

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

LEVEL

10

ADA 087662

SDTIC ELECTED
AUG 7 1980
S D
C

This document has been approved for public release and sale; its distribution is unlimited.

**RECREATIONAL APPENDIX REPORT
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS**

80 8 4 032

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS - MAY, 1973

DDC FILE COPY

12

RECREATIONAL APPENDIX REPORT,
ELM FORK FLOOD CONTROL PROJECT,
DALLAS AND DENTON COUNTIES, TEXAS

DTIC
ELECTE
AUG 7 1980

PREPARED FOR
U. S. ARMY ENGINEER DISTRICT
FORT WORTH, TEXAS

MAY 1973

PRELIMINARY

"This report does not necessarily constitute the
final project concept to be adopted and approved
by the U. S. Army Corps of Engineers."

CONTRACT - DACW63-72-C-0125

MARVIN SPRINGER AND ASSOCIATES
URBAN PLANNERS - AREA DEVELOPMENT CONSULTANTS
DALLAS, TEXAS

Nuc

411 881

This document has been approved
for public release and sale; its
distribution is unlimited.

Unclas

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. <i>AD-A087662</i>	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Recreational Appendix Report Elm Fork Flood Control Project Dallas and Denton Counties, Texas		5. TYPE OF REPORT & PERIOD COVERED Recreational Appendix Report
7. AUTHOR(s) US Army Corps of Engineers Ft Worth, TX		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Corps of Engineers Ft Worth, Texas		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS Fort Worth District, Corps of Engineers Engineering Division, Plng Br, SWFED-P PO Box 17300, Ft Worth, TX 76102		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) NA		12. REPORT DATE May 1973
		13. NUMBER OF PAGES 94
		15. SECURITY CLASS. (of this report) Unclas
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Environmental aspects Recreational benefits Elm Fork Flood Control Project Dallas County, Texas Denton County, Texas		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Extensive and serious effort was made to resolve the recreational features of the project despite the fact that, at this time, no definite agreement exists between the local agencies upstream from Royal Lane, particularly in the Irving, Farmers Branch, Coppell and Carrollton areas, as to the extent of the flood control system and the precise real estate involved. A number of unresolved design details such as sump areas, external drainage facilities and levee configuration made it impossible to make precise recommendations as to the recreational area layouts.		

DD FORM 1473

EDITION OF 1 NOV 68 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

May 25, 1973

Colonel Floyd H. Henk
U. S. Army Corps of Engineer District
Fort Worth, Texas 76102

Dear Colonel Henk:

The accompanying report is the summary of the recreational appendix study conducted for the Elm Fork Flood Control Project. Extensive and serious effort was made to resolve the recreational features of the Project despite the fact that, at this time, no definite agreement exists between the local agencies upstream from Royal Lane, particularly in the Irving, Farmers Branch, Coppell and Carrollton areas, as to the extent of the flood control system and the precise real estate involved. A number of unresolved design details such as sump areas, external drainage facilities and levee configuration made it impossible to make precise recommendations as to the recreational area layouts.

The recreational concepts are well advanced in Dallas and nearly all land involved in the Project is now owned by the City. Irving has specific recreational development intentions but the disagreements on the Project limits prevent detailed recreational design. Carrollton has purchased a site of 180 acres on the Elm Fork but has no detail plan at this time. Farmers Branch has little or no interest in recreational development and is seeking the maximum land reclamation possible. Coppell and Hebron are both small communities, touching the Elm Fork but having no current recreational interests. Lewisville has expressed interest in a very large park immediately below the Lewisville Reservoir.

A State Park has recently been proposed as a device to prevent the alteration of the Elm Fork Channel and make the recreational features dominant. From what is known of the State Park proposal, it would fail to encompass the Elm Fork flood plain and would leave the flood problems largely untouched.

Colonel Floyd H. Henk
May 31, 1973
Page 2

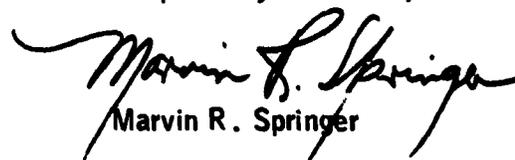
As a result of our extensive review of the Elm Fork, it is our judgment that all interests would be best served by a modification of the proposed Flood Control Project upstream from Royal Lane to recognize the wide range of interests involved and to achieve an equitable treatment of the entire Project as it relates the various cities involved. Unless reasonable modifications can be made which will recognize, to some degree, all interests, it is unlikely that the Project can be undertaken and if attempted would likely be subject to environmental legal action.

We sincerely believe that the most acceptable overall solution to the Elm Fork environmental, flood, recreational and jurisdictional problems will be found in the basic flood control approach by the Corps of Engineers if such approach can be modified to recognize the various interests and we believe that the necessary changes can be agreed upon when all the alternatives are reviewed and the full facts of the situation recognized.

The magnitude of the recreational development outlined in this report and the general cost estimates outlined are considered to be adequate on which to base future planning and project considerations. Time will obviously alter the conditions in the flood plain and the attitudes and intentions of the local agencies. The earlier the project can be implemented, the more valid will be the recommendations contained herein.

It should be noted that: "This report does not necessarily constitute the final project concept to be adopted and approved by the U. S. Army Corps of Engineers".

Respectfully submitted,


Marvin R. Springer

MRS:dp

Accession For	
NTIS GML&I	<input checked="" type="checkbox"/>
DDC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	<input type="checkbox"/>
By _____	
Distribution/_____	
Availability Rules	
Dist	Available/or Special
A	

TABLE OF CONTENTS

Title Page
 Letter of Transmittal
 Table of Contents

<u>Section</u>	<u>Title</u>	<u>Page</u>
I	INTRODUCTION	1
II	CHARACTERISTICS OF PROJECT AREA.	3
	Location of Project	3
	Jurisdictional Boundaries	3
	Climate	9
	Geology and Soils	10
	Land Use	14
	Biologic Resources	14
	Accessibility	17
	Recreation and Open Space Resources	26
	Water Quality and Nature of the River	34
III	PROJECT DATA	43
IV	RECREATION MARKET AREA	44
V	OUTDOOR RECREATION ATTENDANCE	55
VI	PLAN OF DEVELOPMENT	57
	Dallas Jurisdiction	57
	Irving Jurisdiction	66
	Carrollton Jurisdiction	69
	Lewisville Jurisdiction	70
	Un-sponsored Areas	71
VII	COORDINATION WITH OTHER AGENCIES	76
VIII	SPECIAL PROBLEMS	77
IX	MANAGEMENT AND COST SHARING	78
X	ENVIRONMENTAL QUALITY	79
XI	COSTS	80
XII	RECREATIONAL BENEFITS	89

LIST OF PLATES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Project Location in the Region	4
2A	Jurisdictional Boundaries	6
2B	Jurisdictional Boundaries	7
2C	Jurisdictional Boundaries	8
3	Surface Geology - Lower Elm Fork	12
4	General Soil Groups - Lower Elm Fork	15
5	Access and Bridge Crossings	20
6A	Recreational and Open Space Resources	29
6B	Recreational and Open Space Resources	30

LIST OF PLATES

<u>Number</u>	<u>Title</u>	<u>Page</u>
6C	Recreational and Open Space Resources	31
7A	Proposed Flood Control Project	39
7B	Proposed Flood Control Project	40
7C	Proposed Flood Control Project	41
8	Population Distribution - Elm Fork Recreational Market Area - 1970	45
9A	Proposed Recreation and Open Space Plan	58
9B	Proposed Recreation and Open Space Plan	59
9C	Proposed Recreation and Open Space Plan	60
10	Plan for Wildflower Meadow	62
11	Small Trail Side Museum and Rest Area	63
12	Large Trail Side Museum	64
13	Plan - Trail Side Museum Area	65
14	Motorcycle Barrier and Control Gate	67
15	California Crossing Pontoon Bridge	72
16	Equestrian Trails Along New Channel	73
17	Cross Section - New Channel with Trail Facilities	74

LIST OF TABLES

<u>Number</u>	<u>Title</u>	<u>Page</u>
1	Population Change - Combined Dallas, Denton, Collin and Tarrant Counties - 1930 to 1970	44
2	Numerical Changes in Age Composition, Dallas and Fort Worth SMSA'S, 1960 and 1970	47
3	Trend in Family Income Distribution, Dallas County, 1960 and 1970	48
4	Water Oriented Areas in the Region	52
5	Preliminary Cost Estimates, Recreational Elements, Elm Fork Flood Control Project (Initial Increment)	80
6	Preliminary Cost Estimates, Recreational Elements, Elm Fork Flood Control Project (Future Increment)	85
7	Recreational Benefits - Elm Fork Project	89

I - INTRODUCTION

1. PROJECT AUTHORIZATION

The Elm Fork Flood Control Project was authorized by the Rivers and Harbors Act of 1965, approved October 27, 1965 (Public Law 89-298) in accordance with the plan of improvement outlined in House Document 276 (89th Congress, 1st Session).

a. Recreational Authority. Current policy authorizes certain recreational developments on non-reservoir projects constructed by the Corps of Engineers at Federal cost if a non-Federal entity provides all additional lands or rights in land required to insure public control of the development, plus additional contributions sufficient to bring the non-Federal share to at least 50 percent of the total initial cost of the recreation development. The local entity or entities are required to operate and maintain such facilities for the life of the Federal project.

b. Beautification Authority. In consonance with present policy, beautification could be provided as a regular project cost to the extent of the authorized percentage of the total project cost which is authorized. Local cooperation would include maintenance of improved areas for the life of the Federal project.

2. PURPOSE AND SCOPE

The purpose of this Recreational Resource Appendix is to explore the recreational resources of the Elm Fork of the Trinity River within the project limits and to attempt to coordinate the plans for the Flood Control Project with the existing, proposed and potential recreational development of the Elm Fork and to outline the possibilities for Federal and local cooperation in developing the recreational potential of the project area within the basic framework of the Flood Control Project. The scope of the study includes investigations into the nature of the Elm Fork, recreation plans of local agencies, cost estimates for agreed upon local projects, operation and maintenance considerations and forecasts of recreational usage and benefit. The investigation includes evaluation of the probable impact of the proposed project on the recreational resources of the Elm Fork.

3. PREVIOUS STUDIES AND BACKGROUND DATA

The initial studies of the Elm Fork Flood Control Project as included in The Comprehensive Development Plan for the Trinity River System, published by the Corps of Engineers in 1962, did not involve recreational considerations for the Elm Fork Flood Control Project.

(1) In 1959, The Dallas Department of Parks and Recreation and The Department of City Planning published a Plan for Parks and Open Spaces which included the proposal for the acquisition and development of the preponderance of the Elm Fork Flood Plain land located on the east side of the River, in Dallas, from

Farmers Branch southward to the confluence of the West Fork of the Trinity River. Substantial acquisition and development of Park and Open Space land along the Elm Fork has taken place in accordance with the 1959 Plan.

(2) In 1969, under authorization of the City of Dallas the provisions of the 1959 Plan for Parks and Open Spaces as they related to the Trinity River System were reviewed and updated. The coordinated Plan for Open Space Development of the Trinity River System in Dallas, Texas, was published by the Dallas Park Board in December, 1969. In accordance with the provisions of the Plan, acquisition of land by the City of Dallas has proceeded until nearly all the land required by the Plan from Royal Lane southward to the confluence of the West Fork of the Trinity River has been acquired or is under negotiations for acquisition.

(3) The City of Irving and the City of Carrollton have also acquired park lands along the Elm Fork though no extensive development plans for recreational use have yet been prepared by either municipality.

(4) The North Central Texas Council of Governments published a Regional Open Space Policy Plan in March, 1972. The concept of the open space - park development of a substantial portion of the Elm Fork flood plain was included in the Policy Plan.

4. CURRENT STUDIES

The preliminary features of the Flood Control Project including levees and channel realignment as provided by the District Engineer establish the basis for the considerations in the current studies. The studies and investigations leading to the proposals contained herein included the following:

a. Field Trips were made involving on the ground investigations, helicopter flights and two boat trips along the full reach of the project. Observations were made as to the vegetation in the flood plain area, nature of the River, including banks, erosion, trash accumulations, evidence of aquatic life and terrestrial animal life, existing land use and man-made features such as bridges, levees and excavations.

b. Graphic Data in the form of topographic maps, aerial photographs and ground photographs, geologic maps, soil maps and graphic material furnished by the Corps of Engineers was assembled and utilized in the studies.

c. Documents consisting of the Comprehensive Development Plan for the Trinity River System, Corps of Engineers, 1962, Environmental Impact Study of the Elm Fork Region of the Trinity River, Thomas R. Hays, Thomas R. Hellier, Jr., and Thomas E. Kennerly, Jr., April, 1972, were reviewed and utilized for background data. Other related plans and documents relative to community development, highway plans and other transportation plans were reviewed and are hereinafter referenced to specific features of this report.

II - CHARACTERISTICS OF PROJECT AREA

1. LOCATION OF PROJECT

The Elm Fork Project Area herein considered is located centrally in the Dallas Metropolitan Area (See Plate 1).

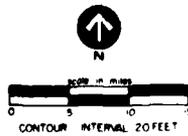
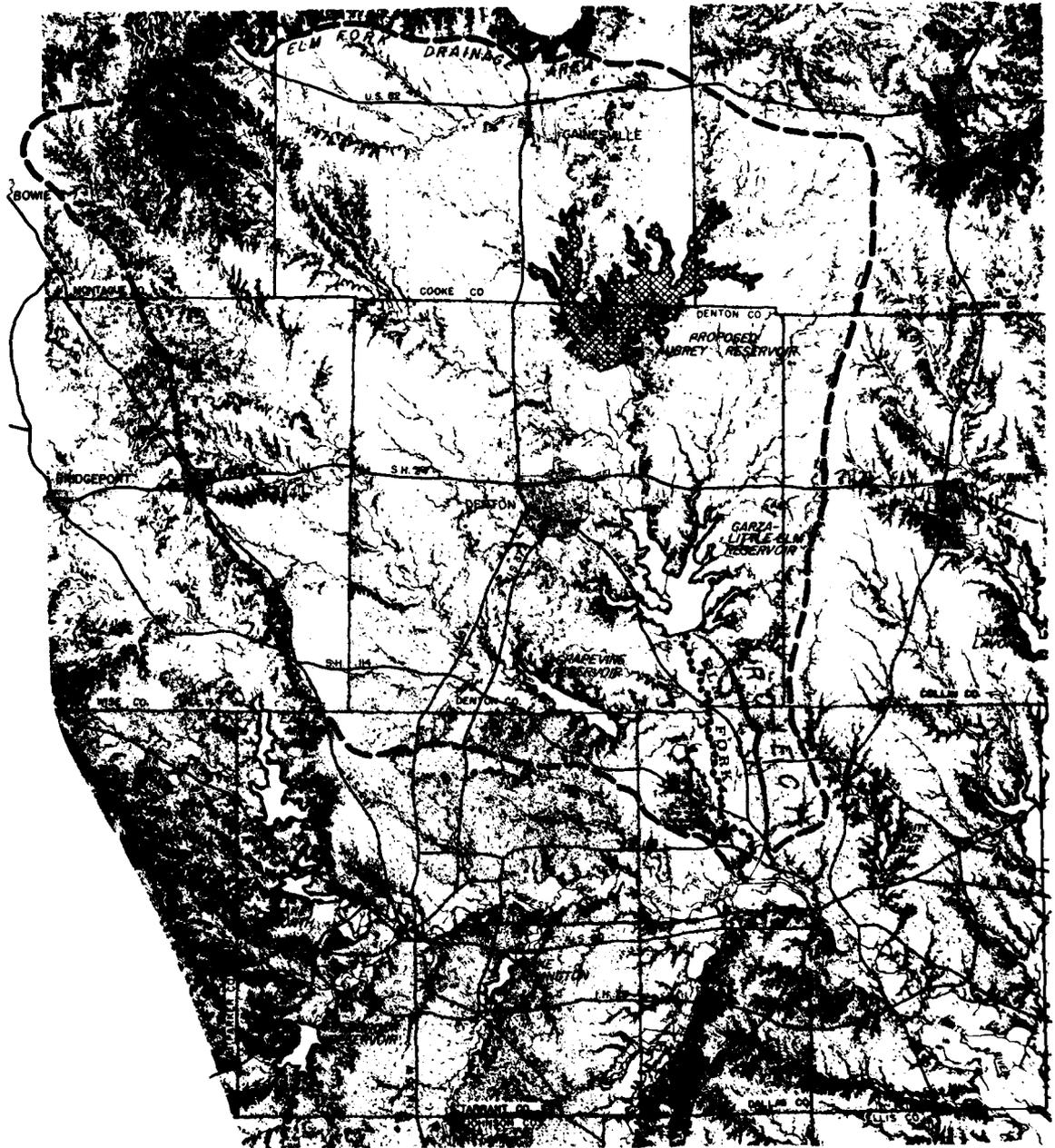
The Elm Fork of the Trinity River drains a large portion of North Central Texas (1,673 square miles) covering all or parts of nine counties which are generally located north and west of the City of Dallas. The upper limits of the Elm Fork Drainage Area reaches nearly to the Red River on the Texas - Oklahoma line and extends over several physiographic regions. Two major reservoirs exist on the Elm Fork System, Grapevine and Garza-Little Elm, and at least one more large reservoir, Aubrey, is planned (See Plate 1). The existing reservoirs are of multipurpose type with flood control and municipal water supply being primary functions.

The Elm Fork Flood Control Project extends from the Lewisville Dam of the Garza-Little Elm Reservoir downstream to the confluence of the Elm Fork and the West Fork of the Trinity River. The distance from the Dam to the confluence with the West Fork by the existing Elm Fork Channel is 30 miles and the straight line distance is 18.9 miles. The difference between the existing channel distance and the straight line distance is accounted for by the significantly meandering nature of the River. The overall elevation difference of the channel bottom from the upstream end at the Lewisville Dam to the confluence is about 50 feet. The relatively gentle gradient, 0.046 to 0.019 percent, of the lower Elm Fork and the alluvial nature of the terraces into which the River channel is cut plus the occasional influence of ledges of Eagle Ford shale create a meandering channel.

The potentially active flood plain (100 Year Flood Limit) of the lower Elm Fork varies from about one mile in width at State Highway 121 south of the Lewisville Dam to nearly 3 miles in width in the Farmers Branch-North Lake Area. At California Crossing Road the natural flood plain is about 2.6 miles wide. The general elevation of the alluvial terraces in the flood plain range from about 460 feet above mean sea level in the vicinity of State Highway 121 to 410 feet above sea level near the West Fork confluence. Both sides of the flood plain are bordered by low deeply eroded hills rising from 50 to 100 feet above the general elevation of the terraces.

2. JURISDICTIONAL BOUNDARIES

The relatively complex arrangement of municipal and county boundaries, as they relate to the Elm Fork of the Trinity River, complicate the overall development of the full recreational potential of the River Valley. No overall agency exists in the area which is capable of the comprehensive recreational development of the Elm Fork area nor is there any overall agency, such as a Regional Park Board, responsible for such development. The City of Dallas is the largest land owner in the Elm Fork Flood Plain and has the most aggressive park and open space development program.



RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

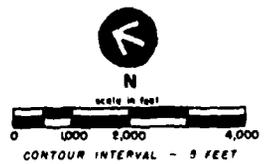
**PROJECT LOCATION IN THE REGION
 PLATE I**

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

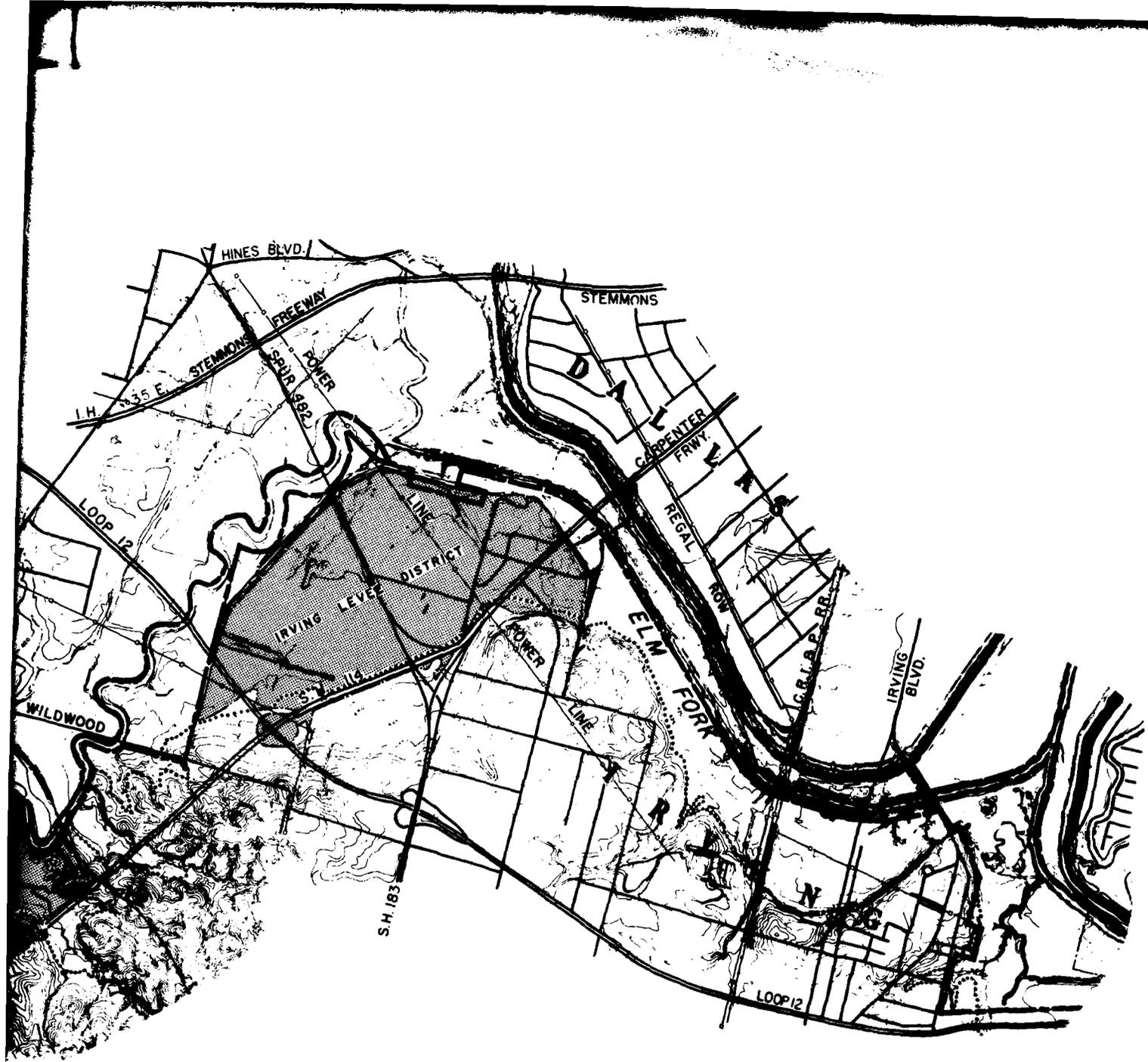
For purposes of local coordination the Trinity River Authority is the responsible agency.

The complex jurisdictional boundary arrangement along the Elm Fork is illustrated by Plates 2A, B and C. From the Elm Fork confluence with the West Fork of the Trinity River upstream, the east side of the river to the existing levee is in the City of Dallas; the west side of the river lies within the corporate limits of the City of Irving. The Dallas City Limits Line continues up the Elm Fork Channel to Royal Lane thereby placing all of the channel and the adjacent area on the east side of the channel within the corporate limits of Dallas. The west side of the Elm Fork Channel northward to State Highway 114 is within the corporate limits of the City of Irving. Irving's jurisdictional annexation authority, where annexation has been initiated through a 10 foot strip along the Elm Fork, continues northward along the west side of the channel to Grapevine Creek. The City of Dallas has annexed a 10 foot strip along the channel plus the entire river channel from Royal Lane northward to Sandy Lake Road. At Sandy Lake Road an area around the Carrollton Dam on both sides of the River is also within the City of Dallas' jurisdiction. A 10 foot City of Dallas strip extends up along Grapevine Creek to and including the North Lake Dallas Power and Light Company Power Plant and the entire North Lake Park site. On the east side of the river north of Royal Lane, the City of Farmers Branch touches the Dallas annexation limit but at no place does the Farmers Branch City Limits touch the east bank of the Elm Fork. On the east side of the Elm Fork Channel, from the vicinity of Valley View Lane northward, the City of Carrollton has jurisdiction eastward from the City of Dallas strip along the channel. The City of Carrollton follows the Elm Fork Channel on the east side to the Denton County Line at which point the Carrollton City Limits turn eastward. From the Denton County Line northward along the channel of the Elm Fork, the City of Hebron has annexed all the territory along the east bank to State Highway 121. On the west side of the Elm Fork Channel, north of the Interstate Highway 35E Bridge, the City of Lewisville has annexed or has taken annexation jurisdiction through a 50 foot strip parallel to the Elm Fork northward to Lewisville proper. The City of Coppell City Limits touch the west bank of the Trinity River in the vicinity of Belt Line Road and continues northward to Sandy Lake Road then west along Sandy Lake Road and northward along Grapevine Creek. The only area along the Elm Fork Channel which does not appear to be within the jurisdiction of any municipality is an area located north of Sandy Lake Road between the Elm Fork Channel and Grapevine Creek and extending northward to the City Limits of Lewisville. North of the Interstate Highway 35E Bridge the area from the channel to the MK&T Railroad has not been annexed by the City of Lewisville but the area is surrounded by an annexation strip. Both Carrollton and Coppell presently overlap the County Line into Denton County with their corporate limits.

