WORK PLAN

ESCONDIDO CREEK WATERSHED

Of the San Antonio River Watershed

Karnes County, Texas

Prepared By

SOIL CONSERVATION SERVICE

U.S. DEPARTMENT OF AGRICULTURE

Temple, Texas

June 1954

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UNITED STATES
DEPARTMENT OF AGRICULTURE
Soil Conservation Service

June 1, 1954

Chairman, Karnes County ASC Committee
Karnes County Extension Agent
Karnes County Administrator, F.H.A.
Karnes County Commissioners Court
Karnes County Vocational Agriculture Dept.
Chairman, San Antonio River Authority

In accordance with the specific request of the farmers and others living in the Escondido Creek Watershed, a Work Plan has been prepared primarily for flood prevention, and a copy is being provided you herewith.

As a result of the discussion held during the development of the plan and as reviewed finally with various members of the group during May of 1954, it is our understanding that the unit coste and schedules shown are in harmony with those currently used by the agencies and organizations which will participate in the carrying out of the plan.

We believe you will be intersted in the attached copies of letters from the Karnes County Soil Conservation District Governing Body concurring in the work plan and indicating that they have incorporated the pertinent aspects in their respective district work plans.

It is our observation, and we believe also that of all who have helped in the development of this plan, that parties who are to participate are "ready to go."

We have in the Soil Conservation Service budget for fiscal year 1954, the money for initiating our part of the work as set forth in the schedule of the work plan for 1954. The remaining Federal contribution, up to the designated amount, will be submitted for inclusion in the Soil Conservation Service budget request for each of the remaining fiscal years as set forth in the schedule of the work plan.

If any significant changes should be needed during the application of this plan, it is expected that the revision will be brought to your attention.

/s/ John Herring
John Herring, Area Conservationist

Attachments

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KARNES COUNTY SOIL CONSERVATION DISTRICT
Karnes, Bee and Goliad Counties

Kenedy, Texas

June 1, 1954

Mr. Roy G. Freeman
Work Unit Conservationist
Soil Conservation Service
Kenedy, Texas

Dear Mr. Freeman:

The Supervisors of our district have reviewed carefully the Work Plan primarily for flood prevention for Escondido Creek Watershed.

We believe that the development of this Watershed Work Plan by joint effort of the landowners, the district supervisors and Soil Conservation Service technicians and others has resulted in a plan which we all thoroughly subscribe to and are willing to push through to completion according to the terms of cooperation and the schedule shown. We have officially incorporated this plan into our District Work Plan, and we have also signed a "Revised Supplemental Memorandum of Understanding and Amendments", setting forth our responsibilities of installation and maintenance.

Very truly yours,

/s/ R. M. Boswell, Chairman
Karnes County Soil Conservation
District

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CHAMBER OF COMMERCE, INC.

Kenedy, Texas
PO Box 98

June 17, 1954

Mr. Roy G. Freeman
Work Unit Conservationist
Soil Conservation Service
Kenedy, Texas

Dear Mr. Freeman:

We have examined the work plan in the Escondido Creek Watershed and can assure you that it meets with our complete approval. Our Soil and Flood Prevention Committee have done a great deal of work in connection with the Escondido Creek Watershed and our Directors have discussed it on numerous occasions.

Our common object is to promote the adoption of soil and water conservation, soil improvement measures and proper use of the land to attain these results.

We wish to follow your lead in these matters and to lend you every support. We also wish to go on record as congratulating the Soil Conservation Service for the splendid work they have done in Kenedy and its vicinity.

Please do not hesitate to call on us at any time as we are only too proud to cooperate.

Yours very sincerely,

/s/ Charles H. Talbot
Manager Chamber of Commerce

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KARNES CITY COMMUNITY

City Hall Karnes City, Texas Chamber of Commerce

June 21, 1954

Mr. Roy G. Freeman
Work Unit Conservationist
Soil Conservation Service
Kenedy, Texas

Dear Mr. Freeman:

We have reviewed with great interest the Escondido Creek Watershed Work Plan and we concur in the attached plan which is primarily for flood prevention in the above mentioned watershed.

We realize the importance of soil and water to our community and we hope that every landowner, operator, businessman and other interested persons will promote, encourage and carry out the necessary conservation measures to achieve soil and water conservation on all of the land in the watershed and bring about the greatest reduction in flood damage feasible at this time.

We as the Karnes City Community Chamber of Commerce extend our wholehearted help and support to the Escondido Watershed Project in the hope that it will create a more prosperous agricultural farming area which in turn will greatly enhance the property of our community.

Sincerely yours,

/s/ Albert J. Fuchs, President

/s/ Herb Smith

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June 1, 1954

Mr. Roy G. Freeman
Work Unit Conservationist
Soil Conservation Service
Kenedy, Texas

Dear Mr. Freeman:

The Governing Body and Cooperators of the Karnes County Soil Conservation District, the Escondido Creek Watershed Association, and the Karnes County Commissioners Court have actively participated in the preparation of the attached work plan primarily for flood prevention for the Escondido Creek Watershed.

This plan represents a common understanding and agreement on the kinds and amounts of measures needed to be applied in the Escondido Creek Watershed to achieve soil and water conservation on all of the lands in the watershed and to bring about the greatest reduction in flood damages feasible at this time. Our common objective is to place the land in condition and so protected that it may be used for the optimum sustained agricultural production for which it is capable. We believe the carrying out of the works of improvement outlined in the attached plan will accomplish this objective.

The work plan for the Escondido Creek Watershed has been incorporated with and made a part of the district work plan of the Karnes County Soil Conservation District. A revised supplemental memorandum of understanding has been entered into between the Soil Conservation Service and the Karnes County Soil Conservation District covering the general terms of cooperation and assumption of responsibilities in the execution of this kind of work.

Very truly yours,

/s/ R. M. Boswell, Chairman	6/2/54
Chairman, Karnes County Soil Conservation District	Date
/s/ Steve Crews III	6/7/54
President, Escondido Creek Watershed Association	Date
/s/ W. S. Pickett	6/14/54
County Judge, Karnes County, Texas, Acting for Karnes County Commissioners Court	Date

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At a called meeting of the Karnes County Soil Conservation District #302 held on Tuesday, August 18, 1953, where four members of the Board of Supervisors were present, the following resolution was passed:

BE IT RESOLVED:

The Karnes County Soil Conservation District #302 Board of Supervisors agree to sponsor the proposed Flood Prevention Program on the Escondido Creek Watershed. They also agree to give their full support and cooperation and to make every effort to obtain the cooperation and support of all other interested individuals and agencies, provided, however, that the Supervisors be free of any personal financial liabilities.

KARNES COUNTY SOIL CONS. DIST. #302

R. M. Boswell, Chairman

Jack K. Hays, Secretary

Henry Hedtke, Member

Edwin G. Mengers

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SAN ANTONIO RIVER AUTHORITY
San Antonio, Texas

December 23, 1953

The following is an excerpt from the minutes of the San Antonio River Authority at their meeting of November 13, 1953:

> "Whereas, the Board of Supervisors of the Karnes County Soil Conservation District have agreed to sponsor the Escondido Creek Pilot Dam Project which is an important link in the Flood Control Program for the San Antonio River Watershed, therefore, the San Antonio River Authority approves and endorses this project as an important feature in the Flood Control Program".

/s/ W. B. Tuttle

W. B. Tuttle, Chairman
San Antonio River Authority

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Washington 25, D. C.
August 24, 1953

TO: Louis P. Merrill, Regional Director, SCS
Fort Worth, Texas

FROM: Robt. M. Salter, Chief, SCS

SUBJECT: Designation of Escondido Creek Watershed, Texas

This is to inform you that I have designated Escondido Creek Watershed in Karnes County, Texas, as a project eligible for Federal assistance in the installation of improvement measures under the Watershed Protection item in the appropriation bill for fiscal year 1954.

Escondido Creek Watershed has been designated on the basis of the formal assurance of the Karnes County Soil Conservation District that it is ready to sponsor the program on the watershed and to cooperate with the Federal Government, state and local agencies and individuals in carrying it out.

Escondido Creek Watershed, with an area of 80 square miles, is to be completely treated within 5 years at an estimated cost of $829,000 to the Federal Government. The program is based on local interests making at least an equal contribution. The treatment will consist of interrelated land treatment and structural measures designed to prevent the formation of damaging floods, soil erosion and to retard runoff and thereby conserve and improve the agricultural resources of the area.

Local interests will be assisted by the Federal Government in the development of a watershed plan and in the installation of watershed protection measures in accordance with this plan. This assistance will consist of (1) providing technical services to accelerate the planning and applying land-treatment measures on the farms of the watershed, (2) designing and supervising the construction of control measures, and (3) issuing invitations to bid and entering into contracts for the installation of structural and related measures.

It is also intended to initiate studies in the Escondido Creek watershed that will provide factual information on the effects of a watershed protection program on crop yields, soil loss and sediment production, runoff, and flood flows. The cooperation of the Geological Survey and other agencies will be sought in carrying out these evaluations. The installation of this program will also serve to demonstrate the willingness and ability of local interests to cooperate with the Federal Government in solving their watershed problems.

The Congress has fixed a ceiling of $28,706,000 in Federal costs to be expended in a five-year period throughout the Nation on this Watershed Protection program. The ceiling for this project as indicated above is $829,000 and cannot be exceeded.

I am sure you have plans to get the work started at once in this watershed and I hope you will do so.

/s/ Robt. M. Salter

WORK PLAN
ESCONDIDO CREEK WATERSHED
Of the San Antonio River Watershed
Karnes County, Texas

Participating Agencies

Karnes County Soil Conservation District
Agricultural Conservation Program Service, USDA
Extension Service, USDA
San Antonio River Authority
Soil Conservation Service
Karnes County Commissioners Court
Farm Home Administration, USDA

Prepared by
Soil Conservation Service
United States Department of Agriculture
June, 1954

WORK PLAN
ESCONDIDO CREEK WATERSHED
Of the San Antonio River Watershed
Karnes County, Texas

June 1954

Introduction

Authority

The Escondito Creek Watershed Protection Project will be carried out under the authority of the Soil Conservation Act of 1935 (Public Law No. 46, 74th Congress) as implemented by the Watershed Protection item in the Department of Agriculture Appropriation Act, 1954. 1/ The Escondido Creek watershed was designated August 24, 1953. A copy of the official designation is included in this work plan.

Purpose and Scope of Plan

The purpose of this plan is to state specifically the feasible practices and measures needed and how they will be carried out to achieve the maximum practicable reduction of erosion, floodwater, and sediment damages. Application of this mutually developed plan will provide the protection to and improvement of land and water resources which can be undertaken at this time with the combined facilities of local interests and state and Federal agencies. Upon completion and continued maintenance of the measures set forth in this plan a material contribution will be made toward increasing agricultural production to the maximum level consistent with the capability of the land, thereby promoting the welfare of the landowners and operators, the community, the state, and the Nation. The area in the watershed lies entirely in Karnes County and contains 74,880 acres.

SUMMARY OF PLAN

This plan is a combination of land treatment practices and measures which contribute directly to erosion control and flood prevention, and of measures primarily for flood prevention. The works of improvement as listed in Table 1 are planned to be installed during a five-year period at an estimated total cost of $1,312,447, of which $668,121 is to be borne by state and local interests and $644,326 by the Federal Government. These estimates are inclusive of the current cost to local interests and state and Federal agencies under the going National programs pertaining to the objectives of this plan. It is estimated that the Federal contribution under going agricultural programs will be $157,980. The Karnes County Soil Conservation District has agreed to assume responsibility for overall periodic inspection and maintenance of the floodwater retarding structures at an estimated annual cost of $825.

1/ H. R. 5227 "A Bill Making Appropriations for the Department of Agriculture for the Fiscal Year ending June 30, 1954, and for Other Purposes," House of Representatives Report No. 900; Senate Amendment No. 26.

The landowners and operators will maintain the land treatment measures at an estimated annual cost of $36,900 in accordance with provisions of the farmer-district cooperative agreements.

Comparison and Benefit and Cost

When the works of improvement are applied and operating at full effectiveness the ratio of the estimated average annual benefit, $324,179, to the estimated average annual cost $91,193 is 3.56 to 1, based on current price levels for costs and long-term prices for benefits. Benefits were claimed on the Escondido Creek flood plain only. No common flood plain benefits were considered. When all watersheds are treated, flood damage reduction could be expected on the flood plain of the San Antonio River, as well as a reduction in sedimentation rates in any major structures that might be constructed at a later date. In the San Antonio River Watershed Survey Report, reductions in flooding resulting from land treatment measures and floodwater retarding structures were routed downstream on the main stem of the San Antonio River. Based on these routings, average annual reductions in floodwater damage on the flood plain of the San Antonio River are expected to equal $1,729 from land treatment and $754 from floodwater retarding structures in the Escondido Creek watershed.

