PRELIMINARY
Flood Control Work Plan
LOWER EAST FORK LATERALS WATERSHED
A Subwatershed of the Trinity River
TX-SCD-6-117 Tr. No. 36
March 1951

DESCRIPTION OF THE WATERSHED

The Lower East Fork Laterals watershed is comprised of a series of small drainages which extend along the east side of the East Fork of the Trinity River between Forney and the confluence of East Fork with the Trinity River near Rosser, Texas, a distance of approximately 21 miles.

The watershed ranges from 2 to 6 miles in width, averaging 3.3 miles. Little Buffalo Creek is the major stream that drains directly into the river. Several smaller drains are intercepted by a floodwater diversion which has been constructed from the spillway of Murphy Lake to the river near Rosser, a distance of 13 miles.

The towns of Crandall and Rosser are located in the watershed. There are 98 miles of roads, of which 26 miles are hard-surfaced. Of the 60 bridges, 10 are major bridges spanning the larger streams.

The watershed has an area of 44,100 acres (69 square miles), of which 42,684 acres are in farms. The remaining 1,416 acres, about 3 percent, are in urban areas, roads, and miscellaneous uses. Bottomland areas cover 14,526 acres of flood plain and 50 acres of stream channels.

Soils and Land Use

The Lower East Fork Laterals lie almost entirely within the Blackland Prairies Problem Area in Soil Conservation. The extreme southern end of the area, approximately 4,200 acres, is covered by sandy forested soils and mixed prairie blackland. These soils represent several stages of development.

The prairies include belts of dark colored, fine-textured soils that are developing from marl or limy clay formations. The soils on the steeper slopes and flood plains are very young and immature. Erosion on the steeper slopes has progressed almost as fast as soil development, even under native vegetation, and the true soil is usually less than two feet deep. On the smooth, more nearly level areas the soils are granular and dark colored, and usually 3 to 4 feet in depth.

The drainage area of Little Buffalo Creek is normally smooth blackland. The present land use of this area is as follows: cropland 62 percent; pasture 33 percent; wooded pasture, 2 percent; and urban areas and farmsteads, 3 percent. The upland drainage of the Rosser levee area has moderately smooth, sandy forested soils and mixed prairie blackland.

The land use is as follows: cropland, 52 percent; pasture, 36 percent; wooded pasture, 10 percent; and urban areas and farmsteads, 2 percent.

Of all land uses approximately 50 percent has been affected by slight erosion, 35 percent by moderate erosion and 15 percent by severe and very severe erosion.

Geology and Topography

The watershed is underlain by two principal geologic formations. The Taylor marl occupies the entire watershed except a small outcrop area of Neylandville marl (Navarro group), east of Reeser.

The Taylor formation is mostly chalks, clays or marls, and sand, but these types of sediment are interbedded and range widely in composition.

The area lies entirely within the Black Prairie section of the Gulf Coastal Plain physiographic province. The watershed consists of a plain dissected by numerous streams that have cut shallow valleys. The topography of the drainage area is, for the most part, undulating to gently rolling with some steep areas adjacent to the stream channels. Bottomlands along the stream courses are level to gently sloping. Local relief ranges from 50 to 100 feet.

Climate

The climate of the area is characterized by long summers and short winters. The winters are usually mild but occasional northers cause sudden drops in temperature. As a rule, these cold spells last only a few days. Few winters pass without a light fall of snow which generally melts as it falls.

Mean temperatures range from 84.6 degrees Fahrenheit in the summer months to 46.0 degrees in the winter months. The average temperature for the area is 65.5 degrees. Extreme temperatures of 2 degrees below zero and 113 degrees above zero have been recorded. The average date of the last killing frost is March 19 and that of the first killing frost is November 15, or a normal frost-free period of 241 days.

The mean annual precipitation of 41.56 inches is fairly evenly distributed, with the greatest amounts of rainfall occurring in April and May. Rains of excessive amounts, which fall at irregular intervals during the year, cause serious erosion and flood damage. The minimum recorded annual rainfall of 18.82 inches occurred in 1917, while the maximum annual precipitation of 53.10 inches fell in 1929.

Water Resources

The principal uses of water in the area are for stock water on farms and domestic purposes on farms and in urban areas. The towns in the watershed are supplied by wells, the water from which contains considerable amounts of minerals.

ECONOMY OF THE WATERSHED

Agricultural Economy

There are estimated to be 267 farms in the Lower East Fo watershed with an average size of 160 acres. The better throughout the area are devoted largely to the production The more broken lands are used to produce livestock and dai Of the cattle in the watershed, 80 percent are used for beef and 20 percent are dairy cattle.

