECTION A-A
SCALE: 3/4" = 1'-0"
U.S. ARMY ENGINEER DISTRICT, FORT WORTH
CORPS OF ENGINEERS
ENGINEERING DIVISION
CIVIL, PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
LAMAR STREET LEVEE
SUMP OUTLET SLUICE
SECTIONS AND DETAILS
STATION 118+60
PAUL J. SMITH, P.E.
CHIEF, CIVIL/STRUCTURAL SECTION



		STATION			
		41+50	87+00	90+80	118+00
LENGTH	L1	150.0	144.0	150.9	125.0
	L2	20.0	20.4	18.8	17.0
	L3	66.0	96.0	72.0	48.0
	L6	116.0	113.2	118.4	92.0
	L9	120.0	117.2	122.4	96.0
SLOPE	SLOPE A	0.1%	0.1%	0.10%	0.13%
ELEVATION	A	421.5	422.8	424.1	425.5
	B	395.0	397.0	397.0	405.0
	C	394.0	396.0	396.0	404.0
	D	394.8	396.8	396.8	404.8


SECTION D-D
INTAKE STRUCTURE SECTION
OUTLET STRUCTURE SECTION
SLUICES DATA
DETAIL C - SLUICE CONTRACTION JOINT
SECTION B-B
PLAN - HOIST PLATFORM
LONGITUDINAL SECTION
SECTION A-A
ENGINEERING DIVISION
CIVIL PLANNING AND ENGINEERING BRANCH
DALLAS FLOODWAY EXTENSION
TRINITY RIVER PROJECT, TEXAS
GENERAL REEVALUATION REPORT
CADILLAC HEIGHTS LEVEE
SUMP OUTLET SLUICES
SECTIONS AND DETAILS
STATION 41+50, 82+00, 91+40, 118+00

APPENDIX D

ECONOMICS

APPENDIX D

ECONOMIC ANALYSIS

GENERAL METHODOLOGY

Purpose and Scope

The principal purpose of this economic analysis was to identify the extent of the flood problem and comparably evaluate solutions to reduce flood losses. As part of these activities, a field survey was conducted to identify the numbers and types of property, and the value of the investment affected by flooding. Calculations were done to develop estimates of the damages and benefits assignable to the various flood protection plans investigated. This analysis was conducted following procedures and guidelines as set forth in the Water Resources Council's Principles and Guidelines (July 1983) and current implementing regulations.

Due to its complexity, the plan formulation for this reevaluation occurs in three stages - 1991-1993, 1993-1996, and 1996-1997. The results of the first two stages are summarized with the final array presented in detail. Annual benefits were determined by subtracting residual flood losses from the without project losses. Significant future changes in hydrology and increased urbanization in the flood plain areas are anticipated in this study, however equivalent average annual damages were assessed for with and without project conditions only in the final stage (1996-1997) of the analysis.

The prevailing price, level of development and the Federal interest rate were documented and applied accordingly. Final estimates of the total array of the plans flood damages and benefits presented herein reflect January 1997 prices and level of development, and a Federal interest rate of 7.375 percent. The Recommended and the Locally Preferred plans were updated to reflect the Fiscal Year 1998 interest rate of 7.125 percent. This rate was also applied to convert first costs and undiscounted future damages and benefits to average annual equivalent values.

Flood Profiles and Delineations.

A full range of water surface profiles, based on existing stream conditions, was developed for this study. These profiles were used to delineate the flood plain limits and determine the relationship of damageable properties to both elevation and frequency of flood occurrence. The satisfactory development of the hydraulic model in each reach was a multistage iterative process, with the reasonableness of the resulting economic effects being used to help in refining the hydraulic models used.

Probabilities of Flood Events

USACE policy (as per ER 1105-2-101) states, "The estimate of NED benefits and costs will be reported as single expected value and on a probabilistic basis for each planning alternative." This requires the classical nomenclature describing the relative risk of given flood events to be changed to reflect the actual probability, rather than the average recurrence interval, of flood events.

For example, the commonly used term "100-year frequency flood", meaning that flood which stands a one percent chance of being equaled or exceeded in any given year period will hereafter be described as the "1 percent annual chance exceedance (ACE) flood". For convenience, the new probabilistic nomenclature will be abbreviated as "1 percent ACE flood".

The classical terminology and the equivalent current terminology for this report is shown below

Classic Terminology	***Current Terminology***
1-Year Flood	<100 Percent Annual Chance Exceedance Flood
2-Year Flood	50 Percent Annual Chance Exceedance Flood
5-Year Flood	20 Percent Annual Chance Exceedance Flood
10-Year Flood	10 Percent Annual Chance Exceedance Flood
25-Year Flood	4 Percent Annual Chance Exceedance Flood
50-Year Flood	2 Percent Annual Chance Exceedance Flood
100-Year Flood	1 Percent Annual Chance Exceedance Flood
500-Year Flood	.2 Percent Annual Chance Exceedance Flood
800-Year Flood	.125 Percent Annual Chance Exceedance Flood

Damage Categories.

Damageable property and costs associated with flooding are divided among five damage categories. Flood damages are calculated in terms of structure and content damage and loss, damage to infrastructures, costs to the public in subsidizing flood insurance, and the cost to combat floods and provide emergency management. These categories are detailed in table D-1.

Data Collection.

In May 1991, an inventory was made of the floodplain lands along the subject streams to identify existing flood plain development. Due to the large size of the floodplain, residential structure data for this inventory was collected in aggregates of city blocks. It included enumeration of the numbers and types of structures within the SPF limit. Existing damageable properties were classified into the major damage categories. This inventory was field-checked and extensively supplemented in June 1992. Surveys were also taken of individual homes within a sample residential city block. Statistical relationships between the sample residential data and the original aggregated data for the same blocks were used to calibrate the aggregated residential data set as a whole. Individual surveys of all nonresidential properties were taken.

A determination was made of the value of flood plain investment (structures and contents) for each major damage category, based on data provided by the Dallas County Tax Appraisal District. These data, which were reviewed by Real Estate Division personnel in Fort Worth District, represent the depreciated replacement value of each structure, net of the value of associated lands. The value of existing residential contents was assumed to be 50 percent of the structure value. The values of contents for the other damage categories were based on direct field observation and interviews with property owners, and the relationships between structure value and content value observed in previous studies of similar areas.

Table D-1
Major Damage Categories

Damage Category	Activity Description
Residential	Single and multifamily dwellings
Commercial & Industrial	Retail and wholesale businesses
Public	Public and quasi-public buildings
Flood Insurance Admin.	Costs to the public of flood insurance program administration
Other:	
Transportation	Streets, highways, and bridges
Communications & Utilities	Electrical, gas, telephone, sewerage, and water supply facilities and buildings
Public Health and Relief	Flood-fighting and related emergency management activities

Flood Damage Programs

The STDMA program, written in the Memphis District in 1977, was originally developed in to avoid certain analytical simplifications common to flood damage computer models of the time. Namely, that within a given reach all properties are at the same stream station and all flowlines are parallel. The program also improved the manipulation of multiple sets of hydraulics data. Since the start of its use in Fort Worth District, the program and its input data sets have been modified to incorporate ongoing field survey findings concerning depth-damage relationships for various kinds of property. More recently, the program has been expanded to provide automatic computation of expected annual benefits for flood proofing every structure to one, two and three feet above the finished floor, and other enhancements.

The STDMA program was used in this analysis to facilitate data tabulation, aggregation and segregation by reach and flood zone. Single-event damage estimates were extracted and entered in the HEC-FDA program to derive depth-damage curves. Average annual damage estimates per structure were used to evaluate nonstructural alternatives.

The NexGen Hydrologic Engineering Center-Flood Damage Assessment Program (HEC-FDA) was developed to facilitate the plan formulation and evaluation of flood damage consistent with federal and Corps of Engineer (COE) policy regulations (ER 1105-2-100 and ER 1105-2-101). The program integrates hydrologic engineering and economic analysis through application of the Monte Carlo simulation, a technique that computes expected value of damage while accounting for uncertainty in the basic value. This program was used to calculate stage-damage-uncertainty information at damage reach index locations and to compute equivalent annual damage.

Depth-Damage Relationships

The original depth-damage curve file was adapted, at the time STDMA was created, from the one used by the older 761-F5-M3020 flood damage computer program and was based on data from the U.S. Flood Insurance Administration. Current files were supplemented and modified based on the findings of numerous subsequent economic field surveys of flood plain properties in Fort Worth District, considering such factors as the design of the structure and nature of the structure contents. The depth-damage relationships determine damages after a comparison of flood elevation with the elevation of the finished floor of each structure. A finished floor – the lowest occupied floor of a building – is generally higher than the local ground elevation by an amount that varies with the structure (typically 0.5 to 1.5 feet above the ground for most detached residences and commercial establishments and 3 feet for mobile homes). For a vehicle, "finished floor" refers to the bottom of the engine block and the floorboard of the passenger compartment, and is assumed to be one foot above the ground.

Residential Vehicles

Formidable practical difficulties are directly related to field-surveying the number and value of residential vehicles in a flood plain at the various times that a flood might occur. Damages for residential automobiles were therefore estimated considering the average number of vehicles per residence characteristic of the study area, and their probability of being present at the time of a flood. An analysis was conducted of registered motor vehicles per occupied housing unit for counties within Metropolitan Statistical Areas in Texas (MSA), using data from the U.S. Census and the Texas State Department of Highways and Public Transportation. The number of registered vehicles per occupied housing unit in MSA counties clusters closely around a mean value of 2.48. However, not all registered motor vehicles are associated with private homes, and not all housing units are occupied. For simplicity, it was assumed that an average of 2.0 vehicles per gross residence exists, about 1.5 of which would be present during non-work hours (128 hours per week) and about 0.5 would be present during work hours (40 hours per week). The expected number of vehicles present at any given time that a flood might occur would therefore be

$$((128/168)*1.5)+((40/168)*0.5)$$

or 1.26 expected vehicles per residence. The exact number would vary depending on the assumptions made, but for further simplicity, and conservatism, it was assumed that one expected vehicle exists per residence, which would be present at the time of a flood. This vehicle was assumed to be at the same location as the structure with which it is associated, with the same stream station and ground elevation values. (As noted above, damages start when flooding reaches one foot above the ground elevation.)

It should be noted that this calculation of the expected number of vehicles that would be present in the flood plain at the time of a flood has nothing to do with the warning time flood plain residents would have. A flood affects only those vehicles present at the time of a flood, While a vehicle is usually the single-most valuable item of personal property, and by definition the most mobile, the overwhelming majority of urban floodplain users experience flooding with little or no warning time. This is either because of a steep flood hydrograph, a lack of a warning system, or both, and substantial vehicle damages are typically observed. In any case, the effects of increased flood warning time would take the expected number of flood plain vehicles as its baseline.

A strong positive correlation would be expected between the value of a residential structure and the value of the vehicles associated with it, based on general field observation. The relationship is not simply proportional, since an extremely low-value structure can have a vehicle worth as much as the structure itself, while the most affluent residence would have vehicle worth not much more than a tenth of the value of the structure. Plausible average vehicle values result by assuming the following relationship for detached single-family residences:

$$V = (0.1*S)+1000$$

where V is the vehicle value and S is the value of the residential structure. The typical residence, with a structure value between $40,000 and $60,000, would have a vehicle worth $5,000 to $7,000. This is in good agreement both with field observation, the observed average age of the private vehicle stock (on the order of five years), the corresponding depreciation (about 50 percent), and the average vehicle cost when new (on the order of $10,000 to $15,000). An exception to this general formula is made for mobile homes, which have a much lower structure value relative to the economic status of the residents (which is the basic determinant of the value of their personal property, including vehicles). The assumed relationship for mobile homes is

$$V = (0.2*S)+1000$$

While each of these calculated vehicle values is assumed rather than empirical, varying them does not greatly affect the resulting assumed average vehicle value or the vehicular flood damages that result from using them. The above set of assumed relationships, although hypothetical, are considered realistic and a sufficient basis for planning purposes.

Flood Insurance Administrative Costs

A public cost is incurred for each flood insurance policy, reflecting the administrative costs of the national flood insurance program. The average cost per policy is $131 per year, which is applied to all structures within the 1 percent ACE (100-year) floodplain.

Other Damages

Damages associated with transportation, communications, and public utilities facilities, and with flood-fighting and public health and relief activities, are estimated based on historical data collected from the City of Dallas Public Works Department. Data includes documented costs submitted to FEMA following major flood events.

Frequency-Damage Calculations

Using the appropriate water surface profiles, the depth of water at each structure within the study area was calculated for the 0.00125, 0.002, 0.01, 0.02, 0.04, 0.1, 0.2, and 1.0 percent ACE flood events. These depths were combined with the damage susceptibility factors and estimated values to estimate damages. Damages to the various activities were accumulated by frequency to produce a frequency-damage function. Estimates of expected annual damages were calculated through an integration process using frequency-damage data. Generally, this involved aggregating the multiplication of the mean damage between each pair of flood events by the difference in exceedance probabilities for that pair of events, repeated over the entire range of flood events for each category of damageable property. These calculations were facilitated by the HEC-FDA program.

Magnitude and Extent of the Flood Problem

Descriptive information on the existing flood problem along the Trinity River is provided below. This includes field survey data and follow-up office analysis to ascertain the severity of the flood hazard, including:

- o Enumeration and estimates of existing flood plain properties.
- o Estimates of single occurrence flood losses for various events.
- o Estimates of average annual flood losses to existing properties.
- o Estimates of risk associated with selected flood events
- o Estimates of equivalent annual flood losses based on significant future changes in hydrology and urbanization.

STUDY AREA DESCRIPTION

Socioeconomic Conditions

The Bureau of the Census reports the population for the city of Dallas as 904,100 persons in 1980 and 1,007,600 persons in 1990. These figures account for more than 80 percent of the population in Dallas County. These figures also show an annual growth rate of over 10 percent. The 1996 population was estimated at 1,039,100.

Employment in the service industry highlights the significant shift from a manufacturing-based economy to a service related economy. Over the 10-year period service industry employment increased almost 50 percent. Between 1990 and 1994 non-farm employment figures increased almost 4 percent. The construction industry lead the job growth figures in 1994 with an increase of over 10 percent.

The Texas Workforce Commission reported area unemployment 1994 at 5.3 percent. In 1996 the unemployment decreased to 3.9 percent and is currently reported by the commission at 3.6 percent. The employment rate continues to be lower than the state and the nation. Per capita income for 1995 was estimated at $18,180 with an average salary of about $30,000.

Dallas is a major hub for hundreds of rail routes. The major railroads that serve the Dallas area include: Burlington Northern, Cotton Belt, Kansas City Southern Lines, Santa Fe Railway, Southern Pacific and Union Pacific. Many of these lines traverse the study area. The city also provides public transportation with a net work of local and suburban bus routes, light rail, and High Occupancy Vehicle lanes.

Reach Determination

The study area is located along the Trinity River in the southern sector of the city of Dallas. The initial area of investigation can be defined as that portion of the Trinity River between the confluence of Five Mile Creek, near Interstate-20 (I-20) downstream and the terminus of the existing Dallas Floodway Levee System upstream. However, preliminary analysis revealed significant hydraulic correlations between the extension area and the existing levee system upstream. Specifically, implementation of flood control projects in the extension area significantly influences the performance of the Dallas Floodway Levee System. Subsequently, about eight miles of the Dallas Floodway Levee System was included in the study area. To facilitate the analysis of benefits and inducements in both locations the study area was divided accordingly. The Dallas Floodway Extension is referred to as the Primary Study Area and the Dallas Floodway Levee System as the Secondary Study Area.

The primary study area was surveyed in 1991 and included all properties identified within the standard project flood (SPF) floodplain along the Trinity River and the White Rock Creek Tributary between station 499+14 and station 954+04. This area was considered the primary study area. The secondary study area includes all properties protected by the Dallas Floodway Levee System between station 1083+80 and 1180+00. The reach extends from the terminus of the levee system to the confluence with the West Fork of the Trinity River. These primary and secondary study areas were further subdivided into reaches based on concentrations of damageable properties. The reach boundaries are shown in table D-2.

Table D-2
Study Area Reach Boundaries

Reach	Reference Name	Station Range	Index	Bank
Primary Study Area				
Reach 1	Sleepy Hollow	499+14 to 823+61	768+24	Both
Reach 2	White Rock Creek	823+61 to 859+16	859+16	Both
Reach 3	Rochester Park	859+16 to 998+01	998+00	Left
Reach 4A	Lamar Street	895+27 to 1083+80	998+00	Left
Reach 4B	Oakland Channel	895+27 to 1083+80	998+00	Left
Reach 5	Cadillac Heights	998+00 to 1083+80	1011+38	Right
Reach 6	Treatment Plant	954+04 to 1011+38	1011+38	Right
Secondary Study Area				
Reach 7	East Levee	1083+80 to 1180+00	1083+80	Left
Reach 8	West Levee	1083+80 to 1180+00	1083+80	Right

Detailed Reach Description

Primary Study Area: This area begins at the Atchison, Topeka and Santa Fe Railroad (AT&SF) upstream and extends southwesterly to the river crossing at I-20. The study area also includes floodplain lands along the White Rock Creek Tributary from I-30 to its confluence with the Trinity River. Under existing conditions the .125 percent ACE floodplain encompasses over 10,400 acres and the 1 percent chance exceedance flood over 9,200 acres. A map of the total study area is presented in the main report. To facilitate the analysis the study area was separated into the following reaches:

Reach 1 (Sleepy Hollow): Extends from the confluence of White Rock Creek south eastward to the confluence of 5-Mile Creek. The reach is bounded by I-20, the MKT Rail Road, and Linfield and Riverwood Roads. This reach includes the Sleepy Hollow Golf Course located near the river and Loop 12. The land use includes commercial, industrial, residential, and public facilities. The McCommas Bluff and Linfield landfill sites are located in this reach.

Reach 2 (White Rock): Includes a portion of the White Rock Creek Tributary from I-30 upstream to its confluence with the Trinity River near Linfield Street. The reach is further bounded by Pemberton Road, I-30, the Southern Pacific Railroad and the Rochester Park Levee. Land use includes single and multi-family residential, commercial and industrial properties.

Reach 3 (Rochester Park): This reach is located near the center of the study area and is predominately enclosed along its southern border by the Rochester Park Levee. The reach is further bounded by Hwy. 175 (Hawn Freeway), and Hwy. 310 (Central Expressway). The land use is predominately single and multi-family residential and a few commercial and public properties.

Reach 4A (Lamar): This reach (initially combined with reach 4B) is located within the SPF floodplain limits along the east bank of the Trinity River. Beginning near the intersection of Lamar Street and Hwy. 175 and continuing northerly upstream to the AT & SF railroad. The reach is bounded on the east by Hwy. 310 (Central Expressway). The major land use categories include residential, commercial and industrial facilities.

Reach 4B (Oakland Channel): This reach (initially combined with reach 4A) is located parallel and to the east of Reach 4A. It is bounded by Hwy. 310 and Second Avenue. The Oakland Channel, which flows into White Rock Creek is located within this reach. The primary land use categories are single and multifamily residential and some commercial facilities.

Reach 5 (Cadillac Heights): Located on the West Bank of the Trinity River, the SPF limit of this reach extends from I-45 to the AT&SF Railroad at the end of the existing Dallas Floodway. This area includes single-family residential, commercial, industrial and public properties.

Reach 6 (Treatment Plant): This reach is located downstream of Reach 5 and consists solely of the Central Wastewater Treatment Plant facility. This public facility represents the greatest single investment in the study area.

Secondary Study Area: Property protected by the east and west levees between the floodway terminus and the confluence of the West Fork of the Trinity River is included in the secondary study area. The total investment behind these levees was estimated at over $5.7 billion.

Reach 7 (East Levee): This reach, located upstream of the primary study area, encompasses the SPF flood plain limits protected by the East Levee of the existing Dallas Floodway System. The area includes the Central Business District and a mixture of all land use categories. Commercial facilities dominate the reach (69 percent) with almost 1982 structures. A total of 2,885 structures was identified with an estimated value of over $4.8 billion.

Reach 8 (West Levee): This reach, located upstream of the primary study area, encompasses the SPF flood plain limits protected by the West Levee of the existing Dallas Floodway. The area includes all land use categories- residential and commercial and industrial and public facilities. Residential structures make up over 90 percent of the land use in this reach with over 6,900 identified. A total of 7,700 structures was identified with an estimated value of over $934 million.

Key Assumptions

- Investigations through 1993 utilized the hydrological model developed for the original 1989 Upper Trinity River Reconnaissance Study, existing two foot topography maps and expected probability water surface elevations.

- Property values, based on the Dallas County Appraisal District data, were adjusted to reflect depreciated replacement value.

- Floodway extension is considered a modification to the existing floodway project. The benefits attributable to restoring the level of protection should be claimed and are not considered incidental benefits. The cost of the extension needs to be incrementally justified.

- In accordance with PGL 26, Benefit Determination Involving Existing Levees benefits were based on Probable Failure Points (PFP) and Probable Non-Failure Points (PNP).

- The chance exceedance flood event for the Rochester Park levee was estimated at the .68 percent ACE level and the Central Wastewater Treatment Plant at the .7 percent ACE level.

- Prevailing interest rate of 8 percent for analysis conducted before fiscal year 1993.

- 1993 analysis used standard frequency models and STDMA to determine benefits. Included benefits\disbenefits for overtopped levees upstream in existing Dallas Floodway.

- Design grade is assumed for benefit and damage calculation. The height of the existing Federal Dallas Floodway Levee System was estimated to stand at the .23 percent ACE flood level based on the design grade. The Dallas Floodway System has settled in some areas and is not currently at design grade.

Structures and Investment Identified

Table D-3 displays the numbers and estimated total values of properties (structures and contents) identified within the Primary study area surveyed. A total of 2,640 structures was identified within the .125 percent ACE (SPF) flood limits, of which about 90 percent are located above the confluence of White Rock Creek. The total flood plain investment within the .125 percent ACE floodplain limit of the primary study area was valued at over $740 million based on June 1993 prices and level of development.

About 90 percent of the structures, representing about 11 percent of the value of floodplain investment, are residential. These are nearly all one or two-story detached residences, with an average structure value of about $26,000. Commercial and industrial properties represent 9 percent of the total number of structures and 10 percent of the total floodplain investment value. Although only 26 public structures are identified, they constitute 78 percent of the floodplain investment value.

Preliminary estimates of the investments protected by the Dallas Floodway Levee System were extracted from the 1989 Dallas Floodway Reconnaissance Report. Investments of over $5.0 billion were identified within the SPF floodplain. The majority of these investments are commercial and industrial in nature.

Single-Occurrence Flood Losses

Cumulative single-occurrence flood losses by reach and flood zone under with and without-project conditions are presented in Table D-4. Within the primary study area, under without-project conditions, damages begin at the 50 percent ACE discharge in reach 4 for railroad facilities. A 10 percent ACE event could produce damages totaling $4.8 million. The 4 percent ACE flood discharge could produce damages that exceed $12.0 million. The 1 percent ACE event could produce losses totaling over $40.0 million. A significant increase in loss occurs with the .2 percent ACE event that could produce over $296.0 million in damage. This would represent about 48 percent of the floodplain investment. It was estimated that a .125 percent ACE event could cause direct structure and content damage of about $374.0 million based on June 1993 prices. A flood of this magnitude would destroy about 50 percent of the total investment in the primary study area. Estimates of flood losses for different single-occurrence flood events by reach, are presented in table D-4.

Single-event damages in the secondary study area were based on data used in the 1989 Dallas floodway Section 215 Reconnaissance Report. The preliminary investigation assumed the entire levee system to be at risk. The single-event damages for the levee system were reported as follows:

East Levee (E):	$7,247 billion
West Levee (W):	$1,550 billion
North West Levee (NW):	$ 388 billion

and tabulated based on a weighted-average of the damages occurring behind the three levees where,

Weighted Average = NW+(E+W+(E+W))/3,

which yields weighted average damages of $6,253 billion. These damages were updated to the prevailing price level based on an October 1988 index of 4555.4 and an October 1993-estimated index of 5208.8. The calculated factor of 1.43 was applied to yield total single-event damages of $7.15 billion for the secondary study area.

Table D-3
Total Floodplain Investments by Reach
(June 1993 Prices and Level of Development)
(1,000's $)

	Single-Family Residential		Multi-Family Residential		Commercial\ Industrial		Public		Total Structure Investment		Vehicles	Rail	Total Investment
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Primary Study Area													
1	73	1,672.9	0	0.0	26	21,601.3	3	2,420.8	102	25,695.0	182.5	4,204.2	30,081.7
2	68	4,105.9	3	450.5	19	1,615.6	0	0.0	90	6,172.0	407.7	0.0	6,579.7
3	247	6,114.8	112	8,736.0	8	188.3	4	34,675.0	371	49,714.1	1,483.2	0.0	51,197.3
4	1,641	39,580.2	6	361.4	131	40,669.8	3	107,013.2	1,781	187,6247.6	2,295.2	6,682.2	196,602.0
5	215	6,025.5	0	0.0	66	17,035.2	0	0.0	281	23,060.7	661.7	1,535.5	25,257.9
6	0	0.0	0	0.0	0	0.0	15	434,133.0	15	434,133.0	0.0	0.0	434,133.0
	Area Total												
	2,244	$57,499.3	121	$9,547.9	250	$81,110.2	25	$578,242.0	2,640	$824,141.1	$3,732.9	$13,129.9	$743,851.6
%	85.0%	8.0%	5.0%	1.0%	9.0%	11.0	1.0%	71.0%	100.0%		1.0%	2.0%	100.0%

Table D-4
Cumulative Single-Event Damages

% ACE Event	1	2	3*	4	5	6*	Total
<100	$0	$0	$0	$13,129	$0	$0.0	$13,129
50	$6,083	$0	$0	$43,596	$22,479	$0.0	$72,158
20	$30,070	$365,150	$0	$243,976	$477,256	$0.0	$1,116,452
10	$317,055	$639,283	$0	$1,470,734	$2,470,518	$0.0	$4,897,590
4	$565,731	$687,813	$0	$6,750,943	$4,041,161	$0.0	$12,045,648
2	$834,462	$747,697	$0	$12,129,761	$5,895,266	$0.0	$19,607,186
1	$3,326,273	$1,116,522	$2,230,000	$24,671,859	$8,367,142	$24,489,000.0	$64,200,796
.2	$14,021,172	$3,448,877	$14,038,560	$91,586,716	$14,902,354	$158,841,900.0	$296,839,579
.125	$16,802,385	$4,001,853	$18,400,480	$102,406,626	$16,167,014	$216,891,800.0	$374,670,158

*Reach 3 assumes 148-year Rochester levee and reach 4 assumes 142-year Treatment Plant levees.

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Expected Annual Damages

Estimates of expected annual damages under existing conditions were calculated through integration of frequency-damage data. Generally, this involved multiplication of the mean damages between each pair of flood events by the difference in exceedance probabilities for that pair of events. The process was repeated over the entire range of flood events for each category of damageable property. Incidental damages (comprising transportation, communications, and utilities' facilities, and public health and relief operations) were estimated based on the historical information submitted by the local sponsor documenting FEMA claims.

The total expected annual flood losses in the primary study area were estimated at over $4.1 million, based on June 1993 prices and level of development. Table D-5 details this information by reach and damage category. As detailed, damage to structures, contents and vehicles account for over 87 percent of the annual damages. Collectively, commercial and industrial, and public properties suffer the greatest financial loss. Losses to commercial and industrial properties contribute to about 30 percent of the total damages and public properties about 33 percent of the total damages.

Based on the water surface elevation occurring at stream station 165.71 just upstream of the AT and SF railroad, it was assumed that a breach could occur one-half foot below the top of the levee. This translates to a flood event with a .00226 probability of occurrence (442-year). Direct application of this probability to the single-event damages of $7.15 billion yields expected annual damages of $16,176,470 for the secondary study area.

Aggregated expected annual damages for both portions of the study area were tabulated as:

Primary Study Area	$ 4,160,516
Secondary Study Area	$16,176,471
Total	**$20,336,987**

Nonstructural Plans Investigated

General

Several nonstructural measures were evaluated during the plan formulation stage. Specifically, evacuation, relocation, and raising-in-place alternatives were investigated. Permanent evacuation within the primary study area was selected for detailed evaluation based on finished floor elevations. The accuracy of the following nonstructural evaluation was supported by estimates obtained from AWARE House and Structural Movers of Fort Worth, Texas for other nonstructural projects currently under investigation. The company described costs and problems associated with the demolition, relocation and raising of the flood prone structures consistent with those found in the Dallas Floodway Extension study area.

Table D-5
Existing Conditions Expected Annual Damages
(June 1993 prices and level of development)

Total Expected Annual Direct Damages							Total Expected Annual Incidental Damages						
Reach	*Res.*	*Comm\Ind*	Public	Vehicles	Rail	Primary Subtotal	Roads	Utilities	Emergency Aid	Clean-Up	Flood Insurance	Incidental Subtotal	Total Damages
1	$10,449	$117,682	$2,356	$1,702	$55,352	$187,541	$992	$1,567	$8,579	$3,039	$2,148	$16,324	$203,865
2	$23,328	$163,241	$0	$7,972	$0	$194,541	$3,443	$5,441	$18,985	$10,550	$1,499	$39,917	$234,458
3	$45,331	$658	$33,995	$8,016	$0	$88,000	$1,559	$2,464	$39,416	$4,778	$0	$48,217	$136,217
4	$200,432	$510,740	$323,497	$47,601	$346,038	$1,428,308	$15,867	$25,076	$161,375	$48,622	$26,124	$277,064	$1,705,372
5	$114,283	$481,849	$0	$19,692	$103,109	$718,933	$8,500	$13,433	$70,250	$26,045	$9,790	$128,018	$846,951
6	$0	$0	$1,033,143	$0	$0	$1,033,143	$66	$104	$139	$201	$0	$509	$1,033,652
TOTAL	**$393,823**	**$1,274,170**	**$1,392,991**	**$84,983**	**$504,499**	**$3,650,466**	**$30,426**	**$48,085**	**$298,743**	**$93,235**	**$39,560**	**$510,049**	**$4,160,516**
%	9.5%	30.6%	33.5%	2.0%	12.1%	87.7%	0.7%	1.2%	7.2%	2.2%	1.0%	12.3%	100.0%

Nonstructural Benefit Methodology

As stated in ER 1105-2-100, and IWR Report 88-R-2, page IX-12, benefits for removing individual structures from the flood plain are limited to the sum of:

annualized residual value of the vacated land, *or* average annual recreation benefits for the land

plus:

reduction in annual flood insurance subsidies:

agency cost:

average annual damages to the structure and its contents,

plus:

agent fees (at 15 percent of the estimated premium), and other administrative costs (at $131 per policy)

minus:

policy holders' cost:

estimated annual insurance premium (at $0.55 per $100 of structure value for the first $45,000 and $0.17 per $100 thereafter, plus $0.65 per $100 of contents value for the first $15,000 and $0.30 per $100 thereafter),

annual deductible ($500 each for structure and contents per flood occurrence, times the probability of a flood in a typical year), and

annual uninsured losses (5 percent of the structure value per flood occurrence, times the probability of a flood in a typical year)

plus:

average annual public damages prevented (that is, damages to communications and public utilities facilities, and costs for flood fighting and public relief) based on actual FEMA claims.

Nonstructural Analysis Results

Floodplain evacuation involves the acquisition and removal or demolition of frequently flooded structures from the flood plain. This alternative was initially evaluated for the evacuation of structures within the 10 percent ACE flood event according to the nonstructural economic criteria previously outlined. Eligibility under the evacuation alternative rests primarily with the economic criteria and the frequency of flooding. The structural integrity of the structure was not a factor in determining feasibility as in other nonstructural plans. Reaches 2 and 5 contain commercial and industrial structures within the 50 to 20 percent ACE flood events, which meet these nonstructural economic criteria. Table D-6 presents a summary of the economic analysis for the evacuation of eligible structures in reaches 2 and 5. The cost estimates include land acquisition, demolition and disposal, and the remediation of asbestos, lead based paint, and other hazardous non-CERCLA contaminants.

In reach 2 about $154,300 in annual damages would be eliminated with the permanent evacuation of 5 commercial structures. The first cost for this plan was estimated at about $874,800. The annual costs and claimable annual benefits are $75,800 and $145,600, respectively with a resultant benefit-to-cost ratio of 1.8 to 1.0 and excess benefits of about $66,000.

In reach 5 an estimated $419,000 in annual damages could be eliminated with the evacuation of only 2 commercial structures. First cost for this plan was estimated at about $580,300. The annual costs and claimable annual benefits are $50,800 and $410,800, respectively with a resultant benefit-to-cost ratio (BCR) of 7.6 and excess benefits of about $357,000. The benefits derived signal the need for a more detailed investigation to obtain empirical flooding evidence associated with the contents in these structures for this reach.

In summary, the permanent evacuation plans were economically feasible for 7 commercial structures. Total damages would be reduced damages by 12 percent in the immediate study area. The combined plans would have an estimated project first cost of $1,455,100. The total annual benefits and costs would be $556,400, and $133,400, respectively. The resultant BCR would be 4.2 to 1.0 with excess benefits of $423,100.

The Uniform Relocation Assistance Program requires that displaced property owners be compensated for losses attributable to evacuation. A maximum of $22,000 was allowed for residential structures to cover moving expenses, temporary lodging, and the cost to obtain housing in accordance with Federal guidelines. Maximum relocation expenses have not been set for commercial/industrial structures. These costs would be 100 percent non-Federal.

The local sponsor needs recreational facilities, however, a specific recreation design was not considered at this point since the BCR exceeds 1.0, and the structures are randomly located throughout the flood plain. It is recognized that individual structures may be selected for evacuation in conjunction with other flood control measures.

Table D-6
Summary of Estimated Benefits and Costs of Investigated Evacuation Plans
(October 1993 prices, 8.0 percent interest rate)
(in thousands of dollars)

Reach	Number of Structures	Total First Costs	Annual Costs	Annual Benefits	Benefit to Cost Ratio	Annual Net Benefits
Reach 2	5	$874.8	$75.8	$145.6	1.8	$ 66.0
Reach 5	2	$580.3	$50.8	$410.8	7.6	$357.0
Combined	7	$1,455.1	$125.1	$556.4	4.2	$423.0

Channel Plans Investigated

The preliminary design features a 5-mile channel extending from the downstream end of the existing Dallas Floodway upstream to Loop 12. The channel would be a grass-lined trapezoid with 3' horizontal to 1' vertical side slopes. Between the existing floodway upstream and continuing just below I-45 with alignment along the West bank of the Trinity River. At I-45 the channel would veer to the east and cross the river to the East bank, rejoining the natural channel at the center of the large oxbow and continue along the East bank to I-20. The channel was aligned to preserve at least 1 side of the river bank. Bottom width sizes investigated for this alignment included the 250', 200', 150', and 100'. The results of the analysis are shown in table D-7.

Project first costs' range from about $37.0 million to $75.0 million. Each plan would be feasible with B/C ratios ranging from 1.7 to 2.8. The optimum bottom width would be 150'. All four designs would increase the level of protection provided by the existing levees in the primary and secondary study portions of the study area and reduce damages in the unprotected primary study area by 50 to 75 percent. However, due to an unfavorable public acceptance, plans with fewer environmental impacts were evaluated.

Table D-7
Summary of Channel Alternatives
(Millions of Dollars)
(June 1993 prices and level of development, 8.0% interest)

Option	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
100' BW	$38.9	$3.6	$11.1	2.8	$6.5
150' BW	$52.1	$5.0	$11.9	2.4	$6.9
200' BW	$74.2	$6.3	$12.5	2.0	$6.2
250' BW	$78.3	$7.6	$13.2	1.7	$5.6

Levees Investigated

Levee designs for the 1 percent and .125 percent ACE flood events, were investigated for the left and right banks of the Trinity River between the existing Dallas Floodway Levee System and Hwy. 75 (Central Expressway).

Lamar Street Levee: Constructed along the left bank with an average height of about 27' with 3.5v on 1h side slopes and a length of about 2.5 miles. A 1 percent ACE levee would consist of a series of small levees with a typical height of about 15' and an aggregate length of about 13,200'.

Cadillac Heights/Treatment Plant Levees: Constructed along the right bank of the Trinity river between the Cedar Creek confluence and Hwy. 75. The levees are referred to as the Cadillac Heights Levee (Reach 5) and Wastewater Treatment Plant Levee (Reach 6). The design of each was based on the permitted design plan developed by the engineering firm of Halff Associates. The average height would be about 25' for the .125 percent ACE levee and 15' for the 1 percent ACE levee. The total length is about 1.3 miles.

As shown in table D-8, annual levee costs are supported by the annual benefits. It was not considered practical to construct single levees along the East or West bank of the Trinity because inducements would occur along the opposite bank. However, as a system, inducements to the existing floodway produced negative net benefits.

Table D-8
Summary of Levee Alternatives
(Millions of Dollars)
(June 1993 prices and level of development, 8.0% interest)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
100-Year Lamar	$9.0	$.8	$1.5	1.9	$.7
100-Year Cadillac	$9.1	$.8	$1.2	1.5	$.4
SPF Lamar	$14.6	$1.3	$2.2	1.7	$.9
SPF Cadillac\Treatment Plant	$29.3	$2.6	$2.8	1.1	$ .2
ALL 100-Year Levees	$18.2	$1.6	$2.6	1.6	($1.1)
All SPF Levees	$43.9	$3.9	$1.8	0.5	($2.1)

Vegetation Management

This plan would clear non-endangered species underbrush from the downstream end of the existing Dallas floodway to Loop 12. The width of the clearing would extend approximately 1,000' from each side of the centerline of the river leaving an overstory of tree cover from 20' upward and a 200' corridor of existing vegetation along the natural channel. Although some selective clearing and pruning may be required, an attempt to leave a buffer zone 100' wide for a riparian habitat along both sides of the river channel. Small parcels of the understory (shrubs and other vegetation of approximately 3-5 acres in size) left in existing state dotted throughout the 2,000 foot area. All remaining understory vegetation would be removed. Hydraulic performance of this alternative demonstrated the significant impact of vegetation on the water surface elevations. The alternative was removed from consideration due to the requirement for expensive, intense maintenance. However, hydraulic findings initiated development of the swale plan.

Swale Plans Investigated

An economic analysis was conducted to ascertain the performance of overbank swales. Bottom width (BW) sizes investigated include an average of 300', 500', 600' 900', 1,200' and 1,500' with both swales in place. The swale plan would clear the site of all non-endangered species vegetation. A description of these swales is given below.

Lower Overbank Swale: Extends from Hwy. 75 (Central Expressway) upstream beginning at least 100' from the edge of the east bank and continues downstream to about 2,000' below Loop 12, for a total length of 17,300' or 3.3 miles. The lower swale was designed with a slope of .0005 ft/ft.

Upper Overbank Swale: To maximize channel relief, this grass-lined, overbank swale was designed to work in conjunction with the lower overbank swale to maximize channel relief. The length of the Upper Swale is about 7,800' or 1.5 miles and extends from the confluence of Cedar Creek upstream to the river crossing of I-45.

The Multi-Objective Management (MOM) Approach was used to design the swales to avoid and minimize environmental impacts. The wider swales impact the higher quality habitat to a greater extent than the 300' BW to 500' BW swales. Fragmentation was unavoidable and will require significant mitigation. Approximately 3,200 acres of land would be required to offset the environmental impacts. Each size swale was determined to be economically feasible. Benefits range from $9.0 million to $15.3 million, without future discharges. greatest net benefits between all the swale plans and among all the alternatives evaluated in the 1991 to 1993-period. The plan captured 75 percent of the floodplain damages. Further, investigations of the 1200' BW swale were not conducted during this period of analysis.

Table D-9
Economic Summary of Swale Alternatives
(Millions $, June 1993 prices and level of development, 8.0% interest)

Option	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
300' BW	$15.2	$1.4	$ 9.3	6.6	$ 7.8
600' BW	$23.7	$2.3	$11.8	5.2	$ 9.5
900' BW	$31.9	$3.1	$12.7	4.1	$ 9.6
1200' BW	$43.8	$4.4	$15.3	3.5	$11.0
1500' BW	$54.8	$5.4	$15.7	2.9	$10.2

Swale and Levee Combination Plans Investigated

An economic analysis was conducted to determine the benefits of placing a single levee along the eastbank of the river. Specifically, either 100-year or SPF levees along Lamar. The results of the analysis are shown below. These plans show significant net benefits, but would not be practical for implementation since damages to reaches 5 and 6 along the opposite bank would be incurred. The investigation showed that individual placement would not induce damages to the secondary study area. Table D-10 summarizes the results of this investigation.

Table D-10
Economic Summary of Various
Swale and Lamar Levee Combination Alternatives
(Millions $, June 1993 prices and level of development, 8.0% interest)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
300' BW & SPF	$27.5	$2.6	$ 8.4	3.2	$ 5.8
500' BW & SPF	$29.6	$2.8	$12.4	4.4	$ 1.8
600' BW & SPF	$30.6	$2.9	$14.1	4.9	$ 2.4
300' BW & 100-Yr	$24.2	$2.2	$ 8.9	4.0	$ 6.7
500' BW & 100-Yr	$26.1	$2.4	$17.8	7.4	$15.4
600' BW & 100-Yr	$27.6	$2.5	$21.4	8.4	$18.9

Recreation Plan

Benefits for the initial recreation plan were derived based on Region 4 facility needs and carrying-capacity factors extracted from the Texas Outdoor Recreational Plan (TORP). The TORP does not identify a net need for picnic facilities therefore, initial benefits were only calculated for the trail system. This project would generate at least $1.0 million in annual recreation benefits. The total estimated project first cost for the recreation plan is about $8.9 million, with a resulting BCR of 1.2 to 1.0. This plan could be adapted to either of the proposed swale alternatives. See Recreation Appendix for plan details.

Summary of 1993 Preliminary Analysis

The most cost effective plan from each category of investigated alternatives is summarized in table D-11. As shown, the optimized 1200' BW upper and lower east bank swales provide the greatest net benefits (not including recreation). This plan was therefore identified as the NED plan.

Table D-11
Economic Analysis of Most Cost Effective Alternatives

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
Non-Structural	$ 1.5	$0.13	$ 0.6	4.2	$ 0.4
150' BW Channel	$52.1	$5.0	$11.9	2.4	$ 6.9
100-Yr Lamar Levee	$ 9.0	$0.8	$ 1.5	1.9	$ 0.7
1200' BW Swale	$43.8	$4.4	$15.3	3.5	$11.0

1994-1996 INVESTIGATED PLANS

Key Assumptions

Adjusted hydraulic model to reflect computed probability water surface elevations.

Incorporated Trinity River hydrology models and topography from the Upper Trinity Study, which incorporated the effects of extending the 100-foot benched channel and raising the levees in the existing floodway levee system.

Updated structure files to current price level and level of development.

Used prevailing Federal interest rate of 7.63 percent.

Integrated Risk Based Analysis with Palisade @RISK model.

Estimated cost of plans were updated for price level and increased haul distance of excavated materials.

Updated Expected Annual Damages

Expected annual Damages under baseline conditions were revised to reflect current price level and changes in the development. The results also reflect the integration of the Upper Trinity River hydraulic model (refer to Appendix B) and the use of the risk based approach to damage assessment. Table E-12 shows the resulting expected annual damages by reach.

Table D-12
Updated Expected Annual Damages
Under Baseline Conditions

Reach	Annual Damages Direct	Incidental	Total	Annual Benefits
1	$338,200	$35,200	$373,400	Below White Rock
2	$58,400	$6,100	$64,500	White Rock
3	$168,000	$17,500	$185,500	Rochester Park
4	$1,853,800	$192,800	$2,046,600	Lamar Area
5	$986,000	$102,500	$1,088,500	Cadillac Heights
6	$1,254,200	$130,400	$1,384,600	Treatment Plant
Subtotal	**$4,658,600**	**$484,500**	**$5,143,100**	**Primary Study Area**
7	$12,131,000	$1,261,600	$13,392,600	East Levee
8	$1,102,400	$114,700	$1,217,100	West Levee
Subtotal	**$13,233,400**	**$1,376,300**	**$14,609,700**	**Secondary Study Area**
Total	**$17,892,000**	**$1,860,800**	**$19,752,800**	

Realigned Swale Alternative

The community's environmental concerns with regard to the impacts of the 1200' BW swales prompted the city to request an evaluation of a west bank alignment for the lower swale paired with the 300' BW upper swale from the original analysis. The Corps presented two alignment options-one through the Linfield Landfill and the other through the Joppa community. The selected alignment would be the basis for the Chain of Wetlands alternative. A description of the preliminary alignments and the selected alternative is shown below.

Linfield Bypass Swale: In conjunction with the 300' BW upper swale this alignment would place a 500' Channel between Loop 12 at the golf course, and the Linfield landfill. The maximum depth would be about 30 feet, with a minimum depth of about 9 feet. HTRW investigations showed manageable levels of contaminants within the landfill.

Joppa Bypass Swale: This plan would place a 500' BW Channel between Loop 12 at the golf course, and the Joppa neighborhood. This alignment would avoid the Linfield landfill and instead go through the Joppa neighborhood. This alignment would displace approximately 17 residents and impact about 68 properties. The alignment would also traverse a large pond, which was previously a gravel pit and a parcel of S&P railroad property that, has been cited as an illegal dumping area. This neighborhood is located outside the floodplain.

Chain of Wetlands: The resulting alignment consists of an undulating swale with connecting wetlands and pockets of sparsely treed areas within an open grassy area. The average depth is about 2 feet and the wetland areas are approximately 2 to 4 feet in depth. Vegetated areas would contain about 10 trees per acre.

Both alignments reduce damages within the study area by more than 30 percent and in the existing floodway by about 12 percent. Costs associated with the Linfield alignment were on par with the cost to relocate and abate contaminated areas associated with the Joppa alignment. Therefore, both plans were considered cost effective. The cost difference was insignificant and HTRW concerns were minimal for the two alignments. However, the residents in the Joppa neighborhood are not situated in the floodplain. Therefore, the plan formulation team used the Linfield alignment to develop the Chain of Wetlands alternative. The final design served to double the preliminary economic benefits. Overall, the economic analysis of the Chain of Wetlands design shows a reduction of damages in the primary study area by over 30 percent with net benefits of $4.1 million. A summary of the economic analysis is presented in table D-13.

Table D-13
Summary of Revised Swale Alternatives
(Millions of Dollars, 7.63 interest, Oct' 1995 prices)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit/Cost Ratio	Net Benefits
Linfield Swale	$35.0	$2.9	$7.2	2.5	$4.4
Joppa Swale	$33.4	$2.8	$6.3	2.3	$3.5
Chain of Wetlands	$50.6	$4.2	$9.4	2.2	$5.2

Evaluation of Combination Plans

The three plans considered above were combined with either the 1 percent ACE (100-year) or .125 percent ACE (SPF) levee to determine the economic efficiency of providing a higher level of protection and facilitate the local sponsor in selecting a plan. Each plan was combined with adding .125 ACE levees to both the East and West banks or adding an .125 ACE height east levee and extending the existing 1 percent ACE levee height around the treatment plant to include the Cadillac Heights neighborhood. The results of this analysis are presented below. As shown in table D-14 the plan with the greatest net benefits is the 1200' BW swale. This plan, not including recreation generates net benefits of $8.6 million and was designated as the NED plan. However, the Chain of Wetlands along with SPF Lamar and Cadillac Heights levees is preferred by the local sponsor. Accordingly, the final array of alternatives to be investigated in detail includes the Authorized Plan (for comparison purposes), the 1200' Swale (NED), the Chain of Wetlands (COW), and the COW plus SPF levees.

Table D-14
Summary of NED Plan Determination
(Millions of Dollars)
(Oct 1995 prices and level of development, 7.63% interest)

Investigated Alternative	First Cost	Annual Cost	Annual Benefit	Benefit to Cost Ratio	Net Benefits
Authorized Plan*	**$166.7**	**$6.3**	**$10.2**	**1.6**	**$4.0**
1200' BW Swale	**$47.5**	**$4.3**	**$12.8**	**3.0**	**$8.6**
Chain of Wetlands	$50.6	$4.2	$9.4	2.2	$5.2
Chain of Wetlands w\SPF Levees	$82.6	$7.2	$11.5	1.6	$4.3

*Based on interest rate of 3.25 percent.

INVESTIGATED STRUCTURAL PLANS 1996-1997

Key Assumptions and Methodology

Without project conditions assume the locally constructed levees are not in-place. The Rochester Park Levee (reach 3) and the Central Wastewater Treatment Plant Levee (reach 6) each offer a 0.0067 percent ACE flood level. Both levees were constructed by the city of Dallas during the study investigation. The WRDA 1996 document grants the city of Dallas credit for the portions of these levees that are compatible with the authorized plan. Therefore, the revised without project conditions reflect the pre-1991 floodplain (no Rochester levee and the treatment plant at a 2 percent ACE levee height).

Supplemented the structure file data gathered through survey and Dallas County Appraisal District with information from Upper Trinity Study.

Further divided Reach 4, located in the primary study area into reaches 4A and 4B to account for unique hydrological characteristics.

Further divided Reach 7, located in the secondary study area into reaches 7 and 8 to account for unique hydrological and economic characteristics.

Interest rate of 7.375 percent.

Revised Investment Value

Table D-15 displays the numbers and estimated total values of properties (structures and contents) located within the primary study area after applying the revised hydrology model. A total of 2,550 structures was identified within the SPF limits. As shown, the total flood plain investment within the SPF limit of the primary study area was valued at over $840.0 million based on January 1997 prices.

Table D-15
Total Floodplain Investments by Reach
Under Existing Conditions
(January 1997 Prices and Level of Development)
(1,000's $)

Reach	Single-Family Residential		Multi-Family Residential		Commercial\ Industrial		Public		Total Structure Investment		Vehicles	Rail	Total Investment
	No.	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*No.*	*Value*	*Value*	*Value*	*Value*
Primary Study Area													
1	73	1,768.3	0	0.0	26	22,876.1	3	2,558.8	102	27,203.2	192.9	4,443.8	31,839.9
2	68	4,339.9	3	476.1	19	1,707.7	0	0.0	90	6,523.7	430.9	0.0	6,954.6
3	247	6,463.4	112	9,234.0	8	199.0	4	36,651.5	371	52,547.9	2,021.0	0.0	54,568.9
4A	107	2,715.3	6	382.0	68	34,194.2	0	0.0	181	37,291.5	345.3	7,063.1	44,699.9
4B	1,432	34,189.1	0	0.0	61	5,102.8	4	177,768.0	1497	217,059.9	0.0	0.0	217,059.9
5	228	6,630.1	0	0.0 6	66	18,006.2	0	0.0	294	24,636.3	742.8	1,623.0	27,002.1
6	0	0.0	0	0.0	0	0.0	15	458,878.6	15	458,878.6	0.0	0.0	458,878.6
	Area Total												
	2,155	$56,106.1	121	$10,092.1	248	$82,086.0	26	$675,856.9	2,550	$824,141.1	$3,732.9	$13,129.9	$841,003.9
%	84.5%	6.7%	4.7%	1.2%	9.7%	9.8%	1.0%	80.4%	100.0%		0.4%	1.6%	100.0%
Secondary Study Area													
7	869	75,871.6	3	1,691.3	1,982	4,553,940.5	31	$220,968.8	2,885	$4,852,472.2	$5,058.1	N/A	$4,857,530.3
8	6,493	$297,262.5	474	$110,933.0	642	$440,403.4	94	$58,497.6	7,703	$907,096.5	$27,221.7	N/A	$934,318.2
	Area Total												
	7,362	$373,134.1	477	$112,624.3	2,624	$4,994,343.	125	$279,466.4	10,588	$5,759,568.7	$32,279.8	$0.0	$5,791,848.5
%	69.5%	6.4%	4.5%	1.9%	24.8%	86.2%	1.2%	4.8%	100.0%		0.6%	0.0%	100.0%
Total Investment													
	9,517	$429,240.2	598	$122,716.4	2,872	$5,076,429.	151	$955,323.3	13,138	$6,583,709.8	$36,012.7	$13,129.9	$6,632,852.4

Risk Assessment Assumptions and Values

In the evaluation of levee projects an element of risk is associated with levee failure. Damage calculations and risk assessment require integration of hydrological, hydraulic and economic data. Table D-16 details each element of data used to assess damages with the FDA program.

Calculations of potential flood losses were extracted from the STDMA model and used to approximate property damages by depth in the primary study area and transferred to the HEC-FDA program to calculate average annual and equivalent annual damages. Hydrological input values included a 40-year period of record for the stream gauges.

The GIS database for the Upper Trinity River was used to estimate potential flood losses in the secondary study area. The estimates were calculated based on water surface elevations with one foot increments. The Dallas Floodway Levee System was constructed to Federal standards. However, failure of the East Levee could occur first since the lowest point is at an elevation of 423', while the West Levee's lowest elevation is 428'.

The hydraulic rating curve was combined with the economic damages to derive the depth-damage curves with a 10 percent margin of error. Since the risk approach was integrated late into the study effort, primary damages were not disaggregated by category.

Table D-17 summarizes the parameters used to model the effects of each levee by condition and plan of improvement. Geotechnical investigations concluded that the top of the levee and the potential failure and non failure points were equal. This conclusion was based on the assumption that all levees were constructed to Federal standards.

Table D-16
Hydrologic, Hydraulic and Economic Parameters by Reach and Elevation

Idx # 76824 (134200)	Sleepy Hollow Area	
	Reach 1	SD1
392.0	$10,710	$1,071
393.7	$15,960	$1,596
396.1	$245,110	$24,511
398.2	$362,347	$36,235
400.3	$580,205	$58,021
402.3	$1,542,677	$154,268
404.2	$4,216,900	$421,690
409.8	$16,255,577	$1,625,558
413.1	$19,786,841	$1,978,684
419.7	$30,135,850	$3,013,585

Idx # 85916 (143280)	White Rock Creek Area	
	Reach 2	SD2
395.7	$0	$0
398.0	$0	$0
400.3	$0	$0
401.4	$16,482	$1,648
403.6	$130,545	$13,055
405.7	$346,016	$34,602
407.6	$662,373	$66,237
413.0	$3,309,568	$330,957
416.3	$4,209,974	$420,997
423.2	$6,579,634	$657,963

Idx # 99800 (157060)	Rochester Park Area	
	Reach 3	SD3
400.4	$0	$0
402.0	$15,231	$1,523
404.6	$273,530	$27,353
406.4	$1,549,743	$154,974
408.9	$7,005,213	$700,521
410.7	$10,297,280	$1,029,728
412.7	$14,523,630	$1,452,363
418.6	$33,622,060	$3,362,206
422.2	$43,019,190	$4,301,919
429.4	$51,197,260	$5,119,726

Idx # 99800 (157060)	Lamar Street Area	
	Reach 4A	SD4
399.9	$114,255	$11,426
401.4	$180,642	$18,064
404.0	$826,621	$82,662
405.7	$2,391,595	$239,160
408.3	$7,681,784	$768,178
410.0	$10,487,711	$1,048,771
412.1	$13,511,957	$1,351,196
418.1	$23,889,189	$2,388,919
421.8	$26,680,326	$2,668,033
429.1	$37,636,890	$3,763,689

Idx # 99800 (157060)	Oakland Channel Area	
	Reach 4B	SD4
399.9	$0	$0
401.4	$0	$0
404.0	$0	$0
405.7	$2,269	$227
408.3	$210,268	$21,027
410.0	$433,059	$43,306
412.1	$1,287,991	$128,799
418.1	$27,358,890	$2,735,889
421.8	$58,756,050	$5,875,605
429.1	$177,768,100	$17,776,810

Table D-16 Continued
Hydrologic, Hydraulic and Economic Parameters by Reach and Elevation

Idx # 101138 (158420)	Cadillac Heights Area	
	Reach 5	SD5
400.4	$26,410	$2,641
402.0	$61,761	$6,176
404.6	$1,468,049	$146,805
406.4	$2,491,248	$249,125
408.9	$4,396,107	$439,611
410.7	$6,209,722	$620,972
412.7	$8,108,719	$810,872
418.6	$14,237,124	$1,423,712
422.2	$16,934,474	$1,693,447
429.4	$25,568,600	$2,556,860

Idx # 101138 (158420)	Central Wastewater Treatment Plant	
	Reach 6	SD6
400.4	$0	$0
402.0	$0	$0
404.6	$0	$0
406.4	$0	$0
408.9	$0	$0
410.7	$39,432,230	$3,943,223
412.7	$52,375,320	$5,237,532
418.6	$167,461,000	$16,746,100
422.2	$286,604,600	$28,660,460
429.4	$434,133,000	$43,413,300

Idx # 108380	Dallas Floodway East Levee	
Elev	Reach 7	SD 7
423.0	$ 3,485,628	$348,563
424.0	$3,961,690	$396,169
425.0	$4,299,849	$429,985
426.0	$4,381,467	$438,147
427.0	$4,476,384	$447,638
428.0	$4,591,795	$459,180
429.0	$4,684,571	$468,457
430.0	$4,802,384	$480,238
433.0	$5,155,962	$515,596

Idx # 118000	Dallas Floodway West Levee	
Elev	Reach 8	SD 8
427.0	$618,269	$61,827
428.0	$683,911	$68,391
429.0	$732,957	$73,296
430.0	$777,231	$77,723
431.0	$806,637	$80,664
432.0	$842,322	$84,232
433.0	$886,892	$88,689
434.0	$924,980	$92,498
438.0	$1,034,088	$103,409

PMF Values based on total zone value.
SD band assumed to be =/- 10%.
Numbers in () are DFE original stations and index points
Reach 7 and 8 calculated using GIS

Table D-17
Summary of Levee Assumptions
by Condition and Alternative

Levee	Existing (Pre '91)			Current (Post '91) NED Chain of Wetlands			COW+SPF+SPF			COW+SPF+100-Yr		
	Top	PFP	PNP	Top	PFP	PNP	Top	PFP	PNP	Top	PFP	PNP
Rochester Park				415.00	415.00	413.00	421.02	421.02	421.02	421.02	421.02	421.02
Treatment Plant	413.40	413.40	412.40	415.00	415.00	415.00	415.00	415.00	415.00	415.00	415.00	415.00
Lamar 4A							421.02	421.02	421.02	421.02	421.02	421.02
Lamar 4B												
Cadillac Heights							421.85	421.85	421.85	418.00	418.00	418.00
East Levee	423.00	423.00	423.00	423.00	423.00	423.00	425.20	425.20	425.20	425.20	425.20	425.20
West Levee	428.00	428.00	428.00	428.00	428.00	428.00	428.00	428.00	428.00	428.00	428.00	428.00

Expected Annual Damages

Expected annual damages were tabulated for the final plan formulation phase based on the aforementioned assumptions. The NexGen FDA program was utilized to perform these calculations. Incidental damages (comprising transportation, communications, and utilities facilities, and public health and relief operations) were added to the results to obtain the total expected annual damages by reach for the primary and secondary study areas.

Damages for two without-project conditions were calculated. The existing conditions model assumes a pre-1991 scenario (prior to construction of the Rochester Park and CWWTP levees). The current conditions model assumes that both local levees are in-place. The expected annual damages are shown in table D-18

Under pre-1991 conditions the annual damages were estimated at $19.7 million. Under current conditions the annual damages would be about $18.5 million. Raising the CWWTP levee reduced damages by $1.1 million and construction of the Rochester levee about $.2 million. As shown, these levee improvements produced a negative impact in the secondary study area by increasing the expected annual damages to the area by $222,000. This equates to a 2 percent increase compared to damages before construction. In either case the level of protection in the secondary study area remained above the .25 percent ACE (400-year) flood event.

Economic Analysis of Local Levees

An evaluation of the local levees was conducted to determine the hydraulic impacts to the primary and secondary study areas and the economic effectiveness of the projects. The projects were evaluated assuming a 50-year project life and an interest rate of 7.38 percent. The result of the economic analysis is shown in table D-19. Total benefits include floodplain user benefits as described in a later section.

From an economic standpoint, construction of the Rochester Park levee was not feasible. The $574,900 in annual benefits to the primary study area were significantly reduced by inducements of $417,000 in the secondary study area. Initial evaluation of this project only included the primary study area which showed a benefit-to-cost ratio of .6 to 1.0. After inclusion of the affects on the Floodway Levee System the ratio fell to 0.2 to 1.0.

The second construction phase of the local levees raised the level of protection for the CWWTP from a 2 percent ACE (50-year) event to a 1 percent ACE (100-year+3') event. The design of the levee raise also included mitigation swales that offset some of the negative impacts to the Floodway Levee System. The benefit to cost ratio was 1.02 to 1.0. As a combined project the levees produce a BC ratio of 0.55 to 1.0.

The inclusion of about $400,000 in floodplain user benefits would improve the benefit cost ratio for the Rochester levee, but it would remain below unity. Intangible benefits derived from the improvements include a significant reduction in the potential for loss of life and mental and financial stress to over 600 residents in the Rochester Park area. Additional benefits from the treatment plant levee raise are generated from the financial costs incurred from environmental fines. These fines are levied by the Environmental Protection Agency when a levee is not constructed to the 1 percent ACE (100-year) flood event.

Table D-18
Expected Annual Damages
Under Without Project Conditions

Pre-1991 Conditions

Reach	Annual Damages			Description
	Direct	Incidental	Total	
1	$294,200	$54,721	$348,900	Below White Rock
2	$50,800	$9,449	$60,200	White Rock
3	$431,500	$80,259	$511,800	Rochester Park
4A	$1,350,000	$251,100	$1,601,100	Lamar Area
4B	$741,100	$137,845	$878,900	Oakland Area
5	$1,085,700	$201,940	$1,287,600	Cadillac Heights
6	$1,696,300	$162,845	$1,859,100	Treatment Plant
Subtotal	$5,649,600	$898,159	$6,547,600	Study Area
7	$10,054,700	$1,870,174	$11,924,900	East Levee
8	$998,500	$185,721	$1,184,200	West Levee
Subtotal	$11,053,200	$2,055,895	$13,109,100	Upstream Levees
Total	$16,702,800	$2,954,054	$19,656,700	

Current Conditions w\Rochester Park & CWWTP Levees

Reach	Residual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$294,200	$54,721	$348,900	$0
2	$49,700	$9,244	$58,900	$1,300
3	$102,700	$19,102	$121,800	$390,000
4A	$1,180,100	$219,499	$1,399,600	$201,500
4B	$724,000	$134,664	$858,700	$20,200
5	$912,700	$169,762	$1,082,500	$205,100
6	$1,150,300	$110,429	$1,260,700	$598,400
Subtotal	$4,413,700	$717,421	$5,131,100	$1,416,500
7	$10,232,100	$1,903,171	$12,135,300	($210,400)
8	$1,008,700	$187,618	$1,196,300	($12,100)
Subtotal	$11,240,800	$2,090,789	$13,331,600	($222,500)
Total	$15,654,500	$2,808,210	$18,462,700	$1,194,000

Pre-1991 Conditions w\CWWTP Raised to 100-yr+3'

Reach	Residual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$294,200	$54,721	$348,900	$0
2	$50,800	$9,449	$60,200	$0
3	$385,600	$71,722	$457,300	$54,500
4A	$1,192,800	$221,861	$1,414,700	$186,400
4B	$724,000	$134,664	$858,700	$20,200
5	$923,400	$171,752	$1,095,200	$192,400
6	$1,119,800	$107,501	$1,227,300	$631,800
Subtotal	$4,690,600	$771,670	$5,462,300	$1,085,300
7	$9,982,000	$1,856,652	$11,838,652	$86,248
8	$994,300	$184,940	$1,179,240	$4,960
Subtotal	$10,976,300	$2,041,592	$13,017,892	$91,208
Total	$15,666,900	$2,813,261	$18,480,192	$1,176,508

Pre-1991 Conditions w\Rochester Park Levee

Reach	Residual Damages			Annual Benefits
	Direct	Incidental	Total	
1	$294,200	$54,721	$348,900	$0
2	$52,700	$9,802	$62,500	($2,300)
3	$107,500	$19,995	$127,500	$384,300
4A	$1,333,400	$248,012	$1,581,400	$19,700
4B	$724,000	$134,664	$858,700	$20,200
5	$1,049,600	$195,226	$1,244,800	$42,800
6	$1,595,700	$153,187	$1,748,900	$110,200
Subtotal	$5,157,100	$815,608	$5,972,700	$574,900
7	$10,387,200	$1,932,019	$12,319,200	($394,300)
8	$1,017,600	$189,274	$1,206,900	($22,700)
Subtotal	$11,404,800	$2,121,293	$13,526,100	($417,000)
Total	$16,561,900	$2,936,900	$19,498,800	$157,900

Table D-19
Economic Analysis of Local Levees

Project Alternatives	Rochester Park Levee	CWWTP Levee	Combined Local Levees
INVESTMENT			
ESTIMATED FIRST COST	$12,738,000	$14,220,000	$26,958,000
ANNUAL INTEREST RATE	0.0738	0.0738	0.0738
PROJECT LIFE (years)	50	50	50
CONSTRUCTION PERIOD (months)	24	24	24
COMPOUND INTEREST FACTOR	25.77523	25.77523	25.77523
CAPITAL RECOVERY FACTOR	0.0759135	0.0759135	0.0759135
INTEREST DURING CONSTRUCTION	$0	$0	$0
INVESTMENT COST	$12,738,000	$14,220,000	$26,958,000
ANNUAL CHARGES			
INTEREST	$939,428	$1,048,725	$1,988,153
AMORTIZATION	$27,559	$30,765	$58,324
OPERATION/MAINTENANCE ($/year)	$50,000	$75,000	$125,000
REPLACEMENTS	$0	$0	$0
TOTAL ANNUAL CHARGES	$1,016,986	$1,154,490	$2,171,500
ANNUAL BENEFITS			
INUNDATION REDUCTION	$574,900	$1,085,300	$1,416,500
EXISTING DALLAS FLOODWAY	($417,000)	$91,208	($222,500)
TOTAL BENEFITS	$157,900	$1,176,508	$1,194,000
NET BENEFITS	**($859,100)**	**$22,000**	**($977,500)**
BENEFIT-TO COST-RATIO	0.16	1.02	0.55

INVESTIGATED NONSTRUCTURAL PLANS 1996-1997

An additional aggregated evaluation of the acquisition and removal of frequently flooded structures was conducted for the primary study area. This generalized approach was used to determine feasibility of a 1 percent chance exceedance flood buyout plan for the entire study area. The evaluation used finished floor elevations and included the 50 to 1 percent ACE flood frequency zones. Eligibility is dependant on economic criteria and flood frequency. The results of this analysis are shown in table D-20.

As shown, no structures were identified in the 50 percent chance exceedance flood zone. In the 20 percent chance exceedance flood frequency zone 13 structures were identified. The first cost was estimated at about $13.0 million with a BCR of 0.8 to 1.0. Both plans result in negative net benefits. Although these negative benefits could be offset with the incorporation of a recreation plan, the identified structures are scattered throughout the floodplain and a recreation plan could not be designed to meet the study area needs. Implementation of this plan would not significantly reduce damages in the study area.

The evaluation of the 10 percent and 1 percent ACE flood zones also resulted in negative net benefits. Development of an economically feasible plan would require a recreation plan expected to increase the first cost of the plan alternative by more than 50 percent while the maximum annual benefits would be limited to the total flood control benefits claimed. Further, removal of the 1 percent ACE flood zone would eliminate about 20 percent of the study area property. The majority of which are of commercial use. This plan could have a significant negative economic impact on the community. Non-structural measures may be more beneficial on a last added basis.

Table D-20
Investigated Evacuation Plans
(October 1996 prices, 7.65 percent interest rate)
(in thousands of dollars)

Flood Frequency Zone	Number of Structures	Total First Costs	Annual Costs	Annual Benefits	Benefit to Cost Ratio	Annual Net Benefits
0-2	0	$0.0	$0.0	$0.0	0.0	$0.0
0-5	13	$13,000.0	$1,075.2	$880.0	0.8	($ 195.2)
0-10	37	$24,000.3	$2,005.0	$1,230.0	0.6	($ 775.0)
0-100	508	$60,000.3	$125.1	$1,275.0	0.2	($4,499.0)

Residual expected annual damages and the resulting annual benefits for each are presented in table D-21 by reach. The plans include the:

- o National Economic Development Plan
- o Chain of Wetlands Only
- o Chain of Wetlands with SPF Lamar and 100-Year Cadillac Heights Levees
- o Chain of Wetlands with SPF Lamar and SPF Cadillac Heights Levees
- o Chain of Wetlands with SPF Lamar Levee
- o Chain of Wetlands with SPF Cadillac Heights Levee

Benefit-to-Cost Analysis

A comparison of the results of the economic analysis shows the 1200' BW swale provides the greatest net benefits and remains to be the NED plan. Among the combination chain of wetland alternatives, construction of the chain of wetlands along with SPF Lamar Levee would provide the greatest net benefits. The ranking of each alternative is shown in table D-22 below. A complete economic analysis of the alternatives is shown in table D-23.

