WATERSHED WORK PLAN

CUMMINS CREEK WATERSHED

Austin, Colorado, Fayette

And

Lee Counties, Texas

Prepared Under The Authority Of The

Watershed Protection And Flood Prevention Act

(Public Law 566, 83rd Congress, 68 Stat, 666)

May 1955

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Prepared Under the Authority of the
Watershed Protection and Flood Prevention Act

Prepared by

Burleson-Lee Soil Conservation District
Bastrop-Fayette Soil Conservation District
Colorado Soil Conservation District
Austin-Washington Soil Conservation District

With Assistance by

U. S. Department of Agriculture
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INTRODUCTION

Authority

The Watershed Work Plan for the Cummins Creek watershed in Austin, Colorado Fayette and Lee Counties, Texas, hereinafter referred to as the Plan, will be carried out under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666).

Purpose and Scope of Plan

The Burleson-Lee, Bastrop-Fayette, Colorado, and Austin-Washington Soil Conservation Districts provide through their Programs and Work Plans for the application of a complete program of soil and water conservation and improved plant management within this watershed. Their objectives are to use each acre of agricultural land in accordance with its capabilities for sustained agricultural production and to treat each acre in accordance with its needs for protection and improvement. Such a program, when applied and maintained on all the land within the watershed, will be effective in reducting runoff from small rains and will effect some reduction in peak flows from excessive rains. An effective land treatment program will have a major effect in the reduction of upland erosion rates which in turn will reduce sediment damages. Additional measures primarily for flood prevention are needed to complete the soil, plant, and water conservation program in the watershed and provide effective reductions in flood damage.

The purpose of this plan is (1) to state specifically the land treatment and structural practices and measures which are designed primarily for, or contribute directly to flood prevention and (2) to specify how, when, and by whom they will be carried out to achieve the maximum practicable reduction of erosion, flood water and sediment damages. The measures and practices planned herein constitute an integral part of the complete soil, plant, and water conservation program in this watershed and have been incorporated in the work plan of each of the soil conservation districts concerned.

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 a level consistent with the capabilities of the land, thereby promoting the welfare of the landowners and operators, the community, the State, and the Nation.

The area in the watershed includes parts of four counties, Lee, Fayette, Colorado, and Austin, and contains 204,896 acres.

SUMMARY OF PLAN

This plan is a combination of land treatment practices and flood prevention measures which contribute directly to soil, plant and water conservation and flood prevention. The works of improvement as listed in Table 1 are planned to be installed during a 10-year period at an estimated total cost of $4,682,951 of which $2,825,451 is to be borne by non-Federal interests and $1,857,500 by the Federal Government.

The Burleson-Lee, Bastrop-Fayette, Colorsdo, and Austin-Washington Soil Conservation Districts, under provisions of State enabling legislation, have agreed to assume responsibility for overall periodic inspection and maintenance of the floodwater retarding structures at an estimated annual cost of $3,262. The landowners and operators will maintain the land treatment measures at an estimated annual cost of $90,359, in accordance with provisions of the farmer-district cooperative agreements.

Comparisons of Benefit and Cost

With the works of improvement applied and operating at full effectiveness, the ratio of the estimated average annual benefit from the structural measures $200,408, to the estimated average annual equivalent costs, $82,046, is 2.44 to 1, based on current price levels for costs and long-term prices for benefits.

DESCRIPTION OF WATERSHED

Physical Data

Cummins Creek rises near the town of Giddings in Lee County and flows in a southeasterly direction toward Round Top in Fayette County and then generally south, entering the Colorado River about one mile northeast of Columbus in Colorado County. The watershed is approximately 40 miles long and averages about 8 miles in width. Red Gages Creek, Boggy Creek, Bull Branch, Clear Creek, Shaws Creek, Rocky Creek, and Jacks Creek are the major tributaries (Figure 1).

The watershed has an area of 204,896 acres (320.15 square miles), of which 200,436 acres are in farms and ranches and 4,460 acres are in urban areas, roads and other miscellaneous uses. There are 13,303 acres of bottom land in the watershed, of which 11,655 acres are flood plain and 1,648 acres are stream channel. Included in this acreage is the flood plain of four tributaries (Bull Branch and Boggy, Clear, and Shaws Creeks) and the bottom land common to Cummins Creek and the Colorado River. The upper limit of the Cummins Creek flood plain is at its confluence with Flat Creek. Under present conditions the entire flood plain would be inundated by the design storm which would produce 6.2 inches of runoff.

The soils of the area, in general, are in fair physical condition. The land now in cultivation has lost approximately seven inches of topsoil and much organic matter through long, intensive cultivation. A considerable acreage of land formerly cultivated is now covered with grass; however, approximately 1,127 acres of Class VII land remain in cultivation.

The topography of the watershed ranges from nearly flat to moderately rolling prairie and savannah. Areas of wooded pasture predominate in the lower portion of the watershed. Elevations range from 480 feet above sea level in the extreme upper headwaters to 185 feet at the confluence of Cummins Creek and the Colorado River. The main alluvial valley of Cummins Creek ranges in width from approximately 10,000 feet at its junction with the flood plain of the Colorado River to less than 150 feet near the headwaters.

At the present time approximately 23 percent of the watershed is in cultivation. Row crops are grown on 72 percent of the cultivated acreage. Johnsongrass and broadcast hay crops occupy 22 percent, and sweet clover and oats the remaining 6 percent of all cropland. Total land use in the watershed is estimated as follows:

Land Use	Acres	Percent
Cultivation	47,437	23
Pasture and Range	101,090	49
Wooded pasture	42,709	21
Woods	1,860	1
Formerly cultivated	7,340	4
Miscellaneous 1/	4,460	2
Total	204,896	100

1/ Includes roads, highways, railroad rights-of-way, towns, etc.

The Cummins Creek watershed is underlain entirely by formations of Tertiary age. Those of Eocene series are the Yegua formation and the Jackson group. Miocene rocks are the Catahoula sandstone, Oakville sandstone and Lagarto clay. These formations dip southeast approximately 40 feet per mile and strike northeast-southwest.

The Jackson group, located in the upper reaches of the watershed, includes all Eocene strata above the Claiborne group. It lies conformably upon the Yegua and is overlain by the Catahoula formation. The Jackson group consists of shallow-water, marine, and beach deposits, composed of medium and fine grained, thin bedded sand, argillaceous and tuffaceous clays and tuffs, and pockets of coarse, rounded, and polished sand grains.

The Catahoula is composed of soft sandstone with interbedded ash beds and also contains heavy clays and considerable large gravel. The rocks are not hard and soften when covered with water. Some of the soils and bedrock may contain considerable amounts of bentonite. Gravel terracing is quite pronounced throughout the areal extent of the formation.

Outcrops of the Oakville sandstone occur in the central reaches of the watershed. This formation consists of sandstone, grits, gritstone and silt interbedded with clay making up a section of strata between the Catahoula formation and the overlying Lagarto clay. Hard cemented sandstone and shale were observed in road cuts near Rocky Creek.

The Largarto clay is found in the southern part of the watershed and is composed of calcareous clay and a little sand. Exposed channel banks show sandy clay and marly clay overlying shaly clay.

Field examination of Piney Creek in the extreme lower reaches of the watershed, revealed heavy deposition of Quaternary sands and gravels. Exposed channel banks consist of well-oxidized, fine to very coarse sands containing a slight amount of clay.

There are three types of range sites in the Cummins Creek watershed, described as follows:

The Oak Sandy Site lies within the Forested Coastal Plains area and includes medium and coarse textured soils. The climax vegetation is savannah grassland composed of scattered post oak and associated woody plants with a heavy cover of little bluestem, Indiangrasses, paspalums, and panicums. Due to continued heavy grazing the more desirable grasses have been severely reduced in density and the oak-brush species have increased.

The Gravelly Hills Site is also a Forested Coastal Plain area of medium and coarse textured soils characterized by a high gravel content. The gravel areas support essentially the same climax plants as the Oak Sandy Site, but with less forage production because of less favorable moisture and inherent fertility conditions. Gravelly Hills sites have also deteriorated in vegetative composition due to continued heavy grazing. Much of the area has been stripped of the surface layer of gravel.

The Blackland Site lies within the Blackland Prairie area and is composed of fine textured soils. In some areas of transition, medium textured soils are intermingled with true prairie soils. This site produces a climax vegetation of little bluestem, big bluestem, Indiangrass, and switchgrass. Occasional liveoak trees or mottes are found scattered through the Blackland Prairie. Much of this site has been in cultivation except steeper slopes, areas along drains, and transition areas which intermingle with the Forested Coastal Plains area. Practically all of the range area within the watershed are in poor condition.