The principal crops grown in the watershed are cotton, corn, an grains, with 65 percent of the cropland being devoted to the pro of these crops. The approximate yields per acre are: lint cotto 200 pounds; corn, 20 bushels; wheat, 15 bushels; and oats, 25 bush Other crops grown are grain sorghums, sweetclover, hay, and truck c Production is still good on the level areas and gentle slopes, but t need for improved crop rotations on all cropland to increase the organic matter and productivity of the soil is apparent. Large areas of steeper slopes are badly eroded and should be planted to permanent grasses.

Only 26 percent of the bottomland is in cultivation at the present time. Because of the frequency of flooding, 67 percent of the flood plain formerly used for the production of high-income crops such as cotton is now Johnsongrass meadow, pasture, or idle land.

The Lower East Fork Laterals watershed is served by the Kaufman and Terrell Soil Conservation Service work unitswhich are assisting the Kaufman-Van Zandt Soil Conservation District. These work units have assisted farmers in preparing 155 conservation plans on 36,640 acres within the watershed boundaries. It is expected that when land treatment practices have been applied and maintained for as long as two or three years, yields in the watershed will be increased approximately 20 percent.

Urban and Other Influences

Scattered throughout the watershed are small villages and residential areas occupied principally by people who commute to and from their work in the larger industrial centers. Also, some people live on small acreages which are inadequate for subsistence and supplement their living by working on farms or in Dallas. These people contribute very little to agricultural production.

The 98 miles of roads are adequate to provide access to all parts of the watershed. However, the frequent floods make many roads impassable because of high water and washed out bridges. The detours thus occasioned cause delays and extra travel distance to and from markets.

Three railroads traverse the watershed and provide ample loading facilities for carload lot shipments.

FLOOD PROBLEMS AND DAMAGES

The streams in the Lower East Fork Laterals watershed have flooded frequently and caused high annual damage. Of the 14,526 acres of flood plain, 826 acres are flooded by Little Buffalo Creek; 11,600 acres by the drainage area above the Rosser levee; and 2,100 acres by East Fork of the Trinity River. Since the flood control measures proposed on the Lower East Fork Laterals watershed would have an undetermined effect on the area flooded by the Trinity River, no flood damages to the area were included in this plan. Little Buffalo Creek has been leveed into the river but the levee remained broken from 1935 to 1948. The levee was repaired and enlarged in 1948. Flood routing indicates this levee to be adequate for a 20-year frequency storm. The 11,600 acres of flood plain in the Rosser levee area is Trinity River bottomland protected from river floodwater by a levee and from 15,637 acres of upland drainage by a floodwater diversion. This diversion broke at frequent intervals until 1935. No repairs were made until 1948 and the diversion remained inoperative during this period. Since 1948 the diversion has broken twice each year and caused severe flood damage.

During the 20-year period, 1923 to 1942 inclusive, there were 40 storms which flooded more than one-half the flood plain, and 64 smaller floods. Half of the larger floods occurred during the spring months, causing great damage to growing crops. Occasional large floods occurred in the fall months and completely destroyed mature crops.

The types of flood damage encountered in the watershed were (1) damage to crops and pasture, (2) deposition of sediment on valley lands, (3) flood plain scour, (4) damage to roads, bridges, fences, and levees, and (5) loss of livestock. Other damages include late planting of crops and the planting of lower-income crops of shorter growing season, due to spring floods.

LAND TREATMENT ACTIVITIES

During the past four years landowners in 3 neighbor groups, with membership wholly or partially within the Lower East Fork Laterals watershed, have been cooperating with their soil conservation districts in the planning and application of land treatment practices on their lands.

FLOOD CONTROL ACTIVITIES

Levee Improvement Districts have been organized and levees constructed along the east side of the River. These levees also provide a floodway to protect bottomlands from Little Buffalo Creek. The main levees have been increased in size and are in a good state of repair. The Corps of Engineers are assisting in the maintenance of the main levees. Approximately 30 years ago a 13-mile floodwater diversion was constructed to divert upland runoff water from the bottomlands in the lower part of the watershed. This diversion has broken often and is inadequate.

HYDRAULIC AND HYDROLOGIC INVESTIGATIONS

From a graph showing cumulative departures from normal precipitation the rainfall series for the period 1923 to 1942 inclusive was selected as most representative for the Lower East Fork Laterals Watershed.

