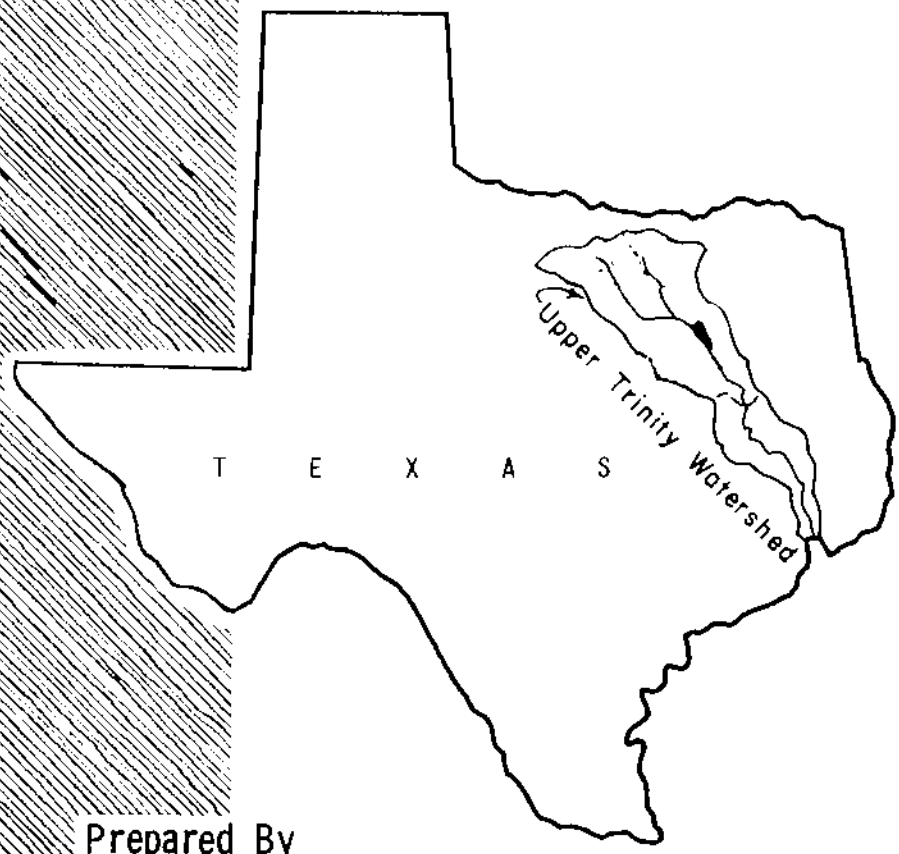
WORK PLAN

NORTH TRINITY LATERALS WATERSHED

OF THE TRINITY RIVER WATERSHED

DALLAS AND KAUFMAN COUNTIES, TEXAS



Prepared By
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Temple, Texas

APRIL 1965

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WATERSHED WORK PLAN AGREEMENT

between the

Dalworth Soil Conservation District
(Name of Local Organization)

Kaufman-Van Zandt Soil Conservation District
(Name of Local Organization)

Dallas County Bois d'Arc Island Levee Improvement District No. 4
(Name of Local Organization)

STATE OF Texas,
(hereinafter referred to as the local organization)

and the

SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE
(hereinafter referred to as the Service)

Whereas, the responsibility for administration of the Flood Prevention Program authorized by the Flood Control Act of 1944, as amended and supplemented, has been assigned by the Secretary of Agriculture to the Soil Conservation Service; and

Whereas, there has been developed through the cooperative efforts of the local organization and the Service a mutually satisfactory plan for works of improvement for said watershed, designated as the watershed work plan for North Trinity Laterals Watershed, State of Texas, which watershed work plan is annexed to and made a part of this agreement; and

Whereas, the watershed work plan describes the watershed and its problems, and sets forth a plan for works of improvement including a schedule of operations, the kinds and quantities of measures to be installed, the estimated cost, cost-sharing arrangements, maintenance and other responsibilities of those participating in the project, and economic justification for installing, operating and maintaining the works of improvement;

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire such land, easements or rights-of-way as will be needed in connection with the works of improvement. (Estimated Cost $ 118,040). The percentages of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Land, Easements, and Rights-of-Way Cost (dollars)
5 Floodwater Retarding Structures	100	0	8,840
12.5 Miles Channel Improvement	100	0	109,200

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
5 Floodwater Retarding Structures	0	100	83,710
12.5 Miles of Channel Improvement	0	100	287,760

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Installation Service Cost (dollars)
5 Floodwater Retarding Structures	0	100	28,970
12.5 Miles of Channel Improvement	0	100	52,910

5. The Service will award and administer the contracts covering the construction of all works of improvements.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

Now, therefore, in view of the foregoing considerations, the local organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan will be installed, operated, and maintained substantially in accordance with the terms, conditions, and stipulations provided for therein.

It is further understood that this agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and that financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose and on the execution of supplemental agreements setting forth the cost-sharing arrangements and other conditions that are applicable to specific works of improvement.

It is further agreed that the watershed work plan may be amended or revised, and that this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

No member of Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C. F. R. Sec. 15.1-15.13), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

v

Dalworth Soil Conservation District
Local Organization

By A. T. Vanderver

Title Oct-19-Chairman

Date Oct-19-1965

The signing of this agreement was authorized by a resolution of the governing body of the Dalworth Soil Conservation District
Local Organization

adopted at a meeting held on Oct-19 1965

O H Skinner
(Secretary, Local Organization)

Date Oct-19-1965

- -

Kaufman-Van Zandt Soil Conservation District
Local Organization

By Frank Springer

Title Chairman Board

Date. Nov. 10-1965

The signing of this agreement was authorized by a resolution of the governing body of the Kaufman-Van Zandt Soil Conservation District
Local Organization

adopted at a meeting held on Nov. 10, 1965

James L Cartwright Jr
(Secretary, Local Organization)

Date Nov 10, 1965

Dallas County Bois d'Arc Island Levee Improvement District No. 4
Local Organization

By John David Smith

Title Chairman

Date 10-19-65

The signing of this agreement was authorized by a resolution of the governing body of the Dallas County Bois d'Arc Island Levee Improvement District No.
Local Organization

adopted at a meeting held on Oct. 19th 1965

Henry Franklin
(Secretary, Local Organization)

Date Oct. 19, 1965

Local Organization

By _____

Title _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the _____
Local Organization

adopted at a meeting held on _____

(Secretary, Local Organization)

Date _____

Soil Conservation Service
United States Department of Agriculture

By _____

Date _____

WORK PLAN

NORTH TRINITY LATERALS WATERSHED
Of the Trinity River Watershed
Dallas and Kaufman Counties, Texas

Plan Prepared and Works of Improvement
to be Installed Under the Authority
of the Flood Control Act of 1944
as Amended and Supplemented

Participating Agencies

Dalworth Soil Conservation District
Kaufman-Van Zandt Soil Conservation District
Dallas County Bois D'Arc Island Levee Improvement
District No. 4

Prepared by:

Soil Conservation Service
U. S. Department of Agriculture

April 1965

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USDA-SCS-FORT WORTH, TEX. 1828

WORK PLAN

NORTH TRINITY LATERALS WATERSHED
Of the Trinity River Watershed
Dallas and Kaufman Counties, Texas
April 1965

INTRODUCTION

Authority

The North Trinity Laterals Project for watershed protection and flood prevention will be carried out under authority of the Soil Conservation Act of 1935 (Public Law No. 46, 74th Congress) and the Flood Control Act of 1944 (Public Law No. 534, 78th Congress), as amended and supplemented.

Purpose and Scope of Work Plan

The purpose of this work plan is to provide for a flood prevention program consisting of land treatment and structural measures on North Trinity Laterals watershed.

SUMMARY OF PLAN

The North Trinity Laterals watershed, consisting of an area of 71,500 acres (approximately 112 square miles), is located in Dallas and Kaufman Counties, Texas. The major land uses are cropland, 22 percent; pasture-land, 21 percent; and miscellaneous land including urban, rurban, and gravel pits, 57 percent.

Sponsoring local organizations for this watershed are:

Dalworth Soil Conservation District
Kaufman-Van Zandt Soil Conservation District
Dallas County Bois D'Arc Island Levee Improvement
District No. 4

The flood plain in the areas benefited by structural measures covers 10,909 acres, excluding 478 acres of stream channels. Twenty-eight major floods each inundating more than half of the flood plain, occurred during the 40-year period covered by the evaluation series.

Neither Dallas County nor Kaufman County has been designated as eligible for assistance under provisions of the Agricultural Redevelopment Act. Needs for agricultural water management are minor in this area and were not given further consideration.

The trend in upland agriculture is toward diversified livestock farming and the conversion of less fertile and more eroded cropland areas to pasture.

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DESCRIPTION OF THE WATERSHED

Physical Data

North Trinity Laterals watershed is located in the southeastern part of Dallas County and the northwestern corner of Kaufman County, Texas. It is a subwatershed of the Trinity River Basin, an authorized flood prevention watershed, and comprises an area of 71,500 acres north of and contiguous to the Trinity River immediately above its confluence with the East Fork of the Trinity. Prairie Creek, in the western part of the watershed, is the largest tributary and drains directly into the Trinity River. Hickory Creek and several unnamed tributaries head in the upland areas in the vicinity of Seagoville and flow south into Parsons Slough, an old river cutoff on the main flood plain. Parsons Slough flows into the Trinity River in the southeastern part of the watershed. Most of the benefited area is Trinity River bottomland that has been leveed.

Topography ranges from nearly level to gently rolling. Elevations range from 323 feet above mean sea level at the confluence of Parsons Slough and the Trinity River to approximately 575 feet along the northern watershed divide.

The watershed lies in the Blackland Prairie Land Resource Area. It is underlain by Upper Cretaceous limestones and shales of the Austin and Taylor groups, unconsolidated Pleistocene terrace deposits and Quaternary alluvium. The Cretaceous deposits dip to the southeast approximately 40 feet per mile. The other deposits are flat lying. The Austin group occupies 8 percent of the watershed area; the Taylor, 12 percent; the Pleistocene terrace deposits, 38 percent; and the Quaternary alluvium, 42 percent.

The major soil series found in the watershed are Trinity, Zavala, Gowan, Houston, Wilson, Lewisville, Houston-Sumpter, Axtell, Travis, Dougherty, and Bastrop. These soils are deep, fine to coarse textured, and are slowly to moderately permeable.

Physiographically, the northern 20 percent of the watershed is a youthful plain whereas the southern 80 percent is a rejuvenated flood plain in which the Trinity River has recently cut to a new level developing a broad clay covered flood plain. The present flood plain is bounded by remnants of an older and higher one in the form of eroded terrace deposits. These terrace deposits comprise about 65 percent of the upland in the watershed.

The over-all land use in the watershed is as follows:

Land Use	Bottomland		Upland		Total	
	Acres	Percent	Acres	Percent	Acres	Percent
Cropland	11,445	57	4,628	9	16,073	22
Pasture	4,217	21	10,798	21	15,015	21
Miscellaneous, Urban, and Rurban	4,417	22	35,995	70	40,412	57
TOTAL	20,079	100	51,421	100	71,500	100

Land use in the uplands consists mainly of open and wooded pasture with the smaller acreage of cropland devoted to truck crops and gardens. The highly productive bottomland and flood plain soils are more intensively cultivated.

The hydrologic cover on pasture lands ranges from poor to good, averaging fair or better. Cropland in the bottomland is used for row crops, small grains, and legumes which provide a fair to good cover during the growing season. Proper management of crop residues provides a fair cover during other seasons of the year.

The average annual rainfall is 34 inches, based on U. S. Weather Bureau records at Dallas, Texas. Rainfall is generally highest in the spring months and lowest in the winter months; however, it is well distributed throughout the year.

The mean temperature ranges from about 46 degrees Fahrenheit in January to about 86 degrees in July. The normal frost-free period of 250 days extends from March 18 through November 23.

Wells and farm ponds supply a majority of the farmers and ranchers with adequate water for domestic and livestock use.

Economic Data

The uplands of the watershed are devoted to urban development, pasture, crops, and some gravel mining operations. Part of the upland has been cultivated in the past, but erosion, low fertility, and low returns caused a shift to pasture. Most of the cultivated land at the present is devoted to truck crops and home gardens. Gravel operations have made some of the uplands useless for agricultural production. The upper one-third of the watershed is highly urbanized.

The bottomland of the watershed is in highly intensified agricultural production. The chief cultivated crops are cotton and alfalfa with lesser acreages of wheat and sorghum hay. Improved pasture, such as coastal bermudagrass, is on the increase, as is the production of alfalfa.

The watershed is served by approximately 1,575 miles of paved roads, plus 125 miles of graveled roads. The majority of these roads are located in urban areas. Seagoville is the commercial center of the watershed and offers adequate railroad facilities. Kleberg and Rylie are other communities also located in the watershed.

Dallas and Kaufman counties have not been designated as areas of underemployment under the Area Redevelopment Act.

Land values in the flood plain range from 200-300 dollars per acre. Gravel mining operations are carried on by several companies, primarily in the lower half of the benefited portion of the flood plain. This has increased market values of land underlain by gravel far beyond its value for agricultural purposes. Land values and farm sizes also are influenced by the proximity of the watershed to the metropolitan Dallas-Fort Worth area.

Cultivation of the flood plain is expected to continue with a reduction in cotton acreage and an increase in alfalfa and improved pasture.

The farmers of the bottomlands are mostly full-time farmers while the upland farmers generally supplement their farm income by employment in the Greater Dallas metropolitan area.

