WATERSHED WORK PLAN AGREEMENT

between the

Comal-Hays-Guadalupe Soil Conservation District
Local Organization

York Creek Improvement District
Local Organization

Local Organization

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 York 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 York 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;

Revised 10/1/56

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 $ 311,179 .)

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 the works of improvement to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Percent Sponsoring Local Organization Will Pay	Percent Service Will Pay	Estimated Construction Cost
1	0	100	197,468
2	0	100	81,952
3	0	100	72,401
4	0	100	49,972
5	0	100	71,069
6	0	100	33,481
7	0	100	41,461
8	0	100	23,212
9	0	100	16,447
10	0	100	59,586
11	0	100	82,061
12	0	100	48,830
13	0	100	65,897
14	0	100	23,811
15	0	100	39,093
16	0	100	40,306
Channel Improvement	0	100	565,877

Revised 10/1/56

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 engineering services applicable to works of improvement for flood prevention, and irrigation, drainage, and other agricultural water management. (Estimated cost $ 275,475 .)

   The Sponsoring Local Organization will bear the cost of all engineering services applicable to works of improvement for all purposes other than flood prevention, and irrigation, drainage, and other agricultural water management. (Estimated cost $ None .)

5. The Sponsoring Local Organization will employ or provide the following engineering and other services in connection with the installation of the works of improvement:

   The Contracting Officer will be Mr. Taylor Thomas, Secretary of the York Creek Improvement District.

   Necessary legal assistance will be furnished by Alwin E. Pape, County Attorney, Guadalupe County.

   Necessary clerical assistance will be furnished by Mrs. Lola Scheffel, secretary of the Guadalupe County Farm Bureau.

   The Sponsoring Local Organization will bear all costs of administering contracts except the cost of engineering services applicable to works of improvement for flood prevention, and irrigation, drainage, and other agricultural water management.

6. The Service will provide the following engineering and other services in connection with the installation of the works of improvement: Necessary engineering services for surveys, site investigations, layout, design, preparation of specifications, supervision of construction and related forms of assistance.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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, the Sponsoring Local Organization and the Contracting 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.

13. 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.

14. 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.

Comal-Hays-Guadulupe Soil Conservation District
Local Organization

By A L Bading

Title Chairman

Date 5/29/57

The signing of this agreement was authorized by a resolution of the governing body of the Comal-Hays-Guadulupe Soil Conservation District
Local Organization

adopted at a meeting held on 5/29/57

Herman Blank
(Secretary, Local Organization)

Date 5/29/57

York Creek Improvement District
Local Organization

By Malcolm Henry Jr

Title President

Date May 29, 1957

The signing of this agreement was authorized by a resolution of the governing body of the York Creek Improvement District
Local Organization

adopted at a meeting held on 5/29/57

Dayle T Rowe
(Secretary, Local Organization)

Date 5/29/57

WATERSHED WORK PLAN

YORK CREEK WATERSHED
Comal, Hays and Guadalupe Counties, Texas

Prepared Under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666 as amended by Public Law 1018, 84th Congress; 70 Stat. 1088)

Prepared by: Comal-Hays-Guadalupe Soil Conservation District
(Cosponsor)

York Creek Improvement District
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service

April 1957

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

List of Tables and Figures

SECTION 1

WATERSHED WORK PLAN

YORK CREEK WATERSHED
Comal, Hays and Guadalupe Counties, Texas
April 1957

SUMMARY OF PLAN

General Summary

The watershed work plan for watershed protection and flood prevention for the York Creek watershed, Texas, was prepared by the Comal-Hays-Guadalupe Soil Conservation District and the York Creek Improvement District as the cosponsoring local organizations. Technical assistance was provided by the United States Department of Agriculture.

The watershed work plan covers an area of approximately 146.6 squsre miles, or 93,824 acres in Comal, Hays and Guadalupe Counties, Texas. Approximately 56 percent of the watershed is cropland, 42 percent is grassland, and 2 percent is in miscellaneous uses, such as stream channels, towns, roads, and railroads.

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 $2,895,678. The local or non-Federal share of this cost will be $903,439. In addition, local interests will bear the entire cost of operation and maintenance, with a capitalized value of $456,123. Of the total project cost of $3,351,801, the non-Federal share will be $1,359,562, and the Federal share $1,992,239.

Agricultural water management in the form of groundwater recharge will be a benefit accruing to two planned structures incidental to the major project purpose, flood prevention.

Land Treatment Measures

The cost for land treatment measures is estimated at $607,260, of which the local share is $582,260. The Federal share, consisting entirely of technical assistance, is $25,000. Costs to be met with Federal funds provided under authorities other than Public Law 566, as amended, are not included in these figures.

Structural Measures

The structural measures included in the plan consist of 16 floodwater

retarding structures having an aggregate capacity of 20,205 acre-feet, and 19.97 miles of channel improvement. The total cost of these measures, including the capitalized value of operation and maintenance, is $2,744,541, of which the local share is $777,302 and the Federal share $1,967,239. The non-Federal share of the total cost of structural measures includes: land, easements and rights-of-way, 40.0 percent; operation and maintenance, 58.7 percent; and administering contracts, 1.3 percent.

Damages and Benefits

The estimated average annual floodwater, sediment and erosion damage without the project is $164,160. The estimated average annual damage with the project, including land treatment and structural measures, is $20,414. The average annual primary benefits accruing to structural measures are $157,694, which are distributed as follows:

Floodwater damage reduction	$101,865
Sediment damage reduction	317
Erosion damage reduction	5,897
Indirect damage reduction	10,808
Benefits from changed use of land	25,346
Benefits from outside project area	5,914
Benefits from water management (ground-water recharge)	7,547

The ratio of the average annual benefits ($157,694) to the average annual cost of structural measures ($96,767) is 1.63 to 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 York Creek Improvement District, which has taxing power, will contract for the construction of the 16 floodwater retarding structures and the 19.97 miles of stream channel improvement listed in the plan. Funds for the local share of the project will be financed by assessment of local taxes.

Operation and Maintenance

Land treatment measures will be installed, operated, and maintained by the landowners or operators of the farms on which the measures are installed under agreements with the Comal-Hays-Guadalupe Soil Conservation District. The 16 floodwater retarding structures and the 19.97 miles of improved channel will be operated and maintained by the York Creek Improvement District, which has legal authority to raise funds.

DESCRIPTION OF WATERSHED

Physical Data

York Creek originates in the southeastern corner of Comal County, approximately 6.5 miles northwest of Hunter, Texas, and flows southeast through Guadalupe County for about 32 miles. It runs into the San Marcos River about one mile west of the town of Prairie Lea, Texas. The largest tributaries are Mesquite, Oyster, Cottonwood and Little Cottonwood Creeks and Long Branch. The watershed has an area of 93,824 acres, nearly all of which is in farms and ranches.

The topography ranges from steeply rolling in the Edwards Plateau, the upper 17 percent of the watershed, to gently rolling in the remainder of the watershed which lies in the Blackland Prairie Land Resource Area. Elevations above mean sea level are 386 feet on the flood plain at the lower end of the watershed, 665 feet in the channel at floodwater retarding structure site 1, and 1,105 feet on the highest point of the watershed divide. The average width of the main alluvial valley ranges from 3,300 feet in the lower one-half of the watershed to 1,400 feet in the upper reaches of the Blackland Prairie area. The valleys in the Edwards Plateau are 50 to 150 feet in width, flanked by steep, rocky slopes or limestone bluffs.

The part of the watershed located in the Edwards Plateau Land Resource Area is characterized by rough, stony and very shallow soils developed from limestone. The predominant land use is range, with less than 3 percent of the area in cultivation. The soils of the Blackland Prairie lie below the Edwards Plateau escarpment and are predominantly deep, dark-colored clays. Slopes range from gentle to moderately steep, with some very steep slopes. Extensive areas of these soils have mantles of egg-shaped gravel ranging from scattered gravel over the surface to a protective cover several inches deep. Normal farming operations are not hampered by the gravel. Over 60 percent of the area is in cultivation. A high percentage of the grassland was formerly in cultivation, some of which was severely eroded before the change in land use was made. The cover on the eroded soils consists mostly of annuals, weeds and low-order native grasses.

The overall land use for the entire watershed is as follows:

Land Use	Acres	Percent
Cultivation	52,190	56
Pasture and range	39,766	42
Miscellaneous 1/	1,868	2
Total	93,824	100

1/ Includes roads, highways, railroads, towns, etc.

The largest storm that occurred in the 30-year period studied was a 6.44-inch rain that extended over two days and produced 4.30 inches of runoff. This runoff flooded the entire 7,745 acres of flood plain. Under present conditions of the watershed, 99 percent of the flood plain would be flooded by the runoff from the maximum storm expected once in 25 years. At the present time, about 61 percent of the flood plain is in cultivation, 21 percent in open pasture, and 16 percent in wooded or brushy pasture.

Average temperatures range from 84 degrees Fahrenheit in the summer to 51 degrees in the winter. The normal frost-free season of 267 days extends from March 7 to November 29.

The mean annual weighted rainfall for the watershed is 33.71 inches. It is well distributed, with the wettest months being April, May, June, September and October. Individual excessive rains causing serious erosion and flood damage may occur in any season, but are most frequent in the spring and fall months. The minimum recorded annual rainfall was 18.94 inches; the maximum was 50.36 inches.

Water for livestock and domestic use is supplied by shallow wells and small farm ponds. In the Blackland Prairie area, a dependable supply is not available. Towns within the watershed obtain their supply from wells but the supply is not always dependable. In the Edwards Plateau area, groundwater levels have dropped steadily in recent years, causing great damage to farm, ranch, and municipal water supplies.

Economic Data

The economy of the watershed is almost entirely agricultural. Below Hunter, cash crop production, chiefly of maize, cotton and corn, predominates. Beef cattle production, along with a few scattered dairy operations, is found throughout this section. The area above Hunter is almost entirely rangeland, used to raise beef cattle, sheep and goats.

The average size farm in the watershed is 200 acres, sufficient for an economical family unit. Owners of smaller tracts, however, have found it necessary to supplement farm income by employment in nearby towns and military installations.

San Antonio, population 507,300, San Marcos, population 12,500, Seguin, population 11,000, and New Braunfels, population 13,500, are within a 35-mile radius of the watershed. These nearby cities provide excellent marketing, educational, cultural, recreational and medical facilities for the people in neighboring communities.

The area is served adequately by 165 miles of roads, of which 62 miles are paved. Adequate rail service is provided by three railroads.

Status of Conservation Work in the Watershed

The York Creek watershed is served by Soil Conservation Service work units at Seguin, San Marcos and New Braunfels, which are assisting the Comal-Hays-Guadalupe Soil Conservation District. These work units have assisted farmers and ranchers in preparing 288 soil and water conservation plans on 57,959 acres (63 percent of the agricultural land) within the watershed and in giving guidance in establishing and maintaining planned measures. Forty-three percent of the needed land treatment measures in the watershed have been applied. Where land treatment measures have been applied and maintained as long as three to five years, average crop yields have increased about one-third.

