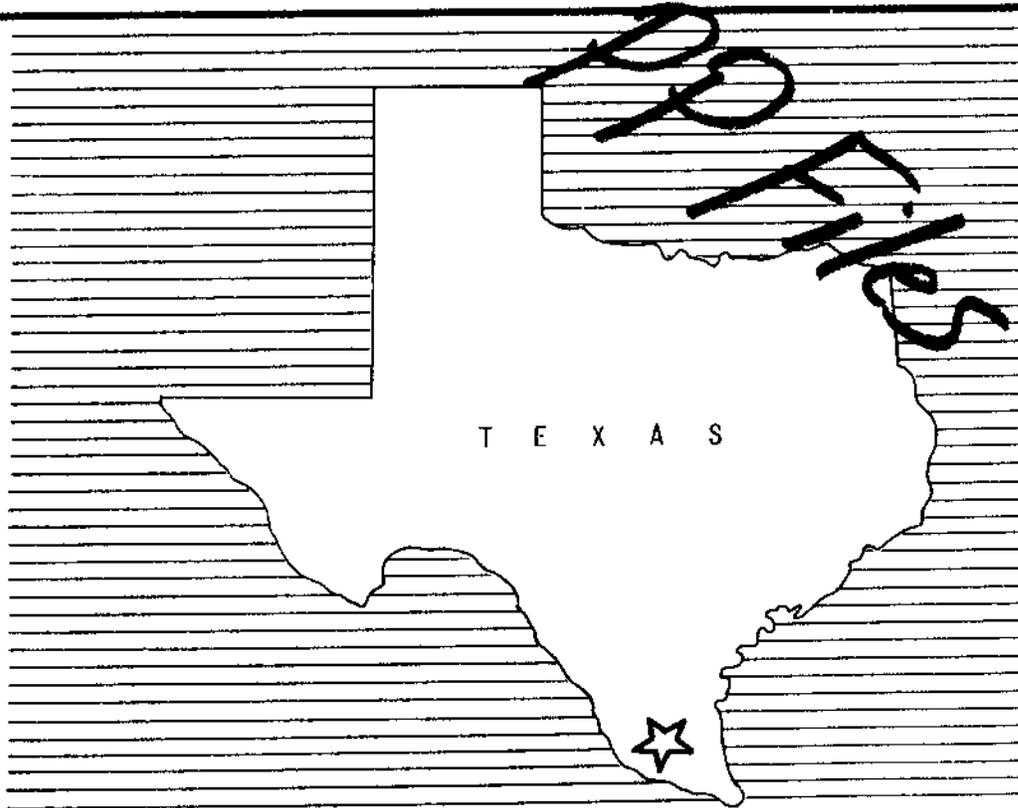


WORK PLAN

FOR WATERSHED PROTECTION,
FLOOD PREVENTION AND AGRICULTURAL WATER MANAGEMENT

RAMIREZ CREEK WATERSHED

STARR COUNTY, TEXAS



August 1959

WATERSHED WORK PLAN AGREEMENT

between the

Starr County Soil Conservation District

Local Organization

Commissioners Court of Starr County

Local Organization

Local Organization

In the State of Texas
(hereinafter referred to as the Sponsoring Local Organization)

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Ramirez Creek Watershed, State of Texas under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended by the Act of August 7, 1956 (Public Law 1018, 84th Congress; 70 Stat. 1088); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Ramirez Creek Watershed, State of Texas, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring 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, within 5 years, and operated and maintained substantially in accordance with the terms, conditions, and stipulations provided for therein.

It is mutually agreed that in installing and operating and maintaining the works of improvement described in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost \$ 18,000.)
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 and land treatment measures for flood prevention to be paid by the Sponsoring Local Organization and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Channel Improvement Ramirez Creek	0	100	6,160
Channel Improvement Fronton Channel	5.5	94.5	13,805
Floodwater Diversion	0	100	15,400

The Sponsoring Local Organization will pay all of the costs allocated to purposes other than flood prevention, and irrigation, drainage, and other agricultural water management.

4. The Service will bear the cost of all installation services applicable to works of improvement for flood prevention. (Estimated cost \$ 9,926.)

The Service will bear 45 percent of the cost of installation services applicable to works of improvement for agricultural water management and the Sponsoring Local Organization will bear 55 percent of the cost of such services. (Estimated cost \$ 402.)

The Sponsoring Local Organization will bear the cost of all installation services applicable to works of improvement for nonagricultural water management. (Estimated cost \$ none.)

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost \$ 1,250.)
6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent of the land above each 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.

- 11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and 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.

Where there is a Federal contribution to the construction cost of works of improvement, a separate agreement in connection with each construction contract will be entered into between the Service and the Sponsoring Local Organization prior to the issuance of the invitation to bid. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

- 12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.
- 13. No member of or delegate to 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.

Starr County Soil Conservation District
 Local Organization
 By *John A. Shuford*
 Title Chairman
 Date **December 17, 1959**

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

adopted at a meeting held on **December 15, 1959**

Uvaldo Salinas
 (Secretary, Local Organization)
 Date **December 17, 1959**

Commissioners Court of Starr County
Local Organization

By *M. J. Rodriguez*
Title County Judge

Date December 17, 1959

The signing of this agreement was authorized by a resolution of the governing body of the Commissioners Court of Starr County
Local Organization

adopted at a meeting held on December 17, 1959

Jose L. Medina
(Secretary, Local Organization)

Date December 17, 1959

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 _____
State Conservationist

Date _____

WORK PLAN
FOR
WATERSHED PROTECTION, FLOOD PREVENTION,
AND AGRICULTURAL WATER MANAGEMENT
RAMIREZ CREEK WATERSHED
Starr County, Texas

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act, (Public
Law 566, 83rd Congress; 68 Stat. 666), as
amended.

Prepared By: Starr County Soil Conservation District
(Cosponsor)

Commissioners Court of Starr County
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
August 1959

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SECTION 1

WATERSHED WORK PLAN

RAMIREZ CREEK WATERSHED Starr County, Texas August 1959

SUMMARY OF PLAN

General Summary

The work plan for watershed protection, flood prevention, and agricultural water management for the Ramirez Creek watershed was prepared by the Starr County Soil Conservation District and the Commissioners Court of Starr County as cosponsoring organizations. Technical assistance was provided by the Soil Conservation Service of the United States Department of Agriculture.

The work plan covers an area of 10.32 square miles, or 6,605 acres in Starr County, Texas. Approximately 29.1 percent of the watershed is cropland, 68.0 percent is grassland, and 2.9 percent is in miscellaneous uses, such as stream channels, and roads.

There are no Federal lands in the watershed.

The work plan proposes installing, in a 5-year period, a project for the protection and development of the watershed at a total estimated installation cost of \$135,370. The share of this cost to be borne by Public Law 566 funds is \$44,715. The share to be borne by other than Public Law 566 funds is \$90,655. In addition, local interests will bear the entire cost of operation and maintenance.

Land Treatment Measures

The cost of land treatment measures is estimated to be \$70,427, all of which will be borne by other than Public Law 566 funds. This includes \$1,115 to be spent by the Soil Conservation Service under its going program for technical assistance during the project period.

Due to the limited quantity of land treatment measures needed for watershed protection, no Public Law 566 funds are provided for accelerating technical assistance. The work plan includes only the land treatment measures that will be installed during the 5-year project period.

Structural Measures

The structural measures included in the plan consist of 2.6 miles of channel improvement and appurtenant structures, and 2.4 miles of floodwater diversion. The total cost of structural measures is \$64,943, of which the

local share is \$20,228 and the Public Law 566 share is \$44,715. The local share of the total cost of structural measures includes land, easements, and rights-of-way, 89.0 percent; construction, 3.7 percent; installation services, 1.1 percent; and administering contracts, 6.2 percent.

The channel improvement and floodwater diversion will be installed during a 2-year period.

Damages and Benefits

The estimated average annual floodwater, sediment, and indirect damage without the project is \$7,854, at long-term price levels. The estimated average annual floodwater, sediment, and indirect damage with the project installed, including land treatment and structural measures, is \$795, a reduction of approximately 90 percent. The average annual primary benefits accruing to structural measures are \$6,244, which are distributed as follows:

Floodwater damage reduction	\$ 4,483
Sediment damage reduction	720
Indirect damage reduction	1,041

The ratio of the average annual benefits (\$6,244) to the average annual cost of structural measures (\$3,881) is 1.6:1.