The farms are operated primarily with hired labor, with most of the landowners residing in Seagoville and the Dallas-Fort Worth ares. The average size farm in the watershed is about 200 acres.

Over 50 percent of family type farms use one and one-half or more man-years of hired labor.

Land Treatment Data

The Dalworth and Kaufman-Van Zandt Soil Conservation Districts have been very active in assisting farmers and ranchers in the establishment of land treatment measures. The districts have obtained a high degree of participation in the soil and water conservation program from farmers and organizations in the watershed. A standard soil survey is nearing completion.

The watershed is served by the Soil Conservation Service work units at Dallas and Kaufman. These work units, through their assistance to the soil conservation districts, have aided land owners and operators in preparing 105 conservation plans, 80 of which are basic plans, covering 20,000 acres. There are numerous small tracts of 10 to 20 acres on which the soil conservation districts only provide consultive assistance to the owner or operator. Land treatment measures have been accomplished to date at a cost of $485,113 (table 1A). It is estimated that approximately 75 percent of the planned land treatment has been applied.

The upper one-third of the watershed is highly urbanized which provides for very effective erosion control.

WATERSHED PROBLEMS

The upland portion of the watershed presents numerous erosion control and soil and water conservation problems. The basic problem is low fertility and low organic matter on steep to gently rolling lands. This is compounded by below-average size farms. In recent years the trend has been toward converting cropland to pasture. This trend will continue to increase, thereby decreasing cotton, grain sorghum, and small grain production. Due to the close proximity of the Dallas-Fort Worth metropolitan complex, there has been an ever-increasing acreage diverted from surplus crops to truck crops. Clubs and similar organizations are developing additional acreage to recreational enterprises.

Floodwater Damage

The flood plain is defined as that area inundated by the runoff from the largest storm considered in the 40-year evaluation series.

The total flood plain area in the North Trinity Laterals watershed is 20,079 acres. The flood plain on Prairie Creek is not flooded frequently, and since urban development is extensive on this portion of the watershed, structural measures are not economically feasible.

Since the East Fork of the Trinity River flood plain area is flooded frequently by the river, no structural measures were planned for this portion of the watershed.

There are 10,909 acres of flood plain along Hickory Creek and Parsons Slough. Of this amount, 3,820 acres are inundated by both floods on the Trinity River and those originating on the watershed. Annually an average of 8,520 acres are flooded by runoff from the watershed alone. The average annual area inundated by the Trinity River is 896 acres.

The flood plain is wide and flat. A small rise above bankfull stage will cause large areas to be inundated. Floods develop rapidly and occur most often during the growing season.

During the 40-year evaluation period, 1924 through 1963, there were 28 major floods each of which inundated more than half of the flood plain of Hickory Creek and Parsons Slough. There were also 173 minor floods. In addition to these floods produced by runoff from the watershed, there were 27 floods from the Trinity River. There were 15 major and 70 minor floods produced by runoff from the watershed during the months of April, May, and June. During the same months, there were 18 floods from the Trinity River. This 3-month period is the season when crops and pastures are at a critical stage in growth and are very susceptible to damage from floodwater.

Despite flooding problems, farmers continue to use the flood plain intensively because of its high productivity. Noxious weeds scattered by floodwater add to the cost of crop and pasture production.

A major flood occurred April 26, 1957. The entire flood plain was inundated and direct floodwater damage on Hickory Creek and Parsons Slough was estimated at $134,750 from this storm. This flood was estimated to equal that of a 25-year frequency.

Based on the floods considered in the 40-year evaluation series, annual direct floodwater damages to crops and pastures on Hickory Creek and Parsons Slough without the program of land treatment and structural measures in place are estimated to total $76,095 (table 5). These damages, by individual evaluation reaches, are shown in the following table:

Annual Floodwater Damages Without Project

Evaluation Reach (Figure 5)		Floodwater Damages in Dollars (Based on Long-Term Prices)	
Number	Name	Crop and Pasture	Total
I	Lower Parsons Slough	16,309	16,309
II	Upper Parsons Slough and Lower Hickory Creek	59,786	59,786
	TOTAL	76,095	76,095

Erosion Damage

Upland erosion rates average from 1.2 acre-feet per square mile annually for pastureland to 2.9 acre-feet per square mile annually for cropland. Bottomland erosion rates are much lower, ranging from 0.1 acre-foot per square mile annually for pastureland to 0.6 acre-foot per square mile annually for cropland. The total annual gross soil loss for the watershed is estimated to be only 70 acre-feet. A high percentage of the watershed is in bottomland, miscellaneous, and urban areas. Low erosion rates in these areas and effective land treatment account for the low rate of soil loss.

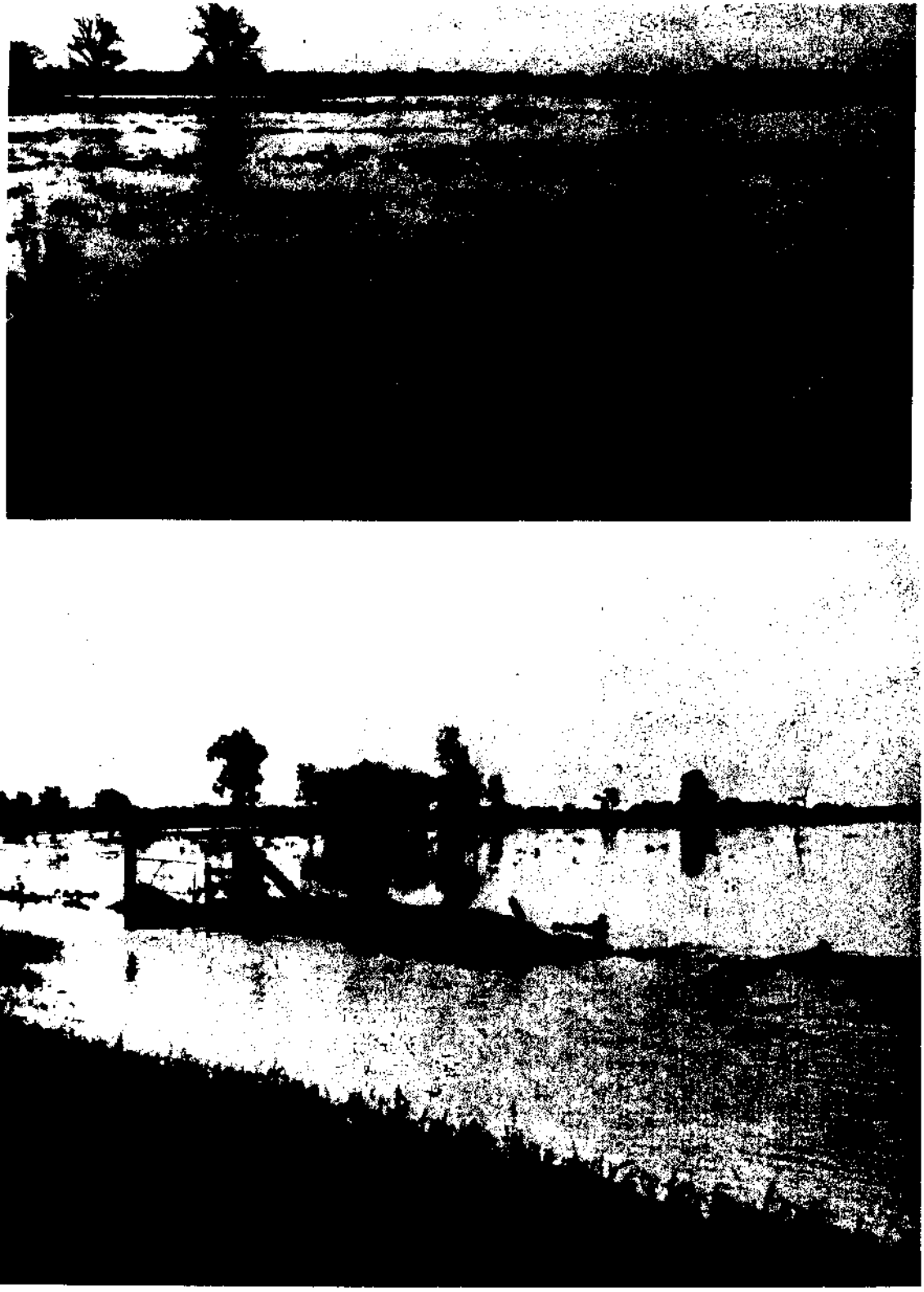
Sheet erosion accounts for 98 percent and streambank erosion for 2 percent of the annual soil loss.

Flood plain scour from overflows of Parsons Slough and Hickory Creek is negligible.

Sediment Damage

Sediment damage due to overbank deposition on the flood plain is slight. Approximately 13 acres in Reach 1 are covered with sandy silt and 3 acres are covered with fine sand in Reach 2. Damage in terms of loss of productive capacity ranges from 20 to 80 percent.

The average annual monetary damage by overbank deposition is estimated to be $227.



Flooding typical of that which occurs on the watershed causing damages to crops and pasture.

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Channel filling in the watershed has reduced channel capacities and resulted in increased flooding.

Problems Relating to Water Management

There is only a minor need for drainage. According to the sponsoring local organizations, there is no known local interest at the present tim in providing storage in any of the structures for irrigation, municipal or industrial water supply, fish and wildlife development, or recreation

PROJECTS OF OTHER AGENCIES

The watershed is protected from Trinity River floods by a levee except at the lower end of the watershed where Parsons Slough outlets into the river. This levee was built and is maintained by the Dallas County Bois D'Arc Island Levee Improvement District No. 4. It will protect the work of improvement included in this plan from damage by flooding of the Trinity River.

BASIS FOR PROJECT FORMULATION

The sponsoring local organizations have stated that when the project is begun it will vastly improve the income of the low farm income group. The sponsoring local organizations said that upon completion of this project there would be a reduction of surplus crops. There will be a trend toward more diversification and this project would act as a stimulus toward more acreage being diverted from cropland to pasture and recreational enterprises. They further stated that with the installation of these works of improvement and other conservation measures on-the-ground that this watershed would be an outstanding billboard of soil and water conservation.

A reconnaissance of the watershed was made by specialists of the Watershed Work Plan Staff, Area and Work Unit Conservationists, and representatives of the sponsoring local organizations. Agricultural enterprises are the principal sources of income; however, operators of small farm and ranch units supplement their income by off-farm employment. Livestock farming is the major type of operation. Extensive gravel deposits provide additional income to landowners in the lower part of the flood plain Moderate to severe flooding causes extensive damage to crops and pastures grown on flood plain land.

Meetings were held to discuss existing problems and to formulate the watershed protection and flood prevention program.

The possibilities and opportunities for including additional storage in floodwater retarding structures for other purposes, such as agricultural and nonagricultural water management, recreational development, and fish and wildlife development, were explained. The sponsors determined that a project for watershed protection and flood prevention most nearly met their needs and that no other group or individual was interested in additional storage for other purposes.

Specific objectives of the local sponsors for the work plan are:

1. Establish land treatment measures during the project installation period which contribute directly to watershed protection and flood prevention.

2. Attain at least a 65 percent reduction in average annual flood damages along Hickory Creek and Parsons Slough to insure sustained agricultural production on flood plain lands and to maintain the economy of the watershed.

The Soil Conservation Service agreed that the desired level of protection was reasonable. After consideration of floodwater retarding structures, levees, and stream channel improvement, it was determined that combination of land treatment measures, floodwater retarding structure and stream channel improvement would be needed to meet project objecti

In selecting the sites for floodwater retarding structures, considerat was given to locations which would provide the desired level or protection to areas subject to flood damage. The size, number, design, a cost of the structures was influenced by the location of the damaged areas, the complex topography, site limitations and obstacles, and the geologic conditions of the watershed. Alternate systems of structural measures were evaluated to obtain the most economical system.

The recommended system of 5 floodwater retarding structures and 12.5 miles of stream channel improvement meet project objectives by providi the desired level of protection for agricultural enterprises of the watershed at least cost.

The project for North Trinity Laterals watershed complements the compr hensive Trinity River basin plan as proposed in the Report of the U. S Study Commission of Texas, Part III, Page 69 and Table 57.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Land treatment measures are being applied under the leadership of the soil conservation districts. Approximately 2,253 acres of the 71,500 acres in the North Trinity Laterals watershed lie above the planned fl water retarding structures. Land treatment is especially important fo protection of these watershed lands to support and protect the structu measures. On the remaining agricultural land, the establishment and maintenance of land treatment constitutes the only planned measures.

Emphasis will be placed on accelerating the establishment of those lan treatment measures which have a measurable effect on reduction of dama from floodwater and sediment and in reducing the cost of providing sed ment storage capacity in the floodwater retarding structures.

The amounts and estimated costs of the measures that will be installed

by the landowners and operators during the 5-year installation period are shown in table 1. Flood prevention funds in the amount of $21,046 will be used to accelerate technical assistance in planning and applyi land treatment.

Conservation cropping systems including such land treatment practices cover and green manure crops, contour cultivation, and improved residu conserving tillage operations will be established on approximately 5,3 acres of cropland. These farming practices will improve water-holding capacity, increase infiltration rate, improve fertility level, and reduce erosion of the soils. About 39,000 linear feet of terraces will installed and provided with needed grassed waterways to control erosio and retard runoff from the more rolling lands. Approximately 106,000 linear feet of diversions will be installed for protection from runoff originating in the steep pasture areas. Establishment of needed waterways will precede construction of terraces and diversions.