In addition to the two county jurisdiction and the seven cities involved along a portion of the Elm Fork under consideration, there are two known separate districts indicated on Plates 2A and B which should be recognized. The first district is the Irving Levee District recently created by the Legislature and this Levee District has plans for the reinforcing of the levees in the area indicated and improving the internal drainage. The second district is a municipal utility district created during the



- — — — — LIMITS OF INCORPORATED AREA
- DALLAS NAME OF INCORPORATED AREA
- LIMITS OF 100 YEAR FLOOD
- — — — — RAILROAD



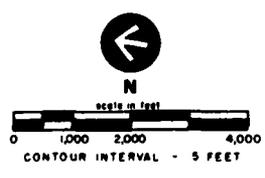
AREA
AREA
OD

2

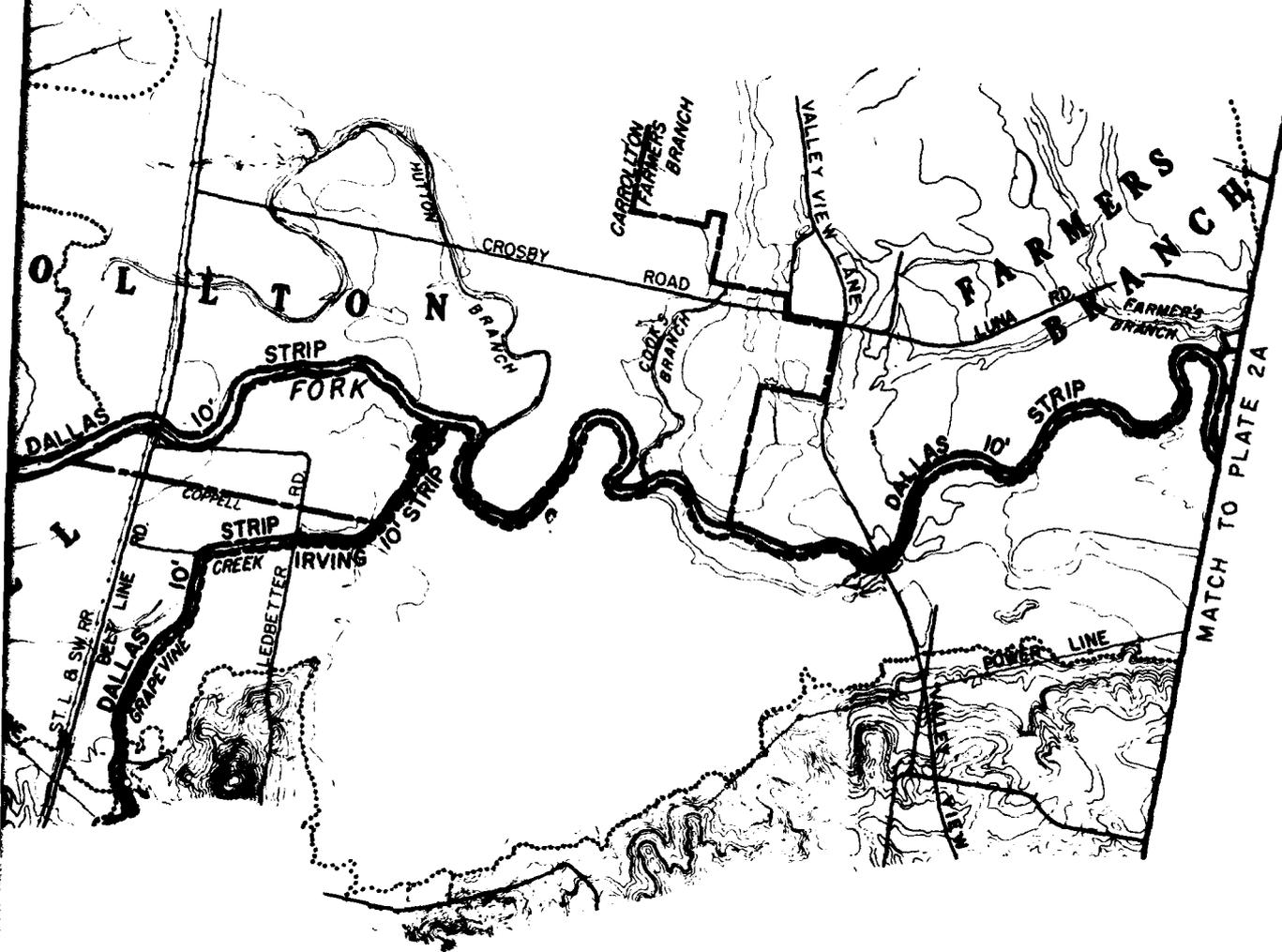
RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

JURISDICTIONAL BOUNDARIES
PLATE 2A

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973



- — — — — LIMITS OF INCORPORATED AREA
- COPPELL NAME OF INCORPORATED AREA
- LIMITS OF 100 YEAR FLOOD
- — — — — RAILROAD



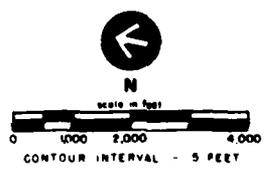
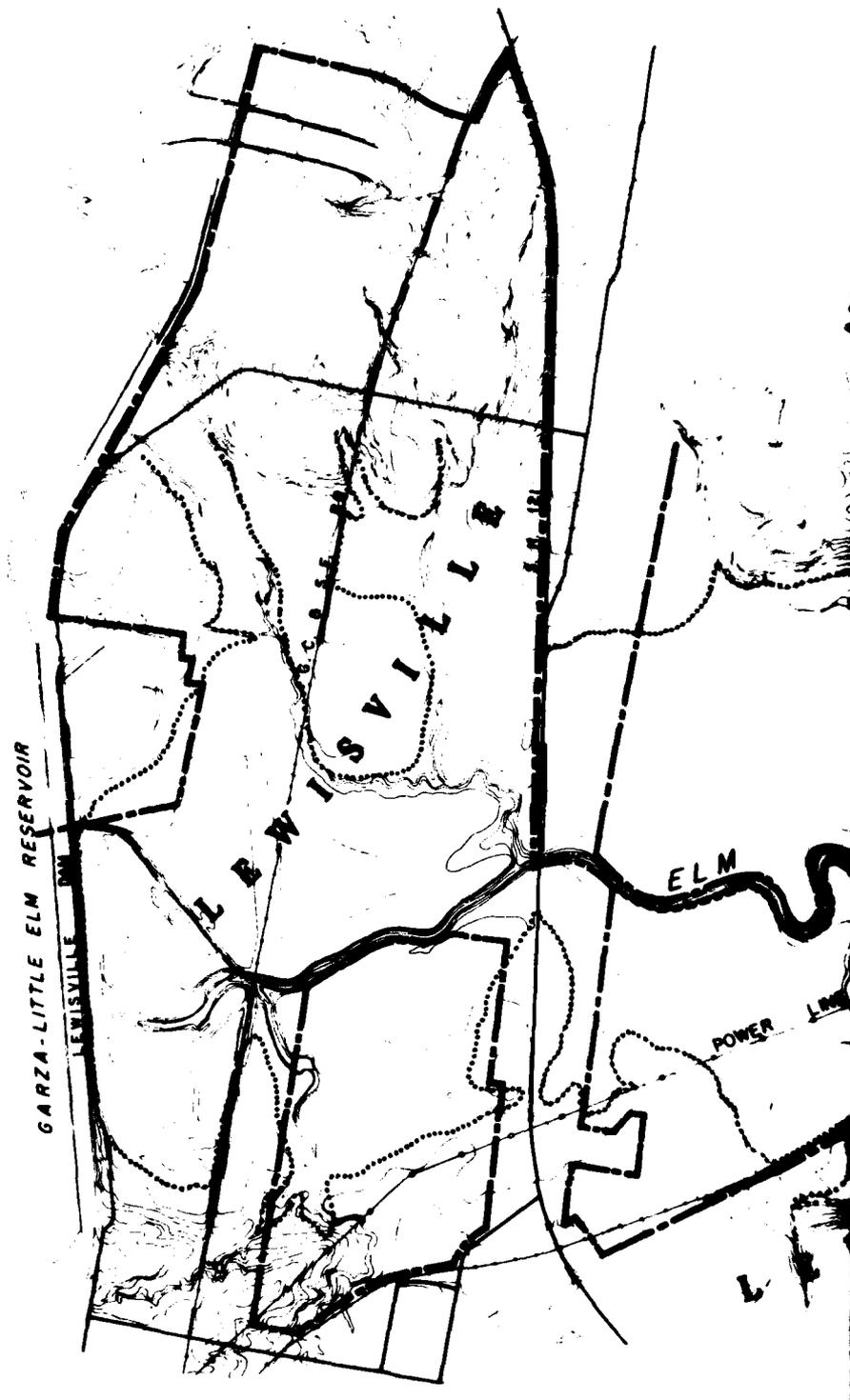
10 AREA
 1 AREA
 1000

RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

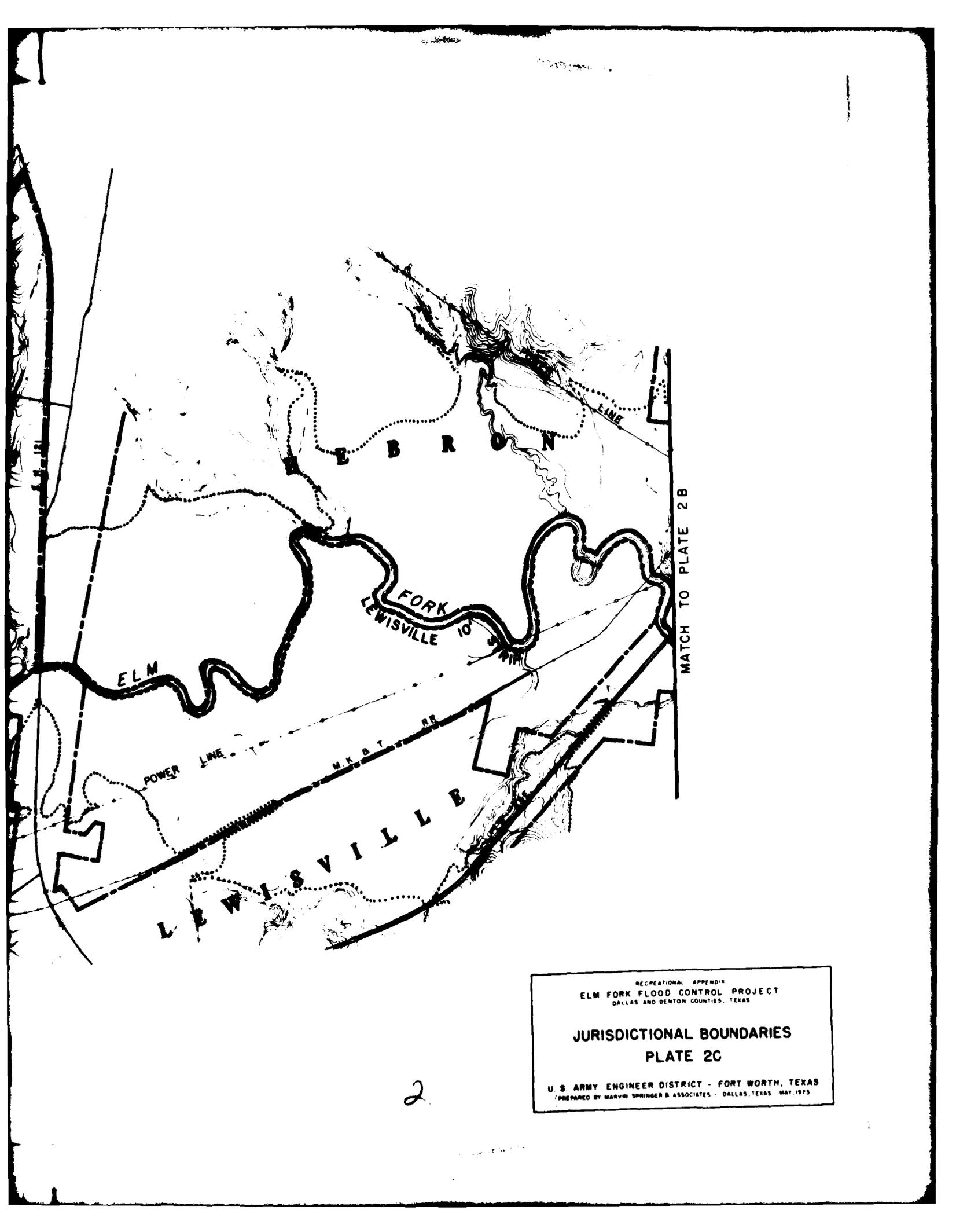
JURISDICTIONAL BOUNDARIES
PLATE 2B

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPINNER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

2



— — — — —	LIMITS OF INCORPORATED AREA
LEWISVILLE	NAME OF INCORPORATED AREA
.....	LIMITS OF 100 YEAR FLOOD
— — — — —	RAILROAD



2

RECREATIONAL APPENDIX
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS

JURISDICTIONAL BOUNDARIES
PLATE 2C

U.S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

past year by the Las Colinas Corporation for the purpose of reclaiming and developing land in the vicinity of Royal Lane, California Road Crossing and State Highway 114. It is indicated that in matters of drainage, utility installation or land reclamation, both districts can function generally independently of the municipalities within whose jurisdiction they are located. It can be assumed that both banks of the Elm Fork of the Trinity River will be in one municipal jurisdiction or another from the Lewisville Dam to the confluence with the West Fork and the Elm Fork prior to the start of construction on the Elm Fork Flood Control Project.

3. CLIMATE

The Elm Fork drainage system is located near the western edge of the moist subtropical forest climate zone. The basic character of the climate is influenced substantially by the air masses which move from the Gulf of Mexico as a result of the prevailing moist southerly winds. The warm moist southerly winds are periodically interrupted by dry, cool or cold polar air masses moving into the area from the north and northwest, resulting in thunderstorms, cold snaps and ice storms and the occasional rainy periods of the Region. The mean temperature for the Region is approximately 65 degrees; however, the summer average maximum temperatures are above 90 degrees and during two months of the summer often above 95 degrees. The monthly range from minimum to maximum temperature is approximately 21 degrees. The temperature range tends to drop rapidly beginning in September and to rise abruptly in late June or early July. The summer temperature extreme ranges from slightly over 100 degrees Fahrenheit to lows of between 55 and 65 degrees. Winter extreme lows range from 10 to 17 degrees while the highs for the same period may reach 80 to 88 degrees. The relatively high summer temperature range contributes to the attractiveness of water oriented sports and park and open space areas which have a water related character.

The average annual precipitation in the Region is 34.6 inches per year with the heaviest rainfall tending to occur in the April through May spring equinox period. Except during the drought conditions, some precipitation occurs each month during the year. The winter and fall months tend to be the driest with the spring period having the highest precipitation rate. The maximum daily precipitation during the spring has ranged upward to nearly 7 inches daily while there is a record in the area of a daily precipitation during September exceeding 8.5 inches. Droughts occur fairly frequently in the Region and result in an annual rainfall which has been recorded as low as 15.9 inches per year. The fluctuating wet and dry periods in the Region are significant in relation to the recreational value of the Elm Fork inasmuch as the water level in the Elm Fork Channel is generally regulated to an acceptable level for some types of water oriented recreation despite wide fluctuations in precipitation. The regular releases from Garza-Little Elm Reservoir for water supply purposes contribute to the Elm Fork being one of the more stable rivers in North Central Texas. The occasional high precipitation rates also create water rises in the tributaries and in the main stem of the Elm Fork which requires special consideration in the recreational development of the flood plain.

The winds in the Region are predominantly from the south and southeast. Over 40 percent of the year, winds occur from the south-southeast direction, while winds from the northern quarter occur 25 percent of the year. Westerly winds occur less than 8 percent of the year and easterly winds occur only about 10 percent of the year. The high velocity winds are generally from the north and northwest and are usually cold dry winds, while the south-southeast winds are more moderate and usually warm and humid. Approximately 50 percent of the time, the winds range from 4 to 12 miles per hour, a range considered desirable for outdoor activity. In the wind velocity ranges above 12 miles per hour, the wind affect becomes more distracting to outdoor activity, often resulting in blowing dust and other material and in swaying of trees and telephone wires. The relatively protected area along the Elm Fork tends to reduce the impact of the winds on recreational activities; however, during about 16 percent of the time the area is calm with winds from only 0 to 3 miles per hour, resulting in the reduction of the comfort factor in the immediate vicinity of the River. The combination of special climatic conditions (river valley microclimate) and the deep alluvial soil contributes to the variety of flora and fauna found along the Elm Fork.

4. GEOLOGY AND SOILS

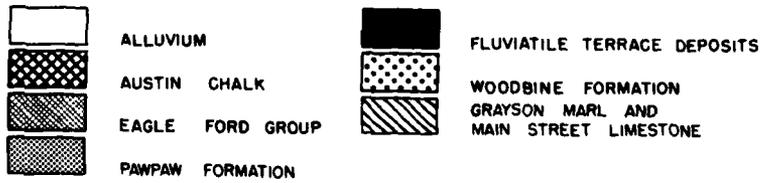
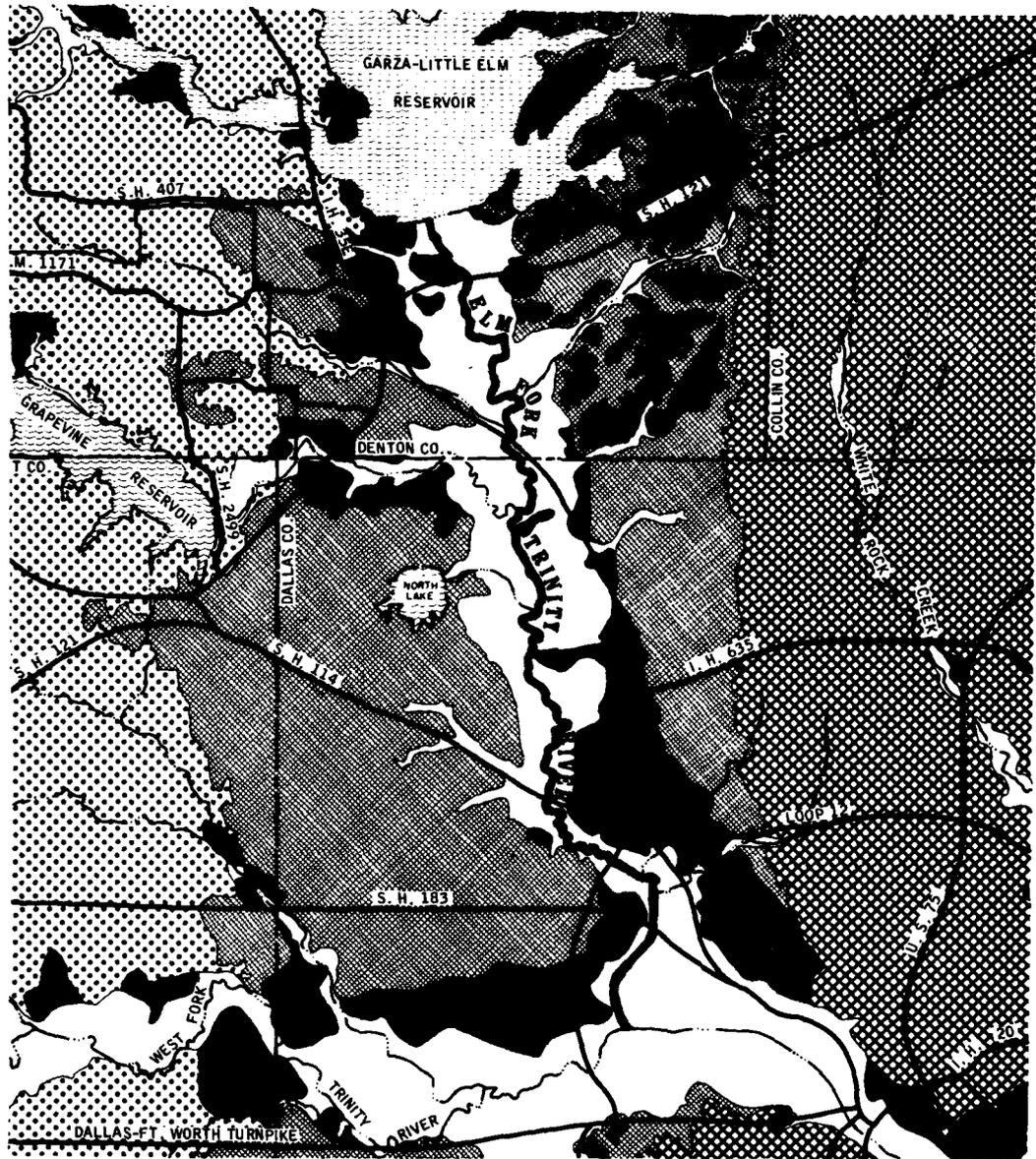
The general surface geologic formations in the project vicinity along the Elm Fork are shown by Plate 3. The lower Elm Fork flood plain generally cuts through one of the prominent geologic formations found in Central Texas, the Eagle Ford Formation of the Upper Cretaceous Period. The present river channel is located mostly in the fluvial terrace deposits of the Quaternary Period but at some locations the Eagle Ford Formation is exposed. The tributaries extending west and northwestward from the lower Elm Fork such as Denton Creek and Timber Creek project into the Woodbine Formation on their upper reaches while the upper portions of Indian Creek and Dudley Branch running north and east from the River extend into the Austin Formation. The Eagle Ford shale outcrops at several locations along both the east and west banks of the Elm Fork. While the shale of the Eagle Ford Formation is extremely soft and weathers rapidly, it is more resistant than the alluvial terraces and the shale outcrops have influenced the alignment of the present channel. The shale ledges always occur on the outside of bends in the channel.

The two features which appear to give some stability to the present channel alignment are the shale outcrops and substantial tree cover along some sections. Where the channel meanderings have been exposed to the alluvial terraces with only sparse tree cover, heavy erosion has occurred (See photographs).

The flood plain along the Elm Fork in the Project Area is classified in the Trinity-Catalpa Soils Group. All of the soils in the group are calcareous clays and clay loams. In some locations, the soils overlay pockets of gravel, sand and clays. The east side of the flood plain is bordered by soils of the Houston Black and Houston Clay Group and the lower portion on both sides of the flood plain (from Farmers Branch south) is in the Bell-Lewisville Soils Group. The Bell-Lewisville Group is largely old alluvium from ancient high stream terraces while the Houston Black Soils Group derives from the parent Austin Limestone material. The upper portion of the flood



EXAMPLES OF THE
UNSTABLE ALLUVIAL
TERRACES WHICH
OVERLAY EAGLE
FORD SHALE ALONG
THE ELM FORK



RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

**SURFACE GEOLOGY
 LOWER ELM FORK**

PLATE 3

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973



**EXAMPLES OF FAIRLY STABLE CHANNEL SECTIONS WHERE
SHALE OUTCROPS AND TREE COVER RESIST FAST EROSION**

plain boundary on the west side is the Wilson-Crocket Soils Group derived from the Eagle Ford Formation. The Wilson-Crocket Soils Group are tight soils with low permeability.

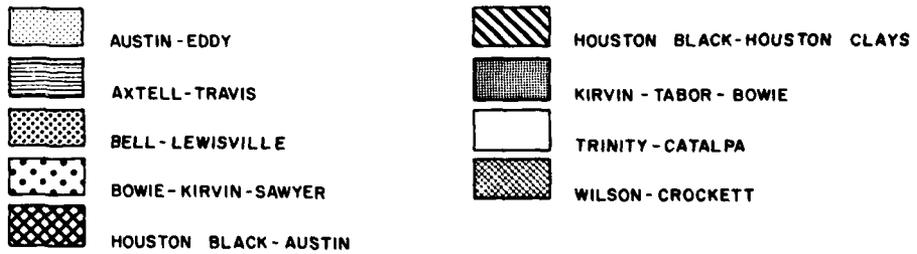
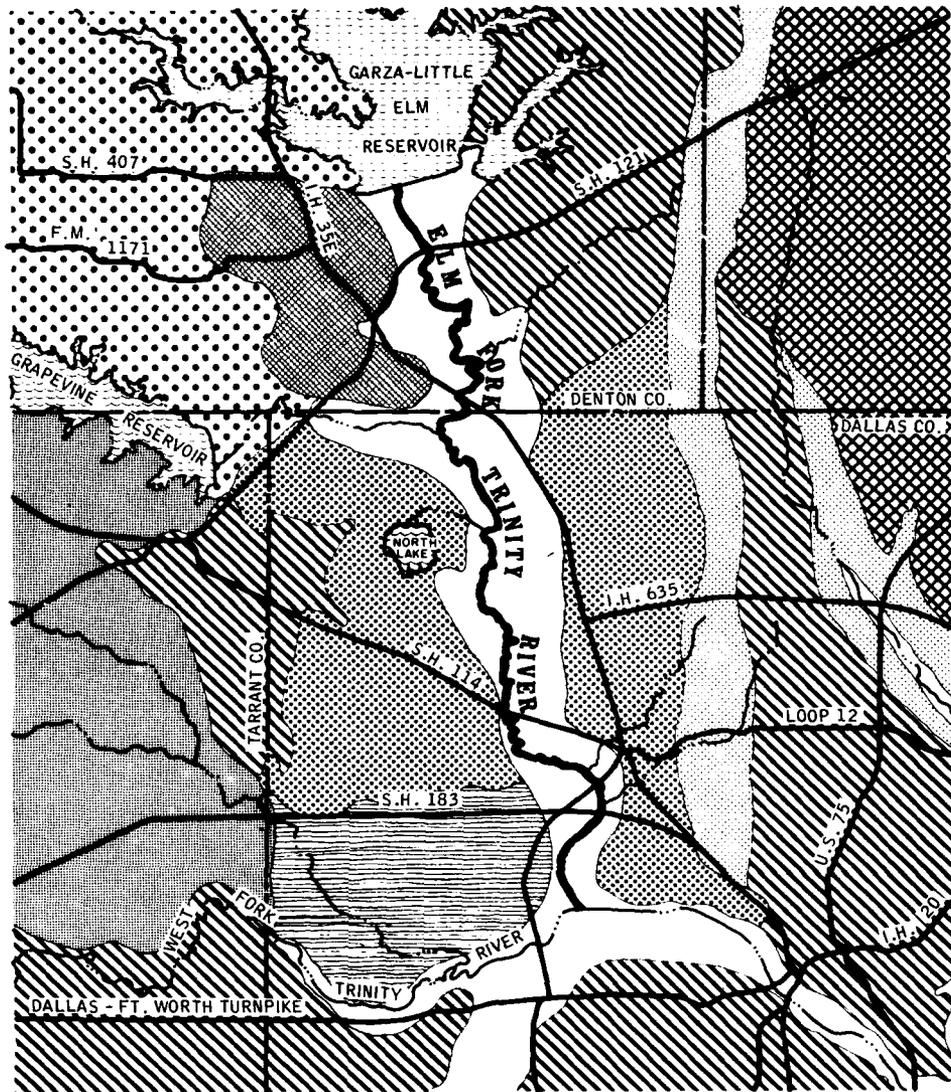
All of the soils along the Elm Fork except those in the Trinity-Catalpa Group along the flood plain have high shrink-swell factors and must be specially handled when construction is involved. Plate 4 shows the general relationship of the various soils groups to the Elm Fork in the Project Area.

5. LAND USE

The preponderance of the land use along the Elm Fork of the Trinity River is agricultural in nature involving grazing of livestock, some cultivated area, timbered area and some horticultural activities such as nursery plantings and pecan groves. The area along the Elm Fork, in the vicinity of Irving Boulevard northward to Interstate Highway 35E, is substantially developed on the east side with industrial districts and on the west side there is a golf course, some industrial development, the Texas Stadium and lands of the University of Dallas. All of the area described has some flood protection either from existing levees or by elevation of the land. Upstream where no flood protection exists there are areas of industrial, commercial and residential development within the flood plain area and a substantial amount of old gravel strip mines. Generally, the flood hazard condition in the area upstream from the vicinity of Spur 382 (old Highway 183) has, to date, prevented major urban development. There are, however, a substantial number of dwellings within the Elm Fork Flood Plain which are subject to serious flood hazard. There has been major filling of old gravel pits and low areas with various types of material including sanitary land fill but very little such filling activities has taken place in the immediate vicinity of the Elm Fork Channel. None of the filling activity to date is considered to have had a serious adverse effect on the recreational development potential of the Elm Fork Area. The flood hazard conditions which have existed on the Elm Fork have deterred any significant urban development, thus preserving, to this time, a substantial portion of the valley for ultimate open space and park use. Within the City of Dallas the park development along the Elm Fork has progressed significantly and practically all of the area along the Elm Fork within the City of Dallas will soon have been acquired for park and open space use. Several other communities including Carrollton, Irving and Lewisville are also taking steps to develop park and open space areas along the Elm Fork. The cities of Farmers Branch and Coppell have both indicated that they do not desire to develop park area adjacent to the River.

6. BIOLOGIC RESOURCES

The additional soil moisture and climate conditions which prevail along the Elm Fork, even during dry periods, tend to extend the East Texas Hardwood Forest Area into and along the stream valleys of North Central Texas. The lower reaches of the Elm Fork is a good example of the forest extension phenomenon.