The total benefits of land treatment measures were not evaluated in monetary terms since experience has shown that these soil and water conservation measures produce benefits in excess of their costs.

Provisions for Financing Construction

The Commissioners Court of Starr County has powers of taxation and eminent domain under applicable State laws. An ad valorem tax has been voted in this county and presently is being collected. Revenue from this tax will be available and is adequate for financing the local share of the structural cost.

Operation and Maintenance

Land treatment measures for watershed protection will be operated and maintained by the landowners or operators of the farms on which the measures are installed under agreement with the Starr County Soil Conservation District.

Under terms of an operation and maintenance agreement to be executed, the 2.6 miles of channel improvement and appurtenant structures, and 2.4 miles of floodwater diversion will be operated and maintained jointly by the Commissioners Court of Starr County and the Starr County Soil Conservation District. Starr County has legal authority to raise and expend funds for this purpose. Revenue from the ad valorem tax is available and adequate. The estimated average annual cost of operation and maintenance of the structural measures is \$1,340.

DESCRIPTION OF WATERSHED

Physical Data

Ramirez Creek heads approximately 5 miles northeast of the community of Fronton, Texas and 4 miles northwest of Roma, Texas. It flows 4 miles toward the southwest and 2 miles toward the southeast before entering the Rio Grande about 2 miles upstream from Roma. A small tributary of Ramirez Creek heads approximately 2.5 miles northwest of Fronton and flows approximately 3 miles across the Rio Grande alluvial valley in a southeasterly direction before converging with Ramirez Creek.

The area of the watershed is 6,605 acres.

The topography ranges from moderately rolling in the upland to nearly level in the Rio Grande alluvial valley. Elevations range from approximately 400 feet to 170 feet above mean sea level. The flood plain above the Rio Grande alluvial valley is narrow and poorly defined.

The geologic formations occurring within the watershed are the Fayette and Yegua of the Tertiary system and the Rio Grande alluvium of the Quaternary system.

The major portion of the watershed is underlain by yellow clays and sandy clays interbedded with gray and yellow sands of the Fayette formation. The Fayette is underlain by clays and sandy clays of the Yegua formation, which crops out in the western portion of the watershed.

The watershed lies within the Rio Grande Plain Land Resource Area. The soils of the upland are primarily deep, moderately permeable, fine sandy loams and sandy clay loams. Shallow, slowly permeable, gravelly clays are found at higher elevations. The soils of the Rio Grande alluvial valley are deep, moderately permeable silt loams and silty clay loams. The physical condition of the soils within the watershed ranges from poor to good, with the majority of the area ranging from fair to good.

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

<u>Land Use</u>	<u>Acres</u>	<u>Percent</u>
Cropland	1,921	29.1
Grassland	4,494	68.0
Miscellaneous <u>1/</u>	190	2.9
Total	6,605	100.0

1/ Includes roads, highways, stream channels, etc.

The hydrologic cover condition of the rangeland is: 77 percent poor condition; 17 percent fair condition, and 6 percent good condition.

About 251 acres of the watershed is flood plain which will be benefited by the project. The flood plain as described herein is the area inundated by the 25-year frequency storm runoff. Land use in the flood plain is 94.4 percent cropland and 5.6 percent miscellaneous.

The average annual rainfall is 17.5 inches as recorded at U. S. Weather Bureau gage at Rio Grande City, Texas. The monthly average ranges from 0.83 inch in January to 3.07 inches in September. Average temperatures range from 86.2 degrees in July to 58.1 degrees in January. The normal frost-free period of 297 days extends from February 8 through December 2.

Water for livestock is supplied primarily by stock ponds. The Rio Grande is the source of water for irrigation with the exception of some supplemental irrigation water from wells. Water for domestic use is chiefly supplied by the Rio Grande.

Economic Data

The area in which the watershed is located is one of the oldest settled regions in Texas. Settlement was started in the early eighteenth century and in 1763 the Viceroy of Spain partitioned the land along the Rio Grande into porciones (the old Spanish term for land apportionments), each approximately 15 miles long and three-fourths of a mile wide, fronting on the river.

The economy of the watershed is based entirely on agriculture. In the lower third of the watershed lies the alluvial valley of the Rio Grande. Production of irrigated crops is prevalent in this area. Approximately 35 percent of the irrigated acreage is devoted to cotton production, with the remaining acreage utilized for the production of vegetables, melons and citrus fruit, principally for northern and eastern markets. Because of the favorable climatic conditions, a double cropping system is followed on most of the irrigated land, with both spring and fall plantings made of vegetables. Production of livestock is the predominant enterprise of farm and ranch operators in the uplands. Beef cattle is the most important class of livestock in the watershed, but there is also some production of sheep and goats.

The average size of the agricultural units in the watershed is approximately 125 acres. However, there is a great range in the size of individual units. In the irrigated area many of the farms are less than 40 acres. In recent years many of the smaller units have been leased to form larger, more economic units.

There are no towns or communities in the watershed. The community of Fronton, estimated population of 600, is located just outside the watershed boundary. Roma, population 3,000, is located approximately 3 miles east of the watershed and Rio Grande City, population 5,500, is located approximately 15 miles east of the watershed. Roma and Rio Grande City are the principal

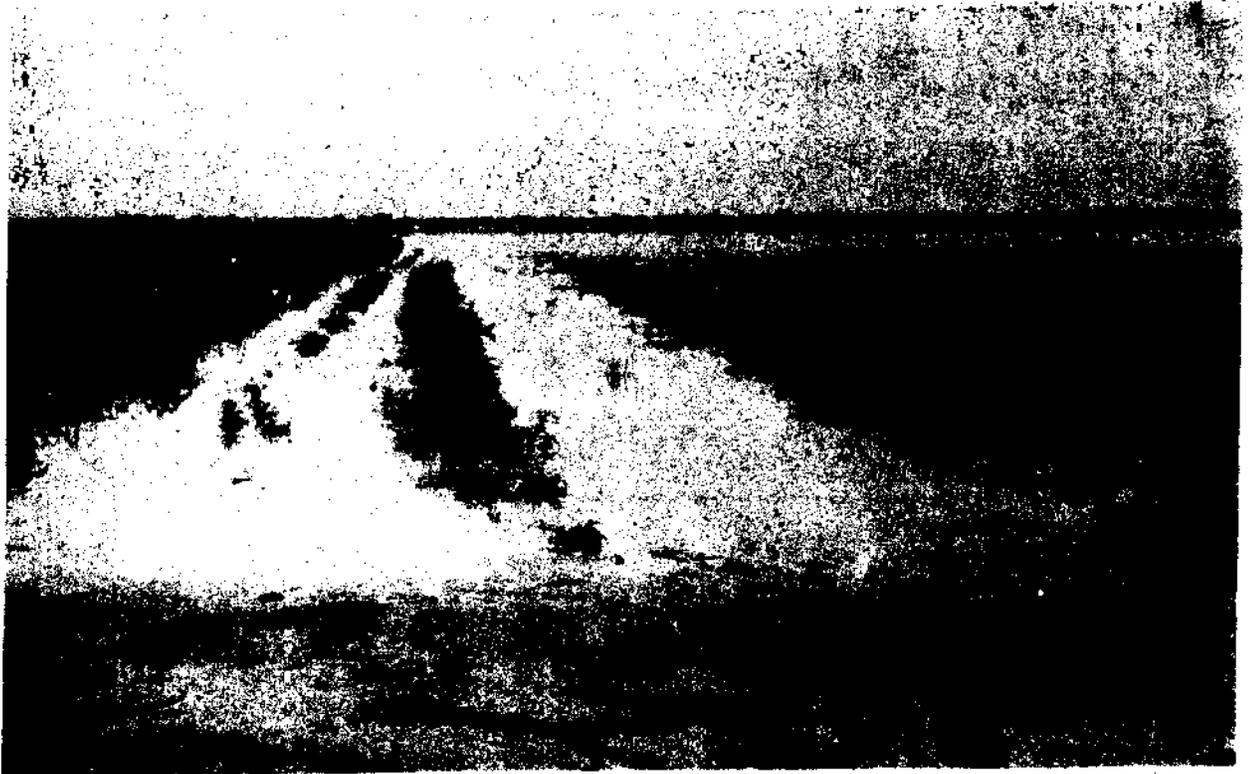
market and supply centers for the project area.