The trend in upland farm areas is toward retirement of cropland to hay or pasture. Proper use will be practiced on 12,600 acres of improved pasture. Approximately 5,700 acres of this area will be renovated by seeding and fertilizing. The remaining 6,900 acres will be improved o re-established by either seeding or sodding to attain a good base grass cover. Special grazing control will be carried out and fertilizers applied as needed.

Brush and weed control will be carried out on 12,600 acres of pastureland. Distribution of grazing will be improved through the use of 200 additional farm ponds.

Application of wildlife area improvement measures, including fish stocking of farm ponds and sediment pools of the floodwater retarding structures, will enhance upland game, fish, and waterfowl habitats. Plantings in field borders and on grassland will furnish food and cover for wildlife. Excellent cover will be established within the fenced areas on the dams and emergency spillways and will furnish additional areas of wildlife habitat.

The installation of land treatment measures will reduce the total annua gross erosion in the watershed by approximately 14 percent. Infiltrati will be increased by the improvement of cover in the cultivated areas a increased grass density and vigor in the pastured areas. Terraces, diversions, and waterways will slow the runoff from cultivated fields, and increased grass cover will reduce runoff of water from runoff-producing storms.

Structural Measures

Five floodwater retarding structures and 12.5 miles of stream channel improvement are required to provide the desired protection to the flood plain. The control afforded by the floodwater retarding structures is small but contributes substantially to flood and sediment damage reduction in the watershed.

Stream channel improvement consists of enlarging a portion of Hickory Creek from a point 3,100 feet below Simonds Road to its confluence wit Parsons Slough and that portion of Parsons Slough from the entry of Hickory Creek to its confluence with the Trinity River.

Figure 1 shows a section of a typical floodwater retarding structure.

The cost of installing these works of improvement is as follows:

Floodwater Retarding Structures	$121,520
Stream Channel Improvement	449,870
Total (Table 2)	$571,390

No structural control is planned for any of the laterals draining dire into the East Fork of the Trinity River.

The total capacity of the floodwater retarding structures is 954 acre- Of this total, 144 acre-feet is provided for sediment accumulation ove 50-year period and 810 acre-feet for floodwater detention. This is an average of 4.31 inches from the area upstream from the structures. Th amount of runoff controlled by each structure is shown in table 3.

All applicable State water laws regulating the appropriation of water the diversion of streamflow will be complied with in the design and co struction of structural measures.

The improved stream channel on Parsons Slough is designed to carry the flow from an average 24-hour storm producing a runoff of approximately inches from the uncontrolled area, plus release waters from the floodw retarding structures. The flood plain will be protected from flood an sediment damages, on an average, approximately equaling those expected from a storm of a 20 percent chance of occurence.

Passage of design flows for the improved stream channel at the bridge Malloy Bridge Road will be accomplished by deepening the existing chan by 4 feet and by providing a bottom 60 feet wide.

Three bridges on county roads will be replaced in order to pass the design flow.

Excavated materials will be disposed of within the right-of-way of the improved channel and may be placed in shaped fills with passageways for side drains or may be placed in contiguous oxbows created by improved alinement. Openings for side drains through spoil fills will be provid at the point where property lines intersect such fills, or more frequen as may be needed. Normally spoil will be placed on both sides of the i proved channel but may be placed on one side as conditions require or i no additional Federal cost is involved.

Details on quantities, costs, and design features of structural measure are shown in tables 1, 1A, 2, 3, and 3A.

EXPLANATION OF INSTALLATION COSTS

The estimated cost of planning and installing land treatment measures during the next 5 years, including expected reimbursement from Agricul tural Conservation Program Service funds, is $161,496 based on current program criteria. Accelerated technical assistance will be provided to land owners and operators through the soil conservation districts t the Soil Conservation Service at an estimated cost of $21,046 from flc prevention funds. These land treatment costs are based on present pri being paid by landowners and operators to establish the individual mea ures.

Estimates of the kinds, amounts, and costs of land treatment measures were furnished by the Dalworth and Kaufman-Van Zandt Soil Conservation Districts.

Land, easements, and rights-of-way for the floodwater retarding struct and for stream channel improvement will be furnished by the local spon at no cost to the Federal Government.

Reinforcing, underpinning, or reconstructing piers and abutments of hi way and public road bridges, necessitated by deepening of channels in connection with stream channel improvement, are considered as construc costs and will be borne by flood prevention funds. Such costs are limited to those required to provide a facility of comparable quality performance capability to the existing bridge.

All other costs of bridge alterations are considered right-of-way cost and will be borne by other than Federal funds.

The local cost for the floodwater retarding structures and 12.5 miles stream channel improvement, estimated to be $118,040, consists of land easements, and rights-of-way ($80,540), relocating and modification of existing improvements and clearing obstacles ($36,000), and legal fees ($1,500).

Construction costs for the floodwater retarding structures and 12.5 mi. of stream channel improvement, estimated to be $371,470, include the engineer's estimate and a 10 percent allowance for contingencies. The engineer's estimates were based on unit costs of structural measures c structed in similar areas and modified by special conditions inherent each individual site location. The cost of installation services is estimated to be $81,880, including engineering and administrative cost: The total construction and installation services costs for these measu is $453,350 and will be borne by Federal funds.

The total cost of the floodwater retarding structures and stream chann improvement for flood prevention is estimated to be $571,390.

The estimated schedule of obligations for the installation period for work plan, including installation of both land treatment and structura measures, is as follows:

Schedule of Obligations

Fiscal Year	Measures	Flood Prevention Funds (dollars)	Other Funds (dollars)	Tota (dolla
First	Floodwater Retarding Structures 3, 4, 5, 6, and 10	112,680	8,840	121,5
	Land Treatment	3,160	21,070	24,2
	Subtotal	115,840	29,910	145,7
Second	Stream Channel Improvement (Hickory Creek and Parsons Slough)	340,670	109,200	449,8
	Land Treatment	4,210	28,090	32,3
	Subtotal	344,880	137,290	482,1
Third	Land Treatment	5,263	35,110	40,3
Fourth	Land Treatment	5,263	35,110	40,3
Fifth	Land Treatment	3,150	21,070	24,1
Total for Installation Period		474,396	258,490	732,8

EFFECTS OF WORKS OF IMPROVEMENT

The land treatment and structural measures will materially influence t conversion of cropland to pasture and other non-surplus crops, and the establishment of income-producing recreational facilities. The sponso local organizations state that marginal cropland in the upland will be established to permanent vegetation. There will be an increase in the of locally produced feed due to the increase in various types of live- stock operations such as riding stables, bridle paths, beef production and dairying.

Water will be temporarily detained in the reservoirs and released in a orderly fashion. This will prevent flooding of the productive bottoml An increased stability will be given the family farm through more effi cient operation, reduced costs, and increased financial returns.

In that portion of the watershed affected by structural measures, six the 28 major floods which occurred during the 40-year evaluation perio (1924-1963) would be reduced to minor floods. Fifteen of the major fl would be eliminated by the project.

Since structural measures on the Prairie Creek portion of the watershe and that portion made up of laterals of the East Fork are not feasible, improvements planned for these areas will be limited to land treatment measures.

The effect on average annual flooding is shown in the tabulation below:

Source of Flooding	Average Annual Flooding	
	Without Project (acres)	With Project (acres)
Hickory Creek and Parsons Slough	8,520	1,948
Trinity River Floodwater	896	896
Total	9,416	2,844

The following data show by evaluation reaches the acres flooded by storms of specified frequencies without project and with the complete project installed:

Agricultural Areas Inundated Below Site Locations

Evaluation Reach (Figure 5)	Average Recurrence Interval					
	33 Percent Chance		10 Percent Chance		4 Percent Chance	
	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)
I	1,360	0	2,650	1,440	2,980	2,569
II	5,075	297	6,700	1,650	7,310	5,115
Subtotal	6,435	297	9,350	3,090	10,290	7,684
Flooding from Trinity River	1,240	1,240	2,300	2,300	4,040	4,040
Total	7,675	1,537	11,650	5,390	14,330	11,724

The following shows the effects that the project will have on flooding and damages by evaluation reaches. All figures represent average annual percent reduction:

Evaluation Reach (Figure 5)		Percent Reduction		
			Damages	
No.	Name	Area Flooded	Crop and Pasture	Overbank Deposition
I	Lower Parsons Slough	50	35	86
II	Upper Parsons Slough and Lower Hickory Creek	77	76	12
Total		70	67	77

After the complete project is installed, a 77 percent reduction in overbank deposition will be effected, with 12 percent resulting from land treatment measures and the remaining 65 percent from structural measures.

Land treatment measures will reduce the present average annual gross sheet erosion above the retarding structures from 1.5 to 1.3 acre-feet per square mile of drainage area, a reduction of 13 percent. Similar reductions are expected in other portions of the watershed.

Without the project, the largest storm in the evaluation series will produce 5.92 inches of runoff from the watershed. Such a storm occurred September 30 through October 1, 1959. This volume of runoff without the project installed on the Hickory Creek and Parsons Slough portion of the watershed would produce a peak discharge of 7,151 cubic feet per second at the reference valley section No. 8, and would inundate 10,909 acres of flood plain land below proposed floodwater retarding structure sites. The accelerated land treatment program will reduce the surface runoff from this storm to 5.81 inches (7,018 c.f.s.) and the area inundated to 10,840 acres. The installation and full functioning of the structural works of improvement will increase the peak discharge to 8,773 c.f.s., but decreases the area inundated to 9,464 acres. Flood damage would be eliminated from 1,445 acres permitting use of this land to its fullest potential. Reduced flooding with the project installed will make it possible for farmers to increase bottomland productivity and to organize cropping systems which will increase returns.

Figure 3 graphically illustrates the reduction at valley section No. 1 for the storm of July 26-27, 1962 (8.18 inches of rainfall, 3.91 inches of runoff), representing a storm of approximately 10-year frequency.

An estimated 85 landowners and operators of flood plain land will benefit directly by the project.

The sediment pools of structures open to the general public will provide water based recreation such as fishing and hunting for local inhabitants. Approximately 1,500 visitors will participate annually with the most intensive use occurring during the period May through September. Peak use of about 110 persons are expected on holidays and week ends.

The project on Hickory Creek and Parsons Slough will reduce the annual water yeild from the watershed approximately 0.09 percent. The annual water yield from the 3.52 square miles controlled by floodwater retarding structures will be reduced approximately five percent.

PROJECT BENEFITS

The system of structural measures will produce average annual damage reduction benefits of $52,763 in the benefited area. In addition, land treatment measures will provide flood damage reduction benefits of $3,185 annually (table 6).

It is estimated that the project will produce secondary benefits averaging $4,843 annually in the local area. Secondary benefits of national significance were not considered pertinent to the evaluation.

Incidental recreation benefits (picnicking, fishing, and hunting) based

on an estimated value of 50 cents per visitor-day will equal $460 annually for structures open for public recreational use. Facilities will be moderately developed. Allowance was made for associated costs of $0.10 per user-day for repairs, maintenance, and operation of facilities and liability insurance.

Other substantial benefits, such as increased sense of security, better living conditions, and improved wildlife habitat will result from the project. None of these benefits were evaluated in monetary terms; nor have they been used for project justification.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures (amortized total installation cost, plus operation and maintenance) is $25,636 (table 4). These measures are expected to produce average annual primary benefits of $53,223. The ratio of primary benefits to cost will be 2.1 to 1. The ratio of total average annual project benefits ($58,066) to the average annual cost of structural measures ($25,636) is 2.3 to 1 (table 6).

PROJECT INSTALLATION

Land Treatment Measures

Land treatment measures itemized in table 1 will be established by farmers and ranchers over a 5-year period in cooperation with the Dalworth and Kaufman-Van Zandt Soil Conservation Districts which provide technical assistance in planning and application of these measures under their going programs. These programs will be accelerated with flood prevention funds to assure application of the planned measures within the 5-year installation period.

All planned land treatment will be installed in an orderly, progressive manner commensurate with the technical assistance man-years available. The land treatment goal is to treat adequately 80 percent of the land during the installation period. In reaching this goal it is planned that accomplishments will progress as follows:

Land Use	Fiscal Year					Total
	1st	2nd	3rd	4th	5th	
Cropland	800	1,100	1,300	1,300	800	5,300
Pastureland	4,120	5,500	6,874	6,873	4,130	27,497
Total	4,920	6,600	8,174	8,173	4,930	32,797

This project will be given special emphasis, priority, and planning in the work unit annual plan of operations for conservation planning and application assistance. The annual plan of operations will be documented to pinpoint who will be responsible for planning how many conservation plans and the goals for each individual conservation practice.

The above will be given full news coverage in all news media.

The governing body of the soil conservation districts will arrange for meetings in accordance with definite schedules. By this means, and by individual contacts, they will encourage the landowners and operators within the watershed to adopt and carry out the soil and water conservation plans on their farms. District-owned equipment will be made available to the landowners in accordance with existing arrangements for equipment usage in the districts.

The Soil Conservation Service work units at Dallas and Kaufman will assist landowners and operators cooperating with the districts in accelerating the preparation of soil and water conservation plans in the application of conservation practices.

The Extension Service will assist with the educational phase of the program by conducting general information and local farm meetings, prepare radio, television and press releases, and using other methods of getting information to landowners and operators in the watershed. This activity will help get the land treatment practices and structural measures for flood prevention established.