WATERSHED PROBLEMS

Floodwater Damage

Flooding occurs frequently in the York Creek watershed and causes severe damage (figure 1). Large floods have occurred on an average of more than once a year, the latest one being in September 1952. During the 30-year period studied, 1924 to 1953, there were 42 floods which covered more than half the flood plain as well as 79 smaller floods. Sixteen of the larger and 38 of the smaller floods occurred during the growing season and caused considerable damage to growing crops. It is estimated that the average

Flood of May, 1929, on York Creek at Zorn.
Estimated Floodwater Damage - $215,876

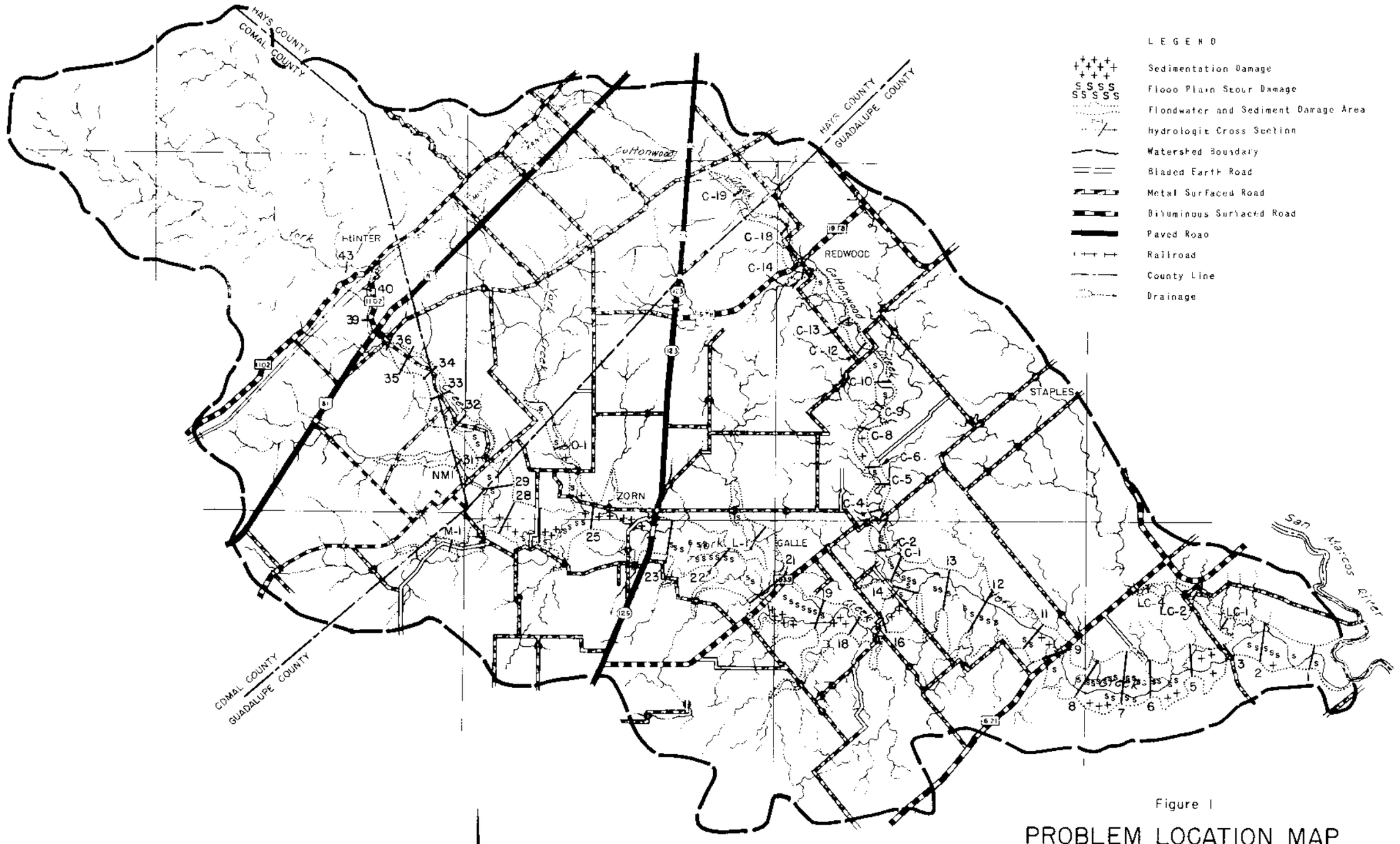


Figure 1

PROBLEM LOCATION MAP
YORK CREEK WATERSHED
IN
GUADALUPE, COMAL, AND HAYS COUNTIES, TEXAS

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

REFERENCE

CARTOGRAPHIC APPROVAL TECHNICAL APPROVAL

COMPILED	TRACED	CHECKED	DATE
	M.D.G.	G.L.B.	5-11-57

4-8-11436

annual direct floodwater damage under existing conditions is $140,393, of which $74,571 is crop and pasture damage, $46,081 is other agricultural damage, and $19,741 is nonagricultural damage, to roads and bridges. In addition, there are numerous indirect damages, such as interruption of travel and initial losses sustained by dealers and industries in the area which are estimated to average $14,924 per year.

Sediment Damage

Sediment damage in this watershed consists of deposition on the York Creek flood plain and the contribution of sediment to the authorized Gonzales Reservoir on the San Marcos River.

Only about 8 percent of the flood plain has been damaged by sediment. Clay and silty clay deposits up to 5 feet deep have affected a total of 601 acres, as follows: 180 acres damaged 10 percent, 255 acres damaged 20 percent, and 166 acres damaged 30 percent, in terms of reduced productivity. These deposits are low in organic matter and are in poor physical condition. Productivity of these areas can be restored through intensive treatment in a short period of time or through natural recovery over a longer period. The amount of these damages is estimated to be $593 annually under present conditions.

Deposition in channels has reduced channel capacities, resulting in more flooding and floodwater damage.

San Marcos River, near Luling, Texas; on silt-laden rise after heavy rains in York Creek watershed.

Of the total sediment produced in the York Creek drainage area under present conditions, it is estimated that 140 acre-feet will be delivered annually to the authorized Gonzales Reservoir, which will impound water to within 10 miles of the mouth of the watershed. This sediment damage to the reservoir is estimated to be $6,195 annually.

Erosion Damage

There are approximately 41,000 acres of land subject to sheet erosion in this watershed. Sheet erosion rates are generally high since most of this area is located within the Blackland Prairie Land Resource Area. Approximately 40 percent of the cropland in the watershed has been given conservation treatment; however, the untreated cropland includes most of the steeper areas in the watershed. Pastures generally are in poor condition, especially on the eroded, formerly cultivated soils. Annuals and poor quality perennial grasses make up much of the cover. Over 98 percent of the sediment delivered to the planned floodwater retarding structures comes from sheet erosion.

Flood plain scour has damaged 1,141 acres (15 percent) of the flood plain. Removal of soil to depths ranging from 6 inches to over 3 feet has caused the following damages: 615 acres, 10 percent; 314 acres, 20 percent; 131 acres, 40 percent; 60 acres, 60 percent; and 21 acres, 80 percent, in terms of reduced productivity. The annual amount of this damage is estimated to be $8,250 under present conditions.

The total area affected by bank erosion in the watershed is small. Most of the erosion occurs in the middle reaches of the mainstem, with lesser amounts occurring on the smaller tributaries. Less than 2 percent of the sediment produced above planned floodwater retarding structures is from channel erosion. Three percent of the estimated annual sediment yield at the mouth of the watershed is from this source.

Problems Relating to Methods Now Used in the Conservation, Development, Utilization and Disposal of Water

There is very little activity relative to drainage or irrigation in the watershed. No individual landowner or groups of landowners have indicated an interest in providing additional storage in any of the floodwater retarding structures for irrigation purposes. None of the towns in the watershed indicated an interest in providing additional storage capacity in any of the floodwater retarding structures.

EXISTING OR PROPOSED WORKS OF IMPROVEMENT

Only minor efforts have been made to prevent or control floods in the York Creek watershed. Some attempts at enlargement and straightening of stream channels have been made on an individual basis, with very little effect on the reduction of flood damages. The Comal-Hays-Guadalupe Soil Conservation District, York Creek Improvement District, and the

Guadalupe-Blanco River Authority have been very active in establishing land treatment measures in the watershed.

In the development of the water resources of the Guadalupe River Basin, the Guadalupe-Blanco River Authority, in cooperation with the U. S. Department of the Army,Corps of Engineers, has proposed several reservoirs within the basin. The Gonzales Reservoir located on the San Marcos River below the mouth of York Creek has been authorized and damages to it by deposition of sediment originating from York Creek drainage area have been calculated under present and future conditions.

It is estimated that 140 acre-feet of sediment from York Creek are delivered annually to the site of the authorized Gonzales Reservoir. The combined land treatment measures and floodwater retarding structures are expected to reduce this amount by 63 percent.

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 Comal-Hays-Guadalupe 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 accelerating the establishment of those land treatment practices which have a measurable effect on the reduction of floodwater and sediment damages.

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, exclusive of expected reimbursement from ACPS or other Federal funds, is $607,260.

Most of the land treatment measures will function to decrease erosion damage and sediment production from fields and pastures by providing improved soil-cover conditions. These measures include cover cropping, use of rotation hay and pasture and crop residue utilization for croplands of the watershed, and pasture and range seeding to establish good cover for grasslands. They also include: brush eradication, to allow grass stands to improve for replacement of the poor soil cover afforded by brushy pastures; the construction of farm ponds, to provide adequate numbers and locations of watering places to prevent cover-destroying, seasonal concentrations of livestock; and proper use of range and pasture, to provide improvement, protection and good maintenance of grass stands. These measures, especially the cropland measures and pasture and range seeding, also effectively improve soil conditions which allow larger amounts of rainfall to soak into the soil at more rapid rates.

TABLE 1 - ESTIMATED INSTALLATION COSTS [1/]

York Creek Watershed, Texas
Price Base: 1956

Items	Unit	No. to be Applied	Total Project Estimated Cost Federal (dollars)	Non-Federal (dollars)	Total (dollars)
LAND TREATMENT PRIMARILY FOR					
I. Watershed Protection					
Soil Conservation Service					
Contour Farming	Acre	18,685	-	9,342	9,342
Cover Cropping	Acre	17,235	-	155,115	155,115
Crop Residue Utilization	Acre	9,825	-	13,878	13,878
Land Clearing	Acre	32	-	800	800
Rotation Hay and Pasture	Acre	3,019	-	27,171	27,171
Brush Control	Acre	8,913	-	69,076	69,076
Deferred Grazing	Acre	19,764	-	44,469	44,469
Pasture Planting	Acre	7,151	-	85,812	85,812
Proper Use	Acre	25,788	-	59,312	59,312
Range Seeding	Acre	1,007	-	9,264	9,264
Rotation Grazing	Acre	3,651	-	3,651	3,651
Diversion Construction	Mile	22.7	-	2,270	2,270
Pond Construction	No.	107	-	24,610	24,610
Terracing	Mile	1,041	-	62,460	62,460
Waterway Development	Acre	501	-	15,030	15,030
Technical Assistance (accel.)	-	-	25,000	-	25,000
TOTAL LAND TREATMENT			25,000	582,260	607,260
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	16	947,047	-	947,047
Channel Improvement	Mile	19.97	565,877	-	565,877
TOTAL CONSTRUCTION COSTS			1,512,924	-	1,512,924
INSTALLATION SERVICES					
Soil Conservation Service					
Engineering Services			275,475	-	275,475
Other			178,840	-	178,840
TOTAL INSTALLATION SERVICES			454,315	-	454,315
OTHER COSTS					
Land, Easements & R/W			-	311,179	311,179
Administering Contracts			-	10,000	10,000
TOTAL OTHER COSTS			-	321,179	321,179
TOTAL INSTALLATION - STRUCTURES			1,967,239	321,179	2,288,418
TOTAL INSTALLATION COST			1,992,239	903,439	2,895,678
SUMMARY					
TOTAL SCS			1,992,239	903,439	2,895,678
TOTAL			1,992,239	903,439	2,895,678

1/ No Federal lands are involved.