DESCRIPTION OF THE WATERSHED

Escondido Creek rises in Karnes County approximately 8 miles west of the town of Karnes City and flows in an easterly direction through the south central part of the county, emptying into the San Antonio River in the southeast corner of the county. Nichols, Panther, Bucker and Olmos Creeks are the major tributaries.

The town of Kenedy is located in the central part of the watershed and Escondido Creek flows through it. The drainage area is served by approximately 143 miles of roads of which 76 miles are hard surfaced. The watershed is crossed by U. S. Highway 181, State Highway 72, and the Texas and New Orleans Railroad.

The area of the watershed is 74,880 acres (117 square miles) of which 72,168 acres are in farms. The remaining 2,712 acres are in roads, urban area, railroads and miscellaneous uses. The bottomland area of Escondido Creek and its tributaries comprises 5,662 acres, of which 4,772 acres is flood plain land, and 890 acres is in stream channels. Under present conditions the entire flood plain would be inundated by a two-day storm producing 11.55 inches of rainfall and 5.10 inches of runoff.

The flood plain of Escondido Creek and its tributaries includes the following land uses: 43.2 percent cropland, 53.3 percent pasture, 1.8 percent idle land, and 1.7 percent miscellaneous use.

The upland soils, in the western part of the watershed, are primarily deep, dark colored, fine textured and slowly permeable with marl, clay or chalky marl parent material. East from Kenedy and Karnes City the

uplands are a mixture of deep, fine textured and slowly permeable, deep medium textured and slowly permeable, and deep medium textured and permeable soils. The parent materials are predominately marls, clays and sandy clays. Alluvial soils are found in both terrace and bottom positions. Most of the terrace soils are deed, fine textured and permeable dark colored loams, while bottomland soils in most places are deep, fine textured and slowly permeable. Approximately 69 percent of the soils in the watershed are fine textured, 29 percent medium textured and 2 percent coarse textured.

The soils of the area, in general, are in fair physical condition. The land now in cultivation has lost an average of five inches of surface soil and much organic matter through long intensive cultivation. A small acreage of formerly cultivated land is now covered with grass. However, the present land use is generally good. Approximately 60 percent of the cultivated land is terraced and about 50 percent is planted to closegrowing crops. The areas in open and wooded pasture are protected with fair to good cover.

The principal crops are flax and cotton, with considerable acreage of grain sorghums, corn, oats, sweet clover and broomcorn.

Total land use in the watershed is estimated as follows:

Land Use	Acres	Percent
Cultivation	34,452	46
Open Pasture	3,921	5
Wooded Pasture	30,595	41
Formerly Cultivated	3,200	4
Miscellaneous 1/	2,712	4
Total	74,880	100

1/ Includes roads, highways, farmsteads, T. & N. O (S.P.) Railroad right-of-way, towns, pump stations, etc.

The topography may be classed as gently rolling to rolling prairie with broad rolling ridges with some escarpments. Surface elevations of the prairie range from 215 feet above mean sea level where Escondido Creek enters the San Antonio River to approximately 530 feet in the extreme headwater area. The upland area is well drained by a system of stream channels which descend rapidly toward the main drainageways. The Escondido Creek channel has an average slope of 12.0 feet per mile between its inception and Kenedy, and a slope of 5.4 feet per mile from Kenedy to its junction with the San Antonio River. The main alluvial valley of Escondido Creek ranges from approximately 1,500 feet wide at its junction with the flood plain of the San Antonio River to less than 200 feet wide near the headwaters.

The climate of the area is characterized by long summers and short winters. Short light freezes may occur several times each winter. The average

annual temperature is 70 degrees Fahrenheit, with an average frost-free growing period of 285 days.

The mean annual precipitation of 31.09 inches is well distributed, with the largest average monthly rainfalls occurring in April, May, June and September. Individual rains of high intensity and excessive amounts fall at irregular intervals during the year and cause erosion and serious flood damage. The minimum recorded annual rainfall was 17.08 inches in 1939, and the maximum annual rainfall of 56.57 inches fell in 1935.

There are no large bodies of surface water within the watershed. The principal source of water for livestock, domestic and municipal use is from wells which range from 200 to 860 feet in depth. The water producing sands are in the Catahoula and Oakville formations. This water contains more than 1,000 parts per million of dissolved solids and is generally potable, but is questionable for irrigation use.

Several medium sized dairies in the watershed ship raw milk to bottling plants in Corpus Christi, Texas. Approximately 25 percent of the cattle in the watershed are used for milk production.

The Escondido Creek watershed is served by the Soil Conservation Service work unit at Kenedy, Texas which is assisting the Karnes County Soil Conservation District. This work unit has assisted farmers in preparing 196 conservation plans on 41,356 acres in the watershed. Where land treatment measures have been applied and maintained for as long as two or three years, crop yields have increased approximately 30 percent.

The 143 miles of roads are adequate to provide access to all parts of the watershed. Of the 271 bridges, 8 are major bridges spanning the larger streams. One railroad traverses the watershed and provides ample loading facilities for car lot shipments.

FLOOD AND EROSION PROBLEMS AND DAMAGES

Escondido Creek has flooded frequently and caused high annual damage. Devastating floods have occurred at intervals of six to seven years, the last one being in September, 1946. During the 20-year period, 1923 to 1943 inclusive, there were 9 floods which covered more than 33 percent of the flood plain and 44 smaller floods. Eight of the larger floods occurred during the growing season, causing considerable damage to growing crops. The total direct floodwater and sedimentation damages caused by the floods experienced during the 20-year period studied were estimated to average $48,230 annually under present conditions, of which $15,836 was crop and pasture damage. Excluding the area of flood plain which would be inundated by the proposed floodwater retarding structures, these damages would be $46,958 and $15,418 respectively. In addition, there are numerous indirect damages such as the interruption of travel, initial losses sustained by dealers and industries in the area reduced value of land in the flooded areas and similar items. The total annual value of these indirect damages are estimated to be $6,104. The average annual monetary floodwater and sediment damages are summarized in Table 4.

Erosion rates on the Escondido Creek watershed are moderately high, since 46 percent of the upland area remains in cultivation. However, the erosion rates have been materially reduced by the terracing of 60 percent of the present cultivated land and the planting of 50 percent of the area in close-growing crops annually. Most of the open and wooded pasture has a fair to good ground cover, with relatively low erosion rates.

The principal sources of sediment are as follows: Sheet erosion (72 percent) gully erosion (8 percent), streambank (3 percent), and flood plain scour (17 percent). The principal land damage in the Escondido Creek flood plain areas is caused by overbank deposition and scour.

Pond Sedimentation

The majority of the farm and ranch ponds in the watershed are located in pasture areas and loss of water storage capacity through sedimentation has been slight.

Channel Enlargement

The channels of Escondido Creek show evidence of slight enlargement. The banks are eroding laterally in the bends at an estimated rate of 0.1 to 0.5 foot annually. While the amount of sediment coming from this source is small, a relatively large portion of it is carried downstream.

Overbank Deposition

Practically all of the modern overbank deposition is located below the 11 proposed floodwater retarding structures. These deposits range from less than one foot to more than 4 feet deep over an area of 427 acres. A high percentage of the modern sediment consists of clay, silt and silty sands, greatly reduced in organic matter, which has caused damage ranging from 10 percent to 80 percent.

Estimated benefits, based on the reduction in sedimentation damages to be brought about by the floodwater retarding structures, were limited to the flood plain area below structures that was inundated by the largest storm considered in the 20 year rainfall series investigated.

Flood Plain Scour

Frequent flooding has caused major scour damage. It is estimated that 1,508 acres of flood plain land has been damaged by scour to the following extent: 496 acres damaged 10 percent, 757 acres damaged 25 percent, 158 acres damaged 50 percent, 56 acres damaged 75 percent, and 41 acres damaged 90 percent. Most of the scour channels noted were broad and shallow and could be crossed with farm machinery.

EXISTING OR PROPOSED WATER MANAGEMENT PROJECTS

Efforts to prevent or to control floods in the Escondido Creek watershed have been minor. A plan for channel improvement on the main stem of

Escondido Creek through the city of Kenedy has been recommended for authorization by the Corps of Engineers.

During the past 12 years a number of neighborhood groups of farmers have cooperated with the Karnes County Soil Conservation District in developing soil and water conservation plans on a community watershed basis. Application of the needed practices has progressed rapidly. The recent formation of a steering committee, composed of interested landowners in the watershed for the purpose of furthering the aims of this plan, will lend much impetus to all phases of the program.

The San Antonio River Authority has been active in flood prevention works, having provided funds to the Soil Conservation Service for developing a program for runoff and waterflow retardation and soil erosion prevention for the entire San Antonio River Watershed.

FLOOD PREVENTION WORKS OF IMPROVEMENT TO BE INSTALLED

Measures Primarily for Flood Prevention

The floodwater retarding structures and other measures needed to provide flood protection for flood plain lands, highways and urban improvements are listed with their costs in Table 2.

A system of 11 floodwater retarding structures is to be installed to protect the flood plain lands along Escondido Creek and its major tributaries. The location of the structures are shown on the Work Plan Map, Figure 2. Data concerning these floodwater retarding structures are summarized in Table 6.

The system of floodwater retarding structures will detain runoff from 38.4 percent of the Escondido Creek watershed. Sufficient detention storage can be developed at all structure sites to make possible the use of vegetated spillways, thereby effecting a substantial reduction in cost over concrete or similar type spillways.

Sites for the floodwater retarding structures will be provided by local interests. The value of these sites is estimated to be $82,885, based on market values furnished by real estate dealers and other local people. Site costs were determined by adding the full value of the land in the sediment pool and one-half the value of the land in the flood pool, since the latter will remain in productive use as pasture. The amortized current value of the sites, $3,858 annually, exceeds the average annual value of the loss of production within the sites at long-term price levels. Therefore, in accordance with sound procedures the larger of the two figures was used in determining the economic evaluation of the program.

The total estimated cost of installing these structures is $699,701. The annual cost, including installation and maintenance is $26,508.

Foundation and Borrow Investigation

In order to provide data on the suitability of foundation conditions and

construction materials at the 11 floodwater retarding structure sites in advance of detailed design and the procuring of easements, semi-detailed investigations were made on all sites.

Measures for Conservation of Water and Watershed Lands

A major phase of work is the seeding of 2,991 acres of idle land and eroded cropland to pasture grasses.

Nine hundred and eighty-six (986) miles of terraces are to be built on 14,790 acres of cultivated land, and twelve (12) miles of diversion terraces are needed to protect lower lying fields. Six hundred and sixteen (616) acres of protected outlets are needed to carry runoff from these terraces and diversions.

Other land treatment measures include the seeding of 29,273 acres of cover crops, 103 farm ponds, 4,190 acres of brush eradication, range and pasture improvement on 22,946 acres, and rotation hay and pasture on 4,814 acres. In addition, landowners should apply all other needed land treatment measures applicable to the watershed area.

The estimated total cost of planning and installing these measures is $640,516 as shown in Table 1. The annual cost, including installation and maintenance, is $64,685.

Instrumentation

The effects of the watershed program have been computed by sound hydraulic, hydrologic, and economic principles and procedures. However, as a part of the operations on this watershed, necessary rain gages and stream gages will be installed to provide information on the actual effect of the recommended watershed protection program on runoff, erosion, sedimentation and evaporation. It is anticipated that cooperative arrangements will be made with the U. S. Geological Survey, the Weather Bureau and other agencies to assist in installing and operating the gages and analyzing the effects of the floodwater retarding structures and land treatment measures.

Effect of These Measures on Damages and Benefits

The combined program of land treatment and flood prevention measures described above would prevent damage on the Escondido Creek flood plain from 38 of the minor floods such as occurred in the 20-year period 1923 to 1942, inclusive. Of the 15 largest floods, 12 would be reduced to minor floods.

Average annual flooding throughout the watershed will be reduced from 2,200 acres to approximately 482 acres on Escondido Creek. The estimated average annual floodwater damage, based on the floods experienced in the 20-year period investigated, will be reduced from $46,684 to $9,446, or 79.8 percent.

Approximately 81.4 percent of the expected reduction in average annual

flood damages within the watershed would result from the system of floodwater retarding structures. The annual value of this reduction is estimated to be $34,369 out of the total of $42,234 from all measures, as shown in Table 4.