Structural Measures

The Soil Conservation Service will contract for the construction of the five floodwater retarding structures and 12.5 miles of channel improvement. It also will provide technical specialists to prepare plans and specifications, supervise contruction, prepare contract payment estimates, make contract payments, make final inspections, certify completion, and perform related duties for the installation of the structural measures.

The various features of cooperation between the parties involved have been covered in appropriate memoranda of understanding and working agreements.

The Dallas County Bois D'Arc Island Levee Improvement District No. 4 has the right of eminent domain under applicable State law and will obtain the necessary land, easements, and rights-of-way, including utility, pipeline, road and improvement changes. The Dallas County Bois D'Arc Island Levee Improvement District No. 4 will determine the legal adequacy of easements, permits, etc. for the construction of the planned structural measures. They will install culverts or make other needed improvements to keep crossings on county roads passable during periods of floodwater release. Local interests will be responsible for the improvement of individually owned crossings.

It will be feasible to construct either the floodwater retarding structures or the channel improvement first. Construction of the channel first will not materially affect its functioning because of the relatively small drainage area controlled by the floodwater retarding structures. All structural measures are included in one construction unit.

The structural measures will be constructed pursuant to the following conditions:

1. The requirements for land treatment in the drainage area above have been satisfied.

2. Land, easements, and rights-of-way have been secured for all structural measures, or written statements are furnished by the appropriate sponsoring local organization(s) that their rights of eminent domain will be used, if needed, to secure any remaining easements within the project installation period, and that sufficient funds are available and will be used to pay for these easements, permits, and rights-of-way.

3. Court orders have been obtained from the Dallas County Commissioners Court showing that the county roads affected by floodwater retarding structures will be relocated, raised 2 feet above emergency spillway crest elevation, closed, or permission granted to temporarily inundate the road and provide equal alternate routes as needed.

4. Project and operation and maintenance agreements have been executed.

5. Flood prevention funds are available.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement as described in this work plan will be provided under the authority of the Flood Control Act of 1944, as amended and supplemented.

Provision of Federal funds is contingent upon the local organizations meeting their obligations and upon appropriation of Federal funds for these purposes.

The Dallas County Bois D'Arc Island Levee Improvement District No. 4 is authorized by law "to levy, assess and collect taxes for the construction of dams and other flood control measures". The taxes are to be levied and collected annually. Revenue from the taxes can be used for acquiring rights-of-way, construction of works of improvement, and operation and maintenance purposes.

The costs of applying land treatment measures will be borne by the owners and operators of the land. Flood prevention funds will be used for technical assistance in accelerating the application of land treatment measures.

Contributions of land, easements or rights-of-way, materials, labor, equipment, services, and money will be used whenever possible. Dallas County Bois D'Arc Island Improvement District No. 4 funds also will be

used where necessary. Landowners were contacted by the local sponsors during development of the work plan, and it is expected that the major portion of the easements and rights-of-way will be donated.

The sponsoring local organizations do not plan to apply for a Farmers Home Administration loan for this project.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers in the area. Educational meetings will be held in cooperation with other agencies to outline the services available and eligibility requirements. Present clients will be encouraged to cooperate in the project.

The County Agricultural Stabilization Conservation Committee will cooperate with the sponsoring organizations by selecting and providing financial assistance for those land treatment measures which will meet the conservation objectives in the shortest possible time.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by the land owners or operators of the farms on which the measures are installed. Representatives of the soil conservation district will make periodic inspections of the land treatment measures to determine maintenance needs. Landowners and operators will be encouraged to perform the management practices and needed maintenance. District-owned equipment is available for this purpose.

Structural Measures

The estimated annual operation and maintenance cost is $2,900 for the floodwater retarding structures and stream channel improvement.

Specific operation and maintenance agreements will be executed prior to the issuance of invitation to bid on construction of any of the structural works of improvement included in this work plan.

Each year the Dallas County Bois D'Arc Island Levee Improvement District No. 4 will budget sufficient funds for operation and maintenance of the floodwater retarding structures and 12.5 miles of stream channel improvement. Maintenance will be accomplished through the use of contributed labor and equipment, by contract, by force account, or by a combination of these methods.

The structural measures will be inspected jointly by representatives of the appropriate soil conservation district and the levee improvement district after each heavy streamflow. The Soil Conservation Service representative will participate in these inspections at least annually. For the floodwater retarding structures, items of inspection will include, but will not be limited to, the condition of the principal spillway and its appurtenances, the earth fill, the emergency spillway, the vegetative

cover, and the fences and gates installed as a part of the structure. For the stream channel improvement, items of inspection will include, but will not be limited to, the degree of scour, silting, and bank erosion; obstructions to flow caused by debris lodged against bridges, fences, and watergates; excessive brush and tree growth within the chanel; and the condition of side inlets and drains. The items of inspection listed are those most likely to require maintenance.

The Soil Conservation Service, through the Dallas County Bois D'Arc Island Levee Improvement District No. 4 and the Dalworth and Kaufman-Van Zandt Soil Conservation Districts, will participate in operation and maintenance only to the extent of furnishing technical assistance.

Provisions will be made for free access of representatives of sponsoring local organizations and Federal representatives to inspect and provide maintenance for all structural measures and their appurtenances at any time.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

Price Base: 1963

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) Federal 1/	Other 2/	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Acre	5,300	-	31,020	31,020
Pastureland	Acre	27,497	-	109,430	109,430
Technical Assistance (Accelerated)			21,046	-	21,046
SCS Subtotal		32,797	21,046	140,450	161,496
TOTAL LAND TREATMENT		32,797	21,046	140,450	161,496
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding					
Structure	No.	5	83,710	-	83,710
Stream Channel Improvement	Foot	66,135	287,760	-	287,760
Subtotal			371,470	-	371,470
Subtotal - Construction			371,470	-	371,470
Installation Services					
Soil Conservation Service					
Engineering Services			49,800	-	49,800
Other			32,080	-	32,080
Subtotal			81,880	-	81,880
Subtotal - Installation Services			81,880	-	81,880
Other Costs					
Land, Easements, and Rights-of-Way			-	116,540	116,540
Legal Fees			-	1,500	1,500
Subtotal - Other Costs			-	118,040	118,040
TOTAL STRUCTURAL MEASURES			453,350	118,040	571,390
Work Plan Preparation Cost			29,000	-	29,000
TOTAL PROJECT			503,396	258,490	761,886
SUMMARY					
Subtotal - SCS			503,396	258,490	761,886
TOTAL PROJECT			503,396	258,490	761,886

1/ Flood prevention funds.
2/ Includes reimbursement from ACP funds under going programs.

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

Price Base: 1963

Measures	Unit	Applied to Date 1/	Total Cost (dollars) 2/
LAND TREATMENT			
Brush and Weed Control	Acre	12,633	61,000
Conservation Cropping System	Acre	11,487	14,203
Contour Farming	Acre	1,209	1,879
Cover and Green Manure Crop	Acre	13,642	35,121
Crop Residue Use	Acre	16,042	19,020
Diversion	Foot	106,422	21,284
Farm Pond	No.	200	140,287
Grade Stabilization Structure	No.	1	6,800
Grassed Waterway or Outlet	Acre	20	450
Pasture and Hayland Renovation	Acre	5,708	83,466
Pasture and Hayland Planting	Acre	2,905	48,201
Pasture Proper Use	Acre	12,606	46,255
Rotation Grazing	Acre	3,468	5,189
Terrace, Gradient	Foot	36,167	1,958
TOTAL	xxx	xxx	485,113

1/ As of June 30, 1964
2/ Includes reimbursement from ACP funds under going programs.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION 1/
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

(Dollars) 2/

Structure Site Number or Name	Installation Cost - Federal Funds				Total Non-Federal Installation Cost 3/	Total Installation Cost
	Construction	Installation Services: Engineering	Installation Services: Other	Total Federal		
Floodwater Retarding Structures						
3	12,580	4,030	1,260	17,870	1,440	19,310
4	14,030	4,490	1,400	19,920	1,310	21,230
5	8,180	2,620	820	11,620	800	12,420
6	41,900	7,630	3,770	53,300	3,750	57,050
10	7,020	2,250	700	9,970	1,540	11,510
Subtotal	83,710	21,020	7,950	112,680	8,840	121,520
Stream Channel Improvement						
Hickory Creek and Parsons Slough	287,760	28,780	24,130	340,670	109,200	449,870
GRAND TOTAL	371,470	49,800	32,080	453,350	118,040	571,390

1/ Does not include work plan preparation cost.
2/ Based on 1963 prices.
3/ Includes land, easements, rights-of-way, legal fees, and removing obstacles.

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TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

Item	Unit	Structure Number 3	4	5	6	10	Total
Drainage Area	Sq.Mi.	0.62	0.50	0.26	1.67	0.47	3.52
Storage Capacity							
Sediment Pool	Ac.Ft.	25	22	10	45	16	118
Sediment in Detention Pool	Ac.Ft.	5	5	2	10	4	26
Floodwater Detention	Ac.Ft.	97	91	45	472	105	810
Total	Ac.Ft.	127	118	57	527	125	954
Surface Area							
Sediment Pool 1/	Acre	7	5	3	13	6	34
Floodwater Pool	Acre	21	17	10	63	22	133
Volume of Fill	Cu.Yd.	18,050	27,270	18,500	82,300	14,500	160,620
Elevation Top of Dam	Foot	401.3	411.0	399.5	402.2	390.3	xxx
Maximum Height of Dam 2/	Foot	25	26	18	28	20	xxx
Emergency Spillway							
Crest Elevation	Foot	399.3	409.0	397.5	399.0	388.3	xxx
Bottom Width	Foot	40	50	30	100	40	xxx
Type		Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Percent Chance of Use 3/		4.0	4.0	4.0	3.6	4.0	xxx
Average Curve No. - Condition II		81	82	78	78	79	xxx
Emergency Spillway Hydrograph							
Storm Rainfall (6-Hour) 4/	Inch	-	-	-	7.00	-	xxx
Storm Runoff	Inch	-	-	-	4.48	-	xxx
Velocity of Flow (V_c) 5/	Ft./Sec.	-	-	-	0	-	xxx
Discharge Rate 5/	C.F.S.	-	-	-	0	-	xxx
Max. Water Surface Elevation 5/	Foot	-	-	-	-	-	xxx
Freeboard Hydrograph							
Storm Rainfall (6-Hour) 6/	Inch	-	-	-	14.50	-	xxx
Storm Runoff	Inch	-	-	-	11.60	-	xxx
Velocity of Flow (V_c) 5/	Ft./Sec.	-	-	-	7.5	-	xxx
Discharge Rate 5/	C.F.S.	-	-	-	1,320	-	xxx
Max. Water Surface Elevation 5/	Foot	-	-	-	402.2	-	xxx
Principal Spillway Capacity (Max.)	C.F.S.	68	41	17	21	19	xxx
Capacity Equivalents							
Sediment Volume	Inch	0.90	0.99	0.85	0.62	0.79	xxx
Detention Volume	Inch	2.92	3.43	3.25	5.30	4.20	xxx
Spillway Storage 7/	Inch	1.53	1.50	1.60	2.58	2.21	xxx
Class of Structure 8/		-	-	-	A	-	xxx

Footnotes:

1/ Surface area at top of riser.

2/ Measures from centerline of stream channel to effective top of dam.

3/ Based on regional stream gage analysis and soil-cover complex characteristics of the watershed of the individual structure.

4/ Value of P taken from Plate 2-a1, Spillway Design Storm, ENGINEERING-HYDROLOGY MEMORANDUM TX-1.

5/ Maximum during passage of hydrograph.

6/ Value of P taken from Plate 2-a2, Freeboard Storm, ENGINEERING-HYDROLOGY MEMORANDUM TX-1.

7/ Storage from emergency spillway crest to top of dam.

8/ All structures except No. 6 designed under small dam criteria as outlined in Texas Engineering Handbook, Section 17.

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TABLE 3A - STRUCTURE DATA - STREAM CHANNEL IMPROVEMENT

North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

Channel Designation	Station Numbering for Reach: Station (100 ft.)	Station Numbering for Reach: Station (100 ft.)	Watershed Area 1/ (sq.mi.)	Required Channel Capacity (c.f.s.)	Planned Channel Capacity (c.f.s.)	Average Bottom Width (ft.)	Average Side Slope	Average Depth (ft.)	Average Grade (pct.)	Average Velocity in Channel (ft./sec.)	Volume of Excavation (1000 cu.yds.)
℄ Trinity River	(Begin Project)										
VS-1	0+00	26+40	52.29	5,056	5,056	80	1.5:1	11.8	0.055	4.42	
VS-2	26+40	57+10	52.29	5,056	5,056	80	1.5:1	11.8	0.055	4.42	
VS-3	57+10	122+05	51.77	5,056	5,130	80	1.5:1	11.8	0.055	4.42	
VS-4	122+05	190+00	50.77	5,056	5,056	80	1.5:1	13.7	0.032	3.69	
VS-5	190+00	269+90	46.63	5,056	5,080	80	1.5:1	12.7	0.043	4.08	
VS-6	269+90	346+80	43.28	5,056	5,070	80	1.5:1	12.3	0.048	4.22	
VS-7	346+80	410+50	40.47	5,056	5,110	80	1.5:1	14.1	0.029	3.55	
VS-8	410+50	464+60	35.83	5,056	5,140	80	1.5:1	13.2	0.036	3.85	
VS-9	464+60	527+65	34.70	5,056	5,100	80	1.5:1	14.8	0.024	3.35	
VS-10	527+65	599+00	31.52	5,056	5,100	60	1.5:1	13.8	0.054	4.60	
	599+00	661+35	28.95	5,056	5,100	50	1.5:1	12.3	0.110	6.00	
	(End Project)										
										TOTAL	1,063.84
										GRAND TOTAL	1,063.84

1/ Does not include area controlled by floodwater retarding structures.