Terrace System and Vegetated Waterway.
A good means of conserving soil and water.

Clover used for winter cover crop being grazed in the spring.

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

Structural Measures for Flood Prevention

A system of 16 floodwater retarding structures and 19.97 miles of channel improvement will be installed in the York Creek watershed to afford the needed protection to flood plain lands that cannot be provided by land treatment measures alone. Figure 2 shows a section of a typical floodwater retarding structure. The structures will detain temporarily the total runoff from 48 percent of the watershed from a storm that can be expected to occur no more often than once in 25 years. The channel improvement will prevent flooding from storms that can be expected to occur no more often than once in three years.

Floodwster retarding structures release water slowly following heavy rains.

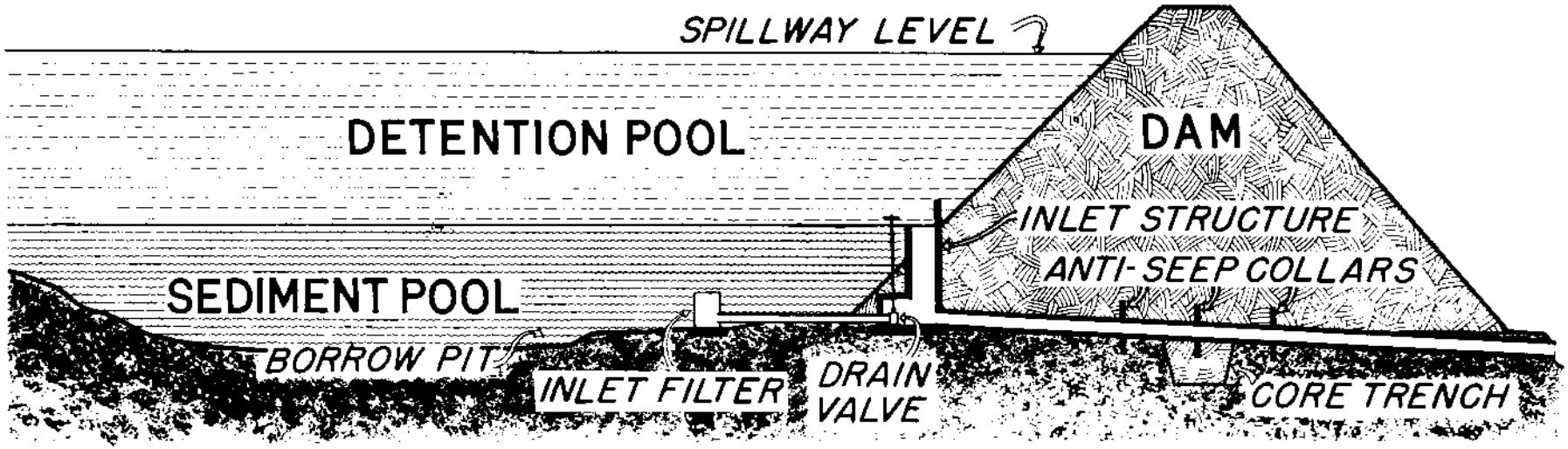


Figure 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

Sites for the floodwater retarding structures will be provided by local interests at no cost to the Federal Government. The value of these sites is estimated to be $165,479, based on current market values as furnished by real estate dealers and other local people. However, the value of production losses in structure and pool areas, capitalized for 50 years, is estimated to be $294,329, so this larger value has been used as the value of the land for these structures. Only 73 acres of flood plain will lie within the sediment pools and 74 additional acres within the detention pools of the structures. The value of additional land required for channel improvement is estimated to be $16,850.

The locations of the floodwater retarding structures and channel improvement are shown on the Planned Structural Measures Map, figure 3. The total estimated cost of establishing these works of improvement (table 1) is $2,288,418, of which $321,179 will be borne by non-Federal interests, and $1,967,239 by the Federal Government.

BENEFITS FROM WORKS OF IMPROVEMENT

The combined program of land treatment and structural measures described above would prevent flood damage from 31 of the total of 121 floods, such as occurred in this watershed from 1924 to 1953, inclusive. Of the 42 major floods, 36 would be reduced to minor floods. Average annual flooding throughout the watershed would be reduced from 13,240 acres to about 2,530.

The estimated average annual flood, erosion and sediment damage within the watershed would be reduced from $164,160 to $20,414, an 88 percent reduction. About 83 percent of the expected reduction in the average annual damage would result from the system of floodwater retarding structures and the channel improvement. With the project installed, the mainstem flood plain above cross section 28 (see figure 1) and the tributary flood plains below floodwater retarding structures will be essentially flood-free for all storms up to the size that can be expected to occur no more frequently than once in 7 years. The mainstem flood plain below cross section 28 will experience some flooding from storms bigger than the 3-year-frequency storm.

Owners and operators of flood plain lands say that, if adequate flood protection is provided, they will restore some of the land now in pasture to the production of high value crops such as cotton, corn and maize. This pastureland was in cultivation at one time, but reverted to pasture because of the flood hazard. It is estimated that increased net income from such restoration will amount to $25,346 (long-term prices) annually.

Benefits of $3,959 annually will accrue to the planned structural measures in the York Creek watershed from reduction of damages on the mainstem of the San Marcos River below the mouth of York Creek. Benefits in the amount of $1,955 annually will be derived from the reduction of sediment

damage to the authorized Gonzales Reservoir. Additional incidental benefits from agricultural water management (groundwater recharge) accruing to floodwater retarding structures No. 1 and No. 2 will amount to $7,547 annually. The total flood prevention benefits, including reduction in flood damages, benefits from restoration of use of flood plain lands, and incidental benefits from agricultural water management, are estimated to be $157,694 annually.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measures (converted from total installation cost, plus operation and maintenance) is estimated to be $96,767. When the project is completely installed, it is expected to produce average annual benefits of $157,694. The project, therefore, will produce benefits of $1.63 for each dollar of cost. There are other substantial values which will accrue from the project, such as increased opportunity for recreation, improved wildlife conditions, better living conditions and a sense of security which have not been used for project justification.

ACCOMPLISHING THE PLAN

Federal assistance for carrying out the works of improvement, 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 by Public Law 1018, 84th Congress; 70 Stat. 1088).

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

Land Treatment Measures

Land treatment measures (table 1) will be established by farmers and ranchers in cooperation with the Comal-Hays-Guadalupe Soil Conservation District. The cost of applying these measures is exclusive of expected reimbursement from the Agricultural Conservation Program or other Federal programs, based on current program criteria, and will be borne by the owners and operators of the land. The soil conservation district, with the help of the Soil Conservation Service, is giving assistance in the planning and application of these measures under its going program. This assistance will be accelerated to assure application of the planned measures within the 5-year installation period of the project.

The governing body of the Comal-Hays-Guadalupe Soil Conservation District, with assistance from the York Creek Improvement District,

will arrange for meetings according to a definite schedule. By this means and by individual contacts they will encourage landowners and operators within the watershed 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 the existing arrangements for equipment usage in the district.

The Soil Conservation Service will assign additional technicians and aids to the Comal-Hays-Guadalupe Soil Conservation District to assist landowners and operators cooperating with the district in accelerating the preparation and application of soil, plant and water conservation plans.

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

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.

Structural Measures for Flood Prevention and Sediment Reduction

The York Creek Improvement District, which has taxing power, will let and service all contracts for the construction of all floodwater retarding structures and channel improvement listed in the plan. Funds for the local share of project costs, including land, easements, rights-of-way and administering contracts, will be raised through a bond issue financed by local taxes. The district will furnish all land, easements and rights-of-way for all structural measures at no cost to the Federal Government. Land or easements for the sites for the structures and the pools created by them, and for the channel improvement work will be obtained as far as possible by private donation. In those instances where such donations would create excessive hardship, easements will be purchased. Construction of the structural measures will be started as soon as the local organization is equipped to handle its responsibilities, Federal funds are available, the necessary easements are obtained and maintenance agreements are executed. Floodwater retarding structures and the planned channel improvement will be scheduled for construction so as to complete the project within a 5-year period.

The following is a grouping of structures for construction purposes, each of which has a favorable benefit-cost ratio, based on those benefits obtained within the boundary of each construction unit:

Construction Unit No. 1 - Sites 13, 14 and 15
Construction Unit No. 2 - Sites 1, 2, 3, 4, 5, 6, 7 and 8

All necessary land, easements, and rights-of-way will be obtained for each construction unit before Federal financial assistance is made available for installation of any part of that construction unit.

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

The cooperating parties have agreed on a schedule for the 5-year installation period calling for installation of the structures in Construction Unit 1 first, then structures 1 through 5 in Construction Unit 2, and the remaining structures and channel improvement last. Construction on sites 6, 8 and 9 will be delayed until 80 percent of the needed land treatment measures have been applied on their respective drainage areas due to unusually high sediment production rates. 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. It will be necessary to construct all floodwater retarding structures included in the plan before starting work on channel improvement.

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

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by the landowners or operators of the farms and ranches on which the measures are installed, under agreements with the Comal-Hays-Guadalupe Soil Conservation District. Representatives of the Soil Conservation District will make periodic inspections of the land treatment measures to determine maintenance needs and encourage landowners and operators to perform maintenance. They will make district-owned equipment available for this purpose.

Structural Measures for Flood Prevention and Sediment Reduction

The 16 floodwater retarding structures and the 19.97 miles of channel improvement will be operated and maintained by the York Creek Improvement District, which has legal authority to raise funds, under a maintenance agreement with the Comal-Hays-Guadalupe Soil Conservation District.

All floodwater retarding structures will be inspected by representatives of the cosponsoring organizations and the Soil Conservation Service at least annually and after each heavy rain or streamflow. Items of

inspection will include, but not be limited to, the conditions of the principal spillway and its appurtenances, the emergency spillway, the earth fill, the vegetative cover of the earth fill and emergency spillway, and fences and gates installed as a part of the floodwater retarding structures. The improved channel will be inspected at least annually by representatives of the cosponsoring organizations and the Soil Conservation Service to determine the need for control of vegetation to prevent the reduction of channel capacity and accumulation of sediment. The cosponsoring local organizations will maintain records of all maintenance inspections.