Table D-21
Expected Annual Damages and Benefits
(January 1997 prices, 7.375% interest, 50-year period of analysis)

1200' East Bank Swale (NED)

Reach	Annual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$209,600	$38,986	$248,600	$100,300
2	$20,500	$3,813	$24,300	$35,900
3	$32,300	$6,008	$38,300	$473,500
4A	$524,500	$97,557	$622,100	$979,000
4B	$306,600	$57,028	$363,600	$515,300
5	$384,400	$71,498	$455,900	$831,700
6	$361,100	$34,666	$395,800	$1,463,300
Subtotal	$1,839,000	$309,555	$2,148,600	$4,399,000
7	$2,544,900	$473,351	$3,018,300	$8,906,600
8	$433,300	$80,594	$513,900	$670,300
Subtotal	$2,978,200	$553,945	$3,532,200	$9,576,900
Total	$4,817,200	$863,500	$5,680,800	$13,975,900

Chain of Wetlands Only

Reach	Residual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$269,700	$50,164	$319,900	$29,000
2	$29,800	$5,543	$35,300	$24,900
3	$47,400	$8,816	$56,200	$455,600
4A	$631,200	$117,403	$748,600	$852,500
4B	$420,300	$78,176	$498,500	$380,400
5	$459,200	$85,411	$544,600	$743,000
6	$538,400	$51,686	$590,100	$1,269,000
Subtotal	$2,396,000	$397,200	$2,793,200	$3,754,400
7	$4,449,800	$827,663	$5,277,500	$6,647,400
8	$602,700	$112,102	$714,800	$469,400
Subtotal	$5,052,500	$939,765	$5,992,300	$7,116,800
Total	$7,448,500	$1,336,965	$8,785,500	$10,871,200

Chain of Wetlands w\SPF Cadillac Heights

Reach	Residual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$269,700	$50,164	$319,900	$29,000
2	$27,700	$5,152	$32,900	$27,300
3	$47,400	$8,816	$56,200	$455,600
4A	$631,200	$117,403	$748,600	$852,500
4B	$420,300	$78,176	$498,500	$380,400
5	$9,800	$1,823	$11,600	$1,276,000
6	$538,400	$51,686	$590,100	$1,269,000
Subtotal	$1,944,500	$313,221	$2,257,800	$4,289,800
7	$4,449,800	$827,663	$5,277,463	$6,647,437
8	$602,700	$112,102	$714,802	$469,398
Subtotal	$5,052,500	$939,765	$5,992,265	$7,116,835
Total	$6,997,000	$1,252,986	$8,250,065	$11,406,635

Chain of Wetlands w\SPF Lamar Street Levee

Reach	Residual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$269,700	$50,164	$319,900	$29,000
2	$27,700	$5,152	$32,900	$27,300
3	$15,200	$2,827	$18,000	$493,800
4A	$17,100	$3,181	$20,300	$1,580,800
4B	$132,200	$24,589	$156,800	$722,100
5	$467,400	$86,936	$554,300	$733,300
6	$574,200	$55,123	$629,300	$1,229,800
Subtotal	$1,503,500	$227,973	$1,731,500	$4,816,100
7	$3,158,800	$587,537	$3,746,300	$6,178,600
8	$671,000	$124,806	$795,800	$388,400
Subtotal	$3,829,800	$712,343	$4,542,100	$8,567,000
Total	$5,333,300	$940,316	$6,273,600	$13,383,100

Table D-21 Continued
Expected Annual Damages and Benefits
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Chain of Wetlands w/SPF Lamar & Cadillac Heights Short Option

Reach	Residual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$269,700	$50,164	$319,900	$29,000
2	$29,800	$5,543	$35,300	$24,900
3	$16,600	$3,088	$19,700	$492,100
4A	$18,400	$3,422	$21,800	$1,579,300
4B	$132,200	$24,589	$156,800	$722,100
5	$13,800	$2,567	$16,400	$1,271,200
6	$688,900	$66,134	$755,000	$1,104,100
Subtotal	$1,169,400	$155,507	$1,324,900	$5,222,700
7	$4,737,000	$881,082	$5,618,082	$6,306,818
8	$873,900	$162,545	$1,036,445	$147,755
Subtotal	$5,610,900	$1,043,627	$6,654,527	$6,454,573
Total	$6,780,300	$1,199,135	$7,979,427	$11,677,273

Chain of Wetlands w\SPF Lamar & 100-Year Cadillac Levees

Reach	Residual Damages			Annual
	Direct	Incidental	Total	Benefits
1	$269,700	$50,164	$319,900	$29,000
2	$27,700	$5,152	$32,900	$27,300
3	$15,200	$2,827	$18,000	$493,800
4A	$17,100	$3,181	$20,300	$1,580,800
4B	$132,200	$24,589	$156,800	$722,100
5	$82,700	$15,382	$98,100	$1,189,500
6	$574,200	$55,123	$629,300	$1,229,800
Subtotal	$1,118,800	$156,419	$1,275,300	$5,272,300
7	$3,158,800	$587,537	$3,746,300	$8,178,600
8	$671,000	$124,806	$795,800	$388,400
Subtotal	$3,829,800	$712,343	$4,542,100	$8,567,000
Total	$4,948,600	$868,762	$5,817,400	$13,839,300

Table D-22
Alternative Rankings
Based on Net Benefits
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Rank	Alternative	Net Benefits
1	National Economic Development Plan	$7,446,300
2	Chain of Wetlands with SPF Lamar	$6,008,300
3	Chain of Wetlands+SPF Lamar & 100-Year Cadillac Levees	$5,134,600
4	Chain of Wetlands	$4,661,300
5	Chain of Wetlands with SPF Cadillac Heights Levee	$4,057,500
6	Chain of Wetlands+SPF Lamar & SPF Cadillac Levees	$2,929,600

Table D-23
Economic Analysis of Flood Control Benefits
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Project Alternatives Include	Authorized	Authorized	1200' Swale	Chain Of Wetlands	Chain Of Wetlands & SPF Levees	Chain Of Wetlands & SPF Lamar	Chain Of Wetlands & SPF Cadillac	Chain Of Wetlands & SPF\100 Levees
	(original rate)	(FY 97 rate)						
ESTIMATED FIRST COST	$194,108,302	$194,108,302	$50,022,200	$48,889,300	$76,780,800	$64,520,500	$61,149,600	$67,225,000
ANNUAL INTEREST RATE	0.0325	0.0738	0.0738	0.0738	0.0738	0.0738	0.0738	0.0738
PROJECT LIFE (years)	100	50	50	50	50	50	50	50
CONSTRUCTION PERIOD (months)	36	36	36	24	36	24	24	24
COMPOUND INTEREST FACTOR	37.75981	40.15579	40.15579	25.77523	40.15579	25.77523	25.77523	25.77523
CAPITAL RECOVERY FACTOR	0.0339	0.0759	0.0759	0.0759	0.0759	0.0759	0.0759	0.0759
INTEREST DURING CONSTRUCTION	$9,617,320	$22,274,403	$5,740,170	$3,649,820	$8,810,785	$4,816,764	$4,565,110	$5,018,668
COST OF LOCAL LEVEES			$26,958,000	$26,958,000	$23,120,000	$23,120,000	$26,958,000	$26,958,000
INVESTMENT COST	$203,725,622	$216,382,705	$82,720,370	$79,497,120	$108,711,585	$92,457,264	$92,672,710	$99,201,668
INTEREST	$6,621,083	$15,958,225	$6,100,627	$5,862,913	$8,017,479	$6,818,723	$6,834,612	$7,316,123
AMORTIZATION	$281,854	$468,144	$178,966	$171,992	$235,198	$200,031	$200,497	$214,623
OPERATION/MAINTENANCE ($/year)	$250,000	$250,000	$250,000	$175,000	$495,000	$356,000	$314,000	$370,000
REPLACEMENTS	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$7,152,937	$16,676,369	$6,529,593	$6,209,905	$8,747,677	$7,374,755	$7,349,110	$7,900,746
INUNDATION REDUCTION	$11,372,400	$11,372,400	$4,399,000	$3,754,400	$5,222,700	$4,816,100	$4,289,800	$4,245,800
EXISTING DALLAS FLOODWAY			$9,576,900	$7,116,800	$6,454,600	$8,567,000	$7,116,800	$8,789,500
TOTAL BENEFITS	$11,372,400	$11,372,400	$13,975,900	$10,871,200	$11,677,300	$13,383,100	$11,406,600	$13,035,300
NET BENEFITS	$4,219,500	($5,304,000)	$7,446,300	$4,661,300	$2,929,600	$6,008,300	$4,057,500	$5,134,600
BENEFIT-TO-COST RATIO	1.59	0.68	2.14	1.75	1.33	1.81	1.55	1.65

Incremental Cost Analysis

Although all of the structural plans are feasible, an incremental analysis was done to determine the added benefits for the addition of each portion of the plan. The results of adding SPF levees to the Chain of Wetlands plan are presented in table D-24. Costs do not include the cost of the local levees. The incremental analysis reveals that the addition of the SPF Lamar levee is incrementally justified. However, the addition of the SPF Cadillac Heights Levee as a first or a last-added piece is not incrementally justified. This addition is not justified as a first-added piece due because the additional annual costs are not offset by inundation reduction benefits to the primary study area. The addition is not justified as a last-added due to the $2.1 million decrease in benefits to the secondary study area as well as the disproportionate amount of benefits to cost in the primary study area.

The results of adding the 1 percent ACE (100-year) Cadillac Heights levee to the Chain of Wetlands plan are presented in table D-23. The analysis shows that the addition is incrementally justified with net benefits of $96,600. The analysis shows that construction of the 1 percent ACE (100-year) Cadillac levee will not reduce the benefits to the secondary study area derived from the chain of wetlands and SPF Lamar Levee.

Table D-24
Incremental Analysis of Chain of Wetlands and SPF Lamar and SPF Cadillac Heights Levees

(January 1997 prices, 7.375% interest, 50-year period of analysis)

Description	Chain of Wetlands Added	Chain of Wetlands Cadillac Levee	Incremental	Chain of Wetlands Lamar Levee	Incremental	Chain of Wetlands Both Levees	Cadillac Heights Last Added
PROJECT COSTS							
Estimated First Cost	$48,889,300	$61,149,593	$12,260,293	$64,520,500	$15,631,200	$76,780,782	$12,260,282
Annual Interest Rate	0.073750	0.07375	0.07375	0.073750	0.073750	0.073750	0.073750
Project Life (years)	50	50	50	50	50	50	50
Construction Period (months)	24	24	24	24	24	36	36
Compound Interest Factor	25.77523	25.77523	25.77523	25.77523	25.77523	40.15579	40.15579
Capital Recovery Factor	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135
Interest During Construction	$3,649,820	$4,565,110	$915,290	$4,816,764	$1,166,944	$8,810,783	$3,994,019
Investment Cost	$52,539,120	$65,714,703	$13,175,583	$69,337,264	$16,798,144	$85,591,565	$16,254,301
ANNUALIZED COSTS							
Interest	$3,874,760	$4,846,459	$971,699	$5,113,623	$1,238,863	$6,312,378	$1,198,755
Amortization	$113,668	$142,174	$28,505	$150,011	$36,343	$185,177	$35,166
O&M ($/year)	$50,000	$189,000	$139,000	$231,000	$181,000	$370,000	$139,000
Replacements	$0	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$4,038,428	$5,177,633	$1,139,205	$5,494,634	$1,456,206	$6,867,555	$1,372,921
ANNUAL BENEFITS							
Inundation Reduction	$2,727,900	$3,263,300	$535,400	$3,789,600	$1,061,700	$4,196,200	$406,600
Existing Dallas Floodway	$7,339,300	$7,339,300	$0	$8,789,500	$1,450,200	$6,677,100	($2,112,400)
TOTAL BENEFITS	$10,067,200	$10,602,600	$535,400	$12,579,100	$2,511,900	$10,873,300	($1,705,800)
BENEFIT/COST RATIO	2.49	2.05	0.47	2.29	1.72	1.58	-1.24
NET ANNUAL BENEFITS	$6,028,800	$5,425,000	($603,800)	$7,084,500	$1,055,700	$4,005,700	($3,078,700)

Table D-25
Incremental Analysis of
Chain of Wetlands and
SPF Lamar and 100-Year Cadillac Heights Levees

(January 1997 prices, 7.375% interest, 50-year period of analysis)

Description	Chain of Wetlands	Chain of Wetlands SPF Lamar Levee Added	Increment	Chain of Wetlands SPF\100 Levees	Cadillac 100-Year Last Added
PROJECT COSTS					
Estimated First Cost	$48,889,300	$64,520,500	$15,631,200	$67,225,000	$2,704,500
Annual Interest Rate	0.073750	0.073750	0.073750	0.073750	0.073750
Project Life (years)	50	50	50	50	50
Construction Period (months)	24	24	24	24	24
Compound Interest Factor	25.77523	25.77523	25.77523	25.77523	25.77523
Capital Recovery Factor	0.0759135	0.0759135	0.0759135	0.0759135	0.0759135
Interest During Construction	$3,649,820	$4,816,764	$1,166,944	$5,018,668	$201,904
Investment Cost	$52,539,120	$69,337,264	$16,798,144	$72,243,668	$2,906,404
ANNUALIZED COSTS					
Interest	$3,874,760	$5,113,623	$1,238,863	$5,327,970	$214,347
Amortization	$113,668	$150,011	$36,343	$156,299	$6,288
O&M ($/year)	$50,000	$231,000	$181,000	$370,000	$139,000
Replacements	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$4,038,428	$5,494,634	$1,456,206	$5,854,270	$359,635
ANNUAL BENEFITS					
Inundation Reduction	$2,727,900	$3,789,600	$1,061,700	$4,245,800	$456,200
Existing Dallas Floodway	$7,339,300	$8,789,500	$1,450,200	$8,789,500	$0
TOTAL BENEFITS	$10,067,200	$12,579,100	$2,511,900	$13,035,300	$456,200
BENEFIT COST RATIO	2.49	2.29	1.72	2.23	1.27
ANNUAL NET BENEFITS	$6,028,800	$7,084,500	$1,055,700	$7,181,000	$96,600

Cadillac Heights Nonstructural Analysis

An evaluation of reach 5 was conducted with a focus on the feasibility of nonstructural plans. The results of the evaluation are shown in table D-26. In plans 2 and 3 nonstructural measures are evaluated on a last added basis. Plan 1 assumes current hydrologic and economic conditions with a total of 235 structures identified within the 1 percent ACE flood zone. As shown, 6 structures were identified in the 50 percent chance exceedance flood zone, 9 structures in the 20 percent ACE flood zone and 17 structures within the 10 percent ACE flood zone. A permanent evacuation plan would be feasible up to the 10 percent ACE event. Within the 4 percent ACE flood zone a buyout of 117 structures would yield a benefit to cost ratio of 0.8 to 1.0 with ($216,800) in net benefits. The economic cost to permanently evacuate the 1 percent ACE flood zone is estimated at almost $24.0 million or $1.9 million annually. This plan generates estimated benefits of about $677,000 which results in a BCR of 0.4 to 1.0. As shown, implementation of Plan 1 is only feasible up through the 10 percent ACE flood zone which a BCR of 1.4 to 1.0.

In Plan 2 construction of the chain of wetlands and Lamar Street is assumed. Following construction, about 160 structures would remain within the 1 percent ACE flood zone. The economic cost to permanently evacuate the area is estimated at almost $16.0 million or $1.3 million annually. Comparatively, benefits are estimated at about $404,900, resulting in a BCR of 0.3 to 1.0. As shown in table D-26, implementation of Plan 2 is feasible up through the 4 percent ACE flood zone which has a BCR of 1.1 to 1.0 and would evacuate 24 of the structures remaining in the 1 percent ACE flood zone.

Plan 3 evaluates the feasibility of permanent evacuation to remaining structures following construction of the chain of wetlands, the Lamar Street levee, and a 1 percent ACE Cadillac Heights levee. The plan would remove over 85 percent of the threatened structures from the 1 percent ACE flood frequency zone. Under this scenario 32 structures would remain in the 1 percent ACE flood plain. The remaining structures are located near Moore Park with several located southwest of the CWWTP. The lowest structures begin to receive damages with less than a 4 percent ACE flood event. The analysis for the purchase of these structures results in a BCR below unity for each flood zone. Therefore, as a last added measure, Plan 3 is not economically feasible.

Table D-26
Analysis of Cadillac Heights (Reach 5) Permanent Evacuation
(January 1997 prices, 7.375% interest, 50-year period of analysis)

Flood Frequency	Hydrologic Condition		
	Plan 1 *Cadillac Heights Buyout (Stand-Alone)*	**Plan 2** *COW+SPF Lamar Levee & Cadillac Heights Buyout (Buyout Increment Only)*	**Plan 3** *COW+SPF Lamar & Cadillac Levees & Moore Park Buyout (Buyout Increment Only)*
0-2 Zone			
# of Strs.	6	0	0
Annual Costs	$146,500	N\A	N\A
Annual Benefits	$538,900	N\A	N\A
Eco. Costs	$1,810,100	N\A	N\A
Fin. Costs	$372,100	N\A	N\A
Total Costs	$2,182,200	$0	$0
BC Ratio	3.7	N\A	N\A
Net Benefits	$392,400	N\A	N\A
0-5 Zone			
# of Strs.	9	3	0
Annual Costs	$362,900	$79,100	N\A
Annual Benefits	$594,600	$194,100	N\A
Eco. Costs	$4,502,200	$977,500	N\A
Fin. Costs	$688,300	$198,500	N\A
Total Costs	$5,190,500	$1,176,000	$0
BC Ratio	1.6	2.5	N\A
Net Benefits	$231,700	$115,000	N\A
0-10 Zone			
# of Strs.	17	7	0
Annual Costs	$451,100	$165,300	N\A
Annual Benefits	$638,600	$179,700	N\A
Eco. Costs	$5,577,300	$2,041,200	N\A
Fin. Costs	$1,131,700	$421,900	N\A
Total Costs	$6,709,000	$2,463,100	$0
BC Ratio	1.4	2.1	N\A
Net Benefits	$187,500	$179,700	N\A
0-25 Zone			
# of Strs.	117	24	3
Annual Costs	$946,300	$334,900	$5,332
Annual Benefits	$729,500	$365,900	$1,200
Eco. Costs	$11,447,600	$4,105,000	$57,200
Fin. Costs	$3,143,800	$947,700	$66,000
Total Costs	$14,591,400	$5,052,700	$123,200
BC Ratio	0.8	1.1	0.23
Net Benefits	($216,800)	$31,000	($4,132)

Table D-26 continued

Flood Frequency	Hydrologic Condition		
	Plan 1 *Cadillac Heights Buyout (Stand-Alone)*	**Plan 2** *COW+SPF Lamar Levee & Cadillac Heights Buyout (Buyout Increment Only)*	**Plan 3** *COW+SPF Lamar & Cadillac Levees & Moore Park Buyout (Buyout Increment Only)*
0-50 Zone			
# of Strs.	164	126	17
Annual Costs	$1,264,346	$823,600	$60,529
Annual Benefits	$746,500	$401,100	$4,700
Eco. Costs	$15,270,300	$9,887,000	$702,500
Fin. Costs	$3,608,000	$2,964,600	$374,000
Total Costs	$18,878,300	$12,851,600	$1,076,500
BC Ratio	0.59	0.5	0.08
Net Benefits	($517,846)	($422,500)	($55,829)
0-100 Zone			
# of Strs.	235	160	32
Annual Costs	$1,942,410	$1,311,230	$107,724
Annual Benefits	$752,700	$404,943	$5,900
Eco. Costs	$23,512,600	$15,868,000	$1,244,800
Fin. Costs	$5,170,000	$3,520,000	$704,000
Total Costs	$28,682,600	$19,388,000	$1,948,800
BC Ratio	0.39	0.3	0.05
Net Benefits	($1,189,710)	($906,287)	($101,824)

ECONOMIC ANALYSIS UNDER WRDA '96

General

The structural plans previously evaluated were revised to reflect project conditions under the authority of WRDA'96. Under this authority portions of the costs to construct the local levees would be credited to the local sponsor. Therefore, the baseline conditions of the analysis of various plans were revised. Table D-27 shows the expected annual damages for the NED and Chain of Wetlands plans along with improvement to the CWWTP levee. The remaining plans include all the costs for the CWWTP and the compatible portion of the Rochester Park Levee. All the benefits associated with the Rochester levee are included because the levee would be an integral part of the Lamar Street levee design and therefore cannot be separated.

Floodplain User Benefits

Implementation of either plan would produce an annual savings in administration of the flood insurance program operating expenses. The current average operating cost per policy is $131.00. The annual benefit that would accrue to each plan is determined by multiplying the number of structures removed from the 1 percent ACE flood frequency zone by the operating cost per policy. Under without project (pre-1991) conditions 794 structures were identified within the 1 percent ACE flood zone. The amount of the benefit was determined by subtracting the number of structures remaining in the 1 percent ACE zone from the number assuming pre-1991 conditions. The total estimated flood insurance savings attributable to each alternative are shown in table D-28.

Table D-27
Economic Analysis of Flood Control Benefits
(January 1997 prices, 7.375% interest, 50-year period of analysis)
(Existing Conditions as Baseline)

	AUTHORIZED PLAN (original rate)	AUTHORIZED PLAN (FY 97 rate)	1200' SWALE & CWWTP**	CHAIN OF WETLANDS & CWWTP**	Includes Benefits From All Local Levees*** CHAIN OF WETLANDS & SPF LEVEES	CHAIN OF WETLANDS & SPF LAMAR	CHAIN OF WETLANDS & SPF CADILLAC	CHAIN OF WETLANDS SPF100 LEVEES
INVESTMENT								
ESTIMATED FIRST COST	$199,214,200	$199,214,200	$50,022,200	$48,889,300	$76,780,800	$64,520,500	$61,149,600	$67,225,000
ANNUAL INTEREST RATE	0.0325	0.0738	0.0738	0.0738	0.0738	0.0738	0.0738	0.0738
PROJECT LIFE (years)	100	50	50	50	50	50	50	50
CONSTRUCTION PERIOD (months)	36	36	36	24	36	24	24	24
COMPOUND INTEREST FACTOR	37.75981	40.15579	40.15579	25.77523	40.15579	25.77523	25.77523	25.77523
CAPITAL RECOVERY FACTOR	0.0339	0.0759	0.0759	0.0759	0.0759	0.0759	0.0759	0.0759
INTEREST DURING CONSTRUCTION	$9,870,297	$22,860,317	$5,740,170	$3,649,820	$8,810,785	$4,816,764	$4,565,110	$5,016,668
COST OF LOCAL LEVEES			$14,220,000	$14,220,000	$23,120,000	$23,120,000	$23,120,000	$23,120,000
INVESTMENT COST	$209,084,497	$222,074,517	$69,982,370	$66,759,120	$108,711,585	$92,457,264	$88,834,710	$95,363,668
ANNUAL CHARGES								
INTEREST	$6,795,246	$16,377,996	$5,161,200	$4,923,485	$8,017,479	$6,818,723	$6,551,560	$7,033,070
AMORTIZATION	$289,268	$480,458	$151,407	$144,433	$235,198	$200,031	$192,194	$206,319
OPERATION/MAINTENANCE ($/year)	$250,000	$250,000	$250,000	$175,000	$495,000	$356,000	$314,000	$370,000
REPLACEMENTS	$0	$0	$0	$0	$0	$0	$0	$0
TOTAL ANNUAL CHARGES	$7,334,515	$17,108,454	$5,562,607	$5,242,918	$8,747,677	$7,374,755	$7,057,754	$7,609,390
ANNUAL BENEFITS								
INUNDATION REDUCTION	$13,016,900	$13,016,900	$4,014,700	$3,370,100	$5,222,700	$4,816,100	$4,289,800	$5,272,300
EXISTING DALLAS FLOODWAY			$9,576,900	$7,116,800	$6,454,600	$8,567,000	$7,116,800	$8,567,000
TOTAL BENEFITS	$13,016,900	$13,016,900	$13,591,600	$10,486,900	$11,677,300	$13,383,100	$11,406,600	$13,839,300
NET BENEFITS	$5,682,400	($4,091,600)	$8,029,000	$5,244,000	$2,929,600	$6,008,300	$4,348,800	$6,229,900
BENEFIT-TO-COST RATIO	1.77	0.76	2.44	2.00	1.33	1.81	1.62	1.82

**Includes construction costs for CWWTP Levee.
***Include construction costs for Compatible Rochester and CWWTP Levees.

Table D-28
Flood Insurance Savings
By Alternative

Investigated Plan	Structures No Longer at 1 Percent ACE Flood Risk
NED+CWWTP	403
COW+SPF Lamar & Cadillac Levees	719
COW+SPF Lamar\1% Cadillac Levees	719
COW	511
Rochester Levee	278
COW+CWWTP	233

Recreation Benefits

Benefits for the recreation plan developed for the final array of alternatives were derived using the unit day value method. This method of benefit calculation was selected based on the criteria set forth in ER 1105-2-100. Specifically, the regional model available is more than seven years old, annual visits are not expected to exceed 750,000, and recreation costs are not expected to exceed 25 percent of the total project costs.

A score of 40 points was assessed for the plan based on the professional judgement of both Federal and local recreation planners. Applying the Planning Guidance Memorandum, a score of 40 points converts to $5.00 per visitor day, at April 1998 price levels, for quantifiable features. The complete recreation master plan would provide 50 miles of trails and 7 picnic pavilions. However, benefits were derived based on those portions located on project lands. Specifically, 31.5 miles of trails and 34 picnic type sites are proposed. Refer to Appendix I for complete details on the recreation plan. Table D-29 details the benefits calculated for the recreation plan by feature. The participation rate in the Dallas-Fort Worth area for multipurpose trails and pavilions exceeds the facility capacity. Therefore, it is assumed that participation equals capacity and a value of one was applied. Annual visitors per miles of equestrian and nature trails were adjusted by the participation rate for the local area.

Table D-29
Dallas Floodway Extension Recreation Benefits
Unit Day Value Method
(April 1998 price levels, 7.125% interest, 50-year period of analysis)

Feature	Amount	Participation Rate	Visitors	Rate	Annual Benefits
Hike\Bike Trail	18 miles	1.0	57,662	$5.00	$5,189,580
Equestrian Trail	8.5 miles	0.2	6,999	$5.00	$59,492
Nature Trail	5 miles	0.6	7,402	$5.00	$111,030
Pavilions	6 sites	1.0	1,665	$5.00	$49,950
Picnic Tables	34 sites	1.0	1,575	$5.00	$267,750
			Total Benefits		**$5,677,802**

CHANNEL REALIGNMENT PROPOSAL AT IH-45 BRIDGE

During the Environmental Impact Statement (EIS) scoping process, the Texas Department of Transportation (TxDOT) submitted a proposal to realign the Trinity River at IH-45 as a part of the Dallas Floodway Extension project. TxDOT provided documentation that the bridge at IH-45 was constructed in 1972 to complement the authorized navigation channel of the Dallas Floodway Extension portion of the Trinity River Project. The bridge, which consists of 23 spans, varying in length from 78' to 480' was constructed with the longer spans to be located over the proposed navigation channel. Currently, three of the shorter 78 foot spans span the existing Trinity River at the IH-45 location. In the years following construction, the constricted flows through the existing 78 foot spans have resulted in a blockage due to debris and subsequent damage to the existing piers. TxDOT cited a 1984 flood event in which massive accumulations of driftwood precipitated a fracture in one of the bridge columns within the existing Trinity River channel. The narrow bridge span was cited as the cause of the debris blockage.

TxDOT's proposal was to relocate a section of the existing Trinity River to a new site beneath a 1,120 foot plate girder structure that was originally designed and constructed for the river in anticipation of a federal navigation channel. This 1,120 foot continuous plate girder unit which consists of two 320 foot end spans and a 480 foot center span have considerably stronger columns and drill shafts designed specifically for lateral forces in anticipation of possible boat or debris impacts.

ALTERNATIVES

Three alternatives were investigated to determine the economic feasibility of a solution to the problem. Federal participation was not addressed. The alternatives were:

- No Action
- Columns/Piers Armoring existing
- River Realignment

"No Action" Plan

In the absence of a project to reroute the Trinity River, the "no action" plan alternative, TxDOT indicated that the three 78 foot spans spanning the existing river would be replaced by a single 320 foot span which would span the existing river in its entirety. This would be done at a future date in a planned replacement scenario, or as a reaction to a catastrophic or partial failure of the bridge during a flood event. This is to remove the possibility of loss of lives due to bridge failure, extensive and expensive repairs if the bridge experiences partial failure, and the significant costs associated with rerouting of traffic and lost of potential wages due to delays should the this major thoroughfare between Dallas and Houston require lengthy maintenance. The cost associated with traffic rerouting was estimated to be $1.3 million. The first cost was estimated to be about $12.4 million with an annualized cost of about $1.0 million.

Columns/Piers Armoring

In lieu of replacing the 78 foot spans to a wider 320 foot section, a less costly alternative of providing additional protection to the existing columns against impacts similar to the 1984 occurrence. This alternative would involve armoring the six sets of columns in the existing Trinity River with concrete. The first cost of this alternative was estimated to be about $4.9 million with an annualized cost of $454,700. There exists an element of risk associated with this alternative. It would still be possible to have a large flood event carrying sufficient debris to cause the bridge to fail.

River Realignment

The third alternative investigated would involve rerouting a portion of the existing Trinity river to a new site beneath the adjacent 1,120 foot plate girder bridge. This location would follow the original authorized navigation channel project location and would provide the needed cross-sectional area under the bridge to avert potential damage from high debris flows. This alternative was estimated to have a first cost of $1.9 million and an annualized cost of $154,900.

IH-45 Economic Analysis

An economic analysis of this proposal was performed, using the "No Action" Plan as the basis for project benefits. This analysis assumes that in time, with no changes in annual maintenance of the existing bridge, the bridge will fail or be damaged to such an extent as to require complete replacement. The results of this analysis is presented in table D-29. As shown, the alternative which involved armored protection of existing columns was economically feasible, with net benefits of about $588,900 million, and a BCR of 2.30 to 1.0. The alternative providing maximum net benefits, however, was determined to be the rerouting of the river to an adjacent span. This River realignment alternative yielded about $888,600 in net benefits, with a BCR of 6.74 to 1.0. The general layout of this plan is shown in Appendix C.

Table D-29
Economic Analysis of IH 45 Proposal
(April 1998 price levels, 7.125% interest, 50-year period of analysis)

	No-Action Plan	Column/Pier Armoring	River Realignment
INVESTMENT			
ESTIMATED FIRST COST	$12,449,132	$4,874,132	$1,935,100
ANNUAL INTEREST RATE	0.0713	0.0713	0.0113
PROJECT LIFE (years)	30	30	50
CONSTRUCTION PERIOD (months)	6	6	6
COMPOUND INTEREST FACTOR	6.08977	6.08977	6.08977
CAPITAL RECOVERY FACTOR	0.0816007	0.0816007	0.0736071
INTEREST DURING CONSTRUCTION	$216,668	$84,831	$33,679
INVESTMENT COST	$12,665,800	$4,958,963	$1,968,779
ANNUAL CHARGES			
INTEREST	$902,438	$353,326	$140,275
AMORTIZATION	$131,100	$51,329	$4,641
OPERATION/MAINTENANCE ($/year)	$10,000	$50,000	$10,000
REPLACEMENTS	$0	$0	$0
TOTAL ANNUAL CHARGES	$1,043,538	$454,655	$154,916
ANNUAL BENEFITS			
Annual Cost Reduction	$1,043,538	$1,043,538	$1,043,538
TOTAL BENEFITS	$1,043,538	$1,043,538	$1,043,538
NET BENEFITS	$0	$588,883	$888,622
BENEFIT-TO-COST RATIO	1.00	2.30	6.74

Equivalent Annual Damages of Investigated Plans

Equivalent annual damages (EAD) were calculated for the recommended plan to account for future changes in urbanization and hydrology. The analysis was performed over a 50 year period (2000 to 2050) using April 1998 prices and level of development with an interest rate of 7.125 percent. Table D-30 summarizes the damages under existing conditions and the residual damages for the federally supportable and locally preferred plans. Table D-31 summarizes the number of structures remaining in each flood zone under the investigated alternatives. The total benefits derived for each plan are shown in table D-32. Tables D-33, D-34, and D-35 show the project performance of the NED Plan, the Chain of Wetlands Plus SPF Lamar Levee and 100-Year Cadillac Heights Levee Plan, and the Recommended Plan, respectively. Finally, the cumulative single event damages with minimum facility sumps for the Lamar Street levee is shown in table D-36.

Table D-30
Equivalent Annual Damages and Benefits
(April 1998 Prices and Level of Development)

Reach	2000 Existing Annual Damages			Description
	Direct	Incidental	Total	
1	$294,200	$54,721	$348,900	Below White Rock
2	$50,800	$9,449	$60,200	White Rock
3	$431,500	$80,259	$511,800	Rochester Park
4A	$1,350,000	$251,100	$1,601,100	Lamar Area
4B	$741,100	$137,845	$878,900	Oakland Area
5	$1,085,700	$201,940	$1,287,600	Cadillac Heights
6	$1,696,300	$162,845	$1,859,100	Treatment Plant
Subtotal	$5,649,600	$898,159	$6,547,600	Study Area
7	$10,054,700	$1,870,174	$11,924,900	East Levee
8	$998,500	$185,721	$1,184,200	West Levee
Subtotal	$11,053,200	$2,055,895	$13,109,100	Upstream Levees
Total	$16,702,800	$2,954,054	$19,656,700	

Reach	2050 Existing Annual Damages			Equivalent Annual Damages
	Direct	Incidental	Total	
1	$324,000	$60,264	$384,300	$357,800
2	$54,600	$10,156	$64,800	$61,400
3	$454,500	$84,537	$539,000	$518,700
4A	$1,398,400	$260,102	$1,658,500	$1,615,600
4B	$807,000	$150,102	$957,100	$898,700
5	$1,116,600	$207,688	$1,324,300	$1,296,900
6	$1,856,400	$178,214	$2,034,600	$1,903,400
Subtotal	$6,011,500	$951,063	$6,962,600	$6,652,500
7	$11,264,800	$2,095,253	$13,360,100	$12,287,500
8	$1,135,900	$211,277	$1,347,200	$1,225,400
Subtotal	$12,400,700	$2,306,530	$14,707,300	$13,512,900
Total	$18,412,200	$3,257,593	$21,669,900	$20,165,400

Table D-30 continued
Equivalent Annual Damages and Benefits

2000 Reach	COW+SPF Lamar+100-Yr Cadillac Residual Damages Direct	Incidental	Total	Annual Benefits	2050 Reach	COW+SPF Lamar+100-Yr Cadillac Residual Damages Direct	Incidental	Total	Annual Benefits	Equivalent Annual Benefits
1	$269,700	$50,164	$319,900	$29,000	1	$298,200	$55,465	$353,700	$30,600	$29,400
2	$27,700	$5,152	$32,900	$27,300	2	$30,200	$5,617	$35,800	$29,000	$27,700
3	$15,200	$2,827	$18,000	$493,800	3	$18,600	$3,460	$22,100	$516,900	$499,600
4A	$17,100	$3,181	$20,300	$1,580,800	4A	$20,000	$3,720	$23,700	$1,634,800	$1,594,400
4B	$132,200	$24,589	$156,800	$722,100	4B	$148,800	$27,677	$176,500	$780,600	$736,900
5	$82,700	$15,382	$98,100	$1,189,500	5	$91,100	$16,945	$108,000	$1,216,300	$1,196,300
6	$574,200	$55,123	$629,300	$1,229,800	6	$646,200	$62,035	$708,200	$1,326,400	$1,254,200
Subtotal	$1,118,800	$156,419	$1,275,300	$5,272,300	Subtotal	$1,253,100	$174,919	$1,428,000	$5,534,600	$5,338,500
7	$3,158,800	$687,537	$3,746,300	$8,178,600	7	$3,634,000	$675,924	$4,309,900	$9,050,200	$8,393,800
8	$671,000	$124,806	$795,800	$388,400	8	$778,600	$144,820	$923,400	$423,800	$397,300
Subtotal	$3,829,800	$712,343	$4,542,100	$8,567,000	Subtotal	$4,412,600	$820,744	$5,233,300	$9,474,000	$8,796,100
Total	$4,948,600	$868,762	$5,817,400	$13,839,300	Total	$5,665,700	$995,662	$6,661,300	$15,008,600	$14,134,600

2000 Reach	COW+SPF Lamar & Cadillac Residual Damages Direct	Incidental	Total	Annual Benefits	2050 Reach	COW+SPF Lamar & Cadillac Residual Damages Direct	Incidental	Total	Annual Benefits	Equivalent Annual Benefits
1	$269,700	$50,164	$319,900	$29,000	1	$298,200	$55,465	$353,700	$30,600	$29,400
2	$29,800	$5,543	$35,300	$24,900	2	$30,200	$5,617	$35,800	$29,000	$25,900
3	$16,600	$3,088	$19,700	$492,100	3	$18,600	$3,460	$22,100	$516,900	$498,400
4A	$18,400	$3,422	$21,800	$1,579,300	4A	$21,500	$3,999	$25,500	$1,633,000	$1,592,900
4B	$132,200	$24,589	$156,800	$722,100	4B	$148,800	$27,677	$176,500	$780,600	$736,900
5	$13,800	$2,567	$16,400	$1,271,200	5	$16,100	$2,995	$19,100	$1,305,200	$1,279,800
6	$688,900	$66,134	$755,000	$1,104,100	6	$773,400	$74,246	$847,600	$1,187,000	$1,125,000
Subtotal	$1,169,400	$155,507	$1,324,900	$5,222,700	Subtotal	$1,306,800	$173,459	$1,480,300	$5,482,300	$5,288,300
7	$4,737,000	$881,082	$5,618,100	$6,306,800	7	$5,374,200	$999,601	$6,373,800	$6,986,300	$6,478,500
8	$873,900	$162,545	$1,036,400	$147,800	8	$997,400	$185,516	$1,182,900	$164,300	$152,000
Subtotal	$5,610,900	$1,043,627	$6,654,500	$6,454,600	Subtotal	$6,371,600	$1,185,118	$7,556,700	$7,150,600	$6,630,500
Total	$6,780,300	$1,199,135	$7,979,400	$11,677,300	Total	$7,678,400	$1,358,576	$9,037,000	$12,632,900	$11,918,800

Table D-31
Number of Structures By Flood Zone
For Selected Alternatives

	Cumulative Flood Zone								
	0-1	0-2	0-5	0-10	0-25	0-50	0-100	0-500	0-SPF
Pre-1991 Conditions	0	2	30	112	334	504	794	1804	2550
NED	0	0	3	16	56	221	391	1250	1970
Chain of Wetlands (COW)	0	0	2	10	57	201	283	1542	2232
COW+SPF & 100-Year Levees	0	0	1	7	21	48	75	1036	2046
COW +SPF Levees	0	0	1	7	21	48	75	1232	1862

Table D-32
Benefits of Levee Plans
(April 1998 Prices and Level of Development)
(Based on Equivalent Annual Damages)

Benefit Type	Chain of Wetlands SPF Lamar & 100-Yr Cadillac Levees	Chain of Wetlands SPF Lamar & SPF Cadillac Levees
Inundation Reduction	$5,338,500	$5,288,300
Insurance Subsidy	$94,200	$94,200
Existing Dallas Floodway	$8,796,100	$6,630,500
Total Flood Reduction	$14,228,800	$12,013,000
Restoration	$5,854,100	$5,854,100
Recreation	$5,677,800	$5,677,800
IH-45 River Realignment	$1,043,500	$1,043,500
TOTAL BENEFITS	$26,804,200	$24,588,400

Table D-33
Project Performance by Reach For 1200' BW Swale Alternative
(April 1998 Prices and Level of Development)

		Expected Annual Target Stage Exceedance Probability		Long Term Risk (Years)			Conditional Non-Exceedance Probability by Event						
Reach	Target Stage	Median	Expected	10	25	50	10%	4%	2%	1%	.4%	.2%
1	395.7	0.145	0.154	0.8131	0.9849	0.9998	0.1748	0.0054	0.0001	0.0000	0.0000	0.0000
2	401.9	0.031	0.039	0.3267	0.6280	0.8616	0.9801	0.6089	0.2254	0.0290	0.0054	0.0006
3	levee	0.001	0.003	0.0249	0.0611	0.1184	1.000	0.9998	0.9939	0.9180	0.7829	0.5737
4A	403.14	0.090	0.099	0.6484	0.9267	0.9946	0.5571	0.0627	0.0062	0.0002	0.0000	0.0000
4B	407.03	0.005	0.008	0.0729	0.1724	0.3152	1.000	0.9947	0.9377	0.6376	0.3868	0.1797
5	402.15	0.114	0.154	0.8125	0.9848	0.9998	0.1753	0.0055	0.0001	0.0000	0.0000	0.0000
6	levee	0.001	0.002	0.0216	0.0531	0.9998	0.1753	0.0055	0.0001	0.0000	0.0000	0.0000
7	levee	0.000	0.000	0.0028	0.0069	0.0138	1.0000	1.0000	0.9999	0.9957	0.9806	0.9313
8	levee	0.000	0.000	0.0023	0.0057	0.0113	1.0000	1.0000	1.0000	0.9965	0.9835	0.9395

Table D-34
Project Performance by Reach For
Chain of Wetlands with SPF Lamar and 100-Year Cadillac Levees
(April 1998 Prices and Level of Development)

		Expected Annual Target Stage Exceedance Probability		Long Term Risk (Years)			Conditional Non-Exceedance Probability by Event					
Reach	Target Stage	Median	Expected	10	25	50	10%	4%	2%	1%	.4%	.2%
1	395.70	0.193	0.201	0.8935	0.9849	0.9998	0.1748	0.0054	0.0001	0.0000	0.0000	0.0000
2	401.88	0.044	0.052	0.4112	0.6280	0.8616	0.9801	0.6089	0.2254	0.0290	0.0054	0.0006
3	levee	0.000	0.000	0.0721	0.0026	0.1184	1.000	0.9998	0.9939	0.9180	0.7829	0.5737
4A	levee	0.000	0.000	0.0032	0.0079	0.0157	1.0000	1.0000	0.9999	0.9952	0.9783	0.9244
4B	levee	0.005	0.007	0.0721	0.1705	0.3119	1.0000	0.9950	0.9387	0.6397	0.3867	0.1802
5	levee	0.000	0.000	0.0034	0.0085	0.0168	1.0000	1.0000	0.9999	0.9941	0.9735	0.9109
6	levee	0.002	0.004	0.0399	0.0969	0.1844	1.0000	0.9993	0.9855	0.8436	0.6451	0.4001
7	levee	0.000	0.000	0.0022	0.0054	0.0109	1.0000	1.0000	0.9996	0.9886	0.9531	0.8597
8	levee	0.000	0.001	0.0067	0.0167	0.0330	1.0000	1.0000	0.9996	0.9885	0.9524	0.8567

Table D-35
Project Performance by Reach For
Chain of Wetlands with SPF Lamar and Cadillac Levees
(April 1998 Prices and Level of Development)

		Expected Annual Target Stage Exceedance Probability		Long Term Risk (Years)			Conditional Non-Exceedance Probability by Event						
Reach	Target Stage	Median	Expected	10	25	50	10%	4%	2%	1%	.4%	.2%
1	395.70	0.193	0.201	0.8935	0.9849	0.9998	0.1748	0.0054	0.0001	0.0000	0.0000	0.0000
2	401.88	0.044	0.052	0.4112	0.6280	0.8616	0.9801	0.6089	0.2254	0.0290	0.0054	0.0006
3	levee	0.000	0.000	0.0721	0.0026	0.1184	1.000	0.9998	0.9939	0.9180	0.7829	0.5737
4A	levee	0.000	0.000	0.0032	0.0079	0.0157	1.0000	1.0000	0.9999	0.9952	0.9783	0.9244
4B	levee	0.005	0.007	0.0721	0.1705	0.3119	1.0000	0.9950	0.9387	0.6397	0.3867	0.1802
5	levee	0.000	0.000	0.0034	0.0085	0.0168	1.0000	1.0000	0.9999	0.9941	0.9735	0.9109
6	levee	0.002	0.004	0.0399	0.0969	0.1844	1.0000	0.9993	0.9855	0.8436	0.6451	0.4001
7	levee	0.000	0.000	0.0022	0.0054	0.0109	1.0000	1.0000	0.9996	0.9886	0.9531	0.8597
8	levee	0.000	0.001	0.0067	0.0167	0.0330	1.0000	1.0000	0.9996	0.9885	0.9524	0.8567

Table D-36
Cumulative Single-Event Damages
For Lamar Street Sumps
(without risk)

% ACE Event	1	2	3	4	5	Total
<100	$0	$0	$0	$0	$0	$0
50	$0	$0	$0	$0	$0	$0
20	$0	$0	$0	$0	$0	$0
10	$0	$0	$0	$0	$0	$0
4	$0	$0	$0	$0	$0	$0
2	$0	$0	$0	$0	$0	$0
1	$0	$0	$0	$0	$0	$0
.4	$43,396	$11,411	$223,538	$0	$0	$278,345
.2	$60,344	$119,551	$331,458	$0	$0	$511,353

Socioeconomic Effects of Plan Implementation

The potential economic and social effects of implementation of the investigated plan on the study area comprise the value of the long-term reduction in periodic flood damages, and direct and indirect short-term income and employment impact of project construction. The permanent reduction in periodic flood damages would effectively increase the income available to flood plain property owners for other purposes, such as (for example) improvements to homes, yards or personal property. Construction of SPF levees could encourage growth of existing business and entice new business to the area. This would improve employment conditions and expand the tax base of the area.

To the extent that this additional disposable income is spent within the surrounding area, it would result in a local "multiplier effect": increases in business revenues, employment, and personal income rippling through the local economy as each new dollar brought in is spent and respent. Property values, and local tax revenues, would also be expected to increase as a general result.

Short-term impacts associated with project construction results from the temporary presence of construction workers and expenditures for construction materials and services, as well as spending by the construction work force for food and other personal needs. These expenditures would be expected to result in a positive multiplier effect on the local economy and would last for about three years. The lasting economic and social effects of project implementation would be the benefits resulting from the permanent reduction in flood damages, as described above.

Financial Capability

A financial capability analysis of the City of Dallas was conducted in accordance with ER 1105-2-100 to ascertain the community's financial condition and its ability to meet the cost sharing responsibilities for the Floodway Extension Project. The assessment involved the calculation and analysis of nine key financial indicators. A number of interrelated economic, fiscal, and management factors support a local government's capacity to finance desired capital improvement projects. Those factors include the health of the local economy, the structure of its revenue base, the management of the community's operations, and the debt history of the community.

The Municipal Fiscal Officers Association has developed a number of financial warning indicators useful in determining the financial health of a community. These indicators are used to help determine the sponsor's current debt position and financial health. Financial indicator ratings are calculated for the city of Dallas and are compared to national averages as outlined in the Environmental Protection Agency's *Financial Capability Guidebook*, dated March 1984. The financial data used to calculate these ratings were obtained from the city of Dallas Office of Budget and Management. Other relevant facts and data which play a role in the analysis include population, per capita income and property tax information. Table D-37 provides a key of the financial indicator ratings and limits. Table D-38 shows the indicator values and rating for the city of Dallas. The indicators, calculated values and corresponding rating have been updated to reflect the city's capability as of September 1997 and are summarized in table D-39.

Table D-37
Financial Indicator Rating Key

Indicator	Weak	Average	Strong
1. Annual rate of change in population	< 1%	1% to 1%	> 1%
2. Current surplus/deficit as a percent of total current expenditures	< 0%	0% to 5%	> 5%
3. Real property tax collection rate	< 96%	96% to 98%	> 98%
4. Property tax revenue as a percent of full market value of real property	> 4%	2% to 4%	< 2%
5. Overall net debt as a percent of full market value of real property	> 5%	3% to 5%	< 3%
6. Overall net debt outstanding as a percent of personal income	> 12%	4% to 12%	< 12%
7. Direct net debt per capita	> $750	$250 to $750	< $250
8. Overall net debt per capita	> $1,200	$500 to $1,200	< $500
9. Percent direct net debt outstanding due within next 5 years	< 10%	10% to 30%	> 30%

Table D-38
Current Community Financial Indicator Values
For the City Of Dallas

INDICATOR	VALUE	RATING
1. Annual rate of change in population	1.2%	Strong
2. Current surplus/deficit as a percent of total current expenditures	1.1%	Average
3. Real property tax collection rate	96.9%	Average
4. Property tax revenues as a percent of full market value of real	.5%	Strong
5. Overall net debt as a percent of full market value of real property	2.2%	Strong
6. Overall net debt outstanding as a percent of personal income	6.2%	Average
7. Direct net debt per capita	$609	Average
8. Overall net debt per capita	$1,277	Weak
9. Percent direct net debt outstanding due within next 5 years	77.0%	Strong

The annual rates of change in Dallas' population between 1980 and 1990 exhibits a strong 1.2 percent annual rate of change. The indicator stability in the economic base is useful because the economic base typically rises and falls with changes in the population. The proportion of surplus/deficit expenditures to total expenditures are also some significant indicators of the community's strength. Dallas is currently operating at a surplus with revenues exceeding expenditures by about 1.1 percent, which is in balance with the national average. The third indicator measures the efficiency of the city's tax collection system. The city is currently strong in this area reporting a 1997 collection rte of 96.9 percent. The city's reliance on tax revenue, indicator four, shows the extensiveness of property taxation and the potential for future revenue growth from this source. A value of 0.5 percent is strong and indicates that the city does not appear to tax heavily in relation to property values in this area.

Indicators' five through nine are used to assess the community's debt capacity. Indicator five compares the amount of tax-supported debt to the full market value of real property. The city of Dallas is average with a value of 2.2 percent. Personal income can be used as a yardstick to judge the city's ability to repay debt. Per Capita income for January 1990 was $20,483. Indicator six shows net debt representing about 6.2 percent of total personal income, which is average for most cities. Indicators' seven and eight represent the per capita direct debt of almost $609 and overall net debt outstanding per capita of $1,277, which indicates a weakness in this area.

Finally, indicator nine compares the percentage of direct net debt due within five years to total outstanding direct net debt. The city's situation is strong with 77 percent of the outstanding debt being paid over the next five years. The overall net debt reported in 1997 was $1,326,830,670.

Based on the national averages the overall financial condition of the city of Dallas is currently in a healthy state. The only indicator falling within the weak range was for the amount of net debt outstanding per capita. However, the calculated value only exceeded the average limits by only $77. The city of Dallas is not over extended and appears to have room to expand their debt load for new capital projects.

Table D-39
City of Dallas
Summary of Financial Capability
Dallas Floodway Extension Dallas, Texas, General Evaluation

A. BOND RATINGS	Rating	Date		
General Obligation	AAA/Aaa (S&P)	Nov-96		
Revenue Bonds:				
Dallas Water Utilities	AA/Aa (S&P)			
Civic Center	A/A1	Apr-98		
B. DEBT				
	Outstanding	**Projected**		**Total**
General Obligation Bonds	$632,940,270		0	$632,940,270
Revenue Bonds	$1,026,993,000		0	$1,026,993,000
Gross Direct Debt	$1,659,933,270		0	$1,659,933,270
Direct Net Debt	$632,940,270		0	$632,940,270
Overlapping Net Debt 1/	$693,890,000		0	$693,890,000
Overall Net Debt	$1,326,830,270		0	$1,326,830,270

C. DEBT REPAYMENT SCHEDULE (principle only)

	Existing	This Project*	Total
Year 1: 1998	$110,829,408	0	$110,829,408
Year 2: 1999	$107,821,082	0	$107,821,082
Year 3: 2000	$100,014,486	0	$100,014,486
Year 4: 2001	$86,486,881	0	$86,486,881
Year 5: 2002	$80,955,880	0	$80,955,880
			$486,107,737

* Assumes project funding at $23.7 million and included in outstanding debts. General Obligation bonds authorized as of May 1997.

D. DEBT LIMITS

Constitutional and Charter Debt Limit: Ten percent of assessed value. Article 717K, Vernon's Annotated Texas Civil Status Constitution and Laws of the State of Texas. Approximately 16.83% of debt limit will be used.

[1] Overlapping net debt is the sponsor's share of taxes owed to other taxing bodies within the community, ie., a flood district.

[2] Other debt obligations include outstanding leases, unfunded pension liabilities, and notes with a maturity.

Non-Federal Financial Planning

The purpose of strategic financial planning is to optimize the use of capital over time in response to long term financial goals. The three principal elements involved include cost recovery alternatives, if needed; selection of the preferred financing alternative; and implementation of the cost recovery approach. Although financing decisions are ultimately the sponsors', the Corps of Engineers can assist in the decision making through the provision of timely information on costs, benefits and cost recovery opportunities. The sponsor is responsible for making arrangements to finance the project sufficiently in advance of construction to enable the project schedule to be met.

Ability-to Pay Analysis

Based on ER 1165-2-121 an ability-to-pay test should be applied to all flood control projects. The test determines the eligibility of the study area to qualify for a reduction in the amount to be cost shared by the Non-Federal interest. To qualify for a reduction the results of both the benefit and income portions of the twofold ability-to-pay test must fall within the specified guidelines.

The benefits' test determines the maximum reduction, called the "benefits based floor" (BBF), in the level of non-Federal cost sharing for any project. The factor is determined by dividing the project B/C ratio by four. If the factor (expressed as a percentage) is less than the standard level of cost sharing, the project may be eligible for a reduction in the non-Federal share to this BBF. The WRDA 86 authorized cost share level for the Flood Protection project is 25 percent. The recommended plan's B/C ratio of 2.06 was divided by four to yield a BBF of .515 or 51.5 percent.

The income test determines qualification for the reduction calculated in the benefit step. Qualification depends on a measure of the current economic resources of both the project area and the State in which the project is located.

In accordance with factors released in Economic Guidance 96-4, the income index factors for the state of Texas and Dallas County are 90.81 and 102.77, respectively. The Eligibility Factor (EF) for a flood control project is calculated according to the following formula:

$$EF = a - b_1 * (\text{State factor}) - b_2 * (\text{area factor})$$

where:

$a = 15.86794$

$b_1 = 0.06771$

$b_2 = 0.13543$

Utilizing the above formula, an EF of -4.2 was calculated for the City of Dallas. An EF less than zero indicates ineligibility for a reduction in construction cost sharing. As stated previously, a BBF factor for the investigated plan was calculated at 51.5 percent. To qualify for a reduction, the BBF factor must be less than the standard level of cost sharing in accordance with ER-1165-2-121 paragraph 5a(2). The City of Dallas does not meet the criteria for a reduction in construction cost because this project meets neither test, therefore, the City of Dallas must pay the standard 25 percent level of the total project cost as authorized in WRDA 86.

APPENDIX E

REAL ESTATE

(763)

APPENDIX E

REAL ESTATE PLAN

PURPOSE

This Real Estate Plan (REP) describes the necessary acquisition of lands, easements and rights of way (LER) for the Recommended Plan, as presented in this General Reevaluation Report. The term "project lands" or "LER", when used in this plan, refers to all lands needed for construction, operation and maintenance of the flood damage reduction features, disposal of excess excavated material, access, recreation and mitigation of losses in terrestrial wildlife habitat for the various plans.

OTHER PLANS

As briefed elsewhere in this report, the authorized plan for the Dallas Floodway Extension involves a 22 mile levee and floodway system and 9.1 miles of channel improvements along the Trinity River, 4.1 miles of channel improvements along White Rock Creek, and 5.4 miles of channel improvements to divert Five Mile Creek. This plan was authorized in 1965 as part of the basin-wide plan of improvements for the Trinity River and Tributaries, Texas. During the current plan formulation process the National Economic Development plan (NED plan) has been determined to be a large flood relief swale. The 1,200-foot wide NED swale would be in two segments, divided generally by the IH-45 bridge. The upstream part would be on the west bank, while the downstream segment would be a clearing on the east side of the river through park lands owned by the City of Dallas. Real Estate costs for the NED plan are estimated at approximately $15.2 million at April 1998 price levels, of which $10.7 are attributed to mitigation.

LANDS, EASEMENTS AND RIGHTS OF WAY FOR THE RECOMMENDED PLAN

Neighborhood Analysis

The project area is located entirely in the City of Dallas, south of the central business district. Zoning and development in the immediate neighborhood is mixed, consisting of single-family detached dwellings, single-family attached dwellings, medium density multi-family dwellings, office, retail, service retail, commercial, industrial, and flood plain. The residential development consists primarily of new to 40-year old single-family detached dwellings located throughout the general neighborhood. Typically, multi-family dwellings can be found interspersed throughout the neighborhood, primarily along connector streets. Commercial, service retail, and industrial uses are located at major intersections and arterial roadways. All public utilities, City services and emergency medical services are readily available.

Project Lands

The flood control features of the plan consist of two levees and a chain of wetlands, located along the Trinity River, downstream of the existing Dallas Floodway. One levee will be constructed on the east bank, generally parallel to Lamar Street. This feature, referred to as the Lamar Street Levee, will connect to the existing Floodway levee on the upstream end and the existing Rochester Park levee at the downstream end. The other levee, known as the Cadillac Heights Levee, will be located on the west bank of the Trinity. It will tie-into high ground just downstream of the existing Floodway, parallel the river to a point of intersection with the levee around the City's Central Waste Water Treatment Plant (CWWTP), utilize and raise of portion of the CWWTP Levee near the entrance, then extend to the west of the CWWTP, terminating at a point near Kiest Boulevard. These levees will provide protection against the standard project flood (SPF). The chain of wetlands is in two segments, both located on the west bank. The upstream segment is between the two new levees and the downstream portion runs from Central Expressway to Loop 12.

The lands required for the project are currently utilized for commercial, industrial, municipal, and residential uses. The total area required for flood control is about 1,198 acres. The standard estate for the levees is flood protection levee easement (Estate No. 9, as contained in Chapter 5 of Engineer Regulation 405-1-12), flowage easements (Estate No. 6) for the sumps and channel improvement easement (Estate No. 8) for the for the chain of wetlands. Since levees are proposed on both the east and west banks of the river in the upper reach this entire reach will become a controlled floodway. The upper portion of the chain of wetlands is located between these levee segments. In order for the project to perform as designed vegetation within this portion of the floodway must be managed. Since neither a flowage easement or a flood protection levee easement conveys the explicit right to manage the vegetative cover, the channel improvement easement estate would seem to be the logical minimum estate for the entire floodway area between the levees.

There are strong arguments to be made for acquiring all the flood control lands in fee. It is the opinion of the appraiser that the increment of value between fee and any of the restrictive easements is slight in this urban setting. Productive uses of the land after imposition of the easement are few, unlike a rural environment, where various agricultural uses could still be enjoyed. Also, with fee, other project purposes such as recreation and environmental restoration could be pursued on the flood control lands. There is an ongoing study of the feasibility of developing a trail system between the Dallas/Fort Worth Metroplex and Lake Texhoma on the Oklahoma border. This proposal has been named the Dalhoma Trail. Fee acquisition in the Dallas Floodway Extension project area would provide the land for a key segment of the Dalhoma system. Other compatible recreational and enironmental uses, which would promote the economic welfare of this region of the City, would also be possible. Furthermore, the existing Dallas Floodway is owned in fee, so such action would provide consistency of estates along the river. If easements are acquired there is potential liability associated with co-use of the project lands by the City and the underlying fee owner. Such liabilities are eliminated by fee acquisition.

For the purposes of this plan, it is assumed that fee will be acquired for the flood control features. Existing real estate improvements will be acquired and removed and occupants will be relocated in compliance with Public Law 91-646, as amended. Mitigation lands will also be acquired in fee simple (Estate No. 1). Temporary work area easements (Estate No. 15) will be acquired in the areas needed for disposal of excess excavated material. The standard road easement estate (Estate No. 11), with a word change, is proposed for use in acquiring trail right-of-way (see additional discussion below). The language of all referenced estates is included at the end of this appendix.

Due to the complexities involved, it is recommended that real estate issues be analyzed further in a Real Estate Design Memorandum (REDM). This will allow fuller assessment of the relative costs, implications of potential HTRW, management of risk related to possible future litigation and other legal considerations, project related recreation and environmental restoration opportunities, impacts to remainder properties, refinement of plans for disposal of excess excavated materials and access for construction. The REDM should be initiated concurrently with detailed engineering studies, currently scheduled to commence in 1999.

The figures in the following table (Table E-1) are calculated on a "first added" basis. That is to say, all LER required for the Chain of Wetlands feature, including the portion of the mitigation lands which can be attributed to the impacts of this feature, are shown first. Then, the additional LER needed (no duplication) for the Lamar Street Levee are shown, including mitigation lands. Likewise, ownerships are listed so that each ownership affected by the project is counted one time, IE. the number of ownerships for the Lamar Street Levee includes all those in addition to the ownerships affected by the Chain of Wetlands (no duplication). The same methodology is utilized in the real estate cost estimates.

TABLE E-1
LANDS, EASEMENTS AND RIGHTS OF WAY
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS

PURPOSE: FLOOD CONTROL		
FEATURE: Chain of Wetlands		
Estate	**Acreage**	**Ownerships**
Fee	736	10
Temporary Easement (disposal)	435	1
FEATURE: Lamar Street Levee		
Estate		
Fee	333	20
Flowage Easement (sumps)	33	*
FEATURE: Cadillac Heights Levee		
Estate		
Fee	96	9
PURPOSE: WILDLIFE HABITAT MITIGATION		
FEATURE: Chain of Wetlands		
Estate	**Acreage**	**Ownerships**
Fee	720	2
FEATURE: Lamar Street Levee		
Estate	**Acreage**	**Ownerships**
Fee	400	1
FEATURE: Cadillac Heights Levee		
Estate	**Acreage**	**Ownerships**
Fee	59	1
PURPOSE: ACCESS / RECREATION		
Estate		
Fee	1	*
Trail Easement	11	*

* Ownerships affected by fee acquisition include all properties needed for sumps (no additional ownerships are affected by sumps)

The majority of the project LER is in private ownership. Approximately 20% is Sponsor-owned. Minor areas, associated with highways, are owned by the State of Texas.

Excavating the chain of wetlands feature will generate a large amount of spoil, even after utilization in the levees. Excess excavated material is proposed to be hauled to a disposal site located south of the project area. This site was identified by the City of Dallas as a disposal area for dredged material from White Rock Lake and there is believed to be sufficient capacity to accommodate both projects. The property is located south of Interstate Highway 20, east of

Interstate Highway 45 and west of the Trinity River. Total area in the site is 1,013 acres. Approximately 435 acres of the site would be utilized for this project. A temporary work area easement over this land will be required. Mitigation of losses to wildlife habitat will require the acquisition of approximately 1,179 acres in fee, of which 71 acres is mitigation of the Interstate Highway 45 river realignment plan. Location of the proposed mitigation lands are shown in Appendix F.

Some minor real estate acquisitions will be necessary to provide adequate access to project lands. This will consist of small (15-20 car capacity) parking areas and trail rights-of-way. Most of the proposed recreation trail system will be located on lands needed for flood control or mitigation. Five of the seven proposed access areas fall outside of this area; however, these amount to a total of only one acre of additional land. About eleven acres of trail easement, outside of the other project lands, will be needed to provide adequate access. Standard Estate No. 11 (Road Easement) is proposed for use in acquiring trail right-of-way. A word change in the estate will be made by replacing the word "road" with the word "trail". This estate is included at the end of this appendix.

Sponsor-Owned LER

The City of Dallas currently owns interests in approximately 20 percent of the project LER. The upper chain of wetlands will partially be located on Central Waste Water Treatment Plant (CWWTP) property and a portion of the Lamar Street Levee and floodway will be on City park lands. In addition, the west end of the Cadillac Heights SPF levee will terminate on a City-owned lot adjacent to Kiest Boulevard. All these lands are owned by the sponsor in fee. Therefore, the estate is sufficient and the lands are considered to be available for project purposes. We will also be connecting the Cadillac Heights Levee to the existing levee around the CWWTP and the Lamar Street Levee to the existing Rochester Park Levee. These existing levees, constructed by the City of Dallas, are creditable toward this project as provided in Section 351 of the Water Resources Development Act of 1996. The right of way associated with these existing features is excluded from discussion under this real estate plan.

Other Federal Projects

As the name implies, the Dallas Floodway Extension, will add onto an existing floodway, the Dallas Floodway, which is a Federally cost-shared project. The City of Dallas is the local sponsor. Construction was completed in 1960. The extension project is located immediately downstream of the existing floodway. Project lands do not overlap.

There are no significant Federal land holdings within the project LER. The only known interest of the United States is an easement for a multi-purpose channel within the right of way of I-45 on the west side of the Trinity River. This easement covers 4.64 acres and was granted by the State of Texas on August 14, 1973, as part of Contract No. DACW63-70-C-0020 for the Trinity River Project. The Trinity River Project was an authorized Federal navigation project at the time that the I-45 bridge was constructed. Therefore, the referenced contract was entered into to pay for the increment of cost necessary to build the bridge to accommodate operation of the navigation channel. The easement partially overlaps the LER for the upper segment of the Chain of Wetlands. The estate appears to be sufficient for project purposes, as it grants the following rights:

> *a perpetual and assignable (assignable only to another or other Government agency or agencies) right and easement in, on, over, and across the land hereinafter described to construct, operate, repair, maintain, patrol and replace a drainage ditch, floodway, multiple purpose channel, channel improvement works and waterway for commercial navigation, as authorized by the Act of Congress approved October 27, 1965, Public Law 89-298, 89th Congress, 1st Session, and to excavate, dredge, cut away and remove any or all of said land, to place levees thereon, and to deposit dredge or spoil material and for such other purposes as may be required in connection with such ditch, channel, channel improvement works, multiple purpose floodway and waterway, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements, or other obstructions from said right-of-way, reserving,*

however, to the State of Texas and its assigns, the right, power, and privilege of constructing, operating, maintaining and replacing a highway bridge, or other structures and appurtenances related to highway use, and further reserving all other rights and privileges as may be used or exercised without interfering with or abridging the rights and easements hereby granted

The channel for the Trinity Project was never constructed, however the easement appears to still be in force and under the jurisdiction of the Department of the Army. The easement could be assigned to the City of Dallas for the purposes of this project.

Navigation Servitude

The Trinity River is a navigable water and some of the land within the floodway, between the two levee segments, is probably within the navigation servitude. We estimate this to be less than ten percent of the approximately 297 acres of floodway. No interest in real estate will have to be acquired over these areas, likewise, no value has been attributed to these lands in the appraisal process. At this point it does not appear that there will be removals of utilities or facilities within the navigation servitude, but any that might arise can be accomplished at no cost to the Government through exercise of the servitude. This issue will be carefully considered in the final Attorney's Opinion of Compensability.

Downstream Impacts

There are no LER requirements downstream of the primary project features. The downstream impacts on water surface elevations are insignificant on this major river system. The with-project 100-year water surface will rise approximately 0.2 feet, immediately downstream of Loop 12 and the SPF will increase approximately 0.3 feet.

BASELINE COST ESTIMATE FOR REAL ESTATE

Property values included in the cost estimate are based on a Gross Appraisal dated April 14, 1997, prepared by a Fort Worth District Staff Appraiser. The appraisal was reviewed and approved by a Reviewing Appraiser in Corps of Engineers Headquarters, Washington, DC on May 30, 1997. The appraisal was supplemented to provide a value estimate for mitigation lands and the supplement was approved after a verbal delegation of authority from HQUSACE. Data from this supplement has been included in the following cost estimates. All land values were predicated on the assumption that the lands are free of hazardous, toxic or radiological wastes, in accordance with Real Estate Policy Guidance Letter No. 1 -- Appraisal of Lands Containing Hazardous and Toxic Wastes. Contingencies have been added to the cost estimate as follows:

01.23.03.01. Real Estate Planning Documents, 20% based on extent and complexity of relocation assistance planning

01.23.03.02. Real Estate Acquisition Documents, 20% based on potential for additional ownerships

01.23.03.03. Real Estate Condemnation Documents, 25% based on the variability of labor and administrative requirements for condemnations and unknown number of cases

01.23.03.05. Real Estate Appraisal Documents, 10% based on reasonable certainty of contract costs

01.23.03.06. Real Estate PL 91-646 Asst. Documents, 25% based on general variability of relocation assistance cases and possibility of increased number of cases

01.23.03.15. Real Estate Payment Documents, 25% based on contingency assigned by the Appraiser in the Gross Appraisal and the know variation in business relocation assistance benefits

01.23.03.17. Real Estate LERRD Crediting Documents, 10% based on reasonable certainty regarding crediting requirements

Costs are presented in the following four tables: E-2, Chain of Wetlands; E-3, Lamar Street Levee; E-4, Cadillac Heights Levee; and E-5, Total Project. All estimates include costs for lands for wildlife habitat mitigation, and were estimated at April 1998 price levels. The amounts attributed to mitigation are shown separately in parenthesis. Estimates are presented in the standard Code of Accounts from the MCACES Models Database, October 1994.

TABLE E-2
REAL ESTATE COST ESTIMATE FOR PROJECT IMPLEMENTATION
CHAIN OF WETLANDS
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS
(April 1998 price levels)

ACCOUNT	DESCRIPTION	ESTIMATE	CONTINGENCY
01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Local Sponsor	2,000	400
	Review of Local Sponsor	500	100
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Local Sponsor	63,000 (14,000)	12,600 (2,800)
	Review of Local Sponsor	5,400 (1,200)	1,080 (240)
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Local Sponsor	72,000 (12,000)	18,000 (3,000)
	Review of Local Sponsor	1,800 (300)	450
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Local Sponsor	20,000 (4,000)	2,000 (400)
	Review of Local Sponsor	3,000 (300)	300
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Local Sponsor		
	Review of Local Sponsor		
01.23.03.15	Real Estate Payment Documents		
	Payments by Local Sponsor (Land)	9,643,200 (1,830,400)	2,410,800 (457,600)
	Payments by Local Sponsor (Damages)	964,320 (183,040)	241,080 (45,760)
	Payments by Local Sponsor (PL 91-646 Asst.)		
	Review of Local Sponsor	5,000 (500)	1,250
01.23.03.17	Real Estate LERRD Crediting Documents	1,000	100
	TOTAL ADMIN & PAYMENTS	10,781,220.00 (2,045,740)	
	TOTAL CONTINGENCY		2,694,407.00 (509,800)
	GRAND TOTAL	13,475,627.00 (2,555,540)	

TABLE E-3
REAL ESTATE COST ESTIMATE FOR PROJECT IMPLEMENTATION
LAMAR STREET LEVEE
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS
(April 1998 prices)

ACCOUNT	DESCRIPTION	ESTIMATE	CONTINGENCY
01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Local Sponsor	2,000	400
	Review of Local Sponsor	500	100
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Local Sponsor	147,000 (7,000)	29,400 (1,400)
	Review of Local Sponsor	12,600 (600)	2,520
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Local Sponsor	108,000	27,000
	Review of Local Sponsor	2,600	650
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Local Sponsor	46,000 (2,000)	4,600 (200)
	Review of Local Sponsor	6,800 (300)	680
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Local Sponsor	5,000	1,250
	Review of Local Sponsor	500	125
01.23.03.15	Real Estate Payment Documents		
	Payments by Local Sponsor (Land)	3,165,230 (1,019,200)	791,307 (254,800)
	Payments by Local Sponsor (Damages)	316,523 (101,920)	79,130 (25,480)
	Payments by Local Sponsor (PL 91-646 Asst.)	800,000	200,000
	Review of Local Sponsor	4,000 (200)	1,000
01.23.03.17	Real Estate LERRD Crediting Documents	2,000	200
	TOTAL ADMIN & PAYMENTS	4,618,753.00 (1,131,220)	
	TOTAL CONTINGENCY		1,138,362.00 (281,880)
	GRAND TOTAL	5,757,115.00 (1,413,100)	

TABLE E-4
REAL ESTATE COST ESTIMATE FOR PROJECT IMPLEMENTATION
CADILLAC HEIGHTS LEVEE
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS
(April 1998 prices)

ACCOUNT	DESCRIPTION	ESTIMATE	CONTINGENCY
01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Local Sponsor	4,000	800
	Review of Local Sponsor	1,000	200
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Local Sponsor	70,000 (7,000)	14,000 (1,400)
	Review of Local Sponsor	6,000 (600)	1,200
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Local Sponsor	24,000	6,000
	Review of Local Sponsor	600	150
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Local Sponsor	22,000 (2,000)	2,200 (200)
	Review of Local Sponsor	3,200 (300)	320
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Local Sponsor	10,000	2,500
	Review of Local Sponsor	1,000	250
01.23.03.15	Real Estate Payment Documents		
	Payments by Local Sponsor (Land)	2,059,870 (150,800)	514,968 (37,700)
	Payments by Local Sponsor (Damages)	205,987 (15,080)	51,497 (3,770)
	Payments by Local Sponsor (PL 91-646 Asst.)	2,415,830	603,957
	Review of Local Sponsor	3,000 (300)	750
01.23.03.17	Real Estate LERRD Crediting Documents	1,000	100
	TOTAL ADMIN & PAYMENTS	4,827,487.00 (176,080)	
	TOTAL CONTINGENCY		1,198,892.00 (43,070)
	GRAND TOTAL	6,026,379.00 (219,150)	

TABLE E-5
REAL ESTATE COST ESTIMATE FOR PROJECT IMPLEMENTATION
TOTAL PROJECT
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS
(April 1998 prices)

ACCOUNT	DESCRIPTION	ESTIMATE	CONTINGENCY
01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Local Sponsor	8,000	1,600
	Review of Local Sponsor	2,000	400
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Local Sponsor	280,000 (28,000)	56,000 (5,600)
	Review of Local Sponsor	24,000 (2,400)	4,800 (480)
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Local Sponsor	204,000 (12,000)	51,000 (3,000)
	Review of Local Sponsor	5,000 (300)	1,250
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Local Sponsor	88,000 (8,000)	8,800 (800)
	Review of Local Sponsor	13,000 (900)	1,300
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Local Sponsor	15,000	3,750
	Review of Local Sponsor	1,500	375
01.23.03.15	Real Estate Payment Documents		
	Payments by Local Sponsor (Land)	14,868,300 (3,000,400)	3,717,075 (750,100)
	Payments by Local Sponsor (Damages)	1,486,830 (300,040)	371,707 (75,010)
	Payments by Local Sponsor (PL 91-646 Asst.)	3,215,830	803,957
	Review of Local Sponsor	12,000 (1,000)	3,000
01.23.03.17	Real Estate LERRD Crediting Documents	4,000	400
	TOTAL ADMIN & PAYMENTS	20,227,460.00 (3,353,040)	
	TOTAL CONTINGENCY		5,025,414.00 (834,990)
	GRAND TOTAL	25,252,874.00 (4,188,030)	

RELOCATIONS OF PERSONS AND BUSINESSES

The Recommended Plan will displace several commercial establishments, and one residence. The occupants of the residence can be relocated within the immediate vicinity as the supply of comparable replacement housing is adequate. The business relocations are more complex and specialized. Additional analysis in the Real Estate Design Memorandum is needed to accurately develop relocation plans and costs. This plan would impact four commercial buildings used for service/industrial purposes, two large warehouses, and an active meat packing plant. A vacant building (formerly used for meat packing) which is within the LER, has recently been approved for use as a waste-products transfer station. Finally, the entire Sleepy Hollow Golf Course will be displaced. Based on the information available, we estimate relocation payments at well over $3 million. More study is needed to increase the level of confidence in this estimate.

MINERALS AND TIMBER

There is no significant mineral exploration or production activity in the project area and none is anticipated. City ordinances preclude such development. Sand and gravel is present in the area and is commonly extracted by open pit mining for construction uses. Again, current City ordinances and permitting in concert with the restrictive language of the standard easement estates should protect the interests of the Government and the Sponsor. Although the Trinity floodplain is heavily wooded, there is no economically merchantable timber.

SPONSOR'S CAPABILITY TO ACQUIRE LER

The City of Dallas has extensive experience and full legal and professional capability to acquire the necessary LER in compliance with the standard Project Cooperation Agreement. A checklist has been prepared in accordance with Corps of Engineers Real Estate Policy Letter No. 12 and is included at the end of this real estate plan. The City has been advised of the requirements of Public Law 91-646, as amended, and the requirements for documenting expenses for credit purposes. We do not anticipate that the Sponsor will request the Government's assistance to acquire LER.

ZONING

There are no special zoning ordinances proposed to be enacted in connection with this project.

MILESTONES FOR REAL ESTATE ACQUISITION.

It is estimated that this acquisition will require approximately 23 months to complete. The project schedule includes this time frame. The following are the major milestones in the acquisition process:

TABLE E-6 REAL ESTATE MILESTONE SCHEDULE DALLAS FLOODWAY EXTENSION PROJECT DALLAS, TEXAS				
ACTIVITY	**COE INITIATE**	**COE COMPLETE**	**LS INITIATE**	**LS COMPLETE**
Final ROW drawings		15 May 2000	--	--
Execution of PCA	--	1 Jun 2000	--	1 Jun 2000
Transmittal of ROW drawings to LS with instruction to acquire LERRD	--	1 Jun 2000	--	--
Conduct landowner meeting	--	--	--	6 Jul 2000
Prepare mapping and legal descriptions	--	--	13 Jun 2000	7 Sep 2000
Review mapping and legal descriptions	10 Aug 2000	2 Oct 2000	--	--
Obtain title evidence	--	--	24 Aug 2000	28 Nov 2000
Review title evidence	3 Oct 2000	18 Dec 2000	--	--
Obtain tract appraisals	--	--	16 Oct 2000	22 Feb 2001
Review tract appraisals	4 Dec 2000	15 Mar 2001	--	--
Conduct negotiations	--	--	8 Jan 2001	8 Jun 2001
Perform closings	--	--	20 Mar 2001	
Prepare condemnations	--	--	20 Mar 2001	29 Jun 2001
Review condemnations	--	--	18 Apr 2001	13 Jul 2001
Perform condemnations	--	--	1 May 2001	1 May 2002
Obtain possession	--	--	10 Oct 2001	1 May 2002
Complete PL 91-646 benefit assistance	--	--	1 Apr 2001	1 May 2002
Review PL 91-646 payments			22 Apr 2001	24 May 2002
Certify availability of LERRD	6 May 2002	7 May 2002	1 May 2002	2 May 2002
Prepare and submit credit requests	--	--	2 May 2002	16 May 2002
Review credit requests	17 May 2002	7 Jun 2002	--	--
Approve or deny credit requests	7 Jun 2002	7 Jun 2002	--	--
Establish value of LERRD credit in accounting records	10 Jun 2002	11 Jun 2002	--	--

UTILITY AND FACILITY RELOCATIONS

A number of utilities and facilities including roads, railroads, sanitary sewers, storm sewers, water lines, fiber optic cables and an electric transmission tower will be affected by the project. These are listed, by owner, in Table E-7 below. A detailed description of each can be found in Appendix C - Civil/Structural Design and Relocations.