RECREATIONAL APPENDIX
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS

**GENERAL SOIL GROUPS
LOWER ELM FORK**

PLATE 4

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1975

By observation, the trees found in the Elm Fork area include:

- | | |
|------------------|-------------------------------|
| 1. Red Cedar | <i>Juniperus virginiana</i> |
| 2. Willow | <i>Salix nigra</i> |
| 3. Cottonwood | <i>Populus deltoides</i> |
| 4. Black Walnut | <i>Juglans nigra</i> |
| 5. Pecan | <i>Carya illinoensis</i> |
| 6. Bur Oak | <i>Quercus macrocarpa</i> |
| 7. Red Oak | <i>Quercus shumardii</i> |
| 8. American Elm | <i>Ulmus</i> |
| 9. Cedar Elm | <i>Ulmus crassifolia</i> |
| 10. Hackberry | <i>Celtis occidentalis</i> |
| 11. Bois D'Arc | <i>Maclura pomifera</i> |
| 12. Red Mulberry | <i>Morus rubra</i> |
| 13. Sycamore | <i>Platanus occidentalis</i> |
| 14. Red Haw | <i>Crataegus, sps.</i> |
| 15. Wild Plum | <i>Prunus mexicana</i> |
| 16. Mesquite | <i>Prosopis glandulosa</i> |
| 17. Red Bud | <i>Cercis canadensis</i> |
| 18. Honey Locust | <i>Gledisia triacanthos</i> |
| 19. China Berry | <i>Melia azederach</i> |
| 20. Smooth Sumac | <i>Rhus glabra</i> |
| 21. Box Elder | <i>Acer negundo</i> |
| 22. White Ash | <i>Fraxinus americana</i> |
| 23. Green Ash | <i>Fraxinus pennsylvanica</i> |
| 24. Hoptree | <i>Ptelra trifoliata</i> |

Some of the trees found along the Elm Fork are natives of Texas, particularly East Texas, while others are exotics which have been transplanted to the area as a result of the action of the River and of birds and animals transporting seeds into the area. In some areas the wooded sections tend to become almost thicket-like and contain a substantial amount of understory growth of vines and small trees and woody shrubs, particularly on the forest edges. Included in the understory growth of vines and shrubs are:

- | | |
|---------------------|------------------------------------|
| 1. Greenbriar | <i>Smilax hispida</i> |
| 2. Woolly Pipevine | <i>Aristolochia tomentosa</i> |
| 3. Dewberry | <i>Rubus trivialis</i> |
| 4. Poison Ivy | <i>Rhus toxicodendron</i> |
| 5. Virginia Creeper | <i>Parthenocissus quinquefolia</i> |
| 6. Wild Grape | <i>Vitus sp.</i> |
| 7. Button Bush | <i>Cephalanthus occidentalis</i> |
| 8. Elder Berry | <i>Sambucus canadensis</i> |
| 9. Texas Sophora | <i>Sophora affinis</i> |

It will be recognized that, among both the trees and the understory woody plants, there are a number of species which produce food for wildlife. The available food

produced by the trees, vines and shrubs, the insects, worms and related organisms and the aquatic food available from the River contribute to over 180 species of birds being common to the area. The birds range from such large species as the Great Blue Heron and other water birds, including Wood Ducks, Sandpipers, Coots, Plover and Gulls. Owls, a variety of Hawks, Vultures, Kingfishers and the common Crow are among others of the larger birds of the area. The smaller birds, which might be placed in the songbird class, include Woodpeckers, Chickadees, Cardinals, Blackbirds, Sparrows, Grosbeaks, Cat Birds, Brown Thrashers, Robins and Mockingbirds.

The river valley environment also provides a habitat for a number of mammals including:

- | | |
|-----------------------|---|
| 1. Opossum | <i>Didelphis virginiana</i> |
| 2. Shrews | <i>Blarina brevicauda</i> and
<i>Cryptotis parva</i> |
| 3. Raccoon | <i>Procyon lotor</i> |
| 4. Striped Skunk | <i>Mephitis mephitis</i> |
| 5. Grey Fox | <i>Urocyon cinereoagenteus</i> |
| 6. Fox Squirrel | <i>Sciurus niger</i> |
| 7. Beaver | <i>Castor canadensis</i> |
| 8. Deer Mouse | <i>Peromyscus maniculatus</i> |
| 9. Cotton Rat | <i>Sigmodon spidus</i> |
| 10. Wood Rat | <i>Neotoma florida</i> |
| 11. Nutria | <i>Myocastor coypus</i> |
| 12. Cottontail Rabbit | <i>Sylvilagus floridanus</i> |
| 13. Swamp Rabbit | <i>Sylvilagus aquaticus</i> |
| 14. Armadillo | <i>Dasyus novemcinctus</i> |

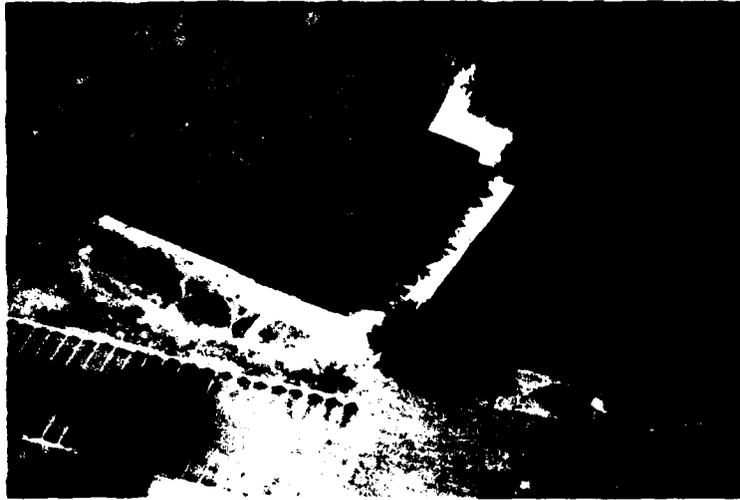
The wide variety of wildlife, both flora and fauna, plus the aquatic creatures living both in the River and in the immediate vicinity of the River, results in the Elm Fork Area being one of the most significant and undisturbed river valley ecosystems to be found in North Central Texas. It was the availability of the abundant wildlife and the particular river environment that resulted in the establishment of the Elm Fork Nature Area by the City of Dallas Park and Recreation Department and the current efforts to expand the area. The Nature Area has now become a wildlife laboratory for many of the educational institutions in the area including those of higher learning. It should be recognized that the specific microclimate conditions which have attracted the type of flora and fauna that exists along the Elm Fork of the Trinity River represent a unique and special educational resource. The lower Elm Fork is the only river valley area in the Dallas Metropolitan Area which appears to be suitable for preservation as a living nature and wildlife museum for the benefit of the present and future generations.

7. ACCESSIBILITY

One of the reasons for the survival of the Elm Fork Flood Plain as a habitat for varied wildlife and plants is the general lack of access to the river. Numerous bridges



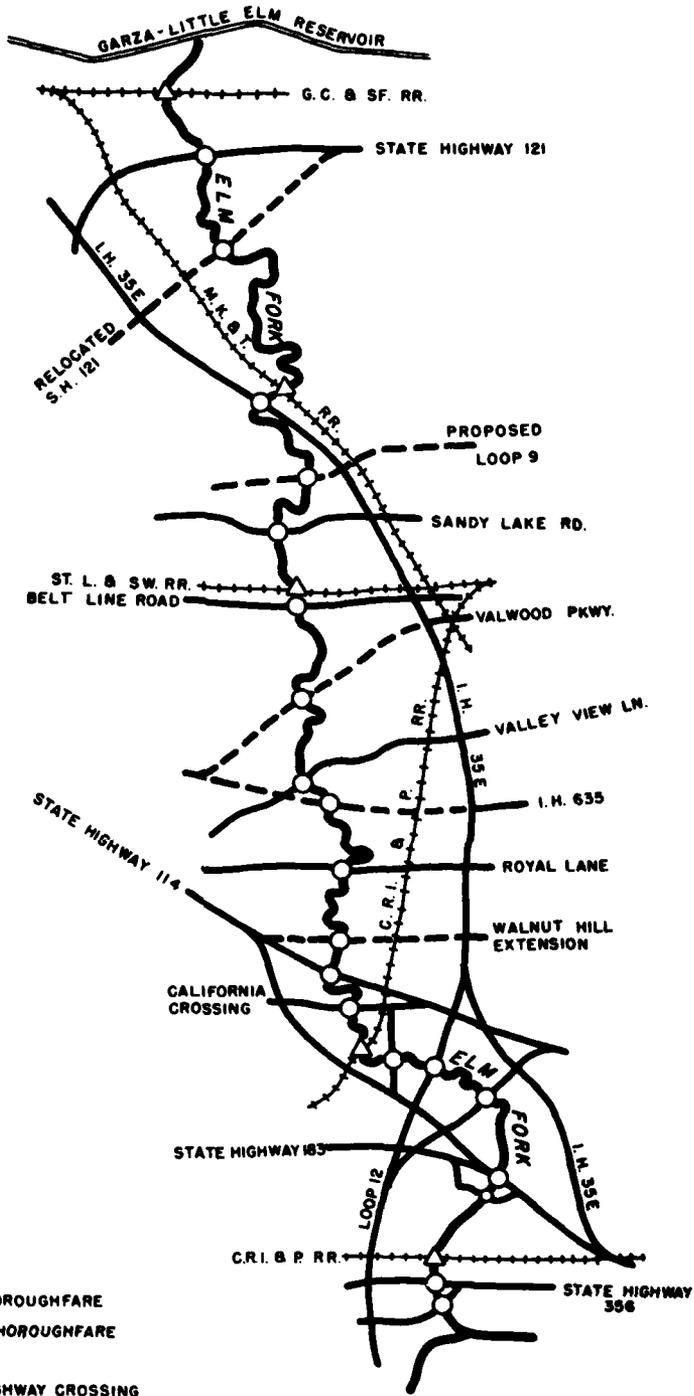
MOST ACCESS TO THE ELM FORK IS BY ROADS
AND HIGHWAYS WHICH CROSS THE RIVER



PARKING ACCESS TO ELM FORK
CALIFORNIA CROSSING PARK



POINTS OF POSSIBLE
VEHICULAR ACCESS
TO ELM FORK AT
IH 35E BRIDGE



- EXISTING THOROUGHFARE
- - - PROPOSED THOROUGHFARE
- + + + RAILROAD
- ROAD OR HIGHWAY CROSSING
- △ RAIL CROSSING



RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

ACCESS AND BRIDGE CROSSINGS
PLATE 5

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

cross the river but there are few significant parallel roads giving access to the river bank area. The deficient access condition has resulted in only limited use of the river banks except in such areas as California Crossing Park.

The Elm Fork is located in the midst of a rapidly urbanizing section of Dallas and Denton Counties and numerous bridge crossings of the river exist and more are planned. The existing and proposed crossings of the Elm Fork are shown by Plate 5. The proposed crossings indicated result from an investigation of the various plans by agencies who are responsible for the development of streets and highways in the area. All of the bridges were originally rural county highway crossings or bridges on the State or Federal highway system. As the surrounding area has become urban, bridges have been rebuilt and expanded to accommodate the growing vehicular traffic and it is anticipated that this process will continue. The reinforcement of existing levees and the extension of the levee system upstream as part of the Elm Fork Flood Control Project will necessitate the adjustment or replacement of a number of existing bridges which are inadequate both in elevation and cross section to accommodate the standards of the project or are inadequate for the growing traffic.

The existing and proposed river bridge crossings of the Elm Fork shown by Plate 5 are listed as follows:

1. Old Irving Boulevard Bridge - The Old Irving Boulevard Bridge was left operable after the construction and relocation of the State Highway and the old bridge continues to perform an important traffic function. It is probable that the bridge will be rebuilt at some future date to assist in the accommodation of the heavy volume of traffic moving between Dallas and Irving along the Irving Boulevard Route.
2. State Highway 356 Bridge - The new bridge north of the Old Irving Boulevard Bridge on the Highway provides direct connection between the City of Irving and the adjacent industrial complex in the City of Dallas across the Elm Fork.
3. State Highway 114 Bridge (Carpenter Freeway) - The high volume freeway (State Highway 114) crossing the Elm Fork provides a view of the river valley in both directions. No additional crossings appear to be appropriate in the space between State Highway 114 and State Highway 356 along the Elm Fork, and it is likely that the intervening space will not be disturbed by future crossing construction.
4. Old Grauwylers Road Bridge - The alignment of Old Grauwylers Road was disrupted by industrial development in Dallas but the bridge and right-of-way exist and are being used for vehicle movement to and from Irving. The old roadway offers an opportunity to provide access to the area in the floodway proposed for development by Dallas.
5. Spur 482 (Old State Highway 183) Bridge - This bridge connecting the



NARROW SANDY LAKE
ROAD BRIDGE AT
CARROLLTON DAM
WHERE WIDER BRIDGE
WILL BE REQUIRED IN
THE FUTURE



BRIDGE CROSSINGS - LOWER ELM FORK

City of Irving and the City of Dallas is on a portion of the highway system which is being reconstructed and a new bridge will be required as part of the project.

6. New Loop 12 Bridge - This is a new bridge immediately north of the Spur 482 Bridge and connects Interstate Highway 35E to State Highway 183 and Loop 12 in Irving. The New Loop 12 Bridge is of freeway standard and generally provides no opportunity for access to the river valley; however, reasonable views of the river valley are obtained from this crossing.
7. Wildwood Road Bridge - This bridge provides direct access to the river valley and to the Dallas Park Department Nature Area. Some improvement to the road and the bridge will be required unless the roadway itself is retained as a low crossing of the floodway. In view of the extensive park and open space development existing and proposed in the vicinity of Wildwood Road, it seems appropriate that the low water concept be considered. A new bridge on Wildwood Road is likely to be required as a result of the upgrading of the thoroughfare.
8. California Crossing Bridge - The California Crossing Bridge is one of the older crossings of the Elm Fork and it can be anticipated that ultimately the bridge will need to be reconstructed. The extension of California Crossing Road (Lombardy Lane) provides access to the California Crossing Park Area which is one of the well used areas along the Elm Fork. The access arrangement at California Crossing Park is illustrative of the type of access and parking facilities which would be desirable along several portions of the Elm Fork to enhance the recreational opportunities.
9. Spur 348 (Old State Highway 114) Bridge - This highway and bridge traverses a substantial existing park development along the Elm Fork and provides access to the Dallas Park Department's Public Shooting Range. It will be necessary to reconstruct the Old Highway 114 Bridge and such reconstruction should recognize the need for access to the existing and proposed park development on both sides of the Highway.
10. Proposed Walnut Hill Lane Crossing Bridge - The Dallas County Thoroughfare Plan proposes to extend Walnut Hill Lane across the Trinity River at a point approximately one mile south of Royal Lane. Space has been left in the park development on the east side of the Elm Fork to accommodate the projection of Walnut Hill Lane through the park area. Walnut Hill Lane's extension will increase the accessibility of park area along the river to a very substantial population residing to the east and to a developing population which is anticipated to the west in Irving.
11. Royal Lane Bridge - The present Royal Lane Bridge will need to be replaced and the entire thoroughfare reconstructed across the flood plain to accommodate the proposed flood control project. Royal Lane provides

access to Luna Road which runs generally parallel to the Trinity River and is the thoroughfare from which access to the Dallas Park Department's Elm Fork Golf Course is obtained. In order to assure the continued function and accessibility of the Elm Fork Golf Course, the access from Luna Road must be recognized in the levee and flood protection development.

12. Proposed Loop 635 Extension Crossing - This proposed access highway to the Regional Airport is currently under development and the bridge across the Elm Fork is under design by the Texas Highway Department. While the bridge is proposed at freeway standard and it is not likely to provide any significant recreational access to the Elm Fork, the elevation of the bridge should, however, provide the motorists excellent views of the park development along the Elm Fork.
13. Valley View Lane Bridge - This thoroughfare is being developed as an auxiliary route to the Regional Airport from Dallas and is located directly north of the Loop 635 Bridge.
14. Projected Valwood Parkway Bridge - The Dallas County Thoroughfare Plan projects Valwood Parkway from its present terminus at Interstate Highway 35E across the Elm Fork Flood Plain to a connection with Hackberry Road on the west. The proposed crossing should be recognized in any park development proposed in the area as well as in the design of the flood control project.
15. Belt Line Road Bridge - The Belt Line Road Bridge exists as part of the County Thoroughfare System and any adjustment required to accommodate the flood control project will require the reconstruction of the Belt Line Road Bridge.
16. Sandy Lake Road Bridge - Sandy Lake Road provides access to the McInnish Park Area on the Elm Fork (a parcel owned by the City of Dallas and developed and used by the City of Carrollton for park purposes). Immediately south of Sandy Lake Road, the City of Carrollton has acquired an additional 180 acres of park land adjacent to the Elm Fork and Sandy Lake Road will provide the most direct access to the new park area. Any adjustment required in Sandy Lake Road as the result of the flood control project should recognize the necessity for access to the adjacent park areas along the River.
17. State Loop 9 Bridge - A new crossing of the Trinity River is proposed for State Highway Loop 9 between Sandy Lake Road and the Denton County Line. The plans for relocating a diversion channel from the vicinity of Sandy Lake Road northward as part of the flood control project appears to create the necessity for two bridges on the Elm Fork along the Loop 9 Route, one on the existing channel and one on the new diversion channel.

18. Interstate Highway 35E Bridge - This important freeway crossing of the Elm Fork is designed so as to permit access to either side of the River from the freeway by off ramps and the off ramp arrangement is currently used by the fishermen seeking to gain access to the river channel. It is proposed to widen the bridge to six lanes and retention of the present frontage road arrangement is important for access to the River area.
19. Future Relocation-State Highway 121 Crossing - No crossings of the Elm Fork exist between the Interstate Highway 35E crossing and State Highway 121 in Lewisville. The lack of bridge crossings in the long stretch of river has restricted the access to the upper portion of the Elm Fork Channel and this condition is likely to continue until demands for new crossings or until State Highway 121 is relocated in the vicinity of Lewisville. The proposal is to cross south of the present bridge and extend the highway westward toward the Regional Airport. The Lewisville Comprehensive Plan provides for the highway relocation. It appears likely that a substantial portion of the river valley between Highway 121 and Interstate Highway 35E will continue to have limited access or be entirely lacking in access for some period of time unless access is provided as part of the Flood Control Project. Any recreational or open space development along the Elm Fork upstream from the Interstate Highway 35E Bridge will require the development of access roads from Interstate 35E or from the meager existing county road system east of the Elm Fork in the Town of Hebron. One access road has been developed to a golf course which has been constructed along the east side of the Elm Fork Channel. If the upper Elm Fork is to be used for canoeing and fishing, restriction of access to very limited points would contribute to the protection of the river from influences which might adversely affect its desirability for canoeing, fishing and general wildlife conservation.
20. State Highway 121 Bridge - Some access is provided to the River by a hazardous drive along the highway right-of-way to a point beneath the Highway 121 Bridge. The City of Lewisville is considering the acquisition of a substantial park site north of State Highway 121 and generally east of the Elm Fork Channel. The development of vehicular access and parking areas in connection with the proposed Lewisville Park would provide a desirable means of access to the River for small boats and for fishermen.

Other crossings of the Elm Fork include three railroad bridges; namely, the Chicago, Rock Island and the Pacific Railroad in the vicinity of Irving Boulevard, the St. Louis and Southwestern Railroad in the vicinity of Belt Line Road, and the Atchison, Topeka and Santa Fe Railroad north of State Highway 121 in the Carrollton area.

Studies for rapid transit development in the Dallas - Fort Worth Area are currently underway, sponsored by the North Central Texas Council of Governments. While the transit studies are incomplete, it appears that one or more transit crossings of the

Elm Fork will be required. The most likely transit crossing location is in the vicinity of the State Highway 114 (Carpenter Freeway) Bridge. The crossing structure is expected to be substantially elevated and will provide visual access to the proposed open space development along the Elm Fork for visitors to the area. The open space development is expected to provide a park-like gateway to the Dallas Area.

In order to provide access to the river bank areas and to provide communication between park systems on opposite sides of the river, it may be desirable occasionally to construct low water type bridges for pedestrian and bicycle use and for possible use by small park patrol vehicles and mounted park police patrol such as now utilized by the City of Dallas.

8. RECREATION AND OPEN SPACE RESOURCES

A study was made of the existing park areas of the potential park and recreation and open space resources on the Elm Fork and the results of the survey are shown by Plates 6A, B and C. Extending northward from the confluence of the Elm Fork and the West Fork along the east side of the channel, the City of Dallas has recently acquired 470 acres of land within the floodway which is all of the land extending from the levees to the channel. The new acquisition is intended for use as part of the Dallas Park and Greenbelt System. Northward from the confluence of Bachman Creek with the Elm Fork, the City of Dallas has acquired approximately 705 acres of land on the east side of the Elm Fork Channel. The area includes the Elm Fork Nature Area and extends to the old State Highway 114 crossing. On the west side of the channel the University of Dallas owns a substantial portion of the area between the old levee and the channel, extending north to the vicinity of Wildwood Road. The Texas Stadium and the Campus of the University of Dallas are both located in this vicinity and the City of Irving has jurisdiction over the entire area and is planning to utilize portions of it for recreational development. Two additional recreational and open space features within the City of Irving include Riverside Hills Golf Course, a private facility on Union Bower Road and extending to the Elm Fork and a playfield which is located near the Elm Fork but does not touch the River. Included in the area in Irving is an old garbage disposal area of the City which ultimately may be converted to a park and open space use.

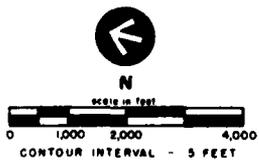
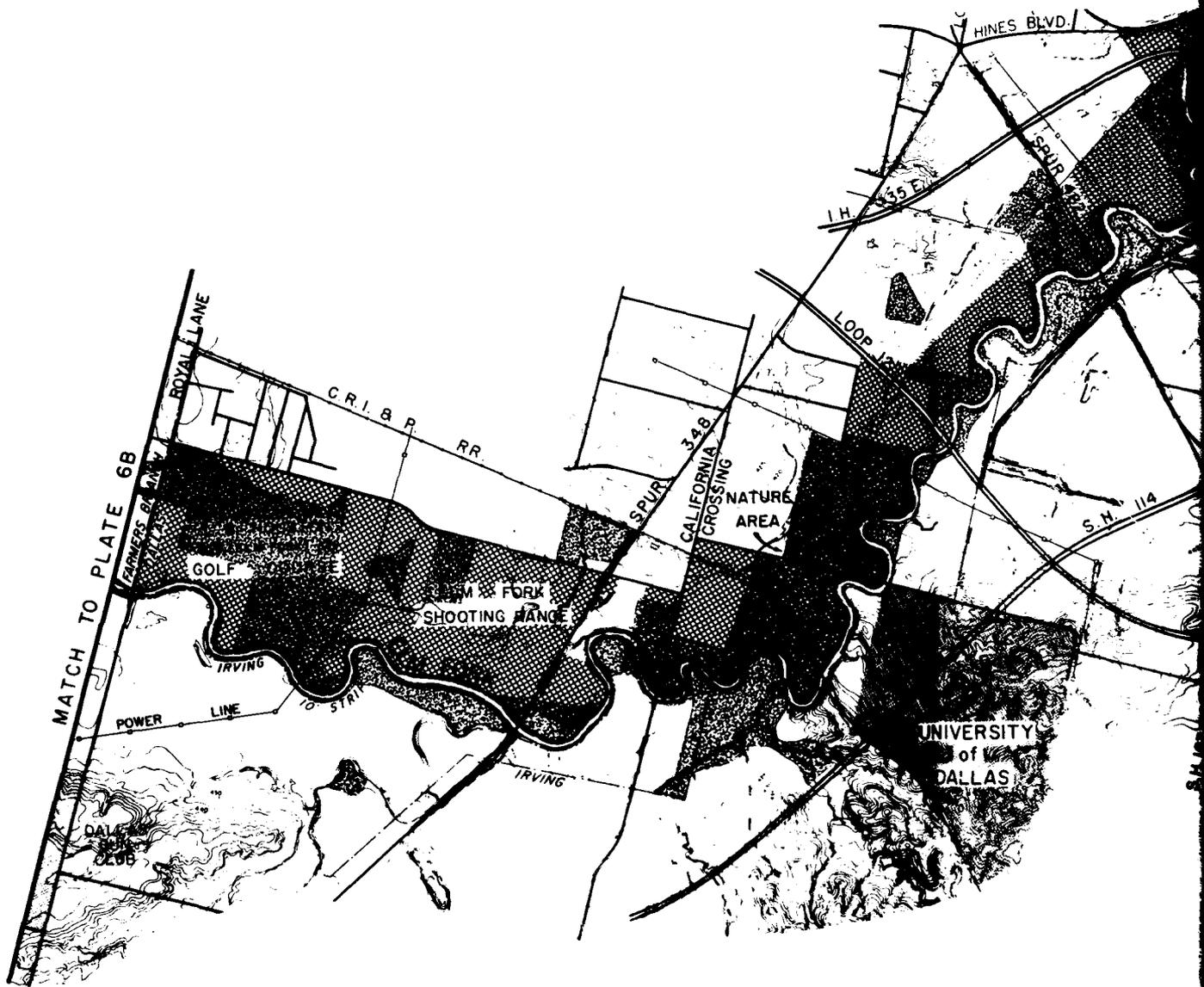
From the West Fork to a point north of the Carpenter Freeway (State Highway 114 crossing of the Elm Fork) the channel and the adjacent land generally lacks trees inasmuch as the area is a designated floodway. North of Carpenter Freeway, there is substantial tree growth including that which makes up the Dallas Park Department Nature Area and the California Crossing Park. Trees generally line the Elm Fork Channel northward from California Crossing to Grapevine Creek with the extent of tree cover varying widely depending upon location and the agricultural use of the adjacent land. Generally, the River Channel throughout its upstream length has a park-like appearance resulting from the adjacent tree growth (See photos). The retention of the trees along the channel has given the channel some stability inasmuch as the channel tends to meander rather widely from Royal Lane northward.