The design storm would produce 4.65 inches of runoff from the watershed under present conditions. Runoff of this magnitude is not expected to occur more frequently than once in 25 years, and this value was used in determining the minimum floodwater detention storage requirements. From a study of the rainfall-runoff relationships for this watershed, it was found that a rain of 1.02 inches, occurring within a one-day period, was the minimum which would cause flooding at the smallest channel section. Therefore, no rains of less than this amount were considered for flood routing purposes.

The largest rain considered, which occurred during the 20-year period of study, was one of 7.10 inches which would produce 2.98 inches of runoff from Little Buffalo Creek and 2.82 inches from the drainage area above the Rosser levee. Under present conditions 769 acres of flood plain lying along Little Buffalo Creek would be flooded by the runoff from this storm.

If such a rain were to occur after land treatment practices and measures have been applied, it is estimated that the area inundated would be reduced to 740 acres. These figures are based on the entire flood plain area. With land treatment measures applied and the proposed floodwater retarding structures in operation, only 36 acres would be flooded as a result of such a storm.

Since the extent of flooding on the 11,600 acres of flood plain in the Rosser levee area would depend on the point at which the floodwater diversion failed and the flood stage of the Trinity River at the time of failure, the amount and depth of flooding in this area cannot be accurately determined. Thus the diversion, which carries runoff from 15,637 acres of upland, was flood routed to determine the frequency of failure under present conditions. It was determined that failures would occur on an average of twice annually. With land treatment measures applied, the proposed detention structures in operation, and low places in the floodwater diversion repaired, it would carry the runoff from the largest rain considered in the series.

The channel capacity of Little Buffalo Creek at section 2, located immediately above the river flood plain, is 1,053 cubic feet per second. The peak discharge at this point for a 7.10 inch rain under present conditions was 6,750 cubic feet per second, which would be reduced to 417 cubic feet per second by the proposed system of detention structures. The capacity of the floodwater diversion in the Rosser area at its outlet is 4,093 cubic feet per second. The peak discharge at this point for a 7.10 inch rain under present conditions was 5,200 cubic feet per second, which would be reduced to 820 cubic feet per second by the proposed system of detention structures.

Accessory Damage

Damages caused by the deposition of fine sediment (silt and clay) on field crops and pasture grasses have been of appreciable magnitude. These damages were measured in terms of field crop and pasture damage, and are included under floodwater damages.

Reservoir Sedimentation

Murphy Lake, located on Long Hollow Creek, was constructed in 1922 to provide floodwater storage for protection of several hundred acres of farm land in the lower stream valley. According to reconnaissance measurements made by the Soil Conservation Service in April 1939 the reservoir has lost 4.0 percent of its capacity annually by sedimentation. This represents an annual accumulation of 16 acre-feet. It is estimated that the useful efficiency of Murphy Lake for both floodwater and sediment storage was lost in 1950. Due to these conditions no benefits were claimed for the reduction of sedimentation in Murphy Lake by the planned land treatment and floodwater retarding structure in the watershed above the lake.

Sediment Output Rates

Present sediment output rates range from 2.0 to 4.0 acre-feet annually per square mile of drainage area. These estimated rates are based on the detailed sedimentation survey of White Rock Lake made in 1935, Terrell City Lake made in 1949, and the reconnaissance survey of Murphy Lake made in 1939 by the Soil Conservation Service. In estimating the present sedimentation rates for the proposed floodwater retarding structures, adjustments were made for: (1) size and shape of the watershed; (2) present land use, erosion rates and vegetative cover of the watershed lands; and (3) the location of high sediment output areas with reference to the structure sites.

OTHER RELATED FLOOD PLAIN DAMAGES

Flood Plain Scour

Scour damage has been slight on the flood plain lands of the watershed. The majority of the scour channels are short (100 to 500 feet in length) with gently sloping sides. A total of 10 acres of cropland has been damaged from 10 to 75 percent. Five acres of pasture land have been damaged 10 to 25 percent.

Channel Enlargement

Bank erosion on the channels within the flood plain areas of the watershed is very slight. However, some local bank erosion is occurring in the headwater tributaries.

FLOOD DAMAGES

Flood damage information for approximately 90 percent of the flood plain area in the watershed was obtained from landowners or operators. Information obtained included flood plain land use, yields of major crops,

proporty damages which would result from a major flood, and general flood problems. The monetary value of the peroentage of damage to flood plain lands by sediment deposition and scour was determinod on the basis of present values.