TABLE E-7
UTILITY & FACILITY RELOCATIONS
DALLAS FLOODWAY EXTENSION PROJECT
DALLAS, TEXAS

Facility Name/Type	Project Feature Involved	Proposed Modification
OWNER: State of Texas		
Central Expressway (U.S. Highway 75) / 4 lane divided highway	Lamar Street Levee	None, owner will raise road to levee height in near future
Interstate 45 / interstate highway	Lamar Street Levee	State maintenance road below I-45 bridge will be ramped over the levee
OWNER: City of Dallas		
Martin Luther King Blvd. / 4 lane divided road	Cadillac Heights Levee	Closure structure at west bridge abutment
Sargent Road / 2 lane road	Cadillac Heights Levee	Abandon a section of road
Cadiz Force Main / sanitary sewer	Lamar Street Levee	Extend valve box to top of levee
Various Sanitary Sewers	Lamar Street Levee and Cadillac Heights Levee	Reconstruction of the lines beneath the levees and installation of valves as appropriate
Various Storm Drains	Lamar Street Levee and Cadillac Heights Levee	Extend under levees to discharge on river side, install collectors, reconstrucf sections under levee or install pressure pipe
Three Water Supply Lines	Cadillac Heights Levee	Relocate pipe over top of levee
OWNER: Texas Utilities Electric		
Electric Transmission Tower	Cadillac Heights Levee	Relocate one tower
OWNER: Dallas Area Rapid Transit		
Inactive Railroad Line	Lamar Street Levee	Abandon railroad line and possibly upgrade for use as a recreational trail
OWNER: Union Pacific Railroad		
Former M-K-T Railroad Line	Lamar Street Levee Cadillac Heights Levee	Add Closure Structure Add Closure Structures at two locations
Railroad Spur serving Dallas Central Wastewater Treatment Plant	Cadillac Heights Levee	Add Closure Section
Former Southern Pacific Railroad Line	Lamar Street Levee	Add Closure Section
OWNER: Qwest Communication		
Fiber Optic Cables	Lamar Street Levee	Relocate sections of cables around closure sections
OWNER: Electra Communication		
Fiber Optic Cables	Lamar Street Levee and Cadillac Heights Levee	Relocate sections of cables around closure sections

A Fort Worth District Real Estate Attorney has prepared a Preliminary Investigation of Utility and Transportation Infrastructure, dated July 23, 1997. The findings are that all the proposed relocations are considered "public" and that there is a need for continued service. The proposed relocation actions are therefore necessary to eliminate permanent interruption of service. Provision of a functionally equivalent facility is believed to constitute just compensation to the owners. All owners are thought to hold a compensable interest in the right of way involved, however formal title evidence and a full Attorney's Opinion of Compensability will be required prior to contractual commitments being made by the Sponsor or the Government. The final Attorney's Opinion of Compensability will be completed along with the Real Estate Design Memorandum.

A relocation agreement is proposed between railroads and the Government, as discussed in the Civil Engineering appendix, to acquire the rights necessary to accommodate the project. This agreement would include the right to periodically close the floodgates. Project impact to railroad operations should be no more restrictive than the design flood would be under existing conditions. No additional cost would be anticipated for this agreement beyond the first cost of construction.

The total cost of relocations is detailed in Appendix K, Cost Estimates, under the 02 Account. None of these costs, or the costs in the 01 Account, are associated with right of way acquisition for relocations. At this stage of project development it appears that relocations can be accomplished within the owners existing right of way or that lands otherwise required for flood control will accommodate the work. In the latter case, standard easement estates may have to be combined to create a dual purpose estate, eg. a flood control levee and utility easement.

HAZARDOUS, TOXIC AND RADIOLOGICAL WASTE

The project area has a history of commercial and industrial uses and includes significant amounts of landfill. There are documented actions and investigations which indicate the presence of buried HTRW. Appendix J details the results of the current investigations based on the access that was possible and other data which was available (During this study the District was unable to obtain rights of entry from a number of private property owners, for the purposes of conducting HTRW investigations). Appendix J also contains maps showing the lands where there is some known or suspected contamination.

This type of problem is often faced in older urban areas because of past practices for handling industrial and municipal wastes. Therefore, in order to implement a necessary public project, a risk-based assessment must be performed and risks must be minimized to the greatest extent possible when developing project alternatives. The plans have been formulated to avoid sites under active CERCLA or RCRA enforcement actions and other sites which represent a high risk, with the exception of the Linfield Landfill.

The Linfield Landfill was closed in 1979. It has been taken off of CERCLA regulatory status by the EPA and given a "no further action" listing. The lower segment of the Chain of Wetlands will require excavation through a portion of the landfill. The alignment has been chosen to pass through the western portion which is believed to be the least hazardous.

ER 1165-2-132 states that the, *local sponsor shall be responsible for ensuring that the development and execution of Federal, State and locally required HTRW response actions are accomplished at 100 percent non-project cost.* The Model Project Cooperation Agreement For Structural Flood Control Projects sets out the guidelines for handling HTRW issues after PCA execution. Article XVIII.b. stipulates that the Government and the Local Sponsor must mutually agree for the Sponsor to acquire or provide any project LER that is found to *contain any hazardous substance regulated under CERCLA.* Article XVIII.c. provides, that *an appropriate response to the contamination* must be determined, *considering any liability that may arise under CERCLA* and that *the Local Sponsor shall be responsible, as between the Government and the Local Sponsor, for any and all necessary clean up costs, to include costs of any studies and investigations.*

Assuming that no project LER is under an active CERCLA or RCRA enforcement action by either the EPA or the Texas Natural Resource Conservation Commission (TNRCC), a risk-based assessment can be used to determine appropriate action. In the floodway between the levees there will be a large amount of project LER which will not be affected by construction activities. Even though some of these lands may contain CERCLA regulated wastes, the appropriate response may be to leave the material in place, because risks are very low. Under the terms of the PCA, it will be a Sponsor cost (non-project cost) to make this assessment and determination, once the PCA is signed. Where construction activities will disturb CERCLA or active RCRA regulated HTRW resulting in identification of any hazardous substance regulated under CERCLA or any other material which may necessitate a required HTRW response action which increases construction costs (including disposal costs), this increment of increase will have to be borne entirely by the Sponsor and will be a non-project cost. Any land necessary for remediation or disposal of CERCLA regulated wastes will not be considered as project LER and will not be credited. If non-CERCLA regulated waste are present and clean up is required, these costs (including LER) will become project costs and cost-shared or credited accordingly.

These assumptions have implications on the value of LER both for acquisition and crediting purposes. For the planning purposes of this report, no special allowance has been made for the possible effect of HTRW on LER value. This is valid since the overall policy of the Corps is to require the Sponsor to provide LER in a "clean" condition, thus the LER credit would be the value of the land as if "clean". If it is determined to be appropriate for the Sponsor to acquire land containing HTRW, the affect on market value and the estimated remediation costs must be evaluated by the appraiser. Credit for LER might be affected if non-CERCLA waste is found and the Sponsor incurs significant LER cost in providing a suitable disposal area. We do not anticipate this scenario, based on available information.

This issue is both controversial and complicated. The public heath and safety concerns, magnitude of potential costs, cost-sharing implications, legal liabilities, time required to resolve issues and the complexity of statutes and regulations make these matters worthy of further detailed study. We propose to address the real estate requirements associated with HTRW more fully in a Real Estate Design Memorandum.

ATTITUDE OF PROPERTY OWNERS

This project has been the subject of a great deal of public involvement. Most property owners in the project area have expressed a desire for flood protection and opposition from the group of affected owners is not anticipated. Apprehension is more descriptive of the general attitude among occupants of the neighborhood. This in typical at this stage, since a detailed picture of the configuration of real estate takings has not been produced. Controversy has centered around environmental matters, particularly preservation of bottom land hardwood habitat and the level of flood protection that will be afforded to the neighborhood. With the exception of HTRW concerns, there are no known issues are expected to greatly protract the acquisition process.

The City of Dallas has a high degree of expertise in real estate acquisition and is proactive in making acquisitions when the time is right. The City has been advised in writing of the risks associated with acquiring LERRD before execution of the PCA. We will work with the sponsor throughout the project, to the extent appropriate and allowable, to assure that there is understanding of the Federal real estate principles. Action will also be taken to address policy issues along the way which could significantly affect the project.

ESTATES TO BE EMPLOYED FOR THE PROJECT

The following estates are proposed for use on this project. They are numbered as they appear in Chapter 5 of Engineer Regulation 405-1-12.

1. Fee

The fee simple title to (the land described in Schedule A) (Tracts Nos._____,_____, and ____), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

6. Flowage Easement (Occasional Flooding)

The perpetual right, power, privilege and easement occasionally to overflow, flood and submerge (the land described in Schedule A) (Tracts Nos. ____, ____, and ____) (and to maintain mosquito control) in connection with the operation and maintenance of the _________project as authorized by the Act of Congress approved__________________, together with all right, title and interest in and to the structures and improvements now situate on the land, except fencing (and also excepting __________________________________(here identify those structures not designed for human habitation which the District Engineer determines may remain on the land); provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the United States in charge of the project, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution.

8. Channel Improvement Easement

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across (the land described in Schedule A) (Tracts Nos.____, ____ and ____) for the purpose as authorized by the Act of Congress approved_____________, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate, dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; and for such other purpose as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public utilities, railroads and pipelines.

9. Flood Protection Levee Easement

A perpetual and assignable right and easement in (the land described in Schedule A) (Tracts Nos.____, ____ and ____) to construct, maintain, repair, operate, patrol and replace a flood protection levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

11. (modified) Trail Easement

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts No. ____, ____ and ____) for the location, construction, operation, maintenance, alteration and replacement of (a) trail(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstruction and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

15. Temporary Work Area Easement

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. ____, ____ and ____), for a period not to exceed ______________________, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies) and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the ____________________________ Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

ASSESSMENT OF NON-FEDERAL SPONSOR'S REAL ESTATE ACQUISITION CAPABILITY DALLAS FLOODWAY EXTENSION PROJECT DALLAS, TEXAS

NON-FEDERAL SPONSOR: City of Dallas, Texas

I. Legal Authority:

a. Does the sponsor have legal authority to acquire and hold title to real property for project purposes? **YES**

b. Does the sponsor have the power of eminent domain for this project? **YES**

c. Does the sponsor have "quick-take" authority for this project? **NO**

d. Are any of the lands / interests in land required for the project located outside of the sponsor's political boundary? **NO**

e. Are any of the lands / interests in land required for the project owned by an entity whose property the sponsor cannot condemn? **YES. THE CITY MAY NOT HAVE POWERS OF EMINENT DOMAIN OVER RAILROAD PROPERTIES.**

II. Human Resource Requirements:

a. Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? **NO**

b. If the answer to II.a. is "yes", has a reasonable plan been developed to provide such training? **N/A**

c. Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? **YES**

d. Is the sponsor's projected in-house staffing level sufficient considering its other work load, if any, and the project schedule? **YES**

e. Can the sponsor obtain contractor support, if required, in a timely fashion? **YES**

f. Will the sponsor likely request USACE assistance in acquiring real estate? **NO**

III. Other Project Variables:

a. Will the sponsor's staff be located within reasonable proximity to the project site? **YES**

b. Has the sponsor approved the project / real estate schedule / milestones? **YES**

IV. Overall Assessment:

a. Has the sponsor performed satisfactorily on other USACE projects? **YES**

b. With regard to this project, the sponsor is anticipated to be:
FULLY CAPABLE

V. Coordination:

a. Has this assessment been coordinated with the sponsor? **YES**

b. Does the sponsor concur with this assessment? **YES**

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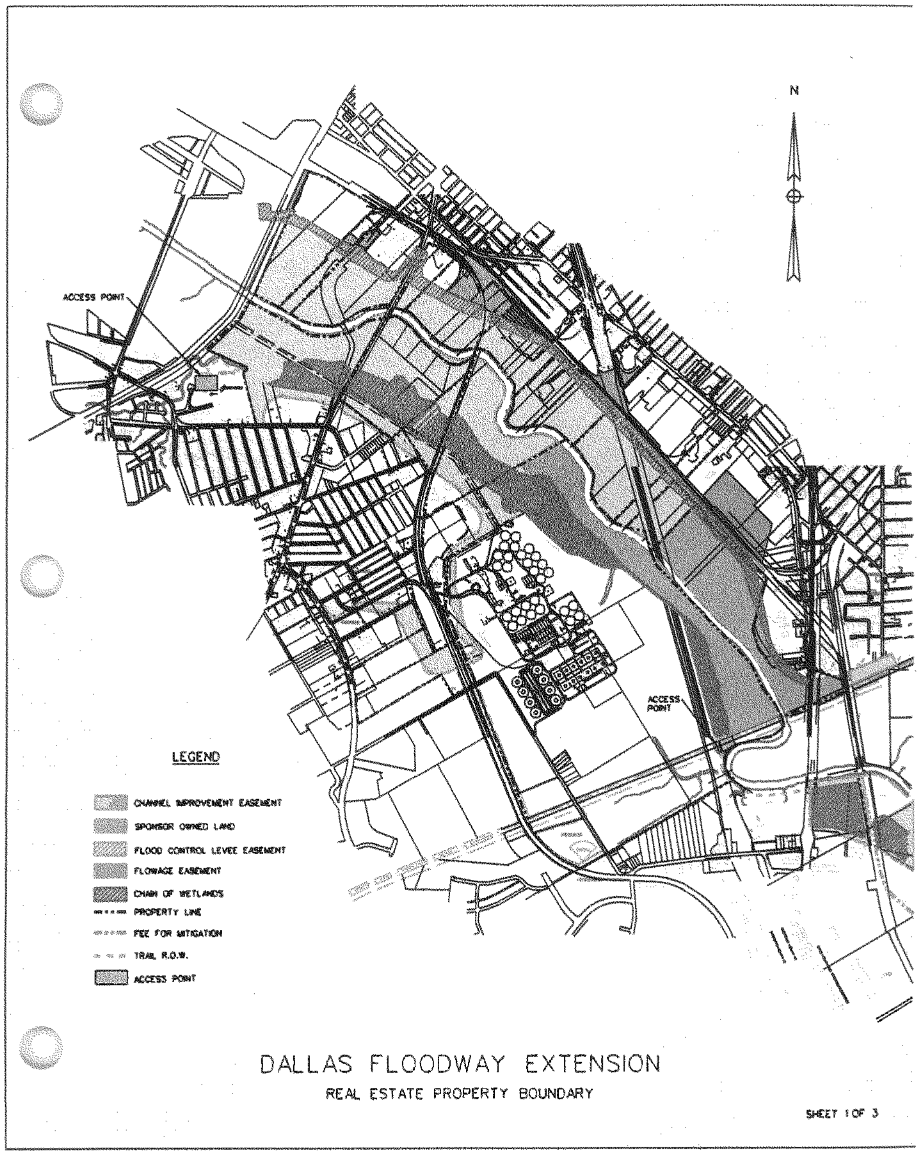
Reviewed and approved by:

Hyla J. Head

Hyla J. Head
Chief, Real Estate Division, CESWF-RE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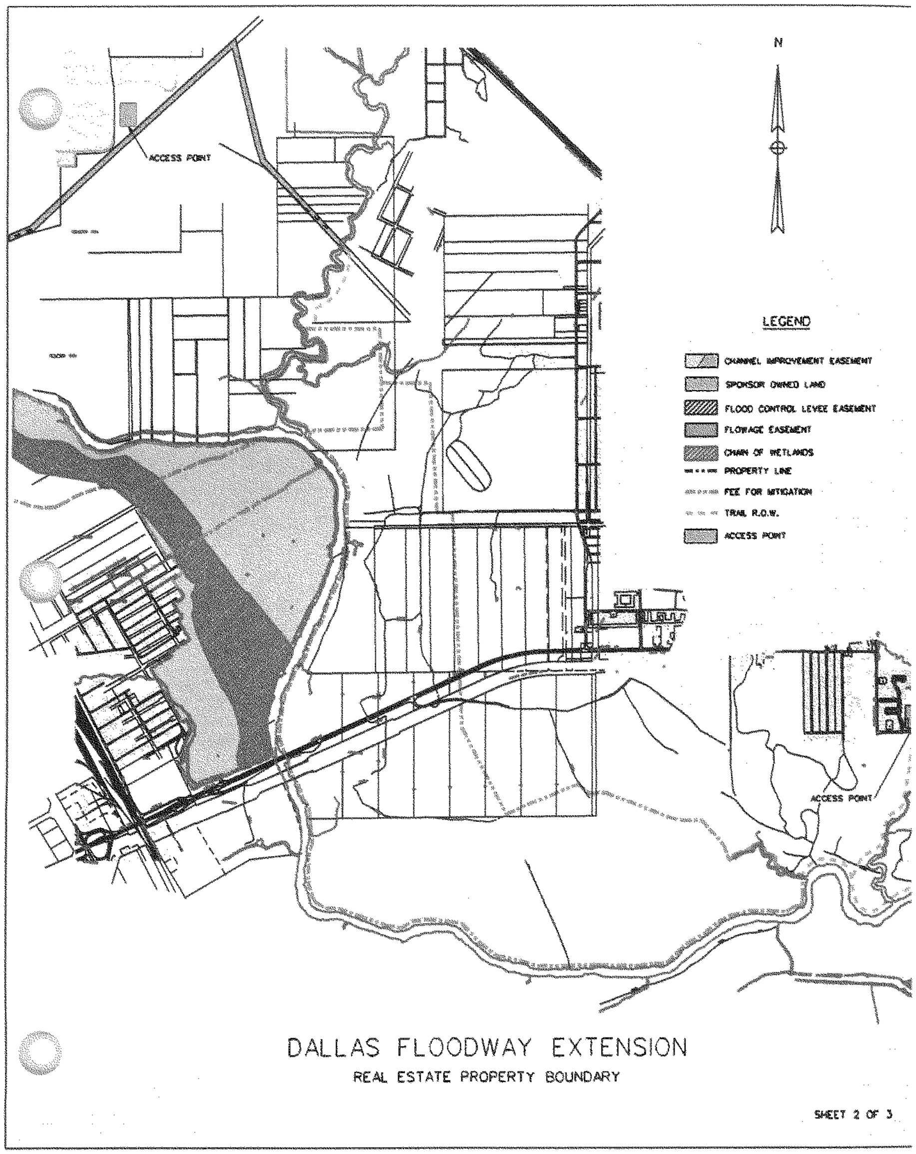
DALLAS FLOODWAY EXTENSION
REAL ESTATE PROPERTY BOUNDARY
SHEET 1 OF 3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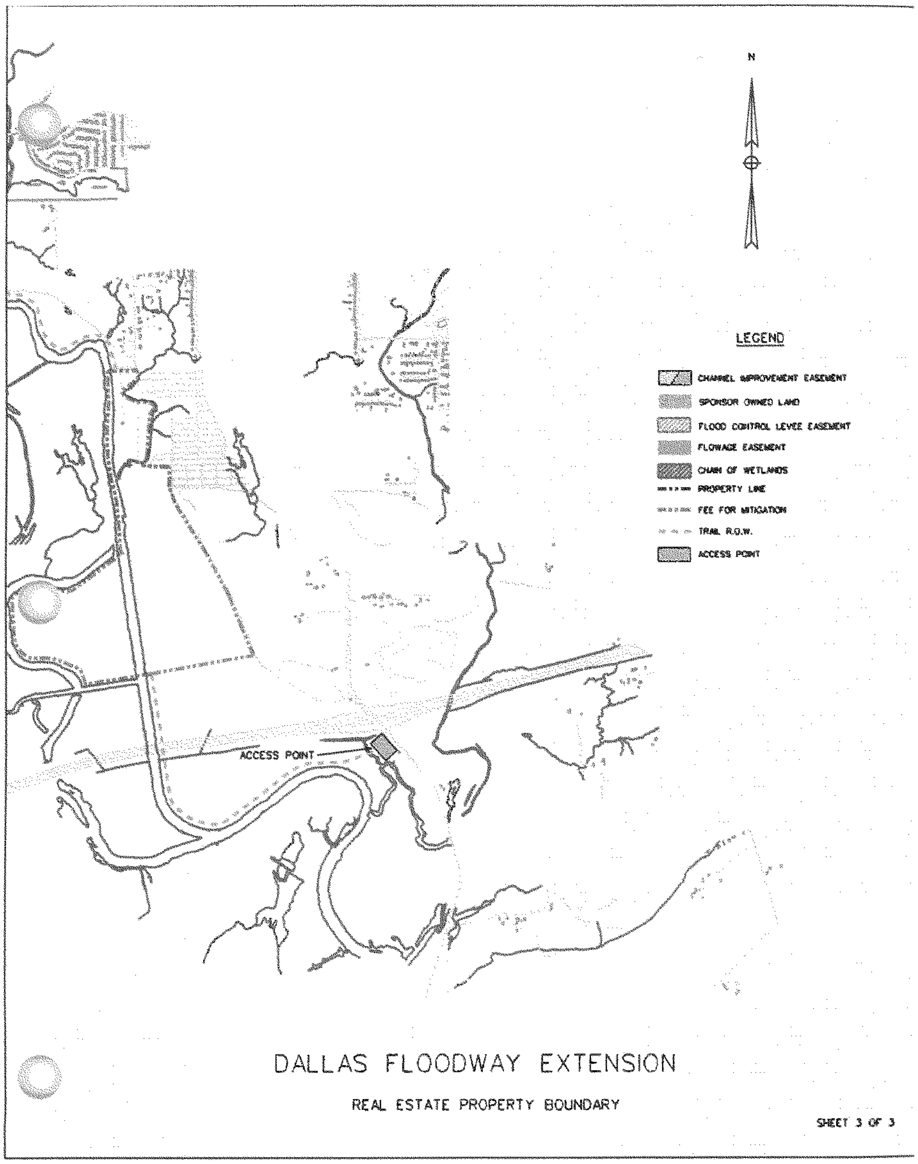
DALLAS FLOODWAY EXTENSION
REAL ESTATE PROPERTY BOUNDARY
SHEET 2 OF 3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DALLAS FLOODWAY EXTENSION
REAL ESTATE PROPERTY BOUNDARY
SHEET 3 OF 3

APPENDIX F

ENVIRONMENTAL RESOURCES
(INCLUDING SECTION 404(b)(1) EVALUATION)

(787)

APPENDIX F

ENVIRONMENTAL RESOURCES

ENVIRONMENTAL SETTING

General Description

The proposed project area is located within a highly developed metropolitan area, leaving the flood plain areas adjacent to the river of major environmental concern. Constructed in 1957 with Federal funds, The Dallas Floodway Project is located immediately upstream of the study area. The Floodway project consisted of channelizing and constructing levees along both sides of the Trinity River from Mountain Creek downstream to the Atchison, Topeka, and Santa Fe (AT&SF) Railroad bridge. The environmental characteristics within this area were significantly modified by the project's construction, but since that time some of the riparian vegetation and wildlife habitat has re-established naturally. From the AT&SF Railroad bridge downstream to the Highway 635 and Interstate 20 Trinity River crossing, the proposed project area consists mainly of bottomland hardwoods, wetlands associated with interior drainage areas, old oxbow scars, and gravel mining operations, open water ponds, and open grasslands located on upland sites developed from reclaimed mine areas and abandoned row-crop agriculture plots, commonly used for grazing livestock.

Climate

The Trinity River watershed is located in a region of temperate mean climatological conditions, experiencing occasional extremes of temperature and rainfall of relatively short duration. According to the National Oceanic and Atmospheric Administration (NOAA 1997) Station at Fort Worth, Texas, the 30 year mean rainfall amount is 33.7 inches per year with the most recent ten year (1987-1996) average being 37.88 inches. The extreme annual rainfall values since 1887 are a maximum of 53.54 inches occurring in 1991 and a minimum of 17.91 inches occurring in 1921. The maximum precipitation in a 24 hour period was 9.57 inches in September 1932. Precipitation is distributed fairly uniformly throughout the year, with the exception of a slight peak in the spring and a low in mid-to-late summer (Yelderman 1993). The mean relative humidity is 65 percent and the average temperature is 65.8°F. Recent temperature extremes range from -1°F in December 1989 to 115°F in June 1980. The average freeze dates are March 23, which is the last in spring and November 13, which is the first to occur in the fall. The temperature falls below freezing an average of 41 days a year, but this drop is usually followed by daily thaws. The length of the growing season is approximately 235 days.

The major storms experienced in the study area are produced by heavy rainfall from frontal-type storms which generally occur in the spring and summer months, but major flooding can also be produced by intense rainfall associated with localized thunderstorms. These thunderstorms may occur at any time during the year, but they are more prevalent in spring and summer months.

Air Quality

The proposed Dallas Floodway Extension (DFE) project would be located within the Environmental Protection Agency's Air Quality Control Region (AQCR) 215 for Texas. AQCR 215 consists of 19 counties including Dallas, Denton, and Tarrant Counties, Texas. AQCR 215 is classified as a non-attainment area for ozone (O_3) and attainment/unclassifiable for other National Ambient Air Quality Standards including lead (Pb), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter of aerodynamic shape less than or equal to 10 micrometers in diameter (PM10) (40 Code of Federal Regulations 52.2308(a)).

In 1995 and 1996 the Texas Natural Resource and Conservation Commission (TNRCC), Office of Air Quality, reported that the average annual criteria pollutant concentrations for the city of Dallas, Texas, were as follows: lead - 0.03 ug/m3, PM10 - 29 ug/m3, carbon monoxide - 0.75 parts per million (ppm), sulfur dioxide - 0.003 ppm, ozone - 0.023 ppm, nitrogen dioxide - 0.017 ppm (Personal Communication: Mr. Larry Butts, Office of Air Quality, TNRCC, Austin, Texas).

Air quality is closely related to trees. Trees can reduce or increase energy use by providing shade, alter air flow, lower air temperatures through transpiration and directly remove or contribute to atmospheric pollution (McPherson et al. 1994, Nowak et al. 1997). Two computer models (Citygreen™, Version 2.0, American Forests and the United States Department of Agriculture's Urban Forest Effects (UFORE)) were initially used to describe the effects which trees have on the removal of the five gaseous criteria pollutants in the DFE. Both Citygreen and UFORE simulation models utilize standard field, air pollution, and meteorologicial data to quantify forests effect (Nowak et al. 1997); however, the Citygreen model used established pollution uptake coefficients of averaged data collected at monitoring sites located in Chicago, Illinois; Baltimore, Maryland; Milwaukee, Wisconsin; and Austin, Texas (Citygreen Users Manual 1997). The UFORE model that was used, derived pollutant uptake coefficients from information collected during 1994, at monitoring sites located in Dallas (four pollutants) and Fort Worth (one pollutant), Texas (Personal Communication: Dr. David J. Nowak, USDA Forest Service, Northeastern Forest Experiment Station, Syracuse, New York). In the interest of using the most accurate information available, the UFORE model was utilized to describe the environmental setting and to evaluate the proposed project and alternative environmental impacts mentioned later in this appendix.

The UFORE estimates of the annual pollution removal rates of trees (in tons/year) currently in the Great Trinity Forest area are 13.30 for carbon monoxide, 11.74 for sulfur dioxide, 32.93 for nitrogen dioxide, 77.16 for PM10, and 145.19 for ozone (Table 1). The estimated total removal rates of air pollutants by trees presently in the Dallas and the existing and future without project for the detailed project area are also summarized in Table 1. It is assumed that herbaceous vegetation also has some pollutant uptake capabilities since they functionally similar to trees, however, refereed published material describing these coefficients is lacking. Because of this it was not possible to determine pollution removal capabilities of the herbaceous plants in the study analysis.

Table 1

The annual removal of regulated air pollutants by trees in areas related to the proposed project calculated using USDA's UFORE[1] computer model. The removal values in the table are expressed in tons/year.

Area	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Particulate Matter (10*um*)	Ozone
Existing Great Trinity Forest	13.30	11.74	32.93	77.16	145.19
Existing City of Dallas[2]	137.72	128.92	355.96	955.24	1,491.82
Detailed Project Area Existing Conditions	1.41	1.24	3.48	8.17	15.37
Detailed Project Area Future Without	2.02	1.78	4.99	11.70	22.02

1- Urban Forest Effects (UFORE) is the computer model developed by Dr. David J. Nowak of the United States Department of Agriculture (USDA) Forest Service, Northeastern Forest Experiment Station.

2-Based on City size of 331 square miles with a tree cover of 28.2% (Nowak et al., 1996)

Vegetational Cover

The proposed project is located in the Blackland Prairie vegetative ecoregion (Correll and Johnston 1970; Gould 1975; Simpson 1988). Running from the Red River south to near San Antonio, the Blackland Prairie stretches in a well defined band for roughly 300 miles and owes its name to the deep, dark calcareous clay soils which cover it. Under natural conditions, Blackland Prairies are dominated by grasses such as little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), switchgrass (*Panicum virgatum*), Indiangrass (*Sorghastrum avenaceum*), and sideoats grama (*Bouteloua curtipendula*) with narrow fringes of bottomland hardwoods being found along rivers and streams (Nixon and Willett 1974).

Within the proposed project area, the topography is gently rolling to nearly level and elevations are approximately 400 feet above sea level (USFWS, 1989). The predominant soil is classified as frequently flooded Trinity Clay (Coffee et al. 1980). Tree species common to this area include elm (*Ulmus sp.)*, sugarberry (*Celtis spp.)*, pecan (*Carya illinoensis)*, oak (*Quercus sp.*), black willow (*Salix nigra)*, cottonwood (*Populus deltoides*), and osage orange (*Maclura pomifera)*.

Bottomland Vegetation

Bottomlands occur in the transition zone between aquatic and upland ecosystems. Bottomland hardwood systems are considered to be Texas' most diverse ecosystem. Prior to European settlement, Texas had approximately 16 million acres of bottomland hardwood riparian habitat. Today the state has less than 5.9 million acres (Texas Center for Policy Studies 1995).

Bottomlands serve several important functions. They contribute to the state's biodiversity. According to the Texas Environmental Almanac (1995), 189 species of trees and shrubs, 42 woody vines, 75 grasses, and 802 herbaceous plants occur in Texas' bottomlands. They are also known to support 116 species of fish, 31 species of amphibians, 54 species of reptiles, 273 bird species and 45 species of mammals. At least 74 species of threatened and endangered animals depend directly on bottomland hardwood systems and over 50 percent of neotropical songbirds not listed as endangered or threatened are associated with these systems. Besides providing critical wildlife and bird habitat, bottomland hardwood systems 1) serve as catchment and water retention areas in times of flooding; 2) help control erosion; 3) contribute to the nutrient cycle, and 4) play a vital role in maintaining water quality by serving as a depository for sediments, wastes and pollutants from runoff. Despite these important functions, bottomland hardwoods ecosystems are one to the most endangered ecosystems in the United States (MacDonald et al. 1979). For all these reasons, the bottomland vegetation system is of great environmental concern in the analysis of the proposed project area.

In addition, according to Nixon and Willett (1974), the bottomland hardwood forests associated with the Sabine, Neches, Trinity, and San Jacinto river were classified as distinct vegetational types by Bray (1906) and Collier (1964). They occupy large areas and are considered by Bray (1906) and Braun (1950) to be westward extensions of hardwood forests typical of river bottom areas to the southeast.

Botanical surveys show that black willow and cottonwood are dominant in the upstream Dallas Floodway portion while downstream from the AT&SF Railroad bridge to the Dallas County line, the dominant tree species are mature black willow, cedar elm (*U. crassifolia)*, sugarberry, green ash (*Fraxinus pennsylvanica)*, pecan, American elm (*U. americana*), box elder (*Acer negundo)*, cottonwood, red mulberry (*Morus rubra)*, and osage orange. The dominant understory woody, shrub and vine species consist of immature trees of the same species as those listed above along with western soapberry (*Sapindus drummondii),* swamp privet (*Lagustrum spp.),* common greenbrier (*Smilax rotundifolia),* honeysuckle (*Lonicera spp.),* and poison ivy (*Rhus toxicodendron).* There is little herbaceous groundcover, but, in areas with dense canopy cover, the dominant species are poison ivy, wild onion (*Allium canadense*), violets (*Viola ssp.*), *Aster sp.,* Virginia creeper (*Parthenocissus quinquefolia)* and Canadian wild rye (*Elymus canadensis*). In areas where the canopy cover is more open, the tree species are the same, but the percent cover of herbaceous vegetation increases with the dominant species being marsh elder (*Iva annua),* ragweed (*Ambrosia trifida),* and a couple members of the sedge family (*Carex cherokeensis and C. crus-corvi*). A more comprehensive list of plant species found within the proposed project area can be found in Table 2 located at the end of this appendix.

Wetland Vegetation

According to the Texas State Almanac (1995), interior wetlands which include bottomland hardwood forests (above), riparian vegetation, inland freshwater marshes, and the playa lakes of West Texas account for 80 percent of the total wetland acreage in Texas and the vast majority are located on private property. In the last 200 years, Texas has lost over 60 percent of these inland wetlands due to agriculture conversion, timber production, reservoir construction and urban and industrial development.

Much of the land within the proposed project area has been highly disturbed by human activities which have altered the topography of the local landscape. These include removal of topsoil (used as cover material for the nearby Linfield Landfill), removal of dirt (used as fill material for the construction of nearby road and railroad beds), mining of gravel by commercial business enterprises and construction activities associated with encroaching industries, commercial businesses, residential neighborhoods, and parklands. Many of these areas have also been impacted by illegal dumping activities over the years. Substantial quantities of concrete and building materials, asphalt shingles, roofing tiles, household furniture and appliances, and old tires were observed during reconnaissance visits.

In many cases the alteration of the topography within the proposed project area has led to the development of wetlands and these, along with isolation of oxbow scars from the main stem of the Trinity River, have led to wetlands being scattered throughout the flood plain in isolated depressions or very low gradient drainages.

The essential characteristics that define a wetland are constant or recurrent, shallow inundation or saturation at or near the surface of the substrate and the presence of physical, chemical, and biological features that reflect these conditions. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation.

Hydrophytes are herbaceous plants capable of growing in an environment that is periodically but continuously flooded for more than 5 days during the growing season (Hammer 1992; Mitsch and Gosselink 1986). Obviously, these include some plant species that are primarily terrestrial, but capable of surviving short periods of flooding or saturated soil conditions. Reconnaissance surveys of the depressional and low gradient wetlands found within the proposed project area during the spring and summer of 1997 showed very little evidence of emergents -- plants that typically grow in shallow water such as cattails (*Typha*), bulrush (*Scripus*), and sedges (*Carex*), and no evidence of submerged or floating plants such as pondweed (*Potomogeton*) and duckweed (*Lemna*), respectively. The dominant types of vegetation growing along the edges of these depressional wetlands were marsh elder and ragweed, both terrestrial species that are known to inhabit low, moist, disturbed areas (Mahler 1988). Within the forested portion of the proposed project area, black willow, cottonwoods and green ash were often found growing in the shallow water or along the edge of these wetlands.

The vegetation found on gravel mining and other excavation sites varied depending on: 1) the extent to which the site was disturbed during excavation operations; 2) whether any restoration and/or mitigation measures were undertaken following shut down of operations; 3) the amount of time that has past since the disturbance; and 4) the current soil makeup and moisture regime. One area which had been mined for its top five feet of soil was characterized by an open field with low, shallow water or saturated soil areas in the middle dominated by sedges, surrounded with higher upland sites dominated by terrestrial grasses and marsh elder and scattered with a few trees. The growth of these trees was obviously being stunted. This was probably caused by a combination of factors including a lack of nutrients normally found in topsoil and because the remaining soil, characterized by a few inches of silty clay over sandy clay, would be incapable of retaining moisture following rain events. The trees would be growing under almost continual drought conditions. Others of these disturbed sites are characterized by quickly colonizing weedy species such as giant ragweed, annual sunflower, and goldenrod. Willow and cottonwoods are the most common colonizing tree species in the most recently disturbed sites. If left undisturbed the sites would probably continue to succeed into areas characterized by the same species that are noted in the bottomland vegetation section.

Wetland delineation surveys have determined that much of the bottomland hardwood forest located within the proposed project area are jurisdictional wetlands under Section 404 of the Clean Water Act. The area that would be impacted by the foot print of either the NED or Chain of Wetlands alignment is approximately 50 percent jurisdictional. The lower NED alignment would cross the White Rock Creek flood plain which was determined to be over 90% jurisdictional forested wetlands. The foot print of the lower swale alignment for the chain of wetlands crosses jurisdictional wetlands over the first half of the alignment only. Permanent water in the form of water hazards at the golf course have been determined to be non jurisdictional.

From a planning perspective, all regulatory wetlands in the area, whether currently forested or not, are becoming forested. The future without a project analysis, therefore, includes all of these jurisdictional areas as forested wetlands. The goal of the U.S. Fish and Wildlife Service for Resource Category 2 habitats (in this case, both bottomland hardwoods as well as jurisdictional forested wetlands) is the same as the Corps of Engineers and planning team's goal, which is to first avoid and minimize impacts and then require in-kind and equal mitigation to the extent possible. Since the mitigation strategy and goals for forested wetland and non jurisdictional bottomland hardwood forest are the same, it was determined that mapping of the numerous small, interwoven individual wetland locations would not add additional clarification within the project study area for planning purposes. Additional information about wetland considerations is addressed further in this appendix in discussions relating to compliance with Section 404 of the Clean Water Act , including the Evaluation of the proposed project in accordance with the Section 404 (b)(1) Guidelines.

Grasslands

Open grasslands located on drier sites developed from reclaimed mine areas and abandoned row-crop agriculture fields have commonly been used for grazing livestock. The vegetation found on these sites is characteristic of disturbed or old field bottomland pastures. Common grass species include purple threeawn, King Ranch bluestem, sideoats grama, Japanese brome, tumble windmillgrass, bermuda grass, jungle rice, barnyard grass, plains lovegrass, perennial ryegrass, Texas wintergrass, Dallisgrass, annual bluegrass, and Johnson grass. Dominant herbaceous species include giant ragweed, annual sunflower and goldenrod. These old field sites can be expected to continue to succeed to scrub/shrub and eventually bottomland hardwood forests. In field reconnaissance trips, a several sites, noted on old aerial photographs as being an open field, are now covered by a dense stand of green ash or cedar elm saplings.

Open Water Areas

These are bodies of water that retain water on a continuous basis. Many of the open water ponds within the proposed project area are former gravel or other type of excavation pits. A considerable amount of open water is located within the Sleepy Hollow Golf Course as water hazards. In most cases there is little or no emergent vegetation and no evidence of any submersed or floating plants, especially within the pelagial, or open water zone. This lack is due to a combination of reasons. The banks of these water bodies tend to be relatively steep making it difficult for vegetation to become established. A second reason is the continuous presence of water of varying depths prohibits the growth of most plant species which are not able to tolerate prolonged and/or deep water conditions. A final reason is the lack of light penetration needed to support this type of vegetation. Many of these ponds are shaded by a dense cover canopy of surrounding trees. In addition, the water in the ponds located within the flood plain is extremely turbid due to the continual addition and stirring of sediments resulting from rainfall events and runoff. Because the Trinity is an urban river and a main artery for a series of reservoirs, the amount and quality of water it receives is influenced by more factors than just upstream and local rainfall amounts. The discharge of effluent from wastewater treatment plants, watershed runoff from impervious surfaces during storms, and overflows from the series of manmade reservoirs which tie into it are major factors and all contribute to turbidity.

Within densely forested areas, cottonwoods, green ash, and black willows, along with an occasional box elder can be observed growing along the perimeter of these ponds. In more open sites, the dominant vegetation is marsh elder and ragweed.

Land Use and Vegetative Cover Mapping

Several iterations have been conducted during the planning process to map and estimate acreages of vegetative cover and land uses within the study area. One mapped area includes an estimate of the vegetation within what has been termed the "Great Trinity Forest". This area roughly includes the Trinity River main stem flood plain lying between the existing Dallas Floodway and

Interstate Highway 20 crossing and within the White Rock Creek flood plain upstream to Interstate Highway 30. Within this area, approximately 5956 acres in size, 5456 acres (92%) are woodland including bottomland hardwoods, mixed Deciduous, and wetlands/bottomland hardwoods. The remaining 500 acres (8%) are composed of water, grassland, scrub/shrub, and urban areas.

The land use within this area (Table 3) was determined from use of 1992 satellite imagery and boundaries were established from comparison of aerial photos and an estimate of the geographic limits of the Great Trinity Forest as defined above. Vegetative cover types have been verified from field visits, however considerable land use change has occurred around the perimeters of the proposed project area and within portions of the flood plain near the Central Wastewater Treatment plant. Therefore, the acreage figures represent a comprehensive estimate to approximate the overall study area.

TABLE 3
UPPER TRINITY RIVER PROPOSED PROJECT
GREAT TRINITY FOREST LAND COVER ESTIMATE

Trinity Forest LAND COVER Types	Acres	% Cover
Water	233	3.9
Bottomland Hardwoods	4198	70.5
Pasture/Unmanaged Grasslands	121	2.0
Mixed Deciduous	213	3.6
Scrub/Shrub	63	1.1
Agriculture	37	0.6
Low Density Urban & Residential	13	0.2
Urban/Roads/Bare Ground	15	0.3
Bare Ground	3	0.1
Wetlands/Bottomland Hardwoods	1045	17.5
Unclassified/Bare Ground	3	0.1
Managed Grassland	12	0.2
TOTAL	5956	100.1

Additional refinement of the vegetative cover was accomplished by onsite evaluation and mapping of vegetative cover within areas that would be impacted by the foot prints of proposed project features. The mapping included delineation of bottomland hardwoods into essentially two levels of importance based upon their overall values to fish and wildlife resources. The higher quality bottomland hardwood areas generally consisted of those areas with old growth forest which included hard mast trees such as pecan, red oak or burr oak. These higher quality bottomland hardwoods are referenced as Pecan-Oak bottomland hardwoods for the remainder of this report. Medium quality bottomland hardwood consisted of less mature stands of trees lacking hard mast producers and are referred to as Ash-Elm bottomland hardwoods . The Ash-Elm bottomland hardwood areas were found to be dominated by homogenous stands or mixtures of green ash, willow, cottonwood, cedar elm and box elder. Most of these sites were initially delineated by evaluation and comparison of 1960's vintage and later aerial photographs of the area. Field verification was accomplished by field visits and by measurement of forest parameters that were used to model habitat quality. Additional verification was obtained during site visits to identify and quantify tree densities on several plots within the study area. This information was ultimately digitized onto an ortho-photo and used to define the vegetative cover and land use within the areas that would be impacted by alternative project features. The cover mapping used for analysis is shown on Figure 1. Table 4 shows the land cover classification used for evaluation of the locally preferred project, including the chain of wetlands, Lamar and Cadillac levees and associated sumps and the proposed channel realignment to protect Interstate Highway 45.

Table 4
Land Cover Tabulations (Digitized from Ortho-photo)

Type	Acres	Percent		
Pecan-Oak	251.02	18.47		
Ash-Elm	326.46	24.02	Forested Subtotal	
MGFB	496.18	36.51	577.48	42.49%
Urban/Exposed Ground	108.34	7.97		
Landfill/Disturbed	16.58	1.22		
Wetland (CWWTP)	9.09	0.67		
Building	7.58	0.56		
Water	143.69	10.57		
Total	1358.94	100.00		

The general area that would be impacted by the proposed project features contain a smaller area and percentage of bottomland hardwoods than were identified within the general study area, reflecting the planning strategy to locate project features in areas that would minimize impacts to this important resource.

Wildlife Resources

Similar to the plant species of the flood plain, the wildlife species found within the proposed project area vary considerably. As noted above, the proposed project is enclosed within a fully developed metropolitan area and much of the area has been highly impacted by human activities. The degree and extent of the changes in habitat have directly influenced the numbers and species of wildlife found in the area. Predator control, modification of habitat, indiscriminate hunting, use of pesticides, and various forms of air, water, and land pollution have been responsible for modified distribution of fish and wildlife populations throughout the area.

The river channel, wetlands, open water areas, and bottomland hardwood forests support a variety of wildlife species for cover, food, and den or nesting sites. Bird species which were observed or have been reported in the area include migratory warblers, sparrows, meadowlark, mourning dove, crow, red-tailed hawk, red-shoulder hawk, American kestrel, herons, egrets, mallard, wood duck, blue-winged teal, green-winged teal, lesser scaup, grackle, scissor-tailed flycatcher, kingbird, logger-head shrike, black bird, swallows, blue jay, chickadees, downy woodpecker, red-belly woodpecker, and barred owl. Amphibians, reptiles, and mammals common to the area include frogs, toads, snakes, turtles, cottontail rabbit, cotton rat, field mice, opossum, raccoon, bobcat, beaver, nutria, and coyotes.

Aquatic Resources

The main stem of the Trinity River which flows through the proposed Dallas Floodway Extension (DFE) Project area receives drainage from several rapidly urbanizing sections of the Dallas-Fort Worth Metroplex. The effluent from these municipalities has resulted in a historical degradation of water quality as the river flows from west to east. Generally, the aquatic resources in the DFE segment of the river are characteristic of the upper Trinity River Basin, however, the poorer water quality has resulted in a shift from a diverse healthy aquatic fauna to a more pollution tolerant community.

Although several current studies indicate that water quality has been improving in the upper Trinity River, it appears that aquatic organisms are continuing to be contaminated by a wide variety of pollutants of industrial and municipal origin (Amold 1989, Kleinsasser and Linam 1990, Davis 1991). The water is generally turbid, especially during high flow episodes due to elevated silt loading. The poor water quality in DFE section of the Trinity River can be attributed to low dissolved oxygen concentrations incurred from low flows, high water temperatures, and elevated biochemical oxygen demands (Tidwell 1982, Davis 1984). High concentrations of ammonia-nitrogen and phosphorus also contribute to the poor water quality in the DFE segment of the river.

Habitat for fisheries is scarce in the DFE segment of the Trinity River. The river channel has not been significantly altered, except around the railroad and highway bridge crossings. Bridge pilings provide some colonization areas for aquatic invertebrates and spatial reference points for fishes to congregate. The river channel banks are steep and nude with numerous deadfall logs and debris that have accumulated during high flow periods. The river bed provides little or no structure and is primarily comprised of silty mud. In most areas, a large canopy of cottonwood and willow trees provides fair to good shading of the river's surface.

A low diversity of aquatic invertebrate and fish species characterizes the proposed DFE project area. The invertebrate community is dominated by the more pollution tolerate pulmonate gastropods, chironomids, and tubificid worms. Fish faunal resources in this segment of the Trinity River are primarily the more pollution tolerant species, such as common carp (*Cyprinus carpio*), river carpsucker (*Carpiodes carpio*), longnose gar (*Lepisosteus osseus*), freshwater drum (*Aplodinotus grunniens*), bullhead catfish (*Ictalurus* sp.), gizzard shad (*Dorosoma cepedianum*), mosquitofish (*Gambusia affinis*), and various species of sunfish (*Lepomis* sp.) and shiners (*Notropis* sp). Although few in number due to inadequate aquatic habitat and poor water quality, the sportfish occurring in the proposed project area are largemouth bass (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), crappie (*Pomoxis* sp.) and white bass (*Morone chryops*). A comprehensive listing of fish in the main stem of the Trinity River south of the Metroplex can be found in "Final Regional Environmental Impact Statement for Trinity River & Tributaries, 1987".

Water Quality

Every 2 years, the Texas Natural Resource Conservation Commission (TNRCC) publishes data on field measurements and water chemistry for the waters of the State. The portion of the river which lies in the proposed project area is in the upper part of segment 805 as designated by TNRCC. While the water quality of the Trinity River continues to improve, there still remain 4 areas of concem in segment 805. These are nitrite+nitrate, orthophosphorus, total phosphorus and fecal coliform. These concentrations were outside criteria or screening levels 92.5%, 97.67%, 94.59% and 38% of the time, respectively. Historically, dissolved oxygen levels have been a serious problem but these have shown great improvement and are now rarely lower than the standards criteria of 5.00 mg/l.

Flow rates vary greatly. Typically, the lowest flows are in the dry summer months and highest flows are associated with spring floods. Low flow rates and high temperatures are conditions under which there may be water quality problems such as high algal growth and low dissolved oxygen.

Effluent from several wastewater treatment plants discharge into tributaries of the Trinity River in the Dallas/Fort Worth metroplex. The effluent from the Central Wastewater Treatment Plant (CWWTP), on the uppermost part of the mainstem (segment 805) in the city of Dallas, is discharged into a small lake first before flowing into the Trinity. This plant meets and often exceeds stringent effluent discharge requirements as stated in the discharge permit issued by the state (personal communication, Donna Long, City of Dallas). In the last three years, 15 chronic toxicity tests have been conducted on the organism *Ceriodaphnia dubia* in 100% effluent. All test results were negative. This is an indication that, under present circumstances, the effluent may be used in the wetlands to provide fish and wildlife habitat (personal communication, Jim Davenport, TNRCC - Water Quality Division, Standards and Assessment Section).

THREATENED AND ENDANGERED SPECIES

The following information indicates that several federally protected species may occasionally migrate through the proposed project area. In addition Black-capped vireo is known to nest in southwestern Dallas County along the juniper forested area associated with that area. In addition least tern has been documented nesting within the Southside Waste Water Treatment (SSWWT) facility grounds several miles southeast of the proposed project area. The SSWWT is located across the river from the proposed disposal site for excess clean materials resulting from excavation of materials from the Chain of Wetlands. The site has been investigated by the Corps of Engineers and the U.S. Fish and Wildlife Service and was approved for disposal of dredge material from the White Rock Lake restoration project.

Table 5
FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES WHOSE MIGRATORY CORRIDOR INCLUDES DALLAS COUNTY TEXAS
(Source U.S. Fish and Wildlife Service, March 1993)

American peregrine falcon,	*Falco peregrinus anatum*	Endangered
Arctic peregrine falcon	*Falco peregrinus tundrius*	Threatened
Bald eagle	*Haliaeetus leucocephalus*	Endangered
Black-capped vireo	*Vireo atricapillus*	Endangered
Interior least tern	*Sterna antillarum*	Endangered
Piping plover	*Charadrius melodus*	Threatened
Whooping crane	*Grus americana*	Endangered

ENVIRONMENTAL NEEDS

The Dallas-Fort Worth Metroplex has extensive development within its main core area and expansion continues into surrounding counties. The need to provide for protection against ravaging floods to developed areas has increased as the new development continues to increase runoff from continually increasing areas of impervious surfaces associated with rooftops, parking lots, and highways. In addition local drainage programs tend to increase the speed of runoff thereby necessitating continuing improvement of flood control features. Within the Metroplex, the Corps of Engineers has constructed Lakes Benbrook, Joe Pool, Grapevine, Lewisville, and Ray Roberts which are multipurpose projects providing flood damage reduction benefits to the area. In addition, the Corps has constructed the Fort Worth and Dallas Floodways which are segments with levees and a main flood conveyance channel that provide needed protection for the downtown business districts of the respective cities.

These projects with exception of Joe Pool and Ray Roberts were constructed prior to legislation was enacted requiring environmental review and prior to Corps authorities to mitigate environmental losses. Review of information available indicates that while providing needed flood damage reduction and water supply for the Metroplex, these projects also forever altered the landscape. The most significant losses that occurred were to the bottomland hardwood areas that existed as riparian forested stringers along the main stem river reaches and tributaries. In addition, many small emergent wetland areas along the streams were either inundated and lost or were removed through the grading and leveling process of channel construction in the leveed reaches. Reduction of flooding brought about by these large projects has also increased secondary development throughout the region. Prior to the mid 1970's there were no regulatory processes to protect or require mitigation of any of these wetland losses.

In 1985 the Corps of Engineers began a study to address the impacts of unrelated development projects along the Trinity River and it tributaries in Dallas, Denton, and Tarrant Counties. The Final Regional Environmental Impact Statement completed in 1987 indicated that within the 73,000 acre study area only 570 acres of herbaceous wetlands were identifiable within the 100 year flood plain and 745 acres were within the Standard project flood plain. Even without a definitive historic record of emergent wetlands losses within the area prior to the major Corps construction activities, it is clear much losses have occurred. These losses to wetlands adjacent to the riparian woodlands in the form of scars, seeps and cutoffs also impacted many species of migratory shore birds, wading birds reptiles and amphibians. From a resource protection stand point, it could be easily argued that efforts should be placed on maintaining and improving the integrity of bottomland hardwood forests because of their ecological significance, their visibility and appeal to observers and the long time frame required to reestablish a mature forest. Emergent wetlands also have ecological significance and because they can be established comparatively quicker than forests, the annualized benefits can be quite high. In addition emergent wetlands can be established in conjunction with other proposed project features without compromising flood reduction benefits or actually inducing flood damages.

ALTERNATIVE PLAN FORMULATION

In general, the planning process followed during development of the recommended plan was predicated on following the objective of minimizing impact to bottomland hardwoods. Planning leading to the determination of a 1200 foot wide swale, the National Economic Development Plan (NED), reduced channelization plans during further consideration due to adverse environmental effects. A vegetative management plan was considered but eliminated because it would have seriously diminished stream aquatic, riparian and bottomland hardwood habitats that have high national priority for protection. An array of "swale" alternatives, including, the NED plan, although causing losses to bottomland hardwoods was designed and aligned to avoid the highest quality forested habitats to the extent possible. The swale plans did not receive endorsement by the entire environmental community but appropriate mitigation plans were found to be feasible for the proposals.

The Chain of Wetlands (CoW) alternative alignment was developed from a smaller swale plan around desires expressed by the sponsor following extensive public involvement. A major planning objective by the Corps and sponsor included the commitment to continue avoidance of bottomland hardwood forest particularly high quality forested areas and minimization of impact to all bottomland hardwood forested areas. The CoW alignment within the upper reach has been moved to the west as far as technically and economically justifiable. The alignment of the Cadillac Heights (100-yr and SPF) and SPF Lamar Levees has also been extensively considered and it has been determined that other reasonable alignments would not produce less impacts to important resources. Alternatives evaluated for the I-45 bridge protection included no action, fortifying the piers in the channel and river realignment. Only the realignment was found to provide long term protection.

The final array of alternatives was developed from combination of plans. The locally preferred plan, or LPP, includes the CoW, the Lamar and Cadillac Heights Levees providing standard project flood protection, and the I-45 channel realignment. The apparent Tentative Federally Supportable Plan (TFSP) includes the features of the LPP, except that only 100-yr protection for the Cadillac Heights would be provided.

A non-structural alternative was developed that considers the feasibility of buying residences and businesses with the Cadillac Heights area. The non structural plan was considered only for the areas that previous studies had shown that some level of buy out could be justified. The remainder of the plan named the non structural includes the chain of wetlands and the Lamar Levee. It was found economically justified to acquire structures up to the 10 year flood elevation. Details of that plan are included in the Economic Appendix. Minimal disturbance to existing resources would occur for the non structural element of the proposed project. In the areas where structures would be removed, the soil would be stabilized with grasses. The most likely future use of the area would be as parkland supporting low density recreation.

ENVIRONMENTAL CONSEQUENCES

As was noted in the bottomland vegetation section of this appendix, because of the losses of bottomland hardwood ecosystems in Texas and in the United States, the bottomland forest is of environmental concem in the analysis of the proposed project area. A coordinated effort was made by the Corps of Engineers and the City of Dallas in consultation with state and federal resource agencies to design a flood control project that would be feasible in terms of economics yet minimize the impacts to the valuable bottomland hardwood resources in the proposed project area. The following narrative and graphics show the impacts of the various potential alternatives on the bottomland hardwood forests within the proposed project area.

Micro-Climate Effects

One of the concems raised by concemed citizens and environmental groups was the impact that removing trees would have on surrounding areas. McPherson, Nowak, and Rowntree (1994) in a report for the U.S. Forest Service document that , by transpiring water, blocking winds, shading surfaces, and modifying storage and exchanges of heat among urban surfaces, trees affect local climate and human thermal comfort. These benefits are also documented in Mapping Micro-Urban Heat Islands Using Satellite Imagery (Lowry and Aniello 1993) for Dallas County, but it must be understood that the microclimate effects of trees to conserve energy and lower temperature are very localized in nature. Without directly being covered by the shade provided by trees or close enough to take advantage of the benefits provided by trees as natural windbreaks, microclimate effects are negligible. Therefore, the removal of trees in conjunction with any of the potential altematives for the proposed DFE flood control project is expected to have little or no impact on microclimate effects of those trees to surrounding residential, industrial and business neighborhoods.

It is also important to remember that none of the potential alternatives call for the addition of any impervious surfaces which might be expected to add radiant heat thereby increasing local temperatures. The replacement of trees by herbaceous vegetation would not have this effect.

Air Quality

Future Without Project Alternative- The "Future Without Project Alternative" would cause no significant adverse impacts to air quality within the proposed project area. Regional trends in air quality indicate that regulated pollutant levels are slightly increasing. Flooding episodes and flood plain regulations imposed by the City of Dallas within the proposed project area would restrict further urban and commercial development. In the absence of urban and commercial growth, mobile and stationary pollution emitting sources would decrease as would their associated pollutants. Addition of Parkways planned by others along existing and proposed levees could result in increases in pollutant levels.

The development of additional tree canopy in the area would provide beneficial impacts through biogenic removal of regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities with this alternative indicate trees in the entire DFE area would have the capacity to assimilate 13.85 tons/year of carbon monoxide, 12.23 tons/year of sulfur dioxide, 34.30 tons/year of nitrogen dioxide, 80.37 tons/year of PM10, and 151.23 tons/year of ozone or approximately 10.1% of the total capacity of trees in the Dallas, Texas, area. The additional tree canopy that would develop would provide a slight improvement of approximately 4.1% in air pollutant removal capability above the existing conditions (Table 1).

National Economic Development (NED) Alternative- The implementation of the NED alternative would cause minor adverse impacts to the quality of air within the proposed project area. Utilization of diesel-fueled heavy equipment, would result in minimal amounts of exhaust fumes, smoke, and dust during construction activities. There would be no stationary emitting sources and no on site storage of petroleum or petroleum based by-products to cause additional negative impacts to air quality. Disposal of cleared vegetation or other debris by burning during the construction would be accomplished only as permitted by the TNRCC. Required maintenance activities required for the NED alternative would contribute little additional mobile air emissions.

The reduction in tree canopy area from clearing activities for swale development would result in negative impacts through removal of biogenic sources which extract regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities by trees in the entire DFE proposed project area with this alternative implemented, indicate there would be an vegetation assimilation capacity of 12.07 tons/year of carbon monoxide, 10.66 tons/year of sulfur dioxide, 29.89 tons/year of nitrogen dioxide, 70.03 tons/year of PM10, and 131.78 tons/year of ozone or approximately 8.8% of the total capacity of trees in the Dallas, Texas, area. The reduction in tree canopy would decrease the air pollutant removal capability below the existing conditions by 9.2% (Table 1).

The NED plan would call for revegetation of the cleared swale area. The planted vegetation would provide a small amount of air pollutant assimilative capacity and to a limited extent, ameliorate the air quality impacts caused from tree removal.

Locally Preferred Plan (LPP) Alternative - The implementation of the LPP alternative would cause minor adverse impacts to the quality of air within the proposed project area. Utilization of diesel-fueled heavy equipment, would result in minimal amounts of exhaust fumes, smoke, and dust during construction activities. There would be no stationary emitting sources and no on site storage of petroleum or petroleum based by-products to cause negative impacts to air quality. Disposal of cleared vegetation or other debris by burning during the construction would be accomplished only as permitted by the TNRCC. Required maintenance activities required for the LPP alternative would contribute few additional mobile air emissions.

The reduction in tree canopy area from clearing activities for wetlands and levee development would result in negative impacts through removal of biogenic sources which extract regulated gaseous air pollutants. UFORE estimates of pollution removal capabilities of trees in the detailed project area under future conditions as listed in Table 1 indicated there would be an vegetation assimilation capacity of 2.02 tons/year of carbon monoxide, 1.78 tons/year of sulfur dioxide, 4.99 tons/year of nitrogen dioxide, 11.70 tons/year of PM10, and 22.02 tons/year of ozone or approximately 1.5% of the total capacity of trees in the Dallas, Texas, area. The impacts of tree removal to these assimilative capacities as a result of implementing the elements of the LPP Alternative are delineated in Table 5.

Tentative Federally Supportable Plan (TFSP) Alternative - The TFSP alternative is similar in impacts to that of the LPP. The difference between the two alternatives is the size of the Cadillac Heights Levee. Neither of the two Cadillac Heights levee alternatives impact large areas of existing forest and therefore their impacts to air quality are minimal.

Table 5

The impact of proposed project measures on annual removal rates (tons per year) of regulated air pollutants by trees as determined by using the USDA's UFORE[1] computer simulation model.

Site	Carbon Monoxide	Sulfur Dioxide	Nitrogen Dioxide	Particulate Matter (10um)	Ozone
CoW, North	-0.15	-0.14	-0.38	-0.89	-1.67
CoW, South	-0.09	-0.08	-0.21	-0.49	-0.93
Cadillac Heights Levee (SPF)	-0.02	-0.02	-0.06	-0.13	-0.25
Cadillac Heights Levee(100yr)	-0.01	-0.01	-0.01	-0.03	-0.06
Lamar Street Levee	-0.13	-0.11	-0.32	-0.76	-1.42
I- 45 Channel Diversion	-0.02	-0.02	-0.05	-0.13	-0.24
Impact for (LPP)	-0.41	-0.37	-1.02	-2.40	-4.51
Impact for (TFSP)	-0.40	-0.36	-0.97	-2.30	-4.32
Impact for Non Structural Alternative [2]	-0.37	-0.33	-0.91	-2.14	-4.02
Preservation value of proposed Mitigation Area	+2.24	+1.99	+5.58	+13.09	+24.60
Conversion of Grasslands to Forest in TFSP Mitigation Area	+0.55	+0.48	+1.36	+3.18	+5.98
Conversion of Grasslands to Forest in LPP Mitigation Area	+0.57	+0.50	+1.41	+3.30	+6.21

[1] - Urban Forest Effects (UFORE) is the computer model developed by Dr. David J. Nowak of the United States Department of Agriculture (USDA) Forest Service, Northeastern Forest Experiment Station, Syracuse, New York.
[2]-Locally Preferred Project with partial buy out in lieu of Cadillac Heights Levee

In addition, the LPP and TFSP plan would call for development of wetlands and replanting of grasses within the cleared swale and turfing of levee areas with grasses. The new vegetation would also provide a small amount of air pollutant assimilative capacity and to a limited extent, ameliorate the air quality impacts caused from tree removal.

Non-Structural Alternative- Air quality impacts associated with implementing the "Non-structural Alternative" would be very similar to those impacts previously described for the LPP and TFSP. The differences in air quality impacts between the LPP and the Nonstructural Alternative would result from the reduction in construction activity associated with the Cadillac Heights levee. Not building this levee as part of the proposed project would reduce the use of heavy equipment for earth moving activities which may cause minor adverse impacts to the air quality through emission of exhaust fumes, dust, and smoke. This alternative would also allow the tree canopy to remain and develop in the areas where the levee construction would have impacted. The remaining tree canopy would provide air quality benefits through air pollutant removal. the use of heavy equipment for earth moving activities or vegetation clearing, or the elimination of plants which remove pollutants.

Mitigational Areas - The tree canopy in the areas delineated for mitigation would provide beneficial impacts through removal of regulated gaseous air pollutants.

Mitigation plus LPP - The addition of the tree canopy in the mitigational areas to that of the canopy area in the LPP Alternative, would increase the total pollutant removal capability over each area individually.

Mitigation plus TFSP -The additional of tree canopy in the mitigation areas for this plan would also increase the total pollutant removal capacity.

As can be seen, the impacts from development of either the LPP or TFSP to all parameters is minimal. In addition acquisition and preservation of the proposed fish and wildlife mitigation area would greatly exceed the losses from implementation of the proposed project features. The proposal to implement mitigation feature of hastening the conversion of existing grasslands within the mitigation areas to bottomland hardwood forest by intensive tree plantings would result in more gains in air quality purification than would be lost by the proposed project features, individually or cumulatively.

Impacts on Bottomland Hardwood Forests

One of the main concerns of citizens and environmental groups has been the impacts of the various potential alternatives on the bottomland hardwood forests located within the proposed DFE project. Table 6 delineates the impacts for the construction alternatives in terms of tree species and numbers.

Table 6
Bottomland Hardwood Forest Impact Analysis

	NED Plan	CoW	Lamar Levee	Cadillac Levee (SPF)	Cadillac Levee (100-yr)	Non Struct-ural	I-45 Diver-sion	TFSP	LPP
Total Acres of Trees	503.9	89.9	53.3	9.4	2.4	143.2	9.0	154.6	161.6
Total Acres - Pecan-Oak BLH	146.6	5.9	10.6	0.0	0.0	16.5	4.1	20.6	20.6
Total Acres - Ash-Elm BLH	357.3	84.0	42.7	9.4	2.4	126.7	4.9	134	141
Average Number of Trees per Acre-Pecan-Oak	196	196	196	196	196	196	196	196	196
Average Number of Trees per Acre-Ash-Elm	218	218	218	218	218	218	218	218	218
Total Number of Trees Impacted-Pecan-Oak (000's)	28.7	1.1	2.0	0.0	0.0	3.2	0.8	4.0	4.0
Total Number of Trees Impacted-Ash-Elm (000's)	77.9	18.3	9.3	2.0	0.5	27.6	1.1	29.2	30.7
Total Number of Trees Impacted(000's)	106.6	19.4	11.3	2.0	0.5	30.8	1.9	33.2	34.7

Pecan-Oak and Ash-Elm bottomland hardwood forest designations were taken from data derived from vegetation cover and land use maps.
Average number of trees per acre was estimated from data collected in the field. These figures were then used to estimate the number of trees impacted by the various alternatives.

Future Without Project Alternative- The long term survivability of the bottomland hardwood forest within the proposed project area would depend on the City of Dallas' Flood Plain Management Plan and any future development, natural disturbances (e.g.,prolonged flood events, tornados) and encroachment by human activities. Current regulations and public concern indicate however that the bottomland hardwood forest would increase in size and quality over time.

Non-structural Alternative- The small number of trees in the Cadillac Heights area which would be impacted by this alternative would probably not be removed as part of any Corps of Engineer activities, but they could be impacted by any future development and prolonged flooding of the area.

National Economic Development Plan (NED) Alternative- This alternative would have major adverse impacts on the bottomland hardwood forest ecosystem now found in the proposed project area. One hundred forty seven acres of Pecan-Oak and 357 acres of Ash-Elm bottomland hardwoods would be lost and the quality of the surrounding bottomland hardwood habitat would be greatly compromised. Fragmentation of forested habitat often eliminates its suitability for certain species who need a more continuous range in order to survive. It also opens up more fringe area to be inhabited by species who would not normally be found in a bottomland hardwood system. This also leads to losses in bottomland hardwood dwelling species who are then not able to adequately compete against the new invader species.

Locally Preferred Plan (LPP) Alternative- This alternative would impact a portion of the bottomland hardwood forest found within the study area, but the impacts would be located in that portion of the proposed project area that has already seen significant impact by human activities such as gravel, dirt, and topsoil mining, landfills, and years of illegal dumping activities. Another consideration is that the bottomland habitat impacted by the LPP would for the most part be located in an area which is of lesser habitat quality than the NED plan. Implementing the LPP instead of the NED plan would save over 73 percent of the bottomland hardwood acres that have been identify as being within the proposed project area. And perhaps more importantly, over 90 percent of the bottomland hardwood forest acres determined to be high quality (Pecan-Oak bottomland hardwood forest) habitat would be protected. Roughly 50 percent of the land that would be impacted by the LPP would be considered wetlands by U.S. Army Corps of Engineer determinations.

Tentative Federally Supportable Plan (TFSP) Alternative- This alternative is similar in impacts to that of the LPP. The lesser length of the 100- yr Cadillac Levee would eliminate impacts to 7 acres of existing forested lands that would occur with implementation of the LPP.

AQUATIC RESOURCES

Water Quality

Future Without Project Alternative- Water quality in the Trinity River within the segment of the Dallas Floodway Extension (DFE) would continue to improve. In addition to more stringent Federal and state regulations aimed at reducing water pollution, comprehensive watershed management programs in the upper watershed of the Trinity River are being initiated by local governments and municipalities. An objective of the these programs is to restore the river and flood plain back to its natural condition. A functional benefit and output of this program has been an overall improvement in all aspects of water quality throughout the entire Trinity River system, including the DFE segment.

Non-structural Alternative- The water quality of the Trinity River would not be altered as a result of the implementing the nonstructural alternative. Future development or utilization of the areas involving the nonstructural alternative could strongly influence water quality in the DFE segment of the Trinity River.

National Economic Development (NED) Alternative- Water quality impacts resulting from the development of a 1200 foot bottom width overland swale would occur from the removal of trees and soil disturbances. A reduction in number of trees within the flood plain would temporarily increase water turbidity and nutrient loads during construction from rain events. This impact would be temporary and would cease after turfing. Water temperature of temporarily stored waters in the off channel swales could increase slightly because of reduced canopy shading and the decreased dissolved oxygen levels that could result temporarily impact water quality in the River during the first minutes of a flushing event.

Locally Preferred Plan (LPP) and TFSP Alternatives- Placement of levees in the DFE could increase the velocity of river water during flood events, however, the levees would not be constructed without a compensating swale which would tend to balance velocities. The levees would only function during extreme flooding events in which case the velocity increases would be negligible. Sump areas would extend water retention times of storm water runoff, allowing for turbidity reduction and possible contaminant removal prior to entering the Trinity River. During nonflood and no rainfall periods the levees and sumps would not affect water quality in the Trinity River. Temporary impacts to turbidity from runoff during construction could occur.

The chain of wetlands would provide both beneficial and adverse impacts to the water quality of the Trinity River. As proposed, the wetlands would beneficially impact the water quality of the river by assimilating nitrogen, phosphorus, and any heavy metals from the Central Waste Water Treatment Plant stream which would be used to hydrate the wetlands. The wetlands would also provide beneficial filtration and cleanup of wastewater prior to groundwater recharge. During conditions of low sunlight, high water temperature, no wind, and low wetland exchange rate, dissolved oxygen concentrations in the chain of wetlands would be very low and the Biochemical Oxygen Demand (BOD) of the water very high from the organic matter generated. Under these conditions, the water flowing from the wetlands into the Trinity River would provide adverse impacts to the water quality of the river at the point of entry and downstream from oxidation of the wetland organic matter. Construction of the wetland outflow points on the river channel would cause temporary impacts by increasing the turbidity of the water. Channelizing the Trinity River at Interstate 45 bridge would result in a short-term increase in river turbidity. A temporary increase in Biochemical Oxygen Demand (BOD) or Chemical Oxygen Demand (COD) may also occur depending upon the molecular composition of the disturbed river sediment. The reduction in light transmittal from elevated turbidity would temporarily shade oxygen-producing phytoplankton and cause lower dissolved oxygen levels.

Aquatic Habitat, Aquatic Invertebrates, and Fisheries

Future Without Project Alternative- With the development of comprehensive watershed management plans in the upper watershed, the aquatic habitat of the main stem of the Trinity River would continue to improve corresponding to the improvement in the water quality. The diversity and number of aquatic invertebrate and fish species would increase in the DFE segment of the river as the pollution sensitive aquatic organisms return to occupy former niches.

Non-structural Alternative- The condition of the aquatic habitat and fisheries resources following implementation of the proposed nonstructural alternative would not be changed in the DFE segment of the Trinity River. Beneficial or negative impacts to the aquatic habitat, aquatic invertebrates and fishes would be highly dependent on future development of these areas.

National Economic Development (NED) Alternative- Impacts resulting from the development of a 1200 foot bottom width, overland swale would occur from the changes in water quality associated with tree removal and soil disturbances. Temporary decreases in aquatic habitat quality would occur under environmental conditions incurred from the implementation of the NED alternative. It is not anticipated that there would be a significant corresponding reduction in the species diversity of aquatic invertebrates and fish.

Locally Preferred Plan (LPP) and TFSP Alternatives- Placement of levees in the DFE would provide no appreciable positive or negative impacts to aquatic habitat or fisheries resources. Sump areas would improve the water quality characteristics of storm water run-off entering the Trinity River and subsequently enhance the aquatic habitat for aquatic invertebrates and fish.