Little bluestem, Indiangrass, and other desirable grasses can still be found in spots which are protected from grazing and provide valuable seed sources for range improvement under good grazing management. Understory species of brush such as yaupon, cedar, gum elastic, and similar brushy plants occur in varying densities. Small relict areas of excellent condition range are scattered throughout the watershed area and show the potential productivity of each range site.

Mean temperatures range from 85 degrees Fahrenheit in summer to 53 degrees in winter. The extreme recorded temperatures are 2 degrees below zero and 111 degrees above zero. The average date of the last killing frost is March 6 and that of the first killing frost is November 22, a normal frostfree period of 261 days. The mean annual precipitation of about 38 inches for this area is well distributed, with the larger monthly average rainfall occurring in April, May, October and December. Individual rains of excessive amounts which may occur during any season cause erosion and serious flood damage. Such storms have occurred most frequently in May, December, October, November, January and June. The minimum annual rainfall recorded by any of the eight stations near the watershed was 13.84 inches and the maximum was 91.07 inches.

Water for livestock and domestic use is supplied largely from shallow wells and small farm ponds. Water for urban areas is obtained from wells and is considered to be adequate at this time.

The Cummins Creek watershed is served by five Soil Conservation Service Work Units which are assisting the Burleson-Lee, Bastrop-Fayette, Austin-Washington, and Colorado Soil Conservation Districts. These Work Units have assisted farmers and ranchers in preparing 566 conservation plans on 90,568 acres within the watershed. Where land treatment measures have been applied and maintained for as long as two or three years, crop yields have increased 25 to 40 percent.

<u>Economic Data</u>

The watershed was a part of the Stephen F. Austin Colony and parts of it were settled by members of Austin's "300" Colonists. These settlers were Anglo-Americans who settled in the area as early as 1819. One of these was Judge James Cummins for whom Cummins Creek was named. The original settlers were largely supplanted by German immigrants during the period 1838 - 1850. Czech immigrants began coming into the area about 1900 and continued in increasing numbers until about 1920.

A very diversified type of farming was characteristic of the early settlers and immigrants and is still being practiced in the Blackland portion of the watershed. The main farm enterprises in the Blackland area are cotton, small grains and livestock, principally for beef production. The average size of farms is approximately 90 acres. Nearly all of the farms are owner-operated. The farm units in the Forested Coastal Plains part of the watershed are larger, with beef cattle as the chief enterprise.

Originally, much of the Cummins Creek flood plain was farmed by plantation-owned slaves. Principal crops grown were cotton, corn and sugar cane. At present, the Cummins Creek flood plain is not intensely utilized because of frequent flooding. Of the flood plain in evaluation reaches 1 to 3 and 10 to 32, 53.41 percent is in cultivation, 6.37 percent is in Johnsongrass meadow, 21.77 percent is open pasture, 13.57 percent is woodland pasture, and 4.88 percent is in miscellaneous uses. In evaluation reaches 4 to 9, 6.34 percent is in cultivation, 10.60 percent is in Johnsongrass meadow, 51.00 percent is open pasture, 27.97 percent is woodland pasture, and 4.09 percent is in miscellaneous uses. The chief crops in the flood plain are cotton, corn and sorghums.

The principal crops grown in the upland portion of the watershed are corn, cotton, and Johnsongrass for hay. Minor crops include grain sorghums, peanuts, oats, sweet clover and cowpeas.

The principal towns and communities in the watershed with their 1950 populations as estimated in the Texas Almanac, are:

Towns	Population
Carmine	650
Fayetteville	464
Ledbetter	200
Warrenton	180
Shelby	150
Round Top	121
Frelsburg	75

The 346 miles of roads, of which 79 miles are paved, are adequate to provide access to all parts of the watershed. However, floods occasionally make some of the roads impassable. The detours thus occasioned cause delay and extra travel to and from places of markets. Of the 89 bridges, 17 span the major streams. The two railroads which traverse the watershed provide ample loading facilities for carload lot shipments.

Principal marketing centers nearby, but outside the watershed include: Brenham, population 6,919, and Columbus, LaGrange and Giddings, each with populations between 2,500 and 3,000. Industries outside the watershed furnish some opportunity for employment to residents of the watershed. One of the chief opportunities for nonagricultural employment is in the oil industry near the lower end of the watershed.

Considerable income is derived from sale of leases, hunting privileges and equipment during the deer hunting season, since the Cummins Creek watershed is in one of the better deer hunting areas of the state.

WATERSHED PROBLEMS

Floodwater Damage

Cummins Creek has flooded frequently and caused high annual damage. Devastating floods have occurred as often as twice in one year, the last such year being 1942. During the 20-year period 1923 - 1942, inclusive, there were 17 floods which inundated more than 50 percent of the flood plain, and 67 smaller floods. Floods occurring during the growing season have caused considerable damage to growing crops. For the floods experienced during the 20-year period studied, the total direct floodwater and sediment damages were estimated to average $284,667 annually under present conditions, of which $108,556 is crop and pasture damage. Excluding the area of flood plain which would be inundated by the proposed floodwater retarding structures, these damages would be $283,480 and $107,736, respectively. In addition, there are numerous indirect damages such as the interruption of travel, initial losses sustained by dealers and industries in the area and similar items. The total annual value of these indirect damages is estimated to be $28,348. The average annual monetary flood damages are summarized in Table 4.

An important problem affecting the economy of the watershed has been the shift from cultivated crops to Johnsongrass meadow or brushy pasture in large areas of the flood plain because of frequent and heavy flood damages. This has shifted crop production to a considerable extent from the bottom lands to upland areas where soil erosion constitutes a serious hazard.

Sediment Damage

No large reservoirs exist in the watershed. Existing farm ponds have suffered low to moderate losses in storage capacity from sedimentation.

Only about 10 percent of the flood plain on Cummins Creek has received substantial amounts of sediment deposition. Practically all of the damaging sediment has been deposited below the locations of the proposed floodwater retarding structures. Approximately 1,143 acres have been damaged 10 to 90 percent. The estimated damages are as follows: 160 acres damaged 10 percent; 339 acres damaged 20 percent; 257 acres damaged 40 percent; 225 acres damaged 60 percent; 115 acres damaged 80 percent; and 47 acres damaged 90 percent.

Most of the damaging sediment deposits consist of sandy materials ranging from medium textured mixtures to coarse textured sands. Organic matter and fertility content range from low to almost none in the coarser sands. Estimated benefits, based on the reduction in sedimentation damages effected by land treatment measures and 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. Sediment damage, chiefly in the form of less fertile sediment deposition on bottom land, will be reduced 30 percent by the floodwater retarding structures, and 63 percent by the entire program.

Erosion Damage

Erosion rates in the Cummins Creek watershed are low to moderate, since only 23 percent of the area is in cultivation. Sheet erosion is the major source of sediment. Eighty-six percent of the total gross erosion in the watershed results from this process. Gully and streambank erosion produce 3 percent of the total and flood plain scour accounts for the remaining 11 percent. The channels of Cummins Creek are enlarging slightly in the central and lower parts of the watershed. The most severe bank erosion occurs in the sharp bends of the streams. Lateral erosion of the banks in these areas ranges from 0.1 to 2.5 feet annually. The average annual land loss from this process is 3.7 acres. The percentage of sediment yield from these sources varies considerably at the mouth of the watershed due to different delivery rates.

Problems Relating to Methods now used in the Conservation, Development, Utilization and Disposal of Water.

Problems relating to methods now used in the conservation, development, utilization and disposal of water are of a minor nature in this watershed and do not warrant a study at this time. The planned works of improvement will produce no detrimental effects on any program which may be developed in the future.

INVESTIGATIONS AND ANALYSES

Program Determination

Determination was made first of the land treatment measures which contribute directly to flood prevention and remain 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 in terms of the reduction of flood damages resulting from such treatment. Although significant benefits would result from installation of these land treatment measures, it was apparent that other flood prevention measures would be required to attain the degree of watershed protection and flood damage reduction desired.

Determination was made secondly 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, and other pertinent items. Using consecutive 4-inch 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 surveyed 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 map was prepared of the flood plain on which land use, cross-section locations and other pertinent data were delineated.

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 and flood pools. The height of the dams and the size of the pools were determined by the storage volume needed to detain temporarily the runoff from the design storm and to provide the additional storage needed for sediment. 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 detention and for sediment storage in acre-feet and in inches of runoff from the drainage areas, the release rate of the outlet tube, and the acres of flood plain inundated by the sediment and detention pools, the volume of fill in the dams and the estimated cost of the structures (Tables 6 and 6A).