THE ELM FORK CHANNEL IS HEAVILY LINED
WITH TREE GROWTH AT MOST POINTS



TYPICAL DENSE
TREE GROWTH
ALONG THE RIVER
CHANNEL



-  TREE COVER
-  PROPERTY OWNED OR UNDER ACQUISITION FOR CITY OF DALLAS
-  OTHER PUBLIC OR SEMI-PUBLIC OPEN SPACE OR INSTITUTIONAL USE



UNDER
OF DALLAS
- PUBLIC
FUNCTIONAL USE

RECREATIONAL APPENDIX
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS

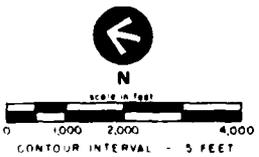
**RECREATIONAL AND
OPEN SPACE RESOURCES**

PLATE 6A

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973



MATCH TO PLATE 6C



-  TREE COVER
-  OTHER PUBLIC OR SEMI-PUBLIC OPEN SPACE OR INSTITUTIONAL USE



CARROLLTON PARK

CARROLLTON PARKS BRANCH

CROSBY ROAD

VALLEY VIEW LANE

LUNA ROAD

MATCH TO PLATE 6A

COPPELL RD

LEDBETTER RD

POWER LINE

ST. L. & SW. RR
BELT LINE
DALLAS
GRAPE VINE

IRVING TO STRIP CREEK

LIC
AL USE

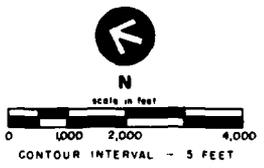
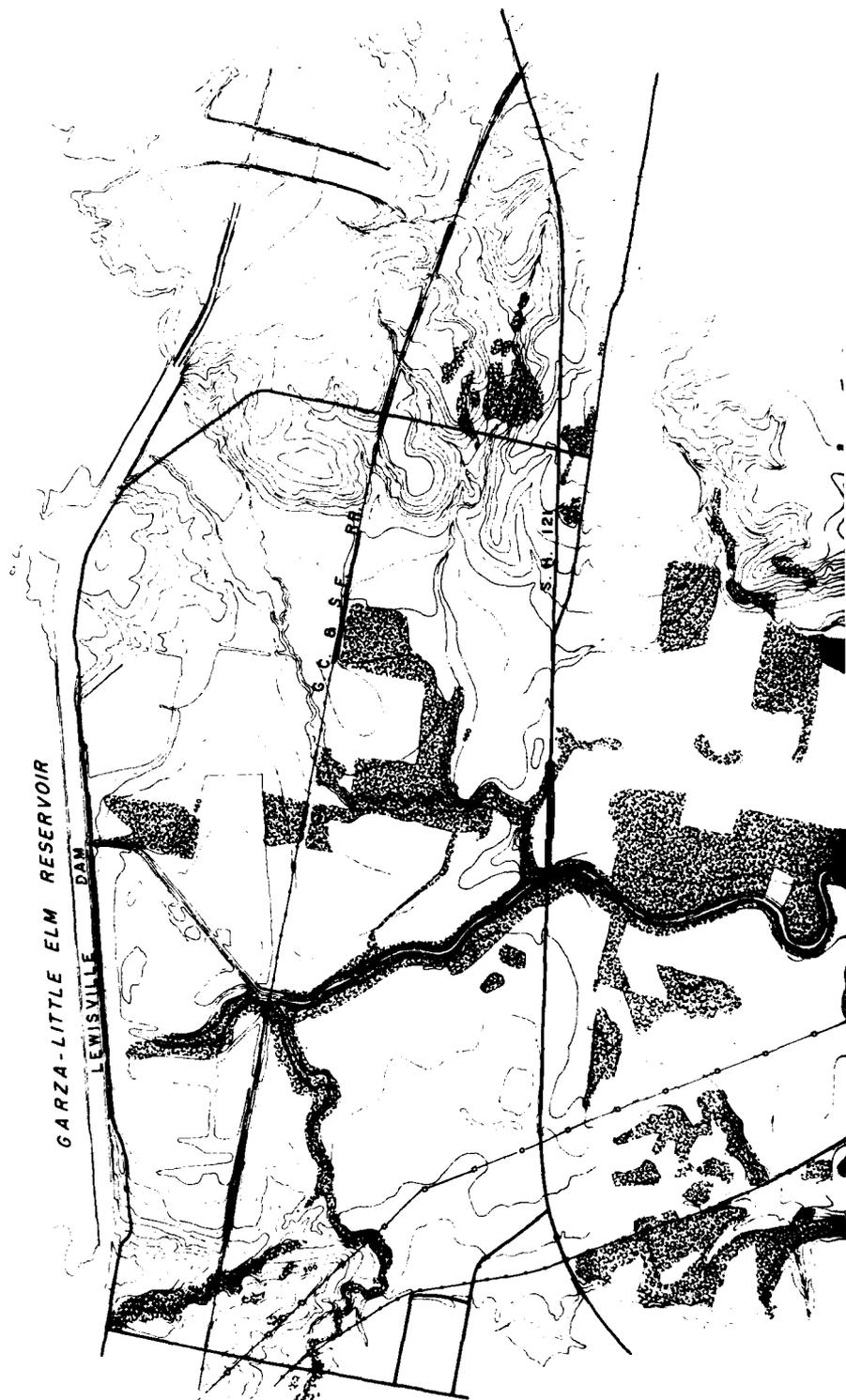
RECREATIONAL APPENDIX
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS

**RECREATIONAL AND
OPEN SPACE RESOURCES**

PLATE 6B

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
PREPARED BY HARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1975

2



-  TREE COVER
-  OTHER PUBLIC OR SEMI-PUBLIC OPEN SPACE OR INSTITUTIONAL USE



RECREATIONAL APPENDIX
ELM FORK FLOOD CONTROL PROJECT
DALLAS AND DENTON COUNTIES, TEXAS

**RECREATIONAL AND
OPEN SPACE RESOURCES**

PLATE 6C

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

The City of Dallas' existing L. B. Houston (Elm Fork) Golf Course and Public Shooting Range are located between Luna Road and the Elm Fork Channel north of Spur 348 (old State Highway 114). California Crossing Park at the California Crossing Dam is located just below Spur 348 and the Park is currently being expanded to take in all the nearby flood plain land. Plans have been developed for expanding the L. B. Houston (Elm Fork) Golf Course by the addition of 18 more holes to make it a 36 hole facility. When Dallas' current land acquisition efforts are completed, the City of Dallas will own all the land on the east side of the channel from Royal Lane to the confluence of the Elm Fork and West Fork totaling approximately 1,840 acres of park and open space land. Contained within this area are a number of borrow pits which have become small lakes.

The Dallas Gun Club, a private organization, is located immediately adjacent to the flood plain area just off Royal Lane and can be considered a private open space and recreation facility related to the River. No public park lands exist north of Royal Lane along the Elm Fork to the vicinity of Sandy Lake Road where the City of Carrollton has recently acquired 180 acres of land adjacent to McInnish Park. There is presently, under ownership or acquisition procedure, by all local agencies, approximately 2,100 acres of public park land within the Elm Fork Flood Plain of which the City of Dallas is the major owner.

Northward from Sandy Lake Road to Interstate Highway 35E, the Elm Fork Channel meanders through an area of dense tree growth of significant park-like character. The tree covered area is considered to have major importance as a potential park area particularly for fishing, boating, nature study, bird watching, picnicking and similar activity. At the present time no community has indicated a desire to develop the area. A portion of the tree covered area from the Denton County Line north to the State Highway 121 Bridge is located in the City of Hebron, some area is in Carrollton and other portions are unincorporated. The Elm Fork near the Interstate Highway 35E crossing has major park significance both as a park gateway to the Dallas Urban Complex and as a significant open space area which should be preserved. The Elm Fork Channel north of Interstate Highway 35E is generally tree lined and meanders through a varied flood plain area containing substantial forest growth and outcrops of the Eagle Ford Formation, and in its present state the River constitutes an excellent canoeing and fishing stream. The adjacent river bank area could readily accommodate facilities for overnight camping by organized groups such as Boy Scouts, as well as nature areas, trails, picnicking and related facilities.

A private country club, the Camelot Country Club, has developed at a major bend in the Elm Fork in the City of Hebron. The Country Club is shown on Plate 6B and represents additional private open space use of the Elm Fork Valley. North of State Highway 121 to the Lewisville Dam, the City of Lewisville is considering the acquisition of a large park area constituting approximately 2,100 acres. The City of Irving has expressed park and greenbelt interests in a total of approximately 2,400 acres of land from the vicinity of the University of Dallas northward to Grapevine Creek on the west side of the Elm Fork. It is indicated that most of the municipalities along both sides of the Elm Fork between the West Fork and the Lewisville Dam currently own or



TWO OF THE THREE DAMS WHICH MAINTAIN
WATER LEVEL OF ELM FORK TO SUITABLE
LEVEL FOR CANOEING AND FISHING

have an interest in approximately 6,500 acres of the Elm Fork Flood Plain for recreation and open space purposes. It is possible and likely that the municipal park interest will expand to larger areas as the potential of the area is recognized and the sources of financing for acquisition become available. The recreational resources illustrated by Plates 6A, B and C actually exceed the current indicated interest of the municipalities in park and open space area. The fact that the resources exceed the current interest is considered natural inasmuch as a number of the municipalities, particularly the City of Hebron, are currently not sufficiently organized as municipalities to have concern for park and open space lands. It would appear that, from Sandy Lake Road downstream to the confluence with the West Fork, the adjacent municipalities with the exception of Farmers Branch are developing specific plans and intend to create a significant greenbelt park in the Elm Fork Flood Plain. From Sandy Lake Road northward and particularly northward from the Interstate Highway 35E crossing there is no existing governmental entity that has expressed an interest in the recreational development of that portion of the Elm Fork. It is possible that an agency such as the County or the Trinity River Authority might be interested in undertaking the development and preservation of those significant recreational and park resources along the Elm Fork which are not presently involved in acquisition or development by the municipalities.

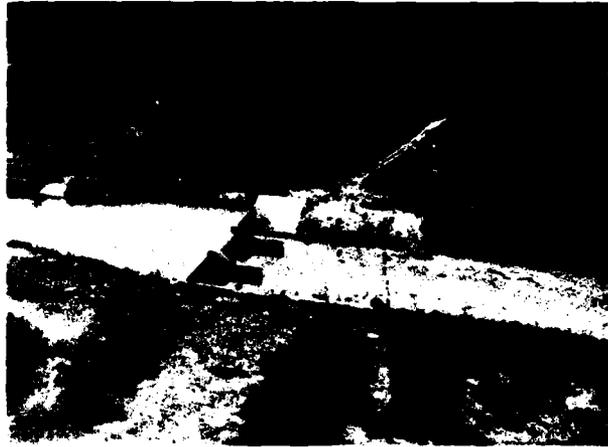
9. WATER QUALITY AND NATURE OF THE RIVER

It must be recognized that the lower Elm Fork is a changing stream as evidenced by the meanders and oxbow cutoffs existing in its alignment. The meandering alignment is considered a recreational asset although the varied alignment increases the time factor in moving water through the system. Releases from the Lewisville Dam require about 36 hours to reach the Bachman intake at Frasier Dam.

The general quality of the raw water in the Elm Fork is considered good and data from water sample analysis taken at the Elm Fork Plant of the Dallas Utilities Department generally confirms the conclusion though urbanization is increasing the danger of pollution from failures of local sewerage systems and other urbanization impact problems.

At the present time the effluent from only one sewage treatment plant (Lewisville) enters the Elm Fork below the Garza-Little Elm Dam. The Lewisville Plant is to be rebuilt and relocated and a new treatment plant for the Town of Flower Mound is expected to come into operation in 1973 on a branch of Denton Creek. The Flower Mound Plant is being designed for tertiary stage treatment and the new Lewisville Plant, will not provide as complete a treatment but the effluent will be pumped upstream to near the Garza-Little Elm discharge and released with the discharge from the Reservoir.

It is obvious that serious effort is being made to protect the quality of water in the Elm Fork Channel. There is a possibility of nutrient increase from the Lewisville Plant, which if coupled with a reduced channel transportation time, could result in algae problems which do not presently appear to exist. It must be assumed that, if



**FREQUENT LOW WATER CONDITION
BELOW FRASIER DAM (BACHMAN INTAKE)**



**HIGH WATER LINE ON STREAMSIDE
TREES INDICATING FREQUENT
ELEVATION DURING FLOOD WATER
RELEASE FROM RESERVOIR**

serious problems do occur as a result of the effluent from either of the two plants now being planned and constructed or from any future sewage treatment facility that might be permitted, such as in the Town of Hebron to the east of the Elm Fork, serious action will be taken to correct the problem.

The basic quality of water in the Elm Fork is likely to be maintained at acceptable standards which will support a wide range of aquatic life and be suitable for canoeing and similar small boat use.

The normal banks of the Elm Fork Channel upstream from the Interstate Highway 35E Bridge are relatively unstable and would be subject to serious erosion and sloughing if heavy recreational activity were to take place immediately adjacent to the channel. At some locations even light fishing activity could create problems. Downstream from the Interstate Highway 35E Bridge, the banks are generally much more stable and as in the case of McInnish Park in Carrollton and the California Crossing Park in Dallas, moderately heavy recreational use is made of the river banks without evident adverse results.

At the present time, the Elm Fork Channel appears to be fairly stable with only a few locations of serious bank erosion. Raw water released from Grapevine and Garza-Little Elm Reservoirs is conducted downstream by Denton Creek and the Elm Fork Channel to the intake of the Elm Fork Water Treatment Plant at Carrollton and to the Bachman and Park Cities Treatment Plants in Dallas. The raw water releases from Garza-Little Elm Reservoir have ranged from 31 to 4,460 cubic feet per second with the average of 20 years being 567 cubic feet per second. The releases maintain a significant flow in the Elm Fork Channel as far downstream as the Bachman intake at Frasier Dam. During periods of restricted flow when the preponderance of the water release is utilized for municipal supply, the flow below Frasier Dam is very low. All parts of the Elm Fork upstream from Frasier Dam have a fairly constant water level except when surplus water is being released from the reservoir's flood pool. During periods when the flood pool is being lowered on Garza-Little Elm Reservoir, the water level often reaches or exceeds "bank full" conditions. High water marks on the stream side trees generally indicate the high water condition during periods of high volume release. The capacity of the present channel of the Elm Fork below the Lewisville Dam has acted as a constraint on the rate of release from the flood plain.

During the entire year, the water level in the Elm Fork, above Frasier Dam, is adequate for light boating, such as canoeing and for fishing. The quality of the water, being a municipal water supply source, is generally superior to that found in any other river in North Central Texas and is greatly superior to the water in the West Fork of the Trinity in the vicinity of the confluence.

Evidence of the quality of Elm Fork water is found in the wide variety of aquatic life which the river supports. The environmental Impact Study of the Elm Fork by Hays, Hellier and Kennerly, April, 1972, reported some 70 species of fish and minnows have been identified in the Elm Fork drainage system and 21 species were collected recently in a sampling of the lower Elm Fork, including such sport fish as channel catfish and large mouth bass.

A new channel is proposed to be constructed from the Lewisville Dam downstream to Royal Lane with all present meanderings of the River generally cut off except for a section from Sandy Lake Road north to the Interstate Highway 35E Bridge crossing where the existing channel will remain active and a flood diversion channel will be constructed to the west which will intercept Denton Creek and rejoin the old channel in the vicinity of Sandy Lake Road.

Two existing sections of the present Elm Fork natural channel will remain intact; namely, (1) that portion of the channel below Royal Lane to the confluence of the West Fork which is located within the City of Dallas and (2) that portion of the present channel from Sandy Lake Road north to Interstate Highway 35E. All other portions of the existing channel are proposed to be diverted or altered by the construction of new, more direct drainageways. The proposed new channel would substantially reduce the channel mileage along the Elm Fork north of Royal Lane and will significantly change the character of the River throughout this area.

The new and realigned channel is intended to have a greater capacity than the existing channel, thereby permitting larger volume releases during flood release periods from the Garza-Little Elm Reservoir. It is obvious that, if larger volumes are released into a more direct channel from the Lewisville Dam, such conditions will likely result in frequent overflow of the undisturbed channel below Royal Lane. The frequency of such high volume discharges is not known but it is obvious that the situation will be different after the Flood Control Project is constructed than it is at the present, particularly in the immediate vicinity of Royal Lane.

The general height of the levees in the lower section from Royal Lane downstream is expected to vary from approximately 15 to 20 feet above the present flood plain level. The levee height would require a total right-of-way including the external sump area from 110 to 155 feet for each levee. A parallel drainage ditch will exist in most cases along the outside of the levee for the collection of local storm water and the conducting of such storm water to a series of sumps which are proposed. A total of 19 sump water storage areas are proposed along the entire stretch of the Elm Fork within the Project. Twelve of the sump areas occur on the east side of the levees and seven occur on the west side. The size and volume of the sumps have not been determined and it is, therefore, not possible to evaluate the affect of the sump areas on recreational facilities that may be located outside the levees. It is apparent, however, that the combination of the drainage ditch and the sump areas will have significant influence on the recreational potential of land immediately adjacent to and outside the levees. The intermittent nature of the water level in both the drainage ditches and the sumps is not likely to contribute to the recreation potential of the project unless the sump areas are well maintained.

The levee design provides for a 2 1/2 to 1 slope on both sides with a berm approximately 12 feet in width at the top. In some cases, it would be possible to place a trail on the levee berm and the 2 1/2 to 1 slope should permit a contact with the trail from other trail systems existing in the floodway between the levees by a diagonal trail alignment along the levee face. At Royal Lane, it is proposed that the

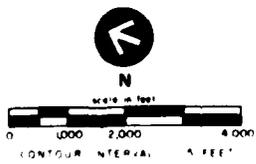
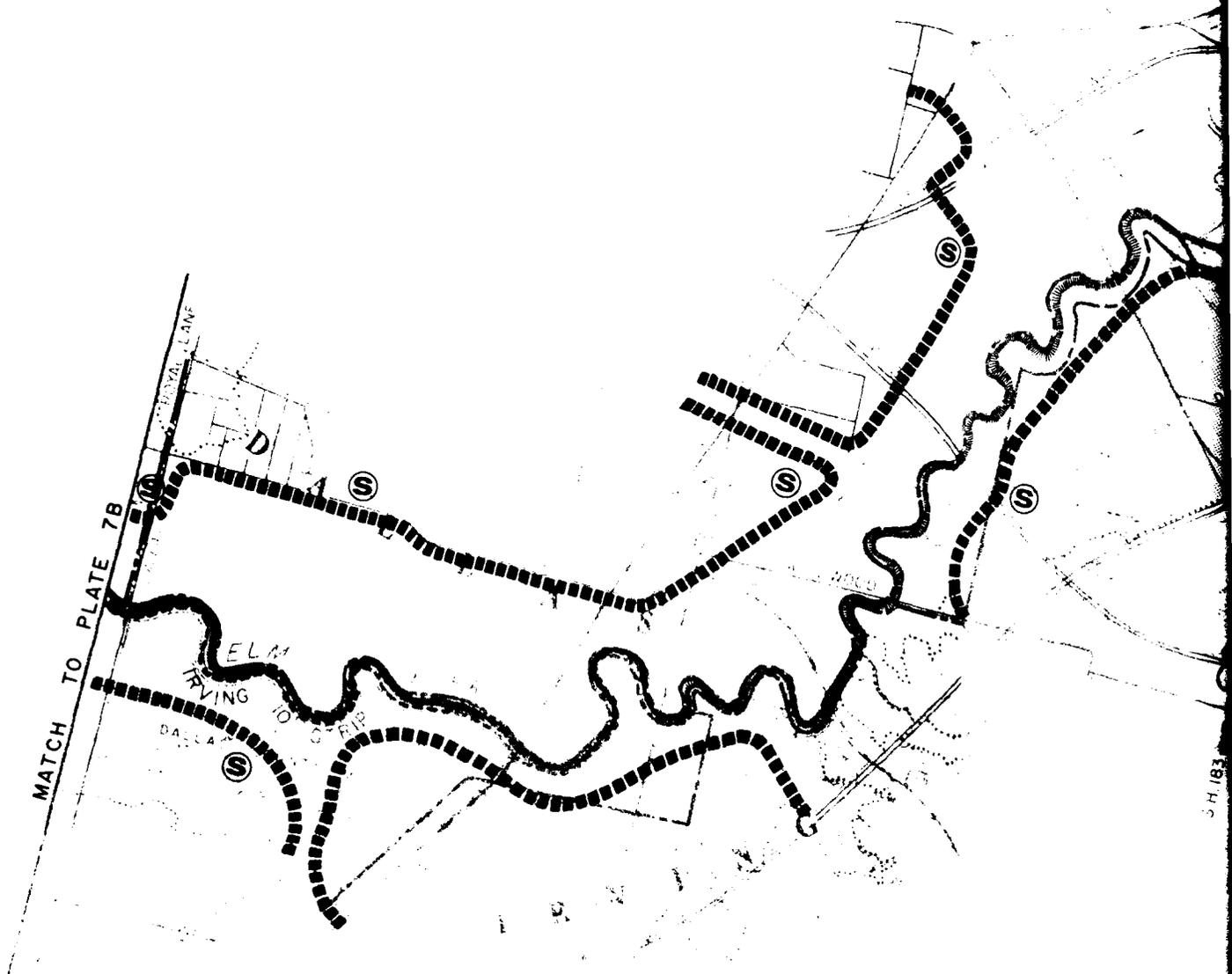
thoroughfare be placed on top of the levee for a distance where the levee runs perpendicular to the River Channel. The proposed berm for the Royal Lane Roadway is approximately 30 feet in width but such standard is inadequate in view of the approved thoroughfare standards for Dallas County and the City of Dallas for Royal Lane. A minimum of 80 feet between the outside roadway curbs, consisting of two 33 foot divided roadways with a 14 foot center median, is required. Where no intersections exist, it might be possible to reduce the width of the median to approximately 4 feet, but it is obvious that some conflict does arise between existing Thoroughfare Plans and the Proposed Levee Plans in the Royal Lane Area. Inasmuch as the present plans call for the levee system downstream from Royal Lane to be constructed parallel to and on the west side of Luna Road, it will be necessary to make provisions for vehicular access over the levees from Luna Road so as to provide a connection to the existing entrance drive to the Elm Fork Golf Course Club House and parking area. Similar access provisions will be required for the Elm Fork Shooting Range and the California Crossing Park and at Wildwood Road to assure access to the Elm Fork Nature Area.

The present proposed configuration of the levees tends to bisect the new 180 acre park site which the City of Carrollton has acquired and this arrangement is considered to adversely affect the park development potential. It is recommended that the proposed levees be adjusted at this location so as to place the entire park area on the stream side on the levee.

The Denton County portion of the Project, including the area within the City of Lewisville and the City of Hebron, is not intended to have levees and the flood protection benefits will come largely from the increased size of the channel in the area and the ability to control the release from the Garza-Little Elm Reservoir to the capacity of the channel. It would appear, however, that, when the water is high in the levee section downstream from Denton Creek, it can be anticipated that some overflow conditions will occur upstream. It is probable that an occasional overflow in the unleveed section would not seriously affect the recreational use of the area but that the flood hazard would tend to prevent any dense urban development of that portion of the flood plain.

Evaluation of the alignment of the proposed channel indicates that a number of tracts of land will be isolated between the old channel and the new channel and some of the tracts have recreational potential. In order to provide access to isolated tracts, it will be necessary to bridge the channel and such bridging also appears likely to be needed in view of the agricultural use of the adjacent land. Access problems will be particularly complicated in the area upstream and downstream from the Interstate Highway 35E Bridge where major channel relocation is proposed.

It is apparent from a review of Plates 7A, B and C that the proposed Elm Fork Flood Control Project partially conforms to the North Central Texas Council of Governments' concept of greenbelt and open space use, but there are also some substantial variations from the concept. A number of adjustments in the thoroughfare and highway plans for the area will be needed as highway improvements are made in order to



- LIMITS OF 100 YEAR FLOOD
- PROPOSED LEVEE
- Ⓢ SUMP AREA

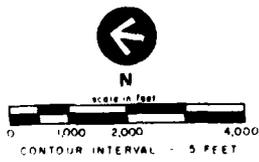
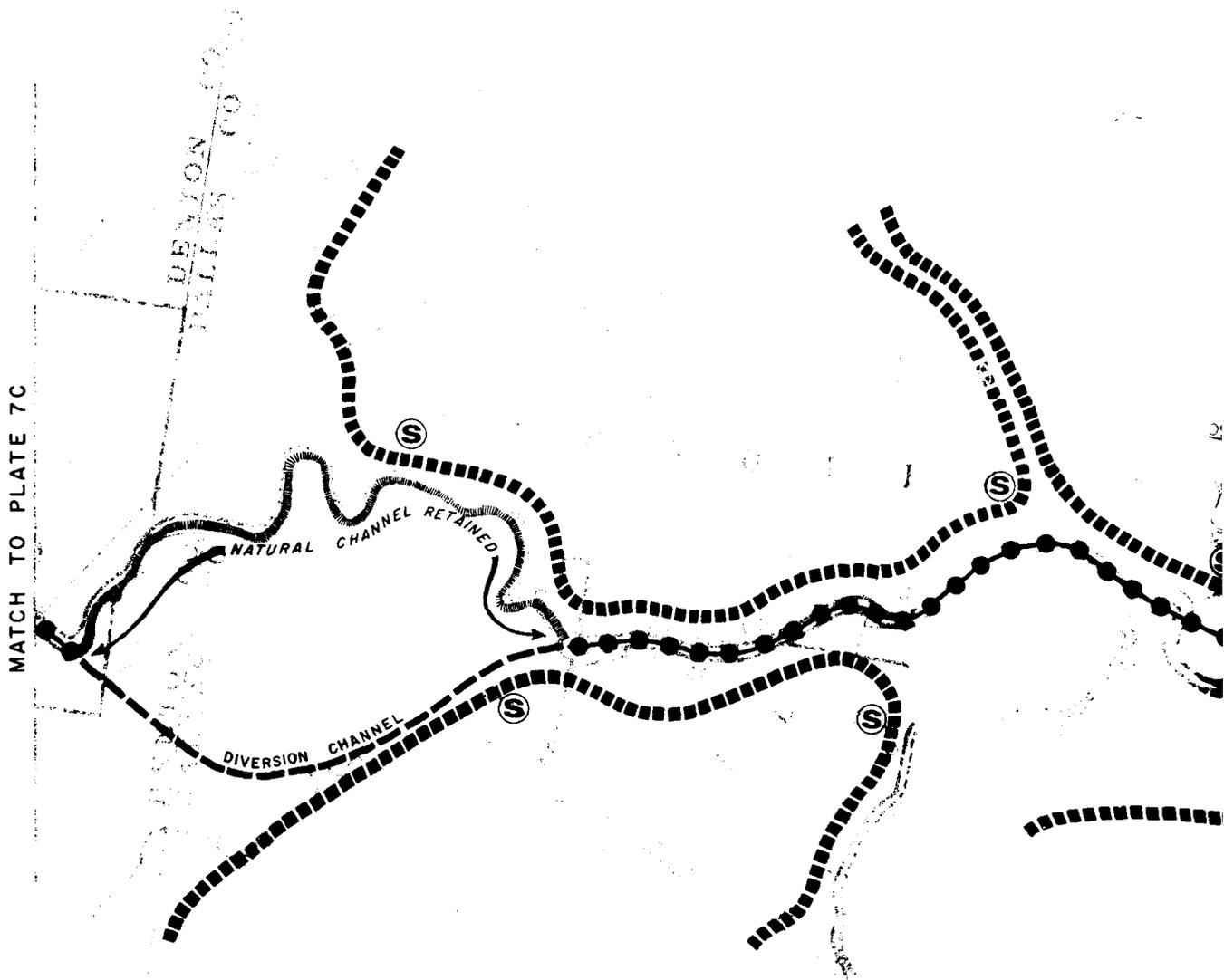