The chain of wetlands would provide both beneficial and negative impacts to the aquatic habitat and fisheries resources of the Trinity River. The improvement in water quality provided by the chain of wetlands would enhance the aquatic habitat and beneficially impact fish and aquatic invertebrate communities. The chain of wetlands would provide new habitat for fish and aquatic invertebrate species which prefer water velocities lower than the flow rates which occur in the main stem of the river. Rip rap armoring at wetland discharge points on the river would provide substrate for colonization by communities of aquatic invertebrates, and food, refuge, and spawning areas for fish. Rock placement to protect the stream bank at the outfalls would produce a structural bottom feature which would benefit fish by providing a congregational point for bait fish and higher predatory fish species. Aquatic habitat in the wetlands and the river would be adversely impacted if environmental conditions (low sunlight, high water temperatures, no wind, and low wetland exchange rates) which generate poor water quality prevail. Management of the wetlands would occur to minimize any impacts to the main stem river. Construction of the wetland outflow points on the river channel would cause temporary negative impacts to aquatic species not tolerant of elevated turbidity levels.

Channelizing the Trinity River at Interstate 45 bridge would result in a short-term increase in river turbidity and decrease in dissolved oxygen concentrations which would adversely impact the aquatic habitat. This would temporarily impact aquatic invertebrate and fish species not tolerant of elevated turbidity levels or reduced dissolved oxygen concentrations. Moving the river channel to avoid bridge pilings would adversely impact the aquatic habitat by removing a feature which would provide structure for colonization of by aquatic invertebrate communities, and a feeding area and congregational focal point for fish.

CUMULATIVE IMPACTS

This section analyzes the proposed project in the context of current and future trends in the Upper Trinity River Basin. The purpose of this section is to assess the cumulative impacts of the proposed action, when combined with other known actions in the vicinity of the Dallas Floodway Extension area. The proposed action, including environmental mitigation, makes little or no contribution to regional trends that are of concern in assessing cumulative impacts.

Land Use

Urbanization has greatly influenced land use patterns within the Dallas area. Upstream development has also led to land use modification within the floodplain of the Trinity River and major tributaries, such as White Rock Creek. As additional runoff from upstream areas has increased the frequency of flooding within the study area, land use has shifted away from agriculture, except for a few areas of pasture land. Voluntary programs leading to the removal of some residences in the more frequently flooded areas have also influenced land changes. Most abandoned areas have revegetated with grasses, followed by young forests. The proposed project would reduce flooding within the project. The project would directly remove forests that have developed during the past 30 to 40 years; however, these losses would be mitigated resulting in a larger area of preserved and reestablished forests. It is anticipated that some intensification of residential and light industrial development would occur within the area immediately protected by the chain of wetlands and levees.

Cultural and Historic Resources

Any impacts to cultural and historical resources would be mitigated, according to provisions of the National Historic Preservation Act. Therefore, the proposed action would make no contributions to cumulative impacts of the area.

Noise

All noise impacts directly attributable to the project would be temporary in nature. Levees would tend to interfere with the distribution of some noises. Some noise associated with roadway traffic could be redistributed to the area should the Texas Department of Transportation decide to utilize existing and proposed levees for reliever roads.

Climate and Air Quality

The proposed project would have only minor impacts to local temperature and air quality parameters. There would be no measurable impacts to climate. Cumulative impacts to air quality would be insignificant, since environmental mitigation would result in an overall increase in the size of preserved and restored forested areas.

Hydrology and Water Resources

An analysis to determine the impacts of the proposed project to areas downstream of the project indicate negligible effects. Potential peak discharge increases downstream of the project are approximately 1 percent for the 100-year event and 3 percent for the SPF.

Ecological Resources

The most significant resource within the proposed project area has been identified as the bottomland hardwood forest ecosystem located in an area referred to as the "Great Trinity Forest". While the proposed project would impact only a small area of the forest, the proposed environmental mitigation plan could provide a catalyst to ultimate acquisition and management of over 1,000 acres of the area which is either currently forested, or could be converted to bottomland hardwood forest through intensive management. In addition, the proposed environmental restoration project, which includes the development of emergent wetlands, helps reverse the trend of losses to this important resource.

ENVIRONMENTAL RESTORATION

The proposal to modify the flood swale to provide restoration of shallow water and emergent wetlands was developed to provide values to fish and wildlife resources, primarily migratory waterfowl, shore and wading birds that utilize the Trinity River corridor as part of the spring and migratory flights. The wetlands would be managed primarily as moist soil units that would optimize production of insects, seeds, tubers and vegetative structures to support several wildlife species during times of critical energy needs. Evaluation of existing constructed wetland features in the area indicated that it was desirable to consider the possibility to use a permanent water source such as the existing Central Wastewater Treatment Plant effluent to assure that water for flooding the wetland cells would be available when needed for wildlife usage. An analysis comparing construction of the wetlands with and without a dependable water supply was made.

The design for the proposed restoration plans was developed based upon extensive input from U. S. Fish and Wildlife Service (USFWS), literature on wetland development in the Trinity River Basin, and from consultation with other biologists within the Corps of Engineers familiar with development of wetlands within this ecoregion for promotion of fish and wildlife benefits. Aside from development of gradual side slopes and provision of a deep permanent water pool, the major characteristics which promote optimized environmental benefits are the ability to regulate water levels with control structures and ability to provide flooding at proper periods during the year. The wetlands as proposed for the Chain of Wetlands (COW) with control structures and a pumping system designed to deliver water from a continually available source reflect optimized conditions based upon the available local expertise.

Table 7 reflects development of the wetlands without the capability to provide water from a local permanent water source. Based upon existing hydraulic models, it was determined that a flow of approximately 8,000 cubic feet per second would provide overbank flows sufficient to flood the wetlands. Based upon watershed characteristics, it was determined that the overbank flood events would coincide with local rainfall sufficient to fill the wetlands and is thus a good estimator for frequency of flooding without use of a pumping system. Hydraulic and hydrologic analyses indicate that approximately 67 % of the time, there would be sufficient water available under natural conditions during the spring and early summer to flood the wetlands and stimulate initial growth of emergent and moist soil plants along the perimeter of the wetlands. However, it was found that only 5 % of the time a flooding event would occur during August to irrigate and promote optimum seed production of wetland plants. Approximately 40% of the time flooding would occur during the October to January period when food and cover produced by the wetlands vegetation is critical for migratory waterfowl and shorebirds. From these data, the average habitat suitability was adjusted to reflect the effect of reduced flooding on the wetlands. It could additionally be argued that the actual average size of the wetlands would also diminish significantly. Looking at suitability values only, there would remain an increase in average annual habitat units in this alternative but approximately 83 % of the values would be attributed to the grassland portion of the complex and less than 16 % of the values would be attributable to the wetland portion. The average habitat value of the permanent water feature is almost totally lost because of the low frequency of flooding that naturally occurs during the summer months.

The wetland complex as proposed with dependable water supply available (Table 8) provides significant increased fish and wildlife resources values as indicated by the increases in habitat values of the permanent water, emergent wetlands and grassland portions of the complex. The plan provides for development of 123 acres of emergent wetland providing over 117 average annual habitat units and more than triples total resource values over the flood damage reduction swale as it would exist without the proposed emergent wetland complex development alternative. By contrast, the Chain of Wetlands without a dependable source of water would provide for development of only 83 acres of emergent wetland providing only 19 average annual habitat units for the priority emergent wetland resources (see Table 7). This represents an increase of 67% in acres and a 616% increase in average annual habitat units of emergent wetlands attributable to a dependable water source.

COST EFFECTIVENESS AND INCREMENTAL ANALYSIS

While an economic standard has been set that requires a flood damage reduction plan to have economic costs be no more than the economic benefits, a similar scale does not exist for environmental restoration proposals due to the fact that although costs are measured in dollars expended, benefits are measured in terms of environmental outputs such as habitat units, acres etc. that preclude development of a benefit to cost ratio to eliminate undesirable, non supportable project alternatives. Cost effectiveness and incremental analysis techniques as reported by Robinson, et al. 1995, are useful tools for the decision maker to eliminate poor alternatives and to guide the thought process in determining what project alternatives are supportable when environmental output levels continue to increase with increased expenditure of economic resources.

Cost Effectiveness of Emergent Wetland Restoration. The procedures outlined by Robinson, et al. (1995) were followed to evaluate the environmental benefits and costs of the two broad environmental restoration alternatives for the proposed Chain of Wetlands. These alternative management plans include providing necessary water when need to optimize fish and wildlife benefits to the proposed emergent wetland complex. This analysis evaluates the benefits that would be derived from the wetland complex relying on naturally occurring weather events versus a pumped supply to provide water for the wetlands. Output information used in the analysis are derived from Tables 7 and 8. Implementation costs information for the environmental restoration measures was developed by cost estimating. It was determined that no costs from opportunities foregone should be attributable to the proposals. Annual costs were derived using the initial costs of $5,651,253 for the wetlands without dependable water supply and $5,854,112 for the proposed wetlands with a dependable water supply. A 7-1/8% interest rate was used, assuming a 50-year project life and assuming that it would take approximately 1 year to construct the wetlands. An operation and maintenance cost of $50,000 was estimated for the COW with dependable water and $35,000 for the COW without dependable water.

Table 7
Chain of Wetlands Habitat Evaluation, with Water Supply not available for Management

	Upper Swale						Lower Swale					
	Area (acres)		HSI		Habitat units		Area(acres)		HSI		Habitat Units	
	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands
Grassland/ Forbland	105	65.77	0.25	0.56	26.25	36.83	165.99	114.44	0.25	0.56	41.50	64.08
Permanent Water		3.25		0.2	0	0.65		4.93		0.20	0	0.99
Emergent Wetlands		**35.98**		0.23	0	**8.28**		**46.62**		0.23	0	**10.72**
Total					26.25	45.76					41.50	75.79
Grand Total											**67.75**	**121.55**

Notes: "With Flood Control Only" reflects on-site conditions if only the flood control portion of the swale were constructed.
"Projected with Chain of Wetlands" reflects projected conditions with wetland restoration superimposed on flood control project.
"Grand Total" is the sum of the Upper and Lower Swale Values

Table 8
Chain of Wetlands Habitat Evaluation, with Water Supply Available for Management

	Upper Swale						Lower Swale					
	Area (acres)		HSI		Habitat units		Area(acres)		HSI		Habitat Units	
	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands	With Flood Control Only	Projected with Chain of Wetlands
Grassland/ Forbland	105	33.3	0.25	0.90	26.25	29.97	165.99	68.96	0.25	0.90	41.50	62.06
Permanent Water		18.03		0.95	0	17.13		27.40		0.95	0	26.03
Emergent Wetlands		**53.71**		0.95	0	**51.02**		**69.59**		0.95	0	**66.11**
Total					26.25	98.12					41.50	154.20
Grand Total											**67.75**	**252.32**

Notes: "With Flood Control Only" reflects on-site conditions if only the flood control portion of the swale were constructed.
"Projected with Chain of Wetlands" reflects projected conditions with wetland restoration superimposed on flood control project.
"Grand Total" is the sum of the Upper and Lower Swale Values

Pertinent information related to the cost effectiveness for the two action alternatives and the no action alternative are displayed in Table 9. Initial analysis indicates that both action alternatives are cost effective in that both provide benefits and that the slightly more expensive plan with dependable water supply provides higher environmental output than the less expensive plan.

Table 9
Cost Effectiveness of the Chain of Wetlands

	ANNUAL COST	AAHU OUTPUT	INCREMENTAL COST	CHANGE IN OUTPUT AAHU	INCREMENTAL COST/AAHU
No action	0	67.75	N/A	N/A	N/A
No pump station for dependable water	$466,857	121.55	$466,857	+53.8	$8678 / AAHU
With pump station for dependable water	$497,360	252.32	$ 30,503	+130.77	$ 233 / AAHU

The plan without dependable water supply provides a net increase in benefits over the no action alternative at an average annual cost of $8,678 per average annual habitat unit (AAHU), which appears to be more costly on average than would be expected in this ecoregion. The benefits of addition of dependable water supply are clearly demonstrated by the analysis. For an additional annual cost of $30,503, an additional 130.77 AAHUs can be developed. Further, evaluation of the data indicates that the best buy is the alternative providing dependable water enabling optimum management of the wetland complex. The no action plan as well as the alternative providing the swale with the wetlands without the capability to provide water when needed provide habitat, the majority of which is associated with the grassland portion of the complex. This scenario with minimal resource values attributable to the wetlands proper does not provide restoration of priority habitat and should not be considered further. The emergent wetland restoration plan which includes provision of a dependable water supply appears to be justified based upon the analysis conducted.

Incremental Analysis of Emergent Wetlands by Cell

Since both action alternatives are considered to be cost effective, further analysis is necessary to determine the optimum extent of environmental restoration through construction of emergent wetlands that is warranted. As in the analysis used to demonstrate that provision of dependable water was desirable and justifiable, an analysis was conducted to determine if the entire COW was justifiable or if only a portion of the complex should be constructed and managed. The COW as proposed and evaluated could contain from one to seven cells (See Figure 2) that would be connected to the water source, and a series of water distribution and control structures would be used to manage the emergent wetlands for optimum habitat output. For this analysis the uppermost or northern wetland cell was named Cell A and the cells were named in alphabetical order downstream, with the most southerly located cell named Cell G. The following general information provides a breakdown of the size of each wetland complex, including shallow water emergent wetland, deep water and surrounding native grasslands that provide the overall restoration values.

CELL	A	B	C	D	E	F	G
SIZE (ACRES)	12.43	25.04	51.7	15.86	16.22	69.08	80.65

Assumptions made in the analysis were based upon engineering and environmental constraints. The source of the dependable water supply proposed to be used is located near the center of the COW at the Central Wastewater Treatment Plant. The flow of water through the COW as proposed would be upstream from Cell C then gravity fed through Cell B and onto Cell A before exiting the system into the receiving waters of the Trinity River. Downstream the flow would be gravity fed from Cell D through E, F, an G in that order if constructed. From an engineering and environmental perspective it was determined that it would be unreasonable to build wetland cells at either end without the intermediate cells due to the high cost of providing water distribution channels or pipelines along long reaches without providing any corresponding environmental benefits along the water distribution area.

The first costs for construction of each cell were determined based upon quantities of material moved and construction of pump and other water supply costs. Subsequent to the analysis, it was determined that the first costs utilized, which included a cultural resources mitigation cost was in error. However, since the cultural resources mitigation costs were initially applied in proportion to the quantity of material excavated from each cell, the analysis conducted would not be effected. See the main report for the environmental restoration costs attributable to the project. Operation and management costs were estimated for the total proposed project and for each combination of wetland cells evaluated. Economy of scale was taken into consideration during formulation of initial and annual cost estimations. Environmental output benefits determined to be attributable to the project as proposed with water supply available as indicated in Tables 8 and 9 were assigned to the wetland cells based upon their relative size and other features including location and values added due to proximity of other resources within the project area.

Due to the complexity of the analysis, the software program "Automated Procedures for Conducting Cost Effectiveness and Incremental Cost Analyses (Beta Version 2.6) was used. The tabular outputs from the analysis are attached to the end of this appendix. As indicated, the analysis was conducted with only one limitation in alternative measure combinations. This limitation was that Cell B wouldn't be constructed unless Cell C was constructed and that Cell A wouldn't be constructed without Cells C and B. Downstream, the procedure precluded analysis of Cell G without D through F being in place, etc. This limitation, as explained, appears logical in that construction of cells remotely located from the water supply would be inordinately expensive due to the need to develop the water supply along the route without any environmental benefits being developed along the same route. This also reduced the number of possible Cell combinations from 128 to 20 for further evaluation.

Least-cost combinations- Whether by computer or manual analysis, the next step in the process encompasses determining least-cost combinations for each level of output. The first iteration eliminated Plan with combination of Cells B, C, D and E because the Plan with the combination of Cells D, E and F provided the same level of output at a lower annual cost.

Cost-Effective Least-Cost Combinations- This analysis eliminated all other combinations of measures that were not cost effective. The measures eliminated were those for which another measure exists that produces a higher level of output at less cost. The Plans eliminated through this analysis were Cells D and E; Cells C and D; Cells C, D and E; Cells B, C, and D; Cells A, B, and C; Cells A, B, C, D and E; and Cells D, E, F and G. Twelve plans were carried further for the next level of analysis.

Cost-Effective Least-Cost Combinations with Incremental Analysis- This step of the process sorts plans by cost, conducts an incremental analysis based upon incremental cost and incremental output and then subjects the plans to a cost-effective least-cost analysis based upon incremental average cost and incremental outputs. Five more alternative plans were eliminated by this portion of the analysis. Seven plans, including the no action measure, were carried further into the final incremental analysis (Table 10).

Combinations for Final Incremental Analysis- The prior processes of the analysis resulted in the elimination of all plans that are not cost effective. All six of the remaining cost effective action and the no action plans were subjected to a final incremental analysis as shown in Table 10 are cost effective. The plans are sorted and shown by increasing annual cost. It should be noted that each successive plan also shows continuing increasing environmental output.

Table 10
Incremental Analysis, Final Array of Alternatives, for Proposed Chain of Wetlands - Analysis by Cell

PLAN	ANNUAL COST	AAHU OUTPUT	INCREMENTAL COST	INCREMENTAL OUTPUT AAHU	INCREMENTAL COST/AAHU
No action	0	68	N/A	N/A	N/A
Cell D	$ 63,349	75	$ 63,349	+ 7	$9,050
Cell C	$ 94,688	99	$ 31,339	+24	$1,306
Cells D and E	$180,927	135	$ 86,239	+36	$2,396
Cells C, D, E and F	$255,615	166	$ 74,688	+31	$2,409
Cells A, B, C, D, E and F	$332,532	196	$ 76,917	+30	$2,564
Cells A, B, C, D, E, F and G	$497,360	252	$164,828	+56	$2,943

Ecosystem Restoration Plan Selection

The planning goal for ecosystem restoration for the proposed project area was to develop a wetland complex that provides maximum wetland and related deepwater and grassland habitat gains within the confines of the proposed swale area in a cost effective manner. The proposed restoration plan should not cause additional unacceptable impacts within the project area to fish and wildlife resources, nor should it cause impacts to flood damage reduction benefits within the study area or preclude the development of any additional flood damage reduction actions that might be needed in the future. The seven cells that were designed individually meet all criteria except they do not maximize total restoration output of important habitat (emergent wetland) that could be achieved. The cost effectiveness and incremental cost analysis was conducted to assist in making the determination if the plan that does maximize total habitat output (plan with all seven cells) is cost effective and, based upon its incremental cost, should be supported as the recommended environmental restoration plan.

By analysis, it has been determined that the plan with all seven cells is cost effective, as were the other five action plans and these alternatives were carried forward for the final incremental analysis

(Table 10). All seven of the final alternatives are viable alternatives that must be carefully evaluated under the question " is this level of output worth it?" The analysis conducted shows that for the six action plans that remained after prior screening, environmental benefits increased with each successive increment of wetlands added. Additional increments of wetland restoration if designed would likely also continue to show increased output, however, other planning constraints would be exceeded. For example, additional emergent wetlands could be designed for location off the flood control swale but this could only occur at the expense of bottomland hardwood habitat that is nationally recognized for its importance. Restoration activities should not result in damages that would require environmental mitigation. Studies in the upstream area of the existing Dallas Floodway have only recently begun under separate authorities and it would be imprudent to design emergent wetlands in that area prior to completion of necessary engineering studies to determine needs for that reach of the system.

Therefore, within the constraints of this project and planning area, it appears that the development of the complete COW would achieve the goal of maximizing emergent wetland habitat within this area without violating other developed criteria. The remaining question of whether the plan is supportable needs to be further scrutinized. Going beyond the no action alternative is relatively simple in that a determination has been made that environmental needs are present in the basin that can be obtained by project construction. The output of 68 AAHUs for the no action alternative is based upon the native grassland complex that would result from construction of the flood damage reduction swale and would essentially provide no benefits attributable to emergent wetlands, the priority output. The next increment, or the first action proposal, construction of Cell D alone, produces only 7 AAHU at a relatively high cost due to the initial high cost of providing the water supply infrastructure and the relatively small size of the Cell. The next measure, construction of Cell C provides an additional 24 AAHU at a cost of $1306 per AAHU. Additionally, these two increments represent the first in a logical implementation sequence upon which all other cells are dependent.

The remaining alternatives, as listed, continue to provide additional output. Again the average cost of $2,564 per added AAHU for the plan which includes wetland Cells A through F, and intermediate plans are judged to be worth the additional expense to gain the additional environmental output. The final alternative which includes all cells, causes need for additional thought in determining whether it is worth the additional expense in adding Cell G to provide an additional 56 AAHUs at an incremental average cost of $2943. For comparison purposes, an analysis conducted for a similar emergent wetland complex developed on Corps lands for mitigation of another project indicates that the incremental addition of this cell to the plan is warranted. That project was designed by the Corps and implemented with funds from another agency with a need to keep costs as minimal as possible. This analysis, which did not include real estate costs, showed an annual cost of over $3000 per AAHU gained. Under these comparative conditions it would appear that the final increment proposed, which would cost less per AAHU than in the comparative example, is supportable.

Following guidance by Robinson, et al., the tendency to select the plan that minimizes average cost, or in other words, is most efficient in production has been bypassed. Instead a rational decision has been made based upon careful examination of the costs and benefits of all potential combinations of wetland cells. The final array of alternatives were examined in the same manner as if a NED plan were being searched for. In our evaluation, the incremental environmental outputs continued to rise with increased expenditure of economic resources. The cap or limit to development of additional alternatives with more wetlands was based upon environmental constraints that precluded development of additional emergent wetlands.

In addition, very few opportunities of this magnitude exist to develop emergent wetlands as proposed in the COW, particularly when considering the other non-habitat benefits such as water quality, aesthetics and sightseeing and possibly other recreational benefits that could be attributable to the emergent wetland complex features of this multi-objective plan. The increase in habitat that would be obtained by addition of Cell G appears to environmentally, economically, and socially justifiable and it is recommended that the entire wetland complex with Cells A through G be included in the environmental restoration plan.

Fish and Wildlife Impacts and Environmental Mitigation

The District has reviewed the proposed project features and has determined that mitigation sequencing has been appropriately followed. Planning leading to the determination of the NED plan eliminated channelization plans from further consideration due to adverse environmental effects and a vegetative management plan was considered but eliminated because it would have seriously diminished stream aquatic, riparian and bottomland hardwood habitats that have high national priority for protection. An array of "swale" alternatives, including, the NED plan, although causing significant losses to bottomland hardwoods was designed and aligned to avoid the highest quality forested habitats to the extent possible. The swale plans did not receive endorsement by the entire environmental community but appropriate mitigation plans were found to be feasible for the proposals.

The Chain of Wetlands (CoW) alternative alignment was developed from a smaller swale plan around desires expressed by the sponsor following extensive public involvement. A major planning objective by the Corps and sponsor included the commitment to continue avoidance of high quality forested areas and minimization of impact to any bottomland hardwood forested areas. The CoW alignment within the upper reach has been moved to the west as far as technically and economically justifiable. The alignment of the Cadillac Heights and Lamar Levees has also been extensively considered and it has been determined that no other reasonable alignments would produce less impacts to important resources.

Based upon experience and lessons learned dealing with levees in the area has determined that the more gradual slope of the proposed levees, although causing slight additional impact due to a widened foot print is necessary to reduce slumping, possible failure and otherwise high operation and maintenance costs. Any additional adjustments to the proposed project features that would reduce environmental impacts to significant resources have been judged to have immediate or long term costs that are not warranted.

Table 11 provides a breakdown by proposed project feature indicating the extent of impacts to important resources that would occur if the proposed project or feature were implemented.

A large number of broad mitigation alternatives were developed and considered by the planning team. The formulation process consisted of the following sequential steps: avoidance and minimization of impacts, identification of positive project impacts which offset the adverse project impacts, identification of project lands which through various management strategies would achieve some mitigation, identification of adjacent public lands which could be managed for mitigation, identification of adjacent private lands which could be acquired and managed for mitigation, and management and/or acquisition of off-site (not adjacent to the project) public and private lands. The planning team eliminated several of these strategies from detailed consideration by consensus because of their unavailability or inability to meet mitigation objectives. For example, it was determined that intensive management of most project lands (or adjacent public lands) would not significantly increase their habitat values over what would be achieved without intensive management. Hydrologic considerations (conveyance requirements) restricted the use of other project lands, such as the golf course, from revegetation and intensive management to obtain additional mitigative value. The team also considered acquisition and management of lower quality habitats far removed from the project site but eliminated this concept from further consideration because it failed to meet the planning objective of preserving and maintaining habitat values within the urban Trinity River floodplain.

Table 11
Impacts by proposed project feature and for TFSP, LPP, NED and Non Structural Alternatives to Important Resources (In Acres).

	NED	CoW	Lamar Levee	Cadillac Levee (SPF)	Cadillac Levee (100 yr)	Non Structural	I-45 Diversion	TFSP	LPP
Pecan-Oak Bottomland Hardwood	*175.6	5.9	10.6	0.0	0.0	16.5	4.1	20.6	20.6
Ash-Elm Bottomland Hardwood	*427.7	84.0	42.7	9.4	2.4	124.9	4.9	134	141
Mixed Grass Forblands	196.7	125.5	44.5	41.7	10.6	170.0	0.0	180.6	211.7
Open Water	24.3	37.8	4.9	1.0	0.0	42.7	7.6	50.3	51.3

**Includes area affected by habitat fragmentation caused by NED alternative within White Rock Creek floodplain.*

All features of the proposed project have been reviewed to determine what measures could be implemented that would reduce impacts and consequently reduce the need to acquire additional lands for environmental mitigation purposes. The area between the proposed levees that would be acquired for project purposes are currently extensively forested. Within this area the largest area of contiguous highest quality forest is already in public ownership and the long term without the project scenario is that only low density non-intrusive recreation, primarily in the form of undeveloped trails, would exist in the area. Forested areas in private ownership within the study area are currently protected by extensive regulations, Section 404, CDC process, and City ordinance, requiring that losses be mitigated. Non forested areas are currently converting through natural processes to bottomland hardwoods with exception of some mowed areas upstream from and adjacent to the Central Wastewater Treatment Plant and the IH 45 crossing. The future "without project" evaluation, therefore indicates that this area would continue to increase in forest cover and habitat value over time.

Based upon these assumptions, management options to further increase values of proposed project lands were considered, however, it has been determined that minimal gains could be accomplished within the area and there is an overall concern that the area may require slight vegetative management in the future to preserve the hydraulic efficiency of the proposed project. In any event it wouldn't be prudent to expend funds to develop a slight increased habitat value that would have only short term benefits. The HEP, however, does attribute slight value increases as part of the proposed project, thereby lessening the total mitigation requirement.

The potential to use proposed sumps for tree planting was also investigated. It was established that tree plantings could be accomplished, however, there are several constraints that would minimize wildlife value of these efforts to the point that it was not deemed appropriate to develop mitigation measures involving the sumps. Foremost of the considerations is that the sumps would require periodic maintenance to remove accumulations of silt and other materials deposited from runoff. These maintenance activities would require complete disruption of any forest that might develop. With a minimum 75 year time period required for forest maturation, the use of the sumps is unfeasible for fish and wildlife mitigation for bottomland hardwood forests. In addition the sumps would be separated from the riparian zone by the proposed levees which would further act to minimize any values that might be obtained by tree growth. Sumps may may be modified by planting trees around the edges and a few within the center however these plantings would result more in aesthetic than environmental mitigation purposes.

The proposed project reach downstream, in particular the golf course area, was also reviewed to determine if mitigation could be accomplished on proposed project lands. It was determined that planting vegetation on those areas would reduce the hydraulic efficiency to an unacceptable level. The acquired project areas would be maintained as currently vegetated. One area from which the topsoil has been previously removed by others adjacent to the lower reach of the CoW, has been identified as having potential for use as a disposal site for excess material from the proposed project. This site would become multipurpose project lands that have potential for reforestation to meet some of the mitigation requirements. The site was included in detailed mitigation evaluations.

Fish and Wildlife Service Recommended Mitigation Plan Development

Using these assumptions for with and without project conditions, the Corps of Engineers, U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department modeled future with and without project conditions to determine impact to fish and wildlife habitat. The Services Habitat Evaluation Procedures were used to evaluate several plans to satisfy mitigation requirements for bottomland hardwood forest habitats impacted by the proposed project. The Corps provided an analysis of impacts to vegetation cover caused by separable project features. According to our studies the proposed project features of the LPP(the CoW, Lamar levee and sumps, Cadillac Levee)and the I-45 channel diversion would result in impacts to 21 acres of Pecan-Oak forest (High Quality), 141 acres of Ash-Elm (Medium Quality) forest, and 212 acres of mixed grass forbland. The HEP indicated that the LPP and 1-45 channel diversion features would result in losses of 14 Average Annual Habitat Units (AAHU) to Pecan-Oak forest and 91 AAHU to Ash-Elm forest over a 50 year period of analysis when compared to the future without project conditions.

Three potential mitigation tracts were identified which remain in private ownership and were evaluated for their potential to offset the losses to fish and wildlife habitat that would result from implementation of the LPP and the I-45 Diversion. These tracts are located within the Trinity River flood plain near the proposed project (See Figures 2 and 3). These tracts contain grasslands that have potential for conversion to bottomland hardwoods and areas of Ash-Elm and Pecan-Oak bottomland hardwood forested habitat that can be managed to improve their future habitat values.

Using the models for species evaluated, measures were developed to optimize habitat conditions on these tracts through conversion of existing grasslands to bottomland hardwoods and the improvement of existing forest stands. While the largest gains in habitat values over the life of the analysis occurs from grassland conversion, the cost associated with this conversion, including land acquisition is the most expensive per acre. Also within the tracts identified there is a limited amount of grassland available for conversion. Table 12 indicates the costs and average annual benefits associated with the three mitigation plans evaluated. Target mitigation values are based on habitat losses of 14 Average Annual Habitat Units (AAHU) to Pecan-Oak forest and 91 AAHU to Ash-Elm forest.

Table 12
Incremental Mitigation Analysis
Fish and Wildlife Service Recommended Plan

Mitigation Plan Alternative	Average Annual Habitat Units		Mitigation Cost Average Annual at 7 1/8%	Annual Cost / AAHU*
	Pecan-Oak Bottomland Hardwood(HQ)	Ash-Elm Bottomland Hardwood(MQ)		
No Mitigation	0	0	0	--
Plan A	+9	+43	$307,589	$5,915
Plan B	+9	+55	$330,347	$5,162
Plan C	+14	+92	$444,472	$4,193

*Average Annual Habitat Unit

Mitigation Plan A consists of modifying existing habitat at a tract located east of the Trinity River, in a corridor adjacent to Loop 12. The management plan to develop bottomland hardwood habitat consists of converting 86 acres of grassland to bottomland hardwood, preservation of 10 acres of grassland and habitat improvement on 753 acres of existing bottomland hardwood.

Plan B consists of adding an additional tract, a 34 acre area located on the west side of the Trinity, adjacent to the proposed lower Chain of Wetlands. This site is the site identified as potential multipurpose, surplus soil disposal and mitigation area. The management proposal is to convert the entire tract to bottomland hardwood.

Plan C is a combination of Plan B and addition of a 271 acre tract near IH 635, within the flood plain near the southern end of Dallas city limits boundary. Management in this tract would include conversion of 88 acres of grassland to bottomland hardwood and improvement of habitat quality on 173 acres and preservation of an additional 10 acres of grassland. Plan C would consist of a total 1154 acres with prescribed management practices that would fully mitigate projected losses to bottomland hardwoods attributable to the currently proposed project including the I-45 realignment. In addition to providing full mitigation of these resources, Plan C presents the best buy in terms of cost per gain in habitat value. Plans A and B are more costly per gain and do not provide the mitigation required to offset losses.

Table 13 displays the development and management techniques associated with the features to obtain the mitigation potential proposed with mitigation Plan C. These features were used to develop the cost estimates shown in the incremental analysis included in Table 12. Table 14 indicates the calculated proportion of the mitigation required in acres to offset fish and wildlife habitat impacts due to each proposed project measure based upon the US Fish and Wildlife Services recommended mitigation plan. The NED cost was determined during earlier planning.

Table 13

Habitat development features to mitigate impacts to bottomland hardwood the Dallas Floodway Extension-LPP, including CoW, SPF Lamar Levee and sumps, SPF Cadillac Heights Levee, and I-45 Channel Diversion based upon U.S Fish and Wildlife Service planting plans.

A. Acquisition

1. 926 ac BLH
2. 228 Mixed grass/forbland

B. Initial Development

1. Habitat Improvement of existing BLH's
   a. Selective thinning 463 acres.
   b. Mast trees (containerized at rate of 5 trees Per acre on 235 acres) 1175 trees
   c. Tree Planting with site prep 1175 trees
   d. Shear, rake, pile and bed 50 acres
   e. Passerine and squirrel nest boxes, acquire and install 270 boxes

2. Conversion of mixed grassland to BLH's
   a. Shredding/disking 208 acres
   b. Mast trees (containerized at rate of 40 trees /acre On 208 acres) 8320 trees
   c. Fruiting shrubs (containerized at rate of 10 shrubs/acre On 208 acres) 2,080 shrubs
   d. Tree planting with site prep 8,320 trees
   e. Shrub planting with site prep 2080 shrubs
   f. Hardwood seedlings (100 seedlings/acre for 208 acres) 20,800 seedlings
   g. Seedling planting 208 acres
   h. Passerine nest boxes 208 boxes

3. Fencing 6 miles
4. Signs

Table 14

Mitigation required by feature, LPP, Non Structural and NED Alternatives based upon U.S. Fish and Wildlife mitigation planting plan

CoW	635 Ac	$ 3,056,477
Lamar Levee/sump	392 Ac	$ 1,886,833
SPF Cadillac Levee	58 Ac	$ 279,173
100 yr Cadillac Levee	1 4.5 Ac	$ 69,793
I45 Diversion	69 Ac	$ 314,412
NON STRUCTURAL	1027 Ac	$ 4,961,022
LPP	1154 Ac	$ 5,554,607
TFSP	1110.5 Ac	$ 5,327,515
NED	3200 Ac	$14,296,736

Corps Analysis of Other Mitigation Alternatives

Areas remote to project area. An analysis of potential locations to conduct fish and wildlife mitigation was conducted, including potential mitigation sites within the main stem Trinity River and East Fork of the Trinity flood plains. The search included review of existing documented information, interviews with representatives of the City of Dallas and Dallas County. A broad search was conducted based upon known locations of existing or potential bottomland hardwood forest lands within the upper and middle Trinity River basin. The U.S. Fish and Wildlife Service (1991) conducted an inventory of lands within the basin that could be preserved or improved with management. This document was used as a guide to determine the ability of off-project locations to meet general planning mitigation objectives as well as meet requirements to offset losses fish and wildlife habitat as determined through use of the Service's Habitat Evaluation Procedures. The Service's report identified three general locations within the East Fork of the Trinity River Basin downstream of Lake Ray Hubbard containing existing tracts of bottomland hardwood forest and five locations along the main stem of the Trinity River between the confluence of the East Fork of the Trinity River and the upstream limits of Lake Livingston that had potential to be managed to achieve environmental mitigation. In addition numerous agricultural tracts adjacent to the East Fork were identified that could be converted or restored to bottomland hardwood habitat. Currently, these agricultural lands are protected by levees that are owned and maintained by levee districts.

East Fork Trinity River. The potential mitigation sites along the East Fork are approximately 20 straight line miles east of the proposed project location and the potential sites along the main stem are located between 40 and 90 straight line miles south of the proposed project. Subsequent reevaluation of the forested tracts and agricultural properties on the East Fork indicated that the tracts available were either too small to provide the necessary mitigation, were already designated as mitigation for numerous unrelated Section 404 permitted activities in the basin or had such social and economic constraints that they were inappropriate for acquisition and management for environmental mitigation. As an example, the agricultural lands along the East Fork, could be converted to bottomland hardwood, however, for the mitigation lands to function appropriately, the existing privately owned agricultural levees would have to be breached and new levees constructed to provide continued protection to the remaining agricultural lands not incorporated into the environmental mitigation. Assuming that conversion of approximately 500 acres of farmland to bottomland hardwood forest would provide the environmental mitigation to offset losses caused by the proposed project, approximately 4700 feet of existing levee would have to be breached and 14,100 linear feet of new levee designed to meet the existing level of protection. Existing levees usually average about 15 feet in height and have an eight foot top width. Repair costs for the agricultural levees in this area currently average approximately $1,000 per linear foot. Even if economy of scale would result in a reduction in the cost per linear foot to 50% of that required for repair, the new levees could still cost more than $7,000,000, excluding any cultural resource or HTRW investigation or mitigation costs that might be necessary. In addition, productive farm lands could cost as much as flood plain lands within the immediate project area. The alternative of utilizing agricultural lands adjacent to the East Fork, although initially appealing to pursue, was ruled out also because of the high cost for initial acquisition, construction and in addition, a high level of management would be required on the part of the project sponsor at a site located approximately 30 road miles from the proposed project site.

Trinity River Alternatives. Five locations were evaluated within the main stem Trinity River flood plain downstream of Dallas County and three sites within the immediate project area were evaluated for the cost effectiveness of providing the environmental mitigation. All of these sites were identified by the evaluation team including the US Fish and Wildlife Service as having potential for habitat improvement and therefore could provide some or all of the mitigation needed for the proposed project. In evaluation of these tracts, the cost of land acquisition and the cost of providing labor to manage the habitat improvements, including travel costs were utilized to determine if it is more cost effective to acquire lands that have an initial lower cost but higher operation and maintenance or to acquire lands closer to the proposed project that would have a higher initial acquisition cost but reduced operation and maintenance cost due to the proximity to the sponsors center of operation. Labor and material costs to plant or conduct other work to obtain the habitat gains were not included in this analysis, however, the potential sites were evaluated to see from a theoretical standpoint that the site could provide the average annual habitat units of bottomland hardwood forest values determined through use of the Service's Habitat Evaluation Procedures that would be needed to compensate for the proposed project impacts.

The tracts evaluated included the Big Lake site, located in Anderson County. This site is located approximately 100 road miles from the city of Dallas. The tract is approximately 9446 acres in size and it has been reported to be under the ownership of a single owner. It is not know if the owner would willingly sell only a portion of the tract. The tract could provide an estimated 1000 acres of land necessary to provide the necessary mitigation.

The tract located at the confluence of Catfish and Beaver Creeks also located in Anderson County would provide only a portion of the habitat needed to offset losses from the proposed project. The site is 1510 acres in size and is located adjacent to a State Wildlife Management Area, however the existing vegetation of the site is 75% marsh land. The site by itself could not provide the entire mitigation needed because converting existing high value marsh land which is likely jurisdictional wetland to bottomland hardwood forest would not meet policy objectives nor would it be met favorably by environmental agencies. It is unlikely that only the 25% that could be managed for mitigation purposes could be acquired separately. This tract is located approximately 60 road miles from the City of Dallas.

At the confluence of Buffalo and Linn Creeks, in Freestone County, a small 532 acre tract exists that is approximately 74% covered by high value bottomland hardwood forest. The remainder of the tract is in upland forest and agriculture. Even intense management would not result in sufficient habitat improvements to provide the necessary mitigation and it is unknown if only the bottomland hardwood site could be acquired. This tract is also located about 63 miles from the proposed project location.

The Middle Trinity Terrace is a 13,516 acre tract of severely cut-over bottomland hardwood forest comprised almost entirely of cedar elm and sugarberry. Management potential is good for this tract located in Navarro and Henderson Counties. The site is approximately 65 road miles from the proposed project site.

The Hagen bottoms is a 921 acre tract located in Anderson County. This tract is composed of approximately one-half cropland that could be converted to bottomland hardwood forest and the remainder of the tract is shrub swamp and bottomland hardwood forest. The tract appears most favorable in initial composition and comparable in size to the mitigation tract recommended by the U.S. Fish and Wildlife Service in their report on the proposed Dallas Floodway Extension project. The tract is located approximately 95 road miles away from the proposed project area.

The three tracts located adjacent to the main-stem Trinity River adjacent and just downstream of the proposed project combined totals 1154 acres in size . The combined tracts contain approximately 926 acres of bottomland hardwood forest and 228 acres of grassland that could be managed and converted respectively to provide mitigation for the project as proposed. These three sites are located close enough to the project area that operation and management expenses could be handled as an extension of the responsibilities of the sponsor's existing staff. Table 15 shows an estimate of the cost breakdown for the alternative sites including operation and maintenance including labor to oversee the mitigation areas. Labor and materials to do actual site preparation, establishment of the mitigation forest and provision of fencing to protect the mitigation area and acquisition and placement of nest boxes are not included in this analysis which is shown to identify the cost effectiveness of utilizing potential mitigation lands adjacent to the area or to establish the mitigation area at a remote location which would have a lower initial acquisition cost.

Table 15
Cost Effectiveness Analysis of Alternative Mitigation Sites

OST ANALYSIS							
NVESTMENT COST		Big Lake	Catfish/	Buffalo/	Middle Trinity	Hagen	Proposed
			Beaver Crk	Linn Crks	Terrace	Bottoms	for LPP
	FIRST COST	$1,260,000	$1,268,400	$446,880	$1,260,000	$1,768,320	$3,779,52
	ANNUAL INTEREST RATE (decimal)	0.07125	0.07125	0.07125	0.07125	0.07125	0.0712
	PROJECT LIFE (years)	100	100	100	100	100	10
	CONSTRUCTION PERIOD (months)	12	12	12	12	12	1
	INTEREST DURING CONSTRUCTION	$48,117	$48,438	$17,065	$48,117	$67,529	$144,3
	INVESTMENT COST	$1,308,117	$1,316,838	$463,945	$1,308,117	$1,835,849	$3,923,85
VERAGE ANNUAL HARGES							
	INTEREST	$93,203	$93,825	$33,056	$93,203	$130,804	$279,57
	AMORTIZATION	$96	$96	$34	$96	$134	$28
	OPERATIONS & MAINTENANCE	$216,153	$165,692	$124,904	$207,126	$174,072	$20,00
	REPLACEMENTS	$0	$0	$0	$0	$0	$
	TOTAL ANNUAL CHARGES	$309,452	$259,613	$157,994	$300,425	$305,010	$299,86
NCREMENTAL NALYSIS							
	AAHU (BLH)GAIN OVER NO ACTION	99.7	25	50	99.7	99.7	99.
	ANNUAL COST/AAHU GAIN	$3,103.83	$10,384.52	$3,159.88	$3,013.29	$3,059.28	$3,007.6

It needs to be made clear that the information developed to compare the cost efficiency of acquiring potential mitigation lands downstream within the Middle Trinity Basin as opposed to acquiring the lands jointly evaluated by the Corps and the U.S. Fish and Wildlife Service and recommended by the U.S. Fish and Wildlife Service, is based upon review of existing information documented during the Lower Trinity River study and does not reflect the degree of technical precision that was obtained during detailed studies of the lands recommended by the U.S. Fish and Wildlife Service. The actual management (tree planting, thinning, fencing, number of nest boxes to be provided) may vary substantially, however, these needs and their subsequent costs cannot be determined without detailed on-site evaluations including field data for the Habitat Evaluation Procedures. It should also be noted that the $20,000 O&M estimated for the District's recommended mitigation plan was developed jointly with the U.S. Fish and Wildlife Service and presumes that due to the proximity of the sites to the sponsor's center of business, that the oversite and routine care of the mitigation features can be handled by currently employed staff as a slight increase in exist duties.

Therefore our review of operation and management responsibilities of an approximate 1000 acre forested wetland mitigation site located within the Trinity flood plain, downstream from Dallas is based upon the difference in land costs and labor and travel costs. After discussion with Corps of Engineer employees representing Real Estate and Operations, it was determined that to reasonably assure that a forested site would respond to prescribed treatments in an manner appropriate to producing fish and wildlife mitigation, an observable physical presence is necessary on-site over the term of the mitigation project life. Fire, disease, vandalism, and timber rustling (firewood, heartwood, saplings, etc.) could devastate a forested mitigation site rapidly unless the property receives continual care and frequent observation. There are a number of ways that this oversite could be achieved.

The options for evaluated for the sponsor who is responsible for O&M include the following :

a. Contract with Texas Parks and Wildlife Department
b. Establish a residence at management area
c. Use existing or hired City of Dallas project manager and hired labor that would travel back and forth.

Based upon past experience, it is highly unlikely that Texas Parks and Wildlife Department would manage a relatively small forested mitigation area. Establishment of a permanent residence would involve additional start up costs and subsequent O&M. In addition, it is anticipated that an on-site manager would still be required to frequently travel to and from Dallas for coordination with other City officials on a frequent basis.

A decision was made to base operations and maintenance costs on having a full time manager and an assistant devoting varying amounts of time to the project. The team would travel back and forth between Dallas and the mitigation site three times per week during construction and in particular during the life of the project to establish a presence in adjacent communities and assure operation and maintenance needs are observed and appropriately addressed. We believe that the information developed adequately and accurately represents the additional current operations and maintenance costs that would be necessary to maintain a forested mitigation site remotely located from the sponsor's center of business.

Of the five remotely located sites economically evaluated, three appear to have potential to provide mitigation for fish and wildlife values, however, the distance away from the Dallas Floodway Extension project impacts ability to successfully manage at a reasonable cost. Of the three having best potential, the Hagen Bottoms Site appears most similar in size and existing vegetative cover breakdowns to the mitigation lands evaluated in Dallas County adjacent to the proposed project. The operations and maintenance costs were estimated for this site based upon three round trips per week plus additional local travel totally 34,320 miles per year. At existing current rates of $0.31 per mile, the mileage costs total $10, 639 per year. Total labor was estimated at $163,433 per year which includes a full time manager at a fully burdened cost of $114,400 per year and an assistant for slightly less than three quarters of a man year at a fully burdened rate of $67,200 per year. Future energy costs and labor costs were not considered but it can safely be presumed that the costs would increase over the life of the mitigation management. Operations and maintenance costs for other sites was calculated from a similar approach.

The results of the evaluation indicates that although land can be acquired at locations remote from the proposed project area at a lower initial cost, the benefits of such a proposal are overcome by the additional operation and management costs during the life of the project. It should be noted that the Catfish/Beaver Creeks area and the Buffalo/Linn Creeks areas do not meet the mitigation (AAHU) requirements to offset losses attributable to the proposed project either singular or when combined with each other. In addition, management of separate tracts so remote from the project site is not desirable from an economic or logistic stand point. The recommended mitigation plan was formulated consistent with project planning objectives and with mitigation policy. Use of mitigation lands in the project study area adjacent to the project causing the damages helps to meet the planning goal of protecting and restoring habitat values within the study area. Further mitigation policy prescribes that a sequence be used in identifying mitigation areas. That sequence calls for first looking for opportunities in project land, then in the immediate project area adjacent to the project causing the damages, and finally if the first options are not available, to look off site (but preferably within the same watershed). While mitigation cannot be accomplished on project lands, the recommended mitigation plan adjacent to the project is cost effective, incrementally justified and fully supported by the resource agencies and project sponsor. It should be also noted that even if the economic evaluation had shown that any of the alternate mitigation sites were slightly more cost effective, the remote sites likely would be found unacceptable to resource agencies and the sponsor. In addition, the proposed removal of trees as part of the project influence many other factors that would not be mitigated by selection of a remote location. For example, Dallas County is in a non-attainment area for ozone, and intensified regulatory requirements are in place currently, that are proposed to be even more strict within the next year. Our analysis indicates that the removal of trees as proposed by our project would have a slight effect on the potential removal of ozone from the local area. Replacement of the trees through the District's proposed fish and wildlife mitigation plan would result in an overall improvement of ozone reducing capability in the study area. Location of the mitigation site in Anderson County would not. As a result of this analysis, it has been determined that acquisition of mitigation lands near to the proposed project as requested by the sponsor and recommended by the Fish and Wildlife Services is economically justifiable.

Habitat Management cost effectiveness

Grassland Conversion to Forest. An almost unlimited combination of tree planting techniques could be evaluated to determine cost effectiveness for various grassland to forest conversion and forest stand improvement techniques. It was determined that only those combinations where it is possible to reliably estimate the effect of the planting combination on the net result in terms of habitat improvement (Habitat Units). An analysis to show cost effectiveness of different planting schemes is presented in Table 16.

Table 16
Vegetation Management Cost Effectiveness

REFORESTATION TECHNIQUES	COST PER ACRE	AVERAGE ANNUAL HABITAT GAIN (AAHU) PER ACRE	COST PER AAHU GAIN
Plan 1. 40 containerized trees and 10 shrubs per acre	$3857	0.71	$5,432
Plan 2. 10 containerized trees, 5 shrubs and 100 seedlings per acre	$1,050	0.65	$1,615
Plan 3. 5 containerized trees, 5 shrubs and 200 seedlings per acre	$ 900	0.67	$1,343
Plan 4. 300 mast tree seedlings and 150 shrub seedlings per acre	$ 500	0.64	$ 781

The analysis indicates that the most cost effective means of forest regeneration within the floodway is derived by following the scheme as outline in Plan 4. Planting of 300 mast tree seedlings and 150 shrub seedlings per acre will provide one average annual habitat unit for every $781 of initial cost investment. However, Plan 1 represents the planting regime recommended by the US Fish and Wildlife Service and was the basis for their recommended mitigation plan of 1154 acres to mitigate the proposed project losses. Since Plan 4 provides only 90 % (0.64/0.71)of the mitigation provided for grassland to forest conversion by Plan 1, an additional 11% of grassland would need to be added to the project to provide the habitat values needed. The Fish and Wildlife Service's recommended mitigation plan contained 228 acres of grassland, an additional 11% increase would result in the need to acquire and convert an additional 25 acres of grassland at an approximate cost of $2500 per acre. The Services plan for converting 208 acres of grassland to bottomland hardwood forest was estimated to cost approximately $624,000 excluding land costs. Addition of 25 acres including land cost and utilizing the mitigation planting technique that appears to be most cost effective for all 233 acres results in a cost to convert grassland to forest of approximately $195,010.

<u>Habitat Improvement of Existing Forest</u>. The Service also recommended in their mitigation plan that 5 containerized mast trees should be planted per acre in lands acquired that contain existing bottomland forest. For several reasons, we have determined that we have determined that planting with bare root seedlings should not be considered as a management option in these existing wooded areas. Shading from existing non-hard-mast trees would preclude their growth and we have determined that no habitat gain would occur from bare root seedlings within the existing forest. The planting with containerized trees at a rate of 5 trees per acre along with appropriate site preparation is recommended for the forested areas that are designated for habitat improvement.

Corps Mitigation Recommendation

Based upon the alternative analyses conducted, it appears that the mitigation plan recommended by the US Fish and Wildlife Service will meet the goal of no net loss of bottomland hardwood habitat. It also appears that location of the mitigation within the Trinity main-stem flood plain near the project is justifiable and appropriate since operation and maintenance costs for sites located farther downstream overcome the benefits of lower initial acquisition cost.

We have determined that the vegetation management plan proposed by the Service in existing forested areas is justifiable; however, it has been determined that planting of bare root mast tree and shrub seedlings is more cost effective than planting containerized trees and shrubs where conversion of grassland to bottomland hardwood forest is proposed. Our analysis indicates that although per acre costs are lower, the average annual habitat gains per acre are only 90% of that achieved by the planting regime recommended by the Service. Therefore an additional 25 acres of grassland should be acquired and converted to bottomland hardwood forest by planting with bare root seedlings. The Corps recommended mitigation plan would result in a significant initial cost savings over that proposed by the US Fish and Wildlife Service and would meet the planning objective of no net loss of bottomland hardwood forest habitat. It is proposed that the additional 25 acres of grassland be acquired adjacent to the area identified on Figure 3 as "Other Public Lands" located between US Highway 175 and the Trinity River and immediately upstream of the mitigation area proposed by the Service that adjoins Loop 12.

Table 17 displays the development and management techniques associated with the mitigation proposed for the LPP as proposed by the Corps. Table 18 shows a breakdown of mitigation required by feature and alternative utilizing the Corps mitigation proposal.

Table 17

Habitat development features to mitigate impacts to bottomland hardwood the Dallas Floodway Extension-LPP, including CoW, Lamar Levee and sumps, Cadillac Heights Levee, and I-45 Channel Diversion based upon Corps of Engineers planting plans.

A. Acquisition

1. 926 acres of Bottomland Hardwood Forest
2. 253 acres of Mixed grass/forbland

B. Initial Development

1. Habitat Improvement of existing BLH's
   a. Selective thinning 463 acres.
   b. Mast trees (containerized at rate of 5 trees Per acre on 235 acres) 1175 trees
   c. Tree Planting with site prep 1175 trees
   d. Shear, rake, pile and bed 50 acres
   e. Passerine and squirrel nest boxes, acquire and install 270 boxes

2. Conversion of mixed grassland to BLH's
   a. Shredding/disking 223 acres
   b. Hardwood seedlings (300 seedlings/acre for 223 acres)
   c. Shrub seedling planting(150 seedlings/acre for 208 acres
   d. Passerine nest boxes 223 boxes

3. Fencing 6 miles
4. Signs

Table 18

Mitigation required by feature, LPP, TFSP and Non Structural Alternatives based upon Corps of Engineers proposed mitigation planting plan.

CoW	649 Ac	$ 2,567,230
Lamar Levee/sump	400 Ac	$ 1,574,600
SPF Cadillac Levee	59 Ac	$ 238,450
100 yr Cadillac Levee	1 5 Ac	$ 25,913
I45 Diversion	71 Ac	$ 279,110
NON STRUCTURAL	1027 Ac	$ 4,420,940
LPP	1179 Ac	$ 4,659,390
TFSP	1135 Ac	$ 4,446,853

Executive Order 11988 - Flood Plain Management

The spirit and intent of Executive Order 11988 have been considered in preparation of this action. There are no feasible alternatives to conducting activities within the 100-year flood plain of the Trinity River and measures have been considered to minimize impacts to the flood plain through project design. Additionally, the City of Dallas currently has several programs for management of the Trinity River 100-year flood plain following proposed project implementation. The City is a participant in the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program and the Community

Rating System (CRS). The City maintains a Corridor Development Certificate from the North Texas Council of Governments, has a Flood Warning System for the Trinity River Basin and a Flood Plain Ordinance which regulates development in the flood plain (Personal Communication: Mr. Loyd Denman, City of Dallas, Department of Flood Plain Management and Erosion Control).

Future flood plain impacts would be controlled through the development of a comprehensive Flood Plain Management Plan (FPMP). An FPMP would be developed by the City which in accordance with Section 202(c) of the Water Resources Development Act of 1996 and the guidance provided by the Secretary of the Army. The FPMP would be developed within one after the signing of the Project Cost Sharing Agreement and implemented within one year after completion of construction of the proposed project.

Section 404 Clean Water Act

The Corps of Engineers has been directed by Congress under Section 404 of the Clean Water Act (33 USC 1344) to regulate the discharge of dredged and fill material into all waters of the United States, including adjacent wetlands. The intent of Section 404 is to protect the nation's waters from indiscriminate discharge of material capable of causing pollution, and to restore and maintain the chemical, physical and biological integrity of these areas. Although the Corps of Engineers does not issue itself permits for proposed activities which would affect waters of the United States the Corps must meet the legal requirements of the Act. Section 404 (r) of the Clean Water Act, waives the requirement to obtain a State Water Quality Certificate provided information on the effects of the discharge of dredged or fill material into waters of the United States, including the application of the Section 404(b)(1) guidelines are included in an environmental impact statement (EIS) on the proposed project and the EIS is submitted to Congress before the actual discharge takes place prior to authorization or appropriation of funds for proposed project construction. A Section 404(b)(1) analysis has been completed and is attached in full as an addendum to this appendix. It is intended to submit the completed GRR and integrated EIS to Congress prior to appropriation of funds for construction occurs.

Sections 9 and 10 Rivers and Harbors Act

Section 9 (33USC 401) and Section 10 (33USC 403) of the Rivers and Harbors Act of 1899 direct the Corps to regulate all work or structures in or affecting the course, condition, or capacity of navigable water of the United States. The main stem Trinity at Dallas is navigable, however, no commercial navigation occurs on the Upper Trinity reach. Recreational use in the form of canoeing and fishing and pleasure boating occurs but to a limited extent and then only during less than flood flow events. The project features proposed would have minimal affect to navigation. The foot print of the Chain of Wetlands would lie on the flood plain adjacent to the main stem. The COW would only function during overbank flow events and during normal operation of the wetlands the hydrologic connections would be to tributary streams. The created wetlands would utilize water from the local waste water treatment plant. Only minimal evaporative losses in water would occur. No impacts to navigational capacity should occur from this feature. The proposed Lamar and Cadillac levees would also lie within the flood plain. Their influence on hydology and hydraulics would also only occur during flood events.

The proposed realignment of the River to protect the I-45 bridge would cause temporary disruption to navigation. The proposed project construction would be phased to allow free flow of the river through the existing channel until the new alignment is almost completed. The lower end of the new channel would then be excavated and connected to the main stem and then the upper connection would be made. Free flow down the new channel would occur quickly and navigation capacity would be restored, prior to backfilling the old channel.

The Corps of Engineers completed an Environmental Impact Statement and a Record of Decision (ROD) in 1988 that addressed the cumulative impacts of a number of unrelated independent proposed actions within the Upper Trinity River basin. The authority for the study was based upon the Corps regulatory requirements. The results of the EIS indicated strongly that there are potential cumulative impacts associated with individual flood plain developments that are both measurable and significant. Public comment and discussion focused on the undesirability of additional regional increases in flood hazards for either the 100-year or Standard Project Flood and that flood plain management should stabilize the flood hazard at existing levels through regulation and efforts of both the Corps and local organizations should be used to reduce flood hazard over the long term. The ROD provided a framework of criteria that would become the basis for the Regulatory Program within the Regional EIS study area. The Regulatory Program includes those actions proposed by the Corps of Engineers that are subject to Section 404, Section 9 or 10 compliance.

Hydraulic criteria applicable to the Dallas Floodway Extension area include that no rise in the 100-year or SPF elevation would be allowed, the maximum allowable loss in storage capacity for the 100-year and SPF discharges will be 0% and 5% respectively, alterations of the flood plain may not create or increase an erosive water velocity on or off site, and the flood plain may be altered only to the extent permitted by equal conveyance reduction on both sides of the channel. The proposed action will also be reviewed on the assumption that adjacent projects would have an equitable chance to be built, such that the cumulative impacts of both will not exceed the common criteria. In addition, since the proposed project includes levees that protect urban development, the minimum design criterion for the top of levee is the SPF plus 4.0, unless a relief system can be designed which would prevent catastrophic failure of the levee system. The ROD also provides criteria for mitigation of unavoidable losses to special aquatic sites including wetlands and guidelines for mitigation of other important resources.

The ROD also provided that variance from the criteria would be made only if public interest factors not accounted for in the Regional EIS overwhelmingly indicated that the "best overall public interest" is served by allowing such variance. During the review of this project proposal by the Corps, other agencies, communities and the public, it will be determined if it meets the ROD criteria or whether resolution of flooding problems of this frequency and magnitude should be deemed as an overriding concern, and if, a variance from the Record of Decision should be allowed as being in "the best overall public interest."

Environmental Justice

Executive Order 12898 provides for review of proposed activities to assess the effect on minority populations and low income populations. The area of potential project impact was screened and it has been determined that the area does contain minority and low income populations. A review of the effects of the proposed project alternatives indicate that all flood control plans, except the combination plan including a non-structural buyout of Cadillac Heights in lieu of a levee, provide significant flood protection for local residents and businesses. The economically feasible buyout of the 25-year flood zone would leave many minority and low income individuals subject to flooding. The proposed Cadillac Heights levee would provide protection from the Standard Project Flood and would reduce adverse economic impacts of repeated flooding in the area. This levee would impact an existing meat packing facility, but the plant could be relocated immediately adjacent to the existing location, thereby minimizing loss of employment opportunities to local residents.

Should the chain of wetlands be built alone, the majority of the economic benefits would accrue upstream within the Central Business District (CBD), with the negative impacts of forest loss occurring within the floodplain adjacent to Cadillac Heights and to the Lamar business area. There would be some flood damage reduction benefits within the immediate area, but not to the same level as provided to the CBD. Other economic benefits from the multi-purpose chain of wetlands project to the minority and low income populations would accrue due to the influx of recreation users of the trail system that would be constructed.

Building the river diversion at IH-45 to protect a major roadway bridge from catastrophic failure would benefit all people and would not be of detriment to any populations. The Tentative Federally Supportable Plan and the Locally Preferred Plan, including the environmental restoration of emergent wetlands, environmental mitigation, and a recreational trail would also provide benefits to the local area. Another benefit of the overall project is the clean-up of accumulations of trash and debris within the projected lands and some of the hazardous and toxic wastes in the project footprint. The proposed project would not result in disproportionate impacts to minority or low income populations. Recognizing the overall balance of benefits and impacts that would occur from the proposed project. It has been determined that implementation of either the TFSP or the LPP along with the river realignment would be in compliance with the intent and spirit of Executive Order 12898.

Table 2
Vegetation Species List

Trees — Common Name	Genus/species
Boxelder	*Acer negundo var. negundo*
Virginia redcedar	*Juniperus virginiana*
Persimmon	*Diospyros virginiana*
Eastern redbud	*Cercis canadensis var. candensis*
Honey locust	*Gleditsia triacanthos*
Eve's necklace	*Sophora affinis*
Bur oak	*Quercus macrocarpa var. macrocarpa*
Shumard red oak	*Quercus shumardii var. shumardii*
Texas buckeye	*Aesculus arguta*
Pecan	*Carya illionensis*
Osage orange	*Maclura pomifera*
White mulberry	*Morus alba*
Red mulberry	*Morus rubra*
American ash	*Fraxinus americana*
Pennsylvania ash	*Fraxinus pennsylvanica*
Texas ash	*Fraxinus texensis*
Green hawthorn	*Crataegus viridis*
Eastern cottonwood	*Populus deltoides ssp. deltoides*
Black willow	*Salix nigra*
Western soapberry	*Sapindus saponaria var. drummondii*
Wooly bumelia, Chittamwood	*Sideroxylon lanuginosa ssp. oblongfolia*
Sugar hackberry	*Celtis laevigata var. laevigata*
American elm	*Ulmus americana var. ameriacana*
Cedar elm	*Ulmus crassifolia*

Shrubs/Vines — Common Name	Genus/species
Oakleaf poison oak/Poison ivy	*Toxicodendron pubescens*
Possumhaw	*Ilex decidua*
Wooly dutchman's pipe	*Aristochia tomentosa*
Smooth swallow wort	*Cynanchum laeve*
Anglepod milkvine	*Gonolobus gonocarpus*
Japanese honeysuckle	*Lonicera japonica*
American elderberry	*Sambucus canadensis var. canadensis*
Coralberry	*Symphoricarpus orbicularis*
Burning bush	*Evonymus atropurpurea*
Sharppod morningglory	*Ipomoea codatotriloba var. codatotriloba*
Roughleaf dogwood	*Cornus drummondii*
Drooping melonette	*Melothria pendula var. pendula*
Swamp privet	*Forestiera acuminata*
Smooth elbowbush	*Forestiera pubescens var. glabrifolia*
Thinleaf privet	*Ligustrum quihoui*
Chinese privet	*Ligustrum sinense*
Maypop	*Passiflora incarnata*
Yellow passionflower	*Passiflora lutea*
Purple leatherflower	*Clematis pitcheri var. pitcheri*
Southern dewberry	*Rubus trivalis*
Balloonvine	*Cardiospermum halicacabum*
Greenbrier	*Smilax bona-nox*
Greenbrier	*Smilax tamnoides*
Common greenbrier	*Smilax rotundifolia*
Peppervine	*Ampelopsis arborea*
Heartleaf peppervine	*Ampelopsis cordata*
Virginia creeper	*Parthenocissus quinquefolia*
Summer grape	*Vitis aestivalis*
Mustang grape	*Vitis mustangensis*

Herbaceous Species — Common Name	Genus/species
Dicliptera	*Dicliptera brachiata*
Limestone ruellia	*Ruellia strepens*
Hairy tonguetube	*Siphonoglossa pilosella*
Alligator weed	*Alternanthera philoxeroides*
Palmer amaranth	*Amaranthus palmeri*
Berlandier amaranth	*Amaranthus polygonoides*
Tamarix amaranth	*Amaranthus rudis*
Canada sanicle	*Sanicula canadensis var. canadensis*
Cluster sanicle	*Sanicula odorata*
Hedge-parsley	*Torilus arvensis*
Golden alexander	*Zizia aurea*
Common ragweed	*Ambrosia artemiisifolia*
Western ragweed	*Ambrosia psilostachya*
Giant ragweed	*Ambrosia trifida var. texana*
Tall aster	*Aster prealtus var prealtus*
Hierba del Marrano	*Aster subulatus var. ligulatus*
Roosevelt weed	*Baccharis neglecta*
Devil's beggar ticks	*Bidens frondosa*
American basketflower	*Centaurea americana*
Texas thistle	*Cirsium texanum*
Prostrate lawnflower	*Calyptocarpus vialis*
Horsetail conyza	*Conyza canadensis var. canadensis*
Clasping coneflower	*Dracopis amplexicaulis*
Yerba de tago	*Eclipta prosrata*
Late eupatorium	*Eupatorium serotinum*
Broadleaf camphorweed	*Heterotheca subaxillaris var. latifolia*
Old plainsman	*Hymenopappus scabiosaeus var. corymbosus*
Marshelder	*Iva annua*
Louisiana lettuce	*Lactuca ludoviciana*
Prickly lettuce	*Lactuca serriola*

False ragweed	*Parthenium hysterophorus*
Sawleaf daisy	*Prionopsis ciliata*
Manystem false dandelion	*Pyrrhopappus pauciflorus*
Prairie coneflower	*Ratibida columnifera*
Brown-eyed Susan	*Rudbeckia hirta var. pulcherrima*
Scabrous goldenrod	*Solidago canadensis var. scabra*
Prickly sowthistle	*Sonchus asper*
Common sowthistle	*onchus oleraceus*
Yellow salsify	*Tragopogon dubius*
Baldwin ironweed	*Vernonia baldwinii ssp. baldwinii*
Cocklebur	*Xanthium strumarium var. canadense*
Shepard's purse	*Capsella bursa-pastoris*
Virginia peppergrass	*Lepidium virginicum var. virginicum*
Clasping Venus lookingglass	*Triodanis perfoliata var. perfoliata*
Sleepy catchfly	*Silene antirrhina*
Chickweed	*Stellaria media*
Lambsquarters	*Chenopodium album var. album*
Pitseed goosefoot	*Chenopodium berlandieri var. berlandieri*
Narrow dayflower	*Commelina erecta var. augustifolia*
Texas bindweed	*Convolvulus equitans*
Carolina ponyfoot	*Dichondra carolinensis*
Cherokee sedge	*Carex cherokeensis*
Emory sedge	*Carex emoryi*
Sawgrass	*Cladium jamaicense*
Taperleaf flatsedge	*Cyperus acuminatus*
Largespike spikerush	*Eleocharis palustris*
Western umbrellagrass	*Fuirena simplex*
Spotted spurge	*Chamaesyce maculata*
Prostrate spurge	*Chamaesyce prostrata*
Mat spurge	*Chamaesyce serpens*
Toothed spurge	*Euphorbia dentata*

Fern acacia	*Acacia angustissima var. Hirta*
Prairie senna	*Chamaecrista fasciculata*
Illinois bundleflower	*Desmanthus illinoensis*
Velvet bundleflower	*Desmanthus velutinus*
Western scarlet pea	*Indigofera miniata var. leptosepala*
Low peavine	*Lathyrus pusillus*
Black medic	*Medicago lupulina*
Buttonclover	*Medicago orbicularis*
White sweetclover	*Melilotus albus*
Sourclover	*Melilotus indicus*
Yellow sweetclover	*Melilotus officinalis*
Filaree	*Erodium cicutarium*
Carolina geranium	*Geranium carolinianum*
Swordleaf blue-eyed grass	*Sisyrinchium chilense*
Henbit	*Lamium amplexicaule*
Purple deadnettle	*Lamium purpureum*
Lemon beebalm	*Monarda citriodora var. citriodora*
Dotted beebalm	*Monarda punctata var. intermedia*
Wood sage	*Teucrium canadense var. canadense*
Wild onion	*Allium canadense var. caradense*
False garlic	*Nothoscordum bivalve*
Low winecup	*Callirhoe involucrata var. involucrata*
Carolina modiola	*Modiola caroliniana*
Spreading spiderling	*Boerhavia diffusa*
Lizardtail gaura	*Guara parviflora*
Roadside gaura	*Guara suffulta ssp. suffulta*
Common evening primrose	*Oenothera biennis ssp. centralis*
Cutleaf evening primrose	*Oenothera laciniata*
Roundleaf evening primrose	*Oenothera rhombipetala*
Showy primrose	*Oenothera speciosa*
Stemless primrose	*Oenothera triloba*

Dillen oxalis	*Oxalis dillenii ssp. dillenii*
White pricklypoppy	*Argemone albiflora ssp. texana*
Pokeberry	*Phytilacca americana var. americana*
Pigeonberry	*Rivina humilis*
Redseed plantain	*Plantago rhodosperma*
Purple threeawn	*Aristida purpurea var. purpurea*
King Ranch bluestem	*Bothriochloa ischaemum var. songarica*
Sideoats grama	*Bouteloua curtipendula var. curtipendula*
Japanese brome	*Bromus japonicus*
Common sandbur	*Cenchrus carolinianus*
Broadleaf woodoats	*Chasmanthuim latifolium*
Tumble windmillgrass	*Chloris vericillata*
Bermudagrass	*Cynodon dactylon*
Wooly rosettegrass	*Dichanthelium acuminatum var. acuminatum*
Jungle rice	*Echinichloa colona*
Barnyardgrass	*Echinichloa crus-galli var. crus-galli*
Barnyardgrass	*Echinichloa crus-pavonis var. macera*
Plains lovegrass	*Eragrostis intermedia*
Canadian wildrye	*Elymus canadensis*
Perennial ryegrass	*Lolium perenne ssp. perenne*
Texas wintergrass	*Nassella leucotricha*
Dallisgrass	*Paspalum dilatatum*
Annual bluegrass	*Poa annua*
Johnsongrass	*Sorghum halepense*
Prostrate knotweed	*Polygonum aviculare*
Swamp smartweed	*Polygonum hydropiperoides var. hydropiperoides*
Pensylvania smartweed	*Polygonum pensylvanicum*
Dotted smartweed	*Polygonum punctatum*
Curly dock	*Rumex crispus*
Fiddle dock	*Rumex pulcher*
Ten-petal anemone	*Anemone berlandieri*

White avens	*Geum canadense var. texanus*
Cleavers	*Galium aparine*
Beach groundcherry	*Physalis cinerascens var. cinerascens*
Clammy groundcherry	*Physalis heterophylla var. heterophylla*
Virginia groundcherry	*Physalis virginiana var. virginiana*
Black nightshade	*Solanum ptycanthum*
Southern cattail	*Typha domingensis*
Heartleaf nettle	*Urtica chamaedryoides var. chamaedryoides*
Prairie verbena	*Glandularia bipinnatifida var. bipinnatifida*
Sawtooth frogfruit	*Phyla incisa*
Slender verbena	*Verbena halei*
American germander	*Teucrium canadense*
Missouri violet	*Viola sororia var. missouriensis*

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EVALUATION OF THE CHAIN OF WETLANDS PLUS LEVEES PLAN OF THE DALLAS FLOODWAY EXTENSION IN ACCORDANCE WITH SECTION 404(b)(1) GUIDELINES

I. PROJECT DESCRIPTION. See basic report

A. Location. See basic report

B. General Description. See basic report

C. Authority and Purpose. This document fulfills the requirements of Section 404 (b)(1) of the Clean Water Act.

D. General Description of Dredged or Fill Material.

(1) General Characteristics of Material. The study area is in the Trinity-Urban land complex which consists of deep, nearly level, somewhat poorly drained soils and Urban land on flood plains. Urban land consists of fill material, and clayey material spread up to 3 feet deep on the flood plains. The Trinity soil is moderately alkaline, very dark, gray clay 30 inches thick. The clay becomes black to a depth of 48 inches and becomes a dark grayish brown clay to a depth of 80 inches. Urban land makes up approximately 20 % of the soil, the Trinity soil makes up approximately 60% and the remaining 20% is comprised of the Frio, Gowen and Ovan soils. (Maxim report of Sept. 1990). In 1995, Maxim Technologies, Inc. tested soil and sediment samples from the river and overbank in an area between the Corinth Street viaduct and the AT&SF railroad bridge. Five soil borings from the right descending bank were obtained by drilling to 20 feet below surface grade. Core lengths ranged from 1.8 to 3.4 feet. All samples contained tan and gray clayey sand(SC), sand (SP) and sand and gravel (SP) to the top of limestone at 7 to 8 feet; these samples also contained petroleum hydrocarbon odors. The odors appeared to decrease with increasing distance from upstream pump discharge points.

(2) Quantity of Material. About 3.2 million cu. yds. of material are proposed to be excavated at the site to create the swale, a series of wetlands, sumps on the protected side of the Lamar Street levee, and levee inspection trenches. The amount of fill which would be required to construct two levees and several wetland control structures is about 1.3 million cu. yds. The amount of material for disposal is, therefore, approximately 1.9 million cu. yds. The material excavated for the new channel is proposed to be used to fill the old channel portion. It is not expected that there would be any excess material from the realignment portion of the project. Approximately 479,000 cubic yards of this material will be disposed on in a class I non-hazardous landfill. In addition, approximately 11,722 cubic yards of concrete would be used to construct the hike and bike trail described in Appendix I, Recreation.

(3) Source of material. The overbank on the right descending side of the river would be the source of the excavated material for the swale and the realigned channel in the flood plain. This includes floodplain lands, two closed sludge landfills and a closed municipal landfill. Excavation would also take place on the protected side of the Lamar Street levee to create sumps.