The watershed is served by 7 miles of Federal, State and County roads, of which 5 miles are hard surfaced. In addition there are numerous private farm and ranch roads serving the area. Rail service is provided by the Missouri Pacific Railroad with loading facilities available at Rio Grande City.

WATERSHED PROBLEMS

Floodwater Damage

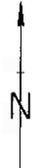
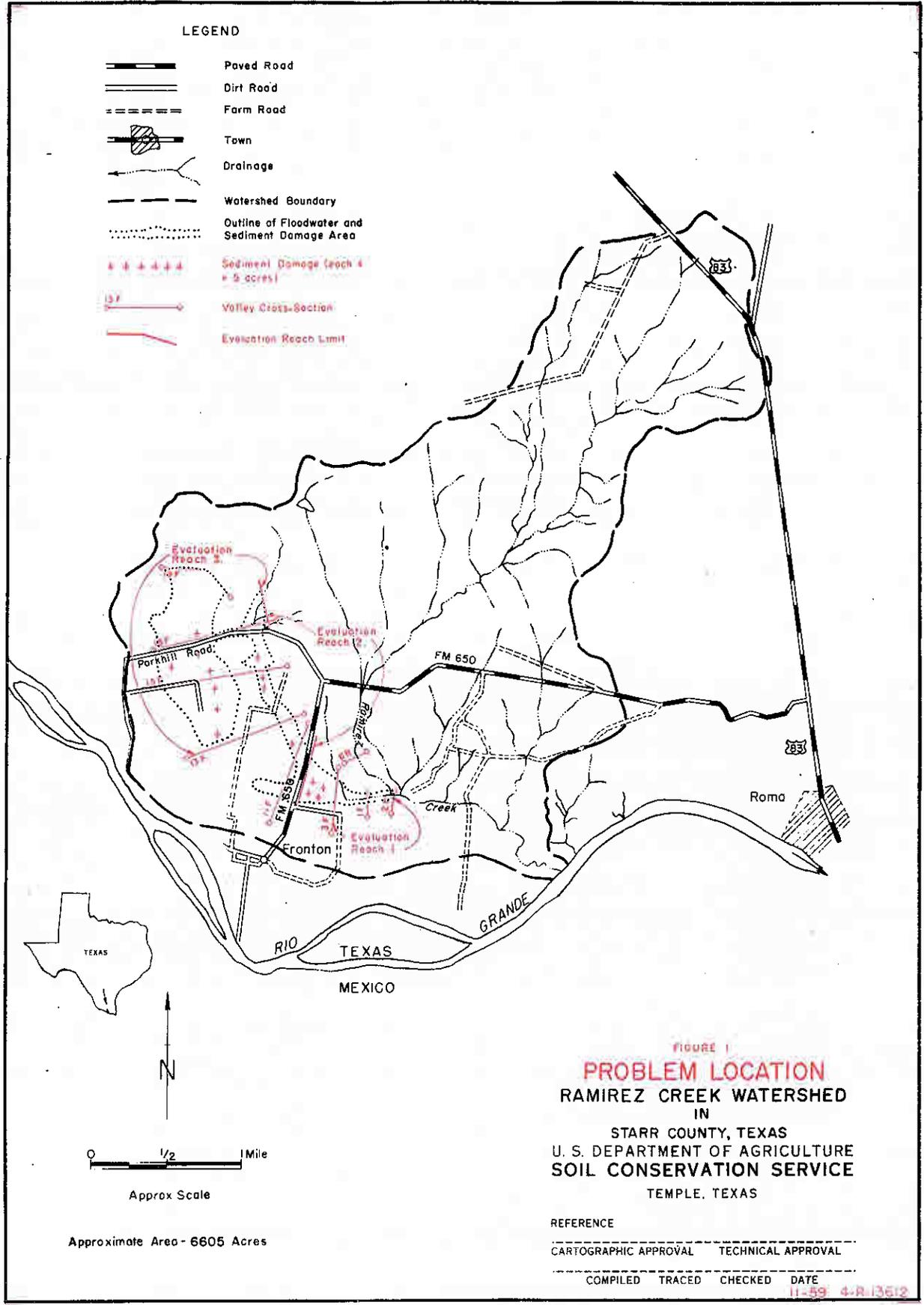
Flooding occurs frequently in the watershed and causes severe damage. During the 35-year period studied, 1923 to 1957, inclusive, which is representative of normal rainfall in this area, there were 10 major floods that inundated more than half of the flood plain (figure 1) as well as 60 minor floods. Due to the year-around cropping pattern in the watershed, all 70 floods occurring in the evaluation series caused severe crop damage. Truck crops are extremely susceptible to flood damage and commonly have values as high as \$300 per acre in the field. Costs of producing these crops range from \$50 per acre to as high as \$160 per acre, exclusive of harvesting costs.



Irrigated farmland being damaged by floodwaters caused by a 4½-inch rain in May 1958. A similar flood causing severe damage to crops on irrigated land occurred in February 1957.

LEGEND

-  Paved Road
-  Dirt Road
-  Farm Road
-  Town
-  Drainage
-  Watershed Boundary
-  Outline of Floodwater and Sediment Damage Area
-  Sediment Damage (each + = 5 acres)
-  Valley Cross-Section
-  Evaluation Reach Limit



0 1/2 1 Mile

Approx Scale

Approximate Area - 6605 Acres

FIGURE 1
PROBLEM LOCATION
 RAMIREZ CREEK WATERSHED
 IN
 STARR COUNTY, TEXAS
 U. S. DEPARTMENT OF AGRICULTURE
 SOIL CONSERVATION SERVICE
 TEMPLE, TEXAS

REFERENCE

CARTOGRAPHIC APPROVAL	TECHNICAL APPROVAL
COMPILED	TRACED
CHECKED	DATE

11-89 4-R-13512

For the floods experienced during the period studied, the total direct floodwater damages were estimated to average \$5,502 annually at long-term price levels of which \$5,443 is crop damage and \$59 other agricultural damages. Also there are numerous indirect damages such as losses suffered by processors, shippers and dealers in the area, loss of labor income suffered by those persons engaged in the vegetable and melon harvesting operations, and similar losses, all of which are estimated to average \$1,309 per year.

Sediment Damage

Overbank deposition in the flood plain has damaged only 77 acres. This damaging sediment, which is low in organic matter, consists primarily of fine sand, silt and silty clay and is estimated to have reduced crop production by 5 percent on 74 acres and 10 percent on 3 acres. This amounts to an average annual monetary damage of \$1,043 at long-term price levels.

Erosion Damage

Erosion rates in the watershed are low to moderate. The average gross erosion rate per square mile is only 1.67 acre-feet annually. This is due primarily to the gently sloping topography of the grassland area and the cultivated portion being on flat terrain. Sheet erosion accounts for 98.1 percent of the total gross erosion. Gully erosion and streambank erosion account for 1.3 and 0.6 percent, respectively. Damage due to flood plain scour is negligible.

Problems Relating to Water Management

There is minor activity relative to drainage of surface waters and considerable activity relative to irrigation in the watershed. Approximately 1,850 acres presently are being irrigated from water secured from the Rio Grande. Generally, the existing irrigation distribution system is adequate. No individual landowner or group of landowners has indicated an interest in providing storage for agricultural water management in the watershed. Recent investigations indicate that there is no need for sub-surface drainage at this time.

EXISTING OR PROPOSED WORKS OF IMPROVEMENT

The watershed is served by the Soil Conservation Service Work Unit at Rio Grande City assisting the Starr County Soil Conservation District. This work unit has assisted farmers and ranchers in preparing 16 soil

and water conservation plans on 5,492 acres (86 percent of the agricultural land) within the watershed and is giving technical assistance in establishing and maintaining planned measures. Approximately 30 percent of the needed conservation practices have been applied.

Efforts to control or prevent flooding of agricultural lands have been made on an individual basis. These efforts, consisting primarily of diversions constructed in an effort to prevent upland runoff from discharging onto the relatively flat areas of irrigated lands, have met with little success in reducing flood damages.

In 1939 an irrigation co-operative was formed in the area and at the present time approximately 400 acres of the irrigated land in the watershed is served through its facilities. The co-operative is composed of small landowners. All other irrigation systems are privately owned and operated. Irrigation water is obtained primarily from the Rio Grande; however, some limited amount of supplemental water is obtained from shallow wells.