1W FLOOD

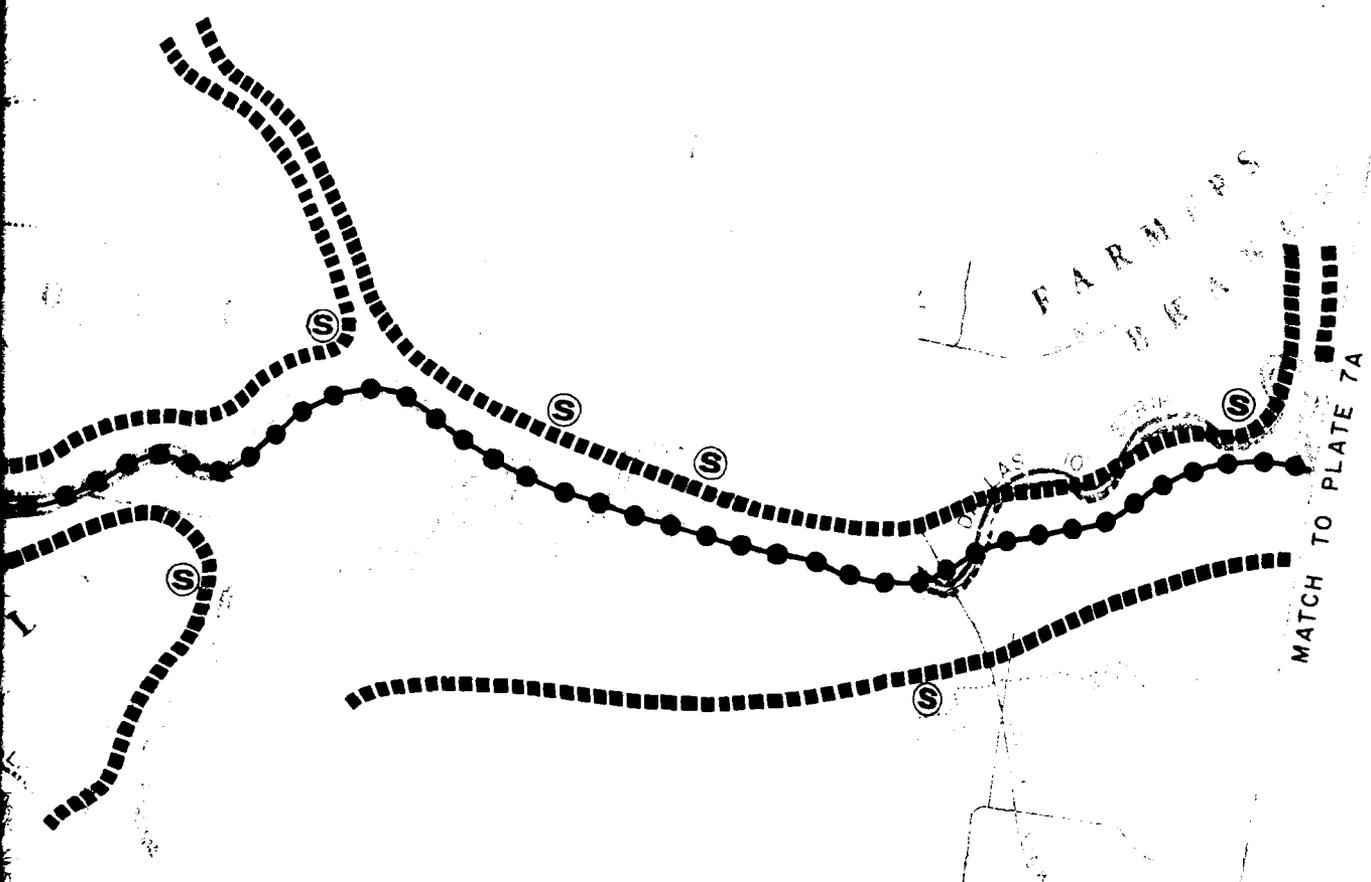
RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

**PROPOSED FLOOD CONTROL PROJECT
 PLATE 7A**

U S ARMY ENGINEER DISTRICT FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER AND COLLEAGUES DALLAS, TEXAS, MAY 1955



- LIMITS OF 100 YEAR FLOOD
- PROPOSED CHANNEL ALIGNMENT
- PROPOSED LEVEE
- Ⓢ SUMP AREA



EAR FLOOD
REL ALIGNMENT

RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

PROPOSED FLOOD CONTROL PROJECT
PLATE 7B

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1975



N

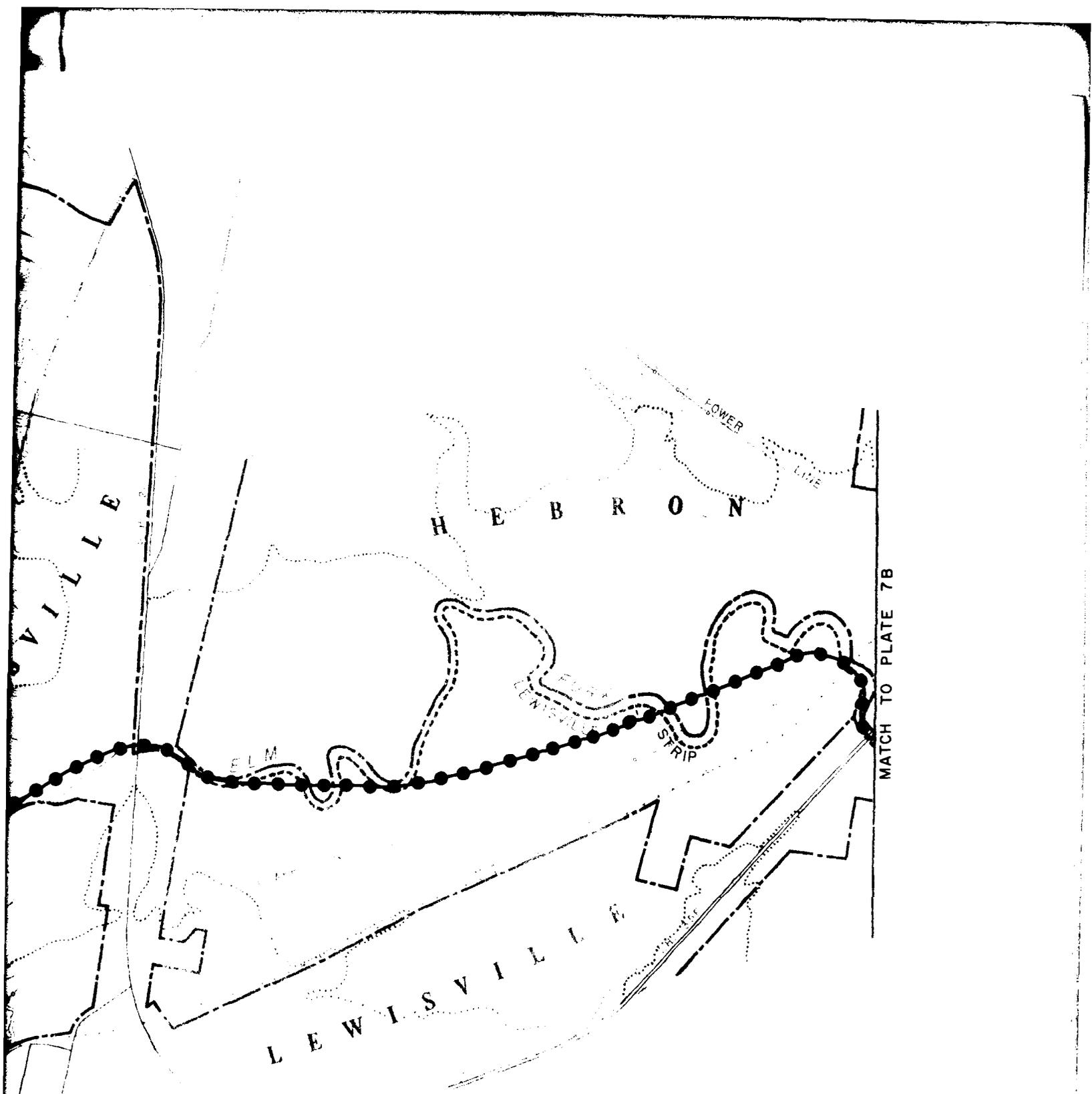


CONTOUR INTERVAL = 5 FEET



LIMITS OF 100 YEAR FLOOD

PROPOSED CHANNEL ALIGNMENT



OF 100 YEAR FLOOD
ED CHANNEL ALIGNMENT

RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

PROPOSED FLOOD CONTROL PROJECT
PLATE 7C

U. S. ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

2.

bring the Flood Control Project into conformance with other proposals of the area. There will be some recreational benefits and some substantial loss of recreational resources as a result of the proposed Flood Control Project. The potential gain or loss in recreational benefits will depend largely upon the facilities which are developed within the Elm Fork Area by the various agencies involved and the degree to which the recreational resources of the River Valley can be conserved as the flood control project is constructed. It has been indicated that four municipalities; namely, Carrollton, Lewisville, Irving and the City of Dallas have plans in various stages of consideration for the development of portions of the Elm Fork.

III - PROJECT DATA

The Comprehensive Development Plan for the Trinity River System published by the Corps of Engineers in 1962 provided for the construction of a levee system on the Elm Fork and its tributaries consisting of a new channel and a floodway between the levees approximately 1,600 feet in width. The initial flood control planned for the Elm Fork envisioned generally parallel levees along a realigned channel with some redirection of the tributary drainage so as to confine it within levees for some distance back from the main levee system. It was anticipated that the entire existing channel of the Elm Fork would be realigned and that the primary function of the entire project would be of flood control and the resulting reclamation of adjacent land within the flood plain. The project would have resulted in the confinement of project storm volumes within a relatively narrow levee system (1,100 feet in width) as contrasted to the present exposure where the flood plain is up to 2 1/2 miles wide. The confinement of the flood waters would result in the provision of flood protection for a substantial amount of real estate.

The current proposed flood control system as represented by Plates 7A, B and C proposes to develop a levee system starting in the vicinity of the Bachman Creek confluence with the Elm Fork continuing northward to Royal Lane with the levees being approximately 3,000 feet apart. Within the lower section of the River, it is proposed that the existing river channel remain basically undisturbed. The City of Dallas has acquired all of the land on the east side of the Elm Fork approximately to the proposed new levees. On the west side of the Elm Fork (the City of Irving side), the levees would follow the alignment of the existing old levee of the Dallas County Levee Improvement District No. 5 to the vicinity of Wildwood Road where highland would terminate them. The levees would pick up north of the St. Louis-San Francisco Railroad bridge and continue along the west side to the vicinity of Royal Lane. The Las Colinas Corporation proposes to develop an independent flood control system in the area generally between Royal Lane and the St. Louis and San Francisco Railroad on the west side of the River. At Royal Lane it is proposed that the levee configuration approximate the original 1962 Plan on the east side through the Farmers Branch - Carrollton Area. On the west side (in the City of Irving), it is proposed to flare the levee widely westward so that, in the vicinity of Grapevine Creek, the space between the levees would reach a width of approximately 6,000 feet. Provision is also made to levee the Farmers Branch - Rawhide Creek drainage system through a new channel with parallel levees extending to Interstate 35E. Similar provision is made for Hutton Branch in Carrollton where the levees and a channel would extend from the Elm Fork to the Interstate Highway 35E Bridge. At Belt Line Road, the levees converge to approximately 1,200 feet apart and continue northward to the vicinity of Sandy Lake Road where the east levee flares in a northeasterly direction to Interstate Highway 35E in the vicinity of Trinity Mills Road and the west levee swings generally parallel with Denton Creek and terminates at highland near the Dallas-Denton County Line. No levees are proposed to be constructed from above the Dallas-Denton County Line to the Lewisville Dam.

IV - RECREATION MARKET AREA

Day and Night Use Market Area

The Elm Fork Flood Control Project and related recreational development is located in the rapidly urbanizing area of Dallas County and southern Denton County. Over 80 percent of all day or night users of the recreational facilities will come from Dallas County and the fringes of Tarrant, Denton and Collin Counties. All recreational and open space facilities are expected to be urban oriented and to serve the market in the same manner as the existing recreational facilities in the Elm Fork Area. Usage experience exists on three major existing facilities and provides a basis for estimating future usage. Competition exists for the Elm Fork facilities only in the golf facilities and picnicking as all other existing facilities are of special and unique character and peculiar to the Elm Fork Area.

Plate 8 shows the relationship of the Elm Fork Flood Control Project to the primary recreational market area. The delineation of the area was determined from data furnished by the Dallas Department of Parks and Recreation on the usage of existing facilities. The future use of the recreational facilities on the Elm Fork will be directly related to the population in the market area and to the facilities provided in the recreational development. The extent and nature of the flood control project is not fully determined or agreed upon by the responsible local agencies and the recreational facilities cannot be completely determined at this time. Projections are made on those facilities which can be reasonably determined.

Socio-Economic Characteristics of the Population

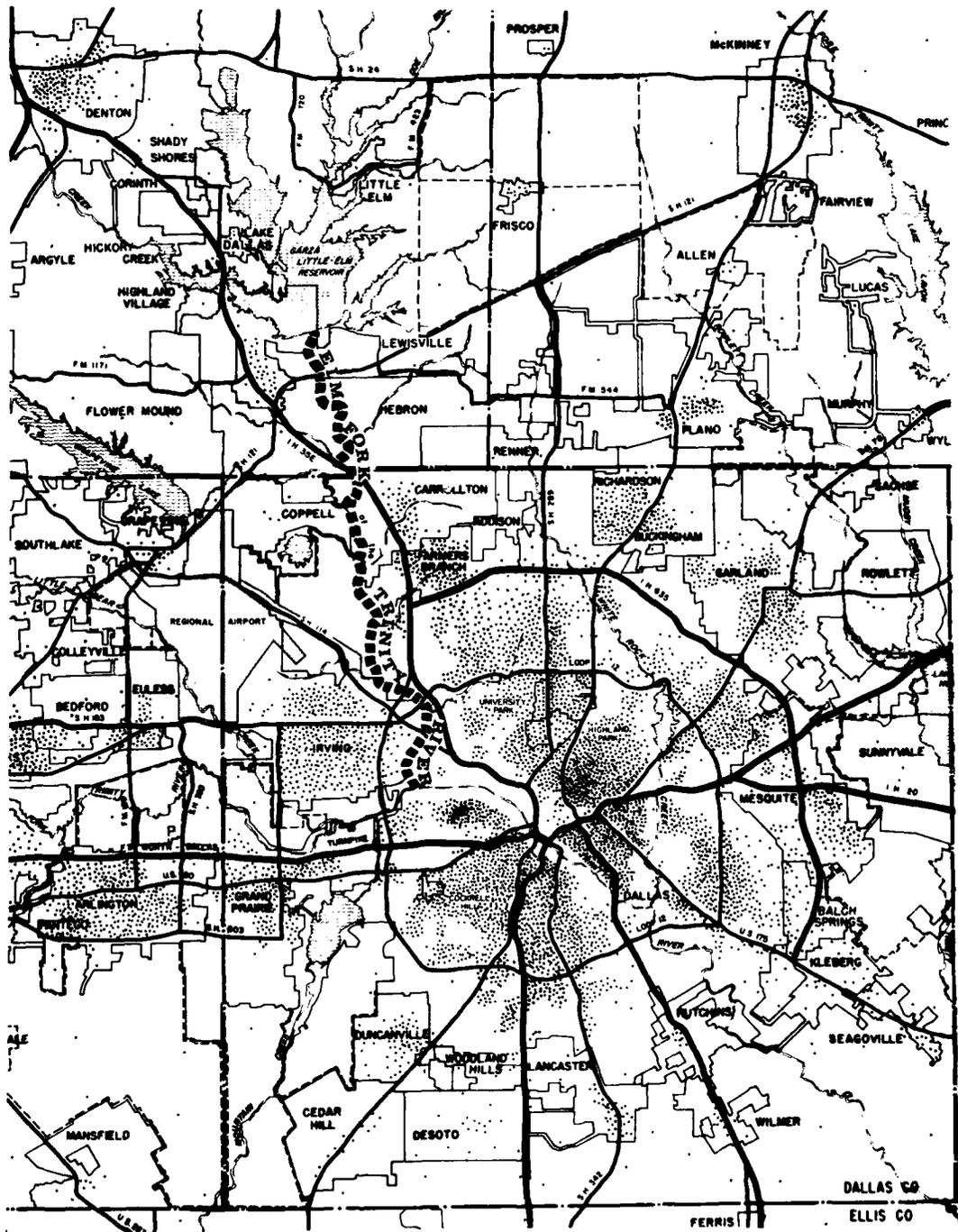
The four county area from which the Elm Fork recreation market is derived has experienced rapid urban growth. Table 1 illustrates the population growth over the past 40 years. The area experienced a 3.6 fold increase during the past 40 years and more than doubled in the past 20 years.

TABLE 1

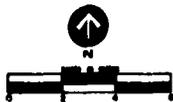
POPULATION CHANGE - COMBINED

DALLAS, DENTON, COLLIN AND TARRANT COUNTIES - 1930 to 1970

<u>County</u>	<u>1930</u>	<u>1940</u>	<u>1950</u>	<u>1960</u>	<u>1970</u>
Collin	46,180	47,190	41,692	41,247	66,920
Dallas	325,691	398,564	614,799	951,527	1,327,320
Denton	32,822	33,658	41,365	47,432	75,633
Tarrant	197,553	225,521	361,253	538,495	716,316
Total	602,246	704,933	1,059,109	1,578,701	2,186,189



EACH DOT REPRESENTS 250 PERSONS



RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

**POPULATION DISTRIBUTION
 ELM FORK RECREATIONAL MARKET AREA
 PLATE 8**

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY, 1973

The Elm Fork recreational market area represented 75 percent of the four county population in 1970 (or 1,640,000 people). The four county area also represented 92 percent of the 1970 population of the combined 8 county Dallas and Fort Worth Metropolitan areas.

Projections of population have been made for the combined Dallas - Fort Worth Metropolitan areas as follows:

**FUTURE POPULATION FOR COMBINED
DALLAS AND FORT WORTH SMSA'S**

<u>1970</u>	<u>1985</u>
2,318,036	3,340,000
<u>1975</u>	<u>1990</u>
2,620,000	3,750,000
<u>1980</u>	<u>1995</u>
2,960,000	4,000,000

Projected Population

It is expected that the Elm Fork recreational market area, as shown by Plate 8, will continue to develop at the same basic rate as the Region and will continue to enjoy the same favored growth potential resulting in the future population of the market area growing as follows:

POPULATION, ELM FORK RECREATIONAL MARKET AREA*

<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>
1,640,000	2,042,000	2,587,500	2,835,000

Some of the major growth areas within the market area will be in the immediate vicinity of the Project. Coppell, Irving, Carrollton, Flower Mound, Lewisville, Plano and Hebron are all expected to experience major urbanization. The economic impact of the Dallas - Fort Worth Regional Airport and the urban growth overflow from Dallas assures that the Elm Fork Project will be in a total urban environment by 1990, and it can be anticipated that the capacity of facilities will be fully utilized by 1995 or 2000.

Age Composition and Income

The age composition of the population in most areas has been changing significantly in recent years as a result of a longer life span and a reduction in the birth rate. The age composition trend in the Dallas - Fort Worth Area is reacting somewhat

* See Plate 8

TABLE 2
NUMERICAL CHANGES IN AGE COMPOSITION
DALLAS AND FORT WORTH SMSA'S, 1960 AND 1970

<u>Age Group</u>	<u>1960</u>		<u>1970</u>	
	<u>Number</u>	<u>Percent of Total</u>	<u>Number</u>	<u>Percent of Total</u>
<u>Young (0-14 Years)</u>				
Under 5	199,342	12.0	217,137	9.4
5 - 9	179,257	10.8	239,404	10.3
10 - 14	151,588	9.2	237,342	10.2
Sub-Total	530,187	32.0	693,883	29.9
<u>High School, College, New Family (15-24)</u>				
15 - 19	113,767	6.9	207,014	8.9
20 - 24	109,165	6.6	204,165	8.8
Sub-Total	222,932	13.5	411,179	17.7
<u>Prime Labor Force (25-44)</u>				
25 - 34	242,383	14.6	340,577	14.7
35 - 44	233,047	14.1	278,292	12.0
Sub-Total	475,430	28.7	618,869	26.7
<u>Older Labor Force (45-64)</u>				
45 - 54	182,634	11.0	246,508	10.6
55 - 59	71,558	4.3	96,692	4.2
60 - 64	55,823	3.4	80,385	3.5
Sub-Total	310,015	18.7	423,585	18.3
<u>Elderly (65 and Over)</u>				
65 - 74	79,355	4.8	108,269	4.7
75 and Over	38,897	2.3	62,251	2.7
Sub-Total	118,252	7.1	170,520	7.4
Total	1,656,816	100.0	2,318,036	100.0

Source: U. S. Census

differently than most urban areas as a result of the heavy in-migration of younger families, resulting in a tendency to offset the natural ageing process of the resident population. Table 2 shows the change in age composition which occurred in the 1960-70 decade in the combined 8 county Dallas and Fort Worth SMSA'S.

The change in the percentage of the total population represented by each age group was modest. The reduction in the birth rate is reflected by the percentage of young in the population. The labor force group remained quite stable and the elderly showed a slight increase. It is anticipated that there will be a continued reduction in the young and youth groups, with the labor force group remaining fairly stable and the elderly showing a significant increase. The change in age composition will result in a higher percentage of adults and elderly in the population. The demand for recreational facilities will be significantly influenced by change with an increase in the demand for more passive facilities such as hiking, bicycling, nature study and for golf and similar games.

Income in the area has also changed significantly in recent years and is expected to continue to change. The median family income in the market area was approximately \$5,300 in 1960 and \$10,500 in 1970. The 1960 per capita income was approximately \$2,100 in 1960 and had risen to \$3,500 by 1970. For example, Table 3 illustrates the family income change for Dallas County from 1960 to 1970 by income range.

TABLE 3
TREND IN FAMILY INCOME DISTRIBUTION
DALLAS COUNTY, 1960 AND 1970

<u>Income</u>	<u>1960</u>		<u>1970</u>	
	<u>Number</u>	<u>Percent of Total</u>	<u>Number</u>	<u>Percent of Total</u>
Under \$ 1,000	9,040	3.6	6,414	1.9
\$ 1,000 to \$ 1,999	13,896	5.6	7,853	2.3
\$ 2,000 to \$ 2,999	17,605	7.1	9,931	2.9
\$ 3,000 to \$ 3,999	23,093	9.3	12,616	3.7
\$ 4,000 to \$ 4,999	26,579	10.8	14,497	4.3
\$ 5,000 to \$ 5,999	28,967	11.7	17,290	5.1
\$ 6,000 to \$ 6,999	26,038	10.5	19,260	5.6
\$ 7,000 to \$ 9,999	55,456	22.3	67,190	19.7
\$ 10,000 and Over	47,458	19.1	185,793	54.5
Total	248,132	100.0	340,844	100.0
Median Income	\$6,188		\$10,680	

Source: U. S. Census

While part of the income rise results from inflationary trends, a substantial amount of the gain represents a genuine increase. It is estimated that the average family income in the market area will rise as follows:

<u>1970</u>	<u>1980</u>	<u>1990</u>
\$10,500	\$12,700	\$15,000

The rise in income will influence the social, cultural and recreational demands of the population. The increased income will make it possible for more people to acquire recreational equipment such as sports equipment, boats, fishing tackle, cameras, bicycles and other items for outdoor activity.

Leisure Time and Mobility

The average work week of the urban dweller has been decreasing in recent years resulting in the availability of more time for hobbies, sports, recreation and entertainment. Several factors are continuing to influence the time spent at work and the availability of leisure including:

- a. An increase in automation and other technological changes in many types of industry.
- b. A trend toward four day and even three day work weeks with a concomitant increase in the number of days available for leisure or nonwork activities.
- c. Retirement systems and pension funds are tending to develop a growing leisure class among the elderly.

The trend toward more leisure time will increase the demand for recreation facilities in all areas including the areas proposed for recreation development on the Elm Fork.

The availability of automobiles and improved highways and streets has increased the attraction of special types of outdoor recreation facilities. The Elm Fork recreation facilities will have regional significance as a result of the availability of excellent automobile transportation and eventually could be served by the regional rapid transit facilities. Interstate Highway 35E generally parallels the Elm Fork and State Highway 114 is located near the west edge of the Elm Fork flood plain for a substantial distance.

No important interstate visitation is anticipated to the future recreational facilities on the Elm Fork as all are expected to be urban oriented to the immediate market area. Some overnight camping facilities would be possible near Interstate Highway 35E in the northern portion of the Project Area.

Local Interests

The interest of the various responsible local agencies in the Elm Fork Flood Control and Related Recreational Projects was not uniform and the conditions, at the time of this study, substantially complicates the planning of recreational facilities and the development of flood control works. The interests and attitudes of the responsible local agencies are summarized as follows:

a. City of Dallas Park and Recreation Department - The City of Dallas has aggressively pursued a greenbelt development program in the entire Trinity River System within the City's jurisdiction and is the major owner of land in the Elm Fork flood plain.

Dallas is cooperative in the flood control effort and the recreational development and is agreeable to altering existing facilities such as the Elm Fork Shooting Range to improve the drainage characteristics of the system. Practically all right-of-way needed for that portion of the flood control works in the City of Dallas is now owned by the City Park and Recreation Department. Dallas seriously seeks to protect its major investment in open space and recreation facilities and desires that the Flood Control Project recognize the importance of their investment and the park function.

The Dallas Water Utility Department also has a major interest in the Elm Fork as it is the main raw water supply channel. The Water Department is cooperative with the Flood Control Project provided that construction procedures and plans protect the water supply function.

b. City of Irving - The City of Irving is not presently a major owner in the Elm Fork Area but proposes the full development of a park and greenbelt system along the west bank of the Elm Fork to compliment the proposals of the City of Dallas. The City of Irving is not in agreement with the levee alignments as currently planned and seek to adjust the levees to achieve a more equitable distribution of floodway, park land and protected land than is currently proposed. The differences concerning the levee alignments have resulted in no agreement as to the full nature of park and recreational facilities desired within the City of Irving.

c. City of Farmers Branch - The major emphasis of Farmers Branch is on land reclamation with little or no interest in the recreational development of the Elm Fork. On the basis of present plans, little or no significant recreational development would be possible or appropriate in Farmers Branch.

d. City of Carrollton - A 180 acre park site has been acquired by the City of Carrollton along the east bank of the Elm Fork. Some conflicts exist between the park site and the proposed levee locations but adjustments to alleviate the conflicts can be easily worked out. Other than the recently acquired park site, Carrollton has no other expressed park or open space interest along the Elm Fork but is definitely interested in the flood protection proposals of the Project. Plans for Carrollton's 180 acre park have not progressed to the point where facilities or cost can be evaluated.

e. City of Lewisville - No flood control works other than channel realignment and the increased channel capacity are proposed in the Lewisville area. The City has expressed interest in a very large park area extending from the Lewisville Dam to State Highway 121. No firm plans for acquisition of the approximately 2,100 acre tract were indicated. The proposed park would be on the extreme upper portion of the Elm Fork Project Area. Areas of important outdoor recreational potential exist downstream from State Highway 121 in what might be considered Lewisville's jurisdictional area, but the City is obviously not equipped to undertake the development or maintenance of the downstream areas at this time.

f. Town of Hebron - Practically no urban municipal facilities exist in Hebron and no plans for park or recreation development are presently contemplated. One private country club, located in the Elm Fork flood plain, exists in the Community. The impact of anticipated future urban development is likely to change the park and open space demands in Hebron.

g. Town of Coppell - The Town of Coppell expressed interest in flood protection but has no current plans for recreational development on the Elm Fork.

h. Counties of Dallas and Denton - The primary concern of the County Agencies contacted was in the road and highway crossings of the Elm Fork and in drainage protections. Both Counties were cooperative in their attitude toward both flood control and recreation development.

i. Local Private Groups - Strong opposition to major channel changes were voiced by such conservation and environmental groups as Save Open Spaces and The Sierra Club. Some local real estate interest were interested in the land reclamation potential of the flood control features of the Elm Fork Project. Generally, substantial disagreement exists over the merits of real estate reclamation versus channelization and it appears unlikely that acceptable plans will evolve without some compromise.

Existing and Prospective Water Oriented Recreational Resources Related to the Market Area

No totally comparable water recreation resource to the Elm Fork exists in the Region. Table 4 lists the major water oriented facilities in the Region which might influence or supplement the recreational activities on the Elm Fork.

All of the existing and proposed facilities listed are reservoirs and only White Rock and Bachman incorporated stream type environment such as exists on the Elm Fork. All of the reservoirs are expected to be significantly competitive for fishing and power boating but none offers the canoeing and natural river environment found on the Elm Fork and except for fishing, power boating, water skiing and picnicking, of which only fishing and picnicking are anticipated on the Elm Fork. The other facilities listed are recreational supplements rather than duplications of the proposed Elm Fork facilities.