Owners and operators of flood plain lands say that if adequate flood protection is provided they will intensify their use of these lands by growing high-value crops such as alfalfa, corn and cotton on areas now used for meadow or abandoned because of frequent flooding. It is estimated that this more intensive use would increase the net income, after all expenses are deducted, by $16,336 annually.

The total flood prevention benefits, including both the reductions in flood damages and the benefits from more intensive use of flood plain lands, of Escondido Creek are estimated to be $58,570 annually. An average annual benefit of $2,483 will accrue also to the main stem of the San Antonio River flood plain. In addition, it is estimated that the conservation benefits to landowners and operators in upland areas of the watershed from the application of land treatment measures would be $263,126 annually. The total expected benefit from the combined program would amount to $324,179 annually.

The installation of the proposed watershed protection program on Escondido Creek and the expansion of the program to the other tributaries of the San Antonio River will give added protection to the flood plain lands along the San Antonio River. The proposed watershed protection program on Escondido Creek will have no known detrimental effect on any downstream projects that might be constructed in the future. On the other hand, at cross-section No. 5 located at the confluence of Escondido Creek and Nichols Creek the proposed program will reduce the peak flow for a 9.67-inch rain from 24,230 cubic feet per second under present conditions to 12,530 cubic feet per second. This will make possible an appreciable reduction in the designed size of the channel in the Corps of Engineers recommended channel improvement project for the protection of the city of Kenedy. The resultant saving in cost has not been claimed as a benefit in the economic evaluation of the watershed protection program.

The expected conservation benefits due to land treatment were determined by estimating the increased net income which would result from the application of the needed practices and measures. Although the total area used for cropland would be decreased by the retirement of steep and severely eroded areas and idle cropland to pasture, it was assumed that the percentage of cropland used for each crop would not change.

Likewise, it was assumed that there would be no change in the percentage of cattle used for dairying and beef production, although the total number of cattle would be increased materially because of the increased acreage of pasture and the greater hay production and pasture carrying capacity to be expected from the application of land treatment measures.

The estimated increase in annual net income to farmers from the application

of land treatment measures is $196,392 from crops and $66,734 from pasture, or a total of $263,126 annually.

Comparison of Cost and Benefit

The ratio of the average annual benefit from measures primarily for flood prevention, $51,459, to the average annual value of the cost of the measures, $26,508, is 1.94 to 1.

The ratio of the average annual benefit, $272,720, from the land treatment measures and practices to their average annual cost, $64,685, is 4.21 to 1.

The ratio of total average annual benefits $324,179, to total average annual value of the costs, $91,193 is 3.56 to 1. (See Table 5.)

In addition to the monetary benefits, there are other substantial values which will accrue from the program such as increased opportunity for recreation, better living conditions, sense of security, etc., which have not been evaluated.

ACCOMPLISHING THE PLAN

The Cooperative Extension Service will conduct general information meetings and local farm meetings, make radio and television broadcasts, prepare radio and press releases and use other forms of disseminating information to help achieve understanding of the program by the landowners and operators in the Escondido Creek watershed and stimulate participation in the entire plan to be carried out, including the land treatment practices and measures and the measures primarily for flood prevention.

The Vocational Agriculture Department will assist in furthering the program.

The Soil Conservation Service will assign additional technicians and aids as needed to the Karnes County Soil Conservation District to assist landowners and operators cooperating with the District in the preparation and application of soil and water conservation plans. Agricultural Conservation Program Service payments will assist the farmers in carrying out the land treatment practices and measures needed in the watershed within the 5-year period specified for completion of the program.

The governing body of the Karnes County Soil Conservation District will arrange for meetings according to a definite schedule, and by individual contacts encourage the landowners and operators within the Escondido Creek 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 District governing bodies will make periodic inspections of the completed conservation measures within its District and follow through to see that needed maintenance is performed.

Professional specialists will be provided by the Soil Conservation Service

to assist in the planning, design, supervision of construction, certification of payments and related duties for the measures primarily for flood prevention. Since most of this work on private lands will be done by contract, the Soil Conservation Service personnel will be responsible for preparing specifications and discharging the various steps involved in the letting of contracts in accordance with customary Federal procedures.

Table 1 and Figure 1 indicate the schedule of operations for each phase of the program which the cooperating parties have agreed should be followed to achieve the most efficient prosecution of the work. This schedule will be adjusted year by year on the basis of any significant change in the plan found to be mutually desired and in light of appropriations and accomplishments actually made.

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

PROVISIONS FOR MAINTENANCE

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

Maintenance responsibility for floodwater retarding structures has been assumed by the Karnes County Soil Conservation District. This maintenance responsibility will in turn be assumed by a watershed association. Monetary assistance for maintenance will be available to the Karnes County Soil Conservation District from other sources.

Table 1

Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	FY 1954 No. to be Applied	Estimated Cost Fiscal Year 1954			
			Federal	Non-Federal: Public	Private	Total
			(dollars)	(dollars)	(dollars)	(dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	1,5,10	140,027	-	13,480	1/ 153,507
Total A-Measures			140,027	-	13,480	153,507
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	1,200	-	-	-	-
Cover Crops	Acre	4,300	-	-	27,950	27,950
Diversion Construction	Mile	2	-	-	845	845
Pasture Reseeding	Acre	200	-	-	3,200	3,200
Farm Ponds	No.	15	-	-	6,000	6,000
Terraces	Mile	100	-	-	13,500	13,500
Waterway Development	Acre	100	-	-	4,000	4,000
Brush Eradication	Acre	600	-	-	9,000	9,000
Rotation Hay & Pasture	Acre	350	-	-	4,200	4,200
Range & Pasture Improvement	Acre	3,946	-	-	1,973	1,973
Farm & Ranch Planning & Application Asst.(Accl.)	Acre	666	1,090	-	-	1,090
Total B-Measures			1,090	-	70,668	71,758
Total A and B-Measures			141,117	-	84,148	225,265
Facilitating Measures						
Program Evaluation (SCS)			5,025	-	-	5,025
Work Plan Development (SCS)			12,906	-	-	12,906
Work Plan Development San Antonio River Authority				4,095	-	4,095
Local Assistance for Easements etc.					693	693
Total (SCS)			159,048	-	-	-
Grand Total			159,048	-	-	-
Going Program (SCS)	Acre	4,924	7,386	-	-	-

1/ Value of land easements and rights-of-way.

Agr-SCS-Ft.Worth,Tex.,1954

UNITED STATES
DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FORT WORTH, TEXAS

Table 1 - Continued

Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	FY 1955 No. to be Applied	Estimated Cost Fiscal Year 1955 Federal	Non-Federal Public	Private	Total
			(dollars)	(dollars)	(dollars)	(dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	2,9,11	181,892	-	32,840 [1/]	214,732
Total A-Measures			181,892	-	32,840	214,732
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	2,300	-	-	-	-
Cover Crops	Acre	6,200	-	-	40,300	40,300
Diversion Construction	Mile	3	-	-	1,267	1,267
Pasture Reseeding	Acre	800	-	-	12,800	12,800
Farm Ponds	No.	30	-	-	12,000	12,000
Terraces	Mile	150	-	-	20,250	20,250
Waterway Development	Acre	200	-	-	8,000	8,000
Brush Eradication	Acre	800	-	-	12,000	12,000
Rotation Hay & Pasture	Acre	1,200	-	-	14,400	14,400
Range & Pasture Improvement	Acre	5,200	-	-	2,600	2,600
Farm & Ranch Planning & Application Asst. (Acol.)	Acre	3,334	5,450	-	-	5,450
Total B-Measures			5,450	-	123,617	129,067
Total A and B-Measures			187,342	-	156,457	343,799
Facilitating Measures						
Program Evaluation (SCS)			2,920	-	-	2,920
Work Plan Development (SCS)			-	-	-	-
Work Plan Development San Antonio River Authority			-	-	-	-
Local Assistance for Easements etc.			-	-	3,807	3,807
Total (SCS)			190,262	-	-	-
Grand Total			190,262	-	160,264	350,526
Going Program (SCS)	Acre	6,181	9,271	-	-	-

Table 1 - Continued
Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	FY 1956 No. to be Applied	Estimated Cost Fiscal Year 1956 Federal	Non-Federal Public	Private	Total
			(dollars)	(dollars)	(dollars)	(dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	3,4	118,620	-	20,605 1/	139,225
Total A-Measures			118,620	-	20,605	139,225
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	2,300	-	-	-	-
Cover Crops	Acre	6,200	-	-	40,300	40,300
Diversion Construction	Mile	3	-	-	1,267	1,267
Pasture Reseeding	Acre	700	-	-	11,200	11,200
Farm Ponds	No.	30	-	-	12,000	12,000
Terraces	Mile	300	-	-	40,500	40,500
Waterway Development	Acre	125	-	-	5,000	5,000
Brush Eradication	Acre	800	-	-	12,000	12,000
Rotation Hay & Pasture	Acre	1,200	-	-	14,400	14,400
Range & Pasture Improvement	Acre	5,200	-	-	2,600	2,600
Farm & Ranch Planning & Application Asst. (Accl.)	Acre	3,333	5,450	-	-	5,450
Total B-Measures			5,450	-	139,267	144,717
Total A and B-Measures			124,070	-	159,872	283,942
Facilitating Measures						
Program Evaluation (SCS)			2,920	-	-	2,920
Work Plan Development (SCS)			-	-	-	-
Work Plan Development San Antonio River Authority			-	-	-	-
Local Assistance for Easements etc.			-	-	-	-
Total (SCS)			126,990	-	-	-
Grand Total			126,990	-	159,870	286,862
Going Program (SCS)	Acre	6,181	9,272	-	-	-

Table 1 - Continued
Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	FY 1957 No. to be Applied	Estimated Cost Fiscal Year 1957 Federal (dollars)	Non-Federal Public (dollars)	Private (dollars)	Total (dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	6, 8	112,997	-	11,130 [1/]	124,127
Total A-Measures			112,997	-	11,130	124,127
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	2,300	-	-	-	-
Cover Crops	Acre	6,500	-	-	42,250	42,250
Diversion Construction	Mile	2	-	-	845	845
Pasture Reseeding	Acre	700	-	-	11,200	11,200
Farm Ponds	No.	14	-	-	5,600	5,600
Terraces	Mile	300	-	-	40,500	40,500
Waterway Development	Acre	125	-	-	5,000	5,000
Brush Eradication	Acre	900	-	-	13,500	13,500
Rotation Hay & Pasture	Acre	1,200	-	-	14,400	14,400
Range & Pasture Improvement	Acre	4,600	-	-	2,300	2,300
Farm & Ranch Planning & Application Asst. (Acol.)	Acre	3,333	5,450	-	-	5,450
Total B-Measures			5,450	-	135,595	141,045
Total A and B-Measures			118,447	-	146,725	265,172
Facilitating Measures						
Program Evaluation (SCS)			2,920	-	-	2,920
Work Plan Development (SCS)			-	-	-	-
Work Plan Development San Antonio River Authority			-	-	-	-
Local Assistance for Easements etc.			-	-	-	-
Total (SCS)			121,367	-	-	-
Grand Total			121,367	-	146,725	268,092
Going Program	Acre	6,181	9,271	-	-	-

Table 1 - Continued
Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	FY 1958 No. to be Applied	Estimated Cost Fiscal Year 1958 Federal (dollars)	Non-Federal Public (dollars)	Private (dollars)	Total (dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	7	39,379	-	7,230 1/2/	46,609
Total A-Measures			39,379	-	7,230	46,609
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	2,052	-	-	-	-
Cover Crops	Acre	6,073	-	-	39,475	39,475
Diversion Construction	Mile	2	-	-	845	845
Pasture Reseeding	Acre	591	-	-	9,456	9,456
Farm Ponds	No.	14	-	-	5,600	5,600
Terraces	Mile	136	-	-	18,360	18,360
Waterway Development	Acre	66	-	-	2,640	2,640
Brush Eradication	Acre	1,090	-	-	16,350	16,350
Rotation Hay & Pasture	Acre	864	-	-	10,368	10,368
Range & Pasture Improvement	Acre	4,000	-	-	2,000	2,000
Farm & Ranch Planning & Application Asst. (Accl.)	Acre	2,667	4,360	-	-	4,360
Total B-Measures			4,360	-	105,094	109,454
Total A and B-Measures			43,739	-	112,324	156,063
Facilitating Measures						
Program Evaluation (SCS)			2,920	-	-	2,920
Work Plan Development (SCS)			-	-	-	-
Work Plan Development San Antonio River Authority			-	-	-	-
Local Assistance for Easements etc.			-	-	-	-
Total (SCS)			46,659	-	-	-
Grand Total			46,659	-	112,324	158,983
Going Program (SCS)	Acre	6,181	9,272	-	-	-

2/ Includes $2,400 for moving pipeline.