When the land treatment measures and those measures primarily for flood prevention had been determined (giving consideration to alternate proposals) 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 proposed watershed protection on 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.

Hydraulic and Hydrologic Investigations

Methodology:

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

1. Tabulation and analysis of basic meteorologic 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 such factors as soils, land use, topography, cover and climate.

4. Determination of rainfall-runoff relationships, frequency of occurrence of meteorologic 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 resulting 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.

   d. Consideration of alternative programs and measures.

From a graph showing cumulative departure from normal precipitation the rainfall for the period 1923 to 1942, inclusive, was selected as most representative of a normal rainfall period for the Cummins Creek Watershed.

The largest runoff producing rain which occurred during the 20-year period investigated was a storm of 11.08 inches on May 22 - 25, 1936. Under present conditions this rain would produce 5.81 inches of runoff and inundate 11,439 acres of flood plain. 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 11,258 acres. With land treatment measures applied and the structural measures for flood prevention in operation 8,005 acres would be flooded.

The above areas of inundation do not include any minor areas of flood plain that might lie within the sediment or detention pools of proposed structures.

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 and infiltration curves and selecting the maximum ordinate between them. With an infiltration rate of 0.10 inch per hour, the maximum runoff from the design storm was 6.0 inches in the upper portion of the watershed and 6.4 at the mouth of Cummins Creek.

From a study of the relationship between runoff and flood stage for this watershed it was found that a runoff of 0.17 inch was the minimum that would cause flooding to a depth of six inches at the smallest cross-section. This cross-section, No. S-2, is located on Shaws Creek about one mile above its confluence with Cummins Creek. Due to the changes in runoff producing characteristica at different seasons of the year, rains of 1.42 to 1.87 inches would be required to cause 0.17 inch runoff and produce a discharge of 504 cubic feet per second at cross-section No. S-2 under present conditions. Such storms would produce a discharge of 2,142 cubic feet per second at cross-section No. 1, the reference section near the mouth of Cummins Creek. Flooding begins at the reference section with a discharge of 13,200 cubic feet per second which is equivalent to 1.11 inches of runoff.

The peak discharge at the smallest cross-section for rains producing 5.81 inches of runoff under present conditions is 16,238 cubic feet per second. After installation and full functioning of the land treatment measures and floodwater retarding structures in the watershed plan, the peak discharge at this section from runoff of this magnitude will be reduced to 3,232 cubic feet per second. The peak discharge at the reference section for a storm producing 5.81 inches of runoff under present conditions is 69,139 cubic feet per second. After installation and full functioning of land treatment measures and floodwater retarding structures the discharge at this point will be reduced to 41,450 cubic feet per second.

Sedimentation Investigations

The field surveys of the sedimentation problems in the Cummins Creek watershed were made according to methods described in the revised "Sedimentation Section of Procedures for Developing Flood Prevention Work Plans" Conservation-6, SCS, Region 4, March 26, 1952. Field studies included reconnaissance surveys of geology and physiography, studies of overbank sediment deposits, flood plain scour, streambank erosion, and the nature of the channels and valley on or near all cross-sections. Borings were made where necessary to measure sediment deposition. In the preparation of the report, tabular summaries of all the above findings were prepared with explanatory texts. These form the basis for calculation of monetary damages by the economist.

Investigations of sediment sources in the watersheds above five proposed floodwater retarding structures were made according to standard procedures. Estimates were then made for both present and future sediment production rates in the drainage area of each proposed structure

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

1. Soil unit in acres by slope in percent, slope length in feet, and present land use (cultivated pasture or woodland.)

2. Average farming practices (percent row crop and/or percent small grain, etc.).

3. Cover condition classes on pasture or woodland.

4. Past history of land use.

5. Maximum 30-minute rainfall intensity to be expected once in two years.

The amount of sediment derived from gully and streambank erosion was estimated by field studies, comparison of old and recent aerial photographs, and by interviews with landowners in the watershed who were able to give information on the history of gully development and channel enlargement.

From these studies, total annual sediment yields above the proposed floodwater retarding structures were calculated to be as follows: 158.1 acre-feet from sheet erosion, 0.2 acre-foot from gully erosion, and 2.7 acre-feet from channel enlargement. The average yield of sediment above structures is 1.37 acre-feet per square mile annually. The principal source of sediment is sheet erosion on cultivated land. It is estimated that 98.2 percent of the total sediment produced above the proposed structures is derived from sheet erosion, 0.1 percent from active gully erosion and 1.7 percent from channel enlargement.

Areas damaged by overbank deposition and flood plain scour will be rendered productive again after they have been protected from flooding and rotation hay and pasture or adapted soil-improving crop rotation have been put into effect. Deep rooted legumes, such as sweet clover will be grown in crop rotations to break up the plow pan, improve percolation rates, and reduce runoff in the Blackland Prairie area. Cover crops, such as winter legumes and small grains, will be grown on the Forested Coastal Plain soils to reduce erosion.

Cultivated land produces most of the sediment in the watershed, however substantial quantities also are derived from pastureland. Some of this land was once in cultivation and has poor cover. Proper range management will improve the grass cover on these areas. Native bluestem grass meadows in good to excellent condition can be found on almost one percent of the watershed area. The application of needed land treatment measures on both cultivated and pasture land will reduce the sediment yield from sheet erosion by approximately 38 percent. Gully erosion has not been serious in the watershed and most of the existing gullies are in the process of being stabilized. Land treatment practices are expected to reduce sediment yields on still active gullies by approximately 30 percent. No appreciable reduction in sediment yields from streambank erosion is expected as a result of land treatment measures.

Geologic Investigations

Reconnaissance geological inspections were made at 13 of the 31 floodwater retarding structure sites. These included brief lithologic, stratigraphic, and structural studies of the valley slopes, alluvium, channel banks, and exposed rock outcrops. No borings were made at the sites; however, a good crosa-section of the materials expected to be encountered in the proposed sites was found in exposed road cuts and stream channels. The formations underlying the area are quite similar to formations in other watersheds already under construction and the problems generally should be the same.

There are no proposed sites in the Yegua formation although it comprises some of the drainage area of the upper part of the watershed.

Sites in the Jackson group (5) contain abundant sandy clays for borrow. At least one site in this area (No. 3) has a perched water table. The abutments consist of thin bedded sandstones and shales and should offer no unusual foundation or excavation problems.

The seven sites in the Catahoula formation contain heavy clays with large gravel. They overlie the sandy and calcareous shales which are interbedded with thin sandstones. The presence of bentonitic clays at some of these sitea may be a possible construction hazard. Materials appear to be adequate and are chiefly heavy clays containing much large gravel. Spillways should offer no serious problems since the bedrock will be fairly easy to excavate. Gravel beds may underlie apillway areaa. There ahould be no difficulty keying a core into the bedrock or the heavy clays. The amount of channel deposition, generally, is rather small.

Thirteen sites are planned in the Oakville sandstone. Some of the abutment areas show hard cemented sandstone and sandy shale. These materials may offer some excavation problems. The flood plain soils consist of heavy black clays that should be adequate for borrow material and core trench location.

The six sites in the Lagarto clay have abutment areas which are mantled by a thin deposit of silty sand. The spillways probably will be cut into the underlying clay formation and probably will not extend into the hard bedrock. The bottoms of the channels are in general composed of shaly clay. The banks contain sandy and marly clay overlying shaly clay near the bottom. No apparent construction problems were found in the sites inspected.

Two possible sites were investigated in the extreme lower reaches of watershed and found to have a very high sand content. These sites would require special construction techniques, such as: foundation drains, relief wells, flattening of dam slopes and mixing of embankment materials. The construction cost of these sites would be high and very detailed geologic investigations would be required for design and construction.

These sites were deleted from the work plan because of the high cost of construction and other economic and hydrologic factors.

Detailed investigations, including exploration with core drilling equipment, will be made at all sites prior to their design and construction. Laboratory tests will be made to determine the stability of foundation strata and the suitability of the available embankment and core-wall materials. Special emphasis will be placed upon investigations of the spillways located in the Oakville sandstone.

Economic Investigations

Determination of Annual Benefit from Reduction in Damage:

Damage schedules covering 90 percent of the flood plain area of Cummins 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 calculation of crop and pasture damage, expenses saved, such as costs of harvesting, were deducted from the gross value of the damage. 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, several floods occurring 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 soils men and other agricultural workers in the area. It was found that differences in land use, yields and flood frequencies were significant. Therefore, to facilitate accurate appraisal the flood plain was divided into three evaluation reaches, each with its own damageable value 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 tbe costs of farm operations to speed recover.