TABLE 4
WATER ORIENTED AREAS IN THE REGION

<u>Existing Facility</u>	<u>County</u>	<u>Agency</u>	<u>Water Area or Total Area</u>
Arlington Lake	Tarrant	City of Arlington	N.A.
Bachman Lake	Dallas	City of Dallas	600 Acres (Total)
Garza-Little Elm	Denton	Corps of Engineers	23,280 Acres (Water)
Grapevine Lake	Tarrant Denton	Corps of Engineers	7,380 Acres (Water)
Lavon Lake	Collin	Corps of Engineers	21,400 Acres (Water)
Eagle Mountain Lake	Tarrant Wise Dallas	Tarrant Co. W.C.E. 10#1	8,500 Acres (Water)
Lake Ray Hubbard	Collin Kaufman Rockwall	City of Dallas	22,745 Acres (Water)
Lake Worth	Tarrant	City of Fort Worth	3,267 Acres (Water)
Mountain Creek Lake	Dallas	City of Dallas and D.P. & L. Co.	2,940 Acres (Water)
North Lake	Dallas	City of Dallas and D.P. & L. Co.	1,200 Acres (Total)
White Rock Lake and Creek	Dallas	City of Dallas	2,306 Acres (Total)
<u>Proposed Facilities</u>			
Aubrey Reservoir	Denton Cooke	Corps of Engineers	25,200 Acres (Water)
Lakeview Reservoir	Dallas Tarrant	Corps of Engineers	9,510 Acres (Water)
Roanoke Reservoir	Ellis Denton	Corps of Engineers	N.A.

Recreation and Related Demands

The demand for open space activities and recreational facilities has already been established in the Elm Fork Project Area by the developments of the City of Dallas, City of Carrollton, City of Irving and two private golf courses (See photos). For example, in 1970 the L. B. Houston Golf Course had an attendance of 60,000 and an income of \$105,000. In a 42 month period, there were 235,000 rounds of golf played on it. The Elm Fork Shooting Range has averaged 4,700 shooters per month over an 82 month period of operation. The Nature Area has an annual attendance of over 25,000 people of which about 10,000 are in organized groups including university and high school classes and classes from the Museum of Natural History. The demands on the Elm Fork Area are expected to increase with the growth



L. B. HOUSTON
(ELM FORK)
GOLF COURSE IN
THE ELM FORK
FLOOD PLAIN



ELM FORK
PUBLIC
SHOOTING
RANGE



PARK AREA AT
CALIFORNIA
CROSSING PARK
IN THE ELM FORK
FLOOD PLAIN

of the urban population in the market area and the availability of facilities. Existing evidence indicates that full utilization will be made of all outdoor recreation and open space facilities provided within the Project limits on the Elm Fork.

Carrying Capacity

The existing facilities in the Elm Fork Area have an annual attendance of 345,000 persons. The future carrying capacity of the recreational development will be determined by the extent of the area developed for recreation and related use and the nature of such development. Except for the Nature Areas, the recreational development is expected to be of an urban type with strict control of sensitive areas resulting in a relative high carrying capacity. Trails are expected to be surfaced, land areas drained and river bank areas subject to heavy use would be protected. The maximum desirable annual capacity of the recreational areas proposed in the Cities of Dallas, Irving and Carrollton is 3.5 million. Full development of the entire Elm Fork Area would provide facilities with an annual capacity of approximately 7 million visitors. The full development capacity compares with 8.5 million users of the White Rock Lake Park in Dallas which is considered to be operating above the desirable capacity at the present time.

The estimated use demand for recreational facilities in the Elm Fork Area is based upon the following maximum annual use demand derived from relationships to existing experience of the City of Dallas and the nature of the areas involved.

Golfing	250,000
Shooting	150,000
Picnicking and other passive use	800,000
Nature Study, etc.	150,000
Boating including special facilities	350,000
Fishing	200,000
Hiking and Bicycling	500,000
Special events	300,000
Athletics including spectators	500,000
Camping	300,000
	<hr/>
Total - Annual	3,500,000

It should be emphasized that both user demand and carrying capacity are subject to influence by decisions beyond the scope of this study such as the final decisions concerning the flood control features of the Project and the desires of the Local Agencies.

V - OUTDOOR RECREATION ATTENDANCE

The per capita use rate for the existing recreational facilities in the Elm Fork Area is relatively low but the increase in population in the close proximity and the expansion of facilities will substantially increase the ratio. The existing per capita use rate for the existing Elm Fork facilities as related to the market area is 0.21. In contrast, the per capita use rate for the White Rock Lake facilities is 5.2. White Rock Lake Park is a fully developed facility in the same general market area and is surrounded by mature urban development.

The facilities on the Elm Fork are not expected to attract as heavy use as those of the White Rock Lake Park. The per capita use rate is expected to change as follows:

<u>Date</u>	<u>Use Rate</u>
1970	0.21
1980	0.5
1990	1.3
2000	1.5

The estimated use rate for the market area is based upon the development of at least 70 percent of the recreational use potential of the Elm Fork and the completion of that percentage of development by about 1980. The addition of camping facilities and total development of the recreational potential of the Elm Fork could result in a per capita use rate of 2.5 by 1990 or 2000 resulting in an annual use demand of 7 million or the estimated capacity of proposed recreation facilities.

Assuming 1980 to be the third year after the Project is completed, the outdoor recreational use would be 1,021,000 as of that year. The following is the projected recreational use needs for the Project.

<u>1980</u>	<u>1990</u>	<u>2000</u>
1,021,000	3,363,750	4,252,500

By the year 2000, the market area is expected to be completely developed and recreational use will expand thereafter largely as a result of increased availability of facilities and the variety of facilities provided.

If local agencies are found to undertake the development of potential facilities which currently have no sponsor, such as the development upstream from the Interstate Highway 35E Bridge and the significant park area immediately downstream from the Bridge, the recreational use will be expanded accordingly. Camping and horse-back riding are especially adapted to the unsponsored areas (See Plate 9C).

The life of the Project is considered to be indefinite or permanent though its utility might be influenced by the life of the upstream reservoirs. The average annual attendance over the period to the year 2000 is estimated to be 3 million uses.

Lacking definition of sump areas and drainage facilities outside the levee areas and precise locations for the levees, it is not possible to determine what additional real estate might be required beyond the Project Area for recreational or related purposes to enhance the use potential.

VI - PLAN OF DEVELOPMENT

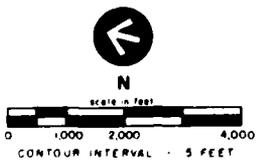
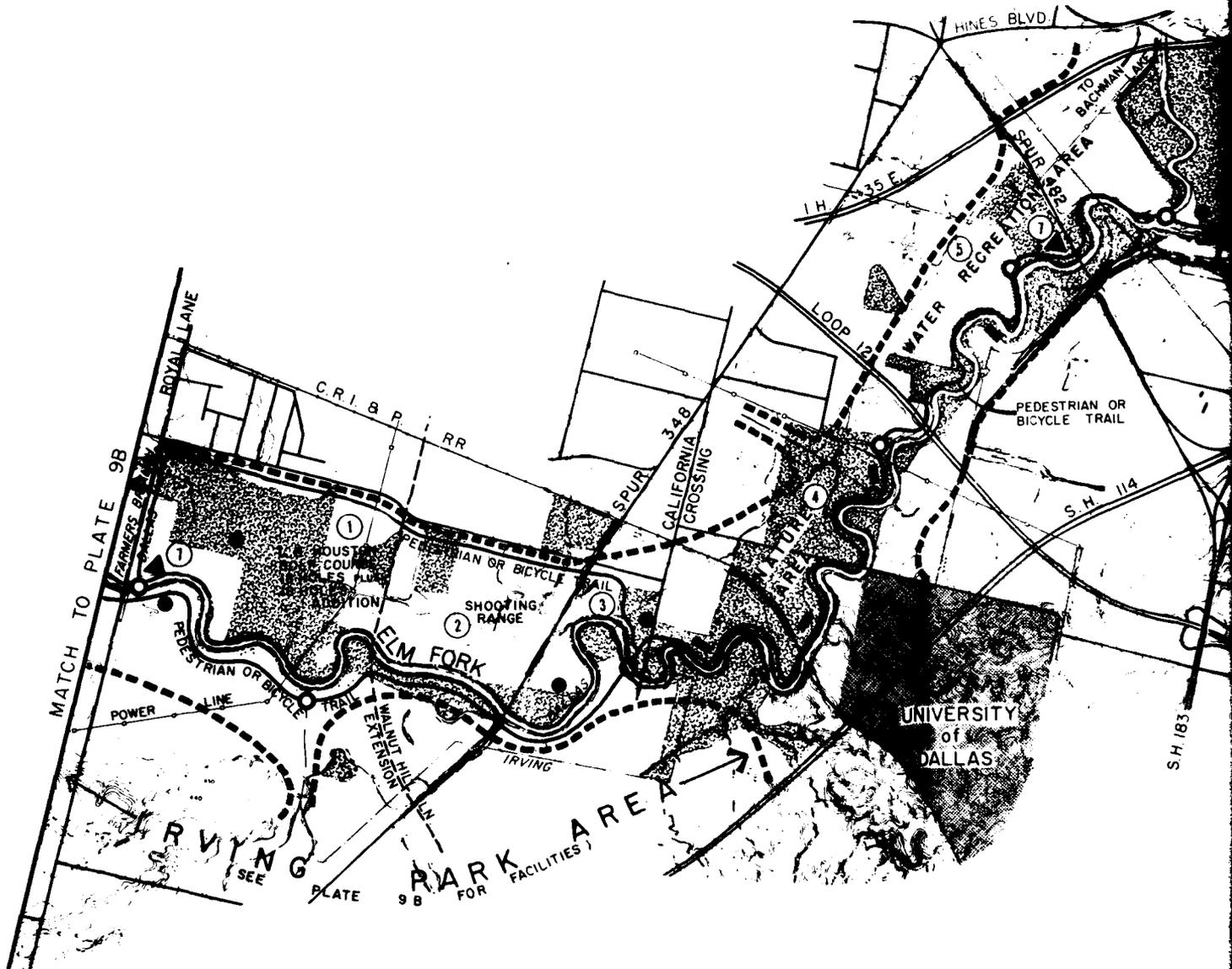
The Plan of Development for Recreation and Open Space on the Elm Fork within the Project Area is shown by Plates 9A, B and C. The Plan represents a combination of local plans plus suggested developments to achieve a reasonable utilization of the potential of the Elm Fork within the constraints of the Project's flood control purpose.

The recreational and open space facilities proposed are unique to the Elm Fork inasmuch as the Elm Fork represents a special environmental condition within a rapidly growing urban complex. There is no other similar area and conservation of its unique quality must be a primary consideration of any development on the Elm Fork flood plain.

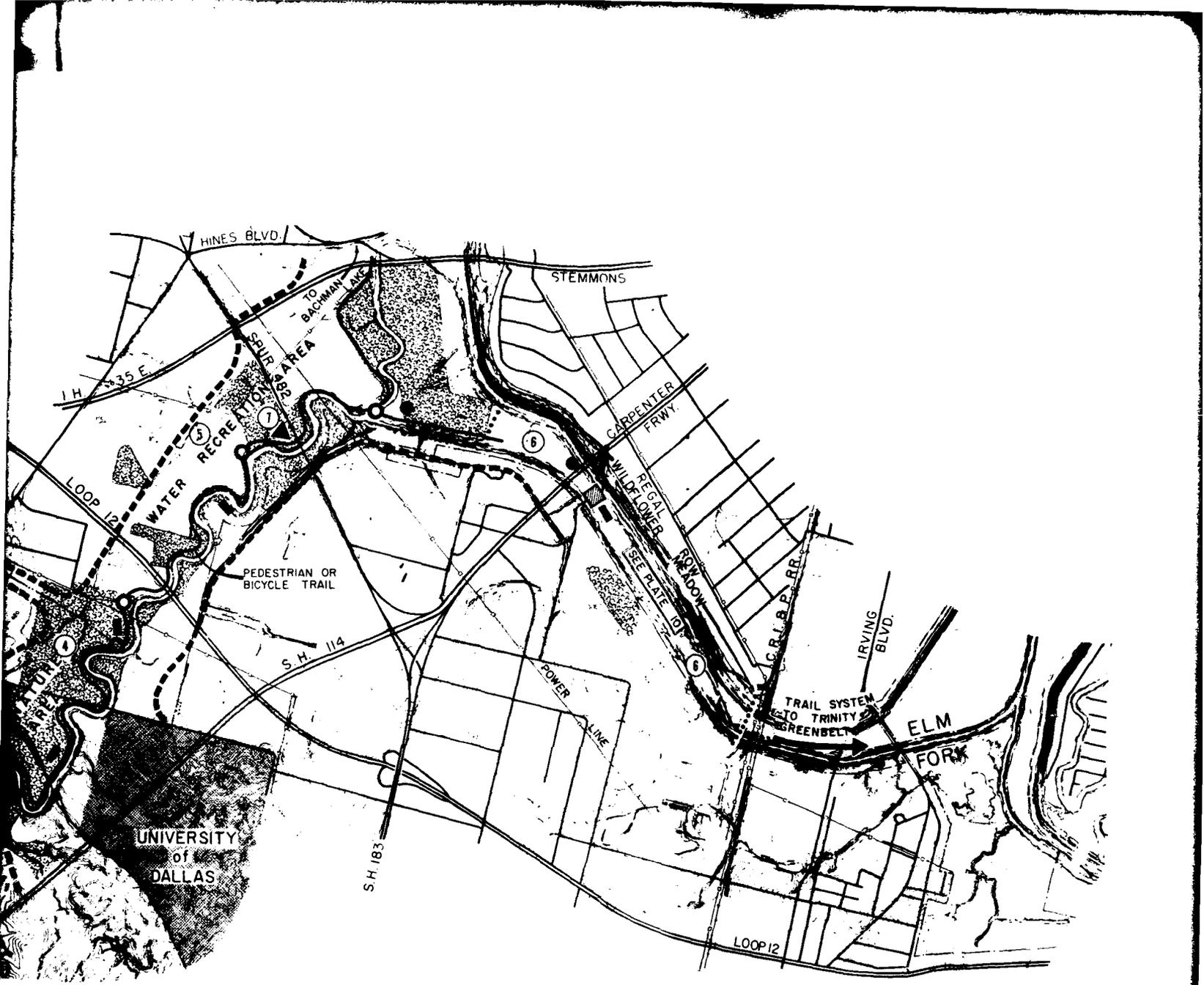
Plate 9A shows the development plans for that portion of the Elm Fork Area within the Dallas jurisdiction. Within the Dallas area the following facilities exist, are planned or will be expanded (Item number reference on Plate 9A).

DALLAS JURISDICTION

1. L. B. Houston Golf Course - All of the land from Royal Lane south to the Walnut Lane extension and from Luna Road to the Elm Fork Channel will be utilized for golf course purposes. The addition of 18 more holes of golf is planned and will be undertaken as a project of the Dallas Parks and Recreation Department without the Corps of Engineers participation. The possible loss of two or more greens and fairways from the existing course for levee right-of-way poses a major space and development problem.
2. Elm Fork Shooting Range - This existing facility is proposed to be moved and realigned so as to reduce the obstruction to the movement of flood waters created by its present design and location.
3. California Crossing Park - The existing park facilities at California Crossing will be expanded to include all of the floodway land from State Highway Spur 348 to California Crossing Road on the east side of the Elm Fork Channel. Picnic facilities with fishing along the River and pedestrian and bicycle trails represent the basic improvements proposed for the expanded California Crossing Park. A special pedestrian-bicycle bridge is indicated just above the California Crossing Dam to tie to the Irving Park Development proposed on the west side of the River. The bridge is proposed to be of special floating pontoon design with provisions for it to be opened like a gate at flood stage. (See Plate 15.)
4. Elm Fork Nature Area - The Nature Area now located on Wildwood Road is proposed to be expanded both upstream and downstream along the meanders of the River extending from California Crossing Road downstream to the Wildflower Meadows which will be a continuation of the Nature Area. A trail system is to interconnect the



- PROPOSED LEVEE
- BRIDGE CROSSING ON TRAIL
- RESTROOMS
- TRAILSIDE MUSEUM
- ▲ CANOE LAUNCHING AREA



RECREATIONAL APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

**PROPOSED
 RECREATION AND OPEN SPACE PLAN
 PLATE 9A**

U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY 1973

TRAIL
 AREA

2

CARROLLTON PARK AREA

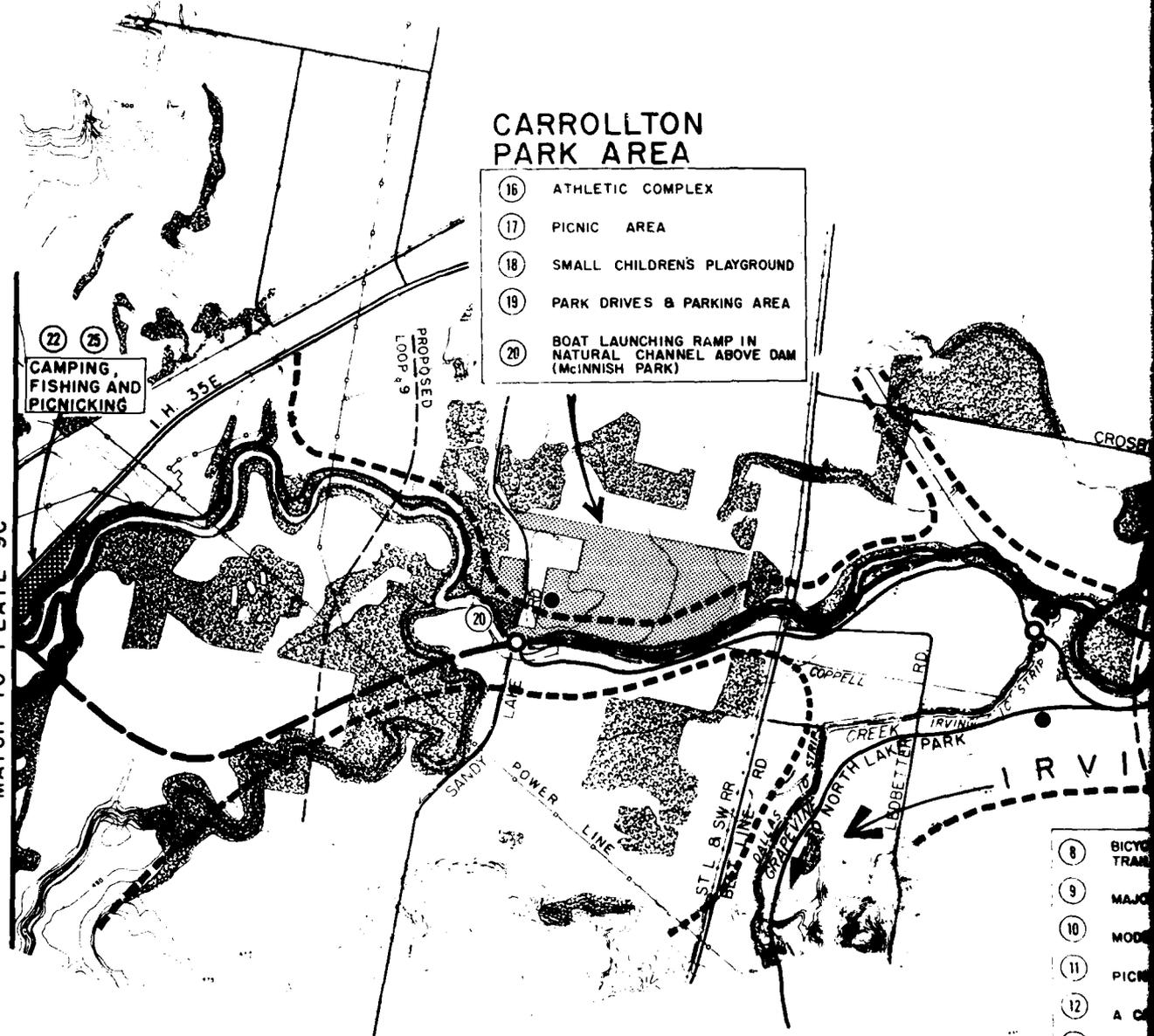
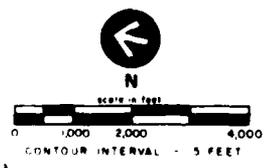
- 16 ATHLETIC COMPLEX
- 17 PICNIC AREA
- 18 SMALL CHILDRENS PLAYGROUND
- 19 PARK DRIVES & PARKING AREA
- 20 BOAT LAUNCHING RAMP IN NATURAL CHANNEL ABOVE DAM (McINNISH PARK)

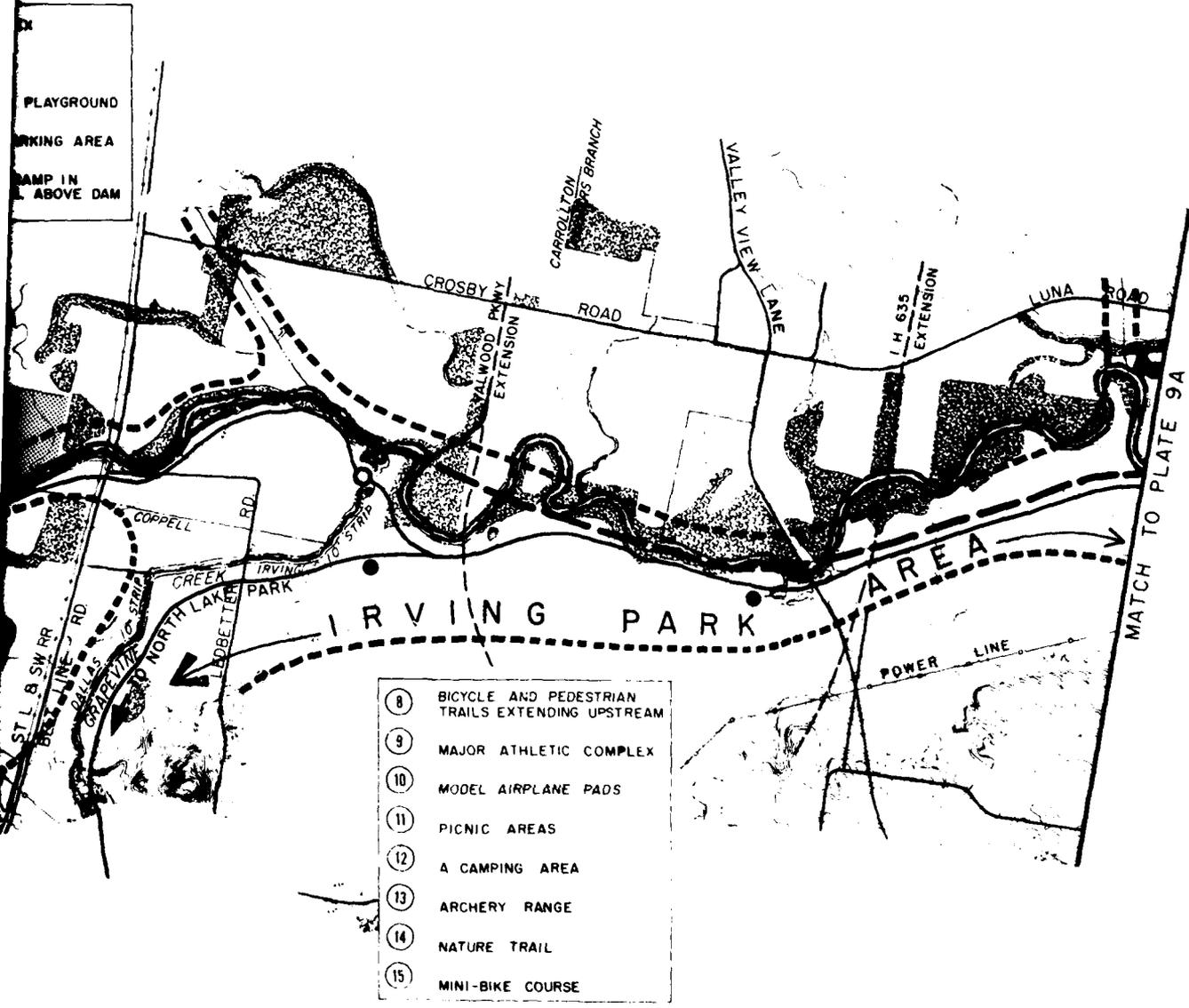
22 25
CAMPING, FISHING AND PIGNICKING

MATCH TO PLATE 9C

- 8 BICYCLE TRAIL
- 9 MAJOR ROAD
- 10 MODERATE ROAD
- 11 PICNIC AREA
- 12 A C...
- 13 ARCH...
- 14 NAT...
- 15 MINN...

- PROPOSED ELM FORK CHANNEL
- PROPOSED LEVEE
- BRIDGE CROSSING ON TRAIL
- RESTROOMS



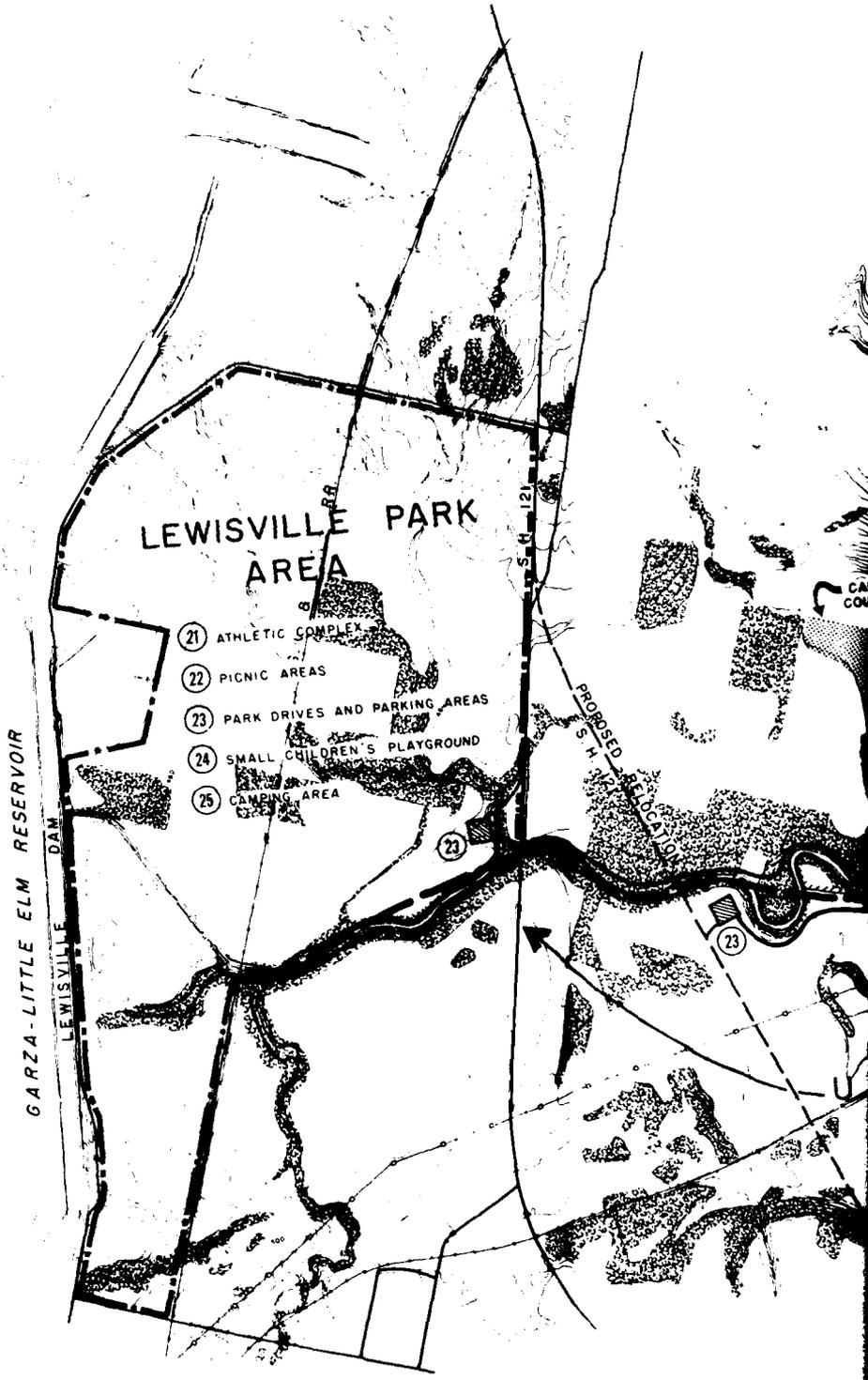


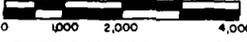
- ⑧ BICYCLE AND PEDESTRIAN TRAILS EXTENDING UPSTREAM
- ⑨ MAJOR ATHLETIC COMPLEX
- ⑩ MODEL AIRPLANE PADS
- ⑪ PICNIC AREAS
- ⑫ A CAMPING AREA
- ⑬ ARCHERY RANGE
- ⑭ NATURE TRAIL
- ⑮ MINI-BIKE COURSE

RECREATION AND OPEN SPACE PLAN
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND FORT WORTH, TEXAS

**PROPOSED
 RECREATION AND OPEN SPACE PLAN
 PLATE 9B**
 U.S. ARMY ENGINEER DISTRICT FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES DALLAS, TEXAS MAY 1975

2



- 
 N
 SCALE IN FEET

 0 1,000 2,000 4,000
 CONTOUR INTERVAL - 5 FEET
-  PROPOSED ELM FORK CHANNEL
 -  PARKING AREA
 -  TREE COVER
 -  SHELTER & RESTROOMS
 -  BRIDGE CROSSING ON TRAIL
 -  "OX-BOW" AREA TO BE RETAINED



MATCH TO PLATE 9B

RECREATION APPENDIX
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND TARRANT COUNTIES, TEXAS

**PROPOSED
 RECREATION AND OPEN SPACE PLAN
 PLATE 9C**

 U S ARMY ENGINEER DISTRICT - FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER & ASSOCIATES - DALLAS, TEXAS - MAY 1973

2

various parts of the Nature Area and extend from California Crossing Road to the confluence of the Elm Fork and the West Fork of the Trinity River. (The lower end of the Project.)