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TABLE 4 - ANNUAL COST
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Floodwater Retarding Structures 3, 4, 5, 6, and 10; and 12.5 Miles of Stream Channel Improvement	22,736	2,900	25,636

1/ Installation cost based on 1964 prices amortized for 50 years at 3.125 percent.
2/ Long-term prices as projected by ARS, September 1957.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefits
Floodwater			
Crop and Pasture	76,095	25,408	50,687
Subtotal	76,095	25,408	50,687
Sediment			
Overbank Deposition	227	52	175
Subtotal	227	52	175
Indirect	7,632	2,546	5,086
TOTAL	83,954	28,006	55,948

1/ Price Base: Long-Term as projected by ARS, September 1957.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

North Trinity Laterals Watershed, Texas
(Trinity River Watershed)

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/				Average Annual Cost 2/	Benefit-Cost Ratio
	Flood Prevention					
	Damage Reduction	Incidental Recreation	Secondary	Total		
Floodwater Retarding Structures 3, 4, 5, 6, and 10; and 12.5 Miles of Channel Improvement 3/	52,763	460	4,843	58,066	25,636	2.3:1.0

1/ Price Base: Long-term prices as projected by ARS, September 1957.
2/ From table 4.
3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $3,185 annually.

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INVESTIGATIONS AND ANALYSES

Land Use and Treatment Investigations

The current status of land treatment measures for the watershed was developed by the Dalworth and Kaufman-Van Zandt Soil Conservation Districts, with assistance from the Soil Conservation Service work unit personnel at Dallas and Kaufman.

Conservation needs data and conservation plans previously developed were examined. The kinds and amounts of land treatment practices to be applied on farms under conservation plans were obtained from records maintained by the Soil Conservation Service and expanded to represent the watershed area.

Trends in farming operations, expected changes in land use, soil condition, land tenure, and other pertinent data were used. From these data, land treatment measures expected to be applied during the 5-year installation period were selected. Past rates of application were examined, and the need for funds to be used for accelerated technical assistance was determined.

Land treatment practices that have been applied on farms under conservation plans, obtained from accomplishment records maintained by the Soil Conservation Service, were expanded to represent the applied to date within the watershed.

An estimate was made of the measures that could be applied in the 5-year installation period. The acres to be treated and cost of treatment measures by land use are shown in table 1.

Table 1A reflects the cost of land treatment measures applied prior to development of the work plan.

Engineering Investigations

The following steps were taken in making the engineering investigations:

1. A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads, and other pertinent information. Probable sites for floodwater retarding structures were located by a study of U. S. Geological Survey maps, stereoscopic study of photographs, and field examinations. Tentative locations of the structure sites and valley cross sections were placed on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations (figure 4).

2. A field examination was made of all possible floodwater retarding structure sites thus located. Two sites were

dropped from further consideration when it was determined that there were insufficient below-site benefits to justify the structures. Three other sites were dropped when it was determined that obstacles such as roads, barns, or houses would be involved in the flood pools. After these deletions, five sites remained for consideration.

3. Topographic maps with 4-foot contour intervals were developed on aerial photographs (1 inch = 660 feet) from engineering field surveys of the flood pool, dam, and emergency spillway areas of each site. Cross section and profile data were obtained at all dam centerlines, pipelines, utility lines, roads, and property lines involved in each site.

   Four sites have small drainage areas and were classified as small dams since the product of the depth and capacity was kept below 3,000. These sites were designed using criteria outlined in Texas Engineering Handbook, Section 17. Sediment storage meets criteria outlined in Engineering Memorandum SCS-27 and Texas State Manual Supplement 241.

   Site No. 6 was classified an "a" structure and was designed using the criteria outlined in Engineering Memorandum SCS-27 and Texas State Manual Supplement 241. The sediment and floodwater storage requirements, structure classification, and emergency spillway layout and design meet or exceed these criteria.

   The limit of the pool areas, estimate of installation cost, and the most economical design for each structure were determined from the surveys of each site.

   Additional cross sections and profile data were obtained to supplement valley section data needed for design and cost estimates for proposed stream channel improvement on Parsons Slough.

4. Structure data tables were developed to show for all proposed floodwater retarding structures, the drainage area, storage capacity planned for floodwater detention and sediment, release rate of the principal spillway, emergency spillway capacity, area inundated by the pools, volume of fill in the dam, estimated cost, and other pertinent data (tables 2 and 3).

   Tables were developed for stream channel improvement to show watershed area, planned capacity, design data, volume of excavation, estimated cost, and other pertinent data (tables 2 and 3A).

5. Floodwater detention capacity was provided in site No. 6 to detain the expected runoff from a 25-year storm event. For sites 3, 4, 5, and 10, the principal spillways were proportioned so that the combined total of the floodwater detention and the 2-day release of each site would equal the expected runoff from a 25-year storm event. The detention requirement for a 25-year storm event was determined from a regional analysis of stream gage records. The percent chance of use of the emergency spillways, based on regional analysis of gaged runoff is shown in table 3.

6. Appropriate emergency spillway design and freeboard storms for site No. 6 were selected from Plates 2-a1 and 2-a2 of ENGINEERING-HYDROLOGY MEMORANDUM TX-1.

   Spillway design and freeboard inflow hydrographs were developed for this structure by the distribution graph method. Various combinations of spillway widths and depths were computed in order to determine the most economical structure. This structure was graphically routed using the Goodrich flood routing method described on page 5.8-12 of the National Engineering Handbook, Section 5, to determine the effective top of dam.

   For sites 3, 4, 5, and 10 the emergency spillways were designed to pass at safe velocities the expected runoff from a 100-year storm event.

7. Estimates were made of the volume of fill in the dams and the costs of the structures. Total costs were determined from a preliminary design and cost estimate of significant individual items such as embankment, principal spillway, clearing, and fencing. Unit prices were determined from recent contracts of structures in sites with similar characteristics. Conditions peculiar to an individual site such as wet excavation and need for foundation drainage were considered.

   Estimate of the volume of excavation for stream channel improvement was made using the additional cross sections surveyed. Where feasible, the natural channel was used and considered in the estimate of excavation. Amount of clearing was estimated from recent aerial photographs. Unit prices were determined from recent contracts.

   Cost distribution tables were developed (table 2).

Hydraulic and Hydrologic Investigations

The following steps were taken as part of the hydrologic and hydraulic investigations:

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau, U. S. Geological Survey Water Supply Papers, and local records. These data were analyzed to determine average precipitation depth-duration relationships, seasonal distribution of precipitation, frequency of occurrence of meteorological events, historical flood series, rainfall-runoff-peak discharge relationships, and the relationship of geology, soils, and climate to runoff depth for single storm events.

2. Engineering surveys were made of valley cross sections, high water marks, bridges, and other data pertinent to determining flood and sediment damages. The cross sections were selected to represent the stream hydraulics and flood plain area. Evaluation reaches were deleineated after joint study with the economist and geologist.

   Partial valley cross sections for planning stream channel improvement were surveyed at approximately 1,000-foot intervals on the main stem of Parsons Slough and Hickory Creek in the reaches where channel improvement was studied and planned.

3. The before-project hydrologic conditions of the watershed were determined on the basis of cover conditions, land treatment, soil groups, and crop distribution. The II-Curve number of 81 for the hydrologic soil-cover complex was determined for that part of the watershed including Parsons Slough, Hickory Creek, and their tributaries.

   The after-project conditions were determined by analysing the results of the land treatment that would be applied during the installation period. This study revealed that a II Condition Curve number of 80 is applicable.

4. Cross section rating curves were computed from field survey data by the use of Manning's formula.

5. Runoff-peak discharge relationships were determined by flood routing the runoff from the 24-hour duration rainfall, 10-year frequency, as selected from Technical Paper No. 40, U. S. Weather Bureau. The storage-indication method of routing, modified by the use of a variable travel time, was used. Initial hydrographs for routing were developed by means of Common's distribution graph. The peak discharge for each subwatershed was determined by the

equation $q = \frac{484\ A\ Q}{\frac{D}{2} + .6\ Tc}$, taken from the National Engineering Handbook, Section 4, Supplement A, Part 3.16, where q = peak rate in cfs
A = drainage area in square miles
Q = the runoff volume in inches
D = the duration of excess rainfall in hours
Tc = the time of concentration in hours.

The peak discharges agree favorably with gaged data on similar watersheds.

Peak discharges under project conditions were determined in a similar manner by flood routing the runoff from the uncontrolled areas and adding the outflow from the floodwater retarding structures.

6. Stage-area inundated curves were developed from field survey data for each portion of the valley represented by a cross section. Runoff-area inundated curves were developed for each evaluation reach for existing watershed conditions. Similar curves were developed to show the effect of the system of floodwater retarding structures, the stream channel improvement, and the levee system.

7. The rainfall records from the Dallas gage were studied for the period 1923 through 1963. From a tabulation of cumulative departure from normal precipitation, the 40-year period 1924 through 1963 was determined to be representative of normal precipitation on the watershed. The historical evaluation series was developed from that period, with individual events limited to a period of 2 days.

8. Determinations were made of the area that would have been inundated by each storm of the evaluation series under each of the following conditions:

   a. The without-project condition using the before-project soil-cover complex number.

   b. The installation of land treatment measures for watershed protection.

   c. The installation of land treatment measures and floodwater retarding structures.

   d. The installation of land treatment measures, floodwater retarding structures, and stream channel improvement.

e. The installation of land treatment measures, floodwater retarding structures, stream channel improvement, and the levee system.

9. The evaluation series contained 201 storms that would cause flood damage at the smallest cross section, an average of approximately five floods per year.

10. To evaluate the levee system, a flood series was prepared for the Trinity River floods. The stream gage records at Dallas, Texas, approximately 40 miles upstream from the confluence of the Trinity River and Parsons Slough, and the stream gage record at Rosser, Texas, approximately 10 miles downstream from the confluence of the Trinity River and Parsons Slough, were used to develop a stage-discharge-area inundated relationship for the Trinity River floods on the watershed. The area inundated was measured from the U. S. Army Corps of Engineers' topographic sheets. The stage-discharge curve for the Trinity River at the confluence of Parsons Slough was based on the stream gage at Rosser, Texas, since it is closer to the mouth of Parsons Slough. Stream gage records from 1908 through 1963 were studied and a frequency curve was developed for each of the two gages. Since the frequency curves agreed closely and the Dallas gage records were longer, the Dallas gage was selected for use in the flood series. Due to the installation of several large reservoirs above the gages, the discharges prior to 1954 were modified according to the U. S. Study Commission-Texas (Work Assignment 2.2a).

There were 27 damaging floods in the 40-year Trinity River evaluation series. Eighteen of these floods occurred simultaneously with floods from runoff within the watershed.

11. Two levee systems to eliminate flooding from the Trinity River were investigated. Neither of these systems was found to be feasible.

12. Proportioning of stream channel improvement for Parsons Slough and Hickory Creek is based on stability, bedload, and tractive force studies. The selected design was planned to protect the flood plain from damage by a storm which would porduce approximately 3.1 inches of runoff from the watershed. The average cross section of the improved channel will carry the runoff from 188 of the 201 storms plus release flows from floodwater retarding structures without causing damage.

13. A reservoir operation study for the period 1948 through 1962 was made for the proposed floodwater retarding structures in the watershed. The surface areas and capacities of the 5 structure sites were related to inches of runoff

and combined for developing the composite area-capacity curve. Gross lake surface evaporation rates were taken from Texas Water Commission data (Texas Board of Water Engineers' Bulletin 6006). This material was adjusted for pan coefficient to conform with data in U. S. Department of Commerce, Weather Bureau, Technical Paper No. 37.

Sedimentation Investigations

Sedimentation investigations were made in accordance with procedures as outlined in Technical Release No. 17, "Geologic Investigations for Watershed Planning", March 1961, and Technical Release No. 12, "Procedure for Computing Sediment Requirements for Retarding Reservoirs", September 1959, U. S. Department of Agriculture, Soil Conservation Service.

Sediment Source Studies

Sediment source studies to determine the 50-year sediment storage requirements were made in the drainage areas of the 5 planned floodwater retarding structures using the following procedures:

1. Detailed investigations were made in the drainage areas of two of the planned floodwater retarding structures. These investigations included: mapping soil units by slope in percent; slope lengths; present land use; present land treatment on cropland; present cover condition classes on rangeland and pasture; land capability classes; lengths, widths and depths of all stream channels and sheet scour affected by erosion; and the estimated annual lateral erosion of stream channels.

2. Office computations included summarizing erosion by sources (sheet erosion and streambank erosion) in order to fit these data into formulas for computation of gross annual soil loss in tons for conversion to acre-feet.

3. Field surveys and office computations to determine sediment volumes under present conditions for the remaining 3 structures, not surveyed in detail, consisted of mapping the land use and arranging the sites into homogeneous groups. Sediment source summary sheets were prepared, based on similar sites which were surveyed in detail.

4. The sediment rates were then adjusted to reflect the effect of expected land treatment on the drainage areas of the planned floodwater retarding structures. The computed sediment storage requirement for each site is based on a gradual improvement of watershed conditions due to the installation of needed land treatment measures expected to be installed during the first five years and maintained at 75 percent effectiveness during the next 45 years.