Damage to other agricultural property such as fences, livestock, and farm equipment were obtained from analysis of schedules and correlated with sizes of floods. The major items 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 Cummins Creek watershed is almost entirely an agricultural area, indirect damages primarily involve extra farming expense, additional travel time to market, extra costs of purchasing additional feed for livestock and the like. 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 those which will prevail after the installation of each class of measures included in the recommended project. 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 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 measure were determined on the basis of estimated reductions in sediment yield 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. However, as estimate was made of the value of the 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 benefit from changed land use in the flood plain:

Farmers were asked to state the changes made in the use of their flood plain lands as a result of past flooding. These estimates provided the basis for separating benefits from changed land use into classes 1 and 2. Benefits from restoration of productive use, described above, were considered as Class 1 benefits.

Operators of flood plain lands were also asked what changes they would make in their use of the flood plain if flooding were halved. Analysis of these responses provided the basis for estimating benefits from more intensive use of the flood plain. 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, reductions in frequency of flooding, and similar factors. The difference between the total benefit from changed land use and the benefit from restoration to productive use assigned as described in the preceding paragraph to Class 1 benefits, constituted the Class 2 benefit. All benefits from change in flood plain land use were discounted over a 5-year build-up period to allow for a lag in installation.

No change in land use was considered in the evaluation reach 4 to 9.

Details of Methodology:

Details of the procedures used in the investigation are described in the Economic Section of Water Conservation 6, Revised, copies of which are on file in the Washington office of the Soil Conservation Service.

EXISTING OR PROPOSED WORKS OF IMPROVEMENT

Little or no effort to prevent or control floods in the Cummins Creek watershed has been made by local landowners.

During the past several years small neighborhood groups of farmers, cooperating with the Austin-Washington, Bastrop-Fayette, Burleson-Lee and Colorado Soil Conservation Districts, have prepared soil and water conservation plans on a community watershed basis. Application of the needed practices has preceeded rapidly. The Cummins Creek Watershed Association has been quite active in solidifying interest in flood prevention work and has exerted its influence toward a high degree of participation in this program on the part of the farmers, ranchers and other interested parties in the watershed.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

An effective conservation program based upon the use of each acre of agricultural land within its capabilities and its treatment in accordance with its needs such as is now being carried out by the Burleson-Lee, Bastrop-Fayette, Colorado and Austin-Washington Soil Conservation Districts is essential to sound and continuing flood prevention in the watershed. Basic to the attainment of this objective is the establishment and maintenance of all applicable soil, water and plant management practices essential to proper land use. Emphasis will be placed on accelerating the establishment of these land treatment practices which have a measurable effect on the reduction of floodwater and sediment damages.

An important phase of work is the aeeding or overseeding of 41,606 acres of idle land and pasture and rangeland which has been so overgrazed that reseeding is necessary to establish cover adequate to reduce erosion and sediment yield. Brush will be controlled on 32,737 acres of rangeland to improve the composition and density of those grasses which will materially improve the hydrologic conditions of the watershed.

Approximately 2,230 miles of terraces will be built. Lower lying fields will be protected by 245 miles of diversion terraces. Seven hundred and fifty-two (752) acres of protected outleta will be established to carry the runoff from these terraces and diveraions.

Other land treatment measures which have a direct effect on flood prevention and which will be applied include contour cultivation, stock ponds, cover crops, rotation hay and pasture and proper use of both pasture and rangeland. Seven hundred and fifteen (715) addition stock ponds will be constructed to assure adequate distribution of grazing on the grasslands. This density provides approximately one farm pond per average size unit. Cover crops will be planted on 36,133 acres and rotation hay and pasture on 10,583 acres of cropland to improve water-holding capacity of soils, increase infiltration rates, and reduce erosion. Proper use of 50,970 acres of pasture and 83,179 acres of rangeland will be achieved to improve and maintain effective vegetative cover. Land treatment measures to be applied on 1,860 acres of pineland in the lower end of the watershed include harvest cutting, improved cutting, woodland thinning, fire protection and grazing control. The application of these practices will improve hydrologic conditions by developing ground cover and will improve the water absorption and retention capacity of the soil. The estimated total cost of planning and installing these measures is $2,495,430 as shown in Table 1.

Under the guidance and with the assistance of the soil conservation districts, landowners and operators will apply other land treatment measures such as deferred and rotation grazing, wildlife area improvement, and stocking and management of fish ponds. These practices are a part of a complete soil, plant, and water conservation program, but since they either do not contribute directly to flood prevention or contribute in a less positive manner due to characteristics of the practices or small areas affected, their costs have not been included in Table 1.

Structural Measures for Flood Prevention

The floodwater retarding structures needed to provide flood protection for flood plain lands, highways, and rural improvements are listed, with their costs, in Table 1. A schematic drawing of a cross-section of a typical floodwater retarding structure is shown on page 18. The provision for sediment reserve is for compliance with the State laws which permit storage of only 200 acre-feet of water without a permit. The sediment pool is designed to store all expected sediment produced in a 50-year period. Any storage requirement in excess of 200 acre-feet is provided for in the sediment reserve.

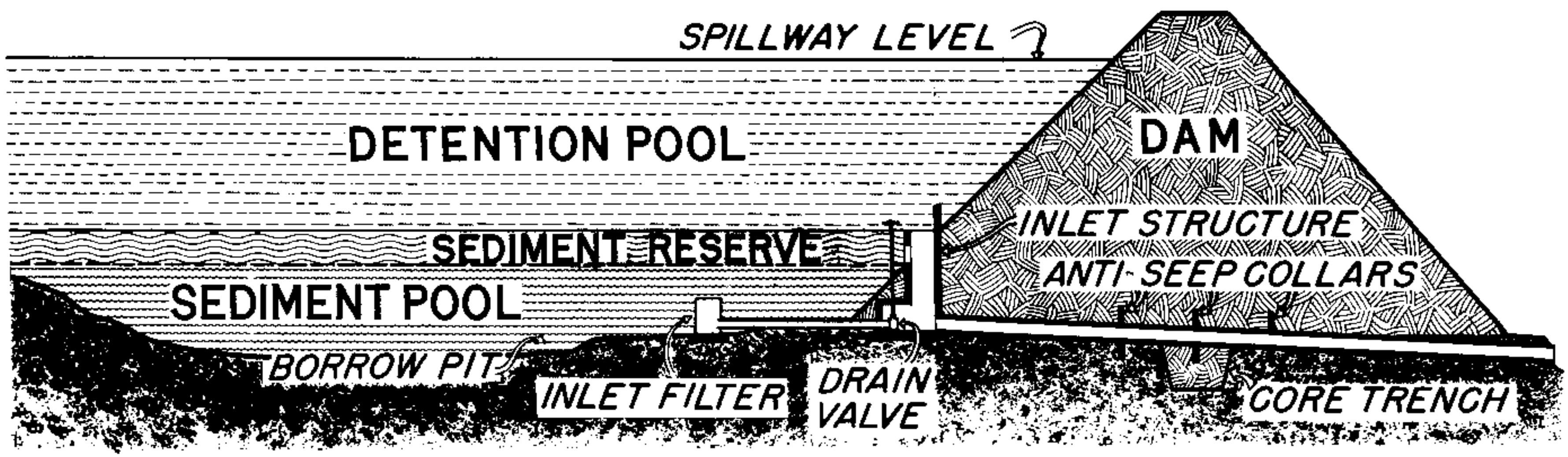
A system of 31 floodwater retarding structures is to be installed to protect the flood plain lands along Cummins Creek and its major tributaries. The structures will be constructed at or near the locations shown on the Structure Location Map, Figure 1. Data concerning the floodwater retarding structures are summarized in Tables 6 and 6A.

The system of floodwater retarding structures will temporarily detain runoff from 36.74 percent of the Cummins Creek watershed. Sufficient detention storage can be developed at all structure sites to make possible the use of vegetated spillways, thereby affecting 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 $168,869, based on market values as determined by local appraisal committees appointed by the Cummins Creek Watershed Association. Site costs were determined by adding the full value of the land in the sediment pool and one-half of the value of the land in the flood pool, since the latter will remain

UNITED STATES
DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE
FORT WORTH, TEXAS



SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

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

Revised 6-24-64 4-R-8653

in productive use as pasture. The average annual loss in production within the sites was calculated to be $6,799, based on long-term prices. The amortized cost of the structure sites is $7,719. Therefore, in accordance with sound economic principles 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 $2,187,521. The annual equivalent cost, including operation and maintenance, is $82,046.

In order to have data on the suitability of foundation conditions and construction materials at the proposed 31 floodwater retarding structure sites in advance of detailed design and the procuring of easements, reconnaissance investigations were made on representative sites throughout the watershed.