E. Description of the Proposed Discharge Site. Much of the excavated material would go into the proposed levees. Contaminated soil and old landfill material would be disposed of in an appropriate landfill. Material excavated for the new channel would be used to fill in the old channel.

Disposal of clean fill would be within a 1000 +/- acre site in the City of Dallas bounded by Post Oak Road, Pleasant Run Road, East Wintergreen Street, and Cottonwood Creek. A portion of it is presently being mined for sand and gravel. It contains some moist sites but is out of the 100-year flood plain and is not jurisdictional.

F. **Description of Disposal Method**. Material would be transported by haul truck from point of excavation to the levee construction site or the old channel bed. Contaminated material would also be hauled by truck for disposal in appropriate landfills. The clean fill would be dumped at the proposed levee site and the excess would be placed at an approved disposal site located out of the flood plain in south Dallas County and graded.

II. FACTUAL DETERMINATIONS.

A. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. The new channel would be at the same elevation as the bypassed segment (371' MSL) and, as is the case in the existing channel bed, it would be at zero slope.

(2) Sediment Type. The sediments in the study area of the Trinity River flood plain are described as alluvium floodplain deposits including indistinct low terrace deposits; gravel, sand, silt, silty clay and organic matter (Maxim, 1990). The new channel bed would be constructed by excavating 25 feet of overbank down to 371' MSL. Boring samples taken in 1980 by the Corps of Engineers show that at that level the soil consists of calcareous clay with sand.

(3) Dredged/Fill Material Movement. Much of the excavated material would be used in the construction of the levees. Some excess clean topsoil would be used as fill in one of the mitigation areas. Material from the new channel excavation would be used as fill for the old channel bed. Contaminated excavated material would be transported by haul truck to a suitable landfill. Minor amounts of fill may be required to stabilize the subgrade for the proposed recreation trails.

(4) Physical Effects on Benthos.

The benthic organisms in the present channel bed would be buried when the channel realignment takes place, but this is a relatively small area. The newly dug channel diversion would likely be repopulated, after a period of stabilization, with the same types of organisms as those which presently exist at the site.

(5) Other Effects. None.

(6) Actions Taken to Minimize Impacts.

(a) The swale alignment has been chosen to impact as little forested area as possible and still provide effective flood control.

(b) The two outflows from the wetlands to the creeks have been designed to prevent erosion at the discharge site. Water would flow from the wetlands through an underground 36" pipe, down a gradual slope and into the creeks below the water surface level.

(c) When the new channel portion is finished and ready to be flooded, it would be filled from the downstream end in order to avoid erosion from high flow rates and turbulence. This would also minimize the amount of sediment which would be carried downstream.

(d) It would be necessary to completely excavate the new channel before the old channel can be filled in. In order to have available the maximum land area for stockpiling the excavated material, the rechannelization construction would precede the construction of the wetlands. In this way, forested areas and grasslands would not be impacted unnecessarily.

(e) A portion of the Linfield Landfill would be excavated when the lower swale is constructed. The remainder would be sealed off with a slurry wall.

B. Water Circulation, Fluctuation and Salinity Determinations.

(1) Water.

(a) Salinity. Not applicable.

(b) Water Chemistry. The portion of the Trinity River in the study area is part of segment 805 as designated by the Texas Natural Resource Conservation Commission (TNRCC). It extends 100 miles "from a point immediately upstream of the confluence of the Cedar Creek reservoir discharge canal in Henderson/Navarro County to a point immediately upstream of the confluence of Elm Fork Trinity River in Dallas County". 1996 water quality information on segment 805 of the Trinity River is as follows (TNRCC, 1996):

- water temperature range: 7.90-33.50 C
- *DO: 4.70-11.60 mg/l
- pH: 6.80-8.20
- chloride: 10.00-201.00 mg/l
- sulfate: 24.00-126.00 mg/l
- specific conductance: 230.00-854.00 μmhos
- TDS: 207.35-555.10 mg/l
- ammonia: 0.02-0.76 mg/l
- *nitrates and nitrites: 0.60-11.83 mg/l
- *orthophosphorus: 0.10-3.69 mg/l
- *total phosphorus: 0.05-9.06 mg/l
- chlorophyll a: 1.00- 23.50 μg/l
- *fecal coliform: 10.00-8900.00 #/100 ml

* indicates areas of concern

These data have shown gradual improvement over time, and, in the last two years, particularly in dissolved oxygen. Passage of the CWWTP effluent through the chain of wetlands can improve the water quality by acting as a sink for the nutrients nitrogen and phosphorus. Tarrant County Water Control and Improvement District (TCWCID) evaluated water quality improvement in a small constructed wetland (4 acres) and reported removal of an average of 90% of nitrogen and 88% of phosphorus (Darryl Andrews TCWCID). Typically, fecal coliform values are reduced as well in water flowing through wetlands.

(c) Clarity. There would be a temporary increase in turbidity when the new channel portion is opened to flow from the river; however, it would be backfilled from the downstream end to minimize erosion and prevent adverse impacts from a high sediment load.

(d) Color. Not applicable.

(e) Odor. Not applicable to realignment project. In the wetlands, possible odor problems might develop.

(f) Taste. Not applicable.

(g) Dissolved Gas Levels. TNRCC (1996) Trinity River segment 805 data reports a dissolved oxygen range of 4.70-11.60 mg/l. USGS has a Continuous Automated Monitoring System (CAMS) in place on the West Fork, East Fork and mainstem Trinity River. The DO is expected to be the same in the river waters after the channel realignment. The DO of the water flowing into the river from the wetlands can be at kept at acceptable levels with constant flow (using the pumping system) if necessary.

(h) Nutrients. Not applicable to realignment project. The nitrates/nitrites water quality screening level used by TNRCC is 1.0 mg/L. In the 1996 TNRCC Water Quality Inventory report, this value was reported to have been exceeded 92.5% of the time for segment 0805. A similar situation exists for phosphorus.

The screening level for orthophosphorous is 0.10 mg/L and for total phosphorus is 0.20 mg/L. These values were exceeded 97.67% and 94.59% of the time respectively. High concentrations of these nutrients are one of several reasons this segment of the Trinity River is classified by the TNRCC as "water quality limited". Although the chain of wetlands has not been designed, nor would it function, as a water quality improvement site, wetland vegetation would become established in the wetland cells and nutrient removal would result as a passive feature of the wetlands complex. The removal of some of these nutrients by wetlands would have a positive effect on the overall water quality in this portion of the river.

(i) Eutrophication. Not applicable to channel realignment. Wetlands would be managed to minimize accumulation of organic materials that would affect water quality.

(j) Others as Appropriate.

(2) Current Patterns and Circulation.

(a) Current Patterns and Flow. The present flow pattern of the river would be changed in a portion of the channel bed. A 3400 linear foot segment of the present river channel under the IH-45 bridge is proposed to be relocated 150 feet to the west in order to reroute flow away from bridge piers in the channel bed. These piers trap debris and impede flow. Flow rates and current patterns would not be changed significantly; however, flow would no longer be impeded by debris accumulation at the bridge piers.

b) Velocity. Normal flows would not be affected by the discharge of dredged or fill material should this project be implemented. The new portion of the channel bed in the realignment project has been designed to be similar to the existing reach in order to maintain present water velocities.

(c) Stratification. Not applicable.

(d) Hydrologic Regime. The chain of wetlands proposed for construction on the west side of the river is a new feature for this area; however, the presence of these wetlands would not significantly change the hydrology of the river either at this location or downstream. Even though the channel would be realigned under the IH-45 bridge, the new channel segment was designed with physical features similar to the old portion so that the hydrology would not change.

(3) Normal Water Level Fluctuations. Nothing in this proposed action would affect normal water level fluctuations. Only extreme floodflows would be affected.

(4) Salinity Gradients. Not applicable.

(5) **Actions That Would be Taken to Minimize Impacts.** In order to prevent a high sediment load from the new channel bed, it would be allowed to backfill first, then the upstream plug would be removed to complete the rerouting of the water. The old channel bed segment would then be plugged and filled with material excavated from the new channel. In this way, there would be little additional turbidity carried downstream from the construction site.

C. Suspended Particulate/Turbidity Determinations.

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Disposal Site. There would be temporary increases in suspended particulates and turbidity levels when the new channel portion is constructed. These increases, however, would be of short duration and at levels tolerable to aquatic organisms downstream. Construction design and phasing have been planned to minimize turbulence and generation of suspended particulates.

Turbidity in the river waters is not expected to change as a result of the wetland construction. Wetlands are typically a sink for suspended particles, however, effluent from the CWWTP is already very clear (average 1.3 NTU) so the discharged water to the creek would not contribute to turbidity.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light Penetration. Realignment of the channel would produce temporarily turbid conditions in the new channel portion and downstream from it, but particulates should settle out again shortly after construction is completed. There would be a relatively short period of decreased light penetration but, because these waters are somewhat turbid under normal circumstances, no adverse effects are expected.

(b) Dissolved Oxygen. Insignificant from standpoint of turbidity in realigned channel and in wetlands. The increased turbidity would be of short duration and would not affect oxygen content.

(c) Toxic Metals and Organics. No release of toxic substances would occur from the realignment of the channel bed. Soil borings taken from this area show no contaminants. The soil to be excavated for the new channel would be used to fill in the old channel portion.
Much of the swale would be located where there are old capped landfills or other sites of contaminated material. (For example, Lagoon E, a closed and capped CWWTP sludge pit; Linfield landfill, closed and capped; Dallas Demolition open dump area; another open area reportedly containing old battery casings; and, the Southern Pacific property adjacent to the Linfield landfill). This material would be removed completely and disposed of at an-as-yet-to-be-designated landfill. Measures would also be taken to prevent leakage of contaminants from these areas into the swale/wetlands area. Such measures would involve, for example, construction of slurry walls to reseal the Linfield landfill.

(d) Pathogens. Not applicable to channel realignment. The Trinity River channel water exceeds the TNRCC standards criteria for fecal coliform bacteria (400 CFU/100 ml) 36% of the time. Wetlands remove coliform bacteria from wastewater through sedimentation and other mechanisms (D.A. Hammer, 1989 p. 332); therefore, water which passes through these constructed wetlands, whether from the wastewater treatment plant or from runoff, would undergo some improvement in coliform content. Neither the channel realignment nor the construction of the sumps would contribute to or create a problem with pathogens.

(e) Aesthetics. This segment of the Trinity River is normally turbid. The increase in turbidity due to the channel realignment would have a negligible and temporary impact on aesthetics. The planned wetlands and recreational areas would ultimately greatly improve the aesthetics of this region of the flood plain.

(f) Others as Appropriate. None.

(3) Effects on Biota

(a) Primary Production, Photosynthesis. There could be a temporary decrease in algal growth during the channel realignment. Construction would produce a short period of high turbidity which would result in reduced light penetration. This situation would be of short duration, however, and have no significant impact. The potential for high algal growth exists for the wetlands. If the high nutrient treatment plant effluent is used to fill them and is left standing (not flowing), conditions would be favorable for high rates of growth in warm temperatures. Water management features of the wetlands such as pumps and weirs, however, provide means for controlling water levels and flow and can be used to prevent buildups of algae.

(b) Suspension/Filter Feeders. Insignificant.

(c) Sight Feeders. Insignificant.

(4) **Actions Taken to Minimize Impacts.** Silt screens and silt curtains would be used to minimize suspended soil content in the river.

D. **Contaminant Determinations.** The channel realignment would not involve sediment removal, only sediment burial. The material to be excavated for the new channel has been determined to contain no contaminants. This material would be used to fill in the old channel bed; therefore, realignment construction would present no contaminant problems.

The swale construction for the upper and lower wetlands would intrude on several contaminated or landfill areas. These include a closed sludge lagoon at the CWWTP, a Southern Pacific RR dump, and the Linfield Landfill. Contaminated material would be completely removed and disposed of at an appropriate landfill. Where the swale would only slightly impinge on a contaminated area such as at the Linfield Landfill, the remaining contaminated material would be resealed.

Sumps would be constructed on the protected side of the Lamar Street levee. This area is and has been highly industrial. Any known contaminated areas would be avoided as sump sites. If any previously unknown contamination is encountered during construction of the sumps, measures would be taken to clean the area or seal off the contaminated volume.

E. **Aquatic Ecosystem and Organism Determinations.**

(1) **Effects on Plankton.** Insignificant in the channel realignment. The potential exists for high algal growth in standing water in the wetlands, however, with a rain event water would flow and flush out the algae. In addition, the wetlands would have a water level management system with water levels able to be controlled by concrete weirs at the outlets of each wetland cell. This feature, coupled with the pumping system proposed at the outflow of the CWWTP, would make possible flushing out of the wetland cells if necessary. There would be no overall effect on river plankton from the wetland discharge waters.

(2) **Effects on Benthos.** Not applicable to wetlands. The benthic organisms in the old channel bed would be buried during the realignment construction. Since this is a relatively short segment (3400 linear feet), it is expected that the same types of organisms would repopulate the new segment shortly after construction is completed. The overall impact would be insignificant.

(3) **Effects on Nekton.** Insignificant.

(4) **Effects on Aquatic Food Web.** Insignificant.

(5) **Effects on Special Aquatic Sites.** Special aquatic sites in the project area, in the form of forested wetlands, would be affected by construction. Other special aquatic site would be constructed, in the form of emergent wetlands. These sites are expected to provide 1) expanded fish and wildlife habitat, 2) natural area buffers and, 3) improved water quality through reduction of nutrients and sediments. The Chain of Wetlands swale would develop a mixture of emergent wetlands, permanent open water and grasslands. These wetlands, in conjunction with the adjacent bottomland hardwood forests and development of native grasslands, have been designed to provide resting and feeding habitat for migrating waterfowl and other waterbirds. Urban tolerant birds would also benefit from the restored wetlands.

(a) Sanctuaries and Refuges. No significant impact.

(b) Wetlands. Some forested wetlands would be removed by construction of the swale, levees and associated sumps, and channel realignment. This information is discussed in the main report text. All wetlands would be mitigated if the proposed project is implemented.

(c) Mudflats. Not significant.

(d) Vegetated Shallows. Not Applicable.

(e) Coral Reefs. Not Applicable.

(f) Riffle and Pool Complexes. Not Applicable.

(6) Threatened and Endangered Species. No threatened or endangered species would be impacted.

(7) Other Wildlife. No significant impacts to other wildlife are expected.

(8) Actions to Minimize Impacts.

f. Proposed Disposal Site Determinations.

(1) Mixing Zone Determination. Downstream of the new channel bed there is the possibility of a temporary increase in sediment load due to erosion. Boring samples in this area show that it would be primarily clay with some sand.

(2) Determination of Compliance with Applicable Water Quality Standards. Through telephone conversations with Jim Davenport in the Standards and Information Group of TNRCC, it has been determined that this project would not exceed applicable water quality standards of the State of Texas as they exist at the present time.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supply. The initial filling of the wetland cells would temporarily divert a large quantity of effluent from the river. This process could take 3-4 weeks. It might be most advantageous to fill the wetlands during the spring in order to take advantage of rain events. Rain water would also dilute the effluent resulting in the impoundment of water not as rich in nutrients. It is not anticipated that any part of this project would have any adverse effects on a water supply.

(b) Recreational and Commercial Fisheries. This portion of the mainstem of the Trinity has been under a Texas Department of Health aquatic life closure since January 1990 due to elevated levels of chlordane; therefore, fish consumption is prohibited. The affected reach extends 19 miles from the upper limit of the segment to IH 20 downstream from Dallas. This project would have no effect on consumable aquatic organisms.

(c) Water Related Recreation. According to the TNRCC, contact recreation use such as swimming is not supported at the present time in the vicinity of the project area. There is no other water related recreation at the present time.

(d) Aesthetics. The aesthetic aspects of this project are of primary concern. Project plans call for full mitigation of all forests, grasslands, wetlands etc. An extensive effort has been put into a plan to develop recreational facilities for a large portion of the study area. Included in this plan are nature trails, equestrian trails, canoe launch sites, etc. At present, there are no recreational facilities other than a small number of parks.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. Not Applicable.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. None

h. Determination of Secondary Effects on the Aquatic Ecosystem. None

III. Findings of Compliance or Non-Compliance with the Restrictions on Discharge.

a. No adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

b. The purpose of the Dallas Floodway Extension Project is to reduce flood damages to local residences and businesses. The Chain of Wetlands Plus Levees Plan has been proposed to provide greater flood protection to the current study area, immediately downstream of the existing Dallas Floodway. Other alternatives to this plan include the no-action, the non-structural plan, the NED Plan and the Chain of Wetlands Plan. The no-action is not practicable due to public pressure to provide greater flood protection to the current study area. The non-structural plan, which would involve buyouts of residences and businesses in the 10-year flood plain in the Cadillac Heights community does not meet project objectives. The NED Plan was controversial because of its adverse impacts on environmental resources within the area and did not have public support. The Chain of Wetlands Plan, without the levees, minimized the environmental impacts, addressed aesthetic concerns, but did not provide flood protection in the study area comparable to that of the Central Business District which is protected by the existing Dallas Floodway levees.

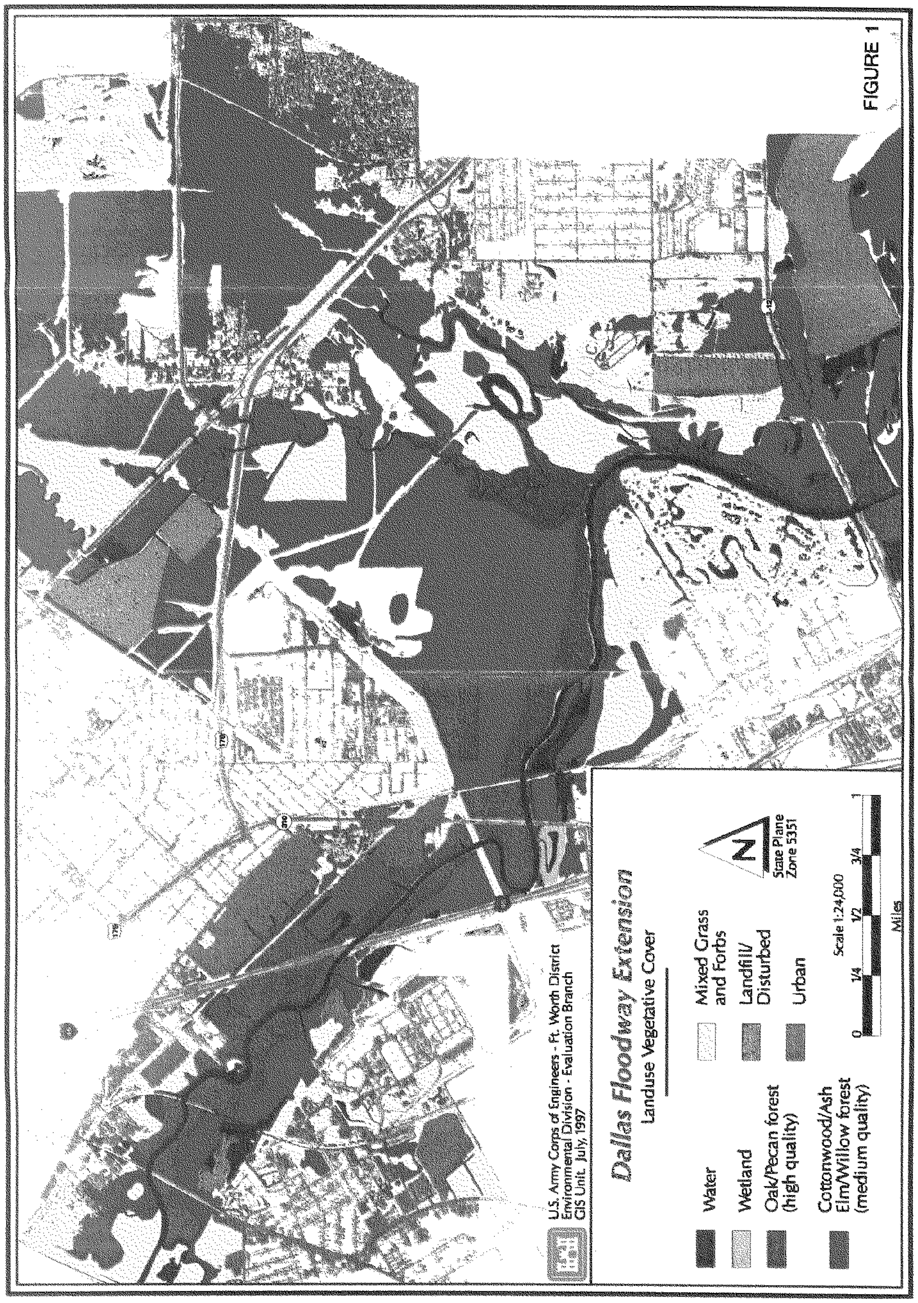
c. The proposed disposal of fill material at the Floodway Extension Project in Dallas, Texas would not violate any applicable State water quality standards. The proposed project would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

d. The proposed project would not affect any federally listed threatened or endangered species or their critical habitat.

e. Neither the Locally Preferred Plan (LPP) nor the Tentative Federally Supportable Plan (TFSP) would result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish and wildlife. The life stages of aquatic life would not be adversely affected nor would life stages of other wildlife. For the LPP, a total of approximately 425 acres would be impacted by the project at the sites for the north and south swales, the 2 levees and the channel realignment. Included would be impacts to 20.62 acres of Pecan- Oak bottomland hardwood forested area, 141.06 acres of Ash-Elm bottomland hardwoods forest and 211.60 acres of mixed grasses and forbs, and 51.3 acres of open water. Mitigation plans would require approximately 1179 acres. This includes acquisition and management of 926 acres of existing forested area, and conversion of 223 acres of existing grassland to bottomland hardwood forest and, preservation of 30 acres of mixed grass forbland. See main appendix text for mitigation details. Mitigation for the TFSP would require approximately 1135 acres with proportional mitigation features to that of the LPP.

f. Appropriate steps to minimize potential adverse impacts of the project on aquatic ecosystems include: designing the new channel bed to the approximate dimensions of the old channel in order to maintain similar water velocities and flow; flooding the new channel from the downstream end in order to prevent a large sediment load from being carried downstream when the new channel is opened; and, developing a storm water pollution prevention plan to be implemented during the construction activities to minimize erosion and sedimentation.

g. On the basis of the guidelines, the proposed disposal site for the discharge of fill material is specified as complying with the requirement of these guidelines.


U.S. Army Corps of Engineers - Ft. Worth District
Environmental Division - Evaluation Branch
GIS Unit. July, 1997
Dallas Floodway Extension
Landuse Vegetative Cover
Water
Wetland
Oak/Pecan forest (high quality)
Cottonwood/Ash Elm/Willow forest (medium quality)
Mixed Grass and Forbs
Landfill/ Disturbed
Urban
N
State Plane Zone 5351
Scale 1:24,000
0
1/4
1/2
3/4
1
Miles
FIGURE 1

DALLAS FLOODWAY EXTENSION

PROJECT LANDS AND OPEN SPACE

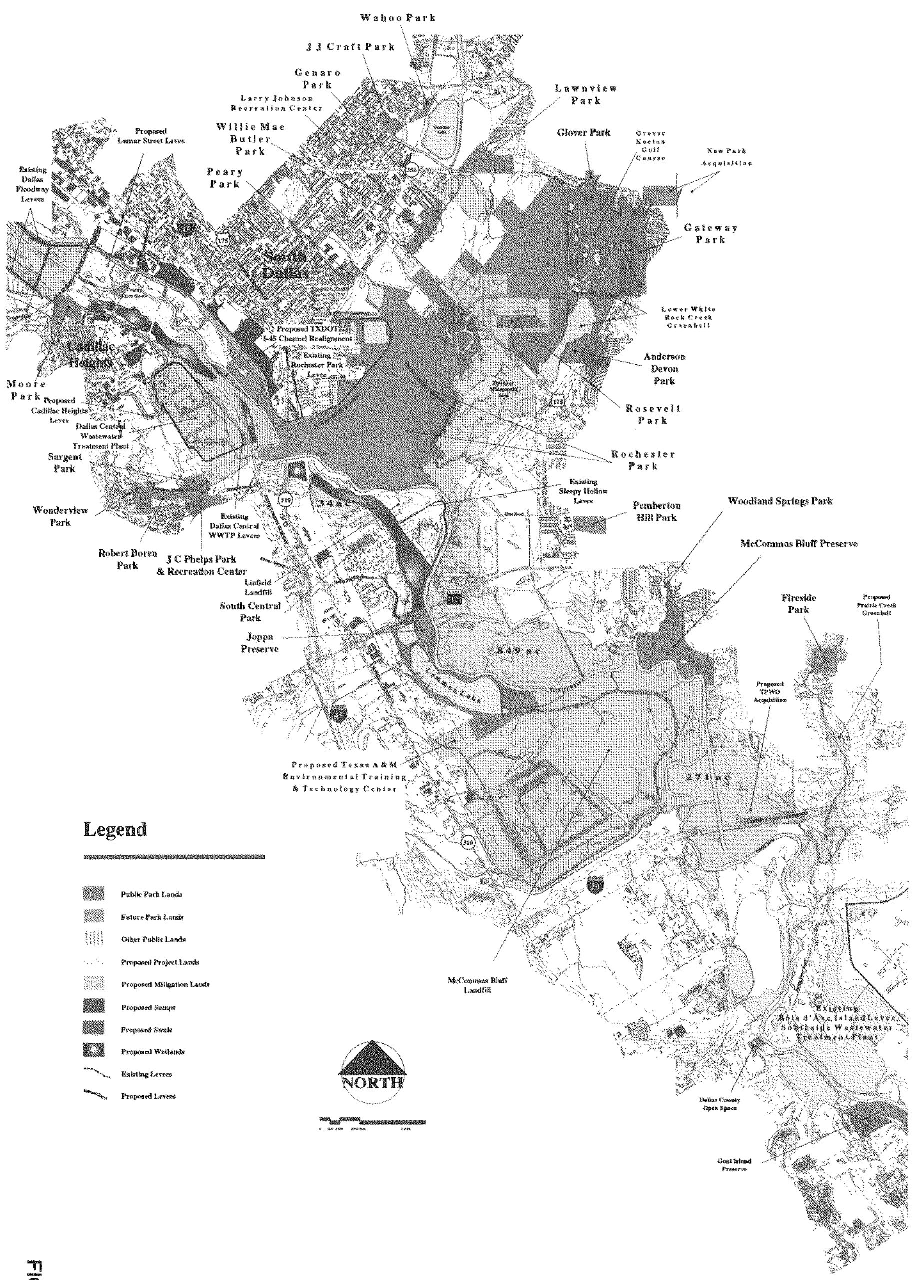


FIGURE 2

U.S. ARMY CORPS OF ENGINEERS

APPENDIX G

USFWS COORDINATION ACT REPORT

(849)

Report of the U.S. Fish and Wildlife Service

on the

Dallas Floodway Extension Project

Dallas, Texas

U.S. Fish and Wildlife Service
Arlington, Texas

February 1999

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Stadium Centre Building
711 Stadium Drive, Suite 252
Arlington, Texas 76011

February 3, 1999

Colonel James S. Weller
District Engineer
U.S. Army, Corps of Engineers
P.O. Box 17300
Fort Worth, Texas 76102-0300

Dear Colonel Weller:

This letter constitutes the report of the U.S. Fish and Wildlife Service (Service) on the Dallas Floodway Extension project, Dallas County, Texas. It has been prepared under authority of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is intended to accompany your Reevaluation Report. Our report has been coordinated with Texas Parks and Wildlife Department as indicated in the enclosed letter, dated July 23, 1997, from Dr. Ray C. Telfair III.

Authorization for this study was provided to the Corps of Engineers (Corps) by the River and Harbor Act of 1965 (Public Law 89-298). Subsequent to this authorization, the Corps conducted engineering studies and submitted a plan of improvement to higher authority which consisted of a multi-purpose channel and floodway levees downstream of the existing Dallas Floodway to the vicinity of Five Mile Creek. This previously authorized plan was suspended due to the lack of local support.

In May-June 1989, the City of Dallas experienced severe flooding along the Trinity River and White Rock Creek. As a result, the City requested that the Corps initiate a reevaluation study of the Dallas Floodway Extension and acknowledged the project cost-sharing requirements for federal water resource development projects. Reevaluation studies were initiated in Fiscal Year 1991 and have continued periodically through Fiscal Year 1999.

DESCRIPTION OF THE PROJECT AREA

The Dallas Floodway Extension lies entirely within the Blackland Prairies land resource area of Texas. Soils in this area generally consist of black, alkaline, organic clays overlying Cretaceous limestone, with some lighter-colored sandy loams on the uplands. These soils support a native, climax plant community of mid and tall grasses such as little and big bluestem, Indiangrass, switchgrass, sideoats grama, and Texas wintergrass. Because of their fertile nature, most of these soils have been converted to agricultural production of crops and improved pasture grasses. Disturbed and overgrazed sites within the area are usually dominated by annual grasses, forbs, and mesquite.

Bottomlands within the region are characterized by a variety of woody and herbaceous vegetation. Late successional sites within the floodplain usually contain higher quality mast-producing trees such as pecan, bur oak, Shumard oak, American elm, and mulberry with little understory vegetation; whereas, disturbed or early successional sites have a greater preponderance of green ash, hackberry, cedar elm, cottonwood, and black willow in the overstory. These lower quality sites often have less tree canopy cover, thus permitting a greater abundance of invading forbs and grasses such as giant ragweed and Johnsongrass. However, in some locations, especially wetter sites, lower quality bottomlands may consist of virtual monocultures of small, even-aged green ash which may develop into extremely dense thickets.

All of the vegetation which now exists in the project area is directly affected by urban influences of Dallas and surrounding communities. Virtually all uplands along the Trinity River floodplain have been developed for residential or industrial use, and many of the lower lying areas have been protected from flooding by the construction of levees or flood channels. Abandoned sand and gravel pits and numerous landfills also dominate the floodplain areas of the Trinity River within the floodway extension area. These activities have resulted in reduced flood assimilative capacity and increased the volume and elevations of flooding within the downstream Trinity River floodplain. This periodic flooding has limited human use of the floodplain and permitted the reestablishment of a variety of forested and emergent wetland communities within the project area.

PLAN OF DEVELOPMENT

The National Economic Development (NED) plan for the project area identified during preliminary planning studies by the Corps consisted of a 1,200-foot wide flood conveyance swale on the west side of the Trinity River extending from the existing Dallas Floodway to the vicinity of the Interstate Highway 45 bridge. Downstream of the IH 45 bridge, the swale would be located on the north and east side of the river, ending at a point just south of Loop 12. The swale would be constructed by clearing all vegetation within the right-of-way and excavating a shallow ditch to convey flood flows more efficiently downstream. The swale would be maintained in herbaceous vegetation to control erosion, and trees and shrubs would not be allowed to reestablish within the area. Normal flows would continue to remain in the natural channel of the Trinity River. Agency evaluation of this NED plan and public review indicated that it would have unacceptable, adverse impacts to the Trinity River's natural resources and the local community. Therefore, at the request of the public and the local project sponsor, additional alternatives were evaluated. These alternatives included various sizes and locations of channels, levees, flood conveyance swales, and combinations of these alternatives. The Corps has also examined non-structural solutions to the flooding problem within the project area.

The Federally Supportable Plan of development, which is also the Locally Preferred Plan, consists of three key features (Figure 1). Two flood conveyance swales ranging in width from 300 to 500 feet would be constructed along the western edge of the Trinity River floodplain. The north swale would extend from the end of the existing Dallas Floodway project southward to just upstream of the City's Central Wastewater Treatment Plant. The south swale would extend southward from the vicinity of IH 45 to just upstream of Loop 12. Both of these swales would contain a series of emergent wetlands constructed for water quality improvement, wildlife habitat, and aesthetics. This "chain of wetlands" feature is being independently evaluated by the Corps as an environmental enhancement feature of the Locally Preferred Plan.

Construction of flood protection levees would be the second key component of the project. One of these levees, the Lamar Street Levee, would extend south approximately 1.5 miles from the existing Dallas Floodway levee system to the City's Rochester Park Levee along the east side of the Trinity floodplain. The second levee, which is also about 1.5 miles in length, would be constructed on the west side of the Trinity River floodplain north of the Central Wastewater Treatment Plant in order to protect the Cadillac Heights subdivision. This levee would tie in with the existing treatment plant levee and extend to the west of the treatment plant where it would turn northward to intersect higher ground.

The final project feature involves the realignment of approximately 3,300 linear feet of the Trinity River at the IH45 bridge. The Texas Department of Transportation has requested this action in order to protect piers of the bridge which are now subject to high velocity flows and debris within the existing river channel.

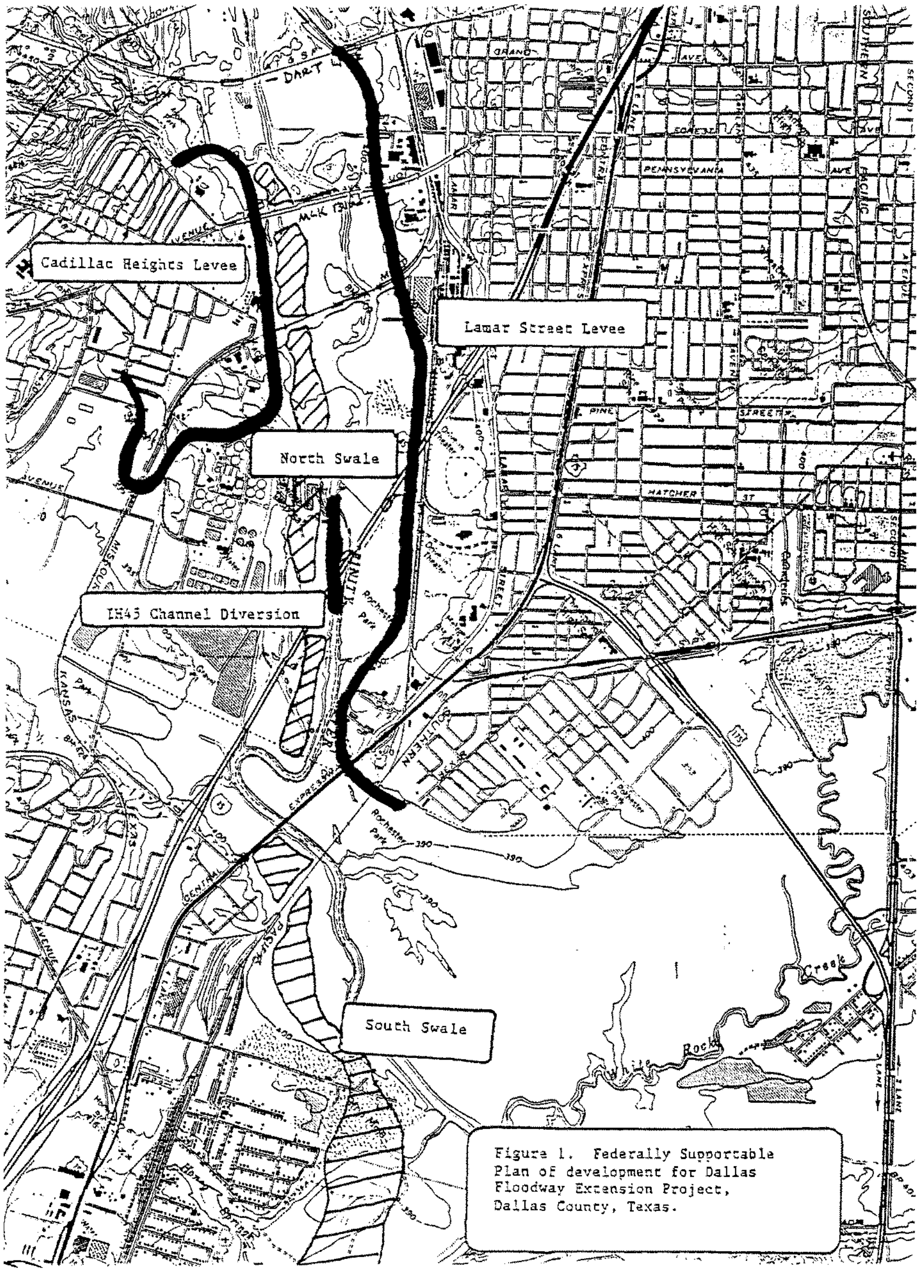


Figure 1. Federally Supportable Plan of development for Dallas Floodway Extension Project, Dallas County, Texas.

4

EVALUATION METHODOLOGY

Wildlife evaluations were conducted on the Dallas Floodway Extension using the Service's Habitat Evaluation Procedures (HEP). This methodology permits the documentation of the quality and quantity of available habitat for selected wildlife species within a project area for both with and without-project conditions. It can be utilized to compare and/or predict available habitat under various development scenarios and time intervals, thus permitting the evaluation of development impacts on wildlife habitat and the formulation of appropriate mitigation measures.

HEP is based on the assumption that habitat for selected wildlife species can be described by a Habitat Suitability Index (HSI). This index value, which ranges from 0 (no suitable habitat) to 1.0 (optimum habitat conditions), is multiplied by the area of available habitat to obtain habitat units. The habitat units are normally annualized over the life-of-the-project in order to compare future habitat conditions under different alternatives. HSI's are obtained by comparing field measured habitat variables (e.g., tree canopy closure, number of nest sites, etc.) to optimum habitat criteria preferred by each wildlife evaluation species.

Within the Dallas Floodway Extension project area, only three major wildlife habitat cover-types were identified and evaluated. These included two successional stages of bottomland hardwood forest and mixed grass-forblands. Higher quality forests are characterized by mature, mast-producing species such as pecan, bur oak, and Shumard oak with larger specimens of American elm, cedar elm, and hackberry. Moderate quality forests are dominated by less mature green ash, cedar elm, hackberry, willow, and cottonwood. Principal herbaceous species within the mixed grass-forblands include giant ragweed, Johnsongrass, Bermudagrass, dallisgrass, and various sedges. Mapping and quantification of the acreage of these habitats was accomplished by the Corps' Environmental Resources Planning staff with the assistance of the Service utilizing low altitude aerial photographs, remote sensing data, and ground verification.

Evaluation species for the HEP analysis were selected through the application of feeding and reproductive guild matrices. This process enabled the identification of key "indicator species" which represent the entire ecological community because of their varied feeding and reproductive requirements. Whenever possible, species selection was based upon available models of species that have high public interest, economic value, or restrictive ecological requirements.

Species selected for evaluation of the habitats in the Dallas Floodway Extension project area included the raccoon, fox squirrel, red-tailed hawk, barred owl, hairy woodpecker, and Carolina chickadee for bottomland hardwood forests and eastern cottontail, red-tailed hawk, and eastern meadowlark for the mixed grass-forblands.

Baseline field data within the project area were initially collected during 1992 and 1993 for bottomland hardwood forests, while field data collected by the Service on the Upper Trinity River Reconnaissance Study in 1989 were used to evaluate mixed grass-forblands. Recent field inspections of the project area have indicated little change in habitat conditions since the collection of the original field data. The HEP identified the average annual habitat units (AAHU's) which would occur for each habitat type within the overall project area for a 50-year period of analysis, both with and without a flood control project. A comparison of these AAHU values quantified what impacts the proposed project would have on wildlife habitats and permitted the Service to evaluate potential mitigation plans for the alternative actions.

For the purposes of the HEP analysis, it was assumed that in the absence of a federal flood control project there would be no significant change in the amount of available terrestrial habitat within the project study area, and habitat quality of the bottomland hardwoods would continue to improve slightly due to natural successional processes. Implementation of a flood control project would result in the immediate loss of habitat within the footprint of the structures, while remaining habitats would experience similar conditions to those anticipated for non-project conditions.

FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

Aquatic Resources

Aquatic resources of the upper Trinity River Basin have been greatly influenced by the level of human development within the Dallas-Fort Worth region. Numerous flood control channels, levees, reservoirs, and wastewater discharges from this urbanized area have dramatically reduced the physical and chemical quality of the habitat and waters, which in turn has reduced the diversity and abundance of the aquatic fauna. Several studies by the Service, Texas Parks and Wildlife Department, Texas Water Commission, universities, and others have documented the direct impacts of poor water quality and habitat degradation on the distribution and health of fish within the Trinity. Some improvement in water quality has been noted in recent years; however, the Trinity River is still largely dominated by wastewater return flows which will continue to strongly influence the biotic community within the river.

Within the Dallas Floodway Extension project area, the Trinity River channel has not been significantly altered, except in the vicinity of the numerous railroad and highway bridge crossings. The river channel has relatively steep, bare banks with numerous deadfall logs and debris which have accumulated during high flow periods. The water is usually turbid, especially during high flow periods, due to the muddy, silty nature of the river's substrate. In most areas, a large canopy of cottonwood, elm, and willow trees provides fair to good shading of the river's surface.

Fish fauna within this stretch of the Trinity River is generally restricted to the more pollution tolerant species, such as common carp, river carpsucker, smallmouth buffalo, longnose gar, bullhead catfish, gizzard shad, mosquitofish, and various species of sunfish and shiners. Few gamefish species occur due to the lack of adequate habitat and poor water quality, although channel catfish, crappie, and largemouth bass may occur in some of the cleaner sites.

Terrestrial Resources

Vegetation resources within the project area are also highly influenced by man's activities and typically consist of only two major cover-types: bottomland hardwood forests and mixed grass-forblands. Some open water and emergent wetlands, primarily associated with old gravel and borrow pits, are found within the overall study area, but these are relatively limited in occurrence within the project site and have not been delineated or evaluated (Figure 2). Most wetlands within the project area are closely associated with the forested and mixed grass-forbland habitat types and are difficult to delineate due to the highly disturbed nature of the project area and their interspersion with the other cover-types.

Two distinct bottomland hardwood forest types were mapped and quantified for the study area. Pecan-oak-elm bottomland hardwoods occupy approximately 246 acres within the evaluation area and are characterized by greater overall tree species diversity and forest maturity than other hardwood dominated sites. Dominant overstory vegetation on these more mature bottomland sites includes pecan, bur and Shumard oak, American and cedar elm, hackberry, green ash, and mulberry (Figure 3).

Approximately 319 acres of ash-elm-willow bottomland hardwoods occur within the study area. This cover-type consists largely of early successional species which can successfully adapt to the extremely wet conditions within the lower portions of the Trinity River floodplain. The most prevalent vegetation in this cover-type includes green ash, boxelder, cedar elm, hackberry, black willow, and cottonwood (Figure 4).

Figure 2. Palustrine open water wetland site formed by excavation.

Figure 3. Pecan-oak-elm bottomland hardwood cover-type.

Figure 4. Green ash thicket representative of ash-elm-willow cover-type.

Figure 5. Mixed grass-forbland cover-type.

Both of the bottomland hardwood cover-types have a varied understory consisting of tree saplings, shrubs, vines, and herbaceous plants. Typical understory species include eastern redcedar, deciduous holly, coralberry, sumac, swamp privet, buttonbush, hawthorn, gum bumelia, wild plum, poison ivy, greenbriar, ratan, Virginia creeper, dewberry, wild grape, peppervine, Bermudagrass, and various sedges.

Mixed grass-forblands occupy about 496 acres within the project study area. Most of this cover-type is not well-managed and consists predominantly of abandoned agricultural sites which are reverting to a higher level of vegetative succession. Primary grass species in this cover-type include common and coastal Bermudagrass, Johnsongrass, threeawns, bushy bluestem, and various panicums and paspalums. Giant ragweed is the dominant forb, with sumpweed and sunflower locally abundant. Some shrub and tree regeneration, primarily green ash, cottonwood, and willow, is beginning to occur on some sites due to the lack of mowing (Figure 5).

Wildlife populations in the project area are relatively diverse, especially within the bottomland hardwoods and transitional areas between forest and openland. Common wildlife species typical to this urban area include fox squirrel, raccoon, opossum, eastern cottontail, skunk, and coyote. Some major bird species include cardinal, bluejay, mockingbird, Carolina chickadee, mourning dove, meadowlark, common crow, red-tailed hawk, and various species of sparrows and warblers. The margins of the river and open water areas are especially important to egrets, herons, and waterfowl. One major heron rookery is located just west of the Central Wastewater Treatment Plant near the southern terminus of the Cadillac Heights Levee.

Endangered Species

Currently, the only federally listed species known to occur in Dallas County are the endangered black-capped vireo (*Vireo atricapillus*) and interior least tern (*Sterna antillarum athalassos*). The mountain plover (*Charadrius montanus*) is a listed candidate species of potential occurrence.

Preferred habitat of the vireo consists of scattered oaks, eastern red cedar, and Ashe juniper interspersed with dense clumps of bushes and open areas of bare ground, rocks, and a sparse vegetative cover of grasses and forbs. This type of habitat is most prevalent in the escarpment area of southwest Dallas County and is not present within the Dallas Floodway project area.

Interior least terns prefer bare to sparsely vegetated river sandbars and flats or similar sites for nesting during the period April through July in north Texas. Important nest site characteristics include barren or sparsely vegetated alluvial or sand substrates, availability of food such as small fish or invertebrates, and favorable water levels that prevent spring flooding of nests. Nesting interior least terns have been observed on the sludge drying beds and levees of the Southside Wastewater Treatment Plant located south of the project area. No suitable nesting habitat occurs along the Trinity River within the project area.

The mountain plover migrates in small numbers throughout north Texas from early March to mid-May and from early August to late October. It prefers large expansive flats of short grass prairie where it feeds on grasshoppers, beetles, crickets, and flies. No nesting is known to occur within the northcentral Texas area. The lack of suitable habitat within the project area makes it highly unlikely that this species would be affected by the proposed project.

FISH AND WILDLIFE RESOURCES WITH THE PROJECT

Aquatic Resources

Based on project evaluations, the Corps has determined that a large-scale channel plan for the Dallas Floodway Extension is not economically justified. The current flood control plans being evaluated, overflow swales and levees, would not include any direct modification or disturbance to the existing Trinity River channel or streambed. Therefore, aquatic habitats would generally remain unaffected by the project except in localized areas where the swales intersect the existing channel. Disturbance at these sites would be limited primarily to the removal of streambank vegetation which could cause increased erosion and siltation within the channel. This potential impact should have no significant effect on aquatic habitats or the fishery if proper streambank stabilization procedures are employed during construction and operations.

A realignment of approximately 3,300 linear feet of the Trinity River is being proposed at the IH 45 bridge in order to prevent undermining of the bridge support pillars which lie within the channel. Approximately 9.5 acres of Trinity River channel would be eliminated with the diversion and replaced with about 12.9 acres of new channel. Most of the old channel would be filled by the borrow from the new channel, although some of the downstream portions of the old channel may be used to develop a canoe launch or other recreational features. Most of the natural stream habitat features in this section of the Trinity, such as natural riparian vegetation, instream cover, pools and runs, etc., would be eliminated by construction, thus negatively impacting aquatic resources.

Terrestrial Resources

Implementation of the swale, levee, and IH45 channel diversion alternatives would have an unavoidable, negative impact on terrestrial habitats and wildlife species within the project area. This would result from the direct impact of the alternatives on Trinity River floodplain habitats, especially bottomland hardwood forests. Secondary impacts would occur as a result of the fragmentation of the remaining habitats in the project area and human encroachment and development of areas within the basin protected from future flooding by the flood control project. Table 1 represents the acreage of terrestrial habitats which would be impacted by the various alternatives under consideration by the Corps.

Table 1. Acreage of terrestrial habitat impacted by the Dallas Floodway Extension project alternatives.

HABITAT COVER-TYPE	SWALES	LEVEES	IH45 Diversion	TOTAL IMPACTS
Pecan-Oak BLH	6	11	4	21
Ash-Elm BLH	84	52	5	141
Mixed Grass-Forbland	126	86	0	212
TOTALS	**216**	**149**	**9**	**374**

As can be observed from Table 1, the proposed project alternatives would impact a total of 374 acres of wildlife habitat within the overall study area. Slightly more than one-half of this acreage would be bottomland hardwood forests associated with the floodplain of the Trinity River and small tributary drainages. However, recent modification of project features, such as reducing the size and location of the flood conveyance swales, has resulted in a substantial decrease in forested habitat impacts over the previously evaluated NED plan.

Impacts on mixed grass-forblands have also been reduced through redesign and relocation of the swales. Although implementation of the swale alternatives would create herbaceous habitat due to the maintenance of the swale right-of-way in herbaceous vegetation to allow conveyance of flood flows, there would still be a net loss in available mixed grass-forbland habitat as a result of more intensive maintenance (i.e., mowing) within the floodway, access facilities, and other project features such as the "chain of wetlands".

The impact of each alternative plan on the average annual habitat units (AAHU's) provided by each habitat type is displayed in Table 2. This analysis confirms the above conclusions that the swale and levee plans would have a negative impact on all wildlife habitat types within the project area. The amount of emergent wetlands within the project area would be increased due to their inclusion as a project feature of the swale plan; however, no separate quantitative baseline evaluations of this habitat were undertaken because of their close association with other habitat types. Small, isolated emergent wetlands occur throughout the forested and mixed grass forblands; however, they were not separately evaluated. Incorporation of emergent wetlands within the swales would provide a valuable enhancement feature within the overall project area.

Table 2. Impact of alternative development plans on the average annual habitat units (AAHU's) of terrestrial wildlife habitats.

ALTERNATIVE	**Pecan-Oak BLH**	**Ash-Elm BLH**	**Mixed Grass-Forbland**
Baseline AAHU's	 212	 233	 278
Swales AAHU's Change	 211 -1	 187 -46	 202 -76
Levees AAHU's Change	 207 -5	 212 -21	 225 -53
IH45 Diversion AAHU's Change *	 213 +1	 249 +16	 278 0
Total Impact AAHU's Change	 198 -14	 142 -91	 188 -90

* Construction of the IH45 diversion channel would result in a net loss of bottomland hardwood habitat rather than an increase as shown; however, overall gains in habitat quality for bottomland hardwoods in the entire project area in future years masks this loss due to the small acreage impacted by the channel when compared to the overall project area. This is an artifact which can occur in HEP when evaluating very small areas with the assumption that remaining habitats will continue to improve over time.

Endangered Species

Our data indicate that no federally listed, proposed, or candidate threatened or endangered species, or any designated critical habitat, would be affected by the proposed Dallas Floodway Extension project.

DISCUSSION

The Service has evaluated this project in accordance with the guidelines and directives contained in its *Mitigation Policy* (Federal Register 46[15]: 7644-7663, January 23, 1981). The *Mitigation Policy* provides guidance for Service biologists in the formulation of recommendations to avoid, reduce, or compensate project-related impacts on fish and wildlife resources. Our recommendations are based on the value and relative abundance of the affected habitat to the evaluation species.

Bottomland hardwood forests within the project area provide relatively high quality habitats for the evaluation species. HSI's for the highest quality bottomland hardwoods ranged from 0.50 for red-tailed hawk to 0.99 for the hairy woodpecker, averaging 0.86 for all evaluation species. The high values were generally the result of the diversity of the tree and shrub cover, which included mature, mast-producing species such as pecan, bur oak, and Shumard oak. Many evaluation sites also contained mature specimens of hackberry, green ash, and cottonwood. There were also abundant snags, cavities, and refuge sites to satisfy the evaluation species life requisites.

The average HSI value for the ash-elm bottomland hardwoods was 0.73, ranging from 0.35 for the red-tailed hawk to 0.97 for the barred owl. Although habitat values were slightly lower for the evaluation species due to reduced structural and vegetation species diversity, these bottomlands still provide high value habitat. Most of these forested sites were dominated by a mosaic of less mature green ash, cedar elm, American elm, hackberry, and black willow.

Numerous federal, state, and private studies have documented the increased vulnerability and scarcity of bottomland hardwood forests in Texas and the nation. Statewide, over 63 percent of the bottomland hardwoods have been lost since the settlement of man due to forestry, agricultural, and water resource development practices. In addition, residential, commercial, and industrial developments in urbanized areas, such as the Dallas-Fort Worth Metroplex, have resulted in increased adverse impacts to bottomland and riparian ecosystems due to encroachment on the floodplain and the need for flood control.

Based on the high value of the bottomland hardwoods to the evaluation species and their relative scarcity, we have classified them as a Resource Category 2 under the *Mitigation Policy*. Our mitigation planning goal for this category is "no net loss of inkind habitat value". Generally, this goal can be accomplished by avoiding negative impacts, restoring impacted areas, compensating for the impacts by creating or improving habitats at a different location, or through a combination of these measures.

The mixed grass-forblands within the project area provide medium to high quality habitat values for the wildlife evaluation species. HSI's averaged 0.56 for all evaluation species, but ranged from 0.20 for the red-tailed hawk to 0.78 for the eastern meadowlark. The overall medium quality of the grass-forblands is due to several factors, but is primarily related to improved vegetation diversity which has resulted from reduced maintenance and disturbance because of frequent flooding of the project area. Although the mixed grass-forblands provide medium quality habitat conditions, they are very abundant in the project area as well as the region, state, and nation due to prevalent land use practices. Therefore, the medium value and relative abundance of mixed grass-forblands requires that they be classified as Resource Category 3. Our mitigation planning goal for this resource category is "no net loss of habitat value while minimizing loss of inkind habitat value". Normally, this category of habitat can be easily restored, and where needed, can be utilized to mitigate or replace lost values of higher-valued habitat.

As previously noted in Table 2, implementation of all the preferred alternatives (i.e., swales, levees, and IH45 channel diversion) would result in the total loss of 105 AAHU's of bottomland hardwood forest. Based on the resource category discussions above, these losses to bottomland hardwood habitat values should be fully mitigated inkind.

Since bottomland hardwoods would be cleared for the swale and the area maintained in herbaceous cover in order to efficiently convey flood flows, mitigation of hardwood habitat values can be accomplished only by offsite improvement of existing forested areas and/or reforestation of grasslands. A small amount of trees could be established in the flood swales in association with the proposed emergent wetlands for aesthetic purposes, however, these would provide little wildlife value because of their small areal coverage and fragmented nature. Various alternative mitigation scenarios were developed and analyzed for their ability to mitigate hardwood losses under these constraints.

The alternative mitigation plans varied in acreage, habitat cover-type, and level of management in order to identify a plan which could fully compensate for the AAHU losses. Although only three mitigation plans are discussed in this report, numerous other alternatives could be identified and evaluated for their feasibility to mitigate habitat losses resulting from construction of the proposed project. However, in developing other alternative mitigation plans it would be necessary to remember the mitigation planning goal of "inkind habitat replacement" for Resource Category 2 bottomland hardwoods and the higher costs associated with complete reforestation and management when compared to habitat improvement of existing wooded tracts.

Table 3 displays three mitigation plans (Plans A - C) which were evaluated for their ability to mitigate bottomland hardwood habitat losses for the Dallas Floodway Extension. These mitigation plans were formulated by incrementally adding tracts of floodplain lands and analyzing increased AAHU's which could be realized with intensified wildlife management practices applied to the tracts. Management practices consist of the improvement of existing bottomland hardwoods to increase their habitat values and the conversion of mixed grass-forblands to bottomland hardwoods.

A comparison of Tables 2 and 3 is needed to determine whether a specific mitigation plan would successfully compensate project-related impacts to bottomland hardwoods. For example, Mitigation Plan A includes an 849-acre tract of floodplain land adjacent to the Trinity River near Loop 12. This tract contains approximately 753 acres of bottomland hardwoods and 96 acres of mixed grass-forblands. Habitat improvement on the 753 acres of hardwoods and reforestation of 86 of the 96 acres of grasslands along with intensive management of the revegetated area would result in a gain of only 52 AAHU's for bottomland hardwoods (i.e., 9 AAHU's for pecan-oak and 43 AAHU's for ash-elm sites). A gain of 52 AAHU's in hardwood habitat value would not be adequate to compensate for the loss of 105 AAHU's resulting from project-related impacts (Table 2). Therefore, additional mitigation lands would be required for bottomland hardwood management in order to increase AAHU values and accomplish the inkind mitigation goal.

A second increment of land was added to the Loop 12 tract to provide for additional gains in AAHU's through management. This small floodplain tract, located south of the Trinity River between the Linfield Landfill and Southern Pacific Railroad, would increase the management area size to 883 acres (Mitigation Plan B). As noted in Table 3, this additional increment would not increase AAHU's for the higher quality pecan-oak bottomlands and would only increase the AAHU's of the ash-elm bottomlands from 43 to 55. Again, the addition of this small increment of land, even with highly intensive management, would not successfully compensate the loss of 105 AAHU's resulting from the proposed plan.

Table 3. Change in AAHU's for alternative mitigation plans at the Dallas Floodway Extension project.

MITIGATION PLAN ALTERNATIVE	Pecan-Oak BLH	Ash-Elm BLH	MIXED G-F
A	+9	+43	Loss
B	+9	+55	Loss
C	+14	+92	Loss

A - 849 ac. tract east of Trinity River adjacent to Loop 12.
B - 883 acres consisting of Loop 12 site and North site.
C - 1,154 acres consisting of the Loop 12, North, and South tracts of floodplain lands.

Finally, a third increment of floodplain land located just north of Interstate Highway 20, identified as the South tract, was added to the previous two tracts and evaluated for its ability to compensate project impacts. These increments, evaluated collectively as Mitigation Plan C, consist of approximately 1,154 acres, including 926 acres of bottomland hardwoods and 228 acres of mixed grass-forblands.

Assuming a high level of management, it was determined that a mitigation area of this size and vegetation composition could fully compensate the losses of bottomland hardwoods resulting from construction of the Dallas Floodway Extension project. An increase of approximately 106 AAHU's could be realized by management of the mitigation land (Table 3), thus offsetting the loss of 105 AAHU's resulting from implementation of all the project alternatives (Table 2). A total of 208 acres of mixed grass-forblands would need to be converted to bottomland hardwoods and intensively managed. In addition, the existing 926 acres of bottomland hardwoods would have to receive intensive management treatments in order to improve their AAHU values. Management measures which would be required to improve habitat conditions within the mitigation lands include tree and shrub planting; selective thinning of undesirable or over-populated vegetation species; introduction of nest boxes for squirrels, passerine birds, and wood ducks; shredding and disking; burning; seeding of desirable grasses and forbs; and fencing.

In order to mitigate the adverse impacts of the selected plan, we recommend, as discussed above in Mitigation Plan C, the acquisition and management of approximately 1,154 acres of mitigation lands, consisting of approximately 926 acres of bottomland hardwoods and

228 acres of mixed grass-forblands. The approximate location of these mitigation lands are delineated in Figure 6, and consists of three separable tracts identified as the North, Loop 12, and South Mitigation Tracts, respectively. This mitigation plan would adequately compensate for the damages to bottomland hardwood forest habitat values if appropriate management measures are implemented to increase habitat values of these tracts. Therefore, we recommend that this mitigation plan be included as a project feature and submitted to Congress for authorization concurrently with the flood prevention plan. Any approved mitigation plan should also include provisions for annual operation & maintenance funding to the managing agency, since habitat improvement and restoration will occur throughout the life-of-the-project. The final amount of mitigation lands and/or revegetation measures may be modified during final plan formulation provided the loss of 105 AAHU's is fully realized.

Mitigation policy dictates that mitigation lands be located contiguous to the project area if feasible. Therefore, the three mitigation tracts evaluated included bottomland hardwood and grassland tracts located either contiguous or in close proximity to the project site. These tracts are also contiguous to existing or proposed publicly owned lands within the Trinity River corridor which will make them more amenable to long-term preservation and management.

Lands which are required to mitigate the unavoidable, adverse impacts of the floodway extension may be publicly or privately owned. However, in order to increase the habitat value of these lands it will be necessary to dedicate them specifically for wildlife management and restrict public use to compatible activities. Compatible activities could include hiking or nature trails or other similar low-density recreation opportunities. If mitigation lands remain in private ownership, they must receive long term protection through the establishment of deed restrictions or other protective covenants which would transfer with ownership of the property.

Table 4 provides an estimate of the mitigation costs associated with the development of the recommended mitigation lands. Initial acquisition costs for the 1,154 acres would be approximately $4,154,400. In addition, approximately $224,600 would be required to improve habitat conditions on the existing bottomland hardwoods, revegetate the grasslands with hardwood trees and shrubs, and fence and delineate the wildlife management area. Total acquisition and initial development costs associated with the recommended mitigation plan are estimated to be approximately $4,423,920. Operation and maintenance would cost about $18,380 annually.

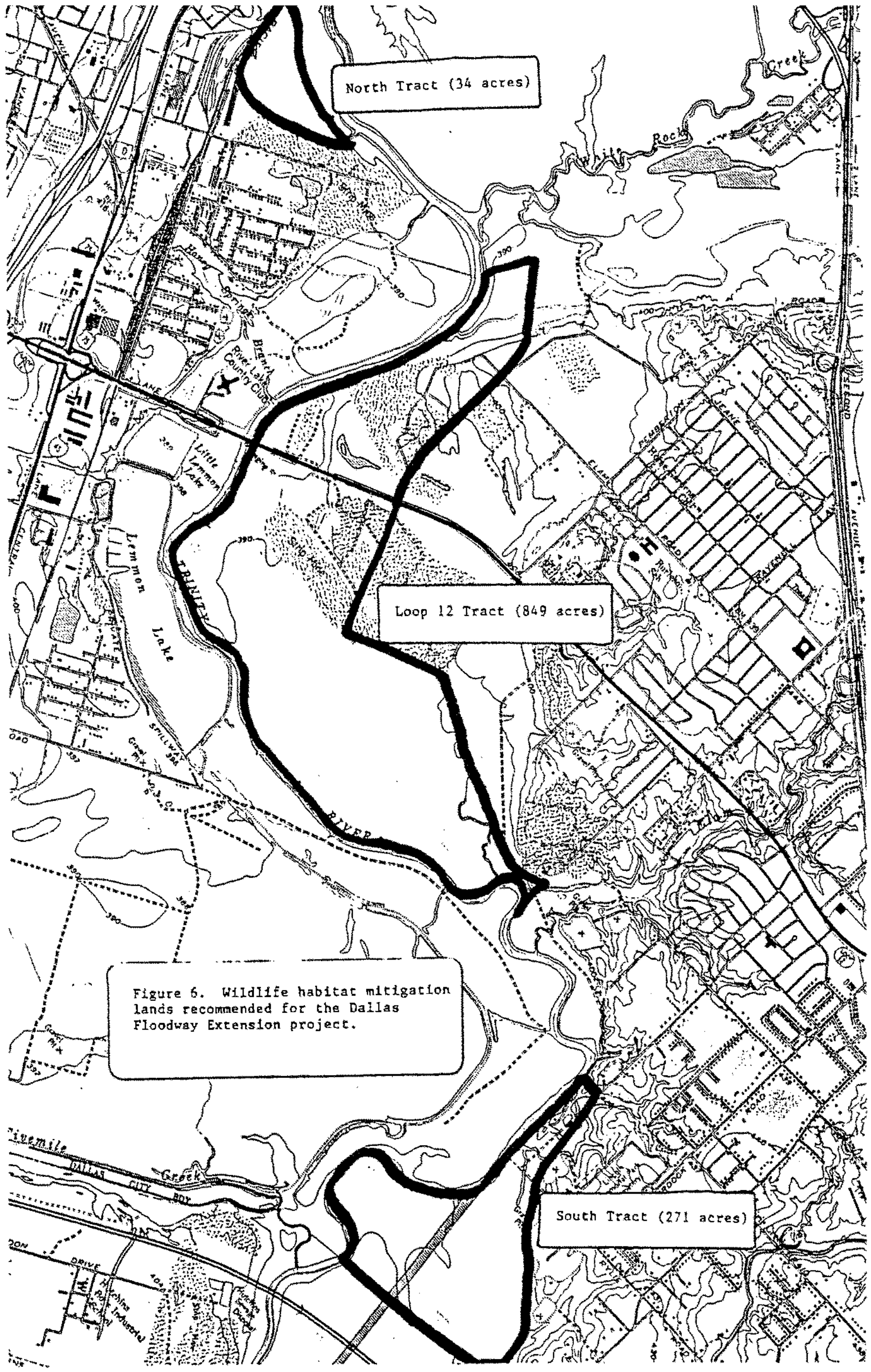


Figure 6. Wildlife habitat mitigation lands recommended for the Dallas Floodway Extension project.

Table 4. Estimated wildlife habitat development and management costs for mitigation of the Dallas Floodway Extension project.

A. Acquisition	Estimated Cost
1. 926 ac. BLH @ $3,600/ac.	$ 3,333,600
2. 228 ac. Mixed G-F @ $3,600/ac.	820,800
Subtotal	$ 4,154,400
B. Initial Development	
1. Habitat Improvement of existing BLH's:	
a. Selective thinning (463 ac. @ $80/ac.)	$ 37,040
b. Mast trees (containerized - $30 ea. for 5 trees/ac. on 200 ac.)	30,000
c. Tree planting with site preparation (1,000 trees @ $30 ea.)	30,000
d. Shear, rake, pile and bed (75 acres @ $160/ac.)	12,000
e. Passerine & squirrel nest boxes (200 @ $30 ea.)	6,000
2. Conversion of Mixed grass-forbland to BLH's:	
a. Shredding/disking (208 ac. @ $40/ac.)	8,320
b. Hardwood seedlings (100 seedlings/ac. for 208 ac. @ $ 0.20 per seedling)	4,160
c. Seedling planting ($60/ac.for 208 ac.)	12,480
d. Passerine bird nest boxes (208 @ $30 ea.)	6,240
3. Fencing (estimated 6 miles @ $ 2.00/ linear ft.)	63,360
4. Signs (estimate)	15,000
Subtotal	$ 224,600
C. Contingencies (20%)	$ 44,920
TOTAL ACQUISITION & INITIAL DEVELOPMENT COSTS	**$ 4,423,920**
D. Operation & Maintenance (Annual cost)	
1. Existing BLH's (926 ac. @ $10/ac.)	$ 9,260
2. Converted BLH's & remaining grasslands (228 ac. @ $40/ac.)	9,120
TOTAL ANNUAL OPERATION & MAINTENANCE COSTS	**$ 18,380**

Improvement of existing bottomland hardwood tracts and reforestation of the grasslands would require the planting of a large quantity of hardwood trees and shrubs. We recommend that a portion of the trees and shrubs be of a containerized size and mast-producing. Larger trees are usually established more successfully and will provide wildlife values in a shorter time period than bareroot seedlings. Containerized specimens should be used principally to improve existing forested stands, while seedlings may be more appropriate for the reforestation of the mixed grass-forblands. Initial establishment of the seedlings should utilize state-of-the-art techniques in order to maximize seedling survival from drought and animal damage. Some available techniques include the use of growth hormones, slow release fertilizers, protective sleeves, adequate irrigation, weed control, and other similar measures.

A minimum of 100 hardwood and shrub seedlings per acre should be planted on the grassland sites in order to provide greater diversity and age classes of trees. Preferred tree species include various oaks (e.g., Shumard oak, bur oak, water oak), pecan, walnut, hickories, hackberry, mulberry,and cedar elm. Trees such as green ash and cottonwood are not recommended, since these plants readily invade managed sites, have lower wildlife food values, and usually need to be controlled in order to promote the production of more valuable wildlife trees.

Recommended shrubs include species such as deciduous holly, American holly, yaupon, Mexican or wild plum, hawthorns, coralberry, native privets, roughleaf dogwood, and sumacs. All planted trees and shrubs should be adequately maintained and have a survival rate of at least 75 to 80 percent after two growing seasons.

There would be a loss of mixed grass-forblands for all of the mitigation plans, since this habitat type would be converted to bottomland hardwoods on the management area (Table 3). However, the loss of grass-forblands is not a major concern, since much of this habitat type would be reestablished within the project area by construction of the flood swales. Also, the loss of this lower valued habitat type can be compensated by gains in higher resource category bottomland hardwoods in accordance with the *Mitigation Policy*.

In order for herbaceous areas to provide acceptable habitat, sites disturbed by construction activities, including the flood conveyance swales and levees, should be revegetated with a variety of native grass and forb species which have proven food and cover values. Examples of preferred grass species include big and little bluestem, switchgrass, Indiangrass, sideoats grama, Canada wildrye, eastern gamagrass, vine-mesquite, and various panicums. Some native forbs which provide high wildlife habitat values include the partridgepeas, crotons, Illinois bundleflower, sunflowers, coneflowers, purple prairie clover, tickclover, daisies, eryngos, lupines, and wildbeans. These native, herbaceous species may be established most successfully on sites not subject to high velocity, scouring flows.

In addition to the planting of native herbaceous species, mowing or other intensive maintenance activities should be restricted to the season of the year most compatible with wildlife reproduction, primarily late fall and winter. This would permit vegetation to go to seed, thus providing greater vegetative production. It would also provide greater cover and food values during the spring of the year, when wildlife reproduction and survival are most dependent upon adequate cover and the higher food values provided by lush vegetation (i.e., green vegetative material, seeds, and insects). Where feasible, mowing of the project area should be restricted to invasive, woody vegetation and not scheduled on a regular basis. No mowing should occur on any of the forested, wildlife mitigation lands once permanent vegetation is reestablished.

As part of the Locally Preferred Plan, a "chain of wetlands" is being evaluated for the flood conveyance swales. Approximately 123.3 acres of open water and emergent wetlands would be created through the excavation of several small wetlands in both the north and south swale areas. These wetlands would contain both deep and shallow water areas for the development of a range of submergent and emergent vegetation. Provisions for water control within the structures, including weirs and pumps, are also being evaluated in order to maximize the habitat value of the wetland sites and enable more reliable management activities. Development of the "chain of wetlands" would contribute substantially to the overall quality of wildlife habitats within the project area and should be implemented as an integral part of the proposed project.

Finally, significant impacts to aquatic habitats and water quality would occur as a result of the realignment of approximately 3,300 linear feet of the Trinity River channel at the IH45 bridge. Best management practices should be applied to this area in order to restore the morphology and hydrological characteristics of the river channel and prevent erosion and sediment runoff. Some useful practices for erosion control include the use of hay bales, fiber mats, temporary vegetation such as annual ryegrass, and hydromulching. The realigned channel should be constructed with similar substrates, slopes, stream gradients, and streamside vegetation. The amount of fill placed in the natural river channel should be limited to the minimum amount necessary to divert flows, and the natural channel downstream of the IH45 bridge should not be filled at all in order to provide a backwater refuge and nursery area for riverine fish and wildlife.

RECOMMENDATIONS

In order to avoid and reduce project-related impacts of the Dallas Floodway Extension project on fish and wildlife resources, the Service recommends the following:

1. The Corps and local project sponsor pursue development of the smaller, less environmentally damaging flood control alternative, identified as the Locally Preferred Plan, in lieu of the larger, NED plan.

2. Mitigation lands consisting of at least 1,154 acres, and comprised of approximately 926 acres of bottomland hardwoods and 228 acres of mixed grass-forblands as identified in the discussion section of this report, be acquired and specifically dedicated for wildlife management activities. Authorization for the acquisition of these mitigation lands be sought from Congress as an integral component of the Dallas Floodway Extension project.

3. The mitigation lands be managed to optimize wildlife habitat values through the improvement of existing forested habitats and reforestation of floodplain grasslands. Grassland sites should be stocked with a minimum of 100 hardwood seedlings and shrubs per acre. Existing forested sites should be stocked at a minimum rate of 5 containerized, mast-producing trees per acre and selectively thinned of undesirable vegetation. A minimum survival rate of 75 - 80 percent after two growing seasons would need to be attained for tree and shrub plantings.

4. Public recreation use of the wildlife mitigation areas be restricted to compatible, low-density activities such as hiking and nature trails, outdoor education, wildlife observation, etc.

5. Operation and maintenance funding in the amount of $18,380, or an amount negotiated between project sponsors and the management entity, be provided annually in the project budget for management of the proposed fish and wildlife features on the mitigation lands.

6. All areas disturbed by construction activities, including the swales and levees, be revegetated with a variety of native herbaceous species beneficial to wildlife.

7. Mowing and other intensive maintenance activities on project lands be restricted, whenever possible, to the late fall and winter months in order to provide optimum wildlife food and cover during the spring and summer reproductive season. Mowing should be restricted to the removal of invasive, woody species

and not scheduled on a regular basis. No mowing should occur on the designated wildlife mitigation lands following successful reestablishment of woody vegetation.

8. The "chain of wetlands", identified in the locally preferred plan, be developed as an integral part of the proposed project and managed to enhance wetland wildlife habitat values within the floodway extension area.

9. Impacts to the Trinity River channel be avoided during construction of the flood swales and levees.

10. Realignment of the Trinity River channel at the IH45 bridge be conducted in such a manner that the morphological and hydrological features of the new channel mimic the natural channel. The amount of fill placed in the natural channel be limited to the minimum amount necessary to divert flows into the realigned channel, and no fill be placed downstream of the IH45 bridge.

11. Best management practices be employed during construction to avoid erosion and sediment runoff into the Trinity River channel.

12. The Corps of Engineers and project sponsor consult with the U.S. Fish and Wildlife Service and Texas Parks and Wildlife Department during development of detailed project plans and specifications in order to insure full consideration of fish and wildlife mitigation features as a project component.

SUMMARY

The Trinity River within the vicinity of the proposed Dallas Floodway Extension project provides relatively high quality terrestrial habitat for a variety of urban wildlife species. The river itself provides poor to fair aquatic habitat due to the influence of urban storm and wastewater runoff which dominates flow during non-flood periods. Implementation of the original NED plan identified by the Corps would have severe impacts on terrestrial wildlife habitats, especially high priority bottomland hardwood forests, which occupy much of the Trinity River floodplain. Thus, the Service prefers the implementation of a smaller, Federally Supportable flood control plan (i.e., Locally Preferred Plan), which would reduce the amount of forest clearing and require less off-site mitigation. The Locally Preferred Plan also incorporates aquatic habitat and wetland features which would be very beneficial to resident and migratory wildlife species. The current project development plan includes the channelization of approximately 3,300 linear feet of the Trinity River in the vicinity of the IH45 bridge. This realignment would require specific measures, such as restoration of the river's morphological and hydrological characteristics and riparian vegetation, to reduce or mitigate adverse impacts to aquatic resources.