There are no existing or proposed works of improvement by other agencies in the watershed.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures for Watershed Protection

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs, such as is now being carried out by the Starr County Soil Conservation District is necessary for a sound flood prevention program on the watershed. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices essential to proper land use. Emphasis will be placed on the establishment of those land treatment practices which have a measurable effect on the reduction of floodwater, sediment, and erosion damages.

Land treatment measures above the proposed structural measures are extremely important for the protection of the floodwater diversion and improved channel to prevent excessive sediment deposition in the channels.

The amounts and estimated costs of the measures that will be installed by the landowners and operators are shown in table 1. The estimated total cost of planning and installing these measures is \$70,427. It is not expected that any additional technical assistance, above the going program will be necessary to keep land treatment in balance with structural development.

Land treatment measures will decrease erosion damage and sediment production from fields, range areas, and pastures by providing improved soil-cover conditions. These measures include cover cropping, use of rotation

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST 1/

Ramirez Creek Watershed, Texas
Price Base: 1959

Installation Cost Item	Unit	No. to be Applied Non-Federal Land	Estimated Cost		
			P. L. 566 Funds	Other Funds	Total
			(dollars)	(dollars)	(dollars)
LAND TREATMENT FOR					
Watershed Protection					
Soil Conservation Service					
Contour Farming	Acre	31	-	23	23
Cover Cropping	Acre	1,640	-	16,400	16,400
Crop Residue Utilization	Acre	1,640	-	3,280	3,280
Rotation Hay and Pasture	Acre	205	-	2,665	2,665
Brush Control	Acre	2,275	-	22,750	22,750
Deferred Grazing	Acre	2,730	-	2,730	2,730
Proper Use	Acre	2,275	-	4,550	4,550
Range Seeding	Acre	2,275	-	9,100	9,100
Diversion Construction	Mile	1.5	-	1,584	1,584
Pond Construction	Each	5	-	5,000	5,000
Terracing	Mile	2	-	230	230
Waterway Development	Acre	5	-	1,000	1,000
Technical Assistance			-	1,115	1,115
SCS Subtotal			-	70,427	70,427
TOTAL LAND TREATMENT			-	70,427	70,427
STRUCTURAL MEASURES					
Soil Conservation Service					
Channel Improvement and Appurtenant Structures	Mile	2.6	19,208	757	19,965
Floodwater Diversion	Mile	2.4	15,400	-	15,400
SCS Subtotal			34,608	757	35,365
Subtotal - Construction			34,608	757	35,365
Installation Services					
Soil Conservation Service					
Engineering Services			6,922	151	7,073
Other			3,185	70	3,255
SCS Subtotal			10,107	221	10,328
Subtotal - Installation Services			10,107	221	10,328
Other Costs					
Land, Easements and Rights-of-way			-	18,000	18,000
Administration of Contracts			-	1,250	1,250
Subtotal - Other			-	19,250	19,250
TOTAL STRUCTURAL MEASURES			44,715	20,228	64,943
TOTAL PROJECT			44,715	90,655	135,370
MARY					
Subtotal SCS			44,715	90,655	135,370
TOTAL PROJECT			44,715	90,655	135,370

No Federal lands involved.

August 1959

hay and pasture, and crop residue utilization for cropland. They also include range seeding and brush control to allow grass stands to replace poor brushy cover; construction of farm ponds to provide watering places for livestock and uniform distribution of grazing; and proper use of rangelands to provide improvement, protection, and maintenance of grass stands. The measures also effectively improve soil conditions which allow rainfall to soak into the soil at a more rapid rate.

In addition to the soil improvement and cover measures, land treatment includes contour farming, terracing, diversion construction, and waterway development to serve these measures, which in combination have a measurable effect in reducing peak discharge by slowing runoff water from fields. These measures also help the soil improvement and cover measures to reduce erosion damage and sediment production.

Structural Measures

The 2.6 miles of channel improvement and appurtenant structures, and 2.4 miles of floodwater diversion will be installed in the watershed to afford the needed flood prevention protection to flood plain lands which cannot be provided by land treatment measures alone.

The following appurtenant structures will be installed:

Fronton Channel

There will be 5 concrete siphons installed at stations 74+20, 77+55, 107+40, 111+00, and 129+00 for the purpose of passing the flow of existing irrigation ditches under the improved channel. The estimated cost of these siphons is \$1,777, of which \$799 will be borne by Public Law 566 funds and \$978 by other than Public Law 566 funds.

Approximately 8 concrete dips will be installed across the improved channel by the local people to provide crossings for private roads without damage to the channel. The estimated cost of these crossings, \$1,200, will be borne by other than Public Law 566 funds and are included in tables 1 and 2 under land, easements, and rights-of-way.

One 6' x 4' concrete culvert will be constructed at station 110+50 by the local people to provide a crossing for Farm Road 650. The estimated cost of this culvert, \$1,920, will be borne by other than Public Law 566 funds, and is included in tables 1 and 2 under land, easements, and rights-of-way.

Floodwater Diversion

At station 64+35 a concrete slab will be installed over the diversion to provide a crossing for the Parkhill Road. At station 106+70

a two-box 5' x 6' culvert will be installed to provide a crossing for Farm Road 650. The estimated cost of these two structures, \$4,550, will be borne by other than Public Law 566 funds and are included in tables 1 and 2 under land, easements, and rights-of-way.

The location of the structural measures is shown on the Planned Structural Measures, figure 2.

The total estimated cost of establishing these works of improvement, including the cost of appurtenant structures, is \$64,943, of which \$20,228 will be borne by local interests and \$44,715 will be borne by Public Law 566 funds (table 1). The annual equivalent cost is estimated to be \$2,289 for installation; \$1,340 for operation and maintenance; and \$252 for other economic costs which consist of net loss of production above the annual equivalent costs of land easements. Total annual costs are \$3,881.

BENEFITS FROM WORKS OF IMPROVEMENT

The combined program of land treatment and structural measures described above would prevent flood damages from 14 of the 70 floods, such as occurred in the watershed from 1923 to 1957, inclusive. Damage from the runoff of all other storms would be confined to areas of 27 acres or less. Average annual flooding would be reduced from 114 acres to 12 acres. Evaluation Reaches 1 and 3 (figure 1) will be flood-free from all storms such as occurred in the evaluation series.

The most damaging flood to occur during recent years was caused by the storm of April 9-10, 1954. This storm inundated 172 acres of flood plain and did an estimated \$18,047 of direct floodwater damage. If the complete program for watershed protection, flood prevention and agricultural water management had been installed, the floodwater damage would have been reduced to an estimated \$1,796.

The area on which sediment damage from overbank deposition will occur annually can be expected to be reduced from 77 acres to 7 acres, a reduction of 91 percent. About 24 percent of the expected reduction will result from land treatment and 76 percent from the structural measures.

The planned land treatment program will reduce the total gross erosion from the watershed from 17.26 to 14.96 acre-feet annually.

The estimated average annual monetary floodwater, sediment and indirect damages within the watershed would be reduced from \$7,854 to \$795, a reduction of 89.9 percent. About 88.4 percent of the expected reduction in the average annual damage would result from the structural measures.

The general locations of the flood reduction benefits to accrue from the combined program of land treatment and structural measures are presented in the following tables.