Effect on Damages and Benefits

The combined program of land treatment and structural measures for flood prevention described above would eliminate damage on the Cummins Creek flood plain from 40 of the minor floods such as occurred in the 20-year period 1923-1942 inclusive. Of the 44 remaining floods, all but four would be reduced to minor floods.

Average annual flooding throughout the watershed will be reduced from 10,958 to approximately 3,297 acres. The estimated average annual floodwater damage based on the floods experienced in the 20-year period of study will be reduced from $246,935 to $60,225, or a reduction of 75.6 percent.

Approximately 75.6 percent of the expected reduction in aversge annual flood damages caused by storms in the 20-year period investigated would result from the system of floodwater retarding structures. The annual value of this reduction is estimated to be $173,614 out of the total of $229,779 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 restore much of the land now in relatively unproductive use to its former intensity of utilization. The increased annual net income of such restoration is estimated at $20,096 after deduction of all expenses. Farmers operating flood plain lands indicate further that intensification of use beyond previous standards will take place in some areas. This will take the form of producing high value crops such as cotton or corn in some areas where sorghums or small grain have been grown in the past, and in improving pasturelands. The increased annual net income from this intensified land use is estimated at $6,698.

The total flood prevention benefits, including both the reductions in flood damages and benefits from more intensive use of flood plain lands, are estimated to be $256,573 annually.

The installation of the proposed project on Cummins Creek and the expansion of this program to the other tributaries of the Colorado River would give added protection to flood plain lands along the Colorado River and greatly reduce the sediment load carried by the stream. The proposed project on Cummins Creek will have no known detrimental effect on any existing or proposed downstream projects that might be constructed in the future.

COMPARISON OF BENEFITS AND COSTS

The ratio of the average annual benefit from structural measures for flood prevention, $200,408, to the annual average value of the costs of the measures, $82,046, is about 2.44 to 1.

Community benefits will be created through opportunities for more complete utilization of existing resources, greater employment and the like. Although these benefits are estimated to equal at least $7,892 annually, they have not been included in the economic justification of the program.

Additional tangible benefits will accrue through reduction of damage on the main stem of the Colorado River below the mouth of Cummins Creek. No data were available for estimation of the amount of these benefits, but it is believed that they would be considerable.

Certain intangible benefits such as an increased sense of security and improved opportunities for economic planning will accrue. These benefits are not measurable in monetary terms.

ACCOMPLISHING THE PLAN

The Extension Service will carry out the educational phase of the program by conducting general information and local farm meetings, the preparation of radio and press releases and the use of other forms of disseminating information to reach the landowners and operators in the Cummins Creek watershed to help achieve understanding and stimulate participation in the entire plan to be carried out, including the land treatment practices and the structural measures for flood prevention.

Land Treatment Measures

Land treatment measures itemized in Table 1 will be established on the land by farmers in cooperation with the Burleson-Lee, Bastrop-Fayette, Colorado, and Austin-Washington Soil Conservation Districts. The cost of applying these measures will be borne by the owners and operators of the land. It is expected that the owners and operators will be reimbursed for a portion of this cost through the existing Agricultural Conservation Program. The amount of reimbursement to be expected was estimated, based on the current program, and was not included in the total estimated non-Federal cost for land treatment as listed in Table 1. The soil conservation districts are giving assistance in the planning and application of these measures under their going program. This assistance will be accelerated so as to assure application of the planned measures within the 10-year life of the project.

The governing bodies of the Bastrop-Fayette, Burleson-Lee, Colorado, and Austin-Washington Soil Conservation Districts with the assistance of the Cummins Creek Watershed Association, will arrange for meetings according to a definite schedule and by individual contacts encourage the landowners and operators within the Cummins 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 districts. Each district-governing body will make periodic inspections of the completed conservation measures within its district and follow through to see that needed maintenance is performed.

The Soil Conservation Service will assign additional technicians and aids to the Burleson-Lee, Bastrop-Fayette, Colorado, and Austin-Washington Districts to assist landowners and operators cooperating with the district in accelerating the preparation and application of soil and water conservation plans.

The Farmers Home Administration soil and water conservation loan program, recently enacted into law, will be made available to all eligible individual farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies outlining the services available and eligibility requirements. Present FHA families will be encouraged to cooperate in the program.

The County ASC Committees will cooperate with the governing bodies of the soil conservation districts 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

The landowners in the watershed are now in the process of forming a special purpose water control and improvement district, which will have the powers of taxation and eminent domain under the State laws of Texas. Temporary officers have been elected. An application for formation has been prepared and will be submitted to the State Board of Water Engineers by September 10, 1955.

The special purpose water control and improvement district will contract for the construction of the thirty-one floodwater retarding structures listed in the plan. Funds for the local share of the construction costs will be raised by a bond issue which will be financed by a district-wide ad valorem tax. The bond issue will be voted on as soon as this project is approved. Land easements for the sites for the floodwater retarding structures and the reservoirs created by them will be obtained in so far as possible by private donation. In those instances where such donations would create excessive hardship, easements will be purchased. Construction of the floodwater retarding structures will be started as soon as the local organization is equipped to handle its responsibilities and Federal funds are available. Floodwater retarding structures will be scheduled for construction so as to complete the project within the 10-year period.

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

Table 1 indicates 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 changes 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 working agreements.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

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 Burleson-Lee, Bastrop-Fayette, Colorado and Austin-Washington Soil Conservation Districts. Representatives of the soil conservation districts will make periodic inspections of the land treatment measures to determine maintenance needs; will encourage landowners and operators to perform maintenance and will make district-owned equipment available for this purpose.

Structural Measures for Flood Prevention

The 31 floodwater retarding structures will be operated and maintained by the Burleson-Lee, Bastrop-Fayette, Colorado, and Austin-Washington Soil Conservation Districts with assistance from the proposed special purpose district having legal authority to raise funds.

All floodwater retarding structures will be inspected at least annually and after each heavy rain or stream flow. 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 emergency spillway, and fences and gates installed as a part of the floodwater retarding structures. The sponsoring local organization will maintain a record of all maintenance inspections.

The estimated annual operation and maintenance cost is $3,262, based on present construction costs. 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 the sale of bonds of the special purpose district.

Provisions will be made for free access of District and Federal representatives to inspect the 31 floodwater retarding structures and their appurtenances at any time.

COST SHARING

Non-Federal interests will be responsible for the installation of the land treatment measures shown in Table 1 within the 10-year installation period at an estimated cost of $2,367,580. The Federal Government will provide technical assistance to accelerate the planning and installation of land treatment measures at an estimated cost of $127,850, which is in addition to funds provided under the going program. Non-Federal interests thus will provide approximately 94.9 percent of the cost of installing land treatment measures, Table A.

The required non-Federal cost of structural measures, including all lands, easements and rights-of-way, the capitalized value of operation and maintenance of the structures during their expected life, and the cost of administering contracts is estimated to be $291,802, Table D. The Federal Government will pay the cost of installation services for the structural measures in an estimated amount of $386,819, Table E. Construction costs, including an allowance for contingencies, are allocated between Federal and non-Federal interests in proportion to the benefits received, Table C.

Benefits were divided into two major classes for the purpose of cost-sharing analysis. Those benefits resulting from reduction of flood or other damage were placed in Class 1 and those represented by the greater income derived from more intensive and productive use of land were placed in Class 2. Each class was further subdivided into subclasses A and B. Subclass B benefits were those where the principal beneficiaries were located outside the project area or were otherwise unidentifiable, or the magnitude of the benefit was not significantly large. Benefits, significant in amount, received by identifiable beneficiaries were assigned to subclass A.

In the cost-sharing analysis for the Cummins Creek watershed, the benefits from changed land use were considered to accrue to identifiable beneficiaries and were assigned to Class 1A or 2A, depending on whether they were derived from restoration of previous levels of production or from enhancement, as described in the section "Economic Investigations."

Benefits from reduction of road and bridge damage were assigned to class 1B because these benefits would accrue to taxpayers and those using the roads, many of whom were located far from the watershed. Reductions to be expected in the severity of flooding were analyzed for representative cross-sections along Cummins Creek and its major tributaries. As a result of this analysis it was found that reductions in flooding would be sufficiently large to effect significant reductions in flooding in all areas except main stem reaches 1 through 3. Flood plain in this area could be flooded by uncontrolled runoff from Brune Creek, or by the Colorado River so a basis for demonstrating firm benefits from flood reduction to the satisfaction of local beneficiaries could not be established. Therefore the damage reduction benefits in this area were assigned to Class 1B. It was found that major and significant reductions in flooding and in damage would accrue in all other areas. Therefore, all damage reduction benefits except those from reduction in road and bridge and indirect damages in these areas were assigned to Class 1A. Benefits from reduction of indirect damage were assigned to Class 1B.