Information concerning flood damages to roads and bridges was obtained from county road officials.

Damage rates, as determined from damage schedules on Little Buffalo Creek, were adjusted on the basis of relationships found from surveys of other watersheds of similar oharaoteristics to indicate damage rates to be expected from floods of various sizes and seasons. These rates were multiplied by acreages flooded by each flood, by size and season, in the evaluation series, and adjusted for recurrence. Flood plain areas lying within the pool limits of proposed floodwater retarding structures were excluded from all damage calculations.

Damage rates in the Rosser levee area could not be determined in this manner because both the Trinity River levee and the floodwater diversion were broken frequently from 1922 to 1935 and both remained inoperative from 1935 to 1948. During these periods it was not possible to evaluate the damage resulting from breaks in the floodwater diversion. Since the Trinity River levee was repaired and improved in 1948, damages caused by breaks in the floodwater diversion during 1949 and 1950 could be evaluated. Because of this condition annual damage rates are based on loss of production to crops and pastures resulting from floodwaters during these two years.

The total direct floodwater and sedimentation damages are estimated to average $66,773 annually under present conditions, of which $61,234 (92 percent) is crop and pasture damage. These figures are based on the entire flood plain area. After excluding the area of flood plain inundated by proposed detention structures and floodways the average annual direct damage would be $66,257, of which $60,746 is crop and pasture damage. In addition, there are numerous indirect damages such as interruption of travel, losses sustained by dealers and industries dependent on agricultural products, depreciation in property values in flooded areas and similar items. Ten percent of the total annual value of direct damages, or $6,626, was taken as a conservative evaluation of the annual indirect flood damages. The average annual monetary flood damages are summarized in Table 1.

THE REMEDIAL PROGRAM AND ITS EVALUATION

Land Treatment Measures Needed

The major land treatment measures needed are: seeding or sodding 5,250 acres of retired land; sodding 397 acres of farm waterways; and construction of 563 miles of terraces.

Other land treatment measures needed include 6 miles of farm diversions; 25 farm ponds; 29 miles of fencing to enclose newly reseeded and retired areas; improved crop rotations on 22,200 acres of cropland; and 18,500 acres of improved range and pasture management.

The estimated total cost of installing these measures is $300,101 and the annual cost, including installation and maintenance, is $18,529.

Structures and Measures for Runoff and Waterflow Retardation

The waterflow retardation structures and measures needed to provide adequate flood protection for flood plain lands and roads are listed in Table 2, items 1 to 4 inclusive.

A system of 12 floodwater retarding structures is needed to protect the flood plain lands in the watershed. Sections of the floodwater diversion in the Rosser levee area will need raising to improve its carrying capacity. The proposed floodwater retarding structures and their drainage areas and the floodwater diversion in the Rossor levee area are shown on the Work Plan Map. Descriptive information concerning the floodwater retarding structures is summarized in Table 5.

The system of floodwater retarding structures will detain the runoff from 57 percent of Little Buffalo Creek, and 61 percent of the floodwater diversion drainage area. Sufficient detention storage capacity can be developed at all proposed sites to permit the use of vegetated emergency spillways.

It will be necessary to raise or relocate portions of several county roads which cross the pool areas of proposed detention structures.

The estimated cost of installing these measures is $529,745 and the annual cost, including installation and maintenance, is $22,932. Prior to the development of this watershed work plan, the Kaufman County Levee Improvement District No. 4 constructed the Murphy Lake dam, floodwater diversion and Trinity River levee for the protection of flood plain lands at a cost of $950,000. The annual cost of these structures, including installation and maintenance, is $44,222.

Effect of These Measures on Damages and Benefits

The combined program of land treatment and flood prevention measures described above would prevent damage from 113 of the 116 floods that occurred in the 20-year period of study. The remaining 3 floods would be roduced to minor floods covering 3 acres annually and causing an estimated average annual damage of only $13.

Most of the expected reduction in annual flood damages would be effected by the floodwater diversion and detention structures. The annual value of the reduction in flood damages attributable to these structures is estimated to be $54,000 out of a total of $72,870 from all measures, as shown in Table 1.

Owners and operators of flood plain lands say that if flood protection is provided, they will intensify their use of these lands by growing high-value crops such as cotton and alfalfa on areas that are now idle or in Johnsongrass meadow because of the frequency of flooding. It is estimated that this more intensive use would increase the net income to the land, after all expenses are deducted, by $95,503 annually. The total flood

control benefit, including both the reduction in flood damages and the benefit from more intensive use of flood plain lands, is estimated to be $168,373 annually. In addition it is estimated that the benefits to landowners and operators in the upland areas of the watershed from the application of land treatment measures would be $169,581 annually. The total expected benefit from the combined program would amount to $337,954 annually.