Table 1 - Continued
Estimated Installation Cost by Years - Total Needed Program
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Measures	Unit	No. of Units to be Applied	Estimated Total Cost			
			Federal	Non-Federal: Public	Private	Total
			(dollars)	(dollars)	(dollars)	(dollars)
A-Measures Primarily for Flood Prevention (SCS)						
Floodwater Retarding Structures	Each	11	592,915	-	85,285 1/ 2/	678,200
Total A-Measures			592,915	-	85,285	678,200
B-Measures for Conservation of Watershed Lands Which Contribute Directly to Flood Prevention (SCS)						
Contour Farming	Acre	10,152	-	-	-	-
Cover Crops	Acre	29,273	-	-	190,275	190,275
Diversion Construction	Mile	12	-	-	5,069	5,069
Pasture Reseeding	Acre	2,991	-	-	47,856	47,856
Farm Ponds	No.	103	-	-	41,200	41,200
Terraces	Mile	986	-	-	133,110	133,110
Waterway Development	Acre	616	-	-	24,640	24,640
Brush Eradication	Acre	4,190	-	-	62,850	62,850
Rotation Hay & Pasture	Acre	4,814	-	-	57,768	57,768
Range & Pasture Improvement	Acre	22,946	-	-	11,473	11,473
Farm & Ranch Planning & Application Asst. (Accl.)	Acre	13,333	21,800	-	-	21,800
Total B-Measures			21,800	-	574,241 3/	596,041
Total A and B-Measures			614,715	-	659,526	1,274,241
Facilitating Measures						
Program Evaluation (SCS)			16,705	-	-	16,705
Work Plan Development (SCS)			12,906	-	-	12,906
Work Plan Development San Antonio River Authority			-	4,095	-	4,095
Local Assistance for Easements etc.			-	-	4,500	4,500
Total (SCS)			644,326	-	-	-
Grand Total			644,326	4,095	664,026	1,312,447
Going Program (SCS)	Acre	29,650	44,475	-	-	44,475

3/ Estimated future ACPS participation of $113,505 included.

Table 2

Status of Conservation Job in Watershed
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

	Unit	Total Conservation Job: Number	Total Conservation Job: Total Cost	Applied to Date	Estimated Cost to Date: Federal 1/	Estimated Cost to Date: Non-Federal Public	Estimated Cost to Date: Private 2/	Remaining to be Applied
			(dollars)		(dollars)	(dollars)	(dollars)	
A-Measures								
Floodwater Retarding Structures	Each	11	699,701	-	-	-	-	11
Sub-Total A-Measures			699,701					
B-Measures								
Contour Farming	Acre	29,255	-	19,103	-	-	-	10,152
Cover Cropping	Acre	37,647	244,705	3,374	2,722	-	51,708	29,273
Diversion Construction	Mile	15	6,336	3	444	-	823	12
Pasture Seeding	Acre	3,216	51,456	225	612	-	2,988	2,991
Pond Construction	No.	240	96,000	137	19,180	-	35,620	103
Terraces	Mile	2,056	277,560	1,070	92,846	-	51,604	986
Waterway Development (Upland)	Acre	944	37,760	328	2,624	-	10,496	616
Brush Eradication	Acre	4,995	74,925	805	3,623	-	8,452	4,190
Rotation Hay & Pasture	Acre	5,059	60,708	245	588	-	2,352	4,814
Pasture & Range Improvement	Acre	23,500	11,750	554	-	-	277	22,946
Farm & Ranch Planning & Application Assistance	Acre	74,880	114,120	31,897	47,845	-	-	42,983
Sub-Total B-Measures			975,320		170,484		164,320	
Total A & B Measures			1,675,021		170,484		164,320	

1/ ACP payments included.
2/ ACP payments have been deducted.

Material included on this page in the preliminary work plan is not applicable to the final work plan.

Table 3
Annual Costs
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

	Amortization of Installation Costs 3/				Operation & Maintenance 4/			
	Federal 1/	Non-Federal Public 1/	Private 2/	Total	Federal	Non-Federal Public	Private	Grand Total
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
A-Measures								
Floodwater Retarding Structures	21,360	144	4,179	25,683	-	825	-	26,508
B-Measures	6,338 7/	0	21,447	27,785	-	-	36,900 6/	64,685
Total A & B Measures	27,698	144	25,626	53,468	-	825 5/	36,900	91,193

1/ 3.5258 percent of Federal and Non-Federal public installation Costs for "A" and "B" measures (50-year period) including interest at 2.5 percent on investment.
2/ 4.6550 percent of private installation cost for "A" and "B" measures, including interest at 4 percent on investment.
3/ 1952 prices, the last complete year for which information is available.
4/ Long term prices (B.A.E.).
5/ Based on estimated average annual maintenance cost of $75 per structure during the 50-year period following installation.
6/ Based on estimated average annual maintenance costs of individual land treatment measures during the 50-year period following application.
7/ Includes $1,568 for Going Program and $4,002 for anticipated ACPS assistance.

Table 4
Summary of Average Annual Monetary Floodwater and Sediment Damage
and Flood Prevention Benefit from the Plan 1/
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)
(Long-term Prices)

Damages	Average Annual Damage			Average Annual Benefit		
	Under Present Conditions	B-Measures Only	With A & B Measures	From B-Measures Only	From A-Measures Only	Total Flood Prevention Benefit from A and B
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Damage						
Crop and Pasture	15,418	13,447	3,627	1,971	9,820	11,791
Flood Plain Scour	9,028	7,809	1,977	1,219	5,832	7,051
Streambank Erosion	36	32	32	4	0	4
Other Agricultural	8,808	7,438	1,416	1,370	6,022	7,392
Roads, Bridges & Railroads	3,880	3,302	636	578	2,666	3,244
Urban	9,514	7,764	1,758	1,750	6,006	7,756
Sub-total	46,684	39,792	9,446	6,892	30,346	37,238
Sediment Damage						
Valley Sediment Deposition	274	205	136	69	69	138
Indirect Damage	6,104	5,200	1,246	904	3,954	4,858
Total Damage	53,062	45,197	10,828	xxx	xxx	xxx
Benefit from Reduction of Damage	xxx	xxx	xxx	7,865	34,369	42,234
Benefit from More Intensive Use of Flood Plain	xxx	xxx	xxx	xxx	16,336	16,336
Mainstem Benefits				1,729	754	2,483
Total Flood Prevention Benefit				9,594	51,459	61,053

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

Table 5
Distribution of Costs and Benefits by Measures and Groups of Measures
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

	Total Cost	Average Annual Cost	Average Annual Benefit				Benefit Cost Ratio
			Floodwater & Sediment Benefit	More Intensive Land Use	Conservation Benefit	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
A-Measures							
Floodwater Retarding Structures Nos. 1 - 11 inclusive	699,701	26,508	35,123	16,336	-	51,459	1.94:1
B-Measures	640,516	64,685	9,594	-	263,126	272,720	4.21:1
Total All Measures	1,340,217	91,193	44,717	16,336	263,126	324,179	3.56:1

Table 6
Floodwater Retarding Structure Data
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Site No.	Drainage Area Sq. Mi.	Storage Capacity Acre Feet: Sediment Pool 1/	Deten-tion Pool	Total	Storage Capacity Inches of Runoff: Sediment Pool 1/	Deten-tion Pool	Total	Surface Area Acres: Top of Sediment Pool 1/	Top of Deten-tion Pool	Max. Ht. of Dam Feet	Flood Plain Area Inundated Acres: Sediment Pool 1/	Deten-tion Pool	Total	Volume of Fill Cu. Yds.	Draw Down Rate cfs	Type of Spillway	Estimated Total Cost (dollars)
1	2.84	304	773	1,077	2.0	5.1	7.1	53	113	28.6	0	3	3	97,954	14	Veg.	59,195
2	2.77	266	753	1,019	1.8	5.1	6.9	49	115	29.5	5	5	10	92,158	14	"	56,786
3	4.66	473	1,268	1,741	1.9	5.1	7.0	61	152	32.6	3	7	10	108,063	23	"	65,850
4	6.24	666	1,697	2,363	2.0	5.1	7.1	106	257	30.0	5	10	15	109,589	31	"	73,375
5	1.33	158	366	524	2.2	5.1	7.3	24	58	26.2	0	0	0	67,713	7	"	39,568
6	2.70	289	736	1,025	2.0	5.1	7.1	43	97	32.7	5	5	10	111,479	14	"	66,007
7	1.96	220	534	754	2.1	5.1	7.2	42	95	25.5	10	12	22	72,257	10	"	46,609
8	3.95	400	1,074	1,474	1.9	5.1	7.9	58	138	29.0	5	10	15	95,853	20	"	58,120
9	7.31	624	2,262	2,886	1.6	5.8	7.4	108	354	30.8	8	10	18	118,968	37	"	78,698
10	2.76	250	750	1,000	1.7	5.1	6.8	44	109	28.4	0	0	0	91,263	14	"	54,744
11	8.43	405	3,013	3,418	0.9	6.7	7.6	99	314	30.1	5	8	13	122,620	42	"	79,248
Total	44.95	4,055	13,226	17,281				687	1,802		46	70	116	1,087,917			2/ 678,200

1/ Maximum, may be reduced in final design

2/

Construction Cost	$435,167
Technical Services	65,275
Contingencies	43,517
Land Easements and Rights-of-way	82,885
Moving Pipeline	2,400
Administrative, Design, Cartographic, etc.	48,956
	678,200

Table 7

Summary of Program Data
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Item	Unit	Quantity
Years to Complete Program	Year	5
Total Remaining Installation Cost		
Federal	Dollar	644,326
Non-Federal	Dollar	668,121 1/
Annual O & M Cost		
Federal	Dollar	0
Non-Federal	Dollar	37,725
Annual Benefits	Dollar	324,179
Floodwater Retarding Structures	Each	11
Maximum Area Inundation by Structures		
Flood Plain	Acre	70
Upland	Acre	1,045
Watershed Area above Structures	Acre	28,768
Reduction of Floodwater Damage		
A-Measures	Percent	65.0
B-Measures	Percent	14.8
Reduction of Sediment Damage		
A-Measures	Percent	25.2
B-Measures	Percent	25.2
Reduction of Upland Erosion Damage		
A-Measures	Percent	0
B-Measures	Percent	64
Other Benefits		
A-Measures	Dollar	17,090
B-Measures	Dollar	264,855

1/ Includes $113,505 that may be available from other Federal funds (ACPS) to reimburse private interests.

Table 8

Summary of Physical Data
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Item	Unit	Quantity Without Program	Quantity With Program
Watershed Area	Sq.Mi.	117.0	117.0
Watershed Area	Ac.	74,880	74,880
Area of Cropland	Ac.	34,452	29,152
Area of Grassland	Ac.	3,921	27,421
Area of Woodland	Ac.	30,595	15,595
Flood Plain Area Subject to Damage by Reservoir Design Storm	Ac.	4,772	2,212
Annual Rate of Erosion			
Sheet	Tons/Yr.	634,804	469,898
Gully	Tons/Yr.	64,977	32,489
Streambank	Tons/Yr.	28,116	25,304
Scour	Tons/Yr.	151,676	33,217
Area Damaged Annually by:			
Sediment	Ac.	8.5	4.3
Flood Plain Scour	Ac.	150.8	33.0
Swamping	Ac.	-	-
Streambank Erosion	Ac.	2.8	2.5
Sheet Erosion	Ac.	32,251	11,603
Sediment Production 1/	Tons/Ac./Yr.	2.3	1.0
Sediment Accumulation in Existing Reservoirs	Ac./Ft./Yr.	-	-
Frequency of Flooding	Events/Yr.	2.65	1.25
Average Annual Rainfall	Inches	31.09	31.09
Average Annual Surface Runoff	Inches	2.99	2.57 2/

1/ Net leaving watershed.

2/ There is no factual information available to indicate that the reduction in surface runoff would cause a corresponding reduction in annual water yield from this watershed.