The estimated annual operation and maintenance cost is $16,082, based on long-term price levels. The necessary maintenance work will be accomplished through the use of contributed labor and equipment, by contract, or by force account or a combination of these methods. Funds for accomplishing the maintenance work will be obtained from revenue derived through assessments on the benefited lands in the York Creek Improvement District.

Provisions will be made for free access of representatives of the cosponsoring organizations and the Federal Government to inspect the 16 floodwater retarding structures and their appurtenances and channel improvements at any time.

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

COST-SHARING

The Federal Government expects to provide technical assistance in the amount of $25,000 during the 5-year installation period to accelerate the installation of land treatment measures included in the plan for reduction of erosion and peak rates of runoff. Private interests will install these measures at an estimated cost of $582,260 (table 1).

The required non-Federal costs for structural measures, consisting of the value of land, easements and rights-of-way, ($311,179), the capitalized value of operation and maintenance of works of improvement ($456,123), and the cost of administering contracts ($10,000), are estimated at $777,302.

The entire cost of constructing the structural measures, amounting to $1,512,924, will be borne by the Federal Government. In addition, the installation services cost of $454,315 will be a Federal expense. This is a total Federal structure installation cost of $1,967,239.

The total project cost of $3,351,801, including operation and maintenance, will be shared 59.4 percent ($1,992,239) by the Federal Government and 40.6 percent ($1,359,562) by non-Federal interests.

CONFORMANCE OF PLAN TO FEDERAL LAWS AND REGULATIONS

The installation of the proposed watershed protection and flood prevention project on the York Creek watershed and the expansion of this program to the San Marcos River would give added protection to flood plain lands along this stream and greatly reduce the sediment load carried by it. The planned works of improvement will constitute a needed and harmonious element in the comprehensive development of the Guadalupe Basin under the program of the Guadalupe-Blanco River Authority. They provide additional upstream developments to supplement and protect downstream flood plains and works and thereby enhance the values that will be derived from them.

This project plan conforms to all Federal laws and regulations, and will have no known detrimental effect on any downstream projects that might be constructed in the future.

SECTION 2

INVESTIGATIONS, ANALYSES AND SUPPORTING TABLES

INVESTIGATIONS AND ANALYSES

Land Treatment

Soil Conditions

The soils in York Creek watershed are generally in fair condition. The treated cropland has a reasonably good agronomic rotation consisting of sweetclover (usually overseeded in small grains) and winter legume cover crops planted with row crops. Less than one-half of the cropland has not had the full land treatment installed. This area includes small areas of severely eroded soils that are in very poor condition. Pastures in the Blackland Prairie are generally in poor condition. Formerly cultivated and severely eroded areas make up a high percentage of the pasture. Natural recovery of desirable native grasses has been slow.

Cover Conditions and Range Sites

The rangeland in the watershed is 4 percent in good range condition, 29 percent in fair range condition, and 67 percent in poor range condition. There are four range sites in the watershed: Steep Rocky Slope site, Fine Textured Upland site, Deep Soil site, and the Deep Upland site. These are described as follows:

The Steep Rocky Slope site occupies steep to very steep slopes with soils ranging from bare rock to rather deep pockets. A large variety of native plants are found. Big bluestem, Indiangrass and other tall grasses are found in the deep pockets; sideoats grama, little bluestem and other midgrasses occupy most of the area; and annual weeds and grasses are found on the very shallow areas. Invaders, such as cedar and Texas grama, often dominate this site.

The Fine Textured Upland site is made up of clay soils which are usually between 10 and 20 inches in depth and occupy gentle to rolling slopes. The native vegetation consists primarily of midgrasses, such as little bluestem, sideoats grama and green sprangletop. Cedar and oak have invaded and often dominate this site. Other invaders include threeawn, Texas grama, and red grama.

The Deep Soil site is composed of soils which are over 20 inches deep and are located on gentle slopes. The better grasses found on this site are big bluestem, Indiangrass and little bluestem. Invaders, such as oak, cedar and annual weeds and grasses currently occupy much of this site.

The Deep Upland site is found on flat or gently sloping areas with deep, fine-textured, dark clay soils. Original climax vegetation consists of little bluestem, big bluestem, switchgrass, Indiangrass and wildrye. Where original vegetation has been reduced in stand and vigor, plants such as Texas wintergrass, Texas cupgrass, silver bluestem and curly mesquite have increased. Where the range has been severely misused, invading plants such as mesquite, tasajillo, prickly pear and lotebush are present in large numbers.

The range condition of these areas is shown on the following table:

Condition Class	Range Site and Condition Class: Acres	Percent For Site
STEEP ROCKY SLOPE SITE		
Good	0	0
Fair	1,510	41
Poor	2,172	59
Total	3,682	100
FINE TEXTURED UPLAND SITE		
Good	0	0
Fair	2,433	26
Poor	6,926	74
Total	9,359	100
DEEP SOIL SITE		
Good	0	0
Fair	0	0
Poor	2,302	100
Total	2,302	100
DEEP UPLAND SITE		
Good	1,710	7
Fair	7,571	31
Poor	15,142	62
Total	24,423	100
ALL SITES		
Good	1,710	4
Fair	11,514	29
Poor	26,542	67
Total	39,766	100

Land Use and Treatment Needs

The land use on the upland was obtained by using a random sample composed of 25 percent of the Edwards Plateau and 20 percent of the Blackland Prairie. These sample areas were expanded to the total upland acreage. The land use of the flood plain was planimetered from the flood plain strip map that was developed during the economic investigation.

The current conservation needs of the Comal-Hays-Guadalupe Soil Conservation District were used as the basis for arriving at the land treatment needs for the watershed.

Program Determination

Determination was made, first, of the needed land treatment measures which contribute directly to flood prevention remaining to be done in the watershed, based on range condition classes and land capability classes developed from soil surveys. The hydraulic, hydrologic, sedimentation and economic investigations provided data on the effects of these measures as related to sediment and flood damages resulting from such treatment. Although significant benefits would result from application of these needed land treatment measures, it was apparent that other sediment and flood prevention measures would be required to attain the degree of watershed protection and sediment and flood reduction desired.

Determination was then made of structural measures for sediment reduction and flood prevention which would be feasible to install. The study made and the procedures used in that determination were as follows:

1. A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads and railroads, and other pertinent information. A stereoscopic study of 4-inch consecutive aerial photographs located all probable floodwater retarding structures, the limits and the area of the flood plain, and points where valley cross sections should be taken for the determination of hydraulic characteristics and for flood-routing purposes. 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. Data developed from these cross sections permitted the computation of stage-area inundated-damage relationships for various flood flows. A map was prepared of the flood plain on which land use, cross section locations, and other pertinent information were recorded.

2. A field examination was made of all probable floodwater retarding structure sites previously located stereoscopically. Sites which did not show good storage possibilities or which would inundate highways or improvements were dropped from further consideration. From the remaining sites a system of floodwater retarding structures was selected for further consideration and detailed survey. Plans of a floodwater retarding structure, typical of those planned for this watershed, are illustrated by figures 4 and 4A.

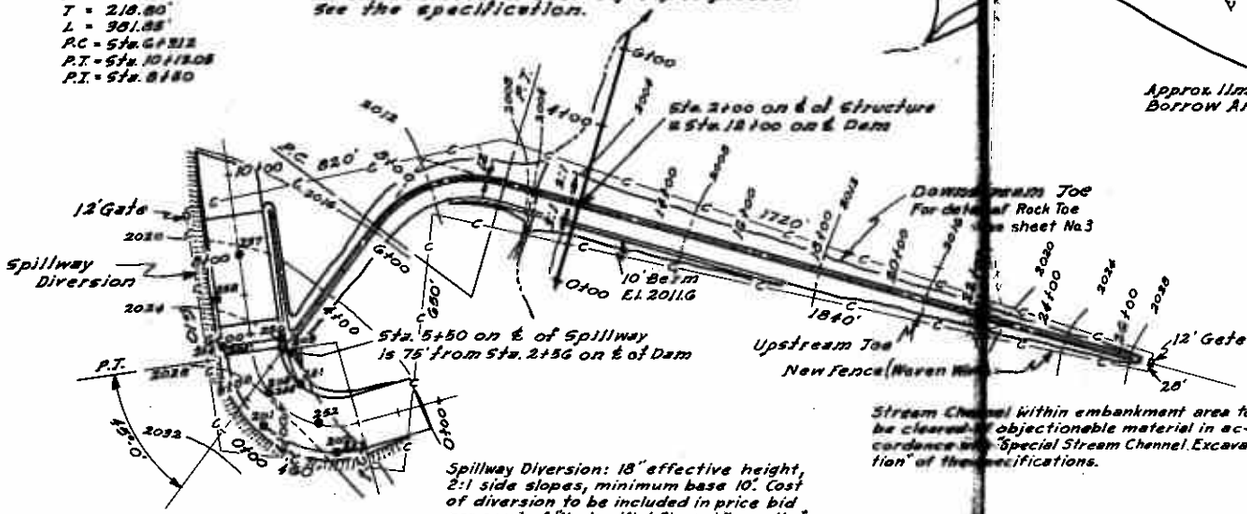
Clay
Silt
Limestone
Flagstone & Cobbles
Lime

C.	Clay	Clayey	Cal.	Calcareous
Sl.	Silt	Silty	Vug.	Vuguler
Ch.	Chalk	Chalky	Fc.	Fractured
S.	Sandy	Sandy	Fri.	Friable
Gr.	Gravel	Gravelly	Fi.	Firm
M.	Marl	Marly	V/	Very
Ls.	Limestone		So.	Soft
Flg.	Flagstone		H.	Hard
Mas.	Massive		Cob	Cobbles
Mat	Matrix			

LEGEND OF BORINGS

EMBANKMENT CURVE DATA
Δ = 69°-0'
D = 18°-04.8'
R = 318.36'
T = 218.80'
L = 381.85'
P.C. = Sta. 6+32
P.T. = Sta. 10+13.85
P.I. = Sta. 8+80

A minimum of 6" of topsoil to be placed in spillway and on all embankment, dike, spillway slopes and waste area except where rock is encountered or rock rip rap is placed. See the specification.