Based on the ratio of local benefits to total benefits the Federal share of these costs would be $682,528. The share of non-Federal interests on this basis would be $910,303, Table G. The entire installation cost of the project, including land treatment measures, is estimated to be $4,682,951. On the above basis non-Federal interests would bear $3,485,754, or 74.4 percent, of the total project cost. The remaining $1,197,197, or 25.6 percent, would be borne by the Federal Government.

Proposed Cost-Sharing Adjustment

A combination of watershed characteristics, land treatment costs and other factors establish $250,000 as the maximum sum, over and above the required non-Federal costs of the structural measures, which the local sponsors believe they can contribute to the construction cost of the floodwater retarding structures and still insure their ability to participate in the project. It is therefore proposed that $660,303 of allocated non-Federal cost be borne by the Federal Government. The share of the total project cost to be borne by the local people after such an adjustment would be $2,909,382, or 61.0 percent. Several of the factors which prompted this proposal were:

a. The land use of the watershed has recently undergone a severe change, as indicated by a decline of 30 percent in the area of cropland harvested between 1944 and 1949. In addition, a 60 percent reduction in the acreage of cotton harvested occurred between 1926 and 1949.

b. Land treatment costs will be high, amounting to an estimated $2,367,580. For example, 41,606 acres of pasture and range seeding is needed on land now idle, on overgrazed land, and land on which brush must be eradicated in order to establish adequate cover to reduce erosion and sediment yield. The establishment of this practice alone will cost the local people over $650,000.

c. Due to the drought conditions which have existed in this area for the past few years, the income of the local landowners in the watershed has been decreased to such an extent that they do not have the financial ability needed to carry the full share of the cost as indicated by the ratio of local benefits to total benefits.

d. The average farm in the watershed has approximately 90 acres and does not provide the financial resources necessary for a large contribution.

e. The costs associated with the procurement of land, easements and rights-of-way are higher than normal, $198,571, and funds will need to be furnished by local residents to obtain some of the easements. Several sites contain considerable acreages of cultivated land; others, because of the flat terrain, will inundate considerable areas of grassland. The additional cost of operating the special purpoae district must also be added to these costs, as well as the annual expense of operation and maintenance of the structures.

f. The 31 planned detention structures would detain floodwater which would be released at a slower rate than formerly. This prolonged flow of a major tributary to the Colorado River would maintain a more uniform flow in the river and would permit farmers, municipalities, and industries located on the river below Cummins Creek to obtain maximum use of the floodwater originating in the watershed which has previously flowed down the river in flash floods at a rate too rapid to be of useful value. Prevention of flash flood flows from Cummins Creek will reduce flood and sediment damage on the Colorado River below the mouth of Cummins Creek. Because of the unidentifiable benefits occurring outside of the watershed and over a large territory, it is felt that the Federal Government should assume a larger share of the costs.

g. The only major flood control structure built or authorized in Texas in which local beneficiaries have been required to contribute any portion of the flood control cost is the authorized Navarro Mills reservoir on Richland Creek, a tributary of the Trinity River. In accordance with Budget Bureau Circular A-47, local beneficiaries will be expected to bear only 11 percent of the flood control cost of this structure. Also, in this instance, local beneficiaries are not expected to furnish land or easements at no cost to the Federal Government. It is the feeling of the sponsoring body that failure to make an adjustment such as is proposed in the case of Cummins Creek would not be compatible with the action of other Federal Agencies in similar cases.

Table A - Land Treatment Costs

Type of Cost	Federal Cost (dollars)	Non-Federal Cost (dollars)	Total Cost (dollars)
Non-Federal Lands			
1. Technical Assistance	127,850	-	127,850
2. Installation Costs 1/	-	2,367,580	2,367,580
3. Total	127,850	2,367,580	2,495,430
Federal Lands			
4. Installation Costs	-	-	-
5. Operation and Maintenance During Installation Period	-	-	-
6. Total	-	-	-
7. GRAND TOTAL	127,850	2,367,580	2,495,430

1/ This cost is exclusive of any reimbursement from ACP or other Federal funds.

Table B - Distribution of Average Annual Benefits and Allocation of Construction Costs by Purposes and by Class of Benefits

Step A — Distribution of Average Annual Benefits

Class of Benefits	Purpose								
	Flood Prevention		Drainage		Irrigation		Agricultural Water Management		Total
	(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)	(dollars)	(percent)	(dollars)
Class 1A Benefits	112,357	53.94							112,357
Class 1B Benefits	89,245	42.85							89,245
Class 2A Benefits	6,698	3.21							6,698
Class 2B Benefits	0	0							0
Total	208,300	100.00							208,300

Step B — Allocation of Construction Costs

Class of Benefits	Purpose								
	Flood Prevention		Drainage		Irrigation		Agricultural Water Management		Total
	(percent)	(dollars)	(percent)	(dollars)	(Percent)	(dollars)	(percent)	(dollars)	(dollars)
Class 1A Benefits	53.94	859,173							859,173
Class 1B Benefits	42.85	682,528							682,528
Class 2A Benefits	3.21	51,130							51,139
Class 2B Benefits	0	0							0
Total	100.00	1,592,831							1,592,831

Table C - Benefits and Allocated Construction Costs

Class of Benefits	Benefits		Allocated Construction Costs	
	(dollars)	(percent)	(dollars)	(percent)
1. Class 1A	112,357	53.94	859,173	53.94
2. Class 1B	89,245	42.85	682,528	42.85
3. Subtotal Class 1	201,602	96.79	1,541,701	96.79
4. Class 2A	6,698	3.21	51,130	3.21
5. Class 2B	0	0	0	0
6. Subtotal Class 2	6,698	3.21	51,130	3.21
7. Total	208,300	100.00	1,592,831	100.00

Table D - Required Non-Federal Costs

Type of Cost	Cost or Appraised Value
	(dollars)
1. Land Easements, R.O.W., etc	
a. Land Value	168,869
b. Power Line Relocation	3,313
c. County Road Adjustment	8,337
d. Legal Fees, Services	18,052
2. Water Rights	0
3. Capacity and facilities for its use on or at the structure for purposes other than flood prevention and features related thereto	0
4. Capitalized value of operation and maintenance during expected life of improvements	83,931
5. Cost of administering contracts	9,300
6. Total	291,802

Table E - Installation Services

Agency	Cost	Total
	(dollars)	(dollars)
Soil Conservation Service	386,819	386,819
Total	386,819	386,819

Table F - Proposed Adjustment in Federal and Non-Federal Costs

Reason for Adjustment	Transfer from Federal to Non-Federal	Transfer from Non-Federal to Federal
	(dollars)	(dollars)
1. Watershed Characteristics, High Land Treatment Costs, Etc.		660,303
Total		660,303

Table G - Proposed Cost-Sharing

Type of Costs	Federal Cost (dollars)	Non-Federal Cost (dollars)	Total Cost (dollars)
COSTS FOR STRUCTURAL MEASURES			
1. Required Non-Federal Costs (Item 6, Table D)	-	291,802	291,802
2. Installation Services (Table E)	386,819	-	386,819
3. Subtotal (Items 1 plus 2)	386,819	291,802	678,621
ALLOCATION OF CONSTRUCTION COST			
4. Costs allocated to Class 1A benefits (Item 1, Table C)	-	859,173	859,173
5. Costs allocated to Class 1B benefits (Item 2, Table C)	682,528	-	682,528
6. Costs allocated to Class 2 benefits (Item 6, Table C)	-	51,130	51,130
7. Subtotal (Items 4 plus 5 plus 6)	682,528	910,303	1,592,831
RECOMMENDED ADJUSTMENT OF CONSTRUCTION COSTS			
8. Increase of Federal Cost (Table F)	660,303	-	-
9. Decrease of Non-Federal Cost (Table F)	-	660,303	-
10. Subtotal (Items 8 plus 9)	660,303	660,303	-
11. Total Cost Sharing for Structural Measures (Items 3 plus 7 plus or minus 10)	1,729,650	541,802	2,271,452
COSTS FOR LAND TREATMENT MEASURES			
12. Non-Federal Lands (Item 3,Table A)	127,850	2,367,580	2,495,430
13. Federal Lands	-	-	-
14. Subtotal (Items 12 plus 13)	127,850	2,367,580	2,495,430
15. Grand Total Project Cost-Sharing (Items 11 plus 14)	1,857,500	2,909,382	4,766,882