5. The volume of sediment storage allocated to the different pools in the planned structures is based on a volume weight of 81-88 pounds per cubic foot for submerged sediment, and 92-96 pounds per cubic foot for aerated sediment.

6. The allocation of sediment to the structure pools was based on 20 percent deposition in the detention pool and 80 percent deposition in the sediment pool. This allocation was determined on the basis of topography and texture of sediment after allowing for 5 to 10 percent of the sediment being carried in suspension through the outlet structure.

Flood Plain Sedimentation and Scour

The following sedimentation and scour damage investigations were made to evaluate the nature and extent of physical damage to flood plain land, giving due consideration to agronomic and other land treatment practices, soils, crop yields, and land capabilities:

1. Field examination and aerial photograph studies were made making note of depth and texture of deposits, scour channels, sheet scour areas, stream channel aggradation or degradation, and other important factors.

2. Estimates of past physical flood plain damages were obtained through interviews with the landowners and operators.

3. A damage table was developed to show percent damage by texture and depth increment for deposition and percent damage by depth and width for scour. No significant scour damage was found.

4. The sediment damages were summarized by evaluation reaches for the entire flood plain and adjusted for recoverability of productive capacity. Estimates for recoverability of productive capacity were developed from field studies and interviews with farmers.

5. Using the average annual erosion rates as a basis, the average annual sediment yeilds to damaged areas of the flood plain were estimated for present conditions, with land treatment and with structural measures installed. The results were compared to show the average annual reduction of sediment load contributing to overbank deposition. The reduction of overbank deposition is based on this reduction of sediment load and reduction of area inundated by floodwater.

Channel Stability Investigations

Borings with a core drill, power auger, and hand auger were made along the route of the planned channel improvement. The materials were logged. Noted were texture and plasticity of the soils along with thickness of strata, presence and nature of bedrock, depth to ground water, and any other pertinent factors. Representative samples of the soil materials were tested by the laboratory for grain size distribution, Atterburg limits, dispersion, and soluble salt content. The laboratory results were analyzed and maximum allowable tractive forces and maximum allowable velocities were determined for various reaches of the channel. These allowable values were compared with the computed tractive forces and velocities that would develop with the preliminary channel design. The studies show that erosion can be expected on certain reaches containing fine silty sand at planned grade.

Geological Investigations

Preliminary geologic dam site investigations were made at each of the 5 planned structure sites in accordance with the National Engineering Handbook, Section 8, Chapter 6, and the Guide to Geologic Site Investigations, Fort Worth E&WP Unit Area, U. S. Department of Agriculture, Soil Conservation Service. The following procedure was used:

1. Available pertinent geologic maps and literature were gathered and studied.

2. Stereoscopic studies were made of aerial photographs to determine the location of rock outcrops and to help trace the strata through the site areas.

3. A field investigation was made of each site and notes were made of the following:

   a. Lithology, thickness, structure and sequence of rock strata.

   b. The nature and thickness of the soil mantle in the foundation, borrow, and possible spillway areas as determined from exposures and from hand auger borings.

   c. General topography.

   d. Stream channel dimensions, bed load, and stability of the bed and banks.

   e. Springs, open bedding planes, erodible areas, water tables, faults, caverns and any other geologic characteristics that might have a bearing on the design and construction of a dam.

4. The field notes along with information pertaining to exact spillway excavation volumes, embankment dimensions and volumes, physiographic description, etc. were used to complete Form SCS-375, "Preliminary Geologic Investigations of Dam Sites".

Description of Problems

All of the planned structures are located on Pleistocene terrace deposits. These deposits are primarily deep, loosely consolidated, clays and sands. According to the Unified Soil Classification System, they are CL, SC, and SM. Rapid lateral variation in thickness of strata and pinching out of strata are common.

The sites have sound foundations and excellent building materials are readily accessible. However, seepage control will be necessary for the sandy foundation materials. Erodible emergency spillway materials are present and should be controlled with a good grass cover as soon as possible after construction.

Detailed investigations, including explorations with core drill equipment, will be made at all floodwater retarding structure sites prior to construction. Laboratory tests will be made to determine precise treatment of soil materials in the foundations and embankments.

Economic Investigations

Basic methods used in the economic investigation and analysis are outlined in the Economics Guide issued March 1964.

Determination of Annual Benefits from Reduction in Damages

Agricultural damage estimates were based upon schedules obtained from owners and operators of flood plain property. The sample covered about 50 percent of the flood plain and was considered adequate and representative for the economic evaluation. These schedules covered past and present land use, crop distribution under normal conditions, crop yields, and data on flooding and flood damage.

Analysis of this information formed the basis for determining damage rates for various depths and seasons of flooding.

The flood plain land use was mapped in the field. Estimates of normal yields were based on data obtained from the schedules and supplemental information from agricultural workers in the area.

It was found that differences in land use, frequency of flooding, and degree of future use justified division of the flood plain into two evaluation reaches. A different damageable value was used for each reach.

No estimates of other agricultural damages were made inasmuch as grazing crops are of minor importance, with the resultant lack of fencing in the

watershed.

Operators anticipate flooding as a result of good news media, and other agricultural loss is seldom experienced.

The estimated monetary value of the physical damage to the flood plain from deposition of infertile sediment upon high producing agricultural land was based on the value of production lost. The estimate took into account the lag in recovery and the cost of farm operations to speed recovery.

There is no flood plain scour damage on the flood plain.

Indirect damages involved such items as additional travel time for farmers; re-routing of general traffic, school busses, and mail deliveries; and costs of extra feed for livestock during and after floods. Based on information and data obtained from detailed studies in this watershed, it was determined that indirect damages approximate 10 percent of the direct damages.

Owners and operators were asked what changes they would make in their flood plain land use or cropping systems if flood protection were provided. They indicated that no change in land use would be made. Consequently, it is not expected that acreages of crops subject to acreage allotments will be increased as a result of the project. No benefits were claimed as a result of the project. No benefits were claimed as a result of more intensive land use, changed land use, or restoration of lands to former productivity.

Evaluation of incidental recreation benefits was based on an economic analysis of existing structures and from past experience. This analysis indicated that the project will have an average of 1,500 visitor-days annually and net benefits of $0.40 per visitor-day, after allowances of $0.10 for associated costs. It was estimated that the capacity of the sediment pools would remain adequate for recreational purposes for 30 years and decline to zero at the end of 50 years. The incidental recreational benefits were discounted to allow for this depletion in capacity.

Dallas and Kaufman Counties have not been designated as a Redevelopment Area under Sections 5(a) and 5(b) of the Area Redevelopment Act, May 1, 1961 (Public Law 87-27).

The value of the local secondary benefits stemming from the project was considered to be equal to 10 percent of the direct primary benefits. This excludes all indirect benefits from the computations of secondary benefits.

The value of easements were determined through local appraisal, giving full consideration to the current real estate market values. An estimate was made of the value of production lost in the pool areas after installation of the program. In this appraisal it was considered that the sediment pools will yield no production. The land covered by the detention pools would be used for grazing after installation of the program.

The average annual loss in production within the floodwater retarding structure sites, plus secondary costs therefrom, were compared with the amortized value of easements. The easement value was found to be greater and, therefore, was used in economic justification to assure a conservative benefit-cost analysis.

Fish and Wildlife Investigations

The Bureau of Sport Fisheries and Wildlife, USDI, in cooperation with the Texas Parks and Wildlife Department, made a reconnaissance study of the proposed North Trinity Laterals watershed project. The following is quoted from their report dated September 7, 1965:

> "The only stream fish habitat in the watershed is the lower 6 miles of Parsons Slough. Minnows are the principal fish in the stream. A few flathead catfish, blue catfish, black bullheads, carp, gars, and sunfishes enter the slough when the Trinity River rises. The habitat is of poor quality and the amount of fishing is insignificant. This condition would not be expected to change without the project.
>
> "There is no commercial fishing in Parsons Slough and none would be expected in the future.
>
> "The construction of farm ponds and floodwater retarding structures will provide fish habitat which, if properly stocked and managed, will provide good fishing. Enlargement of Parsons Slough will permit rapid runoff of water and the fish habitat will be eliminated.
>
> "Fair wildlife habitat occurs on much of the watershed. Wildlife present on the watershed are white-tailed deer, bobwhites, mourning doves, fox squirrels, cottontails, swamp rabbits, jackrabbits, raccoons, opossums, skunks, bobcats, gray foxes, red foxes, red wolves, minks, and several species of waterfowl.
>
> "The populations of deer and bobwhites are low and there is little hunting for them. Mourning doves and fox squirrels are the most common game species and hunting for them is done primarily by landowners and their friends. There is little or no hunting for the other wildlife species in the watershed. Without the project, no significant change is anticipated in the status of wildlife populations and hunting.
>
> "There is no trapping of fur animals in the watershed and none is expected in the future.
>
> "Some of the proposed land treatment measures, such as wildlife development on 300 acres, proper pasture and range use, and probably pasture and hayland planting, will improve habitat for most species of upland game. The proposed preservation of 940 acres of wildlife habitat will retain part of the existing wildlife habitat. Farm ponds and floodwater reservoirs will provide additional resting habitat for waterfowl during periods of migration.

"Land clearing, brush and weed control, and clearing for farm ponds, floodwater retarding structures, and channel improvements will result in losses of wildlife habitat far greater in amount than will be retained or improved by the other proposed land treatment measures.

"The project will provide opportunities to develop good fishing, improve the wildlife habitat in some areas, and minimize losses of wildlife habitat in other areas of the watershed.

"Clearing of timber should be kept to an absolute minimum during the construction of farm ponds and floodwater retarding structures, and enlargement of stream channels. The basins of ponds and floodwater reservoirs should be disked and planted to small grains adaptable to the area upon completion and prior to the storage of water. This practice would increase fertility and decrease turbidity while filling. When practicable, farm ponds and floodwater retarding structures should be fenced to prevent damage to the dams and muddying of the water by livestock. A watering device, if required for livestock use, should be installed below the dams and outside of the enclosures.

"Lands adjacent to the periphery of the ponds and structures should be sown in grass to prevent soil erosion and runoff of silt into the basins of the impoundments.

"The Texas Parks and Wildlife Department should be consulted before stocking the reservoirs with fish and subsequent stocking of fish should be done only upon the advice of that Department.

"Planting wildlife food cover plants on gravel piles, eroded areas, in gullies, on steep banks, on spoil areas, and strip plantings along fencerows and driveways would benefit wildlife. Such plantings would, in addition to providing food and cover for wildlife, serve as windbreaks, prevent erosion, and beautify the landscape.

"To minimize losses of wildlife habitat, a systematic program should be developed to retain patches of timber over as many areas in the watershed as possible during clearing of land and brush and weed control.

"It is recommended:

1. That clearing of timber be kept at a minimum in the process of construction of farm ponds and floodwater retarding structures and of enlargement of the stream channels.

2. That the basins of farm ponds and floodwater retarding structures be disked and planted to small grains adaptable to the area upon completion and prior to storage of water.

3. That the floodwater retarding reservoirs and farm ponds be fenced, when practicable, and a watering device for cattle be installed below the dam and outside of the enclosure.

4. That lands adjacent to the periphery of farm ponds and floodwater retarding structures be planted into grass to prevent soil erosion and runoff of silt into the basins of the impoundments.

5. That farm ponds and floodwater retarding reservoirs be stocked with fish only upon the advice of the Texas Parks and Wildlife Department.

6. That barren areas, eroded areas, gullies and steep banks, spoil disposal areas, and strips along fence-rows and driveways be planted with plants useful to wildlife as food and cover, to prevent soil and wind erosion, and to beautify the landscape.

7. That a systematic clearing plan be devised to retain patches of timber over as many areas as possible in the watershed during clearing of land and brush and weed control.

"Detailed studies by the Bureau of Sport Fisheries and Wildlife are not considered necessary at this time. Opportunities for including storage in the proposed floodwater retarding reservoirs for fish and wildlife development were considered by the project sponsors. No sites were deemed to be suitable. If at a later time it is decided to include storage for fish and wildlife in one or more of the reservoirs, our Bureau in cooperation with the Texas Parks and Wildlife Department will be pleased to offer advice in the preparation of plans for the inclusion of fish and wildlife developments."