The expected land treatment benefits were determined by estimating the increased net income to the land which would result from the application of the needed practices and measures. It was assumed that the proportion of the cropland used for each crop would not change, although the total area used for cropland would be decreased by the retirement of idle cropland and steep and severely eroded areas to pasture or meadow. Likewise, it was assumed that there would be no change in the percentage of cattle used for dairying and beef production, although the total number of cattle would be increased materially because of the increased acreages of meadow and pasture and the greater per-acre hay production and pasture carrying capacity to be expected from the application of land treatment measures.

The estimated increase in annual net income is $131,500 from crop and $38,081 from pasture, or a total of $169,581 annually.

Comparison of Costs and Benefits

The ratio of the average annual benefit from the floodwater retarding and allied structures, $149,503, to their average annual cost, $67,154, is 2.23:1.

The ratio of the average annual benefit, $188,451, from the land treatment measures and practices to their average annual cost, $18,529, is 10.17:1.

The ratio of the total average annual benefit, $337,954, to total average annual cost, $85,683, is 3.94:1. See Table 4.

ANNUAL MAINTENANCE

Estimated annual maintenance costs after the land treatment measures and flood prevention structures have been installed are shown in Table 3.

It is expected that the flood prevention structures will be maintained by the benefited farmers under an agreement with the soil conservation district which carries the responsibility for maintenance. Group organizations of farmers will be developed for this purpose. The land treatment measures will be maintained by the landowners or operators of the farms on which the measures are installed.

Table 1
Summary of Average Annual Monetary Floodwater and Sediment Damage and Waterflow Retardation Benefit from the Recommended Program 1/
LOWER EAST FORK LATERALS WATERSHED

Damages	Average Annual Damage			Average Annual Benefit		
	Under Present Conditions (dollars)	With Land Treatment Only (dollars)	With Land Treatment, Floodwater Diversion & Detention Storage (dollars)	From Land Treatment Only (dollars)	From Floodwater Diversion & Detention Storage (dollars)	Total Waterflow Retardation Benefit (dollars)
Floodwater Damage						
Crop and Pasture	60,746	44,929	8	15,817	44,921	60,738
Flood Plain Scour	81	57	0	24	57	81
Other Agricultural	3,500	2,689	1	811	2,688	3,499
Roads and Bridges	1,930	1,428	3	502	1,425	1,927
Sub-Total	66,257	49,103	12	17,154	49,091	66,245
Indirect Damage	6,626	4,910	1	1,716	4,909	6,625
Total Damage	72,883	54,013	13	xxx	xxx	xxx
Benefit from Reduction of Damage	xxx	xxx	xxx	18,870	54,000	72,870
Benefit from More Intensive Use of Flood Plain	xxx	xxx	xxx	xxx	95,503	95,503
Total Waterflow Retardation Benefit	xxx	xxx	xxx	18,870	149,503	168,373

1/ Areas to be inundated by proposed floodwater retarding structure excluded.

Table 2
Cost Estimate Table
Lower East Fork Laterals Watershed

Structure or Measure	Unit	No.	Cost			
			To Farmer (dollars)	To Federal Funds (dollars)	To State County or Other (dollars)	Total (dollars)
Floodwater Retarding Structures	Each	12		$380,295		$380,295
Site Acquisition	Total		$122,700			122,700
Floodwater Diversion & Levee	Mile	26	950,000	1/ 24,000	2/	974,000
Relocating Roads	Mile	1			$2,750	2,750
Subtotal			1,072,700	404,295	2,750	1,479,745
Farm Waterways	Acre	397	39,700			39,700
Seeding Retired Areas	Acre	5,250	89,250			89,250
Terracing	Mile	563	70,375			70,375
Farm Diversions	Mile	6	900			900
Farm Ponds	Each	25	11,250			11,250
Farm Fencing	Mile	29	11,600			11,600
Drop Structures	Each	7	13,000			13,000
Farm & Ranch Planning & Application	Acre			64,026		64,026
Subtotal			236,075	64,026		300,101
Total			1,308,775	468,321	2,750	1,779,846

1/ Funds spent by the Kaufman County Levee Improvement District No. 4 for the construction of Murphy Lake dam, the floodwater diversion and river levee prior to the development of this plan.