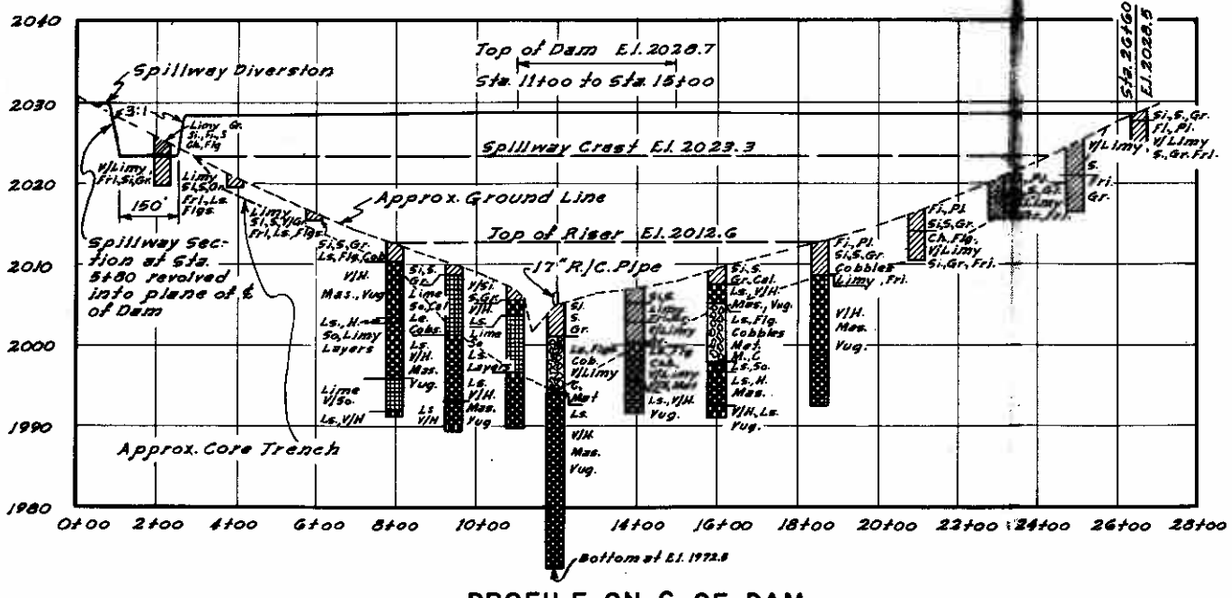
Spillway Diversion: 18" effective height, 2:1 side slopes, minimum base 10'. Cost of diversion to be included in price bid per cu. yd. of "Unclassified Channel Excavation".

Stream Channel within embankment area to be cleared of objectionable material in accordance with "Special Stream Channel Excavation" of the specifications.

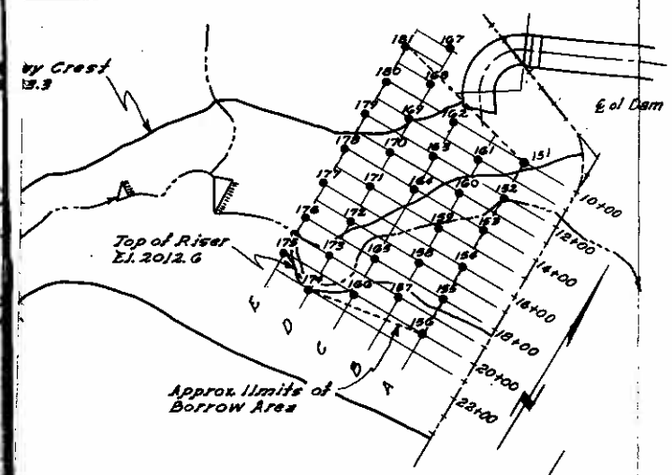
SPILLWAY CURVE DATA
Δ = 98°-0'
D = 28°-0'
R = 206.68'
L = 350.0'
P.C. = Sta. 2+00
P.T. = Sta. 5+50

PLAN OF EMBANKMENT AND SPILLWAY

0 200 400 1000
SCALE IN FEET

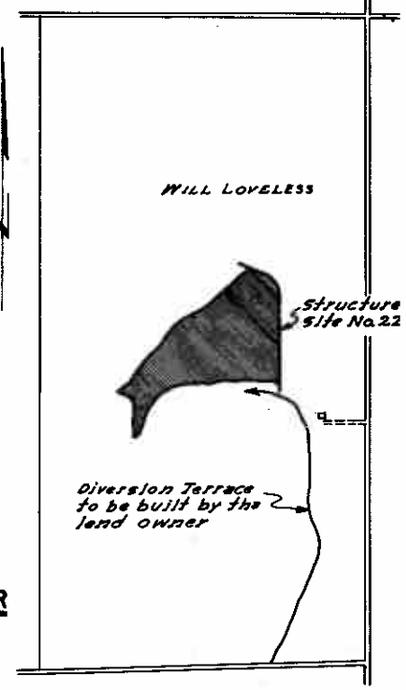


PROFILE ON ℄ OF DAM



GENERAL PLAN OF RESERVOIR

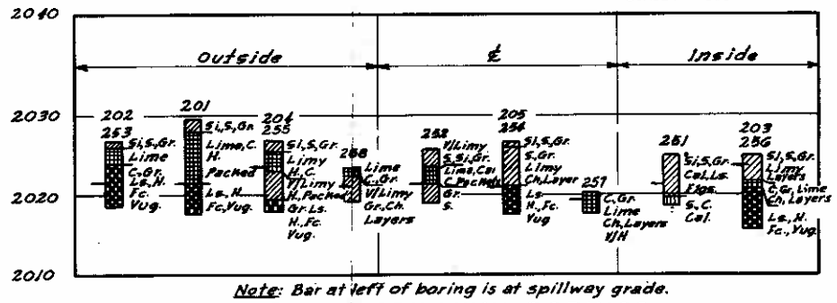
0 400 800 1600
SCALE IN FEET



Located 5½ mi. East and 4 mi. South of Eden, Concho County, Texas

VICINITY MAP

0 ½ 1
SCALE IN MILES



Note: Bar at left of boring is at spillway grade.

LOG OF SPILLWAY BORINGS

SEE PLAN OF EMBANKMENT AND SPILLWAY

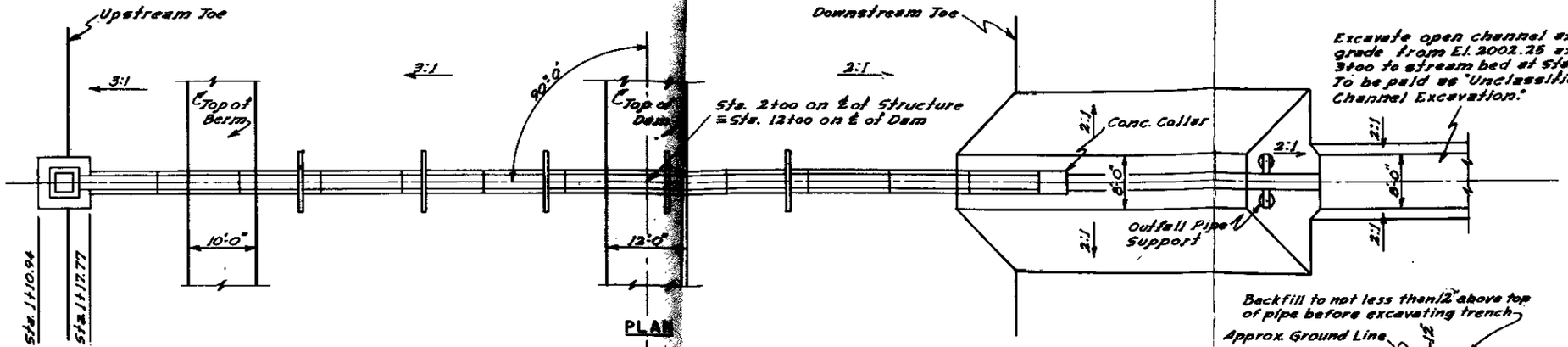
Elevation	Surface Acres	Storage Acre Ft.	Storage Inches
2012.6	16.84	87.70	0.80
2016.0	30.76	132.66	1.28
2020.0	54.21	302.60	2.92
2023.3	74.94	515.68	5.00
2024.0	79.33	569.68	5.50
2028.0	108.17	944.68	9.13

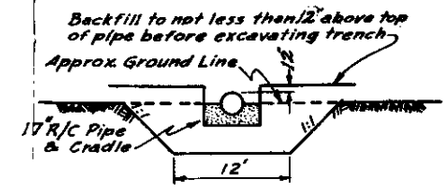
Top of Dam (Effective) Elev.	2028.5
Spillway Crest Elev.	2029.3
Top of Riser Elev.	2012.6
Sediment Pool Elev.	2012.6
Drainage Area, Acres	1242.0
Sediment Storage, Ac. Ft.	51.7
Floodwater Storage, Ac. Ft.	664.0

Figure 4
TYPICAL
FLOODWATER RETARDING STRUCTURE
PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

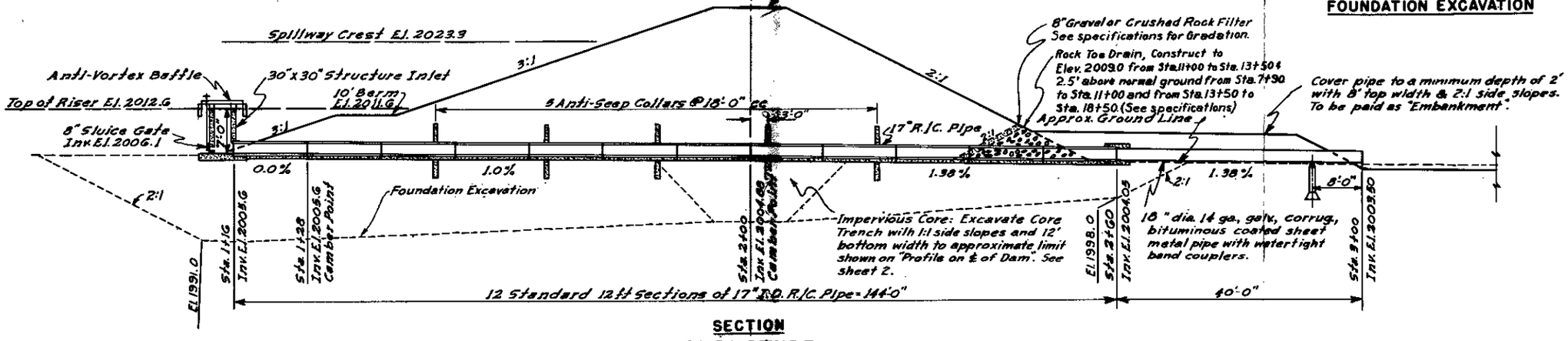
Designed	H.C.N.	Date 8-56	Approved by W. M. ...
Drawn	H.C.N. & G.R.	8-56	PMP
Traced	G.R.	8-56	
Checked	H.C.N. & H.H.L.	8/56	Drawing No. 4-E-10,760





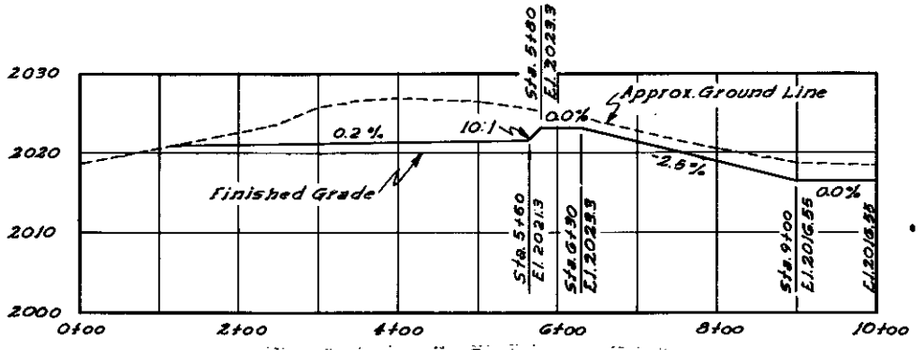
Excavation to be paid as Core Trench Excavation and backfill prior to excavating pipe trench to be paid as "Embankment."