LEGEND

-  Paved Road
-  Dirt Road
-  Farm Road
-  Town
-  Drainage
-  Watershed Boundary
-  Outline of Floodwater and Sediment Damage Area
-  Channel Improvement
-  Floodwater Diversion
-  Drainage Area Boundary
-  Bridge

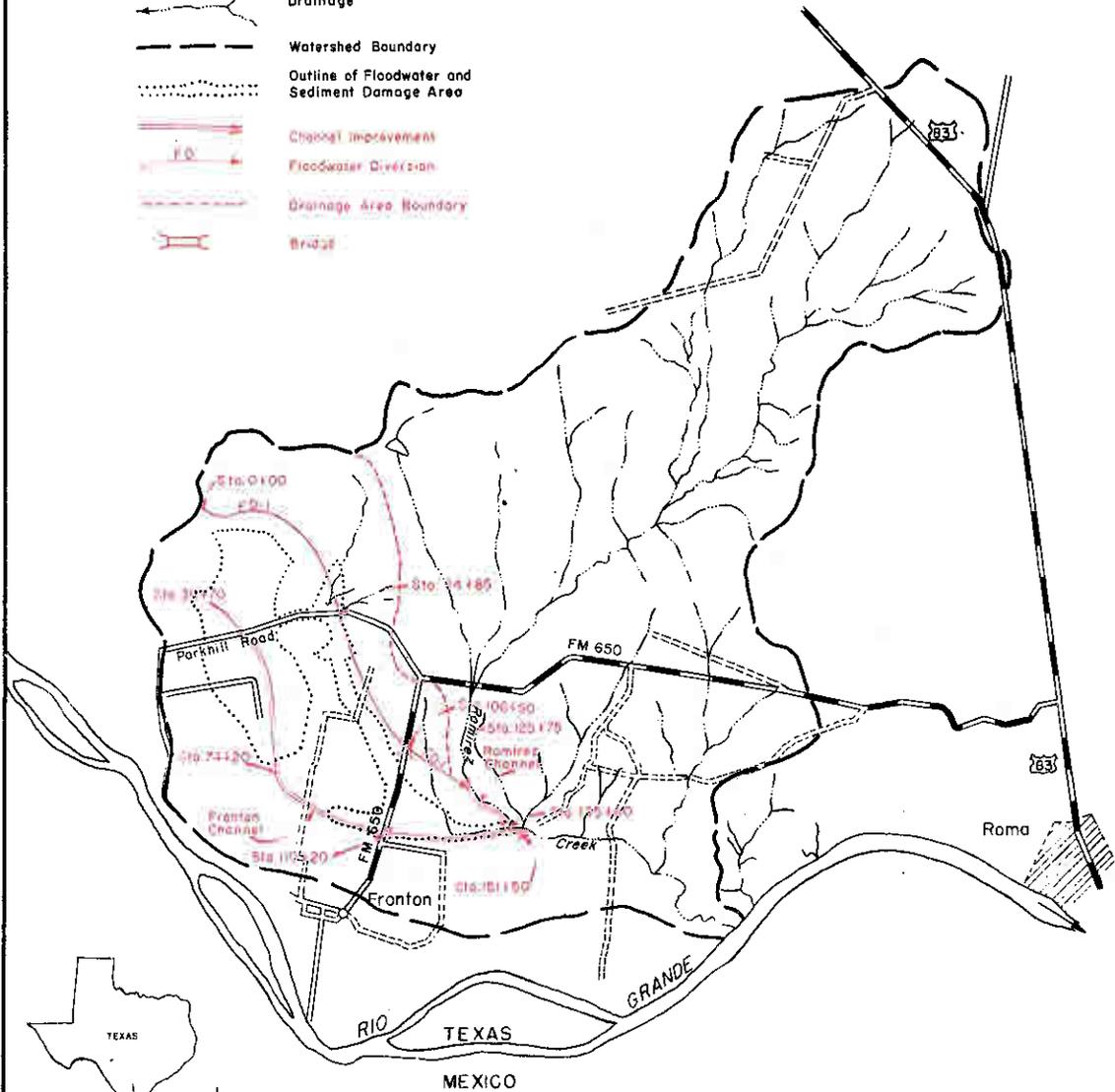


FIGURE 2
PLANNED STRUCTURAL MEASURES

RAMIREZ CREEK WATERSHED
 IN

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

REFERENCE

CARTOGRAPHIC APPROVAL TECHNICAL APPROVAL

COMPILED TRACED CHECKED DATE

Approximate Area - 6605 Acres

11-95 E-R-13611

Average Annual Area Inundated

Evaluation Reach (Figure 1):	Location	Without Project (acres)	With Project (acres)	Reduction (percent)
1	Below FM 650	20	0	100.0
2	FM 650 to Parkhill Road	33	12	63.6
3	Above Guerra Canal	61	0	100.0
Total		114	12	89.5

Average Annual Damages

Evaluation Reach (Figure 1):	Location	Without Project (dollars)	With Project (dollars)	Reduction (percent)
1	Below FM 650	1,519	12 <u>1/</u>	99.2
2	FM 650 to Parkhill Road	2,443	758	69.0
3	Above Guerra Canal	3,892	25 <u>1/</u>	99.4
Total		7,854	795	89.9

1/ Remaining damage with project is discounted for lag in recovery of sediment damage (overbank deposition).

The areas to be benefited and the areas on which structural measures are to be installed are not subject to overflow or backwater from the Rio Grande.

The total benefits, as a result of structural measures, are estimated to be \$6,244 annually.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measures (converted from total installation cost) plus operation and maintenance and other economic costs is estimated to be \$3,881. The structural measures are expected to produce average annual benefits of \$6,244, or \$1.61 for each dollar of cost. In addition to the direct monetary benefits, there are other substantial values which will accrue from the project, such as an increased sense of economic security and better living conditions, none of which have been used for project justification.

The total benefits from land treatment measures were not evaluated in monetary terms since experience has shown that these soil and water conservation measures produce benefits in excess of their costs.

ACCOMPLISHING THE PLAN

Federal assistance for carrying out the works of improvement on non-Federal land, as described in this work plan, will be provided under the authority

of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666) as amended.

Land Treatment Measures

The land treatment measures itemized in table 1 will be established by farmers and ranchers during a 5-year period in cooperation with the Starr County Soil Conservation District, which is giving assistance in the planning and application of these measures under its going program.

The governing body of the Starr County Soil Conservation District will assume aggressive leadership in advancing the land treatment program. The landowners within the watershed will be encouraged to adopt and carry out 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 District.

The county ASC committee will cooperate with the governing body of the Soil Conservation District by selecting and providing financial assistance for those ACPS practices which will accomplish the conservation objectives in the shortest possible time.

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

The Extension Service will assist with the educational phase of the program by conducting general information and local farm meetings, preparing radio, television and press releases, and using other methods of getting information to landowners and operators in the watershed. This activity will help to get the project for watershed protection and flood prevention carried out.

Structural Measures for Flood Prevention and Agricultural Water Management

The cost of the local share of construction and installation services, and all costs of land, easements, rights-of-way, and road and utility changes necessary for the construction of the channel improvement and floodwater diversion will be paid by the Commissioners Court of Starr County. Revenue from an ad valorem tax, now being collected in Starr County, is adequate and available for these costs. The easements will be dedicated jointly to the Starr County Commissioners Court and the Starr County Soil Conservation District.

The Starr County Commissioners Court will be the contracting agency and will let and service all contracts for the 2.6 miles of channel improvement and appurtenant structures, and 2.4 miles of floodwater diversion included in this work plan. The cost of administering contracts will be paid by Starr County Commissioners Court.

The structural measures will be constructed during a 2-year period pursuant to the following conditions:

1. The necessary easements have been obtained.
2. The contracting agency is prepared to discharge its responsibilities.
3. Operation and maintenance agreements have been executed.
4. Public Law 566 funds are available.

Technical assistance will be provided by the Soil Conservation Service to assist in preparation of plans and specifications, supervision of construction, preparation of contract payment estimates, final inspection, execution of certificates of completion, and related tasks necessary to establish the planned structural measures for flood prevention.

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

The estimated schedule of obligation for the complete 5-year installation period, covering installation of both land treatment and structural measures, is as follows:

Fiscal Year	Measure	P. L. 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
1st	Floodwater Diversion	19,897	9,350	29,247
	Land Treatment	-	14,086	14,086
2nd	Channel Improvement	24,818	10,878	35,696
	Land Treatment	-	14,086	14,086
3rd	Land Treatment	xxx	14,085	14,085
4th	Land Treatment	xxx	14,085	14,085
5th	Land Treatment	xxx	14,085	14,085
	Total	44,715	90,655	135,370

This schedule will be adjusted from year-to-year on the basis of any significant changes in the plan found to be mutually desired, and in light of appropriations and accomplishments actually made.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by landowners and operators of the farms and ranches on which the measures are applied, under agreement

with the Starr County Soil Conservation District. Representatives of the District will make periodic inspections of the land treatment measures to determine maintenance needs and encourage landowners and operators to perform management practices and maintenance. They will make district-owned equipment available for this purpose.