2/ Funds required to construct original floodwater diversion to required specifications.

Table 3
Annual Costs
EAST FORK LATERALS WATERSHED

Structure or Measure	Unit	No.	Annual Cost		
			Installation	Maintenance	Total
Floodwater Retarding Structures	Each	12	$13,409	$1,200	$14,609
Site Acquisition	Total		4,908		4,908
Floodwater Diversion & Levee	Mile	26	45,068	2,500	47,568
Relocating Roads	Mile		69		69
Sub-Total			$63,454	$3,700	$67,154
Farm Waterways	Acre	397	$ 1,439	$1,588	$ 3,027
Seeding Retired Areas	Acre	5,250	3,034		3,034
Terracing	Mile	563	2,815	5,630	8,445
Farm Diversions	Mile	6	36	48	84
Farm Ponds	Each	25	450	450	900
Farm Fencing	Mile	29	464	580	1,044
Drop Structures	Each	7	325	70	395
Farm & Ranch Planning & Application	Acre	42,684	1,600		1,600
Sub-Total			$10,163	$ 8,366	$18,529
TOTAL			$73,617	$12,066	$85,683

Table 4
Comparison of Average Annual Benefit and Cost of the Recommended Program
Lower East Fork Laterals Watershed

Source of Benefit	Annual Cost (dollars)	Annual Benefit (dollars)	Benefit for Dollar of Cost (dollars)
Detention Storage	67,154	149,503	2.23
Land Treatment			
Reduction in Flood Damages	xxx	18,870	xx
Land Treatment	xxx	169,581	xx
Total	18,529	188,451	10.17
All Sources	85,683	337,954	3.94

Table 5
Floodwater Retarding Structure Data
LOWER EAST FORK LATERALS WATERSHED

Site No.	Drainage Area Sq. Mi.	Storage Volume: Det. Pool In.	Det. Pool Ac.Ft.	Sed. Pool Ac.Ft.	Reserve Ac.Ft.	Total Ac.Ft.	Surface Area Acres: Top Sed. Pool	Top Det. Pool	Flood Plain Inundated: Sed. Pool Ac.	Spillway Crest Ac.	Max. Ht. of Fill Ft.	Volume of Fill Cu.Yd.	Drawdown rate cfs	Type of Spillway	Estimated Total Cost
1	2.47	6.87	751	153	-	904	27	131	-	-	27	110,600	12	Veg.	$49,770
2	6.86	6.40	2,069	275	-	2,344	44	262	-	-	29	110,000	34	"	49,500
3	1.98	7.52	623	172	-	795	24	82	-	-	30	69,000	10	"	31,050
4	2.30	7.24	707	180	-	887	35	95	-	-	24	67,500	12	"	30,375
5	3.29	6.59	996	162	-	1,158	40	139	-	-	28	60,000	16	"	27,000
6	2.38	6.97	752	131	-	883	28	96	-	-	27	65,500	12	"	29,475
7	1.14	7.52	346	111	-	457	20	56	-	-	24	46,000	6	"	20,700
8	1.78	6.67	493	141	-	634	22	75	-	-	24	59,500	9	"	26,775
9	2.94	6.95	818	195	-	1,013	44	143	-	-	29	40,000	15	"	18,000
10	3.26 1/	6.50	899	208	-	1,107	43	141	-	-	26	75,000	16	"	33,750
11	1.46	6.91	414	123	-	537	17	51	-	-	31	70,000	7	"	31,500
12	1.83	6.54	527	112	-	639	17	71	-	-	30	72,000	9	"	32,400
Total	31.69		9,395	1,963		11,358	361	1,342				845,100			$380,295 2/

1/ Excluding the areas from which runoff is controlled by detention structures.

2/ Construction Cost $312,687
Technical Services 67,608

APPENDIX
Table 1A
Summary of Average Annual Monetary Floodwater and Sediment Damages and Waterflow Retardation Benefit from the Recommended Program
LOWER EAST FORK LATERS WATERSHED
(LITTLE BUFFALO CREEK)