If the Locally Preferred Plan is implemented, the Service recommends the acquisition and intensive management of a minimum 1,154 acres of terrestrial habitat, including habitat improvements on 926 acres of bottomland hardwoods and reforestation of 208 acres of mixed grass-forblands. Additional measures would be necessary to limit construction impacts and promote the recovery of damaged habitats.

We appreciate the opportunity to provide our analysis and recommendations for fish and wildlife conservation during the planning of the Dallas Floodway Extension project. Our report is based on information provided prior to January 1999, and is subject to revision should the Corps modify project plans or evaluate other alternatives at some point in the future. For additional technical assistance or questions regarding implementation of our recommendations, please contact us at the letterhead address or telephone (817) 277-1100.

Sincerely,

Mike McCollum

Mike McCollum
Acting Field Supervisor

enclosure

cc: Regional Director, FWS, Albuquerque, NM (ES/HC)
Field Supervisor, FWS, Austin, TX
Executive Director, TPWD, Austin, TX (Res. Protection Div.)
Ray C. Telfair, TPWD, Tyler, TX

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 SMITH SCHOOL ROAD • AUSTIN, TEXAS 78744 • 512-389-4800

July 23, 1997

Mr. Robert M. Short
Field Supervisor
United States Department of the Interior
Fish and Wildlife Service
Ecological Services
Stadium Centre Building
711 Stadium Drive, Suite 252
Arlington, Texas 76011

Dear Mr. Short:

Staff biologists have reviewed your draft Fish and Wildlife Coordination Act (FWCA) report on the Fort Worth District, U.S. Army Corps of Engineer's proposed Dallas Floodway Extension project. We concur with the evaluation and recommendations for acquistion, restoration, and management of bottomland hardwood forest habitat. Also, we concur with the plan to develop a "chain of wetlands" within the flood conveyance swales for enhancement of fish and wildlife values of the floodway and for recreation and aesthetic purposes.

In addition to your evaluation and recommendations, the Department opposes the proposed plan for realignment of the Trinity River channel and strongly recommends that the project sponsors hire Mr. Dave Rosgen as their consultant. Mr. Rosgen is an expert hydrologist who works with rather than against natural river processes. His advice would be important to the project both environmentally and financially. Mr. Rosgen can be contacted at the Wildland Hydrology Conference Center, 157649 U.S. Highway 160, Pagosa Springs, Colorado 81147.

Also, considerable expertise will be needed to properly manage the "chain of wetlands". The Department recommends the hiring of a project manager who has advanced graduate training in aquatic and moist soil management. If this is not done, the conveyance swales could easily become a liability rather than an asset. The department recommends that the project sponsors consult Dr. Leigh H. Fredrickson who is an authority in wetland management. Dr. Fredrickson can be contacted at the Gaylord Memorial Laboratory, The School of Natural Resources, University of Missouri-Columbia, Puxico, Missouri 63960.

Mr. Robert M. Short
Page 2

We appreciate the opportunity to provide comments on your report concerning the planning of the Dallas Floodway Extension project.

Sincerely,

Ray C. Telfair II

Ray C. Telfair II, Ph.D.
Conservation Scientist
Wildlife Division

cc: Thomas J. Cloud, Jr., Project Biologist, USFWS, Arlington
Roy G. Frye, TPWD, Wildlife Division, Austin

APPENDIX H

CULTURAL RESOURCES

APPENDIX H

ARCHEOLOGICAL, ARCHITECTURAL, ARCHIVAL, AND GEOARCHEOLOGICAL INVESTIGATIONS OF THE PROPOSED DALLAS FLOODWAY EXTENSION PROJECT, DALLAS COUNTY, TEXAS

INTRODUCTION

The City of Dallas, in cooperation with the U.S. Army Corps of Engineers, Fort Worth District, is sponsoring a multi-year project to extend the Dallas Floodway to an area along the Trinity River flood plain between Corinth Street and Interstate 20/635 (Figures 1 and 2). The project will include the construction, renovation, and extension of levees, development of a chain of wetlands with central linear lakes, construction of a series of sumps to contain storm water runoff, and rechannelization of approximately 800 m (2,600 ft) of the Trinity River near its intersection with Interstate 45. Total flood control terrain is 1198 acres for the LPP, 547 of which will be subjected to direct impact. The calculations do not include the area of potential effect (APE). An aspect of the Environmental Impact Statement (EIS) for the project, as required under the National Environmental Policy Act of 1969, as amended (PL 91-190) , is coordination throughout the undertaking with interested parties, which includes the State Historic Preservation Officer. As a consequence, the action initiates a response through processes under the National Historic Preservation Act, as amended through 1992 (PL 102-575). Prior to producing the cultural resources appendix to the EIS, the Corps of Engineers conducted a Phase 1 survey through contractual means as an element of the planning process. The objectives of the project were to compile recorded data, field test (ground truth) and evaluate known and/or reported resources, as well as generate an initial predictive model for buried cultural deposits. The investigation was to report on four primary tasks, which included:

1. Following a literature review, all sites that would be impacted under the current design will be relocated and their condition assessed. The task will also include those sites in the area of potential effect (APE). The action at each site will be at a Phase 1 intensive survey level, although delineation of buried, submerged, or deep fill sites will not be possible. Acquisition of data necessary for preliminary evaluation of the resources would be ideal. Evaluation would be based on three classes: eligible, potentially eligible, and not eligible for inclusion in the *National Register of Historic Places (NRHP).* Due to project constraints, it is anticipated that most occurrences will fall into the potentially eligible class and additional investigations will be necessary for definitive evaluation.

2. A brief, intensive review and assessment of primary historic records and archives, as well as secondary documentary sources is necessary to identify potential historic site loci, as well as for the preliminary evaluation of standing structures. A chain of title will be undertaken on selected parcels to evaluate the completeness and character of available data. These will include such archival sources as conveyance records, probate court records, and birth and death records, among others. Efforts will also be made to contact local historical societies and interested parties to assess and evaluate private archival records.

3. Provide a four-tier assessment of all structures or complexes (may include more than one structural component) in the currently designed project footprint, as well as identified historic structures in the APE. All structures will be placed in four categories: 1 - potentially eligible historic; 2 - not eligible historic; 3 - not historic (<43 years old); and, 4 - not historic (>43 years old, <50 years old). In addition, all structural components considered potentially eligible will be prioritized based upon their historic contribution to the development of Dallas.

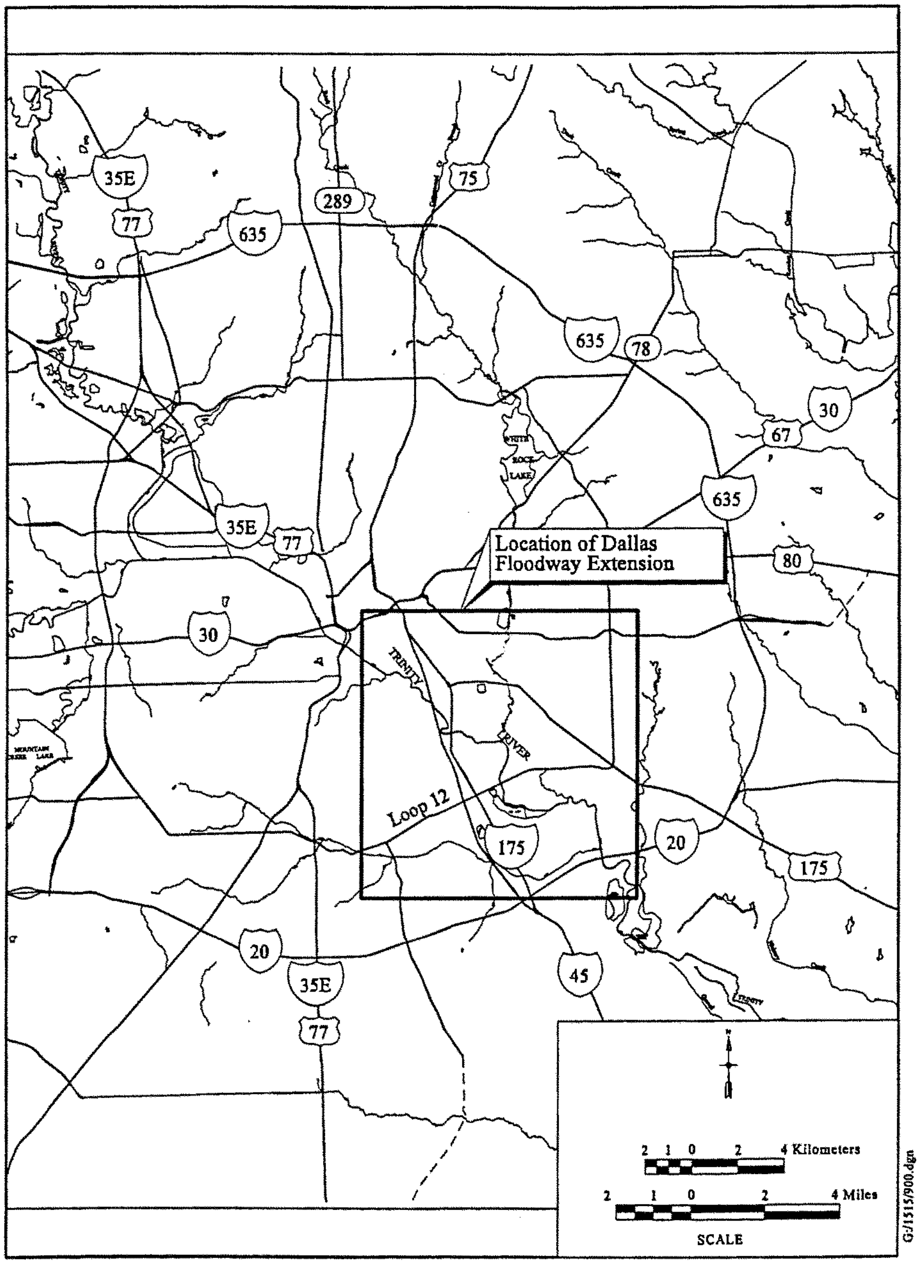


Figure 1. General location of the Dallas Floodway Extension project area within Dallas County.

4. Review all available geological and geomorphological data pertinent to the project area. Primary consideration should be given to core and boring data. A member of the team will be provided access to cores taken by the Corps of Engineers in other investigations. The objective of this task will be to gather enough data to generate a reliable model of buried topographic features or landforms and associated soil suites (paleosols). The surfaces and matrices of these relict and fossil deposits are believed to contain the remains of prehistoric occupations. Consideration should also be given to reconstructing the landscape prior to Euro-American modification, which will aid in the potential identification of buried features. An aspect of task 4 will be to take a series of cores in selected areas to aid in the reconstruction of paleolandscapes within the flood plain. Finally, a brief sampling program designed to evaluate the model will follow formulation. The results of the sampling program will be utilized to reformulate the model. An aspect of the final product will be a generalized estimate of the potential site density in the project terrain, which will include the environmental mitigation area between Loop 12 and Interstate 635.

The APE is defined as the area within the 100-year flood pool of the Trinity River between Corinth Street and Interstate 635, as noted. The Project Footprint area was defined as the area actually to be impacted by the current design, between the Martin Luther King Viaduct and Loop 12 (see Figure 2). This appendix is a synthesis of the technical report of finding and readers are encouraged to refer to the primary document, i.e., Cliff et.al 1997, for additional information.

This appendix is divided into eight sections. Section 2 presents the environmental setting of the project area, while Section 3 describes previous research in the project area and reviews the local prehistoric and historic chronology. Section 4 explains the research methods used during the investigation. Section 5 describes the reevaluation of the previously recorded archeological sites. Section 6 describes the archival research undertaken, while Section 7 presents the preliminary evaluations of the standing structures. Section 8 presents the results of the geoarcheological investigations and the model developed from this data. Finally, Section 9 presents the recommendations for the project. A list of references follows at the end.

ENVIRONMENTAL BACKGROUND

Dallas County is part of the Texan biotic province defined by Blair (1950) as an intermediate zone between the forests of the Austroriparian and Carolinian provinces and the grasslands of the Kansan, Balconian, and Tamaulipan provinces. Some species reach the limits of their range in the Texan province. Dallas County is part of the Blackland Prairie, one of several tall grass prairies present in this part of Texas. The vegetation in the Blackland Prairie is dominated by grasses, with woodlands being restricted to stream courses. Grasses expected to occur within this area include little bluestem, big bluestem, Indiangrass, hairgrama switchgrass, Florida paspalum, eastern gramagrass, sideoats grama, Texas needlegrass, Virginia wildrye, Torrey silver bluestem, meadow dropseed, vine-mesquite, and buffalograss (United States Department of Agriculture [USDA] 1980:88-90). The faunal community in this region has undergone changes due to the expansion of the Dallas-Fort Worth metroplex. However, the species of wildlife which previously inhabited the area include bobwhite, quail, pheasant, meadowlark, field sparrow, sage grouse, lark bunting, cottontail, red fox, antelope, and deer (USDA 1980:50).

The region has a warm, temperate, humid subtropical climate that is generally mild, with periods of extremely hot and cold weather being limited in duration. Yearly rainfall is fairly evenly distributed, with the maximum rainfall occurring in April and May and the minimum in August. Much of the rainfall occurs in the form of heavy thunderstorms, with the rapid runoff allowing only limited absorption of water by the soil. Snowfall is rare, with an average of less than 2.5 cm (1 in) falling per year. The snowfall is generally present for less than one week. The prevailing winds are southerly. Temperatures remain above 0° C (32° F) approximately 240 days each year (USDA 1964:72-73, 1969:51-52).

Dallas County is underlain by four geological formations—the Eagle Ford shale, the Austin chalk, the Taylor marl, and the Neylandville marl (Allen and Flanigan 1986). In addition, Pleistocene terrace deposits and Holocene alluvium are found along major streams and their tributaries. The APE is dominated by the Trinity River and two of its major tributaries—White Rock Creek to the northeast and Five Mile Creek to the west. Several smaller tributaries also join the Trinity River within the APE, including Kings Branch Creek, Little Cedar Creek, Cedar Creek, Honey Springs Branch, and Elam Creek.

Twenty-six soil map units are included within the APE, consisting of 16 upland map units, six flood plain map units, and four disturbed map units (USDA 1980). Given the rationale underlying the project, it is not surprising that the upland map units are limited to small areas within the APE and a small area along the edge of the APE, with the majority of the APE being composed of flood plain and disturbed soils. The upland map units and their role in archaeological research are discussed in detail elsewhere (Cliff et.al 1997).

CULTURAL SETTING

Previous Investigations

The history of archeological investigations within the Upper Trinity River drainage and the culture-historical framework for the area are aptly summarized in three, relatively recent, major reports concerning the archeology of the Upper Trinity River Basin (Peter and McGregor 1988; Prikryl 1990; and Yates and Ferring 1986). Although the combined efforts of professional and avocational archeologists have resulted in the recording of numerous sites, it is apparent that much research remains to be done. As noted by McGregor (1988:27-29), much of the excavation efforts within the Upper Trinity River Basin have focused on reservoir development, especially along the Elm Fork (Brown and Lebo 1991; Crook and Harris 1957, 1958, 1961; Lebo 1995a, 1995b; Lebo and Brown 1990; Skinner and Baird 1985; Skinner et al. 1982) and the East Fork (Dawson and Sullivan 1973; Lorrain and Hoffrichter 1968; Lynott 1975; Ross 1966). Field school excavations by the University of Texas at Arlington at the Northlake site on Grapevine Creek were also reported in the mid-1970s (Morgan 1975). Finally, investigations at Joe Pool Lake (Jurney, Lebo, and Green 1988; Peter and McGregor 1988) and test excavations at the River Bend site, 41TR68 (Peter et al. 1987), have provided the initial assemblage data necessary for an understanding of the adaptations along the West Fork of the Trinity River.

Reservoir studies along the East Fork have included work at Lake Ray Hubbard and Lake Lavon, east and northeast of Dallas, respectively. Lake Lavon was surveyed in 1949 with test excavations being conducted at the Campbell Hole (41COL10) and Hogge Bridge (41COL1) sites (Stephenson 1949). Additional excavations conducted at the Hogge Bridge site resulted in the formal definition of the Wylie focus—a Late Prehistoric manifestation believed to be characterized by arrow points, flexed burials, large pits, and trade pottery from cultures to both the east and west (Stephenson 1952). More recently, excavations were carried out by Southern Methodist University (SMU) as a result of the planned enlargement of Lake Lavon (Dawson and Sullivan 1973; Lynott 1975). Lake Ray Hubbard was surveyed with the help of members of the Dallas Archeological Society (DAS) in 1963 (Harris and Suhm 1963). Subsequently, excavations were carried out at the Glen Hill (41RW4) and Upper Rockwall (41RW2) sites (Ross 1966), and the Lower Rockwall site (41RW1; Lorrain and Hoffrichter 1968). Much of this work was concentrated on excavations at sites with "Wylie focus pits" in an effort to better understand the function of these large features.

More recently, two major reservoir studies have been undertaken a short distance south of the project area—Richland-Chambers Reservoir and Joe Pool Lake. Richland-Chambers Reservoir was originally included in the proposed Tennessee Colony Reservoir, to be constructed on the Trinity River below Dallas (Chamberlin 1972; Richner 1982; Richner and Bagot 1978; Richner and Lee 1976, 1977), but this development was later canceled. Subsequently, dams were planned on both Richland and Tehuacana creeks, and a preliminary overview of the cultural resources was prepared (Burton and Connors 1979). Finally, the project was reduced to the Richland Creek impoundment and became known as the Richland-

Chambers Reservoir. Fieldwork for the project was undertaken by SMU, beginning with a survey of the project area in 1980, during which 911 sites were discovered. This was followed by a testing phase, during which 270 sites were evaluated (Archaeology Research Program [ARP] 1982; Raab, Moir, and McGregor 1980, 1981). Finally, mitigation of 15 prehistoric and 38 historic sites was undertaken during four field seasons from June 1982 to December 1984 (Bruseth and Martin, eds. 1987; Bruseth and Moir 1987; Jurney and Moir, eds. 1987; McGregor and Bruseth 1987; Moir and Jurney, eds. 1987).

Located along Mountain Creek in southwest Dallas County, Joe Pool Lake was originally known as Lakeview Reservoir. Fieldwork began in 1977 with a survey which recorded 42 sites within the project area, including Archaic, Late Prehistoric, and Historic sites (Skinner and Connors 1979). Test excavations were then undertaken at 15 prehistoric and eight historic sites (Ferring and Reese 1980; Raab, Bruseth, and McIntyre 1980; Raab et al. 1982). Finally, mitigation was conducted from 1984 to 1986 at six prehistoric and 13 historic sites (Jurney, Lebo, and Green 1988; Peter and McGregor 1988).

Recent large cultural resources management projects in Dallas County include the excavation of the Freedman's Cemetery and research for the Dallas Area Rapid Transit (DART) rail lines, the latter of which has included both archeological and architectural investigations (Adovasio 1992; ARP 1989, 1991; Dorward and Weston 1990; Dorward et al. 1990; Jurney 1987a, 1987b, 1987c, 1987d, 1987e, 1987f, 1988a, 1988b; Jurney and Moir 1987a, 1987b, 1987c; Jurney, McElhaney, and Weston 1990; Jurney, Moir, Dorward, and Weston 1990, 1991; Jurney, Moir, and Peter 1987; Jurney, Peter, and McElhaney 1987, 1988; Jurney, Peter, McElhaney, Payton, and Girard 1987; Moir, Dorward, and Winchell 1991; Moir and Jurney 1987a, 1987b, 1988; Moir, Peter, and Jurney 1987a, 1987b; Moir and Peter 1987; Myra L. Franks & Associates 1987a, 1987b, 1987c, 1988a, 1988b, 1988c, 1988d, 1988e, 1990, 1993; Myra L. Franks & Associates and ArchiTexas 1987, 1988; Myra L. Franks & Associates and Burson & Cox Architects, Inc., 1987a, 1987b, 1987c, 1987d; Skinner and the Staff of the Archeology Research Program 1996; Skinner et al. 1994; Skinner, Whorton, Trask, Scott, Caran, and Dillon 1996; Weston and Dorward 1990; Winchell and Dorward 1991).

In addition to these large projects, Dallas County has seen many smaller cultural resources investigations within recent years and several projects have occurred in or near the project area. During 1974 and 1975, North Texas State University (NTSU; now known as the University of North Texas) conducted an archeological reconnaissance within the flood plain of Five Mile Creek (McCormick 1976), including the southern end of the APE. Six sites were investigated during this project, two of which, sites 41DL80 (designated 41-DA-5 NTSU) and 41DL102 (designated 41-DA-6 NTSU), are in the APE. In 1981, Environment Consultants, Inc., undertook a survey for the Dallas Floodway Extension (Bennett et al. 1981). Although the exact location is difficult to discern from the maps provided in the report, the project area appears to have been slightly larger than the current APE (Figure 3). Twenty-two sites were investigated during this project, of which 13 (sites 41DL69, 41DL70, 41DL73, 41DL80, 41DL84, 41DL91, 41DL99, 41DL104, 41DL204, 41DL205, 41DL206, 41DL208, and 41DL220) are located within the present APE.

In 1990, AR Consultants undertook an archeological survey for the Rochester Park Levee, immediately adjacent to the project area (Figure 3). Two previously recorded sites, 41DL69 and 41DL70, were investigated. In addition, archival research was conducted for the project area and an oral history of the nearby Metzger Dairy was recorded (Skinner et al. 1990). Also in 1990, AR Consultants began a cultural resources survey of a proposed new levee and associated borrow pits at the Central Waste Water Treatment Plant (Skinner et al. 1991). Following this field work, AR Consultants continued to monitor the sites found at the Central Waste Water Treatment Plant and recorded three new sites (Skinner and Whorton 1995). As a result of this project two prehistoric and two historic sites were recorded. AR Consultants again visited the project area in 1993 for an archeological survey around Little Lemmon Lake (Skinner and Whorton 1993). Two sites (41DL350 and 41DL351) were located, both of which are within the APE. Finally, in 1996, AR Consultants undertook construction monitoring within the Dallas Floodway immediately north of the Project Footprint (Skinner, Whorton, and Trask 1996). Two historic sites, 41DL370 and 41DL371, were recorded during this project.

Prehistoric Chronological Framework

Although the chronological framework for the Upper Trinity River Basin is not well developed, the available data allow the delineation of a generalized chronology (Table 1). Investigations at Joe Pool Lake (Peter and McGregor 1988) have provided evidence for a refinement of the chronology for the Late Prehistoric period, but the overall regional applicability of the phases recognized at Joe Pool Lake remains to be demonstrated. Prikryl (1990) has presented a chronological sequence of six periods. Unfortunately, his sequence relies almost entirely on diagnostic artifacts from surface contexts and comparisons to dated contexts distant from the Upper Trinity River Basin. The generalized chronology presented here reflects the present state of knowledge as interpreted from the Joe Pool Lake investigations. A brief summary of the adaptations associated with these periods is presented below.

Table 1
Chronological Framework for the Upper Trinity River Basin
(after Peter and McGregor 1988)

CULTURAL STAGE	TIME PERIOD
Paleo-Indian	ca. 11,000 - 6,000 B.C.
Archaic	6,000 B.C. - A.D. 700
Late Prehistoric	A.D. 700 - A.D. 1600
Protohistoric	A.D. 1600 - A.D. 1800

The Paleo-Indian occupation of the Upper Trinity River Basin is known primarily through diagnostic projectile points from surface collections or from stratigraphically mixed contexts. The Field Ranch site (X41CO10) (Jensen 1968) along the upper Elm Fork is a primary example of typical site contexts. Clovis and Plainview points are commonly found along both Denton and Clear creeks in the Cross Timbers. Until recently, the Lewisville Lake site (Crook and Harris 1957, 1958, 1961) was the best known Paleo-Indian site within the region. While the original radiocarbon dates (ca. 37,000 B.P.) contributed to the significance of the site, more recent work (Stanford 1981) has resolved the controversy concerning the date of the occupation. It appears that the presence of naturally-occurring lignite as either a fuel in these hearths or an inadvertent inclusion contaminated the radiocarbon samples. Consequently, the usually accepted date of 12,500-10,000 B.P. for Clovis-period occupations is probably a reasonable estimate for the first human occupation of Northcentral Texas. Our knowledge of the settlement-subsistence strategies used by these early occupants is extremely limited. However, recent important excavations at the Aubrey site (41DN479), a well-preserved Clovis-period occupation in Denton County, has indicated that subsistence efforts did not focus on big game animals alone. Rather, the entire range of prairie and forest species was used (Ferring 1989). Whether this pattern of a more generalized foraging subsistence system is characteristic of Clovis adaptations in the Eastern Woodlands and the focus on now extinct, big game species is more characteristic of a Plains adaptation remains to be documented. Furthermore, the situation of the Aubrey site, buried about 7-8 m below surface in the flood plain of the Elm Fork (Ferring 1990), suggests that well-preserved Paleo-Indian sites in this area will only be found by penetrating more recent Holocene alluvium in modern flood plain situations.

Our knowledge of the Archaic period in the Upper Trinity River drainage is limited by a lack of data from major excavations. This is particularly true for the Early and Middle Archaic periods. Recent investigations along the West Fork (Peter and McGregor 1988; Yates and Ferring 1986) indicate that primary contexts for Early and Middle Archaic sites will probably be found deeply buried within flood plain alluvium. Artifacts from these periods are present on terrace surfaces, but they are frequently mixed with later materials. In fact, the initial treatment of the Archaic period in Northcentral Texas (Crook and Harris 1952, 1954), which defined the Carrollton and Elam foci, was based upon materials from such mixed terrace contexts. Consequently, these time-space constructs are no longer recognized as being acceptable for this area of Texas (Peter and McGregor 1988; Prikryl 1990; Yates and Ferring 1986).

Recent investigations at Joe Pool Lake (Peter and McGregor 1988) and at Lake Ray Roberts indicate that remains of the Late Archaic period are characterized by assemblages apparently left by small bands of foraging hunters and gatherers who occupied a locality for a limited time period and then moved to another locality. These sites were apparently reoccupied numerous times on a seasonal basis. Deer and numerous small mammals were the primary food resources. The documentation of large pits associated with Late Archaic period sites in the Richland Creek and Chambers Creek drainages (Bruseth and Martin 1987) suggests that important sociopolitical changes may have been occurring during this time period. Unfortunately, the significance of these pits remains an enigma despite their excellent documentation.

The beginning of the Late Prehistoric period in the Upper Trinity River Basin is marked by the initial appearance of arrow points. A lower date of A.D. 700 for this period is based upon dated contexts for similar material in the Brazos River drainage to the west. Lynott (1977) suggests that the Late Prehistoric period may be divided into an early and a late phase. The early phase is characterized by sand- and grog-tempered ceramics, Scallorn and Alba arrow points, and a continuation of the foraging subsistence system of the preceding Late Archaic period. The late phase reflects Southern Plains influences, with the appearance of Nocona Plain ceramics of the Henrietta focus, various unstemmed triangular points (e.g., Fresno, Harrell, Washita), and the Perdiz point. Evidence of horticulture and the procurement of bison also appears in sites of this period (Harris and Harris 1970; Morris and Morris 1970). Prikryl's (1990) recent assessment of the Late Prehistoric period largely follows that of Lynott (1977).

Recent investigations at the Cobb-Pool site at Joe Pool Lake (Peter and McGregor 1988) have resulted in a reformulation of the Late Prehistoric period. The Cobb-Pool site has yielded house structures, roasting pits, Alba points, grog-tempered ceramics, and charred corn cupules. Radiocarbon dates from several features indicate the site was occupied during the late twelfth or early thirteenth century. Present evidence suggests that the site does not represent an intrusive Caddoan occupation; consequently, a significant adaptive change appears to have occurred during a middle phase of the Late Prehistoric period. It is also likely that ceramics were not introduced to the region before this time. Whether the Cobb-Pool site merely represents a local experiment or reflects a regional adaptive change remains to be fully documented, but a small grouping of disturbed human remains recovered from the Harbor Pointe site (41DL369) suggests that various prehistoric groups in the Dallas County area may have been pursuing radically different adaptive strategies at this time. This site, located on Rowlett Creek (a tributary of the East Fork of the Trinity River) yielded remains of at least four individuals dated by radiocarbon dating of bone collagen to cal A.D. 1010 (1035) 1165. No pottery was recovered with these remains, although shell beads and a shell gorget, were present; and a carbon isotope ratio of -21.6% suggests that the group's diet was not high in maize (Cliff et al. 1996).

Historical documentation and archeological evidence are very sparse for the Protohistoric period in the Upper Trinity River Basin. Numerous historic groups, including Tonkawa, Wichita, Caddo, and Comanche, all are likely to have traversed the area. However, exact locations of their sites and detailed ethnohistoric data are almost nonexistent. Although European trade items (Sollberger 1953) appear on a limited number of sites, no protohistoric site has been thoroughly investigated and characterizations of the Native American adaptations during this time period are conjectural at best. A lack of documentary evidence, together with a lack of interest among ethnologists and archeologists, has contributed to this situation.

Historic Background

The first documented presence of Europeans in Northcentral Texas may have occurred in 1542, when the remnants of the de Soto expedition, led by Luis de Moscoso de Alvorado, entered modern Texas in an effort to find a land route to New Spain. Some researchers believe that the expedition crossed Northcentral Texas (Lebo and Brown 1990:61), although others place the route much farther to the east and south (Bruseth and Kenmotsu 1991; Chipman 1992; Hudson 1986; Schambach 1989; Weber 1992). A consistent presence in the region did not occur until the early 1700s, when French traders from Louisiana began to move west along the Red River. The Spanish considered this French incursion to be a threat to the security of New Spain, and they responded by redoubling efforts to counterbalance the French influence with the Native Americans in East and Northcentral Texas. These efforts continued until 1763, when France ceded Louisiana to Spain under the Treaty of Paris. This reduced the perceived threat to the security of New Spain and resulted in a reduction in Spanish investment in eastern and northern Texas. More important from the Native American viewpoint, was the severe military defeat inflicted on the Spanish by Wichita and allied tribes at Spanish Fort on the Red River in 1758. It has been argued that this defeat put an end to Spanish military and missionary expansion to the north (Weddle 1964, 1965).

The first North Americans to settle in the region were primarily from Arkansas Territory. The first permanent settlement in the Dallas area was Bird's Fort in present-day Tarrant County, established in 1840. Also in 1840, John Neely Bryan reconnoitered the Dallas area to determine its suitability for a trading post. By the time Bryan returned in 1842, troops of the Republic of Texas had removed the Native American groups with whom he had intended trading. As a result, Bryan determined to found a settlement in the same area where downtown Dallas is today. To further this goal, Bryan invited the residents of Bird's Fort to join him in his new settlement. Five individuals—John and James Beeman, Captain Mabel Gilbert, Tom Keenan, and Isaac B. Webb—and their families decided to answer Bryan's call. Prior to this, in 1841, the Republic of Texas had contracted with the Texan Emigration Land Company to establish 600 families on a land grant encompassing portions of the modern Dallas, Denton, Cooke, Collin, Grayson, Ellis, and Wise counties. This land grant became known as the Peter's Colony. The majority of the Peter's Colony settlers held property north of Dallas. The Peter's Colony continued until 1852, when disputes about land title between the Texan Emigration Land Company and the settlers came to a head and some of the settlers rose up in arms to defend their title to the land they had settled. Dallas County was organized from Roberson County in 1846, with Dallas serving as the county seat (Works Progress Administration [WPA] 1992:38-50).

Texas was annexed by the United States in 1846 and some Dallas area residents joined the American army facing the Mexicans. The California gold rush in 1849 affected Dallas in two ways. First, it was near a major trail for the "49ers" that utilized a ford across the Trinity River about seven miles north of Dallas. Second, many Dallas area residents were struck with gold fever. Some, including John Neely, trekked to California, while others explored the nearby Wichita Mountains for gold (WPA 1992:46-47).

In 1855, another major colonizing venture was begun in the Dallas area when 200 French, Belgian, and Swiss immigrants arrived to found the utopian settlement of La Reunion, about three miles west of Dallas along the West Fork of the Trinity River. La Reunion was well funded, with an initial capital of $600,000, but the residents did not adapt well to frontier conditions and the colony never really prospered. Gradually the members of the colony drifted away, with many becoming residents of Dallas. The colony officially dissolved in 1867 (WPA 1992:286-290).

Although present, slavery did not loom as large in the economy of the Dallas area as it did farther to the east. In 1846, there were 45 slaves in Dallas County, a number that grew to 207 by 1850 (Prince 1993:10). In the 1860 census, Dallas County had a total population of 8,655 people, of whom 1,074 were slaves (Prince 1993:16). Most of the white residents of the county were southerners by birth and supported the pro-slavery side of the abolition question. As passions grew during the election of 1860, a fire swept through the Dallas business district, destroying all but one building. This was immediately assumed to be an abolitionist plot, resulting in the hanging of three African-Americans, the flogging of the remaining African-Americans in the county, and the whipping and banishment of two white preachers from Iowa (WPA 1992:53-54).

Following the presidential election of 1860, Texas, in common with the rest of the South, began to consider secession. In a February 23, 1861, referendum on the issue, Dallas County voted 741 to 237 in favor of secession. Many county residents joined Confederate military units and, after a 516 to 3 vote on the issue, Dallas County donated $5,000 in gold to the Confederate cause. The Dallas area provided foodstuffs to the Confederate army, and in 1862 a small arms and ammunition factory opened in Lancaster, south of Dallas. Although the fighting never reached Northcentral Texas, the region was gradually impoverished by the war. Many of the commodities that were imported to the region became difficult to obtain and expensive, while the price of food had risen between two and four times its 1861 levels by September 1863. The *Dallas Herald* was forced to cease publication between September 30, 1863, and July 2, 1864, due to a lack of newsprint. Following Lee's surrender, the Federal Army occupied Texas and announced the emancipation of Texas' slaves on June 19, 1865 (WPA 1992:55-58).

Although the Dallas area suffered economically in the aftermath of the Civil War, it was not as badly affected as other areas of the former Confederacy. This greater economic vitality was fueled in part by streams of immigrants from the rest of the country, who were hoping to make a fresh start in the as yet unsettled West. Other elements in the economy included Dallas' location near one of the cattle trails to Kansas and its role as a center of the buffalo hide market. In 1872, the Dallas economy received a major boost when the Houston & Texas Central Railroad reached the city from the south, while, in 1873, the Texas & Pacific Railway provided important access to points east. After the arrival of the railroads, Dallas began to acquire many of the trappings of a major city, including the beginning of a water distribution system (1873), gas lighting (1874), a private telegraph company (1875), the telephone (1880), and electricity (1882) (WPA 1992: 60-70).

An early dream of the Dallas business community was to gain water transport along the Trinity River. The problems associated with this effort included the seasonal fluctuations in the level of the Trinity River, as well as the many snags and rafts that had to be removed. The first effort in this respect occurred in 1866, when the state legislature chartered the Trinity Slack Water Navigation Company to provide the improvements required for navigation from Galveston to Dallas. Under the terms of the charter, the company was to receive 5,000 acres of public land for every lock and dam completed; unfortunately, the company never started work on the project. In 1867, Captain J.M. McGarvey agreed to bring his *Job Boat No. 1* from Galveston to Dallas. The journey required seven months, with much of the time being spent removing obstructions from the river channel. Although Captain McGarvey claimed that the Upper Trinity was superior to both the upper Red River and the upper Mississippi River, his proposal to provide regular service to Dallas did not prove practical. Following his arrival, construction began in Dallas on the steamer *Sallie Haynes*, which made three trips down river before being sunk; there are no records, however, of the *Sallie Haynes* making the voyage all the way to Galveston.

After the railroads arrived in Dallas, interest in river navigation began to wane, although several small steamers continued to ply the Trinity, some of which are thought to have made the trip from Galveston to Dallas. In 1881, the state government was asked for $75,000 to remove obstructions from the river. During the 1890s interest in Trinity River navigation revived, and the Trinity River Navigation Company was formed in 1891. The company built two steamers, *Dallas* and *The Dallas*, and purchased the *H.A. Harvey, Jr.*, in New Orleans. The *Harvey* made its way up the river in 1893, arriving in Dallas on May 13. A dam was built at McCommas Bluff to provide sufficient water for the steamer, and it spent the next few years carrying cargo between Dallas and the dam. In 1898, the *Harvey* and the remains of *Dallas* were sold to a Galveston firm, and the *Harvey* made a four-month voyage downriver to Galveston.

In 1899, the U.S. Army Corps of Engineers submitted a plan to construct 37 locks and dams between Dallas and the Gulf of Mexico, permitting navigation of the Trinity River for eight months of each year. The plan went on to suggest that if a series of artesian wells were to be dug along the river channel, adding to the water flow, year-round navigation would be possible. In 1902, Congress appropriated $750,000 to improve the Trinity River, with another $500,000 being appropriated in 1904-1905. In addition, the citizens of Dallas contributed $66,000 for the construction of a dam at Parson's Slough, 26 miles below the city. Nine locks were built before the beginning of Wold War I. In 1916 the project was reevaluated, with a new estimate of another $13 million and 15 years being required to complete the project. Finally, in 1921, the Corps of Engineers recommended that any efforts to make the Trinity navigable above Liberty were impractical and should be abandoned.

In 1930, renewed interest in river navigation led to the creation of the Trinity River Canal Association, which in turn sponsored the creation of the Trinity Watershed Soil Conservation and Flood Control Association in 1936. These two organizations later merged to become the Trinity Improvement Authority (TIA). In 1955, the State of Texas created the Trinity River Authority (TRA). Lobbying on the part of the TIA and TRA led to passage of the Trinity River Basin Bill in 1963; however, the bill merely authorized the project and contained no funding. Due to the huge backlog of river and harbor improvement projects approved by congress, no funding was ever appropriated for the project. The dream of a navigable Trinity River once again died in 1979, when the Corps of Engineers again determined that navigation of the Trinity River upstream of Liberty was not economically feasible (Jadrosich 1996; McElhaney 1995; Saunders 1991).

The history of Dallas is punctuated with several severe floods, with the floods of 1844, 1858, 1866, 1871, 1890, 1908, and 1913 being particularly memorable. Following the 1908 flood, the City of Dallas determined to try to reduce the impact of Trinity River flooding. This led to the construction of the Houston Street Viaduct, a 5,106-foot long concrete bridge constructed to ensure communication between Dallas and Oak Cliff even in the event of a major flood. A series of severe floods in the early 1920s led to renewed interest in flood control projects on the part of the local government. In 1926, the Dallas County Commissioners created the City and County of Dallas Levee Improvement District, which formulated the Ulrickson Plan for flood control. This plan called for the construction of levees, straightening and moving the river channel, additional viaducts, storm water drainage, and other improvements. Funds in excess of $15,000,000 dollars were provided for the project by the Levee Improvement District, The City and County of Dallas, and affected utilities and railroads. Among these improvements were the Cadiz Street Viaduct (completed in 1932), the Corinth Street Viaduct (completed in 1933), and the Lamar-McKinney Viaduct (completed in 1934) (Skinner, Whorton, and Trask 1996:18; WPA 1992:85, 94-96, 154-156).

By 1900, Dallas had become a major commercial and manufacturing center and, with a population of 42,638, was the third largest city in Texas. In 1908, a devastating flood occurred along the Trinity River, with the river cresting at 51.3 feet. The flood caused tremendous property loss, estimated at $2,500,000, and left 4,000 people homeless. The flood shut down the Dallas and Oak Cliff water systems and caused the collapse the Texas and Pacific Railroad trestle across the Trinity, as well as threatening several other bridges. During World War I, Dallas served as a training base for aviators, with Love Field and Camp Dick (at the State Fairground) being used for training. During the 1920s, the Ku Klux Klan became a factor in local politics, achieving particular importance between 1921 and 1924. Dallas' first radio station, WRR, was established in 1921, originally as a means of broadcasting emergency messages to the fire department. By 1927, WRR had become a commercial station. Beginning in 1930, Dallas began to be severely impacted by the Great Depression (WPA 1992:80-97, 266-267).

The economy of Dallas, and of the nation as a whole, did not begin to recover from the Depression until the mobilization for World War II began. After the war, the Dallas economy continued to grow along with the rest of the nation. Dallas' image was shattered by the Kennedy assassination on November 22, 1963, and it took many years to recover from this blow. A major economic downturn occurred in the late 1980s, when a drop in oil prices and the collapse of the real estate market dealt a severe blow to the Texas economy. This forced the Dallas region to diversify economically, investing heavily in the modern high-tech industries.

Project Specific Background

Although archeological surveys and archival research show that the Trinity River flood plain was occupied historically, little is known about settlement patterns, land use, social and economic development, historic structures, and the extent to which ethnic diversity may have existed in the area. Resources for historical data which pertain to Dallas County are widely available (see Graff et al. 1977), but data which pertain specifically to the APE are scarce and sometimes difficult to trace. Previous research and archeological surveys indicate that development in this area was limited, due in part to the frequent, unpredictable flooding of the river and its tributaries (Bennett et al. 1981:31, 38). Known historic structures and sites, however, suggest that the river played an important role in the activities which did occur.

Miller's Ferry, Cockrell's Bridge, and Lock and Dam No. 1 all indicate that fording and navigating the river were important considerations for earlier inhabitants (U.S. Army Corps of Engineers, Fort Worth District [USACE-FW] 1996; Yates and Ferring 1986:156). Ferries and bridges became venues for connecting settlements which developed on either side of the river—Dallas and Hord's Ridge (which later became known as Oak Cliff). As the town of Dallas grew to become a mercantile center with county farmers producing marketable crops, such as cotton and wheat, inhabitants dreamed of establishing shipping connections between Dallas and Galveston via the Trinity River. However, in spite of attempts to channel the river and to maintain a navigable level of water, an established water route between Dallas and Galveston never materialized (Bennett et al. 1981:41; McElhaney 1995; Saunders 1991; WPA 1992:150-153). Since the area was not highly developed, it did not receive the same attention from early chroniclers as did the more prominent areas. The early history of the downtown district, for example, is well documented as it was the center of social, economic, and political activities and was the site that John Neely Bryan chose for the original town (American Illustrating Company 1908; A.C. Greene 1973, 1984:59-61).

METHODS

Task 1 - Archeological Evaluation

The records of the U.S. Army Corps of Engineers, Fort Worth District; the Texas Archeology Research Laboratory (TARL), the University of Texas at Austin; and numerous cultural resources reports were consulted to determine what sites had been recorded within the APE. Due to limited right-of-access within the APE, it was not possible to revisit all of the recorded sites, while in other cases access was gained to the property only with significant limitations. For example, neither the Sleepy Hollow County Club nor the Dallas County Joppa Wildlife Preserve would allow shovel testing, greatly reducing the potential for relocating and reevaluating the sites in these areas. In addition, several sites had originally been discovered in cutbanks along the Trinity River, 1.5 to 3 m below present ground surface; and for these sites, shovel testing was futile, while safe examination of the bank was precluded by the high river levels during the period of investigation. A further complication arose in the case of the sites recorded by Forrest Kirkland in the 1940s, since careful reading of the site forms suggested that the TARL site plottings may not be accurate. For example, although the mapped position of site 41DL84 is within the Sleepy Hollow County Club, the latitude and longitude provided by Forrest Kirkland place the site adjacent to a gravel pit/strip mine about 500 m north-northeast of the plotted location, while the site map appears to place it adjacent to the Southern Pacific railroad tracks, over a kilometer away from the plotted location.

On May 14-15, 1997, an attempt was made to relocate all of the sites in the Project Footprint to which the Corps of Engineers had obtained right-of-access. The two-person field crew was able to actually revisit only two of the 13 previously recorded sites that fell into this category. Of the sites which were not revisited, one had been destroyed, two could not be relocated, and eight were inaccessible due to high flood waters. Those sites which could be relocated were shovel tested and recorded at a level equivalent to a Phase 1 survey. Shovel tests consisted of 30-x-30-cm units dug in 20-cm arbitrary levels to a minimum of 40 cm below surface or to subsoil. A Survey Unit Level Form was completed for each shovel test at each site, describing, at a minimum, the soil color and textures and artifacts (if any) recovered from the unit. A pace-and-compass map was drawn to show the locations of the shovel tests and pertinent landform features, and a site update form was completed. Within the Project Footprint, black-and-white and color photographs were taken of all sites that could be relocated, and of the reported location of those that could not. A record was maintained of all photographs taken during the project, and a daily record of the field work was maintained by the field supervisor, describing the survey conditions and the results of the investigations.

Subsequently, beginning on May 26, 1997, attempts were made to revisit sites in the APE outside of the Project Footprint, where the Corps of Engineers had not obtained any right-of-access. The goal of this second phase of fieldwork was twofold: (1) to discover which sites have public access, and (2) to revisit and reevaluate those sites the field crew could reach. Shovel testing could not be undertaken on any of these sites, in the absence of explicit right-of-access. Of the 27 previously recorded sites in this category, the four sites in the Joppa Wildlife Preserve were revisited but could not reevaluated due to the inability to shovel test, one appeared to be within the McCommas Bluff Sanitary Landfill and is probably destroyed, and the remainder could not be reached at all. An attempt was also made to reach the McCommas Bluff Lock and Dam No. 1, constructed in 1904-1905 as the first in a proposed series of 37 locks and dams to allow navigation of the Trinity River (USACE-FW 1992:28). Unfortunately, this site could also not be reached due to lack of access and high flood waters.

Task 2 - Archival Evaluation

The historical research conducted for this project focused on surveying sources for information that might shed light on the historical activities that occurred within the APE from the time that Dallas was settled in the 1840s. While some data were uncovered, the limited amount of available information demonstrates the need for more in-depth historical research on the Trinity River flood plain. Over 35 maps, located at the Dallas Public Library and at Fondren Science Library, Southern Methodist University, were consulted for data on settlement patterns, land use, land ownership, historic structures, and development (see Table 2: Cliff et. al 1997). Inquiries into record holdings were made at the Dallas County Historical Society, Preservation Dallas, and Black Dallas Remembered, Inc. Secondary (or published) material was consulted, as were earlier cultural resources survey reports and the 1903 and 1904 Dallas directories. Finally, deed research was conducted for several parcels of land.

Initial steps toward documenting the cultural and historical development in the APE focused primarily on a review of maps, which were consulted for information regarding historic structures, community development, land use, and land ownership. Unfortunately, the majority of the maps reviewed contained little or no information pertinent to the APE—exceptions included the 1900 *Sam Street's Map of Dallas County, Texas,* the 1920 Dallas County soil survey map, and a few others.

In conjunction with map research, the files at Preservation Dallas were consulted for information pertaining to neighborhood and community developments in or near the project area. Six developments which surround the APE were identified, including Cadillac Heights, Magna Vista (or Cedar View), South Central (or Joppa), Skyline Heights, Ervay Terrace Marlburg,and Colonial Hills (or Wendelkin/Driskell). Of these six districts, the first four (Cadillac Heights, Magna Vista/Cedar View, South Central/Joppa, and Skyline Heights) appear to be adjacent to or within the APE—located on the western side of the Trinity River.

The Colonial Hill Historic District is located adjacent to, but outside, the APE on the eastern side of the Trinity River, bound by Central Expressway and I-45/South Lamar on the east and west, and by Warren Avenue and Hatcher Street on the north and south, respectively. Data for each of these districts in the files at Preservation Dallas vary in detail. For example, no data pertinent to the project were found in the informational notebook for Cadillac Heights. For Magna Vista/Cedar View, Skyline, and South Central/Joppa, however, surveys completed by a neighborhood resident in 1994 at least provided a contact person from whom additional information could be obtained.

Secondary sources that were consulted provided general information for an historical overview of Dallas County and the role of the Trinity River in its development, but little data appeared to relate *directly* to the cultural and historic development of the APE, specifically. The final step in historical research for this project included deed/title and will/probate investigations for two properties, in order to evaluate the completeness and character of available records.

Task 3 - Architectural Evaluation

Addressing the architectural resources within the Dallas Floodway Extension Project Area involved two levels of identification and preliminary NRHP eligibility assessment. First, all architectural resources indicated by the COE Real Estate to be within the Project Footprint (the area that will be directly impacted by the construction of the levees or other components of the levee/flood control system) were assessed for their potential for being included in the NRHP. Second, all architectural resources within what has been defined by the Corps of Engineers as the APE—the 100-year flood pool—were identified. Any architectural resources in the APE that had been previously recommended as eligible for inclusion in the NRHP were assessed in the same manner as the architectural resources within the Project Footprint.

The assessment of the architectural resources included their categorization as:

1 — potentially eligible architectural resource or district (according to field evaluation, resource condition is at least fair, resource integrity is maintained to a reasonable degree, and the resource is likely to be more than 50 years old);
2 — architectural resource considered not eligible due to deteriorated condition or loss of integrity, or because it lacks sufficient significance;
3 — architectural resource that is not eligible because it is currently less than 50 years old, and will not be 50 years old at the time levee construction is scheduled to begin (estimated to be the year 2004);
4 — architectural resource or district that is not eligible because it is currently less than 50 years old, but one which will be 50 years old by the time levee construction is scheduled to begin and will thus need to be assessed when it becomes 50 years old.

The assessment of Category 1 buildings and structures was further refined by prioritizing these potentially eligible resources as:

1a — (highest priority) a resource or district that helps define the development of Dallas, including major municipal facilities, very important examples of local architectural or engineering design, and resources or districts associated with pivotal events or persons in Dallas history;
1b — a resource or district that is characteristic or typical of architectural or engineering styles important in the Dallas area and significant in the history of the city, or associated with important events or persons in the history of Dallas;
1c — a resource or district that is of minor architectural or engineering importance in the Dallas area, of minor significance to the history of the city, or associated with less important events or persons in the history of Dallas (but that will likely be considered eligible because of significance related to broader architectural or engineering styles, historical events, or persons); or
1d — (lowest priority) a resource or district considered to be significant primarily for its associations with architecture and engineering design, events, or persons of importance within broader historical themes (i.e., not Dallas-specific themes).

All buildings and structures within the Dallas Floodway Extension Project Area were given identification numbers. Those shown to lie within the Project Footprint (specifically in areas that will be directly impacted by the construction of the levee system or other flood control components) were assigned identification numbers prefixed with "A" (herein referred to as A-series resources). Those located within the APE but not to be directly impacted by levee construction were assigned identification numbers prefixed with "B" (herein referred to as B-series resources). The number of A-series resources thus identified was 49, and the number of B-series resources was 699 (one of which is a potential historic district that includes other B-series resources).

U.S. Geological Survey (USGS) 7.5-minute quadrangle sheets for the area, in conjunction with historic maps, archives and historic quadrangles, were examined to determine which resources had been constructed subsequent to the original date of the sheets (1958), indicating that the resources were less than approximately 40 years old. In general, assessment for NRHP eligibility should take place at least 50 years after a potential historic property has achieved significance in order to allow proper historical perspective for an accurate assessment. Thus, sufficient time has not yet passed—nor will it have passed by the time the Dallas Floodway Extension Project construction is scheduled to begin (estimated to be the year 2004)—for resources constructed after 1958 to be considered for inclusion in the NRHP. Only resources of exceptional significance should be considered prior to reaching 50 years of age, and there are no known resources of exceptional significance within either the Project Footprint or the APE.

It should be noted that most of the areas identified as ruins on Corps of Engineers map were not assigned identification numbers, since they do not include standing structures and are more appropriately considered as archeological rather than architectural resources. It should also be noted that no architectural resources between Loop 12 and Highway 635 were assigned identification numbers since no construction efforts are planned in that area which would potentially impact architectural resources. In the event actions are planned or undertaken that may impact architectural resources in the area between Loop 12 and Highway 635, inventory and assessment of the resources within the area should be undertaken.

The areas with A-series resources were first visited on May 12, 1997 to ascertain the variety of resource types, general conditions, accessibility, and to assess the resources. A large majority of these buildings and structures were in industrial areas and appeared to serve as storage and industrial activity facilities. Some were retail outlets. Buildings and structures that were estimated to be 50 years old or older were photographed. Unfortunately, several of the buildings and structures could not be observed because they were behind fenced areas, obscured by other buildings, or hidden by trees. A second trip to the area was made on June 9, 1997, to ensure that every effort to locate and assess all architectural resources was made, but this second visit contributed little to the previous resources assessment. Although additional efforts to see buildings and structures on private lands were made (by searching for higher ground, looking for open lines-of-sight around obstructions, and by driving or walking along public transportation routes), only in a few cases could the locations be seen clearly enough to make accurate assessment of the resources thereon.

Preliminary age determinations were made for each of the 699 B-series resources in the APE, based on information contained on the USGS quad sheets of the area. This data allowed a preliminary assessment (using the same five categories employed for the A-series resources) of many of these resources to be made. Several of the B-series resources were visited during field assessment of the A-series resources, but most will need additional assessment should the design or layout of the levee system or other flood control components be altered such that it would impact B-series resources. Field observations were concentrated in locations that contained resources previously recommended as eligible for inclusion in the NRHP and residential areas. While assessing the A-series resources, any nearby B-series resources that appeared to be more than 50 years of age were also assessed.

Task 4 - Geoarcheological Investigation

Field geological investigations in the Dallas Floodway Extension were confined to the Project Footprint and were conducted in May and June 1997. The purpose of the field investigation was to establish a geomorphic model that would compliment a predictive model for buried prehistoric resources in the APE. Prior to the field investigation, geological and geomorphological data pertinent to the APE were collected and reviewed. An initial field reconnaissance of the area was conducted to view geomorphic characteristics of the landscape, identify areas significantly altered by modern land use development, and assess the logistics of implementing the field plan. Access to the areas of impact were limited by logistics of right-of-entry in this mostly urbanized area. Also many areas are already significantly impacted by landfilling, dumps, industrial/commercial activity, and other development.

Primary consideration was given to core and boring data, especially newly acquired data collected with the Geoprobe. A Geoprobe is a hydraulically powered, percussion/probing machine designed specifically for use in environmental soil investigations. Soil probing techniques can be thought of as a direct push technique, where sampling tools and/or sensors are pushed into the ground without the use of drilling to remove soil or to make a path for the tool. The Geoprobe relies on a relatively small amount of static (vehicle) weight combined with percussion as the energy for advancement of a tool string.

Electrical conductivity (EC) logs were run to define zones of varying conductivity in the soil profile. Soil conductivity and earth resistivity (the inverse of conductivity) have long been used to classify soils. Higher EC values are representative of finer-grained sediments, such as silts or clays, while sands and gravels are characterized by distinctly lower electrical conductivities. Site specific core samples, either from discrete depths or a continuous core, were also collected to verify the lithology represented by EC values at a site. The electrical logs are correlated through the Project Footprint to show changes in thickness or elevation of soil units of interest. Seventeen EC traces were collected from the project area during the field investigation. The patterns of the EC curves were compared to discrete soil samples collected and described in the field for verification of soil properties.

The geomorphological map of the Dallas Floodway Extension APE and surrounding area was compiled from existing published geologic reports (Allen and Flannigan 1986; Ferring 1990), the published Soil Survey of Dallas County (USDA 1980), and data collected in this investigation. Stratigraphic contacts were drawn on overlays using parts of the Dallas, Hutchins, and Oak Cliff, TX USGS 7.5-minute topographic quadrangles as a base. The map units and their descriptions are modified from these sources to provide appropriate detail to assess the likelihood of encountering cultural deposits within the delineated APE.

Discrete sediment samples were inspected and described using a modified USDA approach (Soil Survey Staff 1975, 1981). Sediment samples were described as to their position in a vertical profile, color, texture, soil structure, consistence, and other notable sedimentologic and pedologic properties. Descriptions were correlated with corresponding alluvial stratigraphic units in Ferring's (1990) model.

RESULTS

TASK 1 - ARCHEOLOGICAL EVALUATION

A total of 41 archaeological sites were previously recorded within or immediately adjacent to the APE (Tables 2 and 3, Figure 4). Fourteen of these fall within the Project Footprint, another 13 fall within the APE but are outside the Project Footprint, and the remaining seven are on the edge of, or only partially within, the APE. Another seven sites are recorded as being adjacent to, but outside of, the APE. On May 14-15, 1997, an attempt was made to revisit the 13 sites in the Project Footprint to which right-of-access had been obtained. Subsequently, attempts were made to revisit sites in the APE outside of the Project Footprint, although right-of-access had not been obtained and investigation was subsequently limited to surface inspection. However, a crew did return in August and inspected visit all previously identified archaeological sites in the Project Footprint.

Table 2
Location of Archeological Sites Within or Adjacent to the Dallas Floodway Extension APE

SITES WITHIN PROJECT FOOTPRINT	SITES WITHIN APE (100-YEAR FLOOD POOL)	SITES ON EDGE OF, OR PARTIALLY WITHIN, APE [1]	SITES ADJACENT TO, BUT OUTSIDE, APE
41DL69	41DL67	41DL71	41DL68
41DL70	41DL78	41DL72	41DL77
41DL84	41DL79	41DL73	41DL92
41DL104	41DL99	41DL76	41DL105
41DL220	41DL102	41DL80	41DL207
41DL317	41DL204	41DL91	*X41DL39*
41DL318	41DL205	41DL223	*X41DL40*
41DL319	41DL206		
41DL320	41DL208		
41DL337	41DL350		
41DL338	41DL351		
41DL355	*X41DL36* [2]		
41DL356	*X41DL38*		
41DL357			

Footnotes to Table 2
[1] APE = Area of Potential Effect.
[2] *X41DLxx* = Site number assigned by the Archeology Research Program of Southern Methodist University.

Table 3
Summary of Previously Recorded Archeological Sites within the Dallas Floodway Extension APE

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL67	APE[1]	Late Prehistoric; scraper, flakes, "arrow-heads and bird points," no potsherds; found on "deep sand bed in the river bottom"; 150-x-150 yds; Dec. 1940.	Yes	Not investigated; will not be impacted as it is within Central Waste Water Treatment Plant; actually outside 100-year flood pool.	Not evaluated
41DL68	Adjacent to APE[1]	ALate Prehistoric; polished stone axe, two celts, two discoidals, large muller, many "arrowheads and bird points," no potsherds; sand-covered clay hills reaching down to edge of Trinity River bottoms; 500-x-300 yds; reported in Hanna (1940); site form dated Nov. 1940. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined Late Prehistoric period; 460-x-460 m; on terrace along Honey Grove Spring; built over, poor potential for further work.	No	Not relocated.	Not evaluated
41DL69	Project Footprint	Late Prehistoric; many "arrowheads and more than one-hundred bird points," one steatite pipe, potsherds, scrapers, and flakes; on slight ridge at edge of Trinity River bottoms; 200-x-400 yds; Dec. 1940. Not relocated by ECI (Bennett et al. 1981:Appendix B); summarized in Table 2. The result of years of collection at the site were summarized by Bill Young (1988); burials reported.	Yes	Six ST's excavated; some prehistoric material remaining; area badly impacted by excavation of gravel pits.	Ineligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL70	Project Footprint	Late Prehistoric; flakes, two potsherds, some shell; found in deep sand on flat land just above the overflow level; 100-x-400 yds; Dec. 1940. Not relocated by ECI (Bennett et al. 1981:Appendix B); summarized in Table 2.	Yes	Destroyed by construction of Rochester Park Levee.	Ineligible
41DL71	APE[1]	Late Prehistoric; arrowheads, blade cache, six almost complete pots, fragments of three effigy pots, flakes, burial, European battle axe?; sandy ridge at edge of river bottom; 200-x-400 yds; Dec. 23, 1940	No	Some areas of site may retain integrity; need Corps of Engineers to determine landowner and gain right-of-access.	Not evaluated
41DL72	APE[1]	Late Prehistoric, historic; arrowheads, "bird points," blades, flakes, one potsherd, one burial with no grave goods reported by farmer; historic farmstead for over 50 years; extensively collected by 1940; on hill, large spring in center of site; 300-x-400 yds; Dec. 29, 1940.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to find landowner and gain right-of-access.	Not evaluated
41DL73	APE[1]	Late Prehistoric; "many arrowheads and bird points," blades, scrapers, metates, one notched axe, no potsherds; poor condition, artifacts found only in eroded areas; on extended sand bar in river bottom; 200-x-3,000 yds; Dec. 1940 Not relocated by ECI (Bennet et al. 1981:Appendix B); summarized in Table 2.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and gain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL76	APE[1]	Late Prehistoric; arrowheads, "bird points," mano, metate, broken bone gorget, flakes, potsherds, mussel shell; reported burial removed prior to 1940, associated potsherds, gorget; on two knolls at edge of river bottom; 400-x-800 yds; Dec. 1940. Reported destroyed by SMU field crew, 1978. Summarized by Skinner et al. (1978:Table 2); lithic scatter of an undetermined Late Prehistoric period; 360-x-740 m; on a terrace along Elam Creek; altered by quarrying with poor potential for further work.	No	Possible City of Dallas property; need Corps of Engineers to determine landowner and gain right-of-access.	Not evaluated
41DL77	Adjacent to APE[1]	Wood site; Late Prehistoric; arrowheads, scrapers, metate, flakes, potsherds; low, sand-covered hills at edge of river bottoms; on both sides of small drainage near mouth of Elam Creek; badly cut up by two gravel pits; 250-x-400 yds; Dec. 1940. Revisited by SMU field crew in 1978; site listed as "destroyed: borrowing in gravel pits." Summarized in Skinner et al. (1978:Table 2); lithic and ceramic scatter; undetermined Late Prehistoric period; 230-x-360 m; on terrace along Elam Creek; altered by quarrying, poor potential for further work.	No	In McCommas Bluff Park; not relocated, no shovel testing undertaken; site area heavily overgrown, no evidence of recent disturbances	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL78	APE[1]	Late Prehistoric; mussel shells, arrowheads, scraper, blades, flakes, few potsherds; found on deep, flat sand beds near the river bottoms; no disturbance noted; Dec. 1940. Summarized in Skinner et al. (1978:Table 2); lithic and ceramic scatter of an undetermined Late Prehistoric period; 140-x-140 m; found on a terrace of the Trinity River; reported as inundated with no potential for further work.	No	In Joppa Wildlife Preserve; not relocated; heavily overgrown, water in bottom of pit; 2-2.5 m high berm on north side.	Not evaluated
41DL79	APE[1]	Late Prehistoric; bird points, flakes; found on deep, flat sand beds at edge of river bottoms; no disturbance noted; Dec. 1940. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined Late Prehistoric period; 140-x-180 m; found on a terrace of the Trinity River; reported as inundated with no potential for further work.	No	In Joppa Wildlife Preserve; area heavily overgrown, shovel testing not permitted; no significant ground-altering disturbances noted in site area; may be misplotted, site map shows it much closer to RR tracks.	Not evaluated
41DL80	APE[1]	Late Prehistoric; arrowheads, "bird points," scrapers, manos, flakes, potsherds; found on low, sandy loam ridges at edge of river and creek bottoms; 150-x-350 yds; no disturbance noted; Dec. 1940. Reported in McCormick (1976:14-15, Figures 4, 5, and 6); occupied in Archaic, Late Prehistoric, and Early Historic aboriginal periods based on artifacts from R.K. Harris collection; southern half of site severely damaged by I-635 construction.	No	Behind chainlink fence; need to have Corps of Engineers determine landowner, gain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
		Summarized in Skinner et al. (1978:Table 2); lithic and ceramic scatter of Early Archaic to Late Prehistoric II periods; found on a terrace of Five Mile Creek; disturbances include alteration by construction and quarrying; considered to have excellent potential for future work. Relocated by ECI (Bennet et al. 1981:Appendix B); flakes and a biface were collected; site disturbed by I-635, dirt roads, and an animal pen; site measured 60-x-120 m; summarized in Table 2. Visited by NTSU field crew, Sept. 1985; site form largely illegible, but multiple occupations present; considered of unknown eligibility for the NRHP; site has shrunk to 35-x-20 m.			
41DL84	Project Footprint	Late prehistoric; arrowheads, flakes; found on sand ridges at edge of river bottom; reported "most of site area has been dug over for sand and gravel"; 400-x-500 yds; Feb. 1941. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined prehistoric period; 360-x-460 m; found on terrace of the Trinity River; altered by quarrying, fair potential for further work. Not relocated by ECI (Bennet et al. 1981:Appendix B); summarized in Table 2.	Yes	No prehistoric remains located; site may be misplotted or destroyed	Ineligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL91	APE[1]	Late Prehistoric; blades, hand ax, flakes; located on sandy hills at edge of bottoms; site was "badly dug into by a gravel pit and part of it evidently extends into a heavy woods"; 100-x-100 yds; April 1941. Summarized in Skinner et al. (1978:Table 2); lithic and ceramic scatter of an undetermined Late Prehistoric period; 90-x-90 m; found on terrace of Trinity River; altered by quarrying, fair potential for further work. Not relocated by ECI (Bennet et al. 1981:Appendix B); summarized in Table 2.	No	Not relocated; need to have Corps of Engineers determine landowner and obtain right-of-access.	Not evaluated
41DL92	Adjacent to APE[1]	No site form. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined prehistoric period; 90-x-550 m; on terrace along Trinity River; altered by quarrying, fair potential for further work. Reported on in Bennet et al. (1981); site not relocated.	No	In McCommas Bluff Park; site not relocated, no shovel testing undertaken; site area heavily overgrown, no evidence of recent disturbance.	Not evaluated
41DL99	APE[1]	Only summary index card available, no site form; small Archaic lithic scatter, few artifacts. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined prehistoric period; no site size; found on a terrace of the Trinity River; altered by construction, poor potential for further work.	No	Not relocated; need to have Corps of Engineers determine landowner and gain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
		Not relocated by ECI (Bennet et al. 1981:Appendix B); summarized in Table 2.			
41DL102	APE[1]	Only summary index card available; fairly large site with some indication of depth; lithic scatter, dating Early Archaic to Late Prehistoric I. Reported in McCormick (1976:17, Figure 7); northern part of site destroyed by gravel mining; buried 3-4 ft below surface; predominantly Archaic, with some evidence of a Late Prehistoric occupation. Summarized in Skinner et al. (1978:Table 2); lithic scatter dating from Early Archaic to Late Prehistoric periods; found on a terrace of Five Mile Creek; altered by quarrying, good potential for further work.	No	Inside McCommas Bluff Sanitary Landfill; not revisited; probably destroyed.	Not evaluated
41DL104	Project Footprint	No site form available but summary index card is available; recorded by R.K. Harris, probably 1940s or 1950s; small, Archaic lithic scatter; reported destroyed by gravel operation. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined Archaic period; no site size; found on terrace of Trinity River; altered by construction, fair potential for further work. Not relocated by ECI (Bennet et al. 1981:Appendix B); summarized in Table 2.	Yes	No prehistoric remains located; site may be misplotted or destroyed.	Ineligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL105	Adjacent to APE[1]	No site form, summary information from TARL states just south of Elam Creek; very small camp, Archaic as far as can be determined; probably destroyed; TARL information is that this is Old Trinity City. Summarized in Skinner et al. (1978:Table 2); lithic scatter of an undetermined Archaic period; size unknown; on terrace of Trinity River; listed as totally destroyed, but fair potential for further work.	No	Not relocated; need to have Corps of Engineers determine landowner and obtain right-of-access.	Not evaluated
41DL204	APE[1]	Archaic; four points reported (Pedernales, Ellis, two Trinity), cobbles, flakes, possible end scraper; on gently sloping terrace; eroded; sandy red soil with small patches of gray sand; eroded; 150-x-150 m; May 1981. Located by ECI (Bennet et al. 1981:Appendix B); three complete points and two point fragments collected, all dart points; cobbles, flakes, and cores also present; site 150 m in diameter; disturbed by erosion; summarized in Table 1.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated
41DL205	APE[1]	Unknown prehistoric; flakes, cobbles; gently sloping terrace; red/orange sandy loam; heavily eroded; 120-x-60 m; May 1981. Located by ECI (Bennet et al. 1981:Appendix B); flakes and cobble were observed; 120-x-60 m; summarized in Table 1.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL206	APE[1]	Historic; ceramics, glass, cans, coal burner; on terrace at edge of gravel pit; light brown sandy loam; poor condition/eroded; 60-x-60 m; May 1981. Located by ECI (Bennet et al. 1981:Appendix B); late nineteenth-century historic; refined earthenware, bottle glass, milk glass, tin cans, scrap metal, and an oil stove burner observed; 45-x-30 m; summarized in Table 1.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated
41DL207	Adjacent to APE[1]	Unknown prehistoric, historic; scrapers, cobbles, stoneware, earthenware, bottle glass, cartridge case; first terrace above Trinity River; 45-x-30 m; red/orange sandy loam; eroded; May 1981. Site reported in Bennet et al. (1981); chert and quartzite flakes, chert scraper, Alibates cobble, brown transfer-printed whiteware, stoneware, bottle glass observed at site.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated
41DL208	APE[1]	Historic structure; board-and-batten house converted into a barn; first upland terrace above the Trinity River; red/orange sandy loam; clear glass also found; 42-x-24 m; May 1981. Located by ECI (Bennet et al. 1981:Appendix B); board-and-batten house converted to barn; log sills, 4-x-4" posts, metal slanted roof, small asphalt shingles (siding?); summarized in Table 1.	No	Elam Road blocked at Pemberton Hill Road; other access appears to be driveway; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL220	Project Footprint	Historic; apparent well, possible packed clay floor, no artifacts; river edge-flood plain; white clay; 2-x-2 m; May 1981. Located by ECI (Bennet et al. 1981:Appendix B); collapsed limestone well approx. 1 m in diameter; hackberry tree growing out of well; summarized in Table 1.	Yes	No historic remains located; site destroyed.	Ineligible
41DL223	APE[1]	Historic double pen house; moved to this location; in gravel pit; possibly associated with abandoned meat packing plant; no cultural material present; March 1982.	No	In McCommas Bluff Park; no evidence of structure observed, possibly removed.	Ineligible
41DL317	Project Footprint	Historic; Millers Crossing Bridge; consists of two concrete-filled, steel pillars; one pillar 45 ft tall, other 4 ft tall; remnants of second pillar along south bank of Trinity; Dec. 1990.	Yes	Only one column remains, protruding about one meter above water.	Ineligible
41DL318	Project Footprint	Unknown prehistoric; 10-m-long exposure in south bank of Trinity River; five bone fragments, mussel shell, burned rock; occupation thin, begins 1.5 m below surface; possibly associated with buried soil; erosion major threat to site; June 1991.	Yes	Three shell loci observed, one containing *in situ* materials; probably associated with nearby sites 41DL319 and 41DL357.	Eligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL319	Project Footprint	Late Archaic (?); 12-m-long exposure in south bank of Trinity River; 1.5 m below surface, lens not more than 20 cm thick; one large bone fragment (possibly bison), mussel shell, burned rock, one biface fragment (possible Gary preform); possibly associated with buried soil; erosion major threat to site; June 1991.	Yes	New shell locus farther west; shell fragments at both loci in eroded context; no source for fragments observed; may be buried behind slumped soil; probably associated with nearby sites 41DL318 and 41DL357.	Eligible
41DL320	Project Footprint	Historic; old City of Dallas dump; three areas of site, two date ca. 1930s, other 1900s; being looted by bottle collectors; site impacted by road construction, erosion, excavation of storm drain outflow; Dec. 1990.	Yes	Condition apparently unchanged since 1990..	Eligible
41DL337	Project Footprint	Unknown prehistoric; exposed in Central Waste Water Treatment Plant effluent outflow channel; thin (10 cm or less) cultural deposit 3 m below surface; bison bone, mussel shell, one flake; impacted by construction of outflow channel; found at the contact between a black (10YR 2/1) clay and dark brown (10YR 3/3) clay; Sept. 1992.	Yes	No prehistoric remains located; apparently permanently submerged by outflow channel; probably associated with nearby sites 41DL338, 41DL355 and 41DL356.	Eligible
41DL338	Project Footprint	Unknown prehistoric; 3-m-long exposure in Central Waste Water Treatment Plant effluent outflow channel; approximately 3 m below surface; only mussel shell present; materials seem to be on soil contact; impacted by excavation of outflow channel; Sept. 1992.	Yes	No prehisatoric remains located; apparently permanently submerged by outflow channel; probably associated with nearby sites 41DL337, 41DL355 and 41DL356.	Eligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL350	APE[1]	Unknown prehistoric; 50-m exposure along south bank of Trinity River; cultural deposits 2 m deep, 30-60 cm thick; bone fragments (including large mammal, possibly bison), mussel shell; bison bone found above buried A-horizon, other bone, shell found 30 cm below buried A-horizon; impacted by continued erosion of the Trinity River; Jan. 1993. Reported on in Skinner and Whorton 1993.	No	At time of visit, cutbanks too steep to examine safely with high water levels in the Trinity River.	Not evaluated
41DL351	APE[1]	Historic; Wulschlager Farm site; old truck farm; identified by fences, two standing residences, pump house, boat house, sheds; probably post-WW II; surrounded by recent trash; abandoned; Dec. 1993. Reported on in Skinner and Whorton 1993.	No	In Joppa Wildlife Preserve; some structures appear demolished since recorded; site crossed by pedestrian trail, no motor vehicles allowed; no sign of significant ground-altering activities.	Not evaluated
41DL355	Project Footprint	Unknown prehistoric; 11-m exposure in Central Waste Water Treatment Plant effluent outflow channel; thin (less than 25 cm) shell lens found 3 m below surface; mussel shell, bone fragments, burned rock; impacted by erosion, excavation of channel; Sept. 1993.	Yes	No prehistoric remains located; apparently permanently submerged by outflow channel; forms part of site complex with sites 41DL337, 41DL338 and 41DL356.	Eligible
41DL356	Project Footprint	Unknown prehistoric; 20-m long exposure in Central Waste Water Treatment Plant effluent outflow channel; two thin lenses separated by 50 cm, begin 3 m below surface; impacted by channel construction, erosion; Sept. 1993.	Yes	*In situ* shell deposits found ca. 160cmbs; additional shell observed underwater; probably associated with sites 41DL337, 41DL338 and 41DL355.	Eligible

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
41DL357	Project Footprint	Unknown prehistoric; 35-m exposure in bank of Trinity River; cultural deposits begin 1.5 to 2 m below surface; burned and unburned mussel shell, burned rock, biface; major impact erosion; Sept. 1993.	Yes	No *in situ* prehistoric remains located, although redeposited material is present below cutbank; probably associated with nearby sites 41DL318 and 41DL319, and may actually be 41DL319.	Eligible
X[2]*41DL36*	APE[1]	Unknown prehistoric; SMU site number, no site form available; summarized in Skinner et al. (1978:Table2); lithic scatter; no site size; located on a terrace along an abandoned channel of Trinity River; site was totally destroyed and has no remaining research potential.	No	Behind chainlink fence; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated
X[2]*41DL38*	APE[1]	Unknown prehistoric; SMU site number, no site form available; summarized in Skinner et al. (1978:Table 2); lithic scatter; no site size; located on a terrace along an abandoned channel of the Trinity River; site was totally destroyed and has no remaining research potential.	No	Behind chainlink fence; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated
X[2]*41DL39*	Adjacent to APE[1]	Unknown prehistoric; SMU site number, no site form available; summarized in Skinner et al. (1978:Table 2); lithic scatter; unknown size; found on terrace along abandoned channel of Trinity River; major disturbance by natural causes, fair potential for further work.	No	Behind chainlink fence; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated

SITE NUMBER	LOCATION WITHIN PROJECT AREA	SITE DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
X41DL40[2]	Adjacent to APE[1]	Unknown prehistoric; SMU site number, no site form available; summarized in Skinner et al. (1978:Table 2); lithic scatter; unknown size; found on terrace along abandoned channel of Trinity River; major disturbance by natural causes, fair potential for further work.	No	Behind chainlink fence; need Corps of Engineers to determine landowner and obtain right-of-access.	Not evaluated

Footnotes to Table 3
1 APE = Area of Potential Effect.
2 *X41DLxx* = Site number assigned by the Archeology Research Program of Southern Methodist University.