FOUNDATION EXCAVATION

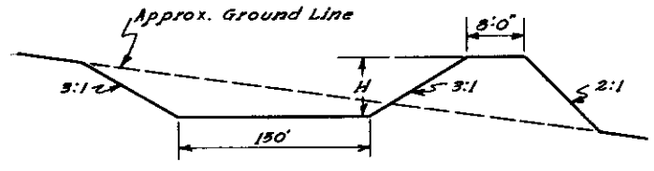


SECTION

STRUCTURE



PROFILE ON ℄ OF SPILLWAY



Top of Dike, El. 2028.55 from Sta. 5+00 to Sta. 6+30 12 ft. top width with 10:1 end slope. Transition from El. 2028.55 at Sta. 6+30 to 4 ft. height at Sta. 7+00, top width 8 ft. H = 4 ft. from Sta. 7+00 to Sta. 9+00, top width 8 ft. with 10:1 end slope.

TYPICAL SPILLWAY SECTION

Figure 4A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed H.C.N.	Date 8-56	Approved by A.M.	
Drawn H.C.N. & G.R.	8-56		
Traced G.R.	8-56		
Checked H.C.N. & H.H.L.	9/56	Sheet No. 3 of 4 Sheets	4-E-10,760

3. A topographic map was made of the pool area of each of the proposed sites in order to determine the storage capacity of the site, the estimated cost of the dam and the areas of flood plain and upland that would be inundated by the sediment and flood pools. The height of the dams and the size of the pools were determined by the storage volume needed to temporarily detain a minimum of 3.4 inches of runoff in the Edwards Plateau Land Resource Area and 4.0 inches in the Blackland and to provide the additional storage needed for sediment. The topographic features are such that costs will be essentially the same with minor variations in storage. The limits of the flood pools and sediment pools of all satisfactory sites and the flood plain of the stream were drawn to scale on a copy of the base map. Structure data tables were developed to show, for each structure, the drainage area, the storage capacity needed for floodwater detention and sediment, storage in acre-feet and in inches of runoff from the drainage areas, the release rate of the principal spillway, the acres inundated by the sediment and detention pools, the volume of fill in the dams, and the estimated cost of the structures (tables 2 and 3).

4. Damages resulting from floodwater, sediment, erosion and lowering the ground-water table were determined from damage schedules and surveys of sample areas. Reductions in these damages resulting from the proposed works of improvements were estimated on the basis of reduction of area inundated and depth of inundation by various run-off depths, in inches, as determined by flood routings. These flood routings were made for conditions without the project and for future conditions, assuming that the proposed works of improvement had been installed. Benefits so determined were allocated to individual measures or groups of interrelated measures on the basis of the effect of each on reduction of damages. In this manner it was determined that floodwater retarding structures and channel improvement could be economically justified. By further analysis those individual floodwater retarding structures and interrelated structures which had favorable benefit-cost ratios were determined. Those which were unfavorable were dropped from further consideration and, where replacements were found to be necessary to effect needed control, alternate sites were investigated until a system of floodwater retarding structures and channel improvement was developed which would give maximum net benefits. These works were included in the plan.

When the structural measures for flood prevention had been determined, a table was developed to show the total cost of each type of measure. The summation of the total costs for all the structures 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 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 meterologic and hydrologic data were tabulated and analyzed.

2. Engineering surveys were made to collect information on selected stream reaches, including valley cross sections, channel capacities, and other hydraulic characteristics, and on proposed structure sites to collect data used in design.

3. Determination was made of the hydrologic conditions of the watershed, taking into consideration such factors as soils, land use, topography, climate and cover.

4. Determination was made of the rainfall-runoff relationship. This was then compared to nearby actual gaged runoff.

5. The frequency of meteorologic events was determined by computing the plotting positions of historical series taken from climatological papers and water supply bulletins, and plotting rainfall, runoff and peak discharges against their respective plotting positions on Hazen probability paper.

6. The relationship of precipitation to runoff, flood stage and area inundated was determined.

7. Determination was made of peak discharges under present conditions, as related to area inundated and damages.

8. Determination was made of peak discharges and area inundated and damages under conditions which would exist due to:

   a. Effect of land treatment measures.

   b. Effect of land treatment measures and floodwater retarding structures.

   c. Effect of land treatment measures, floodwater retarding structures, and channel improvement.

   d. Consideration of alternative programs and measures.

9. Inflow hydrographs were developed for all structure sites.

From a graph showing cumulative departures from normal precipitation the rainfall for the period 1924 to 1953, inclusive, was aelected as most representative of normal rainfall for this watershed.

The largest rain which occurred during the 30-year period was s storm of 6.44 inches. An average rain of this magnitude, under Moisture Condition

No. II, would produce 4.30 inches of runoff. Under present conditions, 7,745 acres of flood plain would be flooded by runoff from this storm. If such a rain were to occur after land treatment practices and measures had been applied, it is estimated that the area inundated would be reduced to 7,545 acres. With land treatment measures applied and the structural measures for flood prevention in operation, only 4,683 acres would be flooded.

The runoff from the 25-year-frequency storm was used to establish the minimum detention storage requirements. A runoff of 3.40 inches in the Edwards Plateau Land Resource Area and 4.00 inches in the Blackland Prairie Land Resource Area were established from analysis of the conditions existing in the watershed as the minimum detention storage requirements in the floodwater retarding structures. Inflow hydrographs for structure design were developed, using the runoff as determined from the Moisture Condition No. II Curve for each site. This amount of runoff would be produced by a 15.50-inch point rain in a period of six hours. The size of the emergency spillway and the depth of flow were calculated for each structure. It was found that a rain of 3.20 inches, Moisture Condition No. 0; 1.60 inches, Moisture Condition No. I; 0.81 inch, Moisture Condition No. II; and 0.31 inch, Moisture Condition No. III, would produce an average of 0.05 inch of runoff. This is the minimum that would cause flooding to a depth of six inches at the smallest channel cross section; therefore, no rains producing less than this amount of runoff were considered for flood-routing purposes. A runoff of 0.05-inch would produce a discharge of 350 cubic feet per second at the minimum cross section (No. 25) and 730 cubic feet per second at the reference cross section (No. 2). The minimum cross section is located about 0.9 mile west of the point where State Highway No. 123 crosses York Creek. The reference cross section is located about 1.75 miles northwest of the confluence of York Creek and the San Marcos River (figure No. 1).

The channel capacity at the reference section is 2,160 cubic feet per second. The peak discharge at this point for a 6.44-inch rain under present conditions is estimated to be 63,640 cubic feet per second. After installation and full functioning of all the planned measures on the York Creek watershed, the discharge at the same point would be reduced to 28,320 cubic feet per second.

Sedimentation Investigations

The field surveys of the sedimentation problems in the watershed were 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 to locate areas of damaging overbank deposits and damaging scour on the flood plain and to determine extent of streambank erosion were made at many points along the length of the channels. Because of the close proximity of this watershed above the authorized Gonzales Reservoir, a prediction of the annual sediment yield from the watershed under both present and future conditions was made. Data from detailed erosion studies made on watersheds above 8

planned floodwater retarding structure sites were expanded, on a weighted basis, to the total watershed area to compute total annual gross erosion. Existing delivery rate curves were used in estimating sediment yield to mouth of watershed. Since the authorized Gonzales Reservoir dam will impound water to within 10 miles of the mouth of York Creek, it was estimated that 90 percent of the sediment would be delivered to the reservoir. Consideration was given to the increased volume this sediment would occupy in the reservoir. In preparation of the work plan, tabular summaries of all the above findings, with explanatory text, were prepared and were used by the economist as a basis for calculating monetary damages.

Estimates of sediment storage requirements in the planned floodwater retarding structures were based on detailed sedimentation surveys of representative floodwater retarding structures in the watershed. These rates were then applied to the other sites and adjusted for drainage area size. Individual detailed studies were made on all sites where apparent sediment rates were excessively high. The use of aerial photographs and interviews with local people also furnished important information to the survey. Estimates of rates of sediment production were made for the areas above and below structures to estimate the present and future sediment yield at the mouth of the watershed.

Based on these studies, the total annual sediment yields above the planned floodwater retarding structures were estimated to be 116 acre-feet from sheet and gully erosion and 1.4 acre-feet from channel enlargement. The estimated average annual production of sediment above structures is 1.66 acre-feet per square mile. The principal source of sediment is sheet erosion from untreated cropland. Sites 6, 8, and 9 were found to have excessive sediment rates. It is recommended that these not be constructed until at least 80 percent of the land treatment measures needed above each of them have been installed.

Effect of Waterahed Treatment on Sediment Yields

Cultivated land produces most of the sediment in the watershed but poor pasture is an important contributor in the Blackland Prairie areas. Application of needed land treatment and pasture improvement measures will reduce the annual rate of sediment production by an estimated 58 percent. Areas damaged by flood plain scour will be rendered productive again after they have been protected from flooding and needed land treatment measures have been put into effect. Future rates of damage caused by these erosive processes will be greatly reduced.

Geologic Investigations

The proposed sites in the Edwards Plateau area present difficult problems in rock excavation and availability of borrow materials. Investigations with a power auger and hand auger indicate that suitable material to furnish 40 to 70 percent of the fill material required in the dams is available, at distances of one-fourth to three-fourths of a mile below these sites. The remaining fill can be designed to include thick blankets of rock. From 50 to 70 percent of the total spillway cuts will require excavation of hard rock.

The foundations will be on hard limestone which is jointed and contains numerous small cavities. The cutoff trenches should be excavated three to four feet into this limestone to prevent excessive leakage underneath the dams. The dam sites are located more than 200 yards from the major faults which occur in this area. These sites are justifiable because of their importance in floodwater reduction and because they will have large incidental effects on ground-water recharge into the Edwards underground reservoir.

The proposed sites in the Coastal Plains area will be in deep clays and will not present any significant problems in construction. However, careful mixing of fill materials will be required to prevent piping and deep cracks from developing in the clay fill materials.

Reconnaissance dam site investigations were made on the two sites in the Edwards Plateau and on seven sites in the Coastal Plains area.

Ground-water Recharge into the Edwards Underground Reservoir

Information on ground water was acquired from recent publications on ground water in the vicinity of the watershed and through conferences with the Ground Water Branch of the U. S Geological Survey at Austin and with the Superintendent of the San Marcos Water Board.

Some significant facts and estimates are as follows:1/

1. The hydraulic gradient of the water table in this area is to the east and northeast, indicating that the ground water moves in those directions.

2. The farm and ranch wells within a few miles northeast of upper York Creek and the springs and water supply wells in San Marcos are in a position to benefit by the recharge from York Creek.