UNITED STATES
DEPARTMENT OF AGRICUATURE

SOIL CONSERVATION SERVICE
TEMPAE, TEXAS

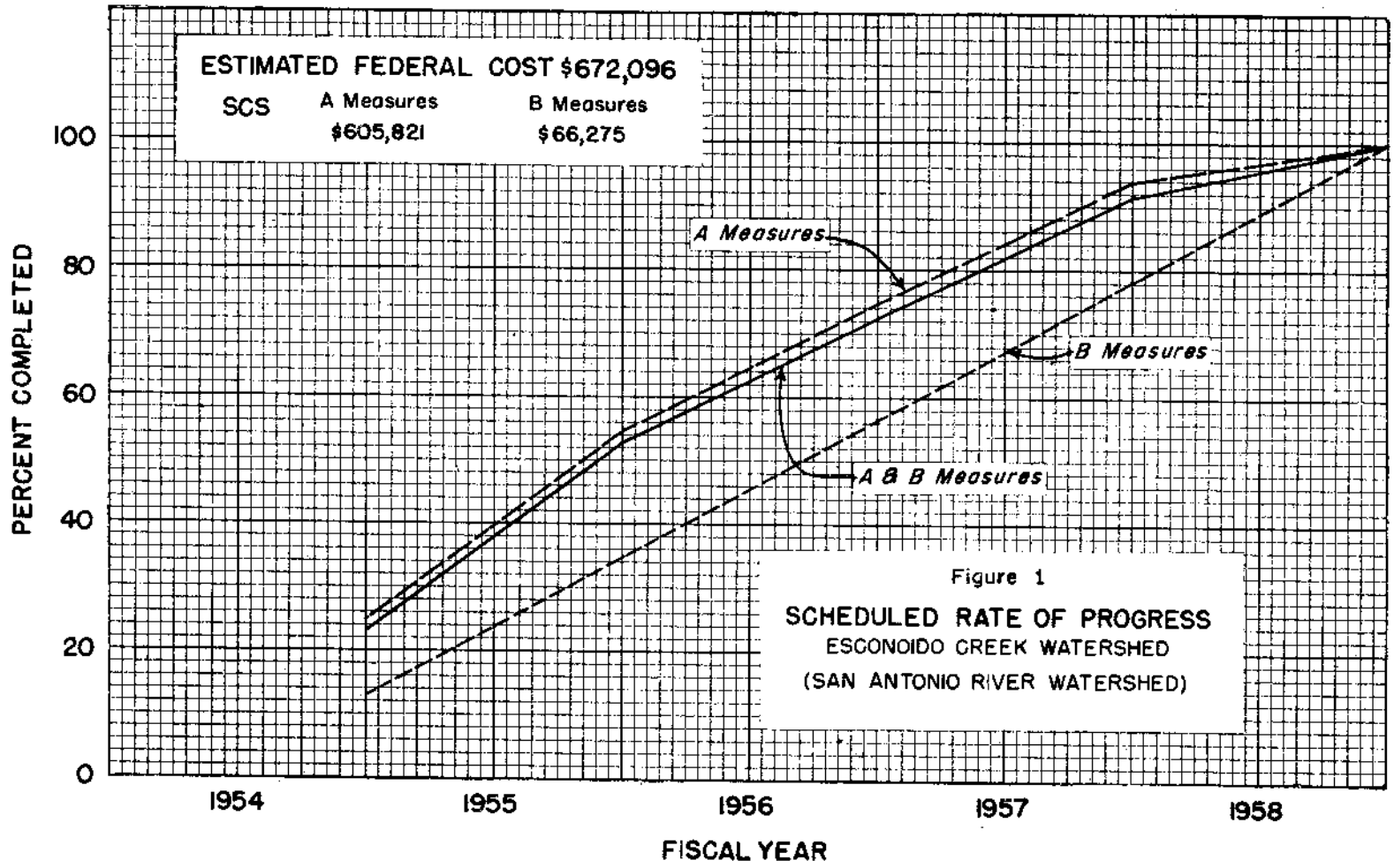


Figure 1

SCHEDULED RATE OF PROGRESS
ESCONOIDO CREEK WATERSHED
(SAN ANTONIO RIVER WATERSHED)

W.C.B. 7-29-54

4-L-8992

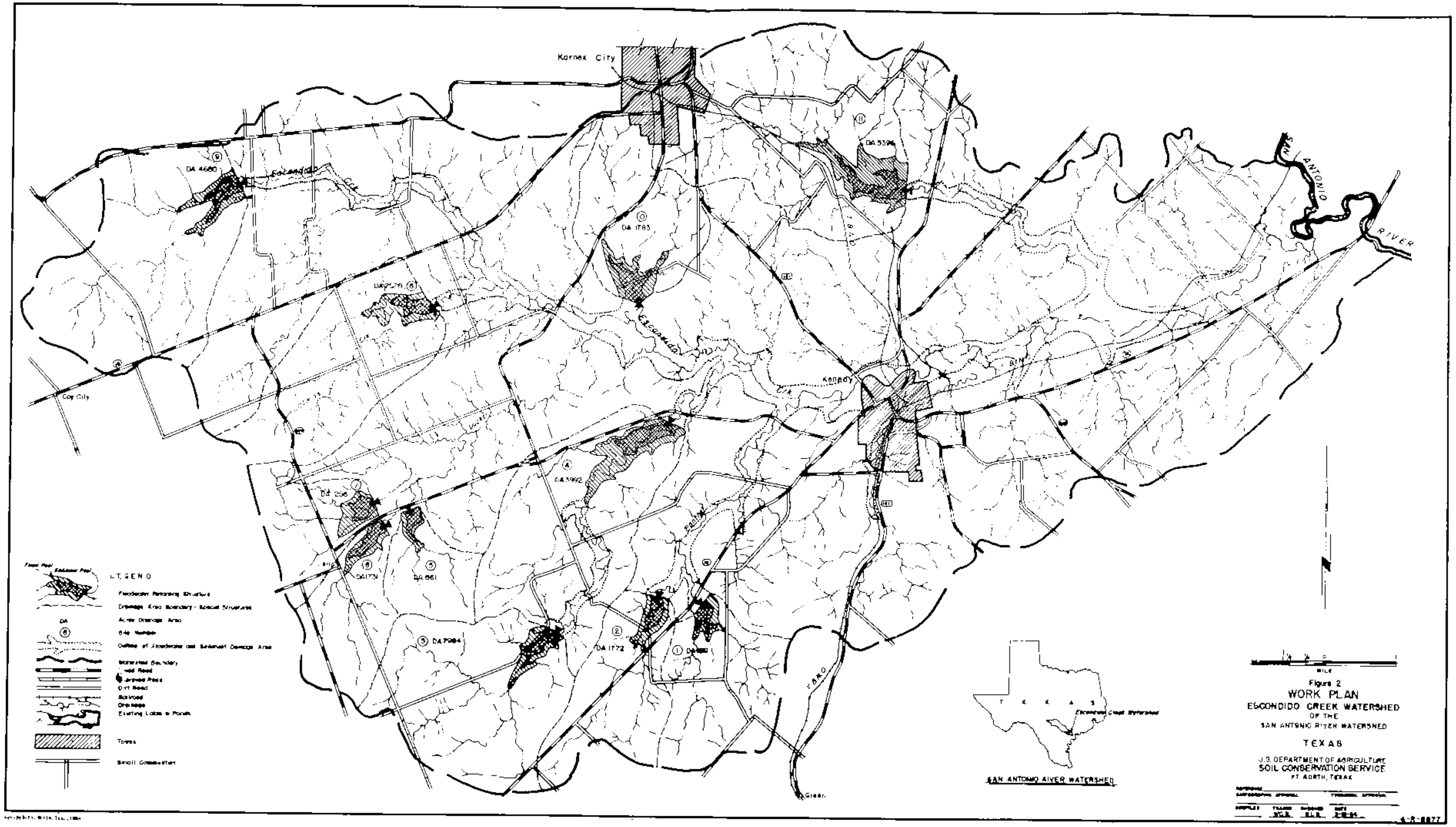


Figure 2
WORK PLAN
ESCONDIDO CREEK WATERSHED
OF THE
SAN ANTONIO RIVER WATERSHED
TEXAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FT. WORTH, TEXAS

A P P E N D I X

I. HYDRAULIC AND HYDROLOGIC INVESTIGATIONS

II. SEDIMENTATION INVESTIGATIONS

III. FOUNDATION AND BORROW INVESTIGATIONS

IV. ECONOMIC INVESTIGATIONS

V. PROGRAM DETERMINATION

VI. TABLES

APPENDIX

HYDRAULIC AND HYDROLOGIC INVESTIGATIONS

Methodology

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

1. Tabulation and analysis of basic meterologic and hydrologic data.

2. Engineering surveys to collect information on stream reaches including valley cross-sections, channel capacities, and other hydraulic characteristics; structure locations and other data for design purposes.

3. Determination of the hydrologic conditions of the watershed, taking into consideration soils, land use, topography, cover, climate, etc.

4. Determination of rainfall-runoff relationships; frequency of occurrence of meterologic events; and relationship of runoff to flood stage and area inundated.

5. Determination of peak discharges under present watershed conditions, as related to area inundated and damages.

6. Determination of peak discharges and area inundated under conditions which will 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 other associated works of improvement.

Determinations

From a graph showing cumulative departures from normal precipitation the rainfall for the period 1923 to 1942, inclusive, was selected as most representative of a normal rainfall period on the Escondido Creek watershed.

The largest rain which occurred during the 20-year period was a storm of 9.67 inches. This rain would, on an average, produce 5.81 inches of runoff. Under present conditions 4,282 acres of the flood plain would be flooded by the runoff from this storm. If such rain were to occur after land treatment practices and measures had been applied, it is estimated that the area inundated would be reduced to 4,127 acres. With land treatment applied and the measures primarily for flood prevention in operation, only 3,751 acres would be flooded.

Approximately 46 acres of flood plain would lie within the sediment reserve pools of the proposed structures and 70 additional acres within the detention pools.

The runoff from the 25-year frequency storm was used to establish the minimum detention storage requirements. The 25-year frequency storm which would produce the maximum runoff was found by plotting intensity-frequency-infiltration curves and selecting the maximum ordinate between them. For Escondido Creek watershed this 25-year maximum runoff was calculated to be 5.10 inches.

From a study of the rainfall-runoff relationships for this watershed it was found that a rain of 2.38 inches, occurring in the period July through October, would produce 0.17 inches of runoff on the average. A rain of 1.57 inches occurring in the period November through June would also produce 0.17 inches runoff on the average. This amount was the minimum that would cause flooding to a depth of six inches at the smallest channel cross-section. Therefore no rains of less than these amounts were considered for flood routing purposes. A runoff of 0.17 inches would produce a discharge of 230 cubic feet per second at the minimum cross-section and 1,000 cubic feet per second at the reference cross-section.

The minimum cross-section is No. 12 located approximately 7 miles northwest of U. S. Highway No. 181. The reference cross-section, No. 5, is located about 1/4 mile northeast of the city limits of Kenedy, Texas, at the confluence of Escondido Creek and Nichols Creek.

Channel capacity at the reference section is 5,110 cubic feet per second. The peak discharge at this point for a 9.67-inch rain under present conditions was 24,230 cubic feet per second. After installation and full functioning of the measures in the watershed plan, the discharge at the same point would be reduced to 12,530 cubic feet per second.

SEDIMENTATION INVESTIGATIONS

Methodology

Field surveys of the sedimentation problems in the Escondido Creek watershed were made according to methods described in the revised "Sedimentation Section of Procedures for Developing Flood Prevention Work Plans," Water Conservation-6, SCS Region 4, March 26, 1952. Field studies included reconnaissance surveys of the upland watershed, studies of overbank sediment deposits, flood plain scour, stream bank erosion, and nature of channels and valleys on and near all hydrologic cross-sections. Borings were made where required to measure and study the modern sediment deposits. In the preparation of the report, tabular summaries of all the above problems with explanatory text were included. These show the basis for evaluation of damages by the economist.

Investigations of sediment sources in the watersheds above the eleven proposed floodwater retarding structures were made according to standard procedures used in Unit 4, and predictions were made for future sedimentation rates in each basin.

Sediment Source Studies

The entire watershed is underlain by uncemented or slightly cemented sedimentary formations of Tertiary (Miocene) age. The upper 35 percent of the area is underlain by the Catahoula formation which consists chiefly of clays, sands and sandy clays with some beds of slightly cemented sandstone. The Oakville formation, which underlies the downstream section (65 percent) of the watershed, consists of calcareous clays and sands on which weathering has produced considerable areas of dark fine-textured soils. Hence the most important sediment sources are clays and sands.