TABLE 1 - ESTIMATED INSTALLATION COSTS

Cummins Creek Watershed, Texas For: First Year

Items	Unit	No. to be Applied Non-Federal Land	Estimated Cost Non-Federal Land Federal (dollars)	Non-Federal (dollars)	Total (dollars)
LAND TREATMENT					
Soil Conservation Service					
Land Treatment Measures					
Contour Cultivation	Acres	1,388	0	694	694
Cover Cropping	Acres	1,807	0	14,936	14,936
Proper Use Range	Acres	4,158	0	6,237	6,237
Proper Use Pasture	Acres	2,548	0	7,644	7,644
Brush Control	Acres	1,622	0	16,758	16,758
Pasture Planting	Acres	966	0	22,756	22,756
Range Seeding	Acres	1,113	0	9,200	9,200
Rotation Hay and Pasture	Acres	528	0	11,880	11,880
Stubble Mulching	Acres	1,655	0	1,075	1,075
Terracing	Miles	112	0	11,850	11,850
Diversion Construction	Miles	12	0	3,967	3,967
Pond Construction	Each	36	0	9,522	9,522
Waterway Development	Acres	38	0	1,727	1,727
Improvement Cutting	Acres	0	0	0	0
Technical Assistance	Dollars	0	0	0	0
TOTAL LAND TREATMENT				118,246	118,246
STRUCTURAL MEASURES					
FLOOD PREVENTION					
Soil Conservation Service					
Waterflow Control	Each	0	0	0	0
TOTAL CONSTRUCTION COSTS			0	0	0
INSTALLATION SERVICES					
Total SCS			0	0	0
OTHER COSTS			0	0	0
TOTAL STRUCTURAL MEASURES			0	0	0
GRAND TOTAL				118,246	118,246
SUMMARY					
Total SCS				0	0

Date: May 1955

TABLE 1 - ESTIMATED INSTALLATION COSTS

Cummins Creek Watershed, Texas For: Second Year

Items	Unit	No. to be Applied Non-Federal Land	Estimated Cost Non-Federal Land Federal (dollars)	Non-Federal (dollars)	Total (dollars)
LAND TREATMENT					
Soil Conservation Service					
Land Treatment Measures					
Contour Cultivation	Acres	2,777	0	1,388	1,388
Cover Cropping	Acres	3,613	0	29 863	29,863
Proper Use Range	Acres	8,313	0	12,477	12,477
Proper Use Pasture	Acres	5,097	0	15,291	15,291
Brush Control	Acres	3,242	0	33,496	33,496
Pasture Planting	Acres	1,934	0	45,559	45,559
Range Seeding	Acres	2,227	0	18,407	18,407
Rotation Hay and Pasture	Acres	1,058	0	23,805	23,805
Stubble Mulching	Acres	3,309	0	2,151	2,151
Terracing	Miles	223	0	23,593	23,593
Diversion Construction	Miles	24	0	7,935	7,935
Pond Construction	Each	72	0	19,044	19,044
Waterway Development	Acres	75	0	3,410	3,410
Improvement Cutting	Acres	0	0	0	0
Technical Assistance	Dollars	0	14,206	0	14,206
TOTAL LAND TREATMENT			14,206	236,419	250,625
STRUCTURAL MEASURES					
FLOOD PREVENTION					
Soil Conservation Service Waterflow Control	Each	1,2,3, 4,5,6	264,462	46,391	310,853
TOTAL CONSTRUCTION COSTS			264,462	46,391	310,853
INSTALLATION SERVICES Total SCS			75,489	1,800	77,289
OTHER COSTS			0	41,801	41,801
TOTAL STRUCTURAL MEASURES			339,951	89,992	429 943
GRAND TOTAL			354,157	326,411	680,568
SUMMARY					
Total SCS			354,157	0	354,157

Date: May 1955

TABLE 1 - ESTIMATED INSTALLATION COSTS

Cummins Creek Watershed, Texas   For: Third Year

Items	Unit	No. to be Applied Non-Federal Land	Estimated Cost Non-Federal Land Federal (dollars)	Non-Federal (dollars)	Total (dollars)
LAND TREATMENT					
Soil Conservation Service					
Land Treatment Measures					
Contour Cultivation	Acres	4,166	0	2,083	2,083
Cover Cropping	Acres	5,420	0	44,799	44,799
Proper Use Range	Acres	12,476	0	18,714	18,714
Proper Use Pasture	Acres	7,646	0	22,938	22,938
Brush Control	Acres	4,866	0	50,275	50,275
Pasture Planting	Acres	2,900	0	68,314	68,314
Range Seeding	Acres	3,340	0	27,607	27,607
Rotation Hay & Pasture	Acres	1,588	0	35,730	35,730
Stubble Mulching	Acres	4,964	0	3,227	3,227
Terracing	Miles	334	0	35,337	35,337
Diversion Construction	Miles	37	0	12,233	12,233
Pond Construction	Each	107	0	28,301	28,301
Waterway Development	Acres	113	0	5,137	5,137
Improvement Cutting	Acres	266	0	399	399
Technical Assistance	Dollars		14,206	0	14,206
TOTAL LAND TREATMENT			14,206	355,094	369,300
STRUCTURAL MEASURES					
FLOOD PREVENTION					
Soil Conservation Service Waterflow Control	Each	7,8,9,10 11,12	249,207	51,540	300,747
TOTAL CONSTRUCTION COSTS			249,207	51,540	300,747
INSTALLATION SERVICES Total SCS			73,039	1,800	74,839
OTHER COSTS			0	31,965	31,965
TOTAL STRUCTURAL MEASURES			322,246	85,305	407,551
GRAND TOTAL			336,452	440,399	776,851
SUMMARY					
Total SCS			336,452	0	336,452

Date: May 1955

TABLE 1 - ESTIMATED INSTALLATION COSTS

Cummins Creek Watershed, Texas For: Remaining to be Done

Items	Unit	No. to be Applied Non-Federal Land	Estimated Cost Non-Federal Land Federal (dollars)	Non-Federal (dollars)	Total (dollars)
LAND TREATMENT					
Soil Conservation Service					
Land Treatment Measures					
Contour Cultivation	Acres	19,439	0	9,720	9,720
Cover Cropping	Acres	25,293	0	209,059	209,059
Proper Use Range	Acres	58,232	0	87,340	87,340
Proper Use Pasture	Acres	35,679	0	107,037	107,037
Brush Control	Acres	22,702	0	234,554	234,554
Pasture Planting	Acres	13,540	0	318,957	318,957
Range Seeding	Acres	15,586	0	128,826	128,826
Rotation Hay & Pasture	Acres	7,409	0	166,702	166,702
Stubble Mulching	Acres	23,164	0	15,057	15,057
Terracing	Miles	1,561	0	165,151	165,151
Diversion Construction	Miles	172	0	56,867	56,867
Pond Construction	Each	500	0	132,248	132,248
Waterway Development	Acres	526	0	23,912	23,912
Improvement Cutting	Acres	1,594	0	2,391	2,391
Technical Assistance	Dollars		99,438	0	99,438
TOTAL LAND TREATMENT			99,438	1,657,821	1,757,259
STRUCTURAL MEASURES					
FLOOD PREVENTION					
Soil Conservation Service					
Waterflow Control	Each	13 thru 31	829,162	152,069	981,231
TOTAL CONSTRUCTION COSTS			829,162	152,069	981,231
INSTALLATION SERVICES					
Total SCS			238,291	5,700	243,991
OTHER COSTS			0	124,805	124,805
TOTAL STRUCTURAL MEASURES			1,067,453	282,574	1,350,027
GRAND TOTAL			1,166,891	1,940,395	3,107,286
SUMMARY					
Total SCS			1,166,891	0	1,166,891

Date: May 1955

TABLE 1 - ESTIMATED INSTALLATION COSTS

Cummins Creek Watershed, Texas For: Total Project

Items	Unit	No. to be Applied Non-Federal Land	Estimated Cost Non-Federal Land Federal (dollars)	Estimated Cost Non-Federal Land Non-Federal (dollars)	Total (dollars)
LAND TREATMENT					
Soil Conservation Service					
Land Treatment Measures					
Contour Cultivation	Acres	27,770	0	13,885	13,885
Cover Cropping	Acres	36,133	0	298,657	298,657
Proper Use Range	Acres	83,179	0	124,768	124,768
Proper Use Pasture	Acres	50,970	0	152,910	152,910
Brush Control	Acres	32,432	0	335,083	335,083
Pasture Planting	Acres	19,340	0	455,586	455,586
Range Seeding	Acres	22,266	0	184,040	184,040
Rotation Hay & Pasture	Acres	10,583	0	238,117	238,117
Stubble Mulching	Acres	33,092	0	21,510	21,510
Terracing	Miles	2,230	0	235,931	235,931
Diversion Construction	Miles	245	0	81,002	81,002
Pond Construction	Each	715	0	189,115	189,115
Waterway Development	Acres	752	0	34,186	34,186
Improvement Cutting	Acres	1,860	0	2,790	2,790
Technical Assistance	Dollars		127,850	0	127,850
TOTAL LAND TREATMENT			127,850	2,367,580	2,495,430
STRUCTURAL MEASURES					
FLOOD PREVENTION					
Soil Conservation Service					
Waterflow Control	Each		1,342,831	250,000	1,592,831
TOTAL CONSTRUCTION COSTS			1,342,831	250,000	1,592,831
INSTALLATION SERVICES					
Total SCS			386,819	9,300	396,119
OTHER COSTS			0	198,571	198,571
TOTAL STRUCTURAL MEASURES			1,729,650	457,871	2,187,521
GRAND TOTAL			1,857,500	2,825,451	4,682,951
SUMMARY					
Total SCS			1,857,500	0	1,857,500