3. The discharge from the San Marcos Springs has dropped to less than 25 percent of the flow they produced in 1947. It has been predicted that by 1960 San Marcos will begin to feel the effects of a lowering water table.

4. The discharge from Comal Springs in New Braunfels was near its peak flow of 420 cubic feet per second in 1942, 1945, and 1947. It dropped to 72 c.f.s.in 1954, and recently some of the springs have gone completely dry.

5. Studies in York Creek and adjacent watersheds indicate that the estimated annual recharge to the ground-water reservoir is 188 acre-feet per square mile, which is approximately 72 percent of the average annual runoff.

1/ The source of much of this data was "Ground-Water Resources of the San Antonio River Area, Texas," Bulletin 5608, Volume I, Texas Board of Water Engineers, July 1956.

6. The numerous joints and faults in the Edwards and associated limestones permit them to take up water rapidly.

7. Computed runoff and streamflow measurements in this area indicate that many streams lose 70 to 90 percent of the runoff before they flow out onto the Coastal Plain. The Guadalupe is the exception in which little water is lost as recharge.

The method used to evaluate benefits from ground-water recharge is as follows:

> As it appears probable from the above data that at present 75 percent of the runoff is recharged into the Edwards underground reservoir, it can be expected that 95 percent of the runoff stored in the two planned detention structures in this physiographic area would be recharged into the Edwards. This represents an increase of 20 percent of the average annual runoff from the drainage areas above these sites which can be claimed as recharge benefits. The average annual runoff from the 10,064 acres above these sites is estimated to be 4,193 acre-feet per year, based on an average of five inches annually. Twenty percent of this amount equals 838.6 acre-feet, the annual increase in recharge resulting from the construction of these dams.

Economic Investigations

Determination of Annual Benefits from Reduction in Damage

Damage schedules covering 75 percent of the flood plain area of York Creek and its major tributaries were obtained from landowners or operators. These schedules covered land use and crop distribution, yields, and historical data on flooding and flood damages. 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 and pasture damage, expenses saved, such as costs of harvesting, were deducted from the gross value of the damage.

Examination of hydrologic cross sections revealed that a marked difference in flood plain land use existed, depending on elevation. It was decided, therefore, to relate crop and pasture damageable values,per acre flooded, to flood stage to reflect the greater intensity of use at higher elevations. The proper rates of damage were applied, flood by flood, to the floods during the historical series and an adjustment was made to take into account the effect of recurrent flooding, where several floods occurred within one crop year. The flood plain land use was mapped in the field. Normal yields were based on data obtained from the schedules, supplemented by information obtained from soil scientists and other agricultural workers in the area. To attain accurate appraisal, the flood plain was divided into three evaluation reaches, each with its own series of damageable values and flood history.

The monetary value of the physical damage to the flood plain from scour and from deposition of sediment was based on the value of the production lost, taking into account the lag in recovery of productivity and/or the cost of farm operations to speed recovery.

Damage to other agricultural property, such as fences, livestock, and farm equipment, was obtained from analysis of schedules, correlated with sizes of floods. The major item of nonagricultural damage was that sustained by roads and bridges. Estimates of these damages were based on information supplied by County Commissioners, supplemented by that from local farmers.

As the watershed is almost entirely an agricultural area, indirect damages primarily involve extra farming expense, such as additional travel time to market snd extra costs of purchasing additional feed for livestock. Information regarding damages of this type was obtained from local residents. Upon analysis, it appeared that indirect damages were rather small, amounting to only about 10 percent of the direct damage.

Floodwater, scour and sediment damages were calculated under present conditions and under conditions which will prevail after the installation of each class of measures included in the planned project. The difference between average annual damages at the time of initiation of each class of measures and those expected after its installation constitutes the benefit brought about by that group through reduction of damage. Benefits from reduction of crop and pasture damages and flood plain scour resulted from the combined effects of reduction in area inundated and reduced depth of inundation. Benefits from reduction of valley sediment damages derived from each class of measures were determined on the basis of estimated reductions in the rate of sediment production and in acreage flooded after installation of each class of measure.

Areas that will be inundated by the sediment and detention pools of floodwater retarding structures were excluded from the damage calculations. An estimate was made, however, of the value of production lost in these areas after installation of the program. In this appraisal it was considered that there would be no production in the sediment pools. The land covered by the detention pools was assumed to be converted to grassland under project conditions.

Determination of Annual Benefits Outside Watershed Resulting from Project

Data from the Corps of Engineers report on the Guadalupe and San Antonio Rivers were analyzed and damages to the mainstem of the San Marcos River above Gonzales Reservoir were calculated. Benefits from the reduction of these damages were apportioned back to the floodwater retarding structures on York Creek in proportion to the reduction in flooding resulting from them. Sediment damage to the authorized Gonzales Reservoir was calculated from this report and benefits from the reduction of sediment to the reservoir were assigned to floodwater retarding structures on York Creek according to their sediment storage capacity.

Determination of Annual Benefits from Agricultural Water Management (Ground-Water Recharge)

Ground-water recharge from floodwater retarding structures 1 and 2, in the Edwards Plateau area, is estimated to be 838.6 acre-feet annually. The value of the ground-water recharge was appraised at $10.00 an acre-foot, giving a total annual recharge benefit of $8,386. It was assumed that the

rate of recharge would diminish slightly during the life of the project due to the deposition of clay in some of the openings of the rock formation. The average annual recharge was discounted 10 percent to allow for this deposition, giving an average annual recharge benefit of $7,547. No additional costs are involved in this recharge as it takes place naturally when water covers the porous Edwards limestone formations.

Determination of Annual Benefits from Changed Land Use in the Flood Plains

Farmers were asked to state the changes made in the use of their flood plain lands as a result of past flooding. Operators of flood plain lands were also asked what changes they would make in their use of the flood plain if flooding were reduced 50 percent. Analysis of these responses provided the basis for estimating the benefits from restoration of lands to their former use. Additional factors considered in this analysis were the size and location of the areas affected, land capability, existence of available markets, management skills of the operators, reduction in frequency of flooding, and similar factors. All benefits from change in flood plain land use were discounted over a 5-year buildup period to allow for a lag in installation.

Details of Methodology

Details of the procedures used in the investigations are described in the Interim Economics Guide for Watershed Protection and Flood Prevention, Revised April 1, 1956.

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

York Creek Watershed, Texas

Price Base: 1956

Structure Site Number	Federal Installation Costs					Non-Fed. Installation Costs			Estimated Total Cost
	Contract (dollars)	Contingencies (dollars)	Installation Service (dollars)	Administration and Misc. (dollars)	Total Federal (dollars)	Administration of Contracts (dollars)	Easements and R/W (dollars)	Total Non-Federal (dollars)	
Floodwater Retarding Structures									
1	179,516	17,952	35,903	23,337	256,708	500	10,065	10,565	267,273
2	74,502	7,450	14,900	9,685	106,537	500	2,943	3,443	109,980
3	65,819	6,582	13,164	8,556	94,121	500	35,931	36,431	130,552
4	45,429	4,543	9,486	5,946	65,404	500	28,571	29,071	94,475
5	64,608	6,461	12,922	8,399	92,390	500	33,154	33,654	126,044
6	30,437	3,044	6,088	3,957	43,526	500	13,477	13,977	57,503
7	37,692	3,769	7,538	4,900	53,899	500	9,211	9,711	63,610
8	21,102	2,110	4,220	2,743	30,175	500	10,823	11,323	41,498
9	14,952	1,495	2,990	1,944	21,381	500	9,043	9,543	30,924
10	54,169	5,417	10,834	7,042	77,462	500	26,935	27,435	104,897
11	74,601	7,460	14,920	9,698	106,679	500	23,085	23,585	130,264
12	44,391	4,439	8,878	5,771	63,479	500	10,025	10,525	74,004
13	59,906	5,991	11,981	7,788	85,666	500	48,201	48,701	134,367
14	21,646	2,165	4,329	2,814	30,954	500	16,852	17,352	48,306
15	35,539	3,554	7,108	4,620	50,821	500	8,474	8,974	59,795
16	36,642	3,664	7,328	4,763	52,397	500	7,539	8,039	60,436
Subtotal	860,951	86,096	172,589	111,963	1,231,599	8,000	294,329	302,329	1,533,928
Channel Improvement	514,433	51,444	102,886	66,877	735,640	2,000	16,850	18,850	754,490
Subtotal	514,433	51,444	102,886	66,877	735,640	2,000	16,850	18,850	754,490
GRAND TOTAL	1,375,384	137,540	275,475	178,840	1,967,239	10,000	311,179	321,179	2,288,418

April 1957

TABLE 3 - STRUCTURE DATA

FLOODWATER RETARDING STRUCTURES

York Creek Watershed, Texas

Item	Unit	STRUCTURE NUMBERS																
		1	2	3	4	5	6	7	8	9	10	12	12	13	14	15	16	Total
Drainage Area	sq.mi.	12.93	2.80	5.87	4.82	8.20	1.71	2.21	2.66	1.14	6.59	5.07	2.51	9.70	1.83	1.66	1.94	70.62
Storage Capacity																		
Sediment Pool	ac.ft.	338	74	200	200	200	164	200	144	146	200	200	200	200	134	132	144	2,676
Sediment Reserve Below Riser	ac.ft.	-	-	267	222	395	-	-	-	-	285	276	26	452	-	-	-	1,923
Sediment Reserve Above Riser	ac.ft.	-	4	34	33	48	18	24	22	12	42	19	19	52	11	11	16	351
Floodwater Detention	ac.ft.	3,035	508	1,252	1,028	1,749	365	471	354	243	1,406	1,082	535	2,069	386	354	414	15,251
Total	ac.ft.	3,173	586	1,757	1,483	2,392	547	695	510	401	1,933	1,577	780	2,773	531	497	574	20,205
Surface Area																		
Sediment Pool 1/	acre	18	11	79	64	82	27	27	29	29	71	44	29	126	29	18	21	704
Floodwater Detention Pool	acre	147	36	101	138	215	70	57	60	56	167	144	64	710	90	48	48	1,741
Maximum Height of Dam	feet	11.9	42.8	29.5	31.7	38.1	28.7	35.0	26.5	25.1	33.7	29.8	38.8	32.6	24.6	34.7	36.1	xxx
Volume of Fill	cu.yds.	236,392	112,731	175,191	121,225	176,024	81,819	102,139	55,150	38,434	146,197	200,288	118,259	158,302	55,417	95,827	98,262	1,971,637
Emergency Spillway																		
Type		Rock	Rock	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	xxx
Frequency of Use	years	77	34	45	45	45	45	45	45	45	45	45	45	45	45	45	45	xxx
Design Storm Rainfall																		
Duration	hours	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	xxx
Total	inches	13.00	14.22	13.70	13.87	17.45	14.45	14.34	14.50	14.70	13.64	13.82	14.27	13.29	14.42	14.50	14.41	xxx
Bottom Width	feet	600	190	275	250	370	100	150	100	70	325	310	200	300	80	120	140	xxx
Design Depth	feet	5.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	xxx
Design Capacity	c.f.s.	13,800	4,218	5,719	5,580	8,170	2,017	7,168	2,046	1,455	7,068	6,908	4,283	6,637	1,691	2,527	3,107	xxx
Total Freeboard 2/	feet	6.2	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	xxx
Total Capacity	c.f.s.	17,800	6,080	8,800	8,000	11,840	3,200	4,800	3,200	2,240	10,400	9,920	6,400	9,600	2,560	3,840	4,480	xxx
Principal Spillway																		
Capacity	c.f.s.	103	14	30	24	41	9	11	8	6	33	25	13	49	9	8	10	xxx
Capacity Equivalents																		
Sediment Volume	inches	.2	.50	1.60	1.77	1.47	2.00	1.90	1.76	2.60	1.50	1.90	1.83	1.36	1.50	2.62	1.55	xxx
Detention Storage	inches	4.4	3.40	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	xxx
Spillway Storage 3/	inches	1.16	1.07	2.35	2.50	2.33	3.62	2.15	3.24	4.50	2.20	2.47	2.17	2.87	4.50	2.58	2.09	xxx
Class of Structure		A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	xxx

1/ Area at elevation of the top of riser.
2/ Difference between emergency spillway crest elevation and elevation of the top of the dam.
3/ Storage from crest elevation to designed depth of flow.