Damages	Average Annual Damage			Average Annual Benefit		
	Under Present Conditions	With Land Treatment Only	With Land Treatment and Detention Storage	From Land Treatment Only	From Detention Storage Only	Total Waterflow Retardation Benefits
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Damage						
Crop and Pasture	6,016	4,429	8	1,587	4,421	6,008
Flood Plain Scour	81	57	0	24	57	81
Other Agricultural	600	543	1	57	542	599
Roads and Bridges	1,930	1,428	3	502	1,425	1,927
Sub-Total	8,627	6,457	12	2,170	6,445	8,615
Indirect Damage	863	646	1	217	645	862
Total Damage	9,490	7,103	13	xxx	xxx	xxx
Benefit from Reduction of Damage	xxx	xxx	xxx	2,387	7,090	9,477
Benefit from More Intensive Use of Flood Plain	xxx	xxx	xxx	xxx	10,809	10,809
Total Waterflow Retardation Benefit	xxx	xxx	xxx	2,387	17,899	20,286

APPENDIX

Table 1B

Summary of Average Annual Monetary Floodwater and Sediment Damages and Waterflow Retardation Benefit from the Recommended Program

LOWER EAST FORK LATERALS WATERSHED

(ROSSER LEVEE AREA)

Damages	Average Annual Damage			Average Annual Benefit		
	Under Present Conditions	With Land Treatment Only	With Land Treatment and Detention Storage	From Land Treatment Only	From Detention Storage Only	Total Waterflow Retardation Benefits
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Damage						
Crop and Pasture	54,730	40,500	0	14,230	40,500	54,730
Flood Plain Scour	0	0	0	0	0	0
Other Agricultural	2,900	2,146	0	754	2,146	2,900
Sub-Total	57,630	42,646	0	14,984	42,646	57,630
Indirect Damage	5,763	4,264	0	1,499	4,264	5,763
Total Damage	63,393	46,910	0	xxx	xxx	xxx
Benefit from Reduction of Damage	xxx	xxx	xxx	16,483	46,910	63,393
Benefit from More Intensive Use of Flood Plain	xxx	xxx	xxx	xxx	84,694	84,694
Total Waterflow Retardation Benefit	xxx	xxx	xxx	16,483	131,604	148,087

APPENDIX
Table 2A
Cost Estimate Table
LOWER EAST FORK LATERALS WATERSHED
(LITTLE BUFFALO CREEK)

Structure or Measure	Unit	No.	Cost			
			To Farmer	To Federal Funds	To State, County or Other	Total
Floodwater Retarding Structuree	Each	5	$	$ 187,695	$	$ 187,695
Site Aoquisition	Total			41,070		41,070
Relocating Roads	Mile	0.6			1,500	1,500
Sub-Total				$228,765	$1,500	$230,265
Farm Waterways	Acre	197	$14,775	$ 4,925		$ 19,700
Seeding Retired Areas	Acre	2,250	22,950	15,300		38,250
Terraoing	Mile	254	31,750			31,750
Farm Diversions	Mile	3	450			450
Farm Ponds	Each	12	5,400			5,400
Farm Fencing	Mile	14	5,600			5,600
Drop Structures	Each	5		10,000		10,000
Farm and Ranch Planning and Application	Acre	15,748		23,622		23,622
Sub-Total			$80,925	$53,847		$134,772
TOTAL			$80,925	$282,612	$1,500	$365,037

APPENDIX
Table 2B
Cost Estimate Table
LOWER EAST FORK LATERALS WATERSHED
(ROSSER LEVEE AREA)

Structure or Measure	Unit	No.	Cost			
			To Farmer	To Federal Funds	To State, County or Other	Total
Floodwater Retarding Structures	Each	7	$	$ 192,600	$	$ 192,600
Site Acquisition	Total			40,680		40,680
Floodwater Diversion 1/	Mile	13		12,000		12,000
Relocating Roads	Mile	0.5			1,250	1,250
Sub-Total				$ 245,280	$1,250	$ 246,530
Farm Waterways	Acre	200	$15,000	$ 5,000		$ 20,000
Seeding Retired Areas	Acre	3,000	30,600	20,400		51,000
Terracing	Mile	309	38,625			38,625
Farm Diversions	Mile	3	450			450
Farm Ponds	Each	13	5,850			5,850
Farm Fencing	Mile	15	6,000			6,000
Drop Structures	Each	2		3,000		3,000
Farm and Ranch Planning and Application	Acre	26,936		40,404		40,404
Sub-Total			$96,525	$68,804		$165,329
TOTAL			$96,525	$314,084	$1,250	$411,859

1/ Cost applies to improving existing diversion.