The sediment derived from sheet erosion was estimated by the method presented in "Suggested Criteria for Estimating Gross Sheet Erosion and Sediment Delivery Rates for the Blackland Prairies Problem Areas in Soil Conservation," SCS Region 4, February, 1953. The formula is based on watershed surveys, including the following data: (1) Soil unit in acres by slope in percent, slope length in feet and land use (cultivated, pasture or woods), (2) average farming practices (percent row crop and/or percent small grain, etc.), (3) cover condition classes on pasture and woods, (4) past history of land use, and (5) maximum 30-minute rainfall intensity to be expected once in two years.

The history of the gully development as given by early settlers indicates that the gullies in the area have developed during the past 60 years. Similar historic information was used to determine the rate of channel enlargement.

Based on these studies total annual sediment yields above the proposed floodwater retarding structures were calculated to be as follows: 69.0 acre-feet (86 percent) from sheet erosion, 8.0 acre-feet (10 percent) from modern gullies, and 3.0 (4 percent) acre-feet from channel enlargement. The average yield of sediment per square mile is 1.77 acre-feet annually.

Effect of Watershed Treatment on Sediment Yields

Areas damaged by overbank deposition and flood plain scour will be rendered productive again after they have been protected from flooding and adapted soil-improving crop rotations put into effect.

Deep-rooted legumes (sweet clover) should be grown in the crop rotations to break up the plow pan, improve percolation rates and reduce runoff. Field observations indicate that such crops would need the application of commercial fertilizers, which should be applied according to soil tests.

Present analysis indicates that 46 percent of the watershed is in cropland. The soil is in fair physical condition and the land use is good. At present 60 percent of the cropland is terraced and sown crops are planted on 50 percent of the cultivated acreage. However, it is recommended that deep-rooted legumes be planted on at least one-fourth of the

cropland annually. In addition, terraces are recommended on the steeper slopes to reduce erosion and control runoff. The maintenance of present terrace systems should be improved and adequate outlet systems should be installed and maintained where needed. It is estimated that 67 percent of the gross erosion from the watershed is sheet erosion derived from cropland.

The amount of sediment derived from sheet erosion on open and wooded pasture land (46 percent of the watershed) constitutes 19 percent of the gross erosion from the watershed. However, there are some areas of overuse which would be improved by proper range management practices.

It is estimated that the application of conservation practices on the watershed will reduce sediment from sheet erosion by 26 percent.

Modern gullies in the pasture land and wooded areas are beginning to heal. No overfalls of any consequence are present, and very little ancient gully erosion was noted.

The application of needed land treatment measures is expected to reduce modern gully erosion by 50 percent.

It is estimated that these reductions in sediment yield throughout the watershed will increase the average life of the sediment reserve pools of floodwater retarding structures by 25 percent.

FOUNDATION AND BORROW INVESTIGATIONS

Methodology

Preliminary foundation investigations were made at four representative dam sites. These investigations included studies of the valleys, the exposed rock sections, including lithology, stratigraphy and structure. Borings were made along the center lines and in the borrow areas at the proposed sites, and both alluvium and bedrock as they might affect construction were described. These investigations were made with a Failing - 1500 core-drill rig. Geologic cross-sections of the valleys were plotted at all four dam sites.

Description of Formations

The center lines of the four sites (1, 2, 3 and 10) investigated are located in the Oakville sand formation of Miocene age. This formation contains interbedded silts and clays as well as sand. Chalk or caliche outcrops occur on the surface, especially on the tops of the hills. The investigations on the above sites should represent conditions in five other sites (4, 5, 6, 7 and 11) located in the Oakville sand formation. Sites 8 and 9 located in the northeast section of the watershed are in the Catahoula tuff formation. This formation contains volcanic tuff, conglomerates, and noncalcareous ash beds.

Valley Slopes

The valley slopes, from the ends of the dams down to the valley floors, are fairly uniform as to surface and underlying material. The soils on the slopes are principally residual silty clays and sandy clays and are underlain by beds of clay and sand.

Borrow Areas

The borrow materials appear to be of adequate quantities and should be suitable for construction throughout the depth examined and sampled. These materials consist principally of fine-textured materials with occasional thin sandy zones.

Preliminary Recommendations

The beds outcropping on the slopes should present no particular difficulties in construction of the abutments. In some sections in the abutments and along the center line of the dams, the clays are underlain by a sandy member of the formation. In most cases this sandy formation should offer no foundation problems, but its situation may necessitate special design. The flood plains are fairly narrow and contain varying deposits of loose sands with small amounts of gravels. These materials should be removed during construction. No borings were made on sites 8 and 9, located in the Catahoula tuff formation. Field inspection of the surface geology at these sites indicate that detailed investigation should be made on these sites. Special design and construction procedures will probably be required on these structures. Laboratory tests will be made to determine the quality of materials for embankments and core walls.

Detailed investigations will be made at all sites before they are designed for construction.

ECONOMIC INVESTIGATIONS

Methodology

The procedures outlined in the Economic Section of Water Conservation-6 Revised, were followed in the economic investigation. The following data have been submitted to the Engineering and Watershed Planning Unit office to substantiate the findings in this work plan:

1. Map of flood plain showing current land use.

2. Table showing damageable value per acre of flood plain.

3. Table showing crop damage rates by seasons and depths.

4. Tables showing damage by floods in the evaluation series to crops, other agricultural and nonagricultural property.

5. Table summarizing damage at current prices.

6. Table showing intensification of flood plain land use.

7. Table showing conservation benefit.

8. Table showing loss of production in reservoir areas.

9. Table showing individual structure justification.

Determination of Damage

Flood damage information for 70 percent of the flood plain area of Escondido Creek and its major tributaries was obtained from landowners or operators. Most of the specific information as to the amount and extent of damage related to the September 1946 flood. Other information obtained included flood plain land use, yields of major crops, property damage which would result from a major flood and the general flood problem. The monetary value of the percentage of damage to flood plain lands by sediment deposition and scour was determined on the basis of present values and costs.

Damage rates were determined for both season and depth of flooding. Monetary evaluation was based on present prices and costs. After determining the amount of crop damage which would have resulted from single floods during the 20-year rainfall period, this figure was adjusted for recurrence of flooding. Other agricultural damage rates were based on acres inundated by a given flood. The percentage of damage to flood plain lands by sedimentation and scour was determined on the basis of reduced productivity and increased cost of production.

Determination of Benefits

1. Floodwater Reduction Benefits

Floodwater and sediment damages were calculated under present conditions and those which will prevail after the installation of each class of measures included in the recommended program. The difference between average annual damages at the time of initiation of each class of measures and those expected after their installation constitutes the benefit brought about by that group through reduction of damage.

Benefits from reduction of crop and pasture damages were estimated from the combined effects of reduction in area inundated and depth of inundation. No benefits were estimated for pool areas of the floodwater retarding structures.

Benefits from the reduction of valley sediment damages, flood plain scour, and other agricultural damages derived from each class of measures were determined on the basis of the reduction of area inundated, lower sediment yield from upland areas and sediment storage in floodwater retarding structures.

2. Determination of Annual Benefit from Intensified Use of the Flood Plain.

Benefits from more intensive agriculture use of flood plain lands resulting from the installation of floodwater retarding structures, were calculated on the basis of reductions in extent and frequency of flooding and statements of intent given by owners or operators of the flood plain lands. See Appendix Table 1, page 9.

PROGRAM DETERMINATION

The location and extent of various land capability classes within the watershed were determined from soil surveys. From this basic information determination was then made of the needed amounts of those conservation measures which contribute directly to flood prevention.

The hydraulic, hydrologic, sedimentation and economic investigations provided data on the effects of land treatment in terms of conservation benefits and the reduction of flood damages resulting from such treatment.

Although significant benefits would result from installation of land treatment measures, it was apparent that additional measures would be required to attain the degree of watershed protection and flood damage reduction desired.

Determination was made secondly, therefore, of measures primarily for flood prevention which would be feasible to install. The study made and the procedures used in that determination were as follows:

A base map of the watershed was prepared showing the watershed boundary, drainage pattern, system of roads and railroads, the limits of the towns of Kenedy and Karnes City and other pertinent items.

Using consecutive 4" aerial photographs and a stereoscope, all probable floodwater retarding structure sites were located, the limits and the area of the flood plain delineated, and points marked 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 made at representative places in the valley. Data developed from these cross-sections permitted the computation of stage-area inundated relationships for various flood flows.

A field examination was made of all probable floodwater retarding structure sites previously located on the watershed base map. Sites which did not show good storage possibilities or which would inundate railroads, improved highways or highly developed areas were dropped from further consideration. From the remaining sites a system of reservoirs was selected for further consideration and detailed survey.

A topographic map was made of each proposed reservoir site 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 reserve and flood pools. The height of the dams and size of the pools were determined by the storage volume needed to detain the runoff from the design storm and additional storage needed for sediment.

The limits of the flood pools and sediment reserve pools of all satisfactory sites and the flood plain of the stream were drawn to scale on a copy of the base map. A structure data table was developed to show for each proposed structure the drainage area, storage capacity for floodwater detention and for sediment storage in acre-feet and inches of runoff from the drainage areas, release rate of the outlet tube, acres of flood plain inundated by the sediment reserve and detention pools, volume of fill in the dams and estimated cost of the structures. Investigated structures which were found to return less benefit than their cost were eliminated from the plan.

When the land treatment measures and those measures primarily for flood prevention had been determined, a table was developed which gave the total cost of each type of measure and the portion of the cost to be borne by the participants. The summation of the total costs for all the needed measures represented the estimated cost of the flood prevention-conservation program for the watershed.

APPENDIX

Table 1

Increase in Income Through More Intensive Use of Flood Plain Lands
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Land Use	Acres	Yield	Production	Gross Income	Cost	Net Income
				(dollars)	(dollars)	(dollars)
		(1952 Price Levels)				
Present Conditions:						
Cotton	641	275 lb.	176,275	73,859	36,992	36,867
Corn	349	35 bu.	12,215	22,353	6,153	16,200
Grain Sorghum	128	18 cwt.	2,304	6,267	1,770	4,497
Forage Sorghum	318	3 ton	954	26,788	5,552	21,236
Oats	109	8 AUM	872	4,447	2,929	1,518
Flax	132	14 bu.	1,848	6,597	1,882	4,715
Idle	70	-	-	-	-	-
Pasture	2,069	0.7 AUM	1,448	7,385	-	7,385
Miscellaneous	66	-	-	-	-	-
Total	3,882			147,696	55,278	92,418
After Land Treatment and Detention Storage:						
Cotton	858	275 lb.	235,950	98,863	49,515	49,348
Corn	468	35 bu.	16,380	29,975	8,251	21,724
Grain Sorghum	172	18 cwt.	3,096	8,421	2,379	6,042
Forage Sorghum	426	3 ton	1,278	35,886	7,438	28,448
Oats	146	8 AUM	1,168	5,957	3,923	2,034
Flax	177	14 bu.	2,478	8,846	2,524	6,322
Pasture	1,569	0.7 AUM	1,098	5,600	-	5,600
Miscellaneous	66	-	-	-	-	-
Total	3,882			193,548	74,030	119,518

Net Increase	27,100
Less Added Damage	527
Less Clearing Cost	1,400
Less Overhead	1,650
	23,523
Discounted to Present Worth	0.926
	21,782
Long-Term Price Adjustment	0.75
Net Benefit	16,336

APPENDIX

Table 2

Individual Justification - Floodwater Retarding Structures
ESCONDIDO CREEK WATERSHED
(San Antonio River Watershed)

Total Benefits from Floodwater Retarding Structures - $ 51,459

Drainage Area Controlled (Table 6) - 44.95 square miles

Benefit per Square Miles Controlled - $1,144.80

Individual Structure Justification

Site No.	Drainage Area Sq. Mi.	Total Cost	Annual Cost	Annual Benefit	Benefit-Cost Ratio
1	2.84	$ 60,553	$ 2,279	$ 3,251	1.43 : 1
2	2.77	58,111	2,201	3,171	1.44 : 1
3	4.66	68,081	2,559	5,335	2.08 : 1
4	6.24	76,360	2,928	7,144	2.44 : 1
5	1.33	40,204	1,523	1,523	1.00 : 1
6	2.70	67,298	2,510	3,091	1.23 : 1
7	1.96	47,546	1,836	2,244	1.22 : 1
8	3.95	60,010	2,262	4,522	2.00 : 1
9	7.31	82,194	3,137	8,368	2.67 : 1
10	2.76	56,063	2,112	3,160	1.50 : 1
11	8.43	83,281	3,161	9,650	3.05 : 1
Total	44.95	699,701	26,508	51,459	1.94 : 1