April 1957

TABLE 4 - SUMMARY OF PHYSICAL DATA

York Creek Watershed, Texas

Item	Unit	Quantity Without Program	Quantity With Program
Watershed area	Sq. Mi.	146.60	xxx
Watershed area	Acres	93,824	xxx
Area of cropland	Acres	52,190	52,190
Area of grassland	Acres	39,766	39,766
Area of miscellaneous use	Acres	1,868	1,868
Overflow area subject to damage	Acres	7,745	4,683
Area damaged annually by:			
Sediment	Acres	601	34
Flood Plain scour	Acres	1,141	130
Streambank erosion	Acres	0.7	0.6
Sheet erosion	Acres	40,652	10,509
Annual rate of erosion			
Sheet	Ac.Ft./Yr.	483.6	325.1
Gully	Ac.Ft./Yr.	2.8	1.4
Streambank	Ac.Ft./Yr.	7.6	5.2
Scour	Ac.Ft./Yr.	24.6	2.7
Sediment production	Ac.Ft./Yr.	111	41
Sediment accumulation in authorized reservoir (Gonzales)	Ac.Ft./Yr.	139.6	51.7
Average annual rainfall	Inches	33.71	xxx

April 1957

TABLE 5 - SUMMARY OF PLAN DATA

York Creek Watershed, Texas

Item	Unit	Quantity
Years to complete program	Year	5
Total installation cost		
Federal	Dollar	1,992,239
Non-Federal	Dollar	903,439
Annual O & M cost		
Federal	Dollar	-
Non-Federal	Dollar	16,082
Average annual monetary benefits	Dollar	157,694
Agricultural	Percent	89
Nonagricultural	Percent	11
Structural measures		
Floodwater retarding structures	Each	16
Channel improvement	Mile	19.97
Area inundated by structures		
Flood plain		
Detention pool	Acre	74
Sediment pool	Acre	73
Upland		
Detention pool	Acre	964
Sediment pool	Acre	630
Watershed area above structures	Acre	45,197
Reduction of floodwater damage		
By land treatment measures		
Watershed protection	Percent	14.9
By structural measures	Percent	72.6
Reduction of erosion damage		
By land treatment measures		
Watershed protection	Percent	17.2
By structural measures	Percent	71.5
Reduction of sediment damage		
By land treatment measures		
Watershed protection	Percent	41.0
By structural measures	Percent	53.5
Flood prevention benefits from changed land use (restoration of productivity)	Dollar	25,346
Agricultural water management (ground water recharge)	Dollar	7,547

TABLE 6 - ANNUAL COSTS

York Creek Watershed, Texas

Measures	Amortization of Installation Costs 1/			Operation & Maintenance Costs 2/			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Floodwater Retarding Structures							
1	9,051	373	9,424	-	180	180	9,604
2	3,756	122	3,878	-	90	90	3,968
3	3,319	1,284	4,603	-	135	135	4,738
4	2,306	1,025	3,331	-	180	180	3,511
5	3,258	1,186	4,444	-	135	135	4,579
6	1,534	493	2,027	-	90	90	2,117
7	1,900	343	2,243	-	90	90	2,333
8	1,064	399	1,463	-	90	90	1,553
9	754	336	1,090	-	90	90	1,180
10	2,731	967	3,698	-	135	135	3,833
11	3,761	832	4,593	-	180	180	4,773
12	2,238	371	2,609	-	135	135	2,744
13	3,020	1,718	4,738	-	135	135	4,873
14	1,091	612	1,703	-	90	90	1,793
15	1,792	316	2,108	-	90	90	2,198
Channel Improvement in Combination with Floodwater Retarding Structure No. 16	27,784	949	28,733	-	14,237	14,237	42,970
TOTAL	69,359	11,326	80,685	-	16,082	16,082	96,767

1/ 1956 prices amortized for 50 years at 2.5 percent.
2/ Long-term prices as projected by ARS, June 1956.

April 1957

TABLE 7 - SUMMARY OF MONETARY BENEFITS

York Creek Watershed, Texas

Price Base: Long Term [1/]

Item	Estimated Ave. Annual Damage: Without Project (dollars)	After Land Treatment For W/S Protection (dollars)	With Project (dollars)	Average Annual Monetary Benefit (dollars)
Floodwater Damage				
Crop and Pasture	74,571	65,061	12,751	52,310
Other Agricultural	46,081	38,116	3,783	34,333
Nonagricultural				
Roads and Bridges	19,741	16,279	1,057	15,222
Subtotal	140,393	119,456	17,591	101,865
Sediment Damage				
Overbank Deposition	593	350	33	317
Subtotal	593	350	33	317
Erosion Damage				
Flood Plain Scour	8,250	6,831	934	5,897
Subtotal	8,250	6,831	934	5,897
Indirect Damage	14,924	12,664	1,856	10,808
Total, All Damage	164,160	139,301	20,414	118,887
Changed Land Use				
Restoration of Productivity	xxx	xxx	xxx	25,346
Subtotal	xxx	xxx	xxx	25,346
Benefit Outside Project Area [2/]	xxx	xxx	xxx	5,914
TOTAL FLOOD PREVENTION BENEFITS	xxx	xxx	xxx	150,147
Other Agricultural Water Management				
Ground Water Recharge	xxx	xxx	xxx	7,547
TOTAL AGRICULTURAL WATER MANAGEMENT BENEFITS	xxx	xxx	xxx	7,547
TOTAL PRIMARY BENEFITS	xxx	xxx	xxx	157,694
TOTAL MONETARY BENEFITS	xxx	xxx	xxx	157,694

1/ As projected by ARS, June, 1956.

2/ Includes $3,959 for damage reduction on the San Marcos River flood plain, below York Creek, and $1,955 for sediment damage reduction to the authorized Gonzales Reservoir.

April 1957

TABLE 8 - BENEFIT-COST ANALYSIS

York Creek Watershed, Texas

Measures	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 2/	Benefit-Cost Ratio
	Flood Prevention					Agricultural Water Management (Ground Water Recharge)	Total		
	Floodwater	Sediment	Erosion	Indirect	Other 3/				
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
STRUCTURAL MEASURES FOR FLOOD PREVENTION									
Floodwater Retarding Structures									
1	14,480	89	931	1,550	2,639	6,204	25,893	9,604	2.70:1
2	3,135	19	202	336	552	1,343	5,587	3,968	1.41:1
3	6,577	40	422	704	1,339	-	9,082	4,738	1.92:1
4	5,557	29	343	593	1,144	-	7,666	3,511	2.18:1
5	7,905	35	466	840	1,708	-	10,954	4,579	2.39:1
6	1,679	8	101	179	380	-	2,347	2,117	1.11:1
7	2,181	8	127	231	490	-	3,037	2,333	1.30:1
8	1,861	6	103	198	392	-	2,560	1,553	1.65:1
9	1,401	4	77	148	306	-	1,936	1,180	1.64:1
10	7,104	12	362	747	1,500	-	9,725	3,833	2.54:1
11	5,369	6	264	564	1,175	-	7,378	4,773	1.55:1
12	2,852	3	138	300	612	-	3,905	2,744	1.42:1
13	10,060	14	587	1,065	5,543	-	17,269	4,873	3.54:1
14	1,427	1	77	150	671	-	2,326	1,793	1.30:1
15	1,642	1	85	174	592	-	2,494	2,198	1.13:1
Channel Improvement in Combination with Floodwater Retarding Structure No. 16	28,635	42	1,612	3,029	12,217	-	45,535	42,970	1.06:1
GRAND TOTAL	101,863	317	5,897	10,808	31,260	7,547	157,694	96,767	1.63:1

1/ Based on long-term prices, as projected by ARS, June 1956.

2/ Derived from installation costs based on 1956 price level and operation and maintenance cost based on long-term price level, as projected by ARS, June 1956.

3/ Includes benefits from intensified land use in flood plain, from reduction in damages to the San Marcos River flood plain below York Creek, and from reduction of sediment damage to the authorized Gonzales Reservoir.

April 1957

TABLE 8A - BENEFITS AND COSTS BY CONSTRUCTION UNITS

York Creek Watershed, Texas

Construction Unit and Structure Nos.	Annual Benefits 1/	Annual Costs 2/
	(dollars)	(dollars)
Construction Unit No. 1		
Structure Nos. 13 thru 15	14,385	8,864
Construction Unit No. 2		
Structure Nos. 1 thru 8	36,766	32,403

1/ Long-term prices as projected by ARS, June 1956.

2/ Derived from installation costs based on 1956 price levels and operation and maintenance cost based on long-term price levels as projected by ARS June 1956.

TABLE 9 - COST-SHARING SUMMARY

York Creek Watershed, Texas

Price Base: 1956 1/

Type of Cost	Federal Cost		Non-Fed. Cost		Total Cost	
	Dollars	Percent	Dollars	Percent	Dollars	Percent
Land Treatment						
Non-Federal Land For Watershed Protection	25,000	4.1	582,260	95.9	607,260	18.1
Subtotal	25,000	4.1	582,260	95.9	607,260	18.1
Structural Measures						
Installation Flood Prevention	1,967,239	86.0	321,179	14.0	2,288,418	68.3
Subtotal	1,967,239	86.0	321,179	14.0	2,288,418	68.3
Total Installation Cost	1,992,239	68.8	903,439	31.2	2,895,678	86.4
Operation and Maintenance 2/	-	0	456,123	100.0	456,123	13.6
Total Structural Cost	1,967,239	71.7	777,302	28.3	2,744,541	81.9
TOTAL PROJECT COST	1,992,239	59.4	1,359,562	40.6	3,351,801	100

1/ Except operation and maintenance which is based on long-term prices, as projected by ARS, June 1956.

2/ Capitalized for 50 years at 2.5 percent.

April 1957