4-20503 8-65

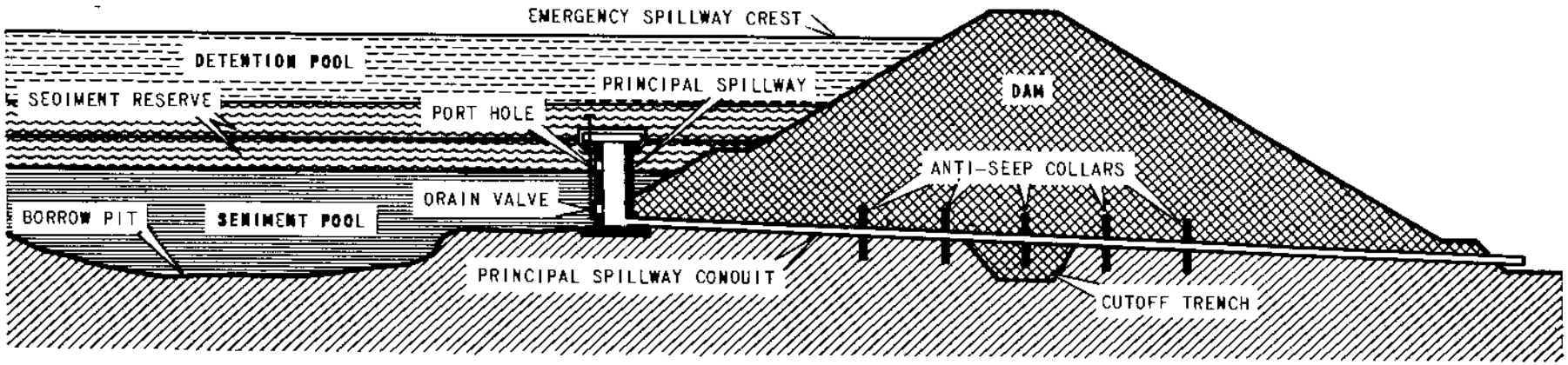


Figure 1

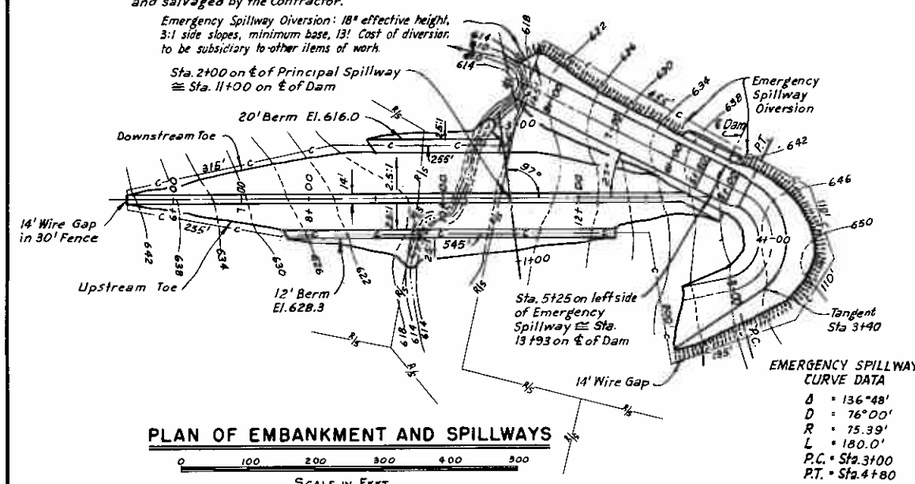
SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

FENCE LEGEND

—C— New fence to be constructed under this contract.

—R/S— Fence in construction area to be removed and salvaged by the Contractor.

A minimum of 6" topsoil to be placed in Emergency Spillway and on all "Compacted Fill Areas." See the specifications.



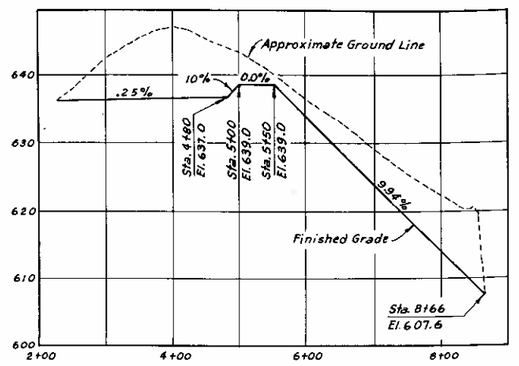
EMERGENCY SPILLWAY CURVE DATA

Δ = 136°48'
D = 76°00'
R = 75.39'
L = 180.0'
P.C. = Sta. 3+00
P.T. = Sta. 4+80

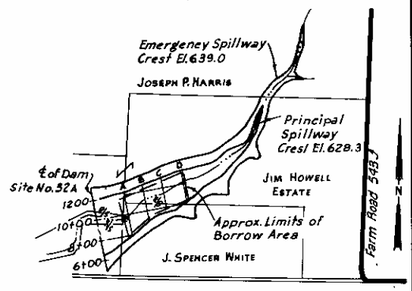
PLAN OF EMBANKMENT AND SPILLWAYS

0 100 200 300 400 500

SCALE IN FEET



PROFILE ON ℄ OF EMERGENCY SPILLWAY

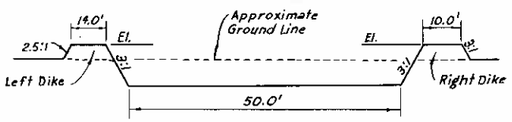


Structure Site No. 32A is located approximately 4.5 miles west of ANNA, Collin County, Texas.

VICINITY MAP & GENERAL PLAN OF RESERVOIR

0 660 1320 1980 2640

SCALE IN FEET



Left Dike Note:

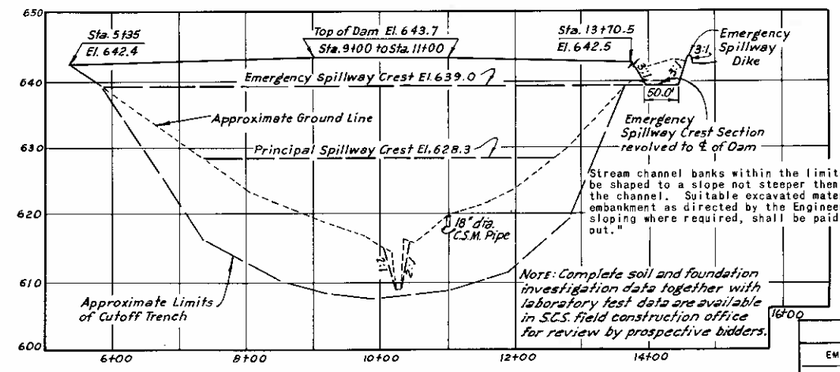
Approximate Sta. 5+00 to Embankment: El. 642.5

Right Dike Note:

Approximate Sta. 5+10 to Sta. 5+50 El. 642.5
Grade top of Dike uniformly from El. 642.5 @ Sta. 5+50 to 3.0' above grade @ approximate Sta. 6+00.

Material forming Dike shall be placed and paid as "Compacted Fill."

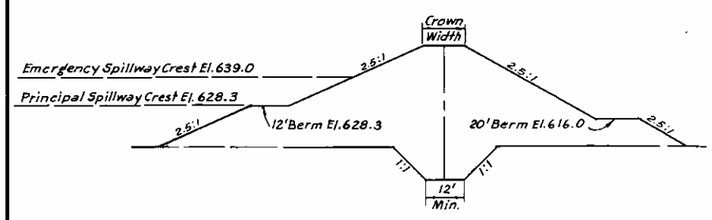
TYPICAL SECTION EMERGENCY SPILLWAY



Stream channel banks within the limits of the embankment shall be shaped to a slope not steeper than 2:1 prior to backfilling the channel. Suitable excavated material may be used in the embankment as directed by the Engineer. Cost of this channel sloping where required, shall be paid as "Stream Channel Clean-out."

NOTE: Complete soil and foundation investigation data together with laboratory test data are available in SCS field construction office for review by prospective bidders.

PROFILE ON ℄ OF DAM



TYPICAL SECTION

MATERIAL PLACEMENT DATA

EMBANKMENT SECTION	SOURCE OF FILL MATERIAL			LAB TEST		COMPACTION REQUIREMENTS			Lab. Curve
		Ave. Depth Feet		Modified		Min. Dry Density	Moisture Range Percent		
Description	Location	From	To	Max. Dry Den.	Opt'm Moist	Lbs. Per Cu. Ft.	From	To	No.
Any Section	Borrow	0	6	111.5	15.5	100.5	16.0	Up	1
	Borrow	6	12	119.5	13.0	107.5	13.0	Up	2
	Borrow	7	12	111.5	15.5	100.5	16.0	Up	3

Notes
1. Material from required excavation may be used for "Compacted Fill," with compaction requirements and limits of placement moisture being the same as for similar material from the borrow area.
2. Place weathered limestone from Emergency Spillway in upstream berm & use the same compactive effort as is used on adjacent materials.
3. No upward limits of placement moisture are established. Upper limits of placement moisture will be established during construction by the engineer, based on the workability aspects of materials being placed in the fill and the densities reached.
4. Maximum dry density, optimum moisture, minimum acceptable dry density and moisture range shown are for material particles passing the number 4 sieve.

EMBANKMENT DATA

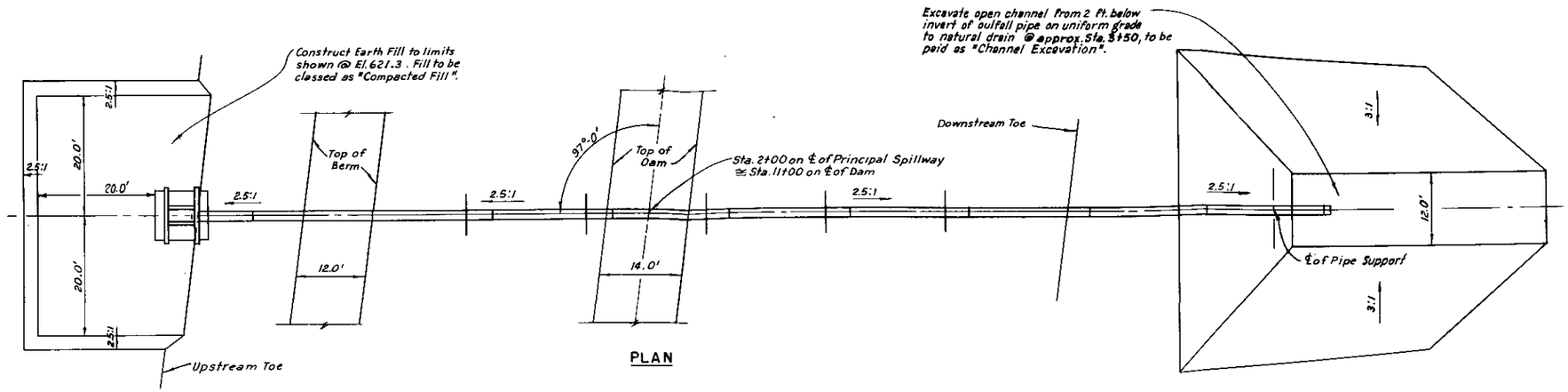
ELEVATION	SURFACE ACRES	STORAGE ACRE FEET	STORAGE INCHES
618	0.5	1	.04
622	3.0	8	.28
626	7.0	28	.99
628.3	10.0	48	1.70
630	11.5	65	2.31
634	15.0	118	4.19
638	20.0	188	6.67
639	22.0	210	7.45
642	27.5	283	10.05

Top of Dam (Effective) Elev.	642.4
Emergency Spillway Crest Elev.	639.0
Principal Spillway Crest Elev.	628.3
Sediment Pool Elev.	628.3
Drainage Area, Acres	338
Sediment Storage, Acre Feet	54
Floodwater Storage, Acre Feet	156
Max. Emergency Spillway Cap., c.f.s.	122

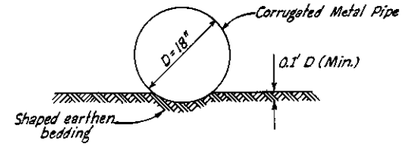
Figure 2
TYPICAL
FLOODWATER RETARDING STRUCTURE
GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed L.L.	Date 10-64	Approved by: ACTING STATE CONSERVATIONIST, TEMPLE, TEXAS; STATE CONSERVATION ENGINEER, FORT WORTH, TEXAS	
Drawn D.L.F. & M.G.C.	10-64		
Traced M.G.C.	11-64		
Checked L.L. & G.W.T.	11-64	Sheet No. 2 of 7	Drawing No. 4-E-19,480

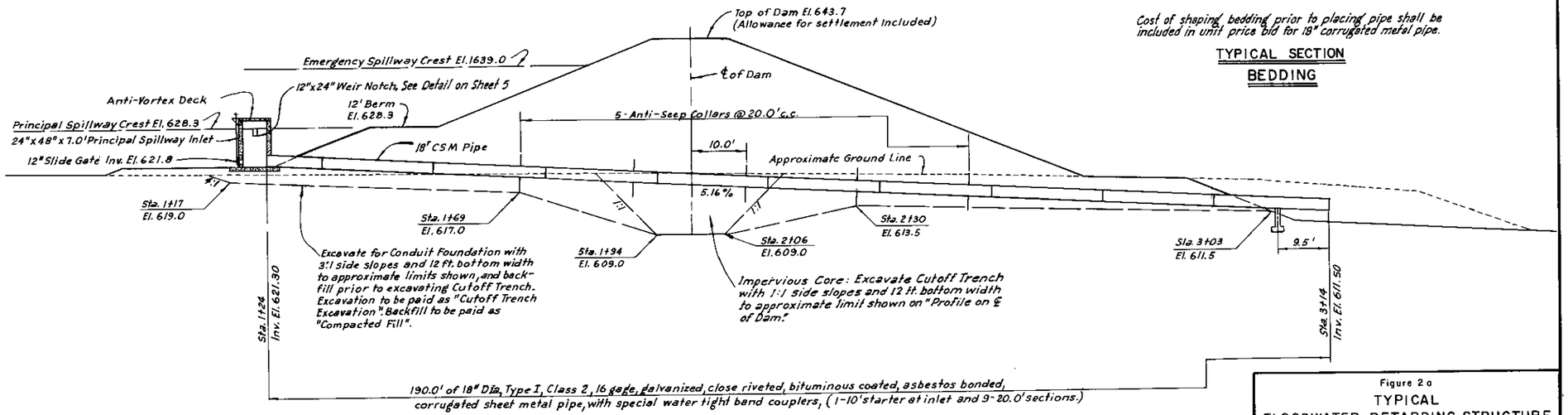


PLAN



Cost of shaping bedding prior to placing pipe shall be included in unit price bid for 18" corrugated metal pipe.