Structural Measures for Flood Prevention and Agricultural Water Management

The 2.6 miles of channel improvement and appurtenant structures, and 2.4 miles of floodwater diversion will be operated and maintained by the Starr County Commissioners Court and the Starr County Soil Conservation District. The cost of operation and maintenance will be borne by the Starr County Commissioners Court and funds for this purpose will come from an ad valorem tax in Starr County which is available for this use. The Starr County Commissioners Court will establish a permanent reserve fund for this purpose in the following manner and amounts. As the structural works of improvement are completed, \$500 per year per mile of channel improvement and floodwater diversion will be placed in a fund for operation and maintenance. The portion of this fund not needed for current operation and maintenance will be placed in a reserve fund until the sum of \$1,000 per mile of channel improvement and floodwater diversion is established. This will amount to \$5,000 when all channel improvement and floodwater diversion is completed. This reserve fund will be kept available for abnormally costly maintenance activities that may result from excessive storms or other causes. When it becomes necessary to use any of the reserve fund for maintenance expenditures, the Starr County Commissioners Court will take appropriate action to replenish the fund in the shortest feasible time.

The improved channel and appurtenant structures, and floodwater diversion will be inspected at least annually and after each heavy rain by representatives of the Starr County Commissioners Court and the Starr County Soil Conservation District. A Soil Conservation Service representative will participate in these inspections at least annually. Items of inspection for channel improvement and floodwater diversion will include, but will not be limited to, the degree of scour, silting and bank erosion; the degree of obstruction to flow caused by debris lodged against bridges, fences and water gates; and excessive brush and tree growth within the open channels.

The Soil Conservation Service, through the Starr County Soil Conservation District, will participate in operation and maintenance activities only to the extent of furnishing technical assistance.

Provisions will be made for free access of representatives of the co-sponsoring local organizations and Federal Agencies to inspect and provide maintenance for structural measures at any time.

The cosponsoring local organizations will maintain a record of all maintenance inspections made and maintenance performed and have it available for inspection by Soil Conservation Service personnel.

The cosponsoring local organizations fully understand their obligations for maintenance and will execute specific maintenance agreements prior to the issuance of invitation to bid on the construction of the structural measures.

The estimated annual operation and maintenance cost of all structural measures is \$1,340, based on long-term prices. The necessary maintenance work will be accomplished either by contract, force account, or equipment owned by the cosponsoring organizations.

COST-SHARING

Land treatment measures will be installed through funds other than Public Law 566 at an estimated cost of \$70,427 (table 1). This cost includes ACPS payments based on present program criteria and technical assistance under the going district program.

The entire construction and installation services cost of the flood prevention structures, \$43,916, will be borne by Public Law 566 funds. The local interest will provide the land, easements, and rights-of-way, \$18,000, and administer the contracts, \$1,250.

The construction and installation services costs of the structural measures for agricultural water management \$1,777, will be shared \$799 (45 percent) by Public Law 566 funds and \$978 (55 percent) by other funds. The ratio of direct identifiable benefits to total benefits accruing in the area benefited by agricultural water management measures is 47 percent. The sharing of costs by the local sponsors was increased to 55 percent to be equivalent to that required by the Federal Government for other similar project-type programs.

The total project cost of \$135,370 will be shared 33 percent (\$44,715) by Public Law 566 funds and 67 percent (\$90,655) by other than Public Law 566 funds.

CONFORMANCE OF PLAN TO FEDERAL LAWS AND REGULATIONS

This project plan conforms to all Federal laws and regulations and will have no known detrimental effects on any downstream projects which are now in existence or that might be constructed in the future.

SECTION 2

INVESTIGATIONS, ANALYSES, AND SUPPORTING TABLES

INVESTIGATIONS AND ANALYSESProject FormulationProject Objectives

Flood problems and project objectives were reviewed with representatives of the Starr County Soil Conservation District and the Starr County Commissioners Court. The desired objectives of the project, as expressed by the local cosponsoring organizations were to provide a degree of flood protection that would result in at least an 80 percent reduction of monetary damages and provide sub-surface drainage, if needed, for the irrigated portion of the watershed.

Land Treatment Measures

The needed land treatment for the watershed, as shown in table 1, was developed by the Soil Conservation Service work unit at Rio Grande City. Conservation needs data were compiled from existing conservation plans within the watershed. These data were expanded to represent the conservation needs of the entire watershed and computed for each land treatment practice which contributes directly to flood prevention to be applied during the 5-year installation period. The hydraulic, hydrologic, sedimentation and economic investigations provided data as to the effects of these land treatment measures in reducing flood damages. Although significant benefits would result from the application of these needed land treatment measures, it was apparent that other flood prevention measures would be required to attain the degree of watershed protection and flood damage reduction desired by the local people.

Structural Measures

Determinations then were made of structural measures for flood prevention and agricultural water management needed to attain the project objectives that could not be accomplished by land treatment measures alone. The study made and the procedures used in that determination were as follows:

1. A base map of the watershed was prepared showing watershed boundary, drainage pattern, system of roads, and other pertinent information. A field study was made of the area which contributes damaging floodwater and it was determined that no suitable floodwater retarding structure sites were available. Further study indicated that the needed protection from storm runoff from the hill lands onto the gently

sloping flood plain could be provided by a floodwater diversion and channel improvement. Determination was made of the limits of the flood plain and the locations at which valley cross sections should be surveyed for the determination of hydraulic characteristics and for hydrologic and economic evaluations. This information was placed on the watershed base map for use in field surveys. Cross sections of the flood plain were surveyed at the selected locations. A map was prepared of the flood plain on which land use, cross section locations, and other pertinent information was recorded.

2. Profiles and representative cross sections were surveyed to determine the location and alignment of the floodwater diversion and improved channel. The needed measures for reconstruction of existing irrigation facilities after installation of flood prevention structures were determined.

Structural data tables were developed from engineering surveys to show for each measure the drainage area contributing, required capacity and design capacity, the volume of excavation, the estimated cost of the structural measures, and other pertinent data (tables 2, 3, and 3A).

3. Investigations were made to determine the need for sub-surface drainage on the irrigated lands in the watershed. These investigations included soil profile studies, water table determinations (study of 27 observation wells), soil salinity determinations, and field hydraulic conductivity tests. Conclusions based on these studies indicate that there is no need for sub-surface drainage at this time.

When the structural measures for flood prevention and agricultural water management had been determined, a table was developed to show the cost of each type of measure. The summation of the total costs for all works of improvement represented the estimated cost of the planned watershed protection and flood prevention project (table 1). A second cost table was developed to show separately the annual installation cost, annual maintenance cost, annual other economic cost, and total annual cost of the structural measures (table 6).

Hydraulic and Hydrologic Investigations

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

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau and Water Supply Papers, Water Bulletins of the International Boundary and Water Commission, and other sources. These data were analyzed to determine average precipitation, the historical series to be used in the evaluation of the program, and the relationship of geology, soils and climate to runoff

depth-frequency for single storm events.

2. The present hydrologic condition of the watershed was determined by the hydrologist, geologist, work unit conservationist, and soil scientists working in the area, on the basis of existing land treatment, soil groups, and crop distribution within the watershed. The future hydrologic condition was determined by obtaining from the work unit conservationist the changes in land use and treatment that could be expected during the installation period. Runoff curves were computed from the soil-cover complex data and used with figure 3.10-1, National Engineering Handbook, Section 4, Supplement A, to determine the depth of runoff from individual storms in the historical storm series.
3. Profiles and valley sections were located and surveyed on the flood plain areas and cross sections were surveyed for alignment and design of the proposed floodwater diversion terrace. The evaluation reaches were delineated in conference with the economist and geologist.
4. A floodwater diversion terrace was located so that excessive runoff from the hills would be intercepted and carried to the Ramirez Creek channel. Several trial alignments were made and it was determined that the most economical design would be a typical floodwater diversion terrace from station 0+00 to station 64+35 (figure 2) with an excavated channel from station 64+35 to station 125+75, where it enters Ramirez Creek. It was necessary to improve a section of Ramirez Creek channel to establish the proper gradient of the floodwater diversion. Yarnell's 6-hour 50-year frequency rainfall for this area was used to design the floodwater diversion terrace and the section of Ramirez Creek for which channel improvement is planned.
5. The rainfall for the period 1923-1957, inclusive, was selected as most representative of a normal rainfall for the watershed, and is the period from which the evaluation flood series was developed.
6. Due to the discharge of floodwaters from the adjacent hill areas directly onto the relatively flat and broad flood plain it was determined that the area flooded is not a direct function of the peak discharge, but more generally is directly related to the flood volume. Therefore the "overland flow" method was used to determine the area that would be inundated by each storm in the evaluation series under each of the following conditions:
 - a. The present conditions of the watershed.