Analysis of Installation Costs

Site No.	Total Cost	Easement Total	Easement Annual	Other Total	Other Annual	Total Annual Cost
1	$ 60,553	$ 5,810	$ 271	$ 54,743	$ 1,933	$ 2,204
2	58,111	6,560	305	51,551	1,821	2,126
3	68,081	6,955	324	61,126	2,160	2,484
4	76,360	13,650	635	62,710	2,218	2,853
5	40,204	2,665	124	37,539	1,324	1,448
6	67,298	5,250	244	62,048	2,191	2,435
7	47,546	4,830	225	42,716	1,536	1,761
8	60,010	5,880	274	54,130	1,913	2,187
9	82,194	13,860	645	68,334	2,417	3,062
10	56,063	5,005	233	51,058	1,804	2,037
11	83,281	12,420	578	70,861	2,508	3,086
Total	699,701	82,885	3,858	616,816	21,825	25,683

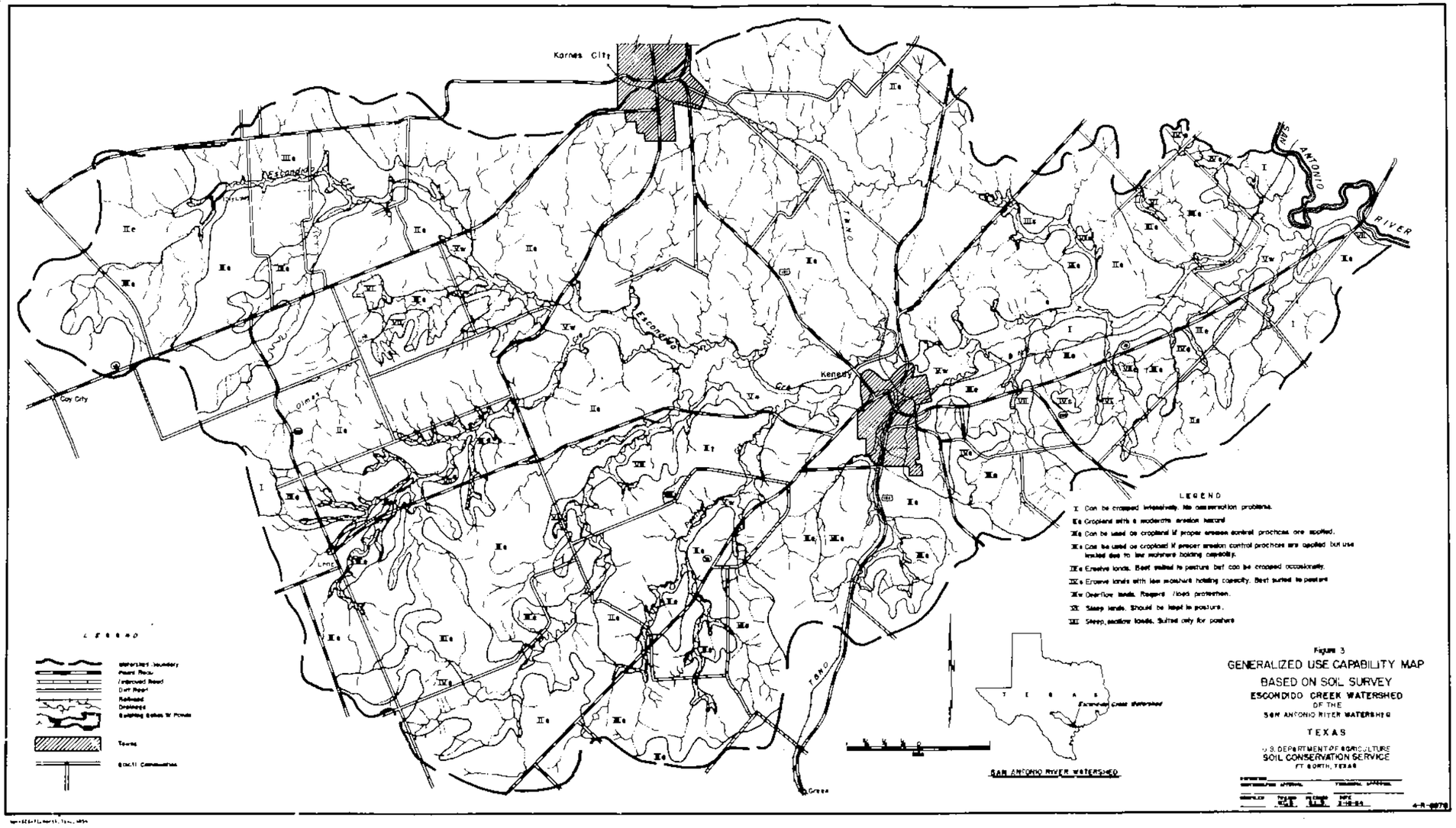


Figure 3

GENERALIZED USE CAPABILITY MAP

BASED ON SOIL SURVEY

ESCONDIDO CREEK WATERSHED

OF THE

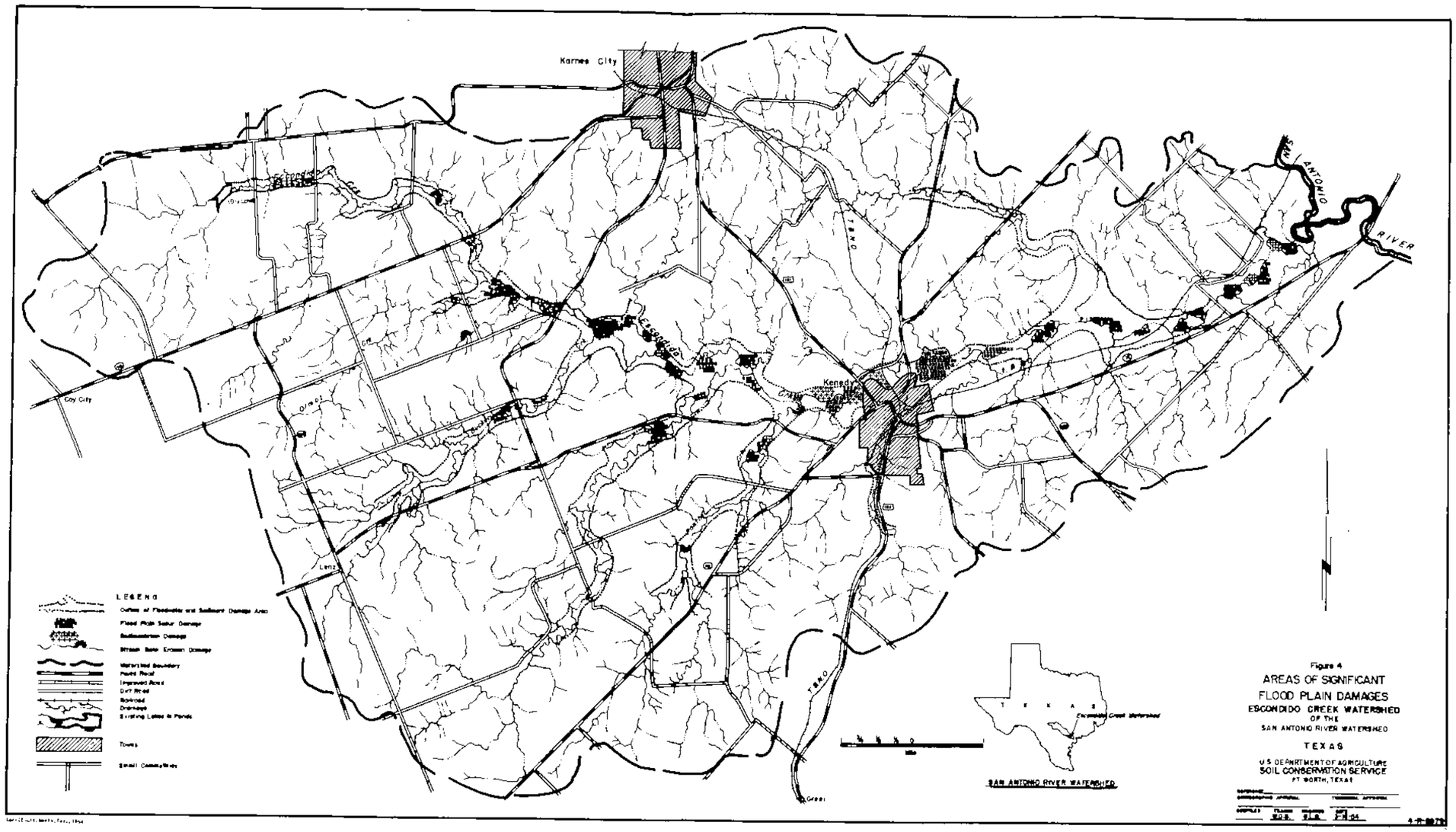
SAN ANTONIO RIVER WATERSHED

TEXAS

U.S. DEPARTMENT OF AGRICULTURE

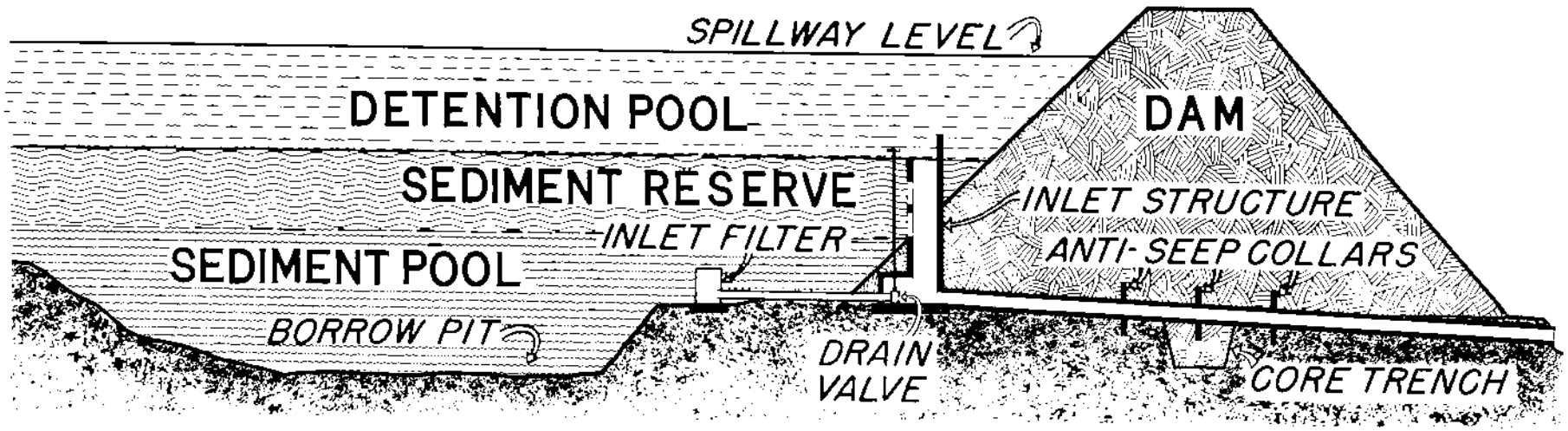
SOIL CONSERVATION SERVICE

FT. WORTH, TEXAS


Karnes City
Kenedy
Gay City
Lenz
Ormet
KENEDY
TEXAS
SAN ANTONIO RIVER
LEGEND
Outlines of Floodwater and Sediment Damage Area
Flood Plain Scour Damage
Sedimentation Damage
Stream Bank Erosion Damage
Watershed Boundary
Paved Road
Improved Road
Dirt Road
Railroad
Drainage
Existing Lakes or Ponds
Towns
Small Community
SAN ANTONIO RIVER WATERSHED
Figure 4
AREAS OF SIGNIFICANT
FLOOD PLAIN DAMAGES
ESCONDIDO CREEK WATERSHED
OF THE
SAN ANTONIO RIVER WATERSHED
TEXAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FT. WORTH, TEXAS

UNITED STATES
DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE
FORT WORTH, TEXAS



SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

Agr-309-Ft. Worth, Tex., 1954

Revised 4-13-54 4-R-8653

PROGRAM EVALUATION SUPPLEMENT

Objective

Areas in which benefits are expected to accrue.

Hydrologic and sedimentation instrumentation needed to measure the effects of the program.

Plan of Study

Cooperative arrangements with other agencies.

Cost of evaluation program.

Structure and hydrologic gage location map.