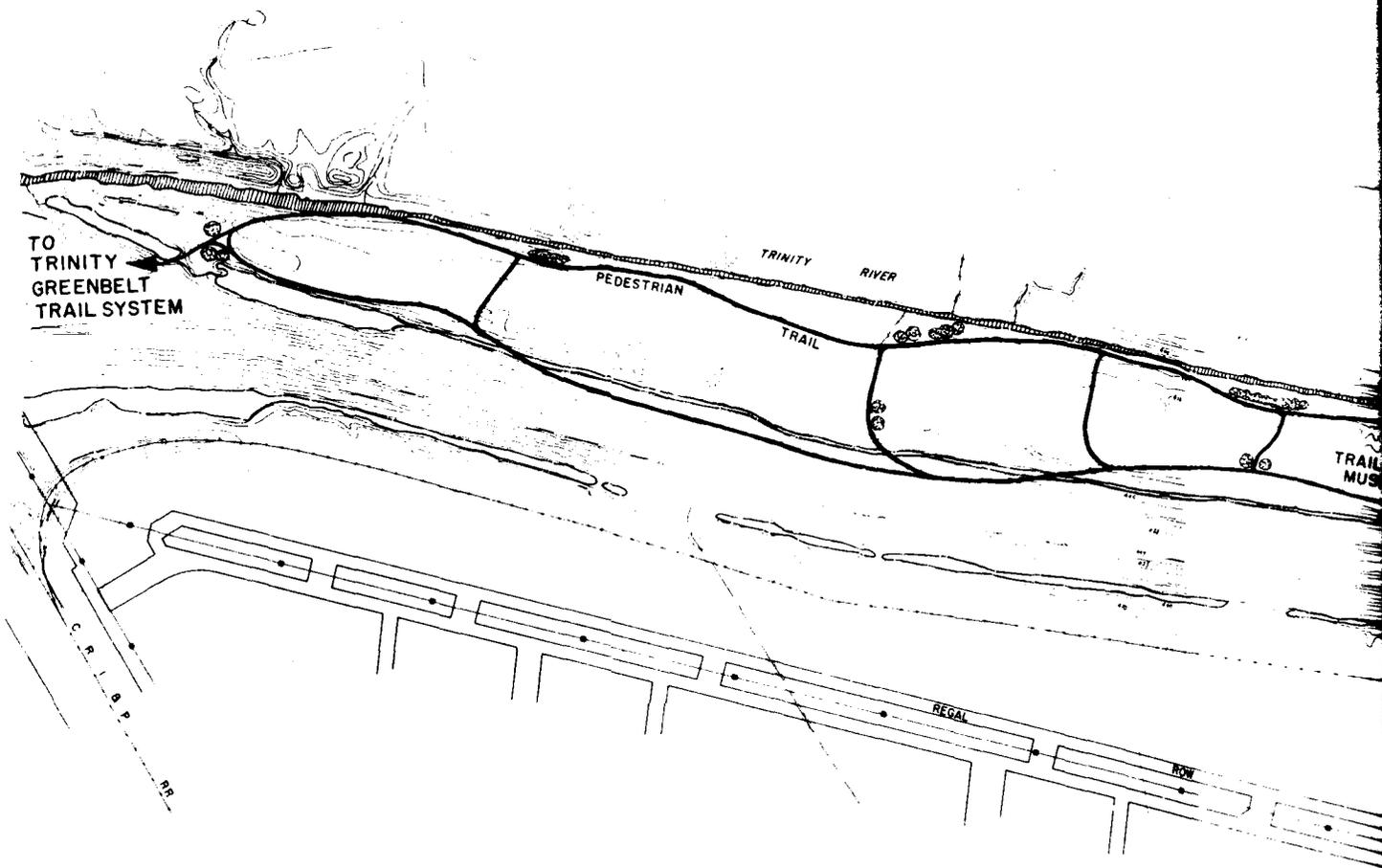
5. Water Recreation Area - A series of borrow pit lakes between the proposed levees and the Elm Fork from the vicinity of Spur 348 downstream to the Bachman water reserve area are proposed to be developed for water recreation including water skiing, fishing and similar activities. A tie to the Bachman Lake Park area is proposed by a trail leading from the main trail system along the north side of the water reserve area.

6. The Wildflower Meadow - The area in the Elm Fork floodway downstream from the Bachman water intake area to the West Fork confluence has been designated for development as a Wildflower Meadow. The Wildflower Meadow is being sponsored by a Dallas Garden Club and is proposed to contain a trail circulation system, trail side herbarium display, a parking area and rest room facilities. The major emphasis will be on massive seasonal displays of Texas Wildflowers. The trail system will be interconnected with the entire Trinity Greenbelt System. The wildflower displays will be visible from State Highway 114 (Carpenter Freeway) Bridge and from the proposed TACV Transit Line between the Dallas - Fort Worth Airport and Downtown Dallas. (See Plate 10.)

7. Canoeing Course - The only portion of the Elm Fork Channel to be left in its natural state, suitable for canoeing and small boat use (no motors), is that portion between Royal Lane and the Bachman water intake area. It is proposed that the 7 mile reach of the Elm Fork between the two points be designated for canoeing and small boat use and that a launching site with parking facilities be constructed at each end of the canoe course.

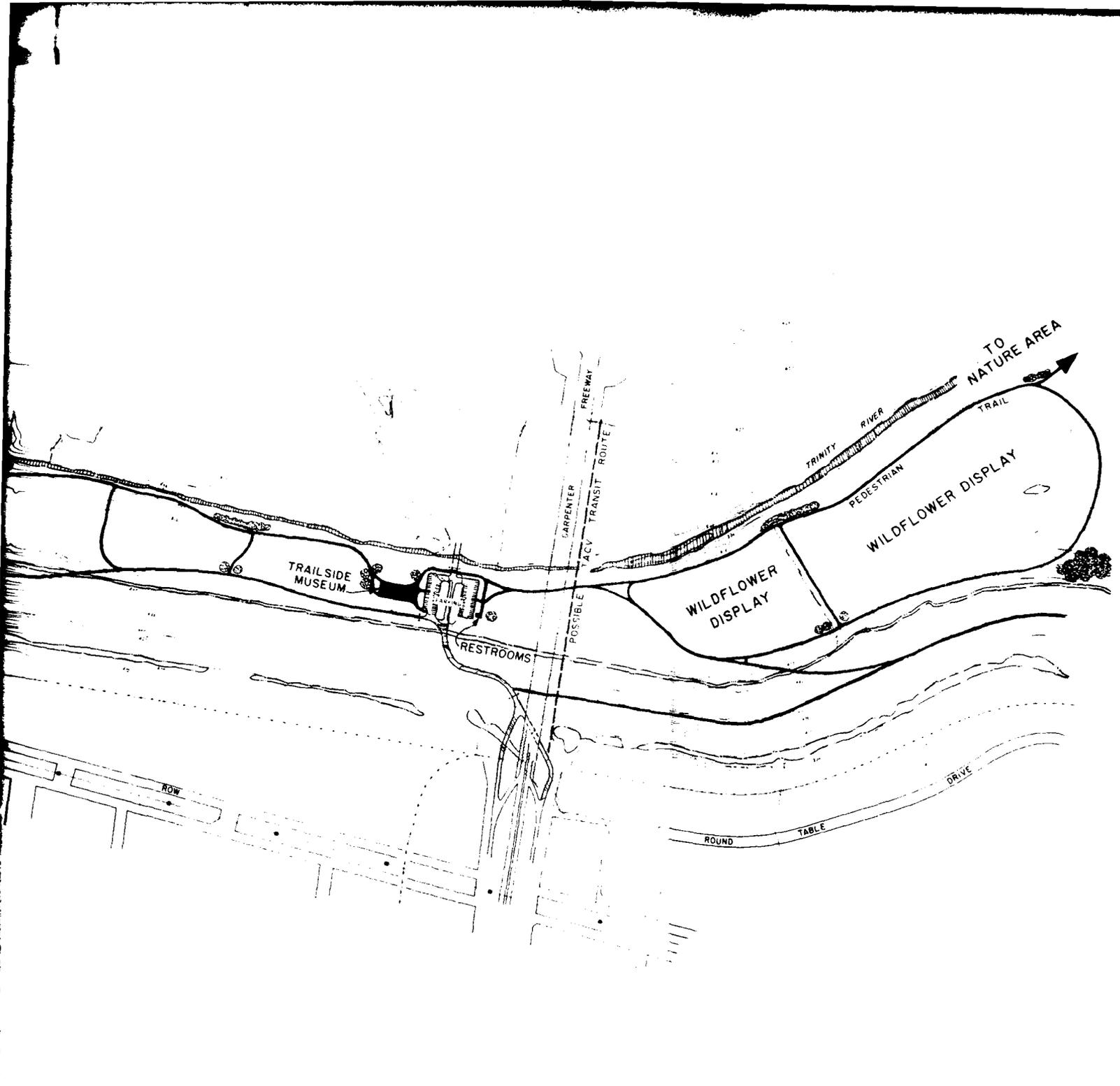
The Project related recreational and open space development considered part of the Dallas Plan includes the following:

- a. 7.2 miles of bicycle and pedestrian trails from Royal Lane south to the Wildflower Meadow and on the levee along Luna Road.
- b. 5.2 miles of trail through the Wildflower Meadow to the West Fork.
- c. 4 Parking areas.
- d. 2 Canoe launching ramps with site improvements.
- e. 3 Additional toilet - rest rooms.
- f. 5 Trail side museum structures (See Plates 11, 12 and 13) - two large and three small ones.
- g. 1 Special pontoon bicycle and pedestrian bridge crossing the Elm Fork (See Plate 15).



MARVIN SPRINGER & ASSOCIATES
 URBAN PLANNING CONSULTANTS
 DALLAS TEXAS

CONTOUR INTERVAL 5 FEET



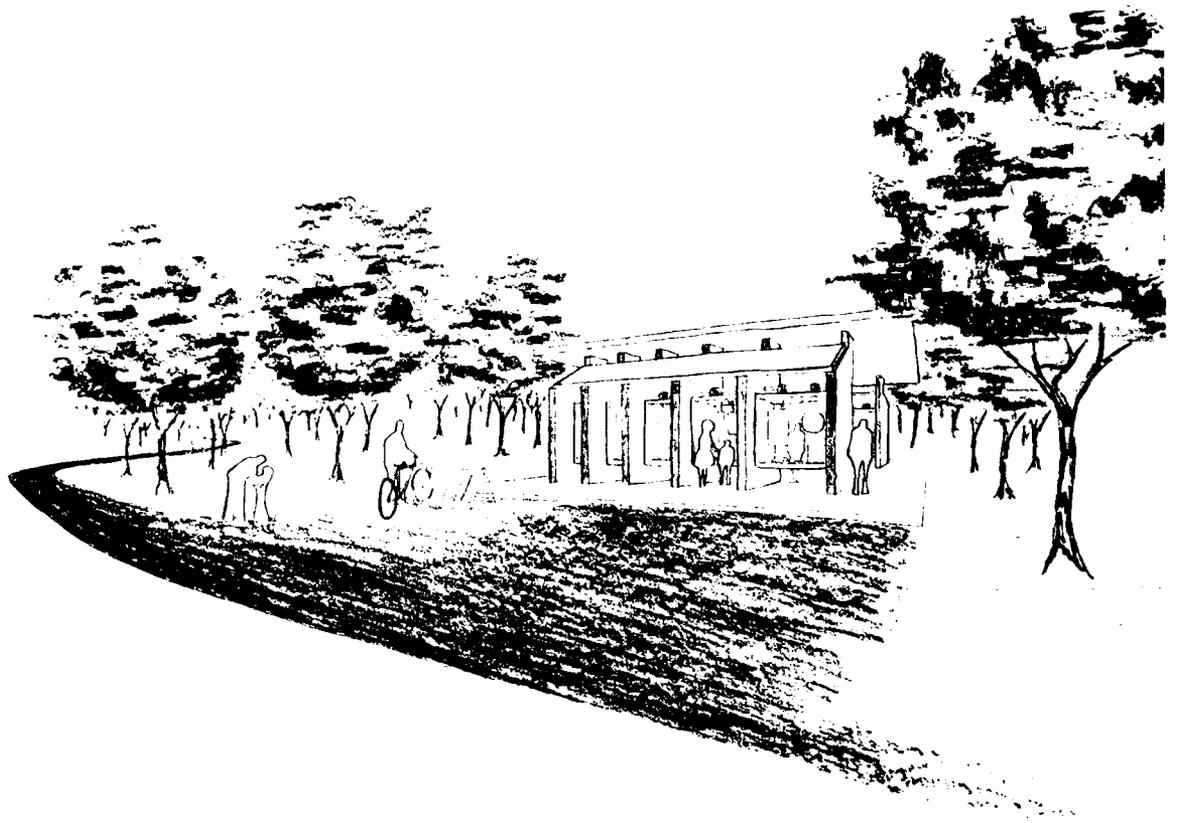
RECREATIONAL AGENCY
 ELM FORK FLOOD CONTROL PROJECT
 DALLAS AND DENTON COUNTIES, TEXAS

**WILDFLOWER MEADOW
 PLATE 10**

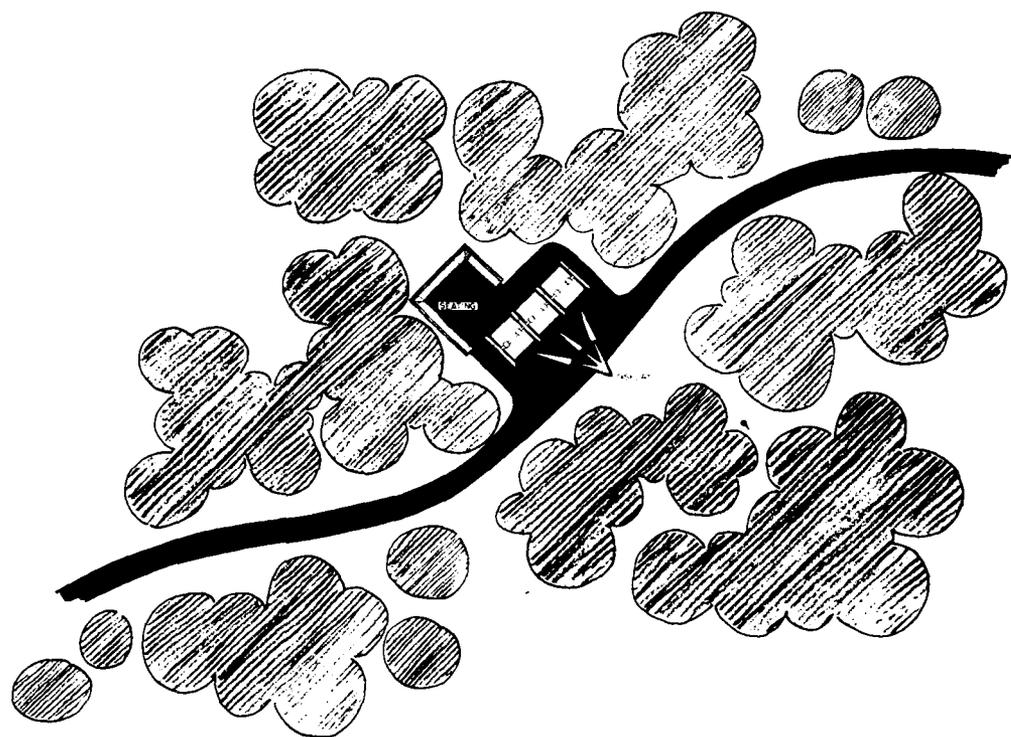
U. S. ARMY ENGINEER DISTRICT, FORT WORTH, TEXAS
 PREPARED BY MARVIN SPRINGER AND ASSOCIATES, DALLAS, TEXAS, MAY, 1974



SMALL TRAILSIDE MUSEUM AND REST AREA



LARGE TRAILSIDE MUSEUM



PLAN - TRAILSIDE MUSEUM AREA

- h. 2 Trail bridge structures over drainage ditches leading from the main channel.
- i. Access roadways to parking areas, 7,000 linear feet.
- j. 20 Picnic units.
- k. 10 Bicycle racks (8 vehicles).
- l. 15 Trail side benches (concrete).
- m. 6 Drinking fountains and water hydrants.
- n. 10 Motorcycle barriers and control gates (See Plate 14).

Trail clearing, site preparation, replacement of turf and vegetation on disturbed areas, some grading and local drainage will also be required but the extent of such work items cannot readily be determined at this time.

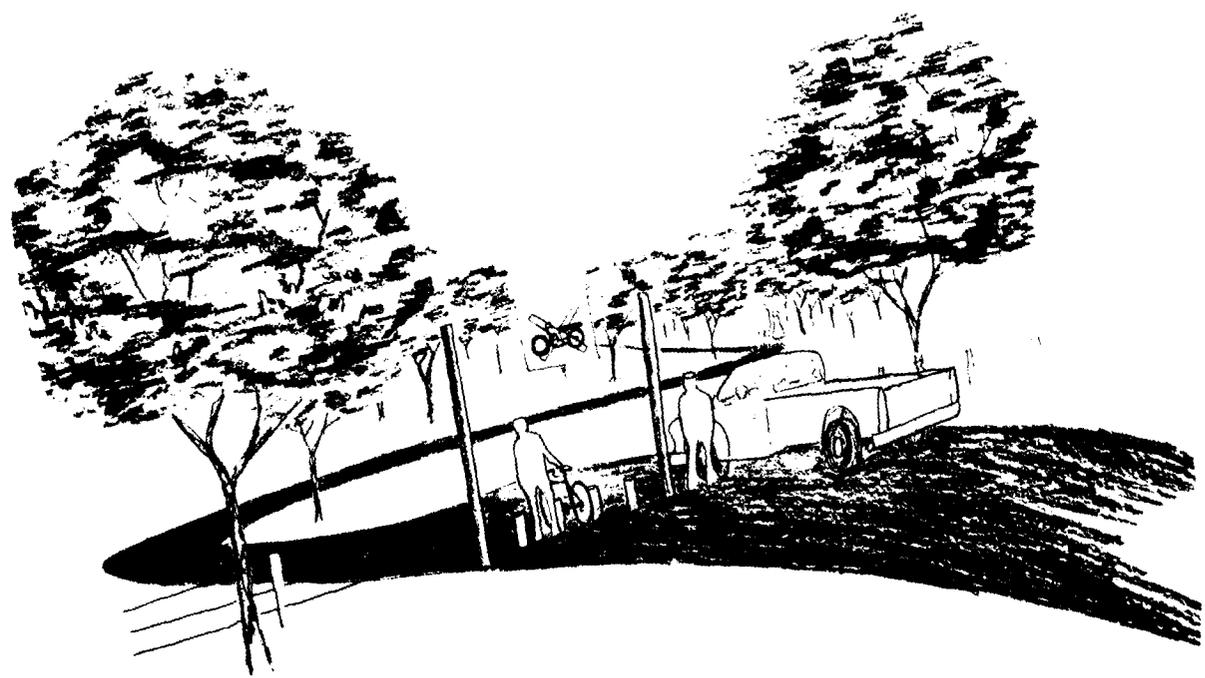
Other development items, such as additions to the L. B. Houston Golf Course other than replacement of greens and fairways resulting from levee construction, are anticipated to be at the cost of the City of Dallas Park and Recreation Department or other local agencies.

IRVING JURISDICTION

Facilities planned for recreational development in the area under Irving's jurisdiction are not as well defined due to the City's uncertainty as to the levee locations on the west side of the Elm Fork.

The following facilities represent the development intent of the City of Irving along the Elm Fork downstream from Belt Line Road:

- 8. Bicycle and pedestrian trails extending upstream from the California Crossing Bridge to North Lake.
- 9. A major athletic complex including softball, football, soccer and baseball.
- 10. Model airplane pads.
- 11. Picnic areas.
- 12. A camping area.
- 13. Archery range.
- 14. Nature trail.



MOTORCYCLE BARRIER AND CONTROL GATE

15. Mini-bike course.

The Project related recreation and open space development in the Irving jurisdiction would include the following:

- a. 12.7 Miles of bicycle and pedestrian trails.
- b. 3 Toilet - rest rooms.
- c. 3 Shelters - picnic areas.
- d. 4 Parking areas (one large one at athletic complex).
- e. 2 Trail side museums (nature area - See Plate 11).
- f. 10 Picnic units.
- g. 10 Trail side benches (concrete).
- h. 2 Trail bridges (tributary drainageways).
- i. 6 Bicycle racks (8 vehicles).
- j. 8 Motorcycle barriers and control gates (See Plate 14).
- k. 10 Drinking fountains and water hydrants.
- l. 5.4 Miles park drives and access roadway.
- m. 6 Softball diamonds.
- n. 1 Football - soccer field.
- o. 2 Baseball diamonds.
- p. Athletic service building with toilets and showers.
- q. Bleachers, backstops, goals and fencing.
- r. Mini-bike course (6,000 square yards).

Trail clearing, tree planting in open areas, general site preparation, replacement of turf and vegetation on disturbed areas, local drainage and seeding will also be required as part of the Project but the extent of such work items cannot be fully determined in the Irving jurisdiction at this time.

CARROLLTON JURISDICTION

The development of the 180 acre park site recently acquired by Carrollton represents the extent of the recreational facilities presently planned in the Carrollton area. To provide some basis for estimating the probable recreational development costs without the benefit of a specific plan, the following items were assigned to the Carrollton Park area:

16. Athletic complex.
17. Picnic area.
18. Small children's playground.
19. Park drives and parking areas.
20. Boat launching ramp in natural channel above the Dam (McInnish Park).

The Project related recreation and open space development in the Carrollton area would include the following facilities.

- a. 2 Softball diamonds.
- b. 1 Baseball diamond
- c. 1 General purpose playfield.
- d. 1 Multipurpose surfaced play area.
- e. 1 Toilet - rest room.
- f. 10 Picnic units.
- g. 2 Boat launching ramps.
- h. 2 Parking areas.
- i. 3 Drinking fountains and hydrants.
- j. 1 Mile pedestrian and bicycle trails.
- k. 1 Park shelter.
- l. Playground equipment and surfacing.

Site preparation, grading, seeding, local drainage and tree planting will also be required but the extent of such work items cannot be determined at this time.

LEWISVILLE JURISDICTION

No specific facilities have been planned in the proposed Lewisville Park nor has any land been acquired. For the purposes of preliminary estimating, a moderate amount of recreational development was assumed in the Lewisville area to include the following facilities.

21. Athletic complex.
22. Picnic areas.
23. Park drives and parking areas.
24. Small children's playground.
25. Camping area.

The Project related recreation and open space development assumed in the Lewisville area would include the following facilities.

- a. 2 Softball diamonds.
- b. 1 Baseball diamond.
- c. 1 General purpose playfield.
- d. 2 Multipurpose surfaced play areas.
- e. 2 Toilet - rest rooms.
- f. 12 Picnic units.
- g. 3 Parking areas.
- h. 4 Drinking fountains and hydrants.
- i. 2 Park shelters.
- j. 3 Miles of pedestrian and bicycle trails.
- k. 3.5 Miles of park drive.
- l. Playground equipment and surfacing.

Site preparation, grading, seeding, local drainage and tree planting will also be required but the extent of such work items cannot be determined at this time.

UNSPONSORED AREAS

The development of a portion of the recreational potential of Elm Fork is located in areas outside of any current local jurisdiction and lacks local sponsorship. To assure allowance for the future development contingencies in unsponsored areas, the following recreational items are assigned to such areas. The unsponsored areas are generally located north of Sandy Lake Road to State Highway 121 including areas in Coppell, Hebron and potentially in the Lewisville jurisdiction.

26. Equestrian trail system upstream from Interstate Highway 35E related to the proposed channel relocation (See Plates 9C, 16 and 17).

27. Bicycle and pedestrian trail system.

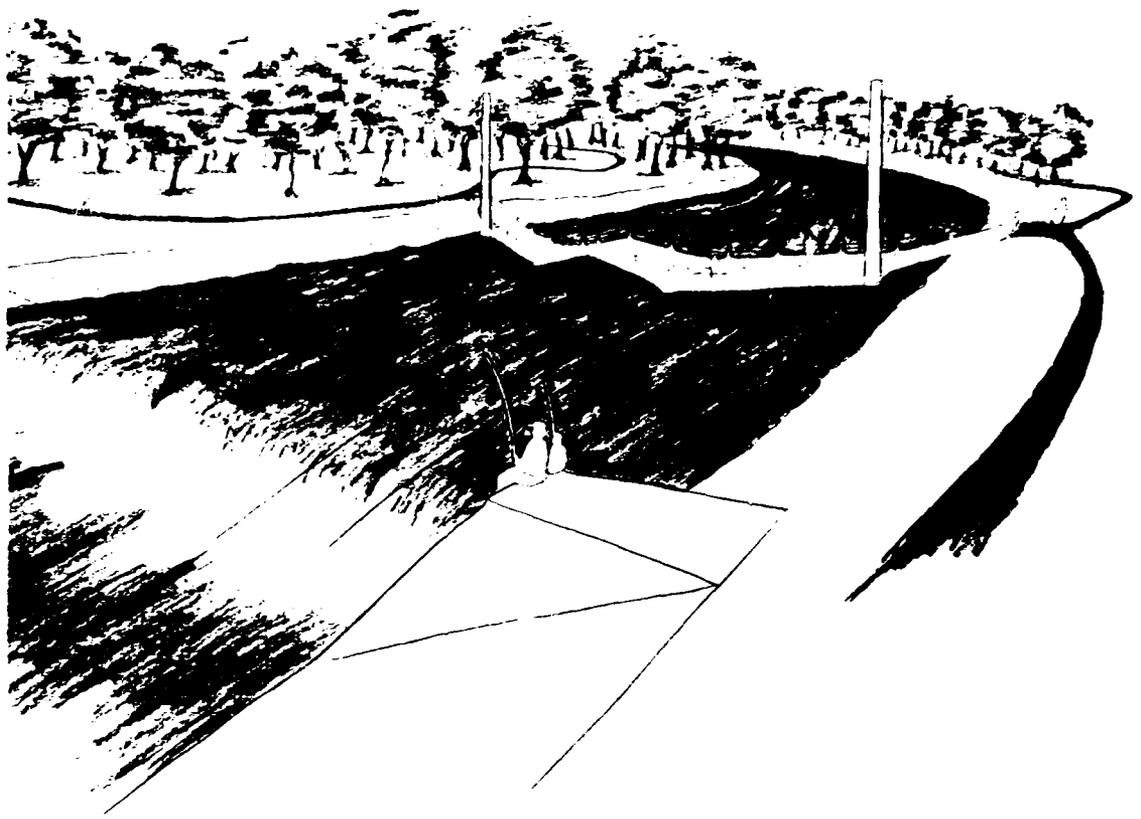
28. Picnic areas in oxbow cutoffs of the old Elm Fork Channel.