- b. The installation of land treatment measures for watershed protection.
 - c. The installation of land treatment measures and structural measures.
7. The largest runoff-producing rain which occurred during the 35-year period was a storm of 3.90 inches on August 23 and 24, 1944. With an antecedent moisture Condition II, the computed runoff from a storm this size is 1.88 inches. The annual flood frequency line developed by means of the computed runoff for the 35-year period indicated a frequency of approximately once in 25 years for this storm. Under present conditions runoff from this storm would inundate 251 acres which is considered in this plan to be the flood plain. If such a storm were to occur after land treatment measures are applied it is estimated that the area inundated would be reduced to 241 acres. With land treatment measures and the planned floodwater diversion and channel improvement in operation, only 27 acres of flood plain would be inundated.
 8. The design of the improved channel referred to as the Fronton Channel (figure 1) was determined by the criteria outlined in Section 16, NEH, Chapter 6. The watershed is topographically classified as "Coastal" and "Minimum hill" areas for drainage. The Minimum hill area was converted to equivalent Coastal area for the determination of the required design Q. The Coastal and Minimum hill curves are shown in Section 16, Chapter 6, Standard Drawing, No. ES-703, NEH.

Sedimentation Investigation

The field survey of the sedimentation problems of the watershed was made in accordance with methods prescribed in the "Sedimentation Section of Procedures for Developing Flood Prevention Work Plans", Water Conservation-6, SCS, Region 4, Revised February 1954. Field studies of the over-bank deposits, flood plain scour, streambank erosion, and the nature of the channels and valleys were made. Physical damage to the flood plain was determined by areal mapping of the entire flood plain. The nature and thickness of the sediment deposits were studied and classified as to percent loss of productivity. These figures were used by the economist as the basis for calculating monetary damages.

Sediment Source Studies

The sediment derived from sheet erosion was estimated by the use of a formula shown in "Suggested Criteria for Estimating Gross Sheet Erosion and Sediment Delivery Rates for the Blackland Prairie Problem Area in Soil Conservation", Soil Conservation Service, Region 4, February 1953.

The sediment derived from gully and streambank erosion was estimated by field studies and the use of aerial photographs.

Effect of Watershed Treatment on Sediment Yields

Areas damaged by overbank deposition should regain full productivity after installation of works of improvement. After installation of the land treatment measures shown in table 1, the total gross erosion will be reduced approximately 13 percent.

Geologic Investigation

Since there were no proposed floodwater retarding structures in the watershed, geologic investigations were limited to studies of the topography, drainage patterns, and the formations affecting channel improvement and floodwater diversion construction.

Economic Investigation

Determination of Annual Benefits from Reduction in Damages

Damage schedules covering approximately 88 percent of the damage area of the watershed were obtained from landowners or operators. These schedules covered land use and crop distribution, yields and historical data on flooding and flood damages. Most of the flood damage information obtained was for floods which occurred in 1954, 1957, and 1958. Analysis of the information contained therein formed the basis for determining damage rates for various depths and seasons of flooding. In the calculation of crop damage, expenses saved, such as cost of harvesting and other production inputs were deducted from the gross value of the damage. Information was obtained from county and State highway officials and others concerning non-agricultural damages. From this information it was determined that non-agricultural damages in the watershed are negligible.

A study of the flood history and physical features of the flood plain and related areas that contribute floodwater indicated that damages could best be appraised by the overland flow method, as outlined in Chapter 3 of the Economics Guide. Based on information obtained from the local people, and correlated with specific flood events, it was calculated that for each acre-foot of floodwater there would be 0.56 of an acre flooded in Evaluation Reach 1, 1.38 acres flooded in Evaluation Reach 2, and 1.0 acre flooded in Evaluation Reach 3.

Floodwater volume was calculated, flood by flood, for the floods included in the period 1923 to 1957, inclusive, and converted to acres inundated. The proper rates of damage were applied and adjustments were made to take into account the effects of recurrent flooding where more than one flood occurred within the same cropping season.

The flood plain land use was mapped in the field and supplemental data was

obtained from operators to reflect the intensive, two-crop system of truck crop production. Estimates of normal flood-free yields were based on data obtained from schedules, supplemented by information obtained from other agricultural workers in the area.

In analyzing flood plain land use, yields, and frequency of flooding, it was found that significant variations existed with respect to location within the watershed. Therefore, the flood plain was divided into three evaluation reaches, each with its own damageable value.

Evaluation Reach 1	Damage area below FM 650
Evaluation Reach 2	The eastern portion of the damage area between FM 650 and Parkhill Road.
Evaluation Reach 3	The remainder of the damage area above VS-13-F.

The area subject to overflow from Ramirez Creek was considered in the damage evaluation. An investigation of preliminary examination scope was made to determine if damages were significant. This investigation indicated that the area subject to overflow is almost entirely brushy rangeland and that damages were not significant enough to warrant a detailed hydrologic and economic evaluation. The area subject to overflow from Ramirez Creek was not included in the flood plain.

The monetary value of the physical damage to the flood plain from deposition of sediment was based on the value of production lost, taking into account the time lag for recovery and the costs of operations necessary to speed recovery.

Indirect damages in this watershed primarily involve losses suffered by dealers, processors, and shippers of vegetables in the area and loss of labor income by those engaged in the harvesting operations. Upon analysis, it appears that these damages are about 20 percent of the direct damage.

The costs of land, easements, and rights-of-way for the floodwater diversion and channel improvement were determined by individual appraisals in conjunction with representatives of the sponsoring organizations. The average annual net loss in production, based on long-term price levels, was calculated and this value compared with the amortized cost of the easements and rights-of-way. The net value of average annual loss in production exceeded the amortized cost of the easements and rights-of-way by \$252 because of the intensive cropping pattern. The larger amount was used in the economic evaluation of the project to assure a conservative appraisal.

Details of Methodology

Details and procedures used in the investigations are described in the Economics Guide for Watershed Protection and Flood Prevention, December 1958.

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Ramirez Creek Watershed, Texas
Price Base: 1959

Structure	Installation Cost - Public Law 566 Funds			Installation Cost - Other Funds			Total					
	Construction	Engineer's Estimate	Contingencies	Construction	Engineer's Estimate	Contingencies	Construction	Engineer's Estimate	Contingencies			
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)			
Channel Improvement Ramirez Creek	5,600	1,232	560	567	7,959	-	250	1,050	1,300	9,259		
Channel Improvement Fronton Channel	11,300	2,486	1,130	1,144	16,060	-	500	8,100	8,600	24,660		
Concrete Siphons Fronton Channel 1/	562	124	56	57	799	688	69	221	0	978	1,777	
Subtotal	17,462	3,842	1,746	1,768	24,818	688	69	221	750	9,150	10,878	35,696
Floodwater Diversion	14,000	3,080	1,400	1,417	19,897	-	-	-	500	8,850	9,350	29,247
Subtotal	14,000	3,080	1,400	1,417	19,897	-	-	-	500	8,850	9,350	29,247
GRAND TOTAL	31,462	6,922	3,146	3,185	44,715	688	69	221	1,250	18,000	20,228	64,943

1/ Includes 5 concrete siphons for the purpose of passing the existing irrigation ditches under the improved channel.