Although the intent of the current study was to provide a Phase 1 evaluation of all known sites, several problems prevented that level of effort. First, neither the River View Country Club nor the Dallas County Parks and Recreation Department would allow shovel testing on their respective properties, negating the efforts to relocate sites 41DL78, 41DL79, 41DL104, 41DL350, and 41DL351. In addition, at the sites in the APE to which the Corps of Engineers did not yet obtain right-of-access, shovel testing was not undertaken without permission. Second, the high water level of the Trinity River during the period of the fieldwork made access to a number of the sites impossible, especially those deeply buried sites originally exposed in cutbanks. During the May 14-15 period of fieldwork, the Trinity had drowned all the deeply buried sites and, although water levels had fallen by May 27, they were still too high to allow safe examination of the steeper cutbanks, where artifact exposure is most likely to occur. The result was that shovel testing during the initial field phase could only be undertaken at two sites within the Project Footprint—41DL69 and 41DL70. The team returned and inspected all known site loci in the Project Footprint during a second phase in August. Descriptions of all of the recorded sites within the Project Footprint are presented in a separate technical report of findings (GMI 1997).

Unrecorded and Potential Archeological Sites

Ninety-five unrecorded and potential historic sites were identified by archival research within the Project Footprint and the APE. Six of these sites were discussed in the *Dallas Floodway Extension Study Area - Feasibility Draft: Cultural Resources Background* (USACE-FW 1992). These six sites include the wreck of the steamboat *Nellie*, Lock and Dam No. 1, the Corinth Street Bridge, the Joppa Slave Settlement, Millermore, and Trinity City (Table 4). Three of these sites (Millermore, Trinity City, and the Joppa Slave Settlement) appear to be located outside of the APE, while the Corinth Street Bridge is more properly recorded as an architectural, rather than an archeological, property. The remaining two sites are located within the Trinity River channel. The location of Lock and Dam No. 1 is shown on both the 1920 soil map and a 1941 county road map. Bennett et al. (1981:45-46) records information about the site received from Peggy Riddle (or Ribble—both spellings are used). At that time only about 40 percent of the structure remained and it was under water most of the time. The steamboat *Nellie* was wrecked during the 1908 Dallas flood. Richner and Bagot (1978:111) state that the *Nellie* was docked at the Commerce Street wharf when the flood waters swept it away. It stopped at the "Dallas-Oak Cliff Street trestle" and sank during salvage operations. The feasibility study (USACE-FW 1992:30) states that it may be located at the Forest Avenue (now Martin Luther King) Bridge. A potentially more likely location is near the modern Houston Street Viaduct, as this appears to be near the first obstruction shown on *Sam Street's Map of Dallas County* (1900).

Only two of the maps consulted during the archival portion of this project showed the location of individual homesteads—*Sam Street's Map of Dallas County* (1900) and the 1920 soils map for Dallas County. These two maps were the source of an additional 89 potential historic sites—66 from the soils map and 23 from Sam Street's map. The locations were then replotted onto the modern USGS 7.5' quad maps. The locations derived from the soils map are probably more accurate than those from Sam Street's map, as the soils map had more identifiable landmarks in common with modern maps and was drawn to a defined scale. With Sam Street's map, the accuracy with which landmarks such as roads and streams are drawn is questionable, while a scale had to be estimated from the presumed correspondence of these landmarks with those shown on the modern quadrangles.

TASK 2 - ARCHIVAL EVALUATIONS

A review of numerous maps suggests that, relative to the downtown area of Dallas, growth and development within the APE was slow. One of the earliest maps to depict the flood plain area is *Sam Street's Map of Dallas*, dated 1900. Structures and communities are plotted along with the names of landowners and homeowners. According to Street's map at least 10 rental houses, 10 owner-occupied houses, a store, a dairy, and a clubhouse (associated with the Rod and Gun Club Lake which is now Lemon Lake) existed in the project area. The map also plots an early African-

American freedmen's town known as Joppa (frequently pronounced "Joppy") of which little is known. According to information on file at Preservation Dallas and communication with Dr. Mamie McKnight, the founding director of Black Dallas Remembered, Inc., Joppa developed near Honey Springs sometime in the 1800s. Now bound by Linfield to the north, Loop 12 to the south, the Sleepy Hollow County Club to the east, and Carbondale Street to the west, some of the structures along the far east side of Joppa (near the streets of Yancy, Luzon, and the east side of Yukon Circle) fall within the APE (M. Greene 1996; Joppa/South Central n.d.; McKnight, personal communication, 1997). Sam Street's map notes that at least two of the houses in Joppa were owned and occupied by African-Americans. Though the names on the map are difficult to decipher, it appears that the last name of one owner is "West" and the other is "Norrel." An attempt was made to locate these names (and variations) in the 1903 and 1904 Dallas directories which were available at Dalla

names. Documents on file at Preservation Dallas indicate that in 1994, eight shotgun-style houses were still standing in Joppa. File information also noted that Lemon Lake was used by community residents for fishing purposes—a use which may have an historical precedent (M. Greene 1996; South Central [Joppa] n.d.).

The examination of historic maps also indicated that the downtown area of Dallas had begun to spread in a southeasterly direction by 1912. Streets, such as Edgar, Oplar, Pine, and Marburg appear east of Lamar Street on *Worley's Street Map of Dallas, Texas*, and on a 1915 city map by Koch and Fowler. By 1927, Forest Avenue is shown crossing the Trinity River in a map of Dallas by Ulrickson, and by 1933, the area of Cadillac Heights and street development along White Rock Creek (within the APE) appear in *H.A. Spencer's Street Guide and Index* (Koch and Fowler 1915; Spencer 1933; Ulrickson 1927; U.S. Geological Survey [USGS] 1920; Worley 1912).

Research at Preservation Dallas provided a limited amount of information on the development of communities within or near the APE. Six communities which surround or cover part of the APE were identified, including Cadillac Heights, Magna Vista (or Cedar View), South Central (or Joppa), Skyline Heights, Ervay Terrace/Marburg, and Colonial Hills (or Wendelkin/Driskell). Of these six, Cadillac Heights, Magna Vista/Cedar View, South Central/Joppa, and Skyline Heights all developed along the western side of the Trinity River and appear to include property that is within the boundaries of the APE. Ervay Terrace/Marburg and Colonial Hills (Wendelkin/Driskell) developed along the eastern side of Lamar Street, and do not appear to extend into the boundaries of the APE. The Colonial Hill Historic District is located adjacent to, but outside, the APE on the eastern side of the Trinity River, bounded by Central Expressway and I-45/South Lamar on the east and west, and by Warren Avenue and Hatcher Street on the north and south, respectively (map supplied by the U.S. Army Corps of Engineers).

Data for each of these communities, on file at Preservation Dallas, vary in detail. For example, no data pertinent to the project was found in the informational notebook for Cadillac Heights or for Colonial Hills (Wendelkin/Driskell). For Magna Vista/Cedar View, Skyline, South Central/Joppa, and Ervay Terrace/Marburg, surveys, completed by a neighborhood resident in 1994, provided a contact person from whom additional information could be solicited. The file on South Central/Joppa contained the most information (which was presented above). Data for Ervay Terrace/Marburg indicate that the neighborhood is transitional and comprised of an older population. The homes in the area are "ready for demolition" and are owned by absentee landlords (Cadillac Heights n.d.; Colonial Hills [Wendelkin/Driskell] n.d.; Ervay Terrace/Marburg n.d.; Magna Vista Cedar View n.d.; Skyline Heights n.d.; South Central [Joppa] n.d.).

Research into deed records and plat maps, located at the Dallas County Records Building, was conducted in an effort to establish the chain of property ownership for several tracts of land within the APE. Dallas County deed records extend back to 1846, however establishing a chain of title is made difficult by incomplete records and indexes, name changes, subdivisions of property, consolidations of property, and time limitations. Several parcels were initially chosen for deed research, but as the chain was interrupted by missing records, or as it became time consuming to try

Table 4
Summary of Unrecorded Archeological Sites within the Dallas Floodway Extension APE

SITE	LOCATION WITHIN PROJECT AREA	DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
Steamboat *Nellie*	Project Footprint	Richner and Bagot (1978:111) state the *Nellie* was docked at the Commerce Street wharf when the 1908 flood swept it away. It wedged against the "Dallas-Oak Cliff Street Trestle" and sank during salvage operations. It was never raised. A subsequent study (USACE-FW 1992:30) states that it may be located south of the Forest Avenue Bridge, now known as the Martin Luther King Blvd. Bridge. A more likely location may be near the modern Houston Street Viaduct, which appears to contain the first potential obstruction downstream of Commerce Street on Sam Street's 1900 map. Other possibilities are the Cadiz Street Viaduct and the Atchison, Topeka & Santa Fe Railroad bridge between the Corinth Street Viaduct and the Martin Luther King Blvd. Bridge—both of which were present in 1900.	Yes	Under water if present; will need a major effort to locate; may not be in Project Area.	Not evaluated
Lock and Dam No. 1	APE[1]	Shown on both the 1920 soil survey map and the 1941 Dallas county road map; Bennett (1981:45-46) states that Lock and Dam No. 1 was destroyed in the 1908 flood; approximately 40 percent of the structure remained in 1981, but this was under water most of the time.	No	Need the Corps of Engineers to determine landowner and obtain right-of-access; high water levels suggest that site is underwater.	Not evaluated

SITE	LOCATION WITHIN PROJECT AREA	DESCRIPTION	RIGHT-OF-ACCESS	RESULTS OF CURRENT INVESTIGATION	NRHP STATUS
Corinth Street Bridge	APE[1]	A prior feasibility study (USACE-FW 1992:30) describes this as a "unique concrete structure built during WPA days (early 1930s)"; structure was actually built with local funds for flood improvement and was completed in 1933 (WPA 1992:155).	Yes	Not an archeological site; will need recording as an architectural property if structure will be impacted.	Potentially Eligible
Joppa Slave Settlement	Adjacent to APE[1]	Described by Corps of Engineers feasibility study (USACE-FW 1992:29) as lying east of U.S. 75, south of Loop 12, and bordered on the east by Little Lemmon Lake; present archival research indicates that Joppa is actually located north of Loop 12 between the Sleepy Hollow Country Club and Carbondale Road, largely outside of the APE.	No	Not investigated, outside APE.	Not evaluated
Millermore	Adjacent to APE[1]	Site of early settler's home at 3110 Bonnie View Road; structure moved to Old City Park (USACE-FW 1992:29).	No	Location not investigated, outside APE.	Not evaluated
Trinity City	Adjacent to APE[1]	1849 settlement north of and including McCommas Bluff (USACE-FW 1992:28-29).	No	Location not investigated, outside APE.	Not evaluated

Footnotes to Table 5
[1] APE = Area of Potential Effect.

to pursue an indirect chain, another tract was chosen for deed research. Plat maps and deed records were examined for a parcel of land in the area south of Loop 12 and another parcel near the northern portion of the APE in the Cadillac Heights area. The results of the deed research are presented below.

Chain of Title—South of Loop 12

This property was chosen for investigation to provide information on activities in the southernmost portion of the APE. However, the deed chain was difficult to establish and time permitted the investigation of only a few transactions. This parcel is bound by the Trinity River to the east, Simpson Stuart to the south, and Lemmon Lake to the north. The legal description for this tract is Lot 2; Block 8002 (*Dallas County Tax Assessor* 1995b). Plat records indicate that the area was a part of the John B. Richards Survey and was assigned to Abstract No. 1192. The earliest transaction discovered for this property (for this particular research survey) dates only to January 17, 1964, when W.C. Jack Miller sold 1,322.161 acres of land for $1,554,000.00 to Trinity Industrial Properties (*Dallas County Deed Records* 64233:1285-1294). Earlier transactions associated with the John B. Richards Survey were lost at this point when the deed chain shows W.C. Jack Miller acquiring property that belonged to W. Jenkins on August 6, 1963 (*Dallas County Deed Records* 128:1580-1586). The property acquired by Miller from Jenkins included much of the land in the 1964 transaction, but the property associated with the John B. Richards Survey was not mentioned in the transaction between Miller and Jenkins (*Dallas County Deed Records* 128:1580-1586 and 5688:317-328). Thus, to determine ownership of this parcel prior to 1964 would have required that the property be traced from the original owner, a process that is often very time-consuming. Since properties generally subdivide over the course of time, going from original owner to current owner often requires that numerous deed transactions be examined in order to follow the trail of the correct parcel of land.

On February 2, 1965, the 1,322.161 acreage was transferred to Central States, Southeast and Southwest Areas Pension Fund (*Dallas County Deed Records* 65495:0722-0731). Central States, Southeast and Southwest Areas Pension Fund sold the property to Metropolitan Sand and Gravel Company for $1,400,000.00 on July 6, 1965 (*Dallas County Deed Records* 65613:2233-2242). Nearly four years later, on June 20, 1969, ownership was transferred from Metropolitan Sand and Gravel Company to Farrell Kahn, Joe Simpkins (President of Metropolitan Sand and Gravel Company), Morris A. Shenker and Morris A. Shenker, Jr. (*Dallas County Deed Records* 69126:1014-1022). On August 22, 1979, ownership was transferred to "Citizens Bk. University C" (*Dallas County Deed Records* 7914:0881). The property is now owned by the city of Dallas (*Dallas County Tax Assessor* 1995b).

Adjacent to, and west of this property is Tract 11, Lot 1, Block 8002, which is an eight-acre parcel currently owned by Fritz Wullschleger (*Dallas County Tax Assessor* 1995c). This property is associated with site 41DL351—a truck-farming operation reported on by Skinner and Whorton (1993:19-24). The tax assessment records spell the owner's last name as "Wullschleger," but Skinner and Whorton spell it as "Wulschleger."

Chain of Title—Lot 85

This parcel of land is associated with the house at 2838 Alex Street in Cadillac Heights. It was assigned Lot No. 85 and is a part of the Robert Sloan Survey, Abstract 1449, Block 6642 in an area known as McNabb's Meadow Garden of the R.C. Day Addition. The earliest known owner of this property was M. Hines who more than likely obtained it from one of the following three landowners—G.W. Givens in December of 1883 (*Dallas County Deed Records* 64:176); D.K. and A.C. King in January of 1885 (*Dallas County Deed Records* 82:52); or from the M.J. Dart trust in September of 1889 (*Dallas County Deed Records* 139:624). Unfortunately, there was insufficient time to review these three documents to determine previous ownership.

On December 4, 1894, Conrad Gansevoart et al. acquired the property from the trust of M. Hines (*Dallas County Deed Records* 187:257-258). Robert C. Day acquired the property on

November 11, 1895, when he purchased a portion of the Robert Sloan Survey for $1,000 (*Dallas County Deed Records* 197:433-434). Robert C. Day died in June of 1933. Since his wife, Susanah, had preceded him in death, his property was subdivided among his children and grandchildren (*Dallas County Deed Records* 1872:203-207). Two daughters, Rachel Childers and Frances M. Day, sold their parcels to Alexander McNabb on April 17, 1942 (*Dallas County Deed Records* 2354:115-116). At some point after this date, this parcel was acquired by the Department of Housing and Urban Development (HUD). To determine who sold this property to HUD would have required an examination of numerous deeds. *Dallas County Deed Indexes* list hundreds of HUD transactions. Even though the number of deeds to examine could have been narrowed down to some extent using property descriptions, there would still have been a large number to inspect. On September 4, 1973, U.C. Ford and his wife Lillian Ford acquired ownership of Lot 85 (*Dallas County Deed Records* 73219:0549).

The data from these two examples, though limited, suggests that by the 1960s, large parcels of land were being purchased for commercial enterprises (such as sand and gravel operations), and for government housing developments. The research for Lot 85 on Alex Street also serves as an example of earlier land inheritance patterns whereby large tracts of family land are quickly subdivided within one generation when children and grandchildren inherit from a parent or grandparent. This record also suggests that the Cadillac Heights area was being developed in the early 1940s when Alexander McNabb purchased the property which became known as McNabb's Meadow Garden. Property records for Dallas County indicate that the structure located on this property is a duplex built in 1949. The property address is listed as 2836 and includes 2838 (*Dallas County Tax Assessor* 1995a).

TASK 3 - ARCHITECTURAL EVALUATIONS

As noted previously, all buildings and structures within the Project Footprint, specifically in areas that will be directly impacted by the Dallas Floodway Extension, were assigned identification numbers prefixed with "A" (A-series resources); and those within the APE but not to be directly impacted by the project were assigned identification numbers prefixed with "B" (B-series resources). Forty-nine A-series resources were identified, and 699 B-series resources (one of which is a potential historic district that includes other B-series resources) were identified.

Three Category 1 (potentially eligible for inclusion in the NRHP) A-series resources were identified (Figure 5 and Table 5). Each of these buildings should be assessed by an architectural historian for their integrity, condition, and architectural/engineering significance. Each structure considered to be NRHP-eligible by the architectural historian will require further archival research to document its history and better determine its significance. The historic context of each resource will need to be established so that the significance of the resource can be effectively conveyed. Each NRHP-eligible resource will also need to be preserved or appropriately documented according to Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) standards (the level of documentation required should be determined through consultation with the Texas State Historic Preservation Officer).

In addition, there are 27 Category 2 A-series resources (see Table 6). These structures are either no longer standing or have been determined to lack enough significance to be considered eligible for inclusion in the NRHP. Sixteen structures were assessed as Category 3 (see Table 6). These resources have been determined (by field observation, by information on the USGS quadrangle sheet, or both) to be of insufficient age to be considered eligible for inclusion in the NRHP. Three building (Resource A-6, A-7 and A-12) have been assessed as a Category 4 A-series resource. They were built in 1949, 1950 and 1954, respectively (*Dallas County Tax Assessor* 1995a), and will require further assessment when it becomes 50 years old. The assessment of this resource should include research into its role in the development and history of the Cadillac Heights community, in which they are located. Further research and assessment of Category 4 resources will be a necessary goal.

Table 5
Assessment of Architectural Resources Within the Dallas Floodway Extension Project Footprint

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-1	2	Oak Cliff (1958, photorevised 1981)	3	structure no longer standing, not an architectural resource
A-2	2	Oak Cliff (1958, photorevised 1981)	3	structure no longer standing, not an architectural resource
A-3	2	Oak Cliff (1958, photorevised 1981)	3	structure no longer standing, not an architectural resource
A-4	2	Oak Cliff (1958, photorevised 1981)	3	structure no longer standing, not an architectural resource
A-5	2	Oak Cliff (1958, photorevised 1981)	3	structure no longer standing, not an architectural resource
A-6	4	Oak Cliff (1958, photorevised 1981)	1, 2	residence; not shown on quad sheet; visited on May 12, 1997, and photographed; the several structures along Alex Street are small vernacular-style residences, frame construction; building A-6 is in good condition; Dallas County tax records indicate A-6 built in 1949
A-7	4	Oak Cliff (1958, photorevised 1981)	1, 2	industrial building; shown on quad sheet as pre-1958 structure; visited on May 12, 1997, photographed; part of Dallas City Packing complex
A-8	3	Oak Cliff (1958, photorevised 1981)	1, 2	industrial building; shown on quad sheet as pre-1958 structure; visited nearby structures on May 12, 1997, but could not see this one; probably part of Dallas City Packing complex
A-9	1c	Oak Cliff (1958, photorevised 1981)	1, 2	industrial building; shown on quad sheet as pre-1958 structure; visited on May 12, 1997, photographed; part of Dallas City Packing complex

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-10	2	Oak Cliff (1958, photorevised 1981)	3	noted to be a ruin on the Corps of Engineers project map; not an architectural resource
A-11	2	Oak Cliff (1958, photorevised 1981)	3	shown on the quad sheet as post-1958 structure
A-12	4	Oak Cliff (1958, photorevised 1981)	3	shown on the quad sheet as post-1958 structure
A-13	3	Oak Cliff (1958, photorevised 1981)	3	shown on the quad sheet; post-1958 structure
A-14	3	Oak Cliff (1958, photorevised 1981)	3	structure not shown on the quad sheet, but area is shaded as post-1958 development; visited on June 9, 1997, resource is a recent metal-sided industrial building
A-15				number not assigned
A-16	1d	Oak Cliff (1958, photorevised 1981)	1, 2	a pre-1958 structure is shown on the quad in this general area, but it is not clearly A-16; visited on May 12, 1997, building appears to be a barn but could not get very close; photographed
A-17	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; visited June 9, 1997 structure is a simple, covered storage area
A-18	2	Dallas (1958, photorevised 1981)	3	very small structure, not shown on quad sheet; no access to structure (which is on private property, on land probably owned by Faubion Associates, Inc.) so assessment could not be made; could not see structure because of vegetation and boundary wall
A-19	2	Dallas (1958, photorevised 1981)	3	very small structure, not shown on quad sheet; no access to structure (which is on private property, on land probably owned by Faubion Associates, Inc.) so assessment could not be made; could not see structure because of vegetation and boundary wall

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-20	3	Dallas (1958, photorevised 1981)	3	shown on quad sheet as post-1958 structure
A-21	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-22	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-23	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-24	2	Dallas (1958, photorevised 1981)	3	noted on Corps of Engineers project map to be a ruin; no longer an architectural resource
A-25	2	Dallas (1958, photorevised 1981)	3	noted on Corps of Engineers project map to be a ruin; no longer an architectural resource
A-26	3	Dallas (1958, photorevised 1981)	3	structure is in an area of post-1958 development
A-27	3	Dallas (1958, photorevised 1981)	3	structure is in an area of post-1958 development; probably part of the old Metzger diary
A-28	2	Dallas (1958, photorevised 1981)	3	structure no longer standing, may have been demolished or removed

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-29	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property; probably owned by P&H Transportation, Inc.) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-30	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property; probably owned by P&H Transportation, Inc.) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-31	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property; probably owned by P&H Transportation, Inc.) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-32	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property; probably owned by P&H Transportation, Inc.) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-33	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property; probably owned by P&H Transportation, Inc.) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-34	2	Dallas (1958, photorevised 1981)	3	structure shown on the quad sheet as pre-1958; visited on May 12, 1997; building is large undistinguished metal sided storage/industrial building
A-35	3	Dallas (1958, photorevised 1981)	3	structure shown on the quad sheet as post-1958
A-36	1c	Dallas (1958, photorevised 1981)	1, 2	probably one of two structures shown on the quad sheet in this area; this building appears to be more than 50 years old; photographed on May 12, 1997; clock on front of building exterior has "White Bottom Socks" in an arch above the face
A-37	2	Dallas (1958, photorevised 1981)	3	structure probably one of two pre-1958 structures shown on the quad sheet in this area; visited on May 12, 1997—retail store, not significant
A-38	2	Dallas (1958, photorevised 1981)	3	structure probably not one of the two pre-1958 structures shown on the quad sheet in this area (see A-36 and A-37); visited on May 12, 1997—vacant retail store, not significant
A-39	2	Dallas (1958, photorevised 1981)	3	structure not shown on the quad sheet; no access to structure (which is on private property) so assessment could not be made; visited area on June 9, 1997, could see only roof jacks (probably large industrial-use vents) and the ridge of a hip or gable roof of a one-story structure; building nearly obscured by heavy vegetation and automobile bodies
A-40	2	Hutchins (1958, photorevised 1968 and 1973)	3	not shown on the quad sheet; no structure currently exists at this location

IDENTIFICATION NUMBER	CATEGORY	MAP REFERENCE (USGS QUAD SHEET)	RECOMMENDATIONS FOR FURTHER WORK[2]	COMMENTS
A-41	2	Hutchins (1958, photorevised 1968 and 1973)	3	not shown on the quad sheet; no structure currently exists at this location
A-42	2	Hutchins (1958, photorevised 1968 and 1973)	3	not shown on the quad sheet; no structure currently exists at this location
A-43	2	Hutchins (1958, photorevised 1968 and 1973)	3	not shown on the quad sheet; no structure currently exists at this location
A-44	2	Hutchins (1958, photorevised 1968 and 1973)	3	not shown on the quad sheet; no structure currently exists at this location
A-45	3	Hutchins (1958, photorevised 1968 and 1973)	3	metal garage for golf cart storage for the country club
A-46	2	Dallas (1958, photorevised 1981)	3	labeled as a tank on the Corps of Engineers project map; does not appear on the quad sheet; in Sump Lamar 2
A-47	2	Oak Cliff (1958, photorevised 1981)	3	structure not shown on the quad sheet; in Sump Lamar 4; no access to structure (which is on private property) so assessment could not be made; could not see structure because of sheet-metal fences, buildings, and vegetation
A-48	3	Dallas (1958, photorevised 1981)	3	shown on the quad sheet as post-1958 structure
A-49	2	Dallas (1958, photorevised 1981)	3	structure is roof for covered parking or storage area
A-50	3	Oak Cliff (1958, photorevised 1981)	3	shown on the quad sheet as post-1958 structure

Footnotes to Table 6

[1] 1 — potentially eligible
- 1a — resource of great importance in Dallas history;
- 1b — resource of moderate importance in Dallas history;
- 1c — resource of minor importance in Dallas history;
- 1d — resource whose significance is not based on its role in Dallas history;

2 — not considered eligible;
3 — currently not 50 years old and will not be 50 years old at the time the project is expected to begin (estimated at 2004);
4 — currently less than 50 years old, but is potentially eligible and will be at least 50 years old before the project is expected to begin (estimated at 2004);

[2] 1 — archival research needed for age determination;
2 — needs assessment by architectural historian for NRHP eligibility;
3 — no further work considered necessary at this time;
4 — gain access to property for preliminary assessment.

As mentioned above, there were 699 B-series resources identified on the Dallas Floodway Extension Project Area maps. A preliminary age determination and assessment (using the same five categories employed for the A-series resources) was made based on information contained on USGS quad sheets of the area (Table 6). Although several of the B-series resources were visited, most were not and will require additional assessment should the design or layout of the project be altered such that it would impact the B-series resources (Table 7). Any resources determined to be Category 1 will need to be assessed by an architectural historian. If the architectural historian determines that the resource is NRHP-eligible, an historic context for the resource will need to be established so that the significance of the resource can be effectively conveyed. Each NRHP-eligible resource will also need to be preserved or appropriately documented according to HABS/HAER standards.

Two resources in the APE that have previously been noted to warrant consideration for inclusion in the NRHP are included in the list of B-series resources. These are the Corinth Street Viaduct and the community of Joppa (also called the Joppa Slave Settlement). The Corinth Street Viaduct, or Bridge (Resource B-268), is located at the far northwestern extent of the Dallas Floodway Extension Project Area. The structure was completed in 1933 at a cost of $745,500 (WPA 1992:155). It has previously been recommended for inclusion on the NRHP by the Corps of Engineers (USACE-FW 1992:30). The community of Joppa (Resource B-727) is one of three freedmen's communities still extant in the Dallas area. African-Americans began settling there as early as the mid-1800s, and a few of the early shotgun-style houses are still standing, although the majority of the more than 250 residences now in the community were constructed during the 1940s (M. Greene 1996:n.p.; South Central/Joppa n.d.). One of the early shotgun houses is only about 60 m outside the APE, on the corner of Luzon and Dutch Harbor.

Joppa is bound by Linfield Road on the north, Loop 12 on the south, Carbondale Street on the west, and the Sleepy Hollow Country Club on the east. The area defined by these boundaries is considered potentially eligible for inclusion on the NRHP as a National Historic District. Few of the architectural resources therein would be considered eligible for inclusion in the NRHP as individual historic properties, but many would be eligible as contributing elements to an historic district. Twenty-seven buildings and structures within the Dallas Floodway Extension Project APE (Resources B-681 through B-691 and B-708 through B-723) are in the community of Joppa as defined above. Should it be determined that the construction of the Dallas Floodway Extension will directly or indirectly impact the Corinth Street Viaduct or elements of the Joppa community, measures will have to be taken to protect these potential historic properties (as well as vacant lots in Joppa, which may contain historic-era archeological sites) from those impacts, and research efforts should be undertaken so that the historical value of the bridge and/or the little-known community may be adequately documented.

These research and documentation efforts are likely to include, but should not be limited to, assessment by an architectural historian; research into the various municipal, county, and state records to determine the history of the resource (and individual resources within a district); the collection of oral history interviews; the development of an historic context so that the significance of the resource can be effectively conveyed; preservation of the resource (and individual resources within a district) that may be impacted by the construction of levees or other components of the flood control system; and/or appropriate HABS/HAER documentation (to be determined in consultation with the Texas State Historic Preservation Officer) of any resources that will be impacted or destroyed by the construction project.

In addition to the above two important B-series resources elsewhere recommended as eligible for inclusion in the NRHP, three buildings (Resources B-121, B-122, and B-123) were identified during the current research as potentially eligible for listing in the NRHP. Resource B-121 is a distinctive industrial/institutional building (functional design with minimal decorative elements, dark red/brown brick construction, limestone accents, original six-over-six light wood-sash windows) that appears to be in good condition. The building was probably built in the 1920s or 1930s. Resources B-122 and B-123 are also constructed of dark red/brown brick with minimal decorative elements, but have accents of white brick rather than limestone, and have single-pane sashes.

Table 6
Assessment of Architectural Resources Within the Dallas Floodway Extension Project APE

CATEGORY 1[1]	CATEGORY 2[2]	CATEGORY 3[3]		CATEGORY 4[4]	CATEGORY 5[5]	
B-121 (1c)	B-13	B-6 - B-9	B-198		B-1 - B-5	B-213
B-122 (1c)	B-91	B-30	B-199		B-10 - B-12	B-215
B-123 (1c)	B-94	B-31	B-206		B-14 - B-17	B-217 - B-227
B-268 (1c)	B-96	B-33	B-216		B-28	B-229
B-727 (1b)	B-99	B-44	B-257		B-29	B-230
	B-102	B-72	B-258		B-32	B-241 - B-256
	B-115	B-73	B-287 - B-294		B-34 - B-43	B-259 - B-267
	B-196	B-85 - B-87	B-296 - B-302		B-45 - B-71	B-269 - B-286
	B-197	B-103	B-304 - B-322		B-74 - B-84	B-295
	B-200	B-107	B-345 - B-347		B-88 - B-90	B-303
	B-201	B-116	B-377		B-92	B-323 - B-344
	B-212	B-119	B-380		B-93	B-348 - B-376
	B-214	B-124 - B-126	B-382		B-95	B-378
	B-228	B-129	B-401		B-97	B-379
	B-231 - B-240	B-142	B-411		B-98	B-381
	B-713	B-173 - B-177	B-537		B-100	B-383 - B-400
	B-724	B-182 - B-185	B-580 - B-582		B-101	B-402 - B-410
	B-725	B-187	B-584		B-104 - B-106	B-412
		B-188	B-586		B-108 - B-114	B-413
		B-190	B-591		B-117	B-419 - B-469

CATEGORY 1[1]	CATEGORY 2[2]	CATEGORY 3[3]		CATEGORY 4[4]	CATEGORY 5[5]	
		B-191	B-677		B-118	B-478 - B-536
		B-195	B-703		B-120	B-539 - B-579
					B-127	B-583
					B-128	B-585
					B-130 - B-141	B-587 - B-590
					B-143 - B-172	B-592 - B-654
					B-178 - B-181	B-656 - B-673
					B-186	B-678 - B-702
					B-189	B-704 - B-712
					B-192 - B-194	B-714 - B-723
					B-202 - B-205	B-726
					B-207 - B-211	

Footnotes to Table 6

[1] Category 1 — potentially eligible
- 1a — resource of great importance in Dallas history;
- 1b — resource of moderate importance in Dallas history;
- 1c — resource of minor importance in Dallas history;
- 1d — resource whose significance is not based on its role in Dallas history.

[2] Category 2 — not considered eligible.

[3] Category 3 — currently not 50 years old and will not be 50 years old at the time the project is expected to begin (estimated at 2004).

[4] Category 4 — currently less than 50 years old, but is potentially eligible and will be at least 50 years old before the project is expected to begin (estimated at 2004).

[5] Category 5 — data insufficient to determine classification.

Table 7
Additional Research Needs for Architectural Resources Within the Dallas Floodway Extension APE[1]

FURTHER RESEARCH NEEDED			NO FURTHER RESEARCH NEEDED	
B-1 - B-5	B-120 - B-123	B-348 - B-376	B-6 - B-9	B-195 - B-201
B-10 - B-12	B-127	B-378	B-13	B-206
B-14 - B-17	B-128	B-379	B-30	B-212
B-28	B-130 - B-141	B-381	B-31	B-214
B-29	B-143 - B-172	B-383 - B-400	B-33	B-216
B-32	B-178 - B-181	B-402 - B-410	B-44	B-228
B-34 - B-43	B-186	B-412	B-72	B-231 - B-240
B-45 - B-71	B-189	B-413	B-73	B-257
B-74 - B-84	B-192 - B-194	B-419 - B-469	B-85 - B-87	B-258
B-88 -- B-90	B-202 - B-205	B-478 - B-536	B-91	B-287 - B-294
B-92	B-207 - B-211	B-539 - B-579	B-94	B-296 - B-302
B-93	B-213	B-583	B-96	B-304 - B-322
B-95	B-215	B-585	B-99	B-345 - B-347
B-97	B-217 - B-227	B-587 - B-590	B-102	B-377
B-98	B-229	B-592 - B-654	B-103	B-380
B-100	B-230	B-656 - B-673	B-107	B-382
B-101	B-241 - B-256	B-678 - B-702	B-115	B-401
B-104 - B-106	B-259 - B-286	B-704 - B-712	B-116	B-411
B-108 - B-114	B-295	B-714 - B-723	B-119	B-537
B-117	B-303	B-726	B-124 - B-126	B-580 - B-582
B-118	B-323 - B-344	B-727	B-129	B-584
			B-142	B-586
			B-173 - B-177	B-591
			B-182 - B-185	B-677
			B-187	B-703
			B-188	B-713
			B-190	B-724
			B-191	B-725

Footnotes to Table 7
[1] Research recommended if the design or layout of the Dallas Floodway Extension Project levee system and flood control components is altered such that it would impact one or more of these resources.

These latter two buildings were probably constructed somewhat later than Resource B-121, their architectural design intended to complement that of the former structure. These three buildings, as well as any other buildings in the complex in which they are located, will need to be assessed by an architectural historian should construction of the levees or other flood control system components directly or indirectly impact these buildings in any way.

TASK 4 - GEOARCHEOLOGICAL INVESTIGATIONS

General Landscape Geomorphology and Geological Setting

Dallas County, Texas, is situated predominantly in the Blackland Prairie Physiographic province, at the up dip edge of the Gulf Coastal Plain and the northwest limit of the East Texas Embayment (Allen and Flannigan 1986). The city of Dallas sits in an hourglass-shaped valley formed by differential erosion of three exposed marine bedrock units of Cretaceous age: Eagle Ford Shale, Austin Chalk, and Taylor Marl. Surficial deposits of clayey upland residuum, terraced alluvial deposits of Pleistocene age, and late Pleistocene to Holocene flood plain alluvium cover bedrock units to various depths. Elevations of upland landscapes in metropolitan Dallas range from about 120 to 150 meters amsl.

The Trinity River drains Dallas County and surroundings. Three branches join west of the city, then the main stem flows through downtown Dallas and through the APE in the southern part of the city. The West Fork, the Elm Fork, and White Rock Creek are the principal tributaries near the Dallas Floodway Extension APE. The main stem of the Trinity River has a distinct Holocene flood plain. Multiple Pleistocene terraces have been recognized on the valley flanks (Ferring 1990).

Surface weathering of the Cretaceous upland bedrock exposures has left most of the uplands covered with residual clay soils. Weathering profiles can be up to 7 m in thickness. Soils developed in chiefly loamy to sandy Pleistocene alluvium form on fluvial terraces. Flood plain soils form at the tops of the alluvial units found beneath flood plain geomorphic surfaces.

The alluvial stratigraphy, soils stratigraphy, and geomorphology of the Upper Trinity River have been investigated in a variety of studies. Ferring (1990) summarizes the history of geomorphic investigations and provides a working stratigraphic framework that can be applied to the Dallas Floodway Extension APE. Details of alluvial stratigraphic units and paleosol stratigraphy can vary within the Trinity River valley; however, lithostratigraphic properties, cross cutting relationships, and superposition of stratigraphic units allow for a general correlation to the stratigraphy of Ferring (1990). General elements of the Ferring (1990) Trinity River model are summarized below for comparison to the newly acquired data from the Dallas Floodway Extension APE.

Ferring (1990) recognized three terraced Pleistocene stratigraphic units and five flood plain stratigraphic units of Late Pleistocene to modern age in the Upper Trinity River. Terraced units are, in decreasing age, Irving, Coppell, and Tioga alluvium. Geomorphic position, areal distribution, lithologic properties, and upper bounding paleosols are included as criteria for unit differentiation. Units beneath the flood plain include, in decreasing age, Carrollton, Aubrey, Sanger, Pilot Point and Recent alluvia. General stratigraphic properties of these units in their type areas are summarized in Table 8. A conceptual cross section (Figure 6) illustrates geologic relationships between alluvial units in the Dallas Floodway area.

In comparing the Ferring (1990) model to the data from the Dallas Floodway Extension APE, technical and logistical considerations must first be addressed. The correlation of the alluvial stratigraphic units by lithostratigraphic properties and relative stratigraphic positions allows for the development of a general correlation scheme. The paleosols at the top of each alluvial unit are implicit in Ferring's (1990) model; however, that does not require that paleosols will exist at all localities nor will they possess all properties described in their type areas. First, there are inherent variabilities in an individual paleosol, and second, there are possible upstream to downstream variations in properties over the distances involved from the type areas to the Dallas Floodway Extension APE.

Table 8
Lithologic Properties, Depositional Environments, and Inferred Ages of Alluvial Stratigraphic Units in the Upper Trinity River (adapted from Ferring 1990)

ALLUVIUM	LITHOLOGY	DEPOSITIONAL ENVIRONMENTS	INFERRED AGE
Recent	silt and clay grading to sand and gravel	meander belt alluvium, abandoned channel fill	alluviation <200 years
Pilot Point	silt and clay grading to sand and gravel	meander belt alluvium, overbank veneer over older alluvium	alluviation and soil formation from 4,500 years to present
Sanger	calcareous silt and clay; grades to sand and gravel	meander belt alluvium	alluviation from 11,000 to 7,500 yrs, soil formation from 7,500 to 4,500 years
Aubrey	bedded sand and gravel, finer-grained alluvial marls and lacustrine sediment	channel, abandoned channel fill, lake plain	alluviation from 14,000 to 11,000 years
Carrollton	loamy sediment grading to sand and gravel	meander belt alluvium	alluviation from 30,000 to 14,000 years
Coppell, Tioga, Irving	loamy sediment to sand and gravel	channel belt alluvium	> 30,000 years

A geomorphological map of the Dallas Floodway Extension APE and surrounding area was compiled from existing published geologic reports (Allen and Flannigan 1986; Ferring 1990), the published Soil Survey of Dallas County (USDA 1980), and data collected in this investigation (Table 9 and Figure 7). Stratigraphic data collected within the Dallas Floodway Extension Project Footprint (Table 10; and, see Appendix B: Cliff et.al 1997) provide information on the lithologic, pedologic, and geometric properties of surficial sediments associated with the geologic map units. A total of 17 vertical profiles was inspected and logged, from continuous EC traces and core samples collected with the Geoprobe (see Figure 7). Sediments associated with the various flood plain depositional environments recognized within the Dallas Floodway Extension Project Footprint have distinctive lithologic and pedologic properties that allow for their differentiation (see Table 11 and Appendix B: Cliff et.al 1997).

Pilot Point alluvium is typically the first mappable unit encountered below the flood plain surface. Recent alluvium locally covers this unit near the present Trinity River channel, and recent overbank deposits may be locally included in Pilot Point overbank veneer deposits. Pilot Point alluvium is characterized as a black to dark gray (10YR 4/1 to 5/2) silty clay loam to silt loam. In channel belt areas it grades downward to loamy or sandy textures, whereas outside of channel belts it veneers older alluvial units. The unit commonly has either an A-Bt-C or A-Bw-C horizon sequence. Plant rooting and bioturbation are the most common pedogenic processes. Pedogenic properties and stratigraphic position correlate to the West Fork paleosol of Ferring (1990). In channel belt areas the soil profile grades to stratified alluvium, but outside channel areas the base of the soil can be mixed with underlying alluvium.

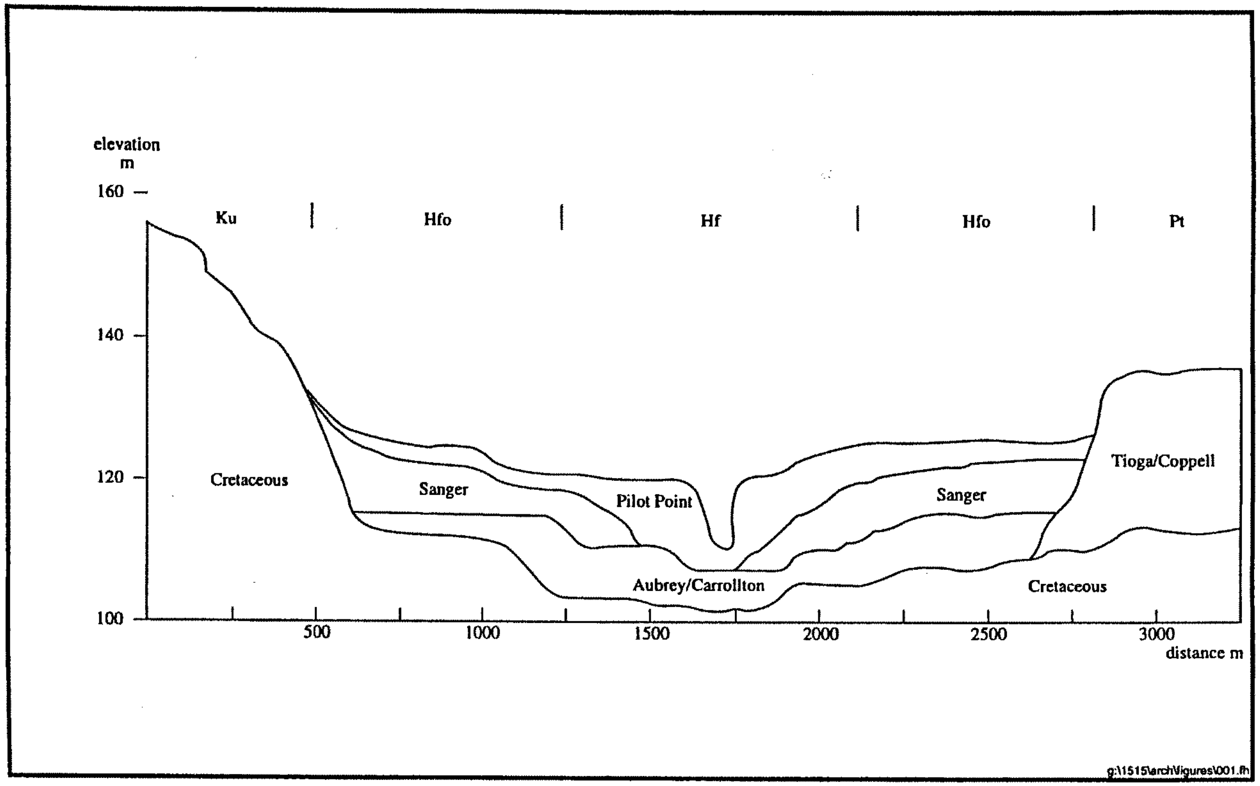


Figure 6. Conceptual geological cross section of the Trinity River valley in the Dallas Floodway. Alluvial deposits are inset into Cretaceous bedrock and terrace Pleistocene Tioga/Campbell alluvium. Pilot Point, Sanger, and Aubrey/Carrollton alluvium are the units beneath the present flood plain. Stratigraphic units are adapted from Ferring (1990).

Sanger alluvium occurs beneath the Pilot Point alluvium in most locations, except where it has been eroded by Pilot Point alluvium. This unit is characterized as a brownish (10YR 6/4) calcareous silt loam with yellowish (10YR 6/6) mottles that commonly grades downward to channel belt sand or sand and gravel. The base of the Sanger alluvium rests either on older Aubrey/Carrollton alluvium or Cretaceous rock. The unit commonly has a buried Btk-Ck or Bwk-Ck horizon sequence. Carbonate accumulations on ped surfaces, in root channels, and as concretions along with dark iron-manganese concretions are the most common pedogenic processes. Pedogenic properties and stratigraphic position correlate to the Arlington paleosol of Ferring (1990).

Table 9
Key to Geomorphological Map of the Dallas Floodway Extension APE

MAP UNIT		DESCRIPTION
Hf	Holocene flood plain	Youngest meander belt alluvium of the Trinity River; primarily Late Holocene in age. Areas of Pilot Point alluvium overlying older flood plain units. Deposits vary from silty clay loam overbank deposits to sandy channel and point bar deposits.
Hfo	Holocene flood plain, older surfaces	Flood plain deposits of the Trinity River primarily of Late Wisconsinan to Middle Holocene in age. Meander belt deposits of Sanger alluvium and lacustrine deposits of Aubrey/Carrollton alluvium underlie a veneer of Pilot Point overbank alluvium. Sanger alluvium generally has silt loam overbank deposits and sandy channel and point bar deposits. Aubrey/Carrollton alluvium are clayey to silty deposits of primarily overbank swamps, marshes, and lakes with interspersed channel deposits.
Ht	Holocene tributary alluvium	Sediments of primarily Holocene age deposited in small tributaries of the Trinity River.
Pt	Pleistocene terraces	Loamy to sandy flood plain alluvium of primarily Middle Wisconsinan age; terraced above flood plain levels. Coppell/Tioga alluvium identified along the terrace edge.
Ku	Cretaceous bedrock	Undifferentiated limestones; surface deposits can be covered with clayey residuum.

Aubrey/Carrollton alluvium occurs beneath younger Pilot Point and/or Sanger alluvium. This unit is characterized as a dark grayish (10YR 5/1) to yellowish brown (10YR 7/6) silty clay loam to clay loam that is interbedded with sandy loam to sand. Plant roots, root traces filled with carbonate and/or iron oxide, carbonate concretions, and gastropod shells characterize the unit. Soil development at the top of the unit is commonly weak, and C or Cg horizons were noted in most samples.

Coppell/Tioga alluvium was identified at a single location beneath the Pleistocene terraces in the Dallas Floodway Extension Project Footprint. At this location a reddish (5YR 6/8) sandy clay loam Bt horizon with grayish (10YR 7/2) mottles was identified. Paleosol characteristics include moderate development of soil structure, clay accumulations on peds and in root traces, and manganese stains and concretions. The paleosol grades downward into bedded sand and gravel.

The traces of EC versus depth are used to identify significant paleosurfaces in the Project Footprint. Buried paleosurfaces are typically represented by a distinct increase in EC, followed by decreases in EC with depth as the probe moves from clay rich, weathered sediments to zones of less weathered soil. Textural variation associated with processes of flood plain sedimentary deposition produce erratic or sawtooth-shaped traces. Zones of high EC values that grade downward to zones of low EC values reflect fining upward sequences in the Trinity River flood plain alluvium.

For example Probe DF8, taken from Sargent Park, clearly shows three alluvial fill sequences above Cretaceous rock (Figure 8;see Figure 10:Cliff et.al 1997). The sharp increase in EC at the top of unit 2 and unit 3 reflect the buried Sanger and Aubrey/Carrollton paleosurfaces respectively. Similar patterns have been identified in EC traces collected elsewhere in the Project Footprint. The typical pattern of EC as a function of sediment texture and soil weathering is affected by the position of the water table. For example, the transition from moist to water-saturated Sanger alluvium at Probe DF14, taken from Moore Park, shows a distinct increase in EC as the water table is encountered (see Figure 11: Cliff et.al 1997).

Pilot Point alluvium is typified by relatively low EC values that often grade into sawtoothed patterns when stratified sediments are present. Sanger alluvium commonly has a sharp upper bulge in conductivity that typically decreases as the trace becomes sawtoothed as it penetrates coarser interbedded sediments below. The Aubrey/Carrollton alluvium often has an erratic sawtoothed trace along with highly variable penetration rates, due to the consolidated nature of the deposit and its high degree of textural variability. Weathered bedrock was recognized by sharp decreases in EC values, followed by a refusal to penetrate the indurated Cretaceous limestone.

Based on the initial characterization of EC traces in the Dallas Floodway Extension Project Footprint, a correlation of EC traces to alluvial units has been accomplished. It is important to note that the relative pattern of EC as a function of depth is the primary correlation criteria, not the quantitative EC values of individual units. Interpretations of alluvial units from the EC traces are labeled on the individual logs (see Appendix B: Cliff et.al 1997). These logs were prepared by importing the EC data into a spreadsheet, converting the depth curve to meters, and plotting the resulting data transforms. Interpreted stratigraphy of individual traces is included on the EC traces (see Appendix B: Cliff et.al 1997).

Landscape Evolution Summary

The data collected in the Dallas Floodway Extension Project Footprint and the implications of the geomorphological mapping can be compared to previous investigations in the Trinity River to provide a general landscape evolution summary applicable to the APE. This landscape evolution summary can be used to infer general paleoenvironmental evolution, assess archeological site distribution data, and provide cultural resources management recommendations for areas impacted by the project. Geomorphological map units and alluvial deposits within the APE are correlated to the model of Ferring (1990) for the purpose of inferring regional events in the Trinity River basin (Table 10).

The oldest Trinity River deposits in the area are the Coppell/Tioga alluvium. This unit reflects a period of slow valley alluviation at a base level higher than present. Stream channels were relatively shallow, bedload dominated meander belts and climatic conditions were probably comparable to the modern. The unit formed in mid- Wisconsinan time, probably before 30,000 years ago (Ferring 1990).

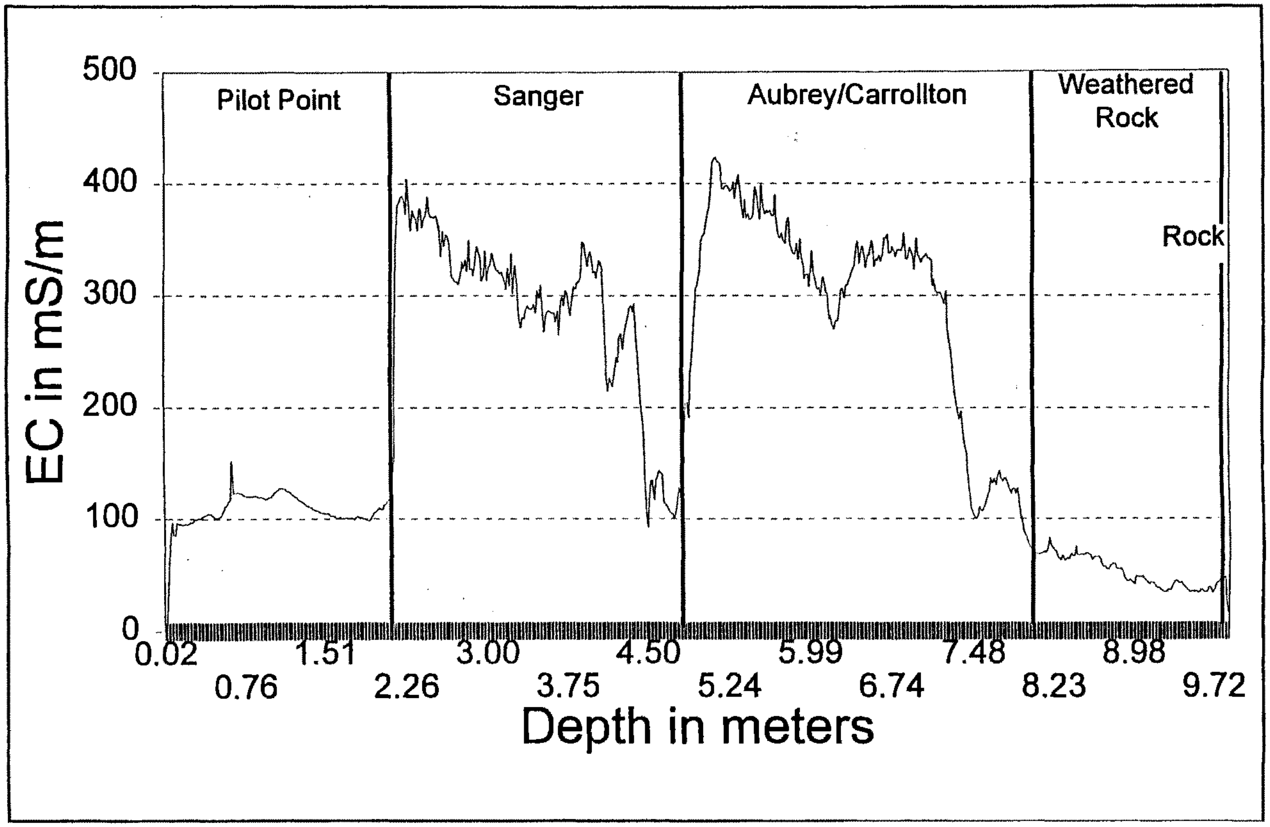


Figure 8. An example of an EC trace, Probe DF8 at Sargent Park, showing interpretations of alluvial units.

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Table 10
Comparison of Upper Trinity River Stratigraphy to Units in the Dallas Floodway Extension Project Footprint

UPPER TRINITY RIVER (FERRING 1990)			DALLAS FLOODWAY EXTENSION	
ALLUVIUM	**TERRACE SURFACE**	**AGE**	**ALLUVIUM**	**SURFACE(S)**
Pilot Point	Denton Creek	< 4,500 years	Pilot Point	Holocene flood plain (Hf)
Sanger	Denton Creek	4,500 to 11,000 years	Sanger	Holocene flood plain, older surfaces (Hfo)
Aubrey	Denton Creek	11,000 to 14,000 years	Aubrey/ Carrollton	Holocene flood plain, older surfaces (Hfo)
Carrollton	Hickory Creek	14,000 to 30,000 years		
Coppell/Tioga	Stewart Creek	> 30,000 years	Coppell/Tioga	Pleistocene terraces (Pt)
Irving	Stewart Creek	> 30,000 years	not identified	

Onset of continental glaciation produced widespread and rapid valley incision throughout much of Central Texas (Blum et al. 1994; Ferring 1990). Climatic instability and associated increases in effective precipitation not only induced incision of Trinity River into its present flood plain, but also resulted in alluviation of the Carrollton/Aubrey sequence in a low relief, wetland dominated flood plain. The lithologic and stratigraphic attributes of this unit suggest that the Trinity River flood plain was a mosaic of swamp, marsh, and lakes with interspersed scattered stream channels. Sediment delivered to the flood plain was derived from erosion of the upland residuum, triggered by vegetational instability associated with full glacial climate changes (Blum et al. 1994).

Rapid alluviation in the Trinity River ensued with early Holocene meander belt development and deposition of the Sanger alluvium (Ferring 1990). A return to increased climatic stability and seasonality occurred (Blum et al. 1994) at this time. The lithology of the Sanger alluvium may in part be a result of the widespread exposure of Cretaceous rock in the Trinity River basin after Late Pleistocene stripping of residuum. The middle Holocene is characterized by a transition toward modern climatic conditions. The Trinity River flood plain exhibited a slowing of the rate of alluviation and concurrent increase in the rate of alluvial pedogenesis (Ferring 1990).

The Late Holocene is typified by varying rates of alluviation and pedogenesis and deposition of channel belt alluvium and overbank veneers draping older flood plain surfaces. Soil formation was concurrent with sedimentation to produce the thick, cumulative West Fork paleosol at the top of Pilot Point alluvium (Ferring 1990). The most significant disruption in the cumulative aggradation of the Pilot Point sequence is an inferred period of drier climate about 1,000 years ago (Hall 1990). Hall cites widespread occurrence of an alluvial discontinuity in the southern Great Plains; however no data to either support or refute this idea was generated in this investigation.

Recent alluviation occurs near the modern channel of the Trinity River. Recent overbank veneers probably drape the entire Trinity River flood plain, but recent mud drapes cannot be confidently separated from upper Pilot Point alluvium based on available data. Ferring (1990) indicates that the Recent alluvium is young, but he does not specifically correlate this unit to the onset of European settlement in the region. Similar alluviation associated with Euro-American land use alteration has been suggested throughout the Mississippi River drainage basin (Autin 1992; Bettis and Autin 1997; Grissinger et al. 1982; Knox 1972).

Results of Model Testing

The preliminary results of the geological investigation of the Dallas Floodway Extension APE suggests the presence of significant buried paleosurfaces in areas of project impact. Geological testing with Geoprobe proved to be useful for recognizing buried paleosurfaces, however documentation of significant cultural deposits cannot be accomplished without further field testing. Trenching at high likelihood locations did not yield significant new sites (see Figure 6), but this does not preclude the possibility of impacting sites during project implementation.

The following areas were field tested to look for buried prehistoric cultural deposits. Moore Park shows stratigraphic continuity between probes DF13 and DF14. The upper dark unit is about 1.8 m thick at DF13, but thins to about 0.9 m on the valley edge at DF14. The upper unit is Pilot Point alluvium and the underlying early to middle Holocene paleosurface is Sanger alluvium containing the Arlington paleosol. The area at Sargent Park (probe DF8) has the most representative of all EC traces. The Sanger paleosurface identified at Moore Park is at about 2.1 m below the land surface. A trench into the Arlington paleosol at the top of the Sanger paleosurface was placed here for comparison to the Moore Park locality. The data collected at Moore Park identify a paleosurface that traces from the valley edge onto the flood plain of the Trinity River. The lithology beneath this surface has been identified at other locations, but the geomorphic development of a terrace edge escarpment is a likely setting for prehistoric cultural deposits.

Two trenches were placed in Moore Park—the first was at the break in slope adjacent to the flood plain east of probe DF14, and the second was upslope and to the south. The first trench revealed about 2 m of colluvial loam with abundant limestone fragments overlying the Sanger paleosurface. The contact between the paleosurface and the colluvium was diffuse, and the surface horizons of the Arlington paleosol were not present. The paleosurface appears to be an eroded B-horizon and yielded no cultural deposits. The second trench was placed about a meter higher in elevation, and the profile was the same, about 2 m of loamy colluvium over the clay loam Sanger paleosurface.

The EC and core data at Sargent Park identified three surfaces above Cretaceous rock, including the present land surface. Multiple episodes of alluviation and landscape stability are conducive to finding possibly significant buried prehistoric cultural deposits. Backhoe trenches were unable to reach the lower Aubrey/Carrollton paleosurface, but did reach the upper Sanger paleosurface. The Sanger appeared to be a truncated or eroded B horizon with surficial paleosol horizons absent. The overlying Pilot Point alluvium is a dark alluvial clay with occasional bits of broken limestone, presumably from the nearby uplands. No cultural deposits were present on the truncated paleosurface. Water-saturated sandy deposits were encountered beneath the truncated Arlington paleosol before reaching the full limit of the backhoe.

The truncated nature of the Sanger paleosurface and its burial by overbank deposits of Pilot Point alluvium, as well as its colluvial equivalent, exemplifies the nature of the alluvial transition between these units. Surface A and E horizons probably developed, but have been reworked into the overlying deposit.

The Diversion Channel is likely to impact flood plain deposits to the greatest depths in sequences that also contain evidence of buried paleosurfaces. Trenching in this area was conducted to provide insight into the potential for buried prehistoric impact prior to channelization during project implementation. The EC traces at DF16 and DF17 show what appear to be a buried paleosurface at about 1.5 m, whereas this surface appears to be at about 3.4 m at DF15. Trenches were aligned to look at the edge of what appeared to be a topographic feature, possibly the edge of a cut-and-fill feature.

The first trench was placed in the vicinity of DF15. It proved to be disturbed sequence with a high water table between 2 and 3 m below land surface. The trench revealed recent sandy loam over a dark clayey sediment with historic material and logs that appears to be artificial fill. The second trench was placed between DF15 and 16 and showed between 1 and 2 m of recent sandy loam over alluvial clayey deposits. At the top of the clayey sediment was the buried West Fork paleosol. Below this buried surface the clay continued to deeper than 4 m, and no cultural deposits were found in the trench.

The third trench was placed almost due east of the second, in a modem natural levee ridge. A 1- to 2-m-thick recent sandy loam levee deposit buried the dark clayey alluvium that contains the West Fork paleosol. The Pilot Point alluvium continued down to deeper than 4 m, and no cultural deposits were found in the trench. The fourth trench was placed east of DF16. Here a dark clay was present from the land surface down, but the upper part appeared to be disturbed, containing an anomalous mottled brown clay. Based on the trench results, the paleosurface defined by the EC traces is the West Fork paleosol covered by recent (European historic?) flood deposits. The depth of the paleosurface in DF15 may be due to disturbance, not to a change in the paleotopography.

RECOMMENDATIONS

Task 1 and Task 4 - Archeological and Geoarchaeological Evaluations

A total of 41 previously recorded archeological sites are located either within or adjacent to the APE, with 14 of these sites in the vicinity of the Project Footprint (see Figure 4). Evaluation of many of these sites proved difficult due to problems of high water conditions and the suspected misplotting of the sites recorded in the 1940s and 1950s. Of the 14 sites in the Project Footprint, it is recommended that six sites be considered not neligible for inclusion in the NRHP (41DL69, 41DL70, 41DL84, 41DL104, 41DL220 and 41DL317) due to heavy disturbance by construction, gravel mining, and erosion. It is further recommended that eight sites (41DL318, 41DL319, 41DL320, 41DL337, 41DL338, 41DL355, 41DL356 and 41DL357) be considered eligible for inclusion in the NRHP based on good research potential. It is believed that the seven prehistoric sites may yield data relevant to research problems like paleoenvironmental reconstruction, culture history, settlement-subsistence systems, lithic raw material use patterns, and prehistoric technology. Sites 41DL318, 41DL319 and 41DL357 are all located 1.5 to 2 m below surface, adjacent to the current channel of the river, within 100-120 m horizontal distance of each other, and may represent a single site composed of multiple artifact concentrations. Likewise, sites 41DL337, 41DL338, 41DL355 and 41DL356 are also arguably a single site. They are all located between the current channel and the Central Waste Water Treatment Plant, approximately 3 m below surface and within 100-120 m horizontal distance of each other. Apart from these two prehistoric site clusters, only the old City of Dallas dump, Site 41DL320, appears to retain substantial research potential..

Of the remaining 27 sites in the APE, it is recommended that one (site 41DL223) be considered not eligible for inclusion in the NRHP, while the other 26 be considered potentially eligible for inclusion in the NRHP (sites 41DL67, 41DL68, 41DL71, 41DL72, 41DL73, 41DL76, 41DL77, 41DL78, 41DL79, 41DL80, 41DL91, 41DL92, 41DL99, 41DL102, 41DL105, 41DL204, 41DL205, 41DL206, 41DL207, 41DL208, 41DL350, 41DL351, X41DL36, X41DL38, X41DL39, and X41DL40). The high proportion of potentially eligible sites is due to the lack of right-of-access to these properties resulting in an inability to evaluate their current condition. Only the sites in the Joppa Wildlife Preserve and the McCommas Bluff Park had clear public access, but the field crew was unable to shovel test these sites.

When the final Project Footprint is identified, it is recommended that a 100 percent pedestrian survey be undertaken during a period of low water to identify the specific cultural resources that will be effected by the project. Prior to the surface survey, a chain of title and archives study should be undertaken to identify historic land use and potential historic site loci for concentrated and intensive search activity. The effort should concentrate on the profiles of minor drainages and borrow cuts for prehistoric resources.

Given the known presence of buried cultural resources sites within the Trinity River flood plain, a multistage Phase 1 subsurface survey must be employed to identify high and moderate site potential loci followed by a program of selective coring and exploratory trenching to locate and define the character and research potential of the resources. It is recommended that the initial survey strategy use a combination of Geoprobe readings at 20 m intervals to generate a topographic map of the buried surfaces that will be effected, followed by a coring program to acquire soil samples of the fossil deposits for sedimentary, pollen and radiometric dating purposes, as well as the identification of fossil sedimentary environments. An alternative to the Geoprobe-coring program may be the use of a Geddings Probe at intervals of 20 meters, although the data from all probes will have to be extensively analyzed to identify the various fossil deposits. Once these data have been analyzed, it will be possible to identify settings and deposits most likely to be associated with human occupation. The subsequent stage of the survey will entail the excavation of trenches using appropriate machinery (backhoe, trackhoe, dredge) dependant on terminal depth. One primary focus of intensive work should be given to those areas identified as containing *Holocene flood plain older surface* deposits. Resources determined to be potentially eligible must then be tested for eligibility through a Phase 2 program. Should any resources prove to be eligible and avoidance is not possible, a Phase 3 data recovery program may be necessary to minimize the loss of the resource. All phases of the investigation would be developed through a Programmatic Agreement or Memorandum of Agreement with interested parties, such as the Texas Historic Preservation Officer.

The APE encompasses an area south of the current Dallas Floodway, from Corinth Street on the northwest to I-635 on the southeast. The APE can be systematically divided into four types of impact areas based on the activities planned for the Dallas Floodway Extension. Each of the impact areas are assessed for the purpose of planning archeological surveys and managing cultural resources (Table 11). The following summary is designed as a general set of recommendations, and inferences should be verified as necessary prior to implementation into management initiatives or policies relative to Floodway construction, operation or maintenance.

Area 1 is an area of *new levee construction*. A total of 123 acres are scheduled for direct impact, which includes 75 acres on the Lamar Street side and 48 acres at Cadillac Heights. These areas include the northeastern edge of the Dallas Floodway Extension from the edge of the existing levee to a point east of I-45 in Rochester Park, the southwestern edge of the Dallas Floodway Extension from the Dallas Waste Water Treatment Plant to I-45, and a ring levee primarily surrounding part of the Cadillac Heights residential area. The new levee construction along the northeastern edge of the Dallas Floodway Extension is along the fringe of an area that is already heavily industrialized and disturbed. Areas previously impacted by industrial development are not likely to contain significant in situ prehistoric deposits. Areas southwest of the railroad track in the Rochester Park area mapped as Holocene, older flood plain may contain locations with possible buried cultural remains. Areas mapped as Pleistocene terraces may contain surficial cultural deposits.

The new levee construction along the southwestern edge of the Dallas Floodway Extension passes along the edge of the Dallas Waste Water Treatment Plant and I-45 right-of-way. Based on a consideration of present land use alterations, the chances of finding significant *in situ* prehistoric deposits are considered low. The new levee construction surrounding part of the Cadillac Heights area passes through areas of disturbed and undisturbed landscape. Much of the undisturbed landscape is mapped as Holocene, older flood plain, as characterized at Sargent Park, where multiple paleosurfaces were identified. Site potential in this area is considered moderate to high.

Area 2 is *a diversion channel* to be developed in an area that parallels the present Trinity River both upstream and downstream of I-45. A total of 23 acres will be affected by the project, although direct massive impact will be essentially restricted to a 14-acre area. In this area, the diversion channel is likely to disturb flood plain alluvium to bedrock or nearly to bedrock.

Table 11
Matrix of Cultural Resources Potential, Dallas Floodway Extension APE

IMPACT AREA	EXISTING SURFACE MODIFICATION	SUBSURFACE POTENTIAL	POTENTIAL PROJECT IMPACTS
New levee construction, northwest area	intensive	moderate to high with depth	moderate to high below 1 meter
New levee construction, Cadillac Heights	low	high	high
Diversion channel	very low	high	high
Sump, northwest area	moderate	moderate to high with depth	moderate to high below 1 meter
Chain of Wetlands	limited	moderate to high	low to nil in upper 1 meter of deposit; moderate to high below 1 meter

Buried paleosurfaces were identified near the impact area. The survey program should be initiated in the area of the diversion channel, where the proposed undertaken will reach greatest depth. Previous survey in the flood plain, especially within the Project Footprint, has shown that sites may occur from 1.5 to 2 m below surface (sites 41DL102, 41DL318, 41DL319, 41DL350, and 41DL357) and as deep as 3 m below surface (41DL337, 41DL338, 41DL355, and 41DL356) in association with the Pilot Point and Sanger alluvia. The downstream portion of the proposed diversion channel will likely include excavation into the deeply buried Arbury Aluvium associated with Paleo-Indian occupation in the watershed.

Area 3 includes the *sump areas* to be created behind the new levees along the northeastern edge of the Dallas Floodway Extension. A total of 139 acres are scheduled for direct impact through sump construction. The areas along the northwest boundary of the Dallas Floodway Extension are mostly disturbed by prior industrial development and are not likely to contain significant *in situ* undisturbed prehistoric cultural deposits in the upper meter of deposits. However, prehistoric and early historic culture-bearing deposits may have been buried by leveling activity and the filling of headward eroding drainages prior to industrial development. The area is in close proximity to the Pleistocene valley wall and may have contained numerous specialized settings, e.g., seeps, drainage heads, that were often exploited by prehistoric inhabitants of the region. Many of these loci would have been covered by fill prior to construction and while they may have suffered compaction, their essential distribution could remain intact. The potential for these deposits should be investigated prior to and during construction.

Area 4 includes proposed *wetlands* that will be created along the southwestern edge of the Dallas Floodway Extension for purposes of environmental mitigation. A total of 271 acres will be impacted through varying amounts of excavation and/or terrain modification. Developing wetlands should produce minimal disturbances to buried cultural deposits, especially if wetland creation is simply the development of bottomland hardwood forest areas in the flood plain. However, using data from the lower West Fork for comparative purposes, the potential for impact to buried deposits increases substantially with excavation. At a minimum, careful monitoring by a professional archaeological team would subsequently be necessary should excavations be included in the undertaking.

Task 2 - Archival Evaluations

The review of historical resources suggests that information for the Project Footprint and APE is available. However, based on the *type* of resources that can be secured, the extraction of data will require a concerted amount of effort and time. Little information associated with the APE is compiled, thus, an in-depth examination of records, collections, and documents will be necessary in order to provide an accurate historical context. Since secondary sources of information on this area are limited, future research should also include interviews with long-term community residents, or other persons with specific knowledge about the area.

Inquiries into archival material at the Dallas Historical Society reveal two collections of papers that may contain valuable data—the Overton Family papers and the Sara Cockrell papers. The archivist was not able to confirm if these collections contained information pertinent to the APE, but given the proximity of the Overton property to the APE and since Cockrell's Bridge traversed the Trinity River, these collections are worth reviewing. It would also be worth investigating other files and collections at this repository. Other resources such as early newspapers, city directories, and historic photographs may also yield pertinent data.

Another potential source of information, especially for little-known African-American communities such as Joppa, is Black Dallas Remembered, Inc., which shares space with Preservation Dallas on Swiss Avenue. Dr. Mamie McKnight, founding director of Black Dallas Remembered, Inc., is currently updating file information on Joppa which should be available in July of 1997. In addition to this information, community residents should be interviewed for information on family and community history. Files at Preservation Dallas indicate that Joppa residents are likely to have historical knowledge, as many have lived in the area throughout their lives and are descendants of original inhabitants. One Joppa resident, in particular, appears to be quite interested in preserving the community's history (M. Greene 1996). Contact persons for all of the communities associated with the APE are available at Preservation Dallas; interviews with these persons could yield valuable information for each particular community.