EVALUATION OF WATERSHED PROGRAM
ESCONDIDO CREEK WATERSHED
Of the San Antonio River Watershed
Karnes County, Texas

Objective

The broad objective of the project evaluation is to evaluate the effects of a watershed protection program in both physical and economic terms. To properly evaluate the effects, it will be desirable to measure various physical and economic factors within the watershed and the changes brought about in them by the application of the program. This will include changes in rainfall-runoff characteristics, erosion, flood and sediment damages, evaporation losses and agricultural production resulting from soil and water conservation improvements.

This information will be beneficial to (1) the Soil Conservation Service in the planning and design of watershed protection measures on other similar watersheds, (2) other Federal agencies in the planning, design and operation of downstream structures, (3) State and Federal agencies in their assistance to industries, municipalities, etc., in the development of water supplies, and (4) landowners and operators in the proper use and management of watershed lands.

The specific objective of the evaluation studies will be to determine the relation between estimated and observed benefits expected to accrue annually as a result of the applied program. These annual benefits are estimated to be: 1/

1.	Reduction of floodwater and sediment damages	$44,717
2.	More intensive use of flood plain lands	16,336
3.	Conservation benefits	263,126
	Total all measures	$324,179

Discussion of areas in which benefits are expected to accrue

Benefits from reduction of floodwater and sediment damage are expected to occur below all floodwater retarding structures. The area now subject to damage is shown on Figure 4 of the preliminary work plan.

Benefits from more intensive use of flood plain lands will accrue along the main channel of Escondido Creek and its tributaries. (See flood plain area, Figure 2 of the preliminary work plan).

Conservation benefits are expected to accrue throughout the watershed as a result of land use adjustments and installing conservation measures. Records will be maintained on the physical and economic effects of these measures.

The major portion of the "off-site" benefits are expected to accrue primarily

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1/ Table 5 Escondido Creek Watershed Preliminary Work Plan.

as a result of installation of the "A" measures included in the program. The groups of "B" measures which will contribute to the reduction of "off-site" damage will be primarily instrumental in bringing about increased conservation benefits.

Hydrologic and sedimentation instrumentation needed to measure the effects of the program

The objectives of installing measuring devices are to measure precipitation in the watershed, and to measure stream flow in such a manner that hydrographs can be computed and relationships between runoff, stage and area inundated can be determined where applicable. Means must also be provided for determining the amount of sediment carried by the stream flow in determining the reduction in sediment deposition and damages.

To accomplish these objectives it will be necessary to install at the locations shown on the attached map the following:

1. 10 standard rain gages
   2 recording rain gages.
2. 2 water stage recorders and staff gages (reservoir)
3. 9 staff gages (reservoir)
4. 2 recording stream flow gaging stations.

Plan of Study

The objective of this plan of study is to outline the procedure to be used in relating the measurements and schedules taken in the field to the benefits to be achieved by the installation of the watershed protection program.

1. The reduction of floodwater and sediment damage will be determined in the following manner:

   The rain gages, water stage recorders, and stream flow gages will provide a record of the storms, inflow and outflow hydrographs in key structures and a record of stream flow for the main stream reach and tributaries in which floodwater and sediment damage occur. Measurement of sediment deposition in the structure will give a quantitative measurement of sediment movement. Damages will be appraised by qualified personnel after each flood occurring during the period of evaluation. For each event, the following determinations will be made:

   a. Damage with measures installed.
   b. Damage that would have occurred without the measures.
   c. Benefits creditable to the measures.

   An annual report will be made of the benefits accruing to the program.

2. More intensive use of land

Annual records will be kept by work unit personnel of land use changes brought about by the protection provided by the floodwater retarding structures and other program measures. Comparison of net returns with and without the program will provide the measurement of benefits.

3. Conservation benefits

Records will be kept by work unit personnel of the quantities of B measures installed, the initial cost and the increased net returns resulting therefrom.

Cooperative arrangements with other agencies

This plan has been formulated in conjunction with representatives of the USGS, the Weather Bureau and the San Antonio River Authority.

The USGS has agreed to the following: furnish and install staff gage scales on 9 floodwater retarding structures; furnish, install, operate and maintain a water stage recorder on Site 11; furnish, install and operate a stream flow gaging station at U. S. Highway 181 on Escondido Creek; furnish, install and operate a recording stream flow gaging station on Dry Escondido Creek below proposed Site 11, until such time as Site 11 is built; and operate a water stage recorder on Site 1 on a reimbursable basis from the Soil Conservation Service and furnish an analysis of flood runoff and data on this site to the Soil Conservation Service. The San Antonio River Authority will assist the USGS in installing and operating the two stream gages mentioned above.

The Weather Bureau has agreed to purchase and install the 10 standard and 2 recording rain gages, cost to be borne by the Soil Conservation Service.

The Soil Conservation Service, in addition to reimbursing the USGS and the Weather Bureau as indicated above, will do the following: furnish and install a water stage recorder on floodwater retarding structure No. 1; furnish and install staff gage backings for 9 additional floodwater retarding structures; and maintain and read the gages and keep the rainfall records.

Once a year, or as necessary, a Soil Conservation Service engineering party will rerun cross-sections and take silt deposition measurements in floodwater retarding structure sites.

Once a year work unit personnel will bring up to date physical inventories and record any other pertinent information available.

With assistance of the Engineering and Watershed Planning Unit, each calendar year a summary of benefits and costs from works of improvement will be prepared for each independently evaluated single or group of "A" measures installed and for the "B" measures as a group. Insofar as possible, these evaluations will be the same as those evaluated in the work plan. This information will be put in report form and made available to the State Conservationist for submission to Washington.

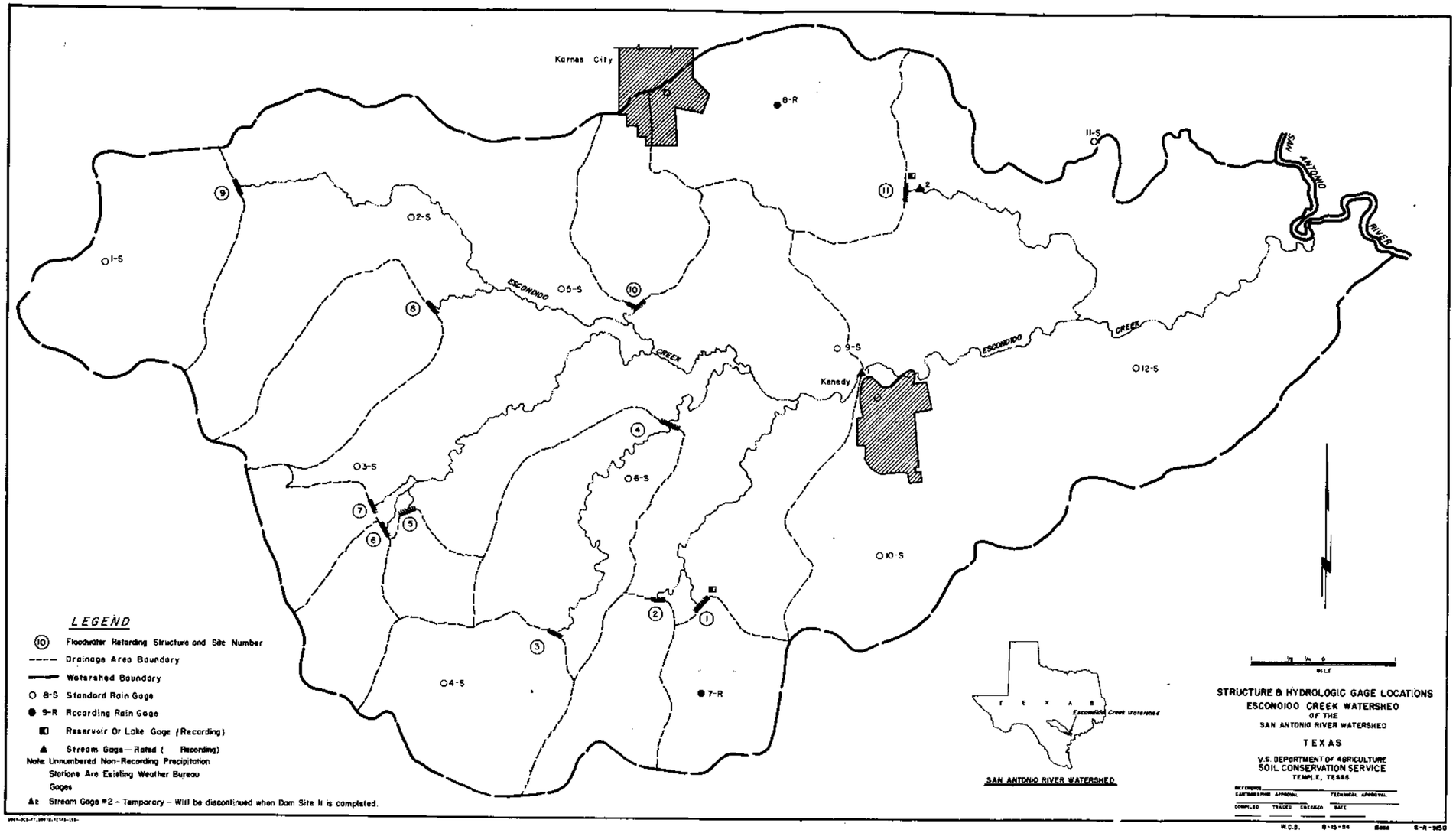
Cost of Evaluation Program

	Costs	
	Installation (Dollars)	Annual Operation (Dollars)
The U. S. Weather Bureau will:		
1. Purchase and install 12 rain gages (10 standard and 2 recording)	0	0
The Soil Conservation Service will:		
1. Furnish, install, and maintain the water stage recorder on Site 1	2,873.00	1/
2. Reimburse USGS for the operation of a water stage recorder and hydrologic computation of reservoir records on Site 1 and analysis of rainfall data		1,400.00
3. Furnish and install staff gage backings on 9 other sites	680.00	
4. Furnish and install fence for rain gages (12)	362.00	
5. Operate and maintain gages		600.00
6. Reimburse U. S. Weather Bureau for the cost and installation of rain gages	1,110.00	
7. Make economic investigations of flood-water and sediment damage, and make periodic resurveys of sedimentation in reservoirs		500.00 2/
8. Make annual inventory of land use and crop yields in the flood plain		420.00 2/
Total Cost SCS	5,025.00	2,920.00

1/ To be inspected at time of rain gage visits.

2/ Source of funds for economic evaluation; These SCS costs will be a part of the technical services charge included in Table 1 of the work plan. It is anticipated that the ARS, Production Economics Research Branch, will supply a part of the personnel services needed in the collecting, recording, analyzing data and preparing reports from funds allotted to them in the Watershed Protection budget.

	Costs	
	Installation (Dollars)	Annual Operation (Dollars)
The U. S. Geological Survey will:		
1. Furnish and install staff gage scales on 9 floodwater retarding structures	1,000.00	
2. Analyze rainfall data; operate a water stage recorder and make hydrologic computations of reservoir records on Site 1	0	0
3. Furnish, install, operate and maintain the water stage recorder at Site 11	2,000.00	1,400.00
4. Furnish, install and operate recording stream flow gaging station at U. S. Highway 181 on Escondido Creek	2,500.00	1,000.00
5. Furnish, install and operate recording stream flow gaging station on Dry Escondido Creek near the site of proposed Site 11. (San Antonio River Authority to assist USGS with cost of items 3, 4 & 5 to the extent of 1/2 the cost)	2,000.00	1,000.00
Total Cost USGS	7,500.00	3,400.00


Karnes City
8-R
11-S
SAN ANTONIO RIVER
ESCONDIDO CREEK
01-S
02-S
05-S
09-S
Kenedy
12-S
03-S
06-S
10-S
04-S
07-R
LEGEND
Floodwater Retarding Structure and Site Number
Drainage Area Boundary
Watershed Boundary
8-S Standard Rain Gage
9-R Recording Rain Gage
Reservoir Or Lake Gage (Recording)
Stream Gage — Rated (Recording)
Note: Unnumbered Non-Recording Precipitation Stations Are Existing Weather Bureau Gages
Stream Gage #2 – Temporary – Will be discontinued when Dam Site 11 is completed.
TEXAS
Escondido Creek Watershed
SAN ANTONIO RIVER WATERSHED
MILE
STRUCTURE & HYDROLOGIC GAGE LOCATIONS
ESCONDIDO CREEK WATERSHED
OF THE
SAN ANTONIO RIVER WATERSHED
TEXAS
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE, TEXAS
W.C.S. 8-15-54 Sheet S-R-1950