TYPICAL SECTION
BEDDING



SECTION
PRINCIPAL SPILLWAY

Figure 2 a
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

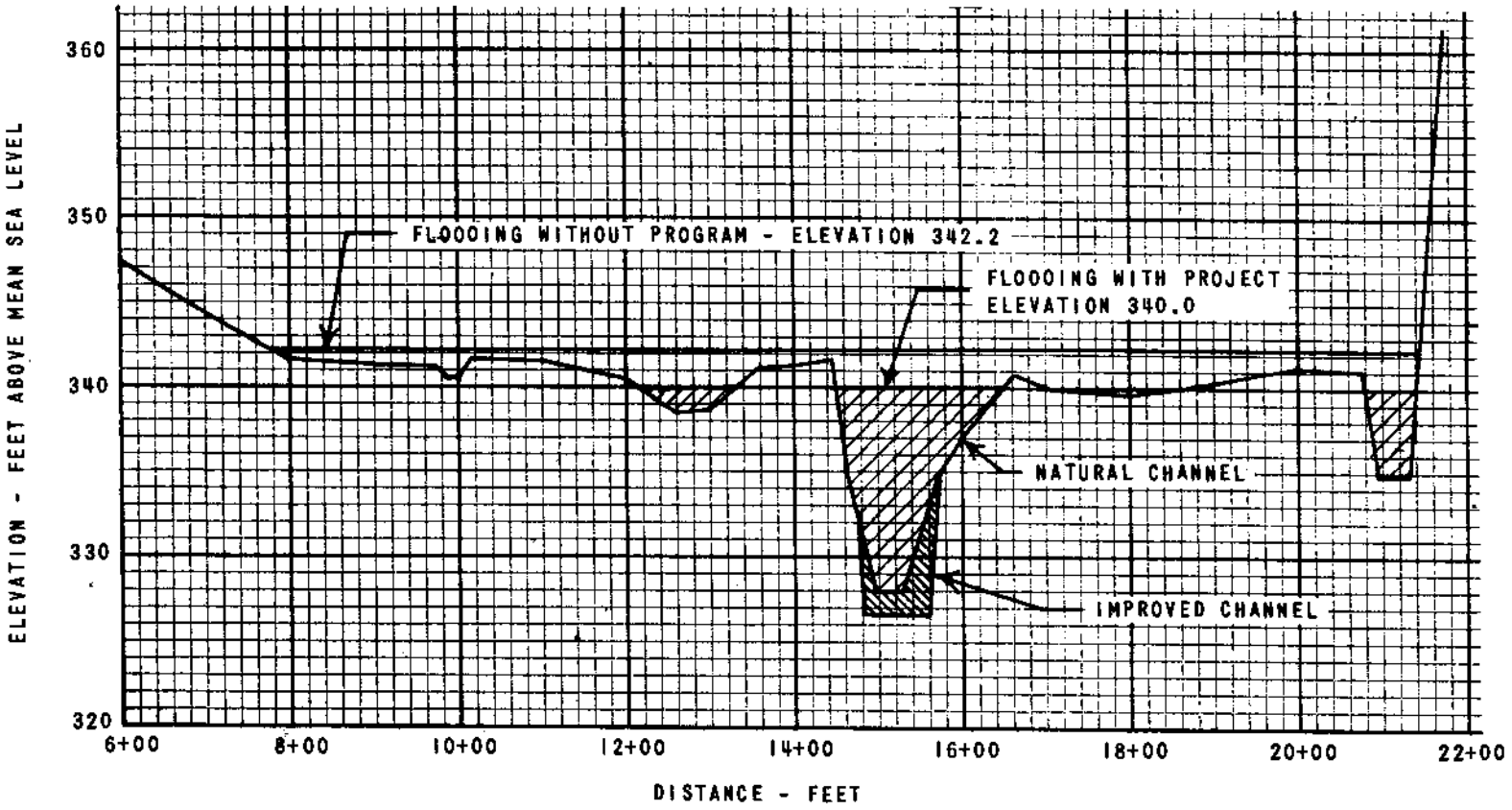
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed L.L.	Date 10-64	Approved by HEAD, ENGINEERING & MECHANIZED PLANTING UNIT, FORT WORTH, TEXAS	
Drawn L.L. & M.G.C.	10-64	STATE CONSERVATION ENGINEER, S. C. S. TEMPLE, TEXAS	
Traced M.G.C.	11-64	Sheet No. 3 of 7	Drawing No. 4-E-19,480
Checked L.L. & G.W.T.	11-64		

Figure 3

DEGREE OF FLOOD PROTECTION

Storm of July 26 - 27, 1962
NORTH TRINITY LATERALS WATERSHED
of the
TRINITY RIVER WATERSHED, TEXAS
8.18" RAINFALL WITH 3.91" RUNOFF
APPROXIMATELY 10-YEAR FREQUENCY



VALLEY CROSS SECTION NO. 1

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Temple, Texas
7-65 4-L-20431

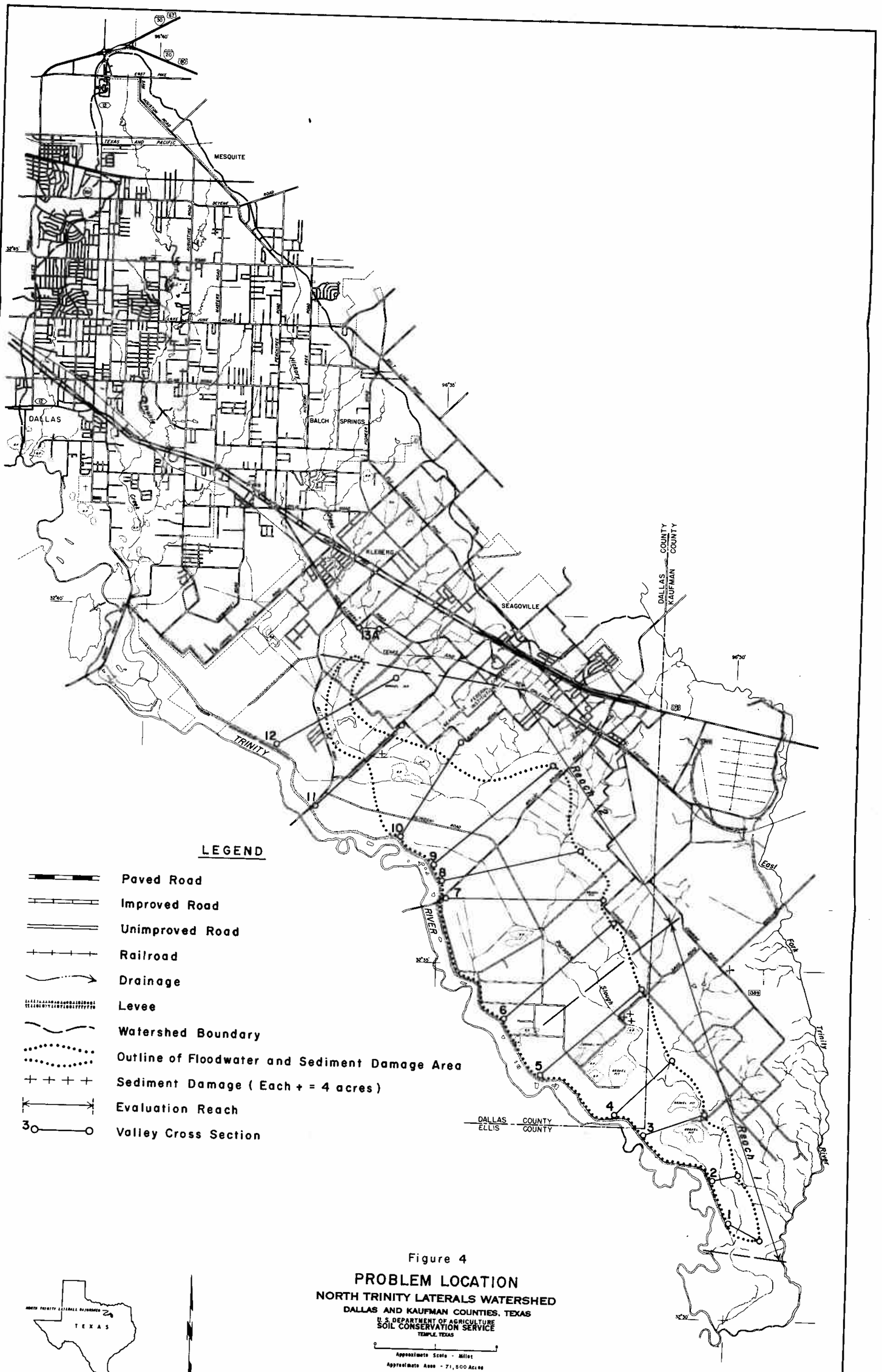


Figure 4

PROBLEM LOCATION

NORTH TRINITY LATERALS WATERSHED

DALLAS AND KAUFMAN COUNTIES, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

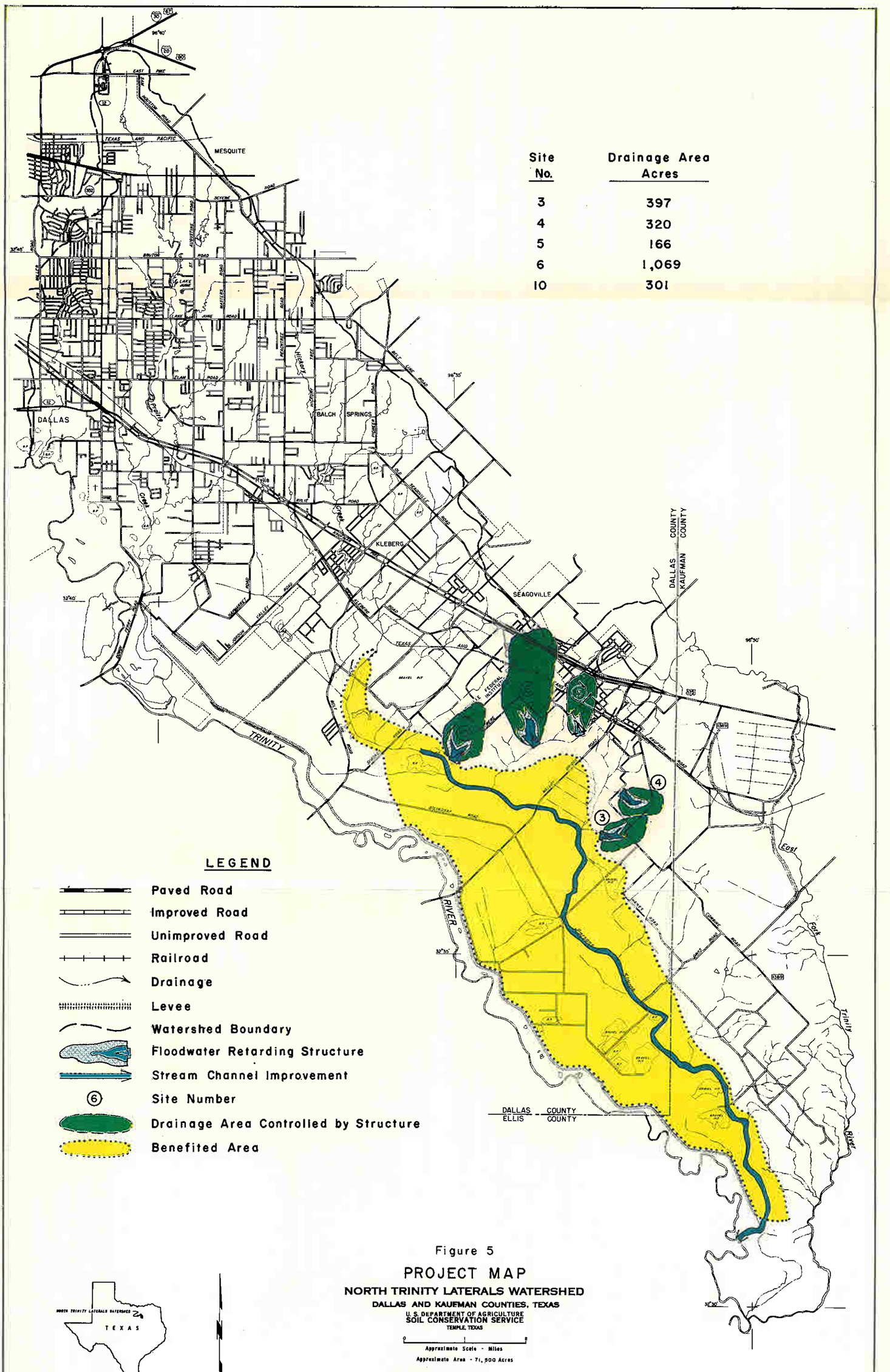
Approximate Scale - Miles

Approximate Area - 71,500 Acres

Base compiled from USGS quadrangle sheets and the latest available General Highway Maps.

Rev. 8-65 4-R-19987

Revised July, 1965 4-R-17695



Site No.	Drainage Area Acres
3	397
4	320
5	166
6	1,069
10	301

Figure 5

PROJECT MAP

NORTH TRINITY LATERALS WATERSHED

DALLAS AND KAUFMAN COUNTIES, TEXAS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS

Approximate Scale - Miles

Approximate Area - 71,500 Acres

Base compiled from USGS quadrangle sheets and the latest available General Highway Maps.

USDA-SCS-FORT WORTH, TEX. 1965

Rev. 8-65 4-R-20210

Revised July, 1965 4-R-17695

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