The data contained in deed records can vary tremendously from one transaction to the next, and, as indicated in the examples for this survey, chain of ownership is not always straightforward, hence, it requires a considerable amount of time to track deed/title chains. Tracking the chain of title for a single property can take up to one day. Though it may take time to establish the chain of ownership, deed records do provide information that is useful for further investigations. Provided it can be established that the landowners lived on or made use of the property, then census records, tax records, wills, and directories may provide data that is useful for understanding land use, migration trends, urban growth, zoning changes, occupational trends, the material culture, and the built environment. Landowner's names are also useful for tracing descendants who might share their family's history, or for inquiring about documents and records left at archival repositories.

Future archival research for this area should include an examination of as many primary sources of information as is possible. Since published sources for this area are limited, data from a wide range of sources should be reviewed in order to develop a more comprehensive historical context that reveals the social and economic trends associated with this area.

Task 3 - Architectural Evaluation

Investigation of the architectural resources within the Project Footprint of the Dallas Floodway Extension revealed that there are 49 architectural resources that will be directly affected by the construction of the levee system or other flood control components, as presently proposed (see Table 6). These resources are composed of:

- Category 1 resources, three that should be assessed by an architectural historian and will require further archival research for any that the architectural historian recommends as NRHP-eligible;
- Category 2 and 3 resources, 43 that require no further work;
- Category 4 resources, three that will need to be assessed by an architectural historian or that requires further archival research when they become 50 years old (1999).

In addition, there are 699 B-series architectural resources. Of these, assessments have been made as follows:

- Category 1 resources, five that will need additional assessment and research should the layout or design of the levee system or other flood control components be altered such that these resources would be impacted;
- Category 2 and 3 resources, 120 that will require no further work should the layout or design of the levee system or other flood control components be altered such that these resources would be impacted;
- Category 4 resources, none have been assessed as such; and
- 574 will need additional research in order for an accurate assessment to be made should the layout or design of the levee system or other flood control components be altered such that these resources would be impacted.

The B-series resources that have been assessed as Category 1 resources (potentially eligible for inclusion in the NRHP) are:

- B-121, B-122, and B-123, all industrial/institutional buildings of distinctive architectural style that appear to be in good condition and to retain a reasonable degree of integrity;
- the Corinth Street Viaduct (B-268), which has previously been recommended eligible for inclusion in the NRHP by the Corps of Engineers (USACE-FW 1992:30); and
- the community of Joppa (B-727), a potential NRHP Historic District (only a portion of which is located within the APE).

All Category 1 resources are potentially eligible for inclusion on the NRHP. Each Category 1 A-series resource will need to be assessed by an architectural historian for their integrity, condition, and architectural/engineering significance. Each of those that is considered to be NRHP-eligible by the architectural historian will require further archival research to document its history and better determine its significance. The historic context of each resource will need to be established so that the significance of the resource can be effectively conveyed. Each NRHP-eligible resource will also need to be preserved or appropriately documented according to HABS/HAER standards (the level of documentation required should be determined through consultation with the Texas State Historic Preservation Officer). Any Category 4 A-series resource that is upgraded to a Category 1 resource will require the same documentation efforts.

At this time, a Category 1 assessment of a B-series resource does not necessitate further research, documentation, or evaluation. However, should the layout or design of the levee system or other flood control components be altered such that these resources would be impacted, each will need to be treated in the same manner as the Category 1 A-series resources, as described in the preceding paragraph. Any Category 4 or 5 B-series resource that is upgraded to a Category 1 resource in future assessments will require the same documentation efforts if subject to impacts because of changes made to the layout or design of the levee system or other components of the flood control system.

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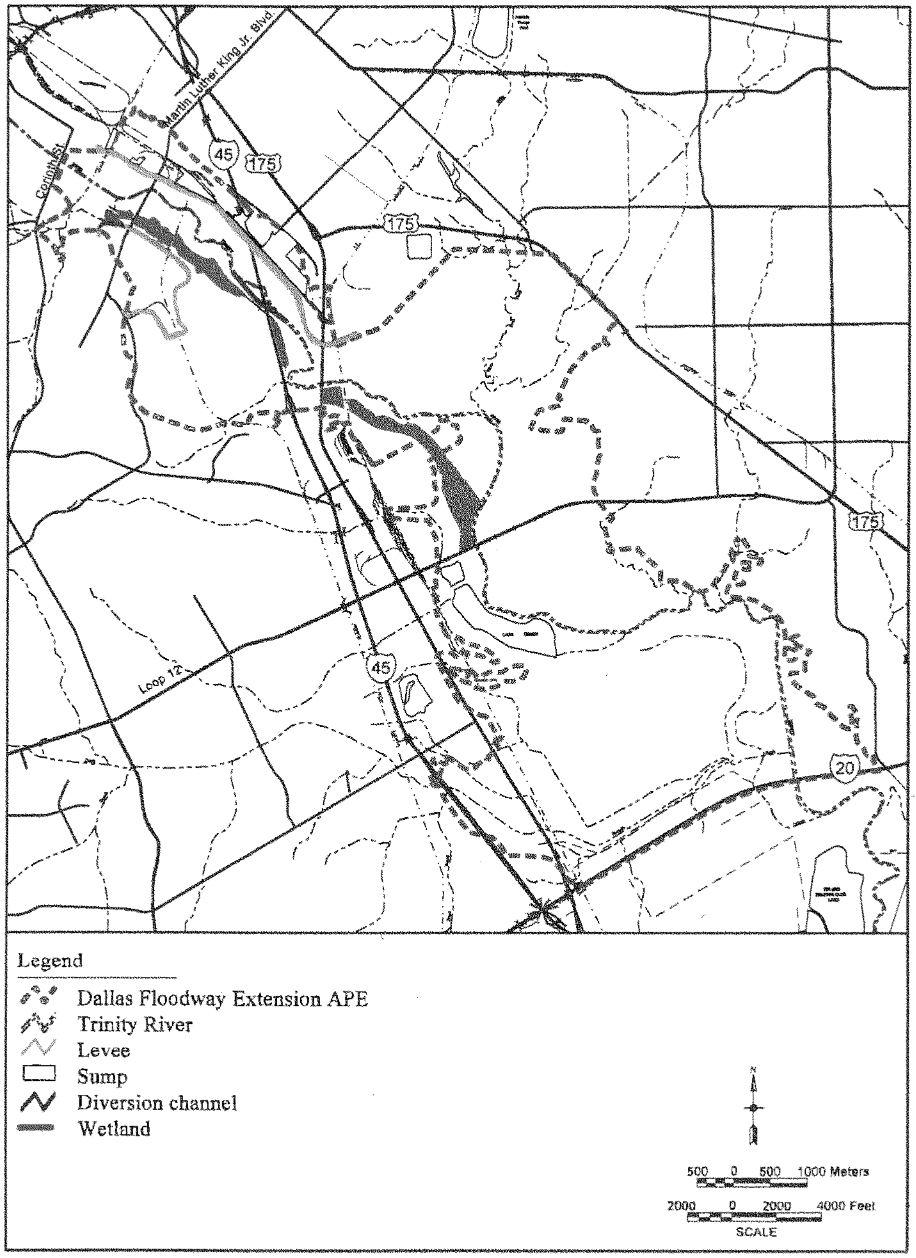

Figure 2. Map of the Dallas Floodway Extension APE and Project Footprint.

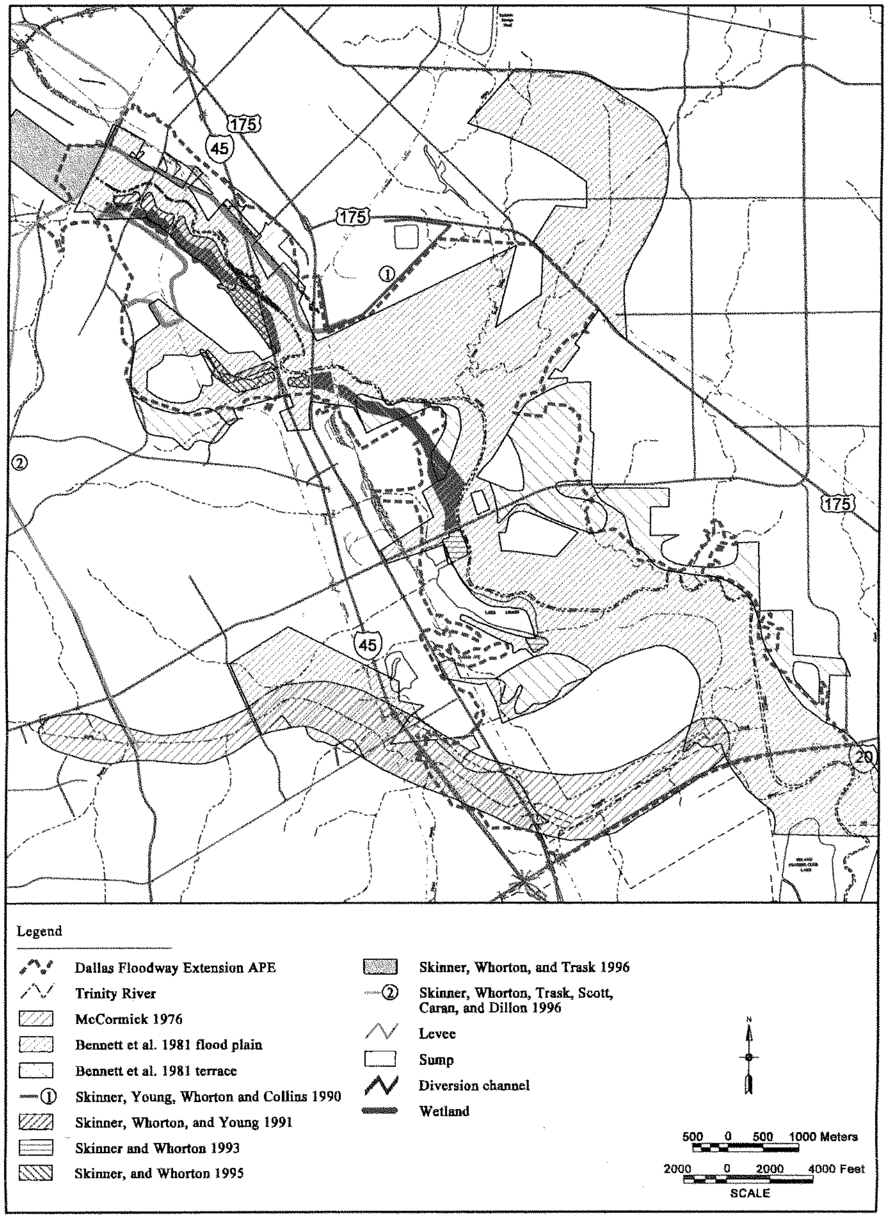

Figure 3. Map of Dallas Floodway Extension APE and Project Footprint, showing locations of previous cultural resources investigations conducted in the area.

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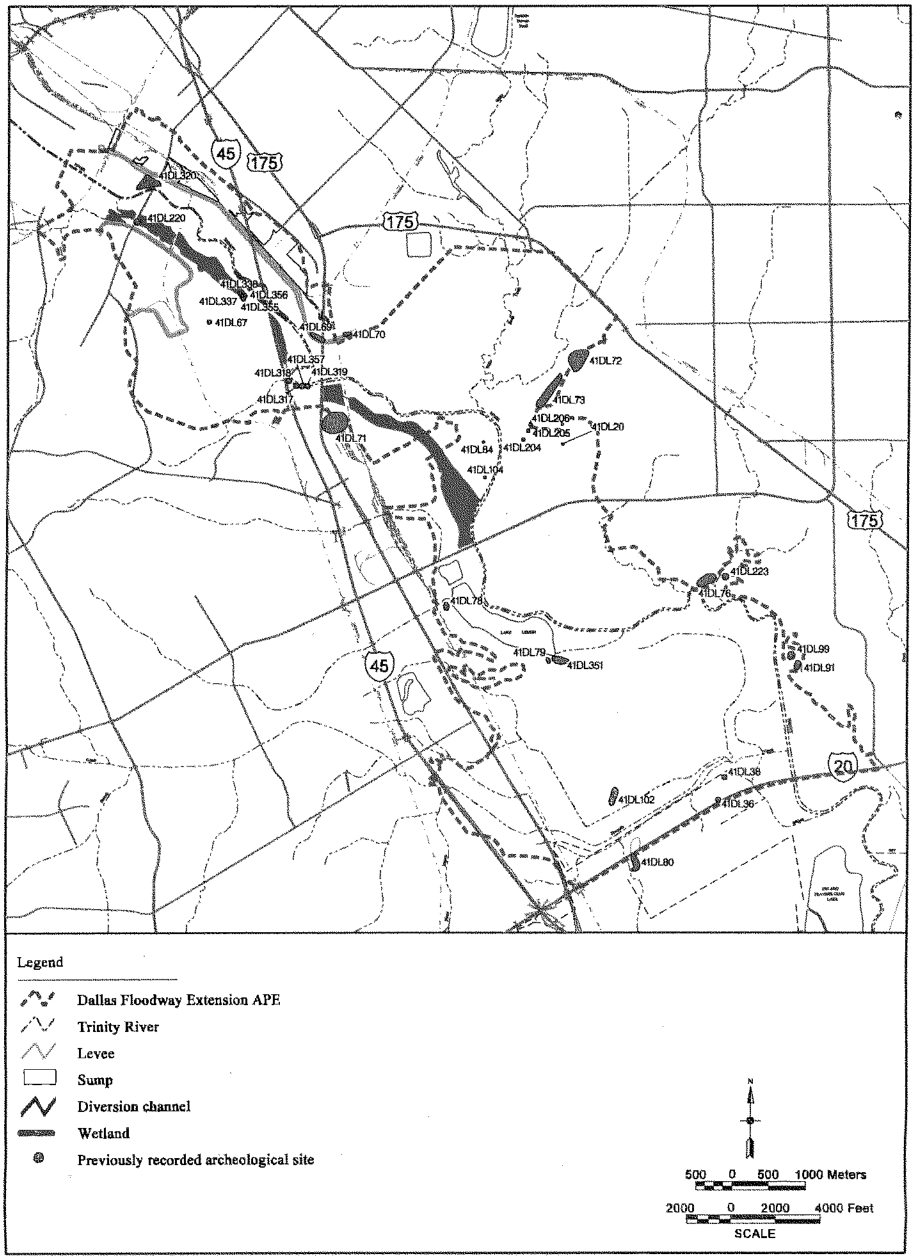

Figure 4. Map of identified archeological resources within the Dallas Floodway extension APE.

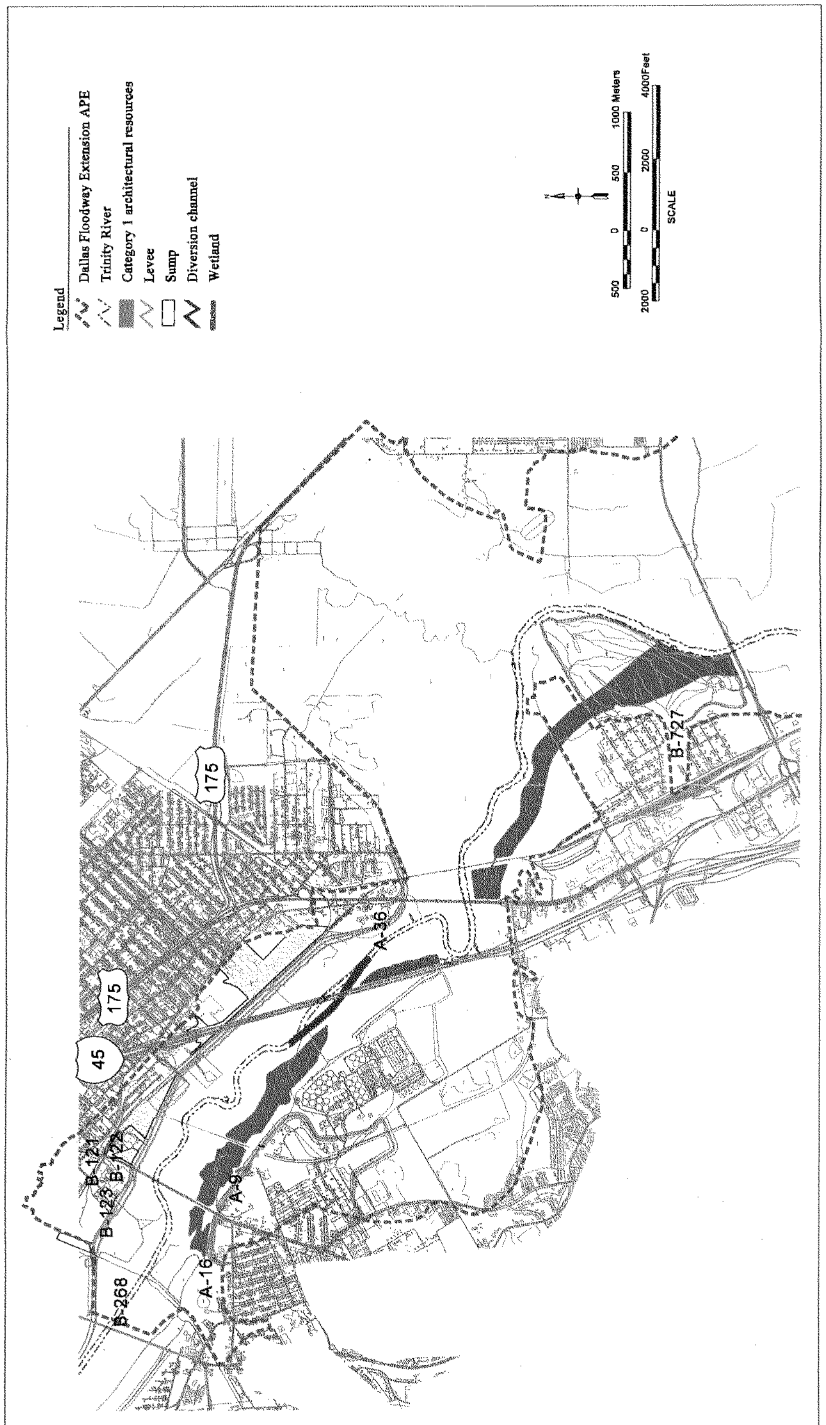

Figure 5. Map of Category 1 architectural resources within the Dallas Floodway Extension APE.

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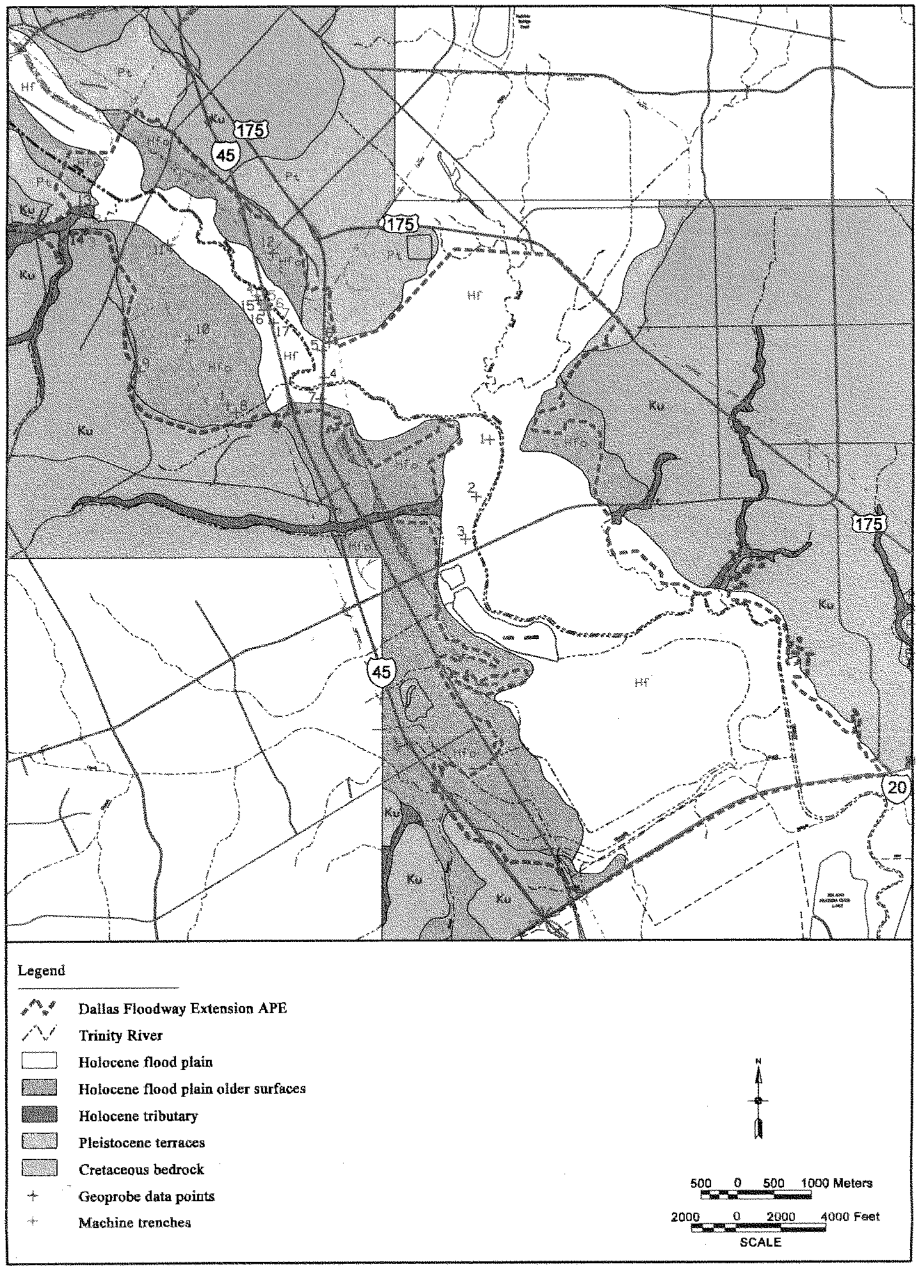

Figure 7. Geomorphological map of the Dallas Floodway Extension area (base map includes part of Dallas, Oak Cliff, and Hutchins, TX, USGS 7.5-minute topographic quadrangles.

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APPENDIX I

RECREATION

APPENDIX I

RECREATION AND OPEN SPACE

EXISTING RECREATIONAL RESOURCES

Regional Recreation Resources

The 1990 Texas Outdoor Recreation Plan (TORP) prepared by the Texas Parks and Wildlife Department (TPWD) identifies existing recreational facilities, usage trends, and projected recreational needs for 23 regions within the state. The Dallas Floodway Extension is located within a 16 county area designated in the TORP as Region 4 (see Figure 1).

Region 4 has experienced several years of rapid population growth. With 336.6 people per square mile, the density of Region 4 is surpassed only by the Houston region. Many of the small towns and rural areas within Region 4 have become part of the rapidly expanding metropolitan area as people have moved from the heavily populated cities to the suburbs. People in these urbanizing areas are finding open space increasingly scarce. The region now ranks 21st out of 23 regions in recreation land per thousand population.

Residents of Region 4 are generally worse off than the state as a whole in recreational facility supply. Of 19 commonly used facilities or designated resources, 13 have a below average supply. The supply of baseball fields, swimming pools, and campsites is among the lowest in the state in facilities per thousand population. Table 1 shows the supply of recreational land, water, and facilities managed by various providers. The administrative category with the highest proportion of park land acres (39 percent) is the aggregate of municipalities. The Corps of Engineers follows closely with 38 percent of the regional total. Much of the 48,737 acres of recreational land in this region operated by the Corps of Engineers can be found in close proximity to the urban areas. Only 9.6 percent of the park land acres found within the region is provided by the Texas Parks and Wildlife Department. State parks located within a one hour drive of the study area include Ray Roberts Lake State Park and Cedar Hill State Park at Joe Pool Lake. There are several other state parks within a two hour drive of the Metroplex. The Texas Legislature has authorized the acquisition of approximately 1500 acres along the Trinity River within the study area for a future low density recreational area to be named Trinity River State Park. Funding sources for acquisition of all of these lands, however, have not been identified.

Residents in the metroplex need not drive far to find recreational waters because many of the state's major reservoirs are located in the metropolitan area. A total of 232,581 surface acres gives the region more lake acres than all regions except Deep East Texas; however, the large numbers of people residing in the region make the suitable surface acres per thousand population still fall below the state average.

With so many reservoirs in the area, the value of the free-flowing sections of the region's rivers increases as they become more rare. Public agencies within Region 4 are taking a fresh look at the valuable natural resources along these long neglected streams. Many cities have identified linear corridor resources within their jurisdictions which are highly desirable for recreation, and sites within the Trinity River floodplain are among those most actively studied. Nine cities and three counties within the region are participating with the (NCTCOG) in the development of a *Common Vision* to protect the resources within this corridor.

Figure 1
TORP REGION 4

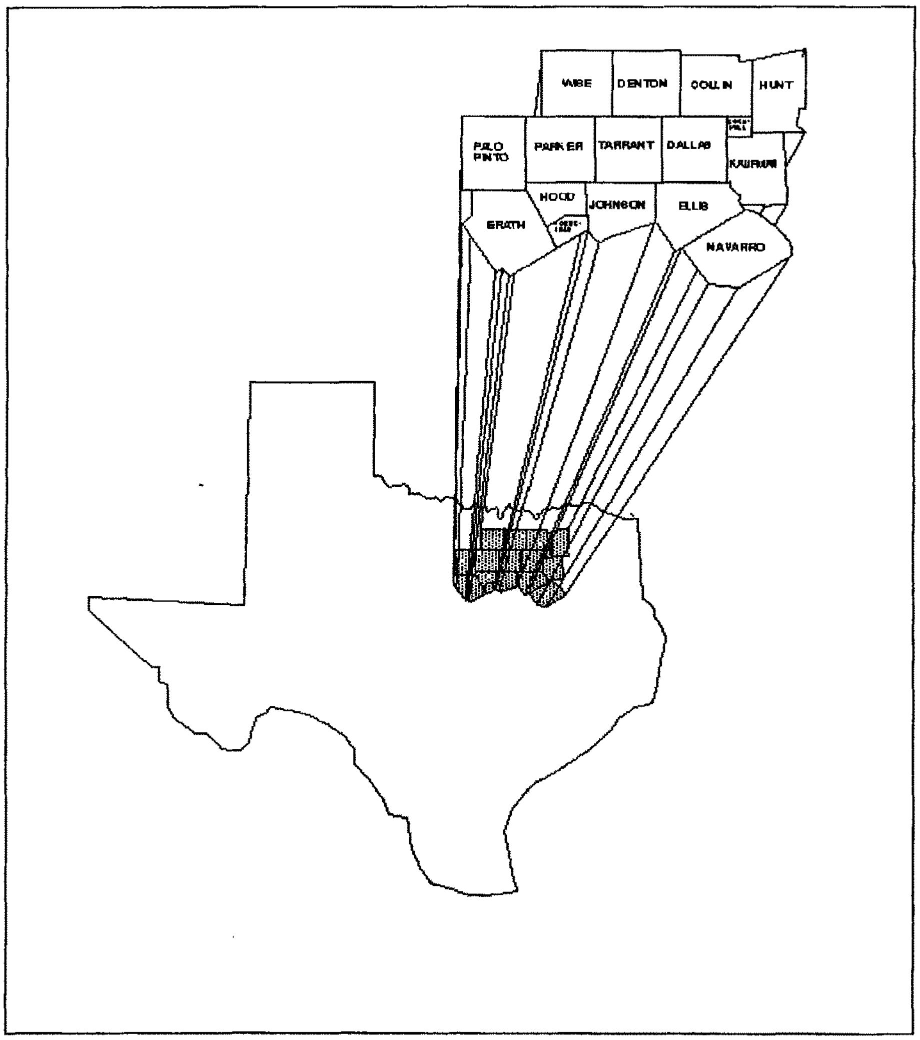


TABLE 1
Supply of Recreational Land, Water, and Facilities
Within the Upper Trinity Study Area

Facility / Resource	Forest Service	Corps of Engineers	TPWD State Park System	TPWD Wildlife Mgmt. Areas	Other State	River Authorities	Counties	Cities	Other Local	Commercial	TOTAL
Number of Parks/ Rec. Areas	1	58	10	2	3	7	11	1,218	24	120	1,454
Total Park Land (ac.)	15	48,737	12,192	6,570	190	394	560	50,160	667	8,081	127,567
Developed (ac.)	4	8,588	1,944	0	190	331	61	21,302	413	4,370	37,203
Developable (ac.)	11	6,818	6,335	0	0	63	374	19,862	211	3,352	37,026
Preserved or Unsuitable (ac.)	0	33,331	3,913	6,570	0	0	125	8,996	44	359	53,338
Baseball Fields	0	0	0	0	0	0	0	305	4	1	310
Basketball Goals	0	0	0	0	0	2	0	438	21	8	469
Boat Ramp Lanes	1	195	9	0	7	13	3	92	0	103	423
Campsites	0	1,011	405	0	0	299	62	313	0	3,303	5,393
Fishing Bank Access (yd.)	0	60,850	7,040	0	0	18,000	0	11,162	0	30,310	127,362
Fishing Structures (yd.)	0	550	212	0	0	650	0	2,703	0	4,052	8,167
Golf Holes	0	0	0	0	18	0	0	486	0	162	666
Hiking Trails (mi.)	0	0	12	0	0	0	0	11	0	0	23
Horseback Riding Trails (mi.)	0	15	9	0	0	0	0	7	0	0	31
Lake Acres (BFS Suitable)											165,749
Off-road Vehicle Area (ac.)	0	0	0	0	0	0	0	94	0	2,805	2,899
Picnic Tables	8	730	248	0	0	23	18	5,877	0	2,044	8,947
Playground Areas, Equipped	0	0	11	0	0	2	0	863	11	28	915
Soccer/Football Fields	0	0	0	0	0	0	0	553	12	0	564
Softball Fields	0	0	1	0	0	0	0	469	6	2	478
Swimming, Designated Lake (yd2)	0	142,400	3,900	0	0	150	3,000	39,500	0	200,698	389,648
Swimming, Pool (yd2)	0	0	0	0	0	0	0	78,361	0	11,775	90,136
Tennis Courts	0	0	0	0	0	1	0	826	40	10	877
Trails, Walk, Bike, Jog (mi.)	0	2	0	0	0	0	0	116	0	0	118

Source: Parks Division, TPWD, 1988. Figures are based on 1986 inventories.

Goals include the development of a regional construction permit system and cooperation in the creation of a linear greenbelt of parks and trails along and adjacent to the river and its tributaries.

Local Recreational Resources

Over 6000 acres of existing parks, open spaces, natural areas, and cemeteries are available for present or future public use within an 80 square mile section of the county that includes the study area (Figure 2). These public and private lands and facilities provide recreational opportunities for residents of the Metroplex, especially those who are unable to travel to recreational sites outside the metropolitan area.

Most of the recreational resources within the study area are owned and managed by the City of Dallas, the Dallas Independent School District, and the Dallas County Open Space Board. A list of these resources and their approximate acreages are included in Table 2.

Recreational lands and open space areas proposed for future use are also shown on Figure 2. These areas have been identified and recommended for acquisition by the City of Dallas, and the Dallas County Open Space Board in support of the comprehensive Trinity River Greenbelt concept.

TABLE 2
Trinity River Floodway Extension Landuse Acreage

Landuse Type	Number of Facilities	Approximate Acreage
Lakes	1	149
Landfills	1	2,009
Private Parks/Recreational Facilities	1	4
Golf Courses	4	627
Cemeteries	5	340
Public Parks	81	5617
Natural Parks	2	243
City Open Space	4	765
Large Outdoor Stadiums	2	33
Proposed City Parks/Open Space	16	824
Proposed State Parks/Open Space	5	1245

Regional Recreational Activities

The projected per capita outdoor recreation participation generated by Region 4 residents in each of the 26 activities shown in Table 3 closely matches the statewide figures. The exceptions are the saltwater activities, in which Region 4 residents are less likely to participate as a whole.

Table 3 also shows the activities garnering the most participation per capita. The top five activities which people do most frequently are walking, bicycling, pool swimming, playground use, and jogging. The state averages show the same top activities. Compared to the state rates per capita for the 26 activities, Region 4 residents participate at higher rates for 7 activities, at the same rate for 5 activities, and at lower rates for 14 activities. Soccer and tennis participation in Region 4 is higher than almost all other regions.

Recreation on the Trinity River and Tributaries

The most scenic wooded areas in Region 4 are often found in stream and river corridors. Scenic corridors along the Trinity, with natural meandering water courses bordered by riparian hardwoods or dense stands of trees and shrubs, are the most desirable segments of the river and the portions most intensely used by the recreating public. Use of these segments is the heaviest during higher stream flow periods, generally during the spring and fall seasons. Recreation providers have expressed concern over stream bank erosion, instream flows and the quality of the water for contact recreation. Some feel the standards for designating stream segments as fishable and swimmable should be tightened to give citizens higher quality water resources. Minimum instream flows are also needed to preserve fish and wildlife habitat and historical and recreational resources.

The Elm Fork of the Trinity River and its tributaries are currently being used for a variety of recreational activities even though access is limited or restricted. In spite of these limitations, avid canoeists, kayakers, fishermen, bicyclists, and bird watchers have located access points where park areas, roads and bridges intersect with the river.

Two of the most active canoe/kayak groups in the Metroplex are the Dallas Down River Club and North Texas River Runners. These groups have identified various Trinity and tributary segments which are currently being used for canoeing. Canoeists often put in above Interstate 30, near Trammel Crow Park, where there is a shale shelf on the east side of the river. The only existing river access point within the study area is on the west side of the river at Loop 12, which is approximately 10 river miles downstream of the Trammel Crow entry site. Under average conditions, a canoe trip between these points takes about five hours. The next take out point is where the river passes under Dowdy Ferry Road, south of Interstate 20. This is approximately eight river miles below Loop 12. Many canoeists have made the entire trip from above I-30 to the Dowdy Ferry take out, but it is a very long trip, under the best conditions. For convenience and safety reasons, it would be prudent to examine options for additional access points within the study area intermediate to these existing sites.

Representatives of area bicycle groups, including the Dallas Off-Road Bicycle Association and the Greater Dallas Bicyclists have indicated that no organized use of the floodway extension area occurs at this time. Reasons given include the lack of trail facilities in the area, and safety concerns. Riders are using trails and streets in the upper regions of the corridor and along the tributaries near the floodway extension area. They have expressed much interest in extending both surfaced and unsurfaced trails into this stretch of the greenway.

There are a number of relatively small equestrian groups who use the resources in Region 4. While they lack overall organizational unity, these groups share a common desire for more quality places to ride. Representatives of several of these groups indicate that equestrian use of the floodway extension area is limited at this time, however much interest was expressed in opportunities to include equestrian trails in future development of the area.

The Dallas Floodway Extension area is an attractive resource which provides habitat for numerous species of birds, mammals, and butterflies. According to Mr. E.G. White-Swift, president of the Dallas County Audubon Society, Lemon Lake is the area most heavily used by birders and other nature enthusiasts. Early morning hours are preferred for wildlife observation. Use of other locations within the study area is restricted by limited access and safety concerns. High water levels and muddy soils also discourage visitation.

TABLE 3
Projected 1995 per Capita Outdoor Recreation Participation
Generated by Residents of Region 4 and Texans
(in Annual User Occasions)

Activity/Facility Use	Projected Per Capita Particiipation Generated By Residents of Region 4 in Region 4 Only	Occurring in All Regions	All Texans Statewide
Boat Ramp Lanes, FW	0.8	1.3	1.3
Boat Ramp Lanes, SW		*	0.3
Boating (Pleasure), FW	0.4	1.7	1.7
Boating (Pleasure), SW		*	0.1
Camping	0.4	1.7	1.7
Fishing, FW	1.6	2.4	2.4
Fishing from Banks	0.5	0.8	0.8
Fishing from Boats	0.7	1.1	1.1
Fishing from Structures	0.4	0.5	0.5
Fishing, SW	*	0.2	0.7
Fishing from Banks	*	*	0.3
Fishing from Boats	*	*	0.1
Fishing from Structures	*	*	0.3
Hiking	0.2	0.3	0.4
Hunting	0.4	1.1	1.3
Lake Use (BFS Suitable), FW	1.0	1.4	1.5
Nature Study	0.6	0.9	0.9
Picnicking	1.4	1.8	1.9
Swimming, FW	1.3	2.1	2.1
Swimming, SW	*	0.5	1.2
Baseball	1.2		1.5
Basketball	1.4		1.6
Bicycling	10.5		10.7
Bicycling on Trails	0.6		0.7
Football	0.7		0.8
Golf	1.4		1.3
Horseback Riding	0.8		0.8
Horseback Riding on Trails	0.2		0.2
Jogging/Running	4.8		5.4
Jogging/Running on Trails	1.5		1.7
Off-road Vehicle Riding	1.4		1.4
Off-road Vehicle Riding/Trails	0.3		0.3
Open Space Activities	3.4		3.2
Playground Use	4.9		4.8
Soccer	1.4		1.2
Softball	1.6		1.8
Swimming, Pool	6.3		6.4
Tennis	1.5		1.3
Walking (Pleasure/Exercise		15.1	14.8
Walking on Trails	3.5		3.5

Source: 1986 Participation Survey, Parks Division, TPWD, 1987.
Notes: Asterisk (*) indicates value is less than 0.1 occasion per capita.

The Dallas Park and Recreation Department conducted a recreational user survey in the communities surrounding the Floodway Extension project area. Questionnaires were distributed to area residents through six neighborhood recreation centers. A copy of the questionnaire form is included in the back of this appendix. Centers chosen for the survey are listed below.

Recreation Center Location		***No. of Surveys Returned***
J.C. Phelps	3030 Tips Blvd 75216	24
Eloise Lundy	1229 Sabine 75203	18
Exline	2525 Pine St. 75215	16
Fireside	8601 Fireside 75217	27
Pemberton Hill	6424 Elam Rd. 75217	28
Rhoades Terrace	5712 Pilgrim 75215	13
Martin Luther King Jr	.2922 MLK Blvd 75215	0
Fruitdale	4408 Vandervoort 75216	0

The first part of the questionnaire provided a list of outdoor recreational activities and asked participants to indicate those activities in which they are currently participating within the project area. A tabular report of the survey findings related to existing recreational activities is shown in Table 4. The activities most often selected from the list were picnicking, hiking/walking/jogging, bicycling, and fishing. While the survey is not statistically reliable due to the method of sampling, it does provide some insight into the types of activities residents of the area enjoy.

TABLE 4
Existing Recreational Use Patterns
From Neighborhood User Survey

	NEIGHBORHOOD RECREATION CENTERS						
	EXLINE	FIRESIDE	J.C. PHELPS	LUNDY	PEMBERTON HILL	RHOADES TERRACE	TOTALS
NUMBER OF SURVEYS RETURNED >	16	27	24	18	23	13	121
EXISTING ACTIVITIES							
Picnicking	1	5	15	15	23	10	69
Hiking/Walking/Jogging	0	8	16	4	20	7	55
Bicycling	1	5	10	3	22	6	47
Fishing: Riverbank	6	2	10	6	10	2	36
Other Facilities [1]	2	6	10	2	1	8	29
Horseback Riding	2	0	5	2	7	3	19
Birdwatching/Nature Study	1	0	3	3	5	2	14
Canoeing/Boating	1	1	2	2	5	2	13
Fishing: Boat	2	0	4	1	6	0	13

1. Other activities reported included Baseball, Softball, Volleyball, Water Skiing, and Badminton

IDENTIFICATION OF RECREATIONAL NEEDS

Open space and outdoor recreational facilities which currently exist within the study area are discussed in a preceding section of this report. While there are substantial amounts of open space and recreational facilities available to the residents of the area, projections show that the demand for these facilities is continuing to increase. Table 5 and Figure 3 show the most popular outdoor recreational activities which were expected to occur in Region 4 in years 1995, and 2000,

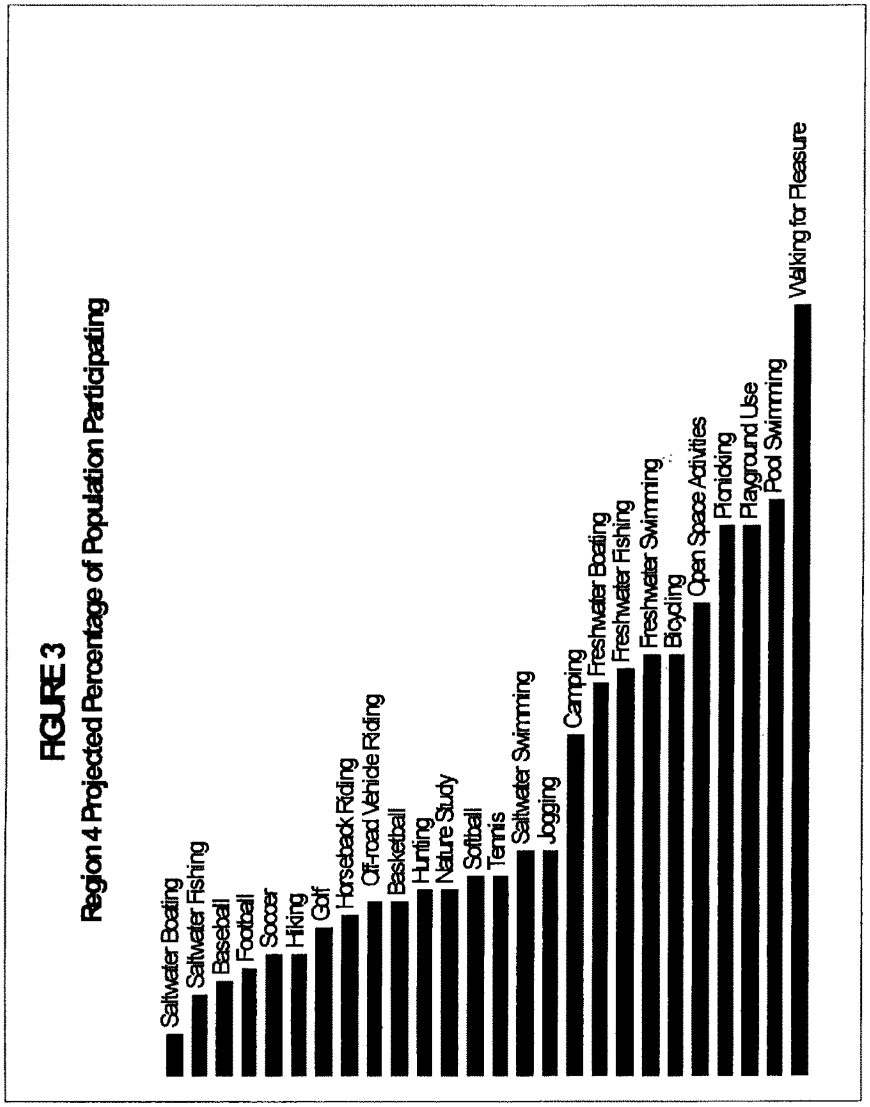


FIGURE 3
Region 4 Projected Percentage of Population Participating

as projected in the 1990 Texas Outdoor Recreation Plan (TORP). Participation will increase for each projection year. Fresh water fishing, swimming, and picnicking will attract the most participation in the region for resource based activities. Participation in urban oriented activities projected for 1995 were over eight times as high as the participation in resource based activities in the region. This ratio is one of the highest in Texas. Texans from outside Region 4 will have little impact on the region's resources.

Table 6 shows regional facility needs for 13 of the 18 commonly used facilities/resources by 1995. Increases of more than 100 percent over existing supply are needed for five facilities (hiking, horseback, and multi-use trails, playgrounds, and freshwater swimming areas). Table 7 ranks the outdoor recreation needs within the region. Multi-use trails are the highest need followed by freshwater swimming, playgrounds, and hiking trails.

Public recreation providers in the region have repeatedly expressed a need for more parks and passive open space. In recent years, park land and open space have become increasingly scarce as available sites have been reduced. Rapid development has replaced many natural areas with buildings and pavement. Needed lands shown in Table 6 represent only the acres required to develop recreational facilities. Most park providers have identified undeveloped land as their highest priority need (park sites, open space, and greenbelt acquisition). The next greatest need expressed is for upgrading and renovating existing facilities.

The City of Dallas and the Dallas County Open Space Board have specific plans to acquire additional lands to meet future public recreational demands. Proposed acquisitions are often dependent on the availability of public funds and are influenced by private development pressures and development permit approvals. Both the City and the County have bond funded open space acquisition programs. The recent slump in the Texas economy has temporarily suppressed rising land costs, making the present a very good time to pursue needed acquisitions.

Public Use of Rivers, Tributaries, and Corridors

As would be expected, river and creek segments which have had trees and shrubs removed, have been channelized, lined with levees, or heavily developed are less desirable and the least utilized by area canoeists, bicyclists, hikers, and bird watchers. Many of these channelized and leveed river segments offer recreation potential but will need to be enhanced with river access points, trails, play areas, sports fields, tree and shrub plantings and wildlife habitat improvements in order to attract recreational users to the floodway.

Recreational Fishing

The Texas Department of Health issued an aquatic life closure for a stretch of the Trinity River in January 1990 due to elevated levels of chlordane in fish tissue. This 66-mile stretch of the Trinity River, denoted as Segment 806, extends from Fort Worth to IH-20 in southern Dallas County, which includes the DFE project area. Fishing can be conducted, but no taking of fish is currently allowed. In addition, the TNRCC does not support contact recreation within the waters of Segment 806 due to continued water quality violations.

Trinity Corridor and Greenbelt

Without exception, the recreational master plans and sector plans of the cities and counties with jurisdiction along the Trinity River call for utilization of the flood plain for open space, linear parks, access areas, active and passive use areas, interpretive areas, natural areas, "urban wilderness" areas, and a system of linked hiking, biking and equestrian trails. A regional goal is to tie public lands and open space within the Trinity Corridor and its tributaries from Lewisville Lake, Lewisville, Coppell, Carrollton, Irving, White Rock Lake, Dallas, Grand Prairie, Mountain Creek Lake, Joe Pool Lake, Arlington, Fort Worth, Lake Worth, Benbrook Lake and other publicly owned areas.

The cities have expressed interest in exploring Federal cost sharing options for acquiring riparian forests, open fields and wetlands which border the Trinity River and its tributaries, and have encouraged the Corps to consider the full potential for cost sharing in the acquisition of natural areas and open space, and in the construction of recreational facilities in conjunction with structural and nonstructural flood protection alternatives.

TABLE 5
Projected Urban Outdoor Recreation Participation for Region 4

	Projected Participation (in 1000's Annual User Occasions)		
Activity/Facility Use	*1990*	*1995*	*2000*
Baseball	4,582	4,882	5,183
Basketball	5,662	6,020	6,379
Bicycling	41,405	44,140	46,880
Bicycling on Trails	2,551	2,719	2,888
Football	2,673	2,870	3,068
Golf	5,268	5,781	6,295
Horseback Riding	3,054	3,255	3,456
Horseback Riding on Trails	784	835	887
Jogging/Running	19,073	20,055	21,039
Jogging/Running on Trails	5,875	6,177	6,480
Off-road Vehicle Riding	5,374	5,723	6,074
ORV Riding on Trails	1,053	1,121	1,190
Open Space Activities	13,358	14,076	14,794
Playground Use	19,374	20,435	21,497
Soccer	5,748	6,073	6,398
Softball	6,607	6,911	7,217
Swimming, Pool	24,685	26,216	27,749
Tennis	5,732	6,132	6,533
Walking (Pleasure/Exercise)	57,876	63,100	68,330
Walking on Trails	13,549	14,772	15,996

Source: 1986 Participation Survey, Parks Division, TPWD, 1987.

Working toward a system of parks, recreational areas, and linear trails along the Trinity is an integral portion of the North Central Texas Council of Government's ***Common Vision*** work program. NCTCOG has identified the Trinity River Corridor as a "unique regional resource." The value of this resource is increased because of its location within the heart of a growing Metroplex. The 100-mile long corridor encompasses the SPF flood plain of the West Fork above Eagle Mountain Lake and the Clear Fork from Benbrook to the Elm Fork, and along the Elm Fork from Lewisville Lake through the mainstem of the river, with its major tributaries, downstream to south Dallas.

While there are obviously conflicts between desires to reclaim the flood plain or preserve it, there is room within the 70,000 acres of the Corridor for both of these desires to be met. "The Trinity River Corridor is valuable to all 4 million residents of the Region and the millions to come." (NCTCOG, 1989)

The North Central Texas Council of Governments (NCTCOG) is pursuing a Trinity Greenbelt of major parks linked by a regional trail system. According to NCTCOG, "Tens of thousands of acres of open space are being preserved within the river corridor with outstanding potential for active and passive recreation. Using the Trinity River Information Network, local park departments and recreational professionals will prepare a realistic Trinity Greenbelt strategy of major parks linked by a regional trails system." It is the intent of NCTCOG to implement a "world class" Trinity Greenbelt strategy.

Local bicycle, equestrian, and conservation groups have shown a keen interest in the development of trails as part of a recreation plan for the project area. The following planning/design recommendations have been offered for consideration.

Bicycles

- Create an extended linear spine trail, at least 5-10 miles long, with shorter loops coming off of it.

- Keep the trail elevations as high as possible in the flood plain. Consider using the top and/or sides of levee for portions of the trail.

- Use American Association of State Highway and Transportation Officials (AASHTO) standards for main trail construction to minimize maintenance requirements. Consider alternative materials for loops.

- Include signage which conveys the rules of the trail system, warns of potential danger spots, and provides trail information such as mile markers, location of streets and facilities, special features, etc. Signs which display location maps would also be helpful.

- Trails should take a meandering path, rather than straight. The layout should seek to avoid blind corners and 90 degree turns.

- Parallel trails should not encourage users to cross over in front of each other. Try to avoid at-grade crossings on the main spine trail.

- Parking areas should be in secure areas, visible from the road and tied into the existing city street network. Good lighting and visibility are also necessary. Informational signage at these and other entry points are a must. Take advantage of existing parking lots in contiguous parks and commercial areas.

- The transportation value of trails should be given a high profile. Make useful connections to downtown Dallas and to residential and commercial areas. Consider nearby DART stations as access points.

- Establish discernable "gateways" into the system. Important linkages into the trail network which should be considered are:

Five Mile Creek	Parkdale at Scyene
White Rock Creek	Trinity River State Park
Riverchon Park	Lemon Lake/Joppa Preserve
The KATY trail	Woodland Springs

- Safety measures should incorporate barriers to exclude motor vehicles, 911 call boxes, and lighting in parking lots, underpasses, tunnels, etc. Trails should be farther than "bottle throwing distance" from vehicular roads.

Other recreational activities which cyclists may wish to engage in along or near the trail include picnicking, nature study, birding, and fishing. Trail amenities requested include bike racks, park benches, picnic tables (off the trail but not too far into the woods), drinking fountains (every 1 1/2 to 2 miles, just off the trail), information kiosks, and restrooms. Bicycle users indicate that they would be willing to help with the maintenance of a quality trail system, if one could be established in the study area.

TABLE 6
Additional Urban Outdoor Recreation Facilities/Resources
Needed in Region 4

Facility/Resource	*1986 Facility Supply*	*Facilities Needed Above 1986 Supply* *1990*	*1995*	*2000*
Baseball Fields	310	24	46	68
Basketball Goals	469	214	258	301
Boat Ramp Lanes	423	*	*	*
Campsites	5,393	*	*	*
Fishing Structures, (yd.)	8,167	316	967	1,619
Golf Holes	666	*	28	89
Hiking Trail Miles	23	63	69	76
Horseback Riding Trail Miles	31	81	89	96
Lake Acres (BFS Suitable)	165,749	*	*	*
Off-Road Vehicle Riding Acres	2,899	*	*	*
Picnic Tables	8,947	*	*	*
Playground Areas, Equipped	915	930	1,031	1,133
Soccer/Football Fields	564	103	118	134
Softball Fields	478	*	16	37
Swimming, Freshwater (1000 yd^2)	390	1,029	1,100	1,170
Swimming, Pool (1000 yd^2)	90	67	77	87
Tennis Courts	877	621	726	830
Trail Miles, Multi-use (Walk, Bike, Jog)	118	263	292	322
Developed Land Acres		4,572	5,457	6,709

Source: Parks Division, TPWD, 1988.
Notes: Asterisks indicate no needs exist based on a regional analysis of supply and participation; however, needs may exist locally within the region due to inadequate distribution of existing facilities.

TABLE 7
Ranking of Outdoor Recreation Facility/Resource Needs in Region 4 through 1995

Need by Rank	*Facility/Resource*
1	Trail Miles, Multi-Use (Walk, Bike, Jog)
2	Swimming, Freshwater (1000 yd^2)
3	Playground Areas, Equipped
4	Hiking Trail Miles
5	Horseback Riding Trail Miles
6	Soccer/Football Fields
7	Swimming, Pool (1000 yd^2)
8	Tennis Courts
9	Basketball Goals
10	Baseball Fields
11	Golf Holes
12	Fishing Structures, Freshwater (yd.)
13	Softball Fields
14	Boat Ramp Lanes, Freshwater
15	Campsites
16	Picnic Tables
17	Off-Road Vehicle Riding Acres
18	Lake Acres (BFS Suitable)

Source: Parks Division, TPWD, 1988.

Equestrian

- The primary concern of equestrians is the safety of their animals and equipment. Parking area security is considered very important.

- Provide at least 10 miles of trail, preferably a loop system which permits them to return to their vehicles along a different route. A system with a remote pick-up point is undesirable.

- Consider an overnight camping area. While customary amenities are desirable, the only absolute requirement would be water for the horses.

- Trails should be more primitive than bike trails. Riders prefer a mixture of spatial/visual experiences, such as narrow wooded corridors, open meadows, and high bluffs with expansive views.

- Equestrian users do not mind sharing portions of a trail corridor with other users, but would prefer separate trails within the corridor for horses. Riders could use an unpaved trail running parallel to paved surfaces.

- Access to fishing points or nature study areas along or near the trail would be a definite plus.

- Address the problem of poor communication between bicycle users and equestrians on multi-use trails. Trails with blind corners and sudden grade changes, such as the crest of a hill, especially contribute to dangerous situations. The major problem appears to be in situations where horses are startled by the unexpected appearance of cyclists approaching head-on or from the rear. Signage which conveys the rules of the trail system, warns of potential danger spots, and provides trail information such as the location of facilities, special features, etc., would play a significant part of the solution to this problem.

- With respect to creek crossings, culverts are acceptable with a 5 foot minimum width. Low water crossings are also okay if the slopes are not too steep and the surfaces do not become boggy. Footbridges are fine if they are a minimum 6 foot wide. Wood decking is okay. Bridges should have adequate signage to require that other users remain clear until horses have crossed.

- Parking areas should be designed to allow trailers to maneuver. Security of these areas is very important. Equestrian users recommend that parking areas be located at the end of regular police patrol routes, so that patrol vehicles would drive through the lots on a routine basis. Good lighting and visibility are also necessary.

Nature Study

- Access to high quality nature areas is presently a problem. High water levels and muddy soils discourage visitation. Sidewalks, boardwalks, and observation platforms would facilitate better access.

- Walking distances from parking areas to various observation locations should be as short as possible. In some instances, it may even be appropriate to observe wildlife from one's vehicle.

- Safety is a major concem for individuals and small groups. Create focal points to attract more visitors to one location. Place viewing areas in open, cleared spaces. Special events, such as annual spring walks, would help establish the worthiness of a wildlife viewing area and encourage additional visitation.

- Create small sub-impoundments and wetland areas to attract waterfowl and shore birds,. To encourage the presence of butterflies, mowing along the banks should be kept to a minimum.

- Early moming hours are best suited for wildlife observation. To prevent glare from the moming sun, overlooks should be oriented to face west.

- Equestrians and conservations have also indicated their willingness to help with the maintenance of a quality trail system, if one could be established in the study area.

Neighborhood Questionaire

The second part of the questionnaire provided a list of outdoor recreational activities and asked participants to indicate those activities which they would likely participate in if they were available within the project area. A tabular report of the survey findings related to preferred recreational activities is shown in Table 8. The activities most often selected from the list were picnic areas, athletic facilities, hiking/walking/jogging and bicycle trails, and fishing piers. While the survey is not statistically reliable due to the method of sampling, it does provide some insight into the types of activities residents of the area prefer.

RECREATION MASTER PLAN

The regional recreation master plan for the Dallas Floodway Extension is shown in Figure 4. The plan is designed to meet existing needs for passive and non-structured recreational activities within the regional service area, and addresses state and regional shortfalls in facilties for walking, hiking, cycling, and jogging identified in the TORP. Facilities proposed for this project are necessary to provide public access, protect sensitive environmental resources and promote safe use of the area. The plan creates linkages between existing recreational areas and public open space areas, both existing and necessary for the Floodway Extension project. Most access points take advantage of existing facilities within local parks and preserves. The plan is consistent with locally adopted recommendations for long range development of a "Great Trinity Forest Park" within the Floodway Extension area. Those facilities proposed for the Dallas Floodway Extension recreation master plan are highlighted in Figure 5 and described below.

Trails

Twenty-six miles of all weather hike/bike trails are proposed. Eighteen miles of trail qualify as cost sharable. These trails would be 10 ft wide concrete, with informational and directional signage and rest stops, including an 8 ft bench or picnic table at one mile intervals. All weather trails will include low water crossings, culverts, grading and drainage. Increasing the width to 12 feet, as desired by the sponsor, would be considered a betterment, and would be a 100 percent non-Federal cost.

A life-cycle cost analysis has been included in this appendix, which verifies the cost efficiency of utilizing concrete trails for the proposed trail locations.

Sixteen miles of natural surface equestrian trails are proposed, of which 8.5 miles are cost sharable. These trails would be 8 ft wide with a 15 ft overhead clearance and would have informational and directional signage and a rest stop every 3 miles, with 8 ft bench or picnic table and a hitching post. Natural surface equestrian trails would require clearing and grubbing, low water crossings, culverts, grading and drainage.

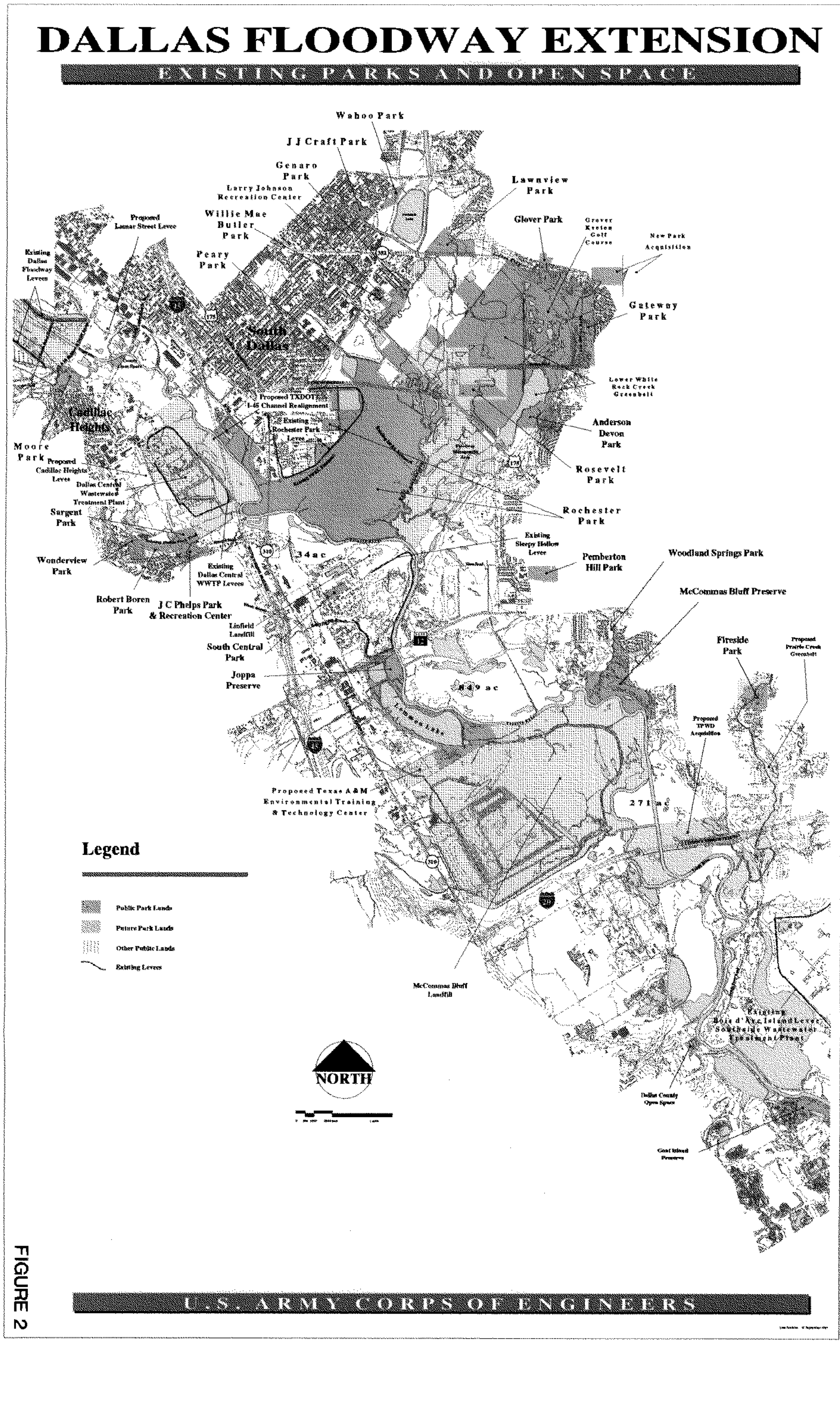
Ten miles of natural surface nature trails are proposed. Five miles are cost sharable. These trails would be 4 ft wide with 8 ft overhead clearance. They would need informational and directional signage and a rest stop with and 8 ft bench at one mile intervals. Nature trails will require clearing and grubbing, low water crossings, culverts, grading and drainage. The plan includes approximately four miles of natural surface off-road bike trails. These trails would be 4 ft wide and would be constructed by volunteers at no cost to the government.

Footbridges

Two footbridges will be required to span the Trinity River. They would need to be 10 ft wide, with 54 inch side rails, and wood decking (necessary for equestrian use), and would require signage for safe use by multiple recreation groups. These bridges would be accessible to maintenance vehicles.

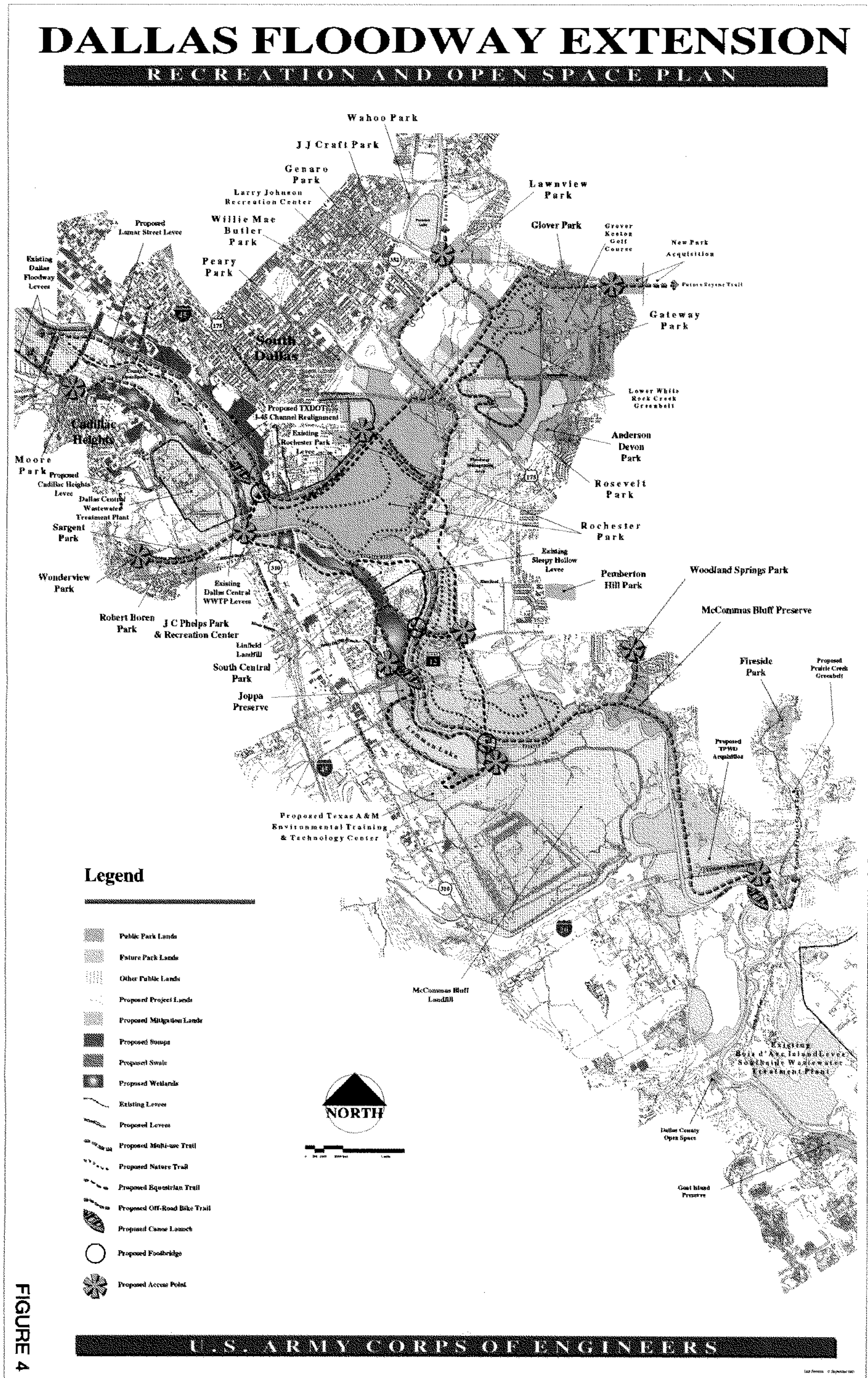
Access Areas

A total of seven access areas are proposed, three of which would be located at existing parks or areas with adequate existing parking areas. These areas are located at Moore Park near Cedar Creek, at Woodland Springs Park near the McCommas Bluff Preserve, and at IH-45 near the Central Wastewater Treatment Plant. Each of these areas would need an entry sign, a 30-foot by 60-foot picnic pavilion, and a trailhead with an informational kiosk. The clubhouse at the Sleepy Hollow Golf Course is included as an access point, but would require no modifications. One of the new access areas would be located near the upstream end of the existing Rochester Park levee, with another located on the east side of the Trinity River across from Lemmon Lake, and the final one located at the southern end of the study area near IH-20. The new access areas would require concrete entry drives and parking spaces to accommodate 20 cars each, with adequate turn-around space for busses and trailers. Each of these access areas would need an entry sign, a 30-foot by 60-foot picnic pavilion, a trailhead with an informational kiosk, security lighting, and a drinking fountain and hose bib.



DALLAS FLOODWAY EXTENSION
EXISTING PARKS AND OPEN SPACE
Wahoo Park
J J Craft Park
Genaro Park
Larry Johnson Recreation Center
Willie Mae Butler Park
Peary Park
Lawnview Park
Glover Park
Grover Keeton Golf Course
New Park Acquisition
Gateway Park
Proposed Lamar Street Levee
Existing Dallas Floodway Levees
South Dallas
Cadillac Heights
Proposed TXDOT I-45 Channel Realignment
Existing Rochester Park Levee
Lower White Rock Creek Greenbelt
Anderson Devon Park
Rosevelt Park
Rochester Park
Moore Park
Proposed Cadillac Heights Levee
Dallas Central Wastewater Treatment Plant
Sargent Park
Wonderview Park
Robert Boren Park
J C Phelps Park & Recreation Center
Existing Dallas Central WWTP Levees
Linfield Landfill
South Central Park
Joppa Preserve
34 ac
Existing Sleepy Hollow Levee
Pemberton Hill Park
Woodland Springs Park
McCommas Bluff Preserve
Fireside Park
Proposed Prairie Creek Greenbelt
849 ac
Proposed TPWD Acquisition
271 ac
Proposed Texas A&M Environmental Training & Technology Center
Legend
Public Park Lands
Future Park Lands
Other Public Lands
Existing Levees
McCommas Bluff Landfill
Existing Bois d'Arc Island Levee
Southside Wastewater Treatment Plant
Dallas County Open Space
Goat Island Preserve
NORTH
U.S. ARMY CORPS OF ENGINEERS

FIGURE 2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Legend
Public Park Lands
Future Park Lands
Other Public Lands
Proposed Project Lands
Proposed Mitigation Lands
Proposed Sumps
Proposed Swale
Proposed Wetlands
Existing Levees
Proposed Levees
Proposed Multi-use Trail
Proposed Nature Trail
Proposed Equestrian Trail
Proposed Off-Road Bike Trail
Proposed Canoe Launch
Proposed Footbridge
Proposed Access Point
NORTH
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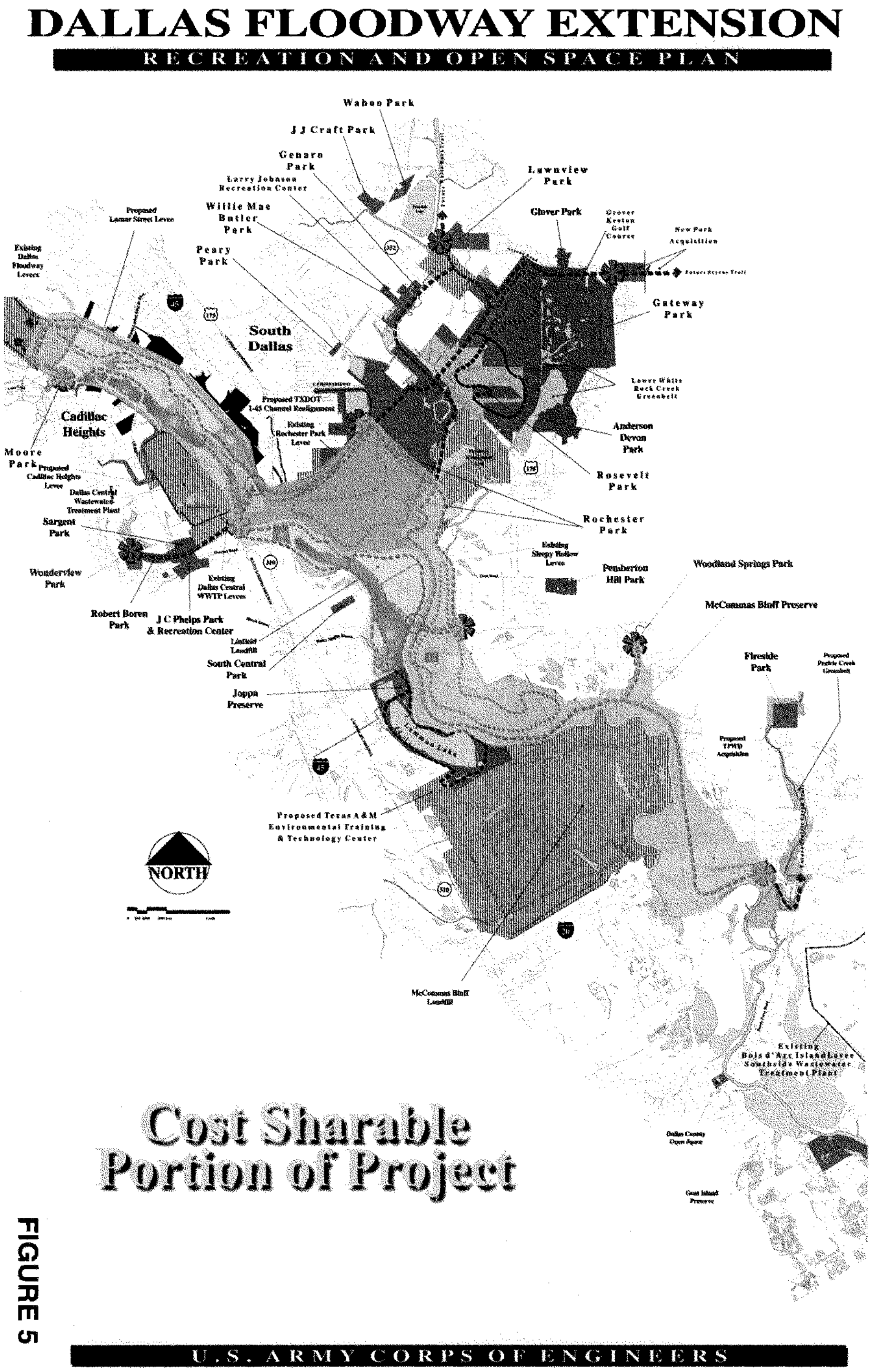
FIGURE 4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Proposed Texas A&M Environmental Training & Technology Center
NORTH
McCommas Bluff Landfill
Existing Bois d'Arc Island Levee
Southside Wastewater Treatment Plant
Dallas County Open Space
Goat Island Preserve
Cost Sharable Portion of Project
U.S. ARMY CORPS OF ENGINEERS

FIGURE 5

FOR CONTINUATION OF HOUSE DOCUMENT 111-33
THE DALLAS FLOODWAY EXTENSION
SEE VOLUME 2