TABLE 3 - STRUCTURE DATA

FLOODWATER DIVERSION

Ramirez Creek Watershed, Texas

Diversion Designation (No.)	Station (100 ft.)	Area (acres)	Watershed (100 ft.)	Required Capacity (c.f.s.)	Designed Capacity (c.f.s.)	Natural Capacity (c.f.s.)	Flow Above: Natural	Flow Above: Ground	Flow Above: Surface at: Designed	Width of Water: Designed	Borrow Ditch: Width	Water: Depth	Water: Surface Slope	Design: Velocity	Volume: Excavation
1	0+00	80	6+60	135	156	1.4	0.5	0.5	94	8	6:1	0.7	.0020	2.48	1
	6+60	210	42+25	283	283	1.3	0.5	0.5	113	8	6:1	0.9	.0020	2.80	4
	42+25	330	56+10	430	450	1.4	0.5	0.5	133	8	6:1	1.4	.0015	2.70	1
	56+10	392	64+35	487	487	2.0	0.5	0.5	132	8	6:1	1.0	.0020	3.33	1
	64+35	406	72+60	515	515	1.5	0.5	0.5	128	20	6:1	2.0	.0025	2.75	2
	72+60	431	81+80	515	515	1.5	0.5	0.5	124	16	6:1	2.0	.0030	2.97	2
	81+80	457	91+10	575	575	0	-	-	47	28	2½:1	3.2	.0030	4.02	3
	91+10	470	101+00	575	575	0	-	-	42	16	2½:1	5.2	.0020	3.77	5
	101+00	475	106+50	575	575	0	-	-	40	10	2½:1	6.0	.0020	3.81	3
	106+50	475	(2)-5' x 6' box culverts (concrete) 40' in length												
TOTAL	106+90	540	125+75	640	645	0	-	-	66	4.5	2½:1	4.2	.0011	2.77	41
															63

August 1959

TABLE 3A - STRUCTURE DATA

STREAM CHANNEL IMPROVEMENT

Ramirez Creek Watershed, Texas

Channel Designation	Station	Station (100 ft.)	Water-shed Area (acres)	Required Channel Capacity (c.f.s.)	Planned Channel Capacity (c.f.s.)	Bottom Width (foot)	Side Slope (H:V)	Depth (foot)	Fall	Design Depth	Velocity at Design	Excavation Volume	
Ramirez Creek Channel 1/	125+75	139+20	540	646	645	30	2.5:1	4.0	0.0026	4.02	4.02	15	
	139+20	151+50	540	646	645	50	2.5:1	4.4	0.00075	2.41	2.41	10	
Fronton Channel	36+70	74+20	861	61	57	4.0	1.5:1	4.0	0.0008	1.57	1.57	21	
	74+20	77+55	976	64	64	4.0	1.5:1	4.0	0.0008	1.57	1.57	2	
	77+55	110+20	1,655	100	102	4.0	1.5:1	5.0	0.0008	1.77	1.77	16	
	110+20	110+75	(1) - 4' x 6' Concrete Culvert										
	110+75	129+00	1,852	110	112	4.0	1.5:1	5.2	0.0008	1.82	1.82	12	
	129+00	145+80	1,877	110	112	4.0	1.5:1	5.2	0.0008	1.82	1.82	4	

1/ Channel improvement on Ramirez Creek is for the purpose of securing required gradient to establish adequate outlet for floodwater diversion. Overflows caused by maximum diversion outflow and runoff from Upper Ramirez Creek occurring simultaneously will cause no damage nor affect the functioning of the floodwater diversion or the Fronton Channel.

August 1959

TABLE 4 - SUMMARY OF PHYSICAL DATA

Ramirez Creek Watershed, Texas

Item	: Unit :	: Quantity Without Project :	: Quantity With Project :
Watershed Area	Sq.Mi.	10.32	xxx
Watershed Area	Acre	6,605	xxx
Area of Cropland	Acre	1,921	1,899
Area of Grassland	Acre	4,494	4,479
Area of Miscellaneous Use	Acre	190	227
Overflow Area Subject to Damage	Acre	<u>1/</u> 251	<u>1/</u> 27
Area Damaged Annually by:			
Sediment	Acre	<u>2/</u> 77	<u>3/</u> 7
Streambank Erosion	Acre	.06	.06
Annual Rate of Erosion:			
Sheet	Ac.Ft.	16.93	14.67
Gully	Ac.Ft.	.23	.19
Streambank	Ac.Ft.	.10	.10
Average Annual Rainfall	Inch	17.5	xxx

1/ Area inundated from the runoff of a 25-year frequency storm.

2/ Area on which some production loss is occurring each year.

3/ The area on which production loss will occur each year after all recovery has taken place; and equilibrium has been reached. This applies to all flooding up to the areas inundated by the storm as listed in 1/.

August 1959

TABLE 5 - SUMMARY OF PLAN DATA

Ramirez Creek Watershed, Texas

Item	Unit	Quantity
Years to Complete Project	Year	5
Total Installation Cost		
Public Law 566 Funds	Dollar	44,715
Other Funds	Dollar	90,655
Annual O & M Cost		
Public Law 566	Dollar	0
Other	Dollar	1,340
Average Annual Monetary Benefits ^{1/}	Dollar	6,244
Agricultural	Percent	100
Nonagricultural	Percent	0
Structural Measures		
Channel Improvement	Mile	2.6
Floodwater Diversion	Mile	2.4
Reduction of Floodwater Damage	Dollar	4,907
By Land Treatment Measures		
Watershed Protection	Percent	8
By Structural Measures	Percent	81
Reduction of Sediment Damage	Dollar	975
By Land Treatment Measures		
Watershed Protection	Percent	24
By Structural Measures	Percent	69

^{1/} From Structural Measures.

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TABLE 6 - ANNUAL COSTS

Ramirez Creek Watershed, Texas

Measures	Amortization of : Operation and Maintenance Costs <u>2/</u> :		Other		Total
	Installation : Cost <u>1/</u> :	Public Law : 566 : Other :	Total :	Economic : Cost <u>4/</u> :	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Channel Improvement in Combination with Flood- water Diversion <u>3/</u>	2,289	0	1,340	252	3,881
TOTAL	2,289	0	1,340	252	3,881

1/ Price Base: 1959 prices amortized for 50 years at 2.5 percent.

2/ Long-term prices as projected by ARS, September 1957.

3/ Interdependent measures.

4/ The value by which the average annual net loss in production exceeds the amortized cost of easements and rights-of-way.

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TABLE 7 - MONETARY BENEFITS FROM STRUCTURAL MEASURES

Ramirez Creek Watershed, Texas
Price Base: Long Term 1/

Item	Estimated Average Annual Damage			Average Annual Monetary Benefits
	Without Project (dollars)	After Land Treatment For W/S Protection (dollars)	With Project (dollars)	
Floodwater Damage				
Crop and Pasture	5,443	5,024	594	4,430
Other Agricultural	59	54	1	53
Nonagricultural	xxx	xxx	xxx	xxx
Subtotal	5,502	5,078	595	4,483
Sediment Damage				
Overbank Deposition	1,043	788	68	720
Subtotal	1,043	788	68	720
Indirect Damage	1,309	1,173	132	1,041
Total, All Damage	7,854	7,039	795	6,244
TOTAL PRIMARY BENEFITS	xxx	xxx	xxx	6,244
TOTAL MONETARY BENEFITS	xxx	xxx	xxx	6,244

1/ As projected by ARS, September 1957.

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TABLE 8 - BENEFIT COST ANALYSIS

Ramirez Creek Watershed, Texas

Measures	AVERAGE ANNUAL BENEFITS <u>1/</u>			Total	Average Annual Cost <u>2/</u>	Benefit-Cost Ratio
	Flood-water (dollars)	Sediment (dollars)	Indirect (dollars)			
Channel Improvement in Combination With Floodwater Diversion <u>3/</u>	4,483	720	1,041	6,244	3,881	1.6:1
GRAND TOTAL	4,483	720	1,041	6,244	3,881	1.6:1

STRUCTURAL MEASURES FOR FLOOD PREVENTION AND AGRICULTURAL WATER MANAGEMENT

Channel Improvement in Combination With Floodwater Diversion 3/

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

2/ Derived from installation costs based on 1959 price level and operation and maintenance cost based on long-term price levels as projected by ARS, September 1957.

3/ Interdependent measures.

TABLE 9 - ALLOCATION OF INSTALLATION COSTS
OF STRUCTURAL MEASURES

Ramirez Creek Watershed, Texas
Price Base: 1959

Item	Purpose		Total
	Flood Prevention	Agricultural Water Management	
	(dollars)	(dollars)	(dollars)
<u>STEP A</u>			
Single Purpose			
Channel Improvement (Ramirez Creek)	9,259	-	9,259
Floodwater Diversion	29,247	-	29,247
Channel Improvement (Fronton Channel)	24,660	-	24,660
Concrete Siphons	-	1,777	1,777
Total	63,166	1,777	64,943
<u>STEP B</u>			
Public Law 566	43,916	799	44,715
Other	19,250	978	20,228
Total	63,166	1,777	64,943

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