APPENDIX
Table 3A
Annual Costs
LOWER EAST FORK LATERALS WATERSHED
(LITTLE BUFFALO CREEK)

Structure or Measure	Unit	No.	Annual Cost		
			Installation	Maintenance	Total
Floodwater Retarding Structures	Each	5	$ 6,617	$ 500	$ 7,117
Site Aoquisition	Total		1,643		1,643
Relocating Roads	Mile	0.6	38		38
Sub-Total			$ 8,298	$ 500	$ 8,798
Farm Waterways	Acre	197	714	788	1,502
Seeding Retired Areas	Acre	2,250	1,300		1,300
Terracing	Mile	254	1,270	2,540	3,810
Farm Diversions	Mile	3	18	24	42
Farm Ponds	Each	12	216	216	432
Farm Fencing	Mile	14	224	280	504
Drop Structures	Each	5	250	50	300
Farm and Ranch Planning & Application	Acre	15,748	590		590
Sub-Total			$ 4,582	$ 3,898	$ 8,480
TOTAL			$12,880	$ 4,398	$17,278
Annual Maintenance - Farmer				$ 4,398	

APPENDIX
Table 3B
Annual Costs
LOWER EAST FORK LATERALS WATERSHED
(ROSSER LEVEE AREA)

Structure or Measure	Unit	No.	Annual Cost		
			Installation	Maintenance	Total
Floodwater Retarding Structures	Each	7	$ 6,791	$ 700	$ 7,491
Site Acquisition	Total		1,627		1,627
Floodwater Diversion	Mile	13	300	600	900
Relocating Roads	Mile	0.5	31		31
Sub-Total			$ 8,749	$ 1,300	$ 10,049
Farm Waterways	Acre	200	$ 725	$ 800	$ 1,525
Seeding Retired Areas	Acre	3,000	1,734		1,734
Terracing	Mile	309	1,545	3,090	4,635
Farm Diversions	Mile	3	18	24	42
Farm Ponds	Each	13	234	234	468
Farm Fencing	Mile	15	240	300	540
Drop Structures	Each	2	75	20	95
Farm & Ranch Planning and Application	Acre	26,936	1,010		1,010
Sub-Total			$5,581	$4,468	$10,049
TOTAL			$14,330	$5,768	$20,098
Annual Maintenance - Farmer				$5,768	

APPENDIX
Table 4A
Comparison of Average Annual Benefit and Cost of the Recommended Program
LOWER EAST FORK LATERALS WATERSHED
(LITTLE BUFFALO CREEK)

Source of Benefit	Annual Cost	Annual Benefit	Benefit per Dollar of Cost
	(dollars)	(dollars)	(dollars)
Detention Storage	8,798	17,899	2.03
Land Treatment			
Reduction in Flood Damages	xxx	2,387	xxx
Land Treatment	xxx	91,142	xxx
Total	8,480	93,529	11.03
All Sources	17,278	111,428	6.45

APPENDIX
Table 4B
Comparison of Average Annual Benefit and Cost of the Recommended Program
LOWER EAST FORK LATERALS WATERSHED
(ROSSER LEVEE AREA)

Source of Benefit	Annual Cost	Annual Benefit	Benefit per Dollar of Cost
	(dollars)	(dollars)	(dollars)
Detention Storage	10,049	131,604	13.10
Land Treatment			
Reduction in Flood Damages	xxx	16,483	xxx
Land Treatment	xxx	78,439	xxx
Total	10,049	94,922	9.44
All Sources	20,098	226,526	11.27

APPENDIX
Table 6A
Increase in Income Through More Intensive Use of Flood Plain Lands
EAST FORK LATERALS WATERSHED
LITTLE BUFFALO CREEK

	Acres	Yield	Production	Gross Income	Cost	Net Income
Present Conditions						
Cotton	53	500 lb.	26,500	$ 8,771	$ 3,943	$ 4,828
Meadow	31	2 ton	62	1,085	440	645
Pasture	524	4 AUM	2,096	5,659	524	5,135
Idle	130					
Miscellaneous	25					
Total	763			$15,515	$ 4,907	$10,608
After Land Treatment and Detention Storage						
Cotton	125	500 lb.	62,500	$20,688	$ 9,300	$11,388
Corn	100	45 bu.	4,500	5,760	1,925	3,835
Meadow	31	2 ton	62	1,085	440	645
Hubam	82	3 CWT	246	3,690	1,312	2,378
Pasture	400	4 AUM	1,600	4,320	400	3,920
Miscellaneous	25					
Total	763			$35,543	$13,377	$22,166
Flood Plain in Detention Structures	63					
Total	826					

Net Increase	$11,558
Less Increased Overhead 254 ac. @ $2.95	749
Net Benefit	$10,809