The possible project related recreation and open space development assumed in the unsponsored area would include the following facilities.

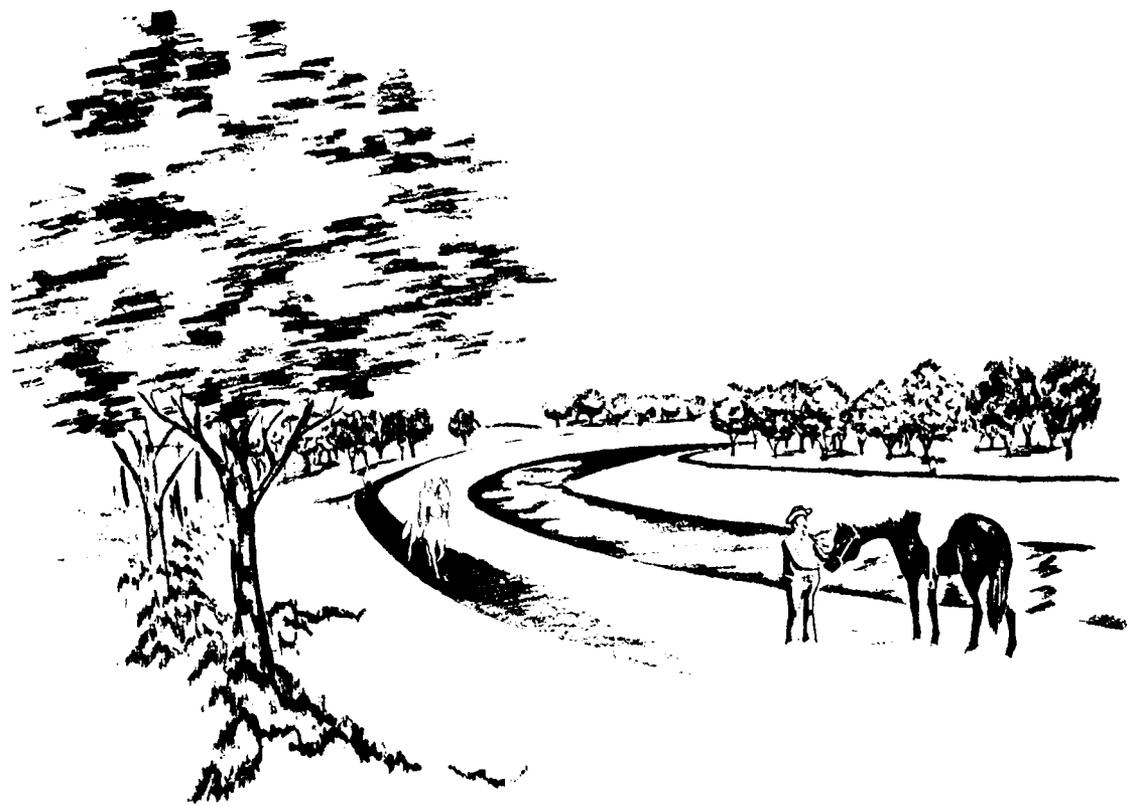
- a. 3 Miles of equestrian trail (graded and drained earth).
- b. 2 Parking areas and horse trailer storage.
- c. 4.3 Miles of pedestrian and bicycle trails.
- d. 10 Picnic units.
- f. 1 Toilet - rest room.
- g. 2 Park shelters.
- h. 2 Fenced paddock areas.
- i. 3 Miles perimeter fencing on equestrian trail side of new channel.
- j. 4 Motorcycle barriers and control gates (See Plate 14).
- k. 1 Pedestrian-Bicycle Bridge over new channel.

The initial recreation development as part of the Project is expected to consist primarily of the facilities planned by the Cities of Dallas, Irving and Carrollton. Future development is expected to include the Lewisville Park and unsponsored recreational development illustrated by Plates 9B and C. The time of initiation of the Project will influence the extent of initial development sponsored by local agencies.

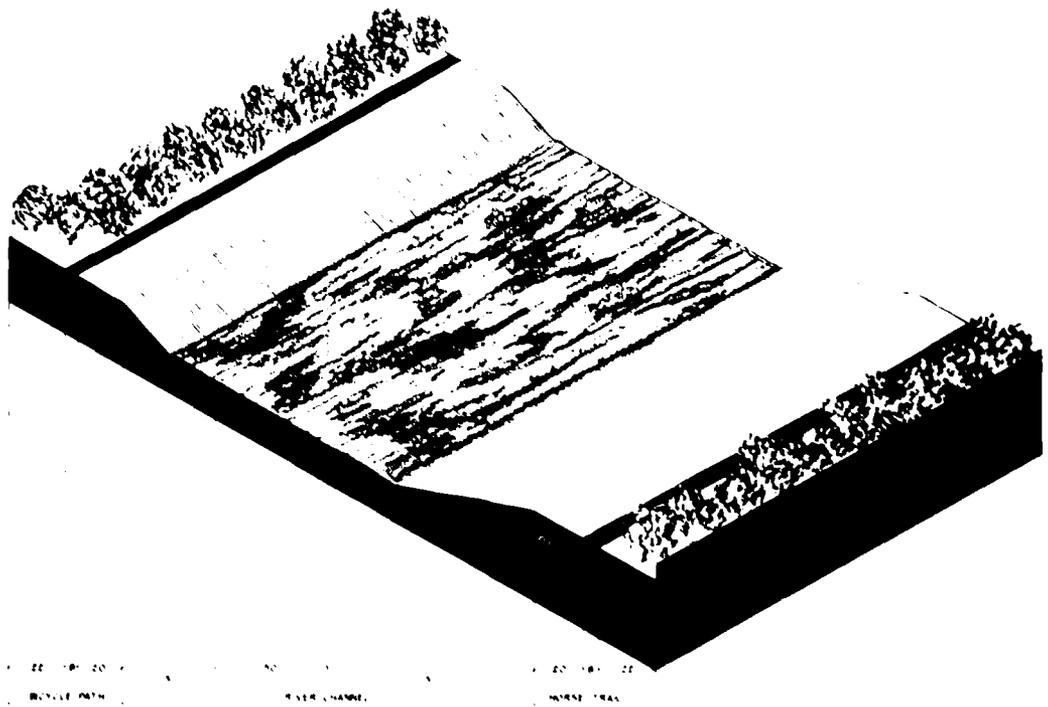
The major channelization proposed for flood control purposes on the Elm Fork is expected to adversely affect aquatic life and reduce the fishing and boating potential. The emphasis on nature areas and park development should assure the



CALIFORNIA CROSSING PONTOON BRIDGE



EQUESTRIAN TRAIL ALONG NEW CHANNEL



CROSS SECTION
NEW CHANNEL WITH TRAIL FACILITIES

preservation and enhancement of bird life and conservation of most of the mammals which inhabit the area. The restoration of trees and shrubs in the area should emphasize those woody plants which provide food and shelter for wildlife. No hunting will be permitted and all wildlife interest will be toward conservation.

Where cultivated or grazed fields on the flood plain are included in the recreational development areas, some reforestation will be desirable. In specific floodway areas, such as that downstream from the Bachman water intake, tree planting is proposed to be very sparse in recognition of the flood control function. In contrast, the wooded Elm Fork Nature Area is expected to remain largely undisturbed.

Recommendations are made for the treatment of the proposed realignment of the Elm Fork Channel above the Interstate Highway 35E Bridge and for the minimum right-of-way for the new channel. It is proposed that a minimum of 50 feet be acquired in addition to the channel width on each side (See Plate 17). The west side of the channel is proposed to be developed with an equestrian trail 3 miles in length, extending from the proposed location of the realignment of State Highway 121 to the vicinity of the Interstate Highway 35E crossing. The east side of the channel is proposed to have a bicycle-pedestrian trail along the full length to the present State Highway 121.

A pedestrian-bicycle bridge over the new channel is proposed at the south end to interconnect the two sides and provide access to the east bank trail. Two parking areas, one at either end of the equestrian trail and a shelter and a toilet structure are located near the proposed bridge to serve both the horsemen and the cyclist and hikers.

Incorporating some oxbow cutoffs into the new channel right-of-way would provide space for picnicking and preserve some of the existing river bank tree cover.

Immediately downstream from the Interstate Highway 35E Bridge, excellent areas for camping, picnicking and fishing exist in the unsponsored area.

VII - COORDINATION WITH OTHER AGENCIES

A number of agencies, Federal, State and Local, have interests in the Elm Fork Area. Previous comments are under Section IV (Local Interests). The following summarizes additional interests in the Project:

1. The Bureau of Outdoor Recreation, through the Texas Parks and Wildlife Department, has been a participant in the land acquisition along the Elm Fork for recreational purposes.
2. The Department of Housing and Urban Development has also been a participant in the overall greenbelt development of the Trinity River System in Dallas of which the Elm Fork is a part.
3. A recent legislative proposal sought to create a State Park on land in the Elm Fork flood plain upstream from Royal Lane. The sponsoring legislation is not likely to be approved.
4. The Texas State Highway Department and the County of Dallas have definite plans for highway crossings of the Elm Fork and transit crossings are being considered.
5. The Dallas Water Utility Department has two water treatment plants which are supplied with water from the Elm Fork and the Department is concerned about the maintenance of water quality and the prevention of construction damage, interruption or degradation of the water supply. Silting during construction is a matter of special concern to the Water Utility Department.
6. The North Central Texas Council of Governments encourages recognition of the environmental corridor greenbelt concept on the Elm Fork as generally suggested by the Regional Policy Plan.
7. Two local districts are proceeding with drainage improvement plans and one district (Las Colinas) is proposing to dedicate a strip of river frontage to Irving for park use and to assist in its development.
8. The Trinity River Authority is the responsible local agency and has agreed to the recreational development concept.

AD-A087 662

SPRINGER (MARVIN) AND ASSOCIATES DALLAS TX
RECREATIONAL APPENDIX REPORT, ELM FORK FLOOD CONTROL PROJECT, D--ETC(U)
MAY 73 DAC63-72-C-0125
NL

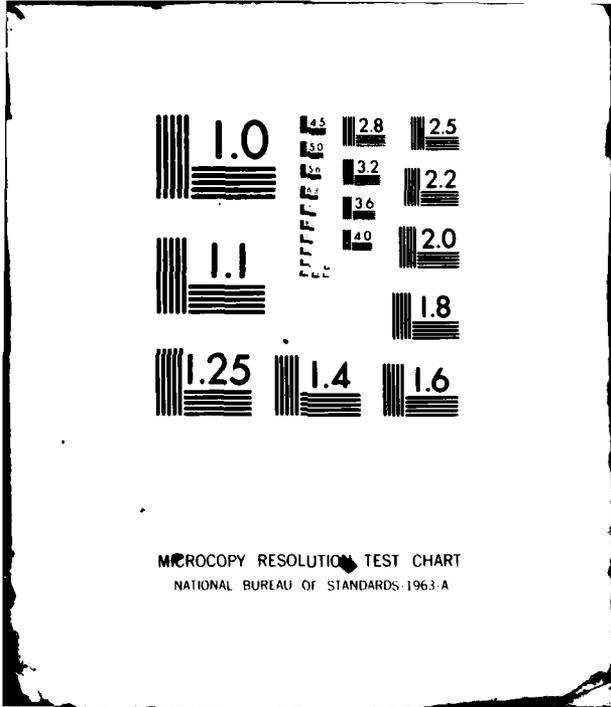
UNCLASSIFIED

2 - 2

AD-VA



END
DATE
FILMED
9 80
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

VIII - SPECIAL PROBLEMS

The fact that the Elm Fork Flood Control Project is located in a rapidly urbanizing area creates a number of problems of timing and coordination. The following are areas in which known problems and conflicts exist.

1. Highway construction is proceeding and decisions are required on bridge design and thoroughfare location.

2. Some gravel mining is continuing in the area which may be needed for recreational use.

3. The Dallas Park and Recreation Department is completing their planned acquisition of Elm Fork flood plain land and will be under increasing pressure to start development.

4. Private conservation interests are seeking to influence a flood plain management approach to the Elm Fork flood problem and to discourage levees and rechanneling of the River.

5. Unless a solution is arrived at soon, there will be a proliferation of levee and utility districts designed to reclaim and develop real estate and all of such reclamation effort will represent flood plain encroachment lacking a comprehensive design guide and could result in serious degradation of the environment.

6. The multiple jurisdiction problem inherent in the Elm Fork Project greatly complicates decisions and adds to delay.

IX - MANAGEMENT AND COST SHARING

The responsibility of the Corps of Engineers in the Elm Fork Flood Control Project is largely that of construction and supervision of standards. All law enforcement, maintenance, flood control management policing and safety patrol would be vested with the local agencies (municipalities) within which the facilities are located. Mounted park ranger patrol already exists in the Dallas portion of the recreational area.

It is proposed that those items listed in Table 5 for cost sharing be those subject to Federal cost sharing participation. The division of cost for the Elm Fork Flood Control Project would be apportioned as follows:

- a. Federal - The Federal Government will:
 - (1) Design and construct the flood control works including levees, sumps and channel improvements.
 - (2) Assume not more than one-half of the separable first cost of initial and future recreational facilities and open space development and enhancement.
- b. Non-Federal - Non-Federal (Local) agencies will:
 - (1) Assume at least one-half of the first separable costs of construction of recreational facilities including access and basic site preparation.
 - (2) Assume all costs and full responsibility for the maintenance, replacement, operation and management of all recreational areas and facilities.
 - (3) Assume all responsibility for policing, safety and operational control of all recreational facilities.

X - ENVIRONMENTAL QUALITY

The following environmental and site factors were considered in the Plan for recreational development on the Elm Fork:

(a) The Elm Fork is a unique section of river in North Central Texas in that it exists in a relatively undisturbed and natural state in the midst of a rapidly urbanizing area. The protection of a portion of the river valley ecological systems as a living museum for continued study and enjoyment is a major consideration in the Nature Area elements of the Plan.

(b) The protection of the maximum possible amount of natural river channel for canoeing and floating use and for conservation of waterfowl and water bird environment is a significant feature of the Plan.

(c) Restoration of areas to as near as possible a natural state such as the Wildflower Meadow is intended as an additional step toward the enhancement of the environmental quality of the entire area.

(d) Heavy use areas and roads and parking lots will be surfaced and the movement of vehicles controlled to minimize the disturbance on the passive and natural areas.

(e) Existing and future construction borrow pits will be restored as nearly as possible or converted into water features in the development.

(f) River bank areas where fishing and heavy contact is likely will be protected and stabilized.

(g) Usage will be controlled during and immediately following flood conditions to permit reasonable recovery of the water impacted areas.

(h) Existing trees and other vegetation will be conserved and protected wherever possible. Where construction causes loss of natural vegetation the Plan calls for restoration of the cover.

XI - COSTS

The preliminary cost estimates for the development of the project related recreational and open space facilities for the Elm Fork Flood Control Project are shown by Table 5. The estimates are arranged by jurisdictional units and cover the project related items listed in Section VI. No land is included in the cost items as all land involved is assumed to be directly related to the Flood Control Project and not attributable to recreation cost.

TABLE 5
PRELIMINARY COST ESTIMATES, RECREATIONAL ELEMENTS
ELM FORK FLOOD CONTROL PROJECT (INITIAL INCREMENT)

<u>Facility</u> <u>Dallas Jurisdiction</u> <u>Initial Increment</u>	<u>Unit Cost</u>	<u>Quantity</u>	<u>Total Cost</u>
1. Pedestrian and Bicycle Trails, 8' wide	\$12,000 per mile	8.4 miles	\$ 100,800
2. Pedestrian and Bicycle Trails, 4' wide	\$8,000 per mile	4.0 miles	32,000
3. Parking areas, asphalt surfaced	\$4.50 per square yard	20,000 square yards	90,000
4. Canoe and Boat launching ramps, concrete	\$8.00 per square yard	6,000 square yards	48,000
5. Toilet - rest rooms, concrete precast	\$35,000 each	3	105,000
6. Trail side Museums, large precast concrete with display cases	\$75,000 each	2	150,000
7. Trail side Museums, small precast concrete with display cases	\$50,000 each	3	150,000

8. Pontoon Bridge, Ferro-concrete, Elm Fork	\$210,000 each	1	\$ 210,000
9. Trail bridge, structures	\$35,000 each	2	70,000
10. Access roadway, 24' concrete curb and gutter	\$23 per linear foot	7,000 linear feet	161,000
11. Picnic unit, (table, fireplace and trash recep- tacle)	\$220 each	20	4,400
12. Bicycle rack, rest areas, 8 vehicles	\$325 each	10	3,250
13. Trail side benches, concrete	\$130 each	15	1,950
14. Drinking fountains and hydrants (water supply, city source)	\$550 each	6	3,300
15. Motorcycle barrier and control gates with directional signs	\$1,200 each	10	12,000
Sub-Total, less site preparation, grading, etc., Dallas Jurisdiction			<u>\$1,141,700</u>
16. Site preparation, grading and seeding and related work	\$450 per acre	700 acres	\$ 315,000
17. Tree planting	\$35 per tree	3,000	105,000
Sub-Total, project related work - Dallas			<u>\$1,561,700</u>
Engineering, design and supervision - 10%			156,170
Total - Dallas			<u>\$1,717,870</u>

**Irving Jurisdiction
Initial Increment**

1. Pedestrian and Bicycle Trails, 8' wide	\$12,000 per mile	8.7 miles	\$ 104,400
2. Pedestrian and Bicycle Trails, 4' wide	\$8,000 per mile	4 miles	32,000
3. Parking areas, asphalt surfaced	\$4.50 per square yard	26,000 square yards	117,000
4. Toilet - rest rooms	\$35,000 each	3	105,000
5. Trail side Museums, small precast concrete	\$50,000 each	2	100,000
6. Picnic units (table, fireplace, trash receptacle)	\$220 each	10	2,200
7. Trail side benches, concrete	\$130 each	10	1,300
8. Motorcycle barriers and control gates with signs	\$1,200 each	8	9,600
9. Bicycle racks, 8 vehicles at rest areas	\$325 each	6	1,950
10. Trail bridge structures	\$35,000 each	2	70,000
11. Drinking fountains and hydrants (water supply, city source)	\$550 each	10	5,500
12. Park drive and access roadway, 24' concrete curb and gutter	\$23 per linear foot	28,500 linear feet	655,500

13.	Softball diamonds with backstop and bleachers	\$1,800 each	6	\$ 10,800
14.	Baseball diamond with backstop and bleachers	\$2,200 each	2	4,400
15.	Football field, grading, seeding and goal posts	\$3,000 each	1	3,000
16.	Athletic Service Center, building with showers and toilets	\$25 per square foot	2,500 square feet	62,500
17.	Fencing - steel athletic area and mini-bike course	\$1.20 per linear foot	8,000 linear feet	9,600
18.	Mini-bike course, asphalt	\$4.50 per square yard	6,000 square yards	27,000
19.	Shelters, picnic, precast concrete	\$20,000 each	3	60,000
	Sub-Total, less site preparation, grading, etc., Irving Jurisdiction			<u>\$1,381,750</u>
20.	Site preparation, grading, seeding and related work	\$450 per acre	600 acres	270,000
21.	Tree planting	\$35 per tree	2,500	87,500
	Sub-Total, project related work			<u>\$1,739,250</u>
	Engineering, design and supervision	10%		173,925
	Total - Irving			<u>\$1,913,175</u>

**Carrollton Jurisdiction
Initial Increment**

1. Pedestrian and Bicycle Trails, 4' wide	\$8,000 per mile	1 mile	\$ 8,000
2. Parking areas, asphalt surfaced with access	\$4.50 per square yard	8,000 square yards	36,000
3. Park shelter, precast concrete	\$20,000 each	1	20,000
4. Toilet - rest room, concrete precast	\$35,000 each	1	35,000
5. Picnic units (table, fireplace and receptacle)	\$220 each	10	2,200
6. Softball diamond, backstop and bleachers	\$1,800 each	2	3,600
7. Baseball diamond, backstop and bleachers	\$2,200 each	1	2,200
8. Multipurpose play area, concrete surface	\$6.50 per square yard	1,000 square yards	6,500
9. Boat launching ramps, concrete	\$8.00 per square yard	6,000 square yards	48,000
10. Drinking fountain and hydrants (water supply, city source)	\$550 each	3	1,650
11. Playground, surfacing and equipment	\$25,000 each	1	25,000
Sub-Total, less site preparation, grading, etc., Carrollton Jurisdiction			\$188,150

12. Tree planting	\$35 each	50	\$ 1,750
13. Site preparation, grading and seed- ing	\$450 per acre	100 acres	45,000
Sub-Total, project related work			\$234,900
Engineering, design and supervision - 10%			23,490
Total - Carrollton			\$258,390

TABLE 6

**PRELIMINARY COST ESTIMATES, RECREATIONAL ELEMENTS
ELM FORK FLOOD CONTROL PROJECT (FUTURE INCREMENT)**

<u>Facility</u> <u>Lewisville Jurisdiction</u> <u>Future Increment</u>	<u>Unit Cost</u>	<u>Quantity</u>	<u>Total Cost</u>
1. Pedestrian and Bicycle Trail, 4' wide	\$8,000 per mile	3 miles	\$ 24,000
2. Park drive, 24' asphalt with curb and gutter	\$16 per linear foot	18,500 linear feet	296,000
3. Parking areas, asphalt surfaced	\$4.50 per square yard	20,000 square yards	90,000
4. Toilet - rest rooms, precast concrete	\$35,000 each	2	70,000
5. Park shelters, precast concrete	\$20,000 each	2	40,000
6. Drinking fountains and hydrants (water, city sources)	\$550 each	4	2,200
7. Picnic units (table, fireplace and receptacle)	\$220 each	12	2,640
8. Softball diamond, backstop and bleachers	\$1,800	2	3,600

9.	Baseball diamond, backstop and bleachers	\$2,200	1	\$ 2,200
10.	Surfaced play areas, multipurpose con- crete	\$6.50 per square yard	2,000 square yards	13,000
11.	Playground sur- face and equip- ment	\$25,000	1	25,000
Sub-Total, less site preparation and grading, Lewisville Jurisdiction				<u>\$568,640</u>
12.	Site preparation and grading	\$350 per acre	300 acres	\$105,000
Sub-Total, project related work				<u>\$673,640</u>
Engineering design and supervision - 10%				67,364
Total - Lewisville				<u>\$741,004</u>

Un-sponsored
Future Increment

1.	Pedestrian and Bicycle Trails, 4' wide	\$8,000 per mile	4.3 miles	\$ 34,400
2.	Equestrian trail, graded and drained	\$5,000 per mile	3 miles	15,000
3.	Parking areas, asphalt surfaced	\$4.50 per square yard	3,000 square yards	13,500
4.	Picnic units (table, fireplace and receptacle)	\$220 each	10	2,200
5.	Toilet - rest rooms, precast concrete	\$35,000 each	2	70,000
6.	Park shelter, small concrete	\$14,000 each	2	28,000

7. Perimeter fence, equestrian trail	\$1 per linear foot	16,000 linear feet	\$ 16,000
8. Fenced paddock with water tank	\$3,000 each	2	6,000
9. Motorcycle barriers and control gates with signs	\$1,200	4	4,800
10. Camping units (table, fireplace and access)	\$1,000 each	20	20,000
11. Access roadway, 24' wide curb and gutter, asphalt	\$16 per linear foot	3,500 linear feet	56,000
12. Pedestrian - Bicycle bridge across new channel	\$120,000	1	120,000
Sub-Total, less site preparation and planting			<u>\$385,900</u>
13. Trees along new channel	\$10 each	1,000	10,000
14. Site preparation and seeding along channel	\$450 per acre	150 acres	67,500
Sub-Total, project related work			<u>\$463,400</u>
Engineering, design and contingencies - 10%			46,340
Total - Un-sponsored			<u>\$509,740</u>

Note: Acquisition of land in oxbows and for picnicking and camping areas not included in cost estimate.

The summary of cost estimates for the initial and future recreational development increments is shown as follows:

<u>Initial Increment</u>	
1. Dallas Jurisdiction	\$1,717,870
2. Irving Jurisdiction	1,913,175
3. Carrollton Jurisdiction	258,390
Total Initial Increment	<u>\$3,889,435</u>
<u>Future Increment</u>	
4. Lewisville Jurisdiction	\$ 741,004
5. Un-sponsored Area	509,740
Total Future Increment	<u>\$1,250,744</u>

Total initial and future recreational development increments, Elm Fork Project
\$5,140,179.

XII - RECREATIONAL BENEFITS

The computation of economic benefits deriving from the recreational development of the Elm Fork Flood Control Project is based upon the estimated use demand of 3.5 million users of the initial increment facilities. The close relationship of the Elm Fork Project to the developing urban complex surrounding it requires that a fairly high value be assigned to the recreational benefits. A unit value of \$1 per day was assigned to all uses except golfing and special events which were assigned \$1.50 per day but the golf factor will be self canceling.

The recreational benefit estimates for the Elm Fork facilities are shown in the following Table 7.

TABLE 7

RECREATIONAL BENEFITS - ELM FORK PROJECT

<u>Total Positive Benefits</u>	
Golfing, 250,000 @ \$1.50	\$ 375,000
General Recreation (Athletics) picnicking, hiking, etc.) 2,600,000 @ \$1	2,600,000
Boating	
Dallas facilities 200,000 @ \$1	200,000
Project facilities 150,000 @ \$1	150,000
Special Events (meetings, shows, etc.) 300,000 @ \$1.50	450,000
Total Positive Benefits	\$3,775,000
<u>Deductible Existing or Negative Benefits</u>	
Golfing (non project) 250,000 @ \$1.50	\$ 375,000
Shooting (non project) 150,000 @ \$1	150,000
Boating (non project) 200,000 @ \$1	200,000
Canoeing loss from channel realignment 50,000 days @ \$1	50,000
Fishing loss from channel realignment 100,000 days @ \$1	100,000
Nature study and wildlife loss from channel realignment 150,000 days @ \$1	150,000
Total Deductible or Negative Benefits	\$1,025,000
 Net annual recreational benefits (total \$3,775,000 less deductible \$1,025,000) for the Elm Fork Project are estimated to be \$2,750,000.	

DATE
FILMED
0-8