Date: May 1955

TABLE 2 - STATUS OF WATERSHED WORKS OF IMPROVEMENT
June 30, 1954
Cummins Creek Watershed, Texas

Measures	Unit	Applied to Date	Total Non-Federal Cost (dollars)
LAND TREATMENT			
Contour Cultivation	Acres	8,000	4,000
Cover Cropping	Acres	14,934	102,679
Proper Use, Range	Acres	8,236	12,444
Proper Use, Pasture	Acres	5,084	15,252
Brush Control	Acres	305	4,050
Pasture Planting	Acres	1,612	27,880
Range Seeding	Acres	207	1,290
Rotation Hay and Pasture	Acres	29	518
Stubble Mulching	Acres	13,292	9,242
Terracing	Miles	421	34,860
Diversion Construction	Miles	27	6,196
Pond Construction	Each	235	41,006
Waterway Development	Acres	92	3,709
Improvement Cutting (Pine)	Acres	0	0
STRUCTURAL MEASURES FOR FLOOD PREVENTION			
Floodwater retarding structures	Each	0	0
Total	xx	xx	263,126

Date: May 1955

TABLE 3 - ANNUAL COSTS

Cummins Creek Watershed, Texas

Measures	AMORTIZATION OF INSTALLATION COSTS			OPERATION AND MAINTENANCE COSTS			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Waterflow Control							
1. Floodwater retarding structure No. 1	2,389	697	3,086		115	115	3,201
2. Floodwater retarding structure No. 2	2,133	623	2,756		115	115	2,871
3. Floodwater retarding structure No. 3	1,797	524	2,321		115	115	2,436
4. Floodwater retarding structure No. 4	2,137	624	2,761		115	115	2,876
5. Floodwater retarding structure No. 5	2,249	656	2,905		115	115	3,020
6. Floodwater retarding structure No. 6	1,281	374	1,655		77	77	1,732
7. Floodwater retarding structure No. 7	2,821	823	3,644		115	115	3,759
8. Floodwater retarding structure No. 8	2,099	613	2,712		115	115	2,827
9. Floodwater retarding structures No. 9 and 10	3,805	1,111	4,916		192	192	5,108
10. Floodwater retarding structure No.11	1,035	302	1,337		77	77	1,414
11. Floodwater retarding structure No.12	1,602	468	2,070		77	77	2,147
12. Floodwater retarding structures No. 13 and 14	4,181	1,221	5,402		192	192	5,594
13. Floodwater retarding structures No. 15 and 16	5,227	1,526	6,753		230	230	6,983
14. Floodwater retarding structure No.17	1,201	350	1,551		77	77	1,628
15. Floodwater retarding structure No.18	1,794	523	2,317		115	115	2,432
16. Floodwater retarding structure No.19	1,703	497	2,200		115	115	2,315
17. Floodwater retarding structure No.20	2,722	795	3,517		115	115	3,632
18. Floodwater retarding structure No.21	1,886	551	2,437		115	115	2,552
19. Floodwater retarding structure No.22	1,834	535	2,369		115	115	2,484
20. Floodwater retarding structure No.23	3,638	1,062	4,700		154	154	4,854

TABLE 3 - ANNUAL COSTS (Continued)

Cummins Creek Watershed, Texas

Measures	AMORTIZATION OF INSTALLATION COSTS			OPERATION AND MAINTENANCE COSTS			Total
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
STRUCTURAL MEASURES FOR FLOOD PREVENTION							
Waterflow Control							
21. Floodwater retarding structure No. 24	1,436	419	1,855		115	115	1,970
22. Floodwater retarding structure No. 25	1,430	417	1,847		115	115	1,962
23. Floodwater retarding structure No. 26	1,172	342	1,514		77	77	1,591
24. Floodwater retarding structure No. 27	1,836	536	2,372		115	115	2,487
25. Floodwater retarding structure No. 28	1,130	330	1,460		77	77	1,537
26. Floodwater retarding structures No. 29 and 30	3,681	1,074	4,755		192	192	4,947
27. Floodwater retarding structure No. 31	2,765	807	3,572		115	115	3,687
Subtotal	60,984	17,800	78,784		3,262	3,262	82,046
TOTAL STRUCTURAL MEASURES FOR FLOOD PREVENTION	60,984	17,800	78,784		3,262	3,262	82,046
GRAND TOTAL	60,984	17,800	78,784		3,262	3,262	82,046

TABLE 4 - SUMMARY OF BENEFITS

Cummins Creek Watershed, Texas

	Estimated Average Annual Damage Without Project	Estimated Average Annual Damage Without Structural Measures	Estimated Average Annual Damage With Project	Benefits From Structural Measures	Classes of Benefits 1 A	Classes of Benefits 1 B	Classes of Benefits 2 A	Classes of Benefits 2 B
	(dollars)	(dollars)	(dollars)	(dollars)				
Floodwater	246,935	206,715	60,225	146,490	82,717	63,773		
Sediment	25,738	16,295	12,218	4,077	3,431	646		
Erosion	10,807	9,411	2,147	7,264	6,113	1,151		
Indirect	28,348	23,242	7,459	15,783		15,783		
SUBTOTAL	311,828	255,663	82,049	173,614	92,261	81,353		
Benefit from Changed Use of Land	xxx	xxx	xxx	26,794	20,096		6,698	
TOTAL FLOOD PREVENTION BENEFITS	xxx	xxx	xxx	200,408	112,357	81,353	6,698	

GRAND TOTAL ALL BENEFITS $200,408

Date: May 1955

TABLE 5 - BENEFIT COST ANALYSIS

Cummins Creek Watershed, Texas

Measures	AVERAGE ANNUAL BENEFITS						Average Annual Cost	Benefit-Cost Ratio
	Floodwater	Sediment	Erosion	Indirect	Change of Land Use	Total		
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
STRUCTURAL MEASURES FOR FLOOD PREVENTION								
Waterflow Control								
1. Floodwater retarding structure No. 1	10,698	298	530	1,153	1,957	14,636	3,201	4.57:1
2. Floodwater retarding structure No. 2	3,574	100	177	385	654	4,890	2,871	1.70:1
3. Floodwater retarding structure No. 3	7,573	211	375	816	1,385	10,360	2,436	4.25:1
4. Floodwater retarding structure No. 4	5,280	147	262	569	966	7,224	2,876	2.51:1
5. Floodwater retarding structure No. 5	6,738	188	334	726	1,232	9,218	3,020	3.05:1
6. Floodwater retarding structure No. 6	3,724	104	185	401	681	5,095	1,732	2.94:1
7. Floodwater retarding structure No. 7	7,660	213	380	825	1,401	10,479	3,759	2.79:1
8. Floodwater retarding structure No. 8	2,765	77	137	298	506	3,783	2,827	1.34:1
9. Floodwater retarding structures No. 9 and 10	11,421	318	566	1,230	2,089	15,624	5,108	3.06:1
10. Floodwater retarding structure No.11	2,491	69	124	268	456	3,408	1,414	2.41:1
11. Floodwater retarding structure No.12	3,574	100	177	385	654	4,890	2,147	2.28:1
12. Floodwater retarding structures No. 13 and 14	11,110	309	551	1,197	2,032	15,199	5,594	2.72:1
13. Floodwater retarding structures No. 15 and 16	9,652	269	479	1,040	1,765	13,205	6,983	1.89:1
14. Floodwater retarding structure No.17	1,955	54	97	211	358	2,675	1,628	1.64:1
15. Floodwater retarding structure No.18	3,587	100	178	386	656	4,907	2,432	2.02:1
16. Floodwater retarding structure No.19	3,014	84	149	325	551	4,123	2,315	1.78:1
17. Floodwater retarding structure No.20	6,103	169	303	658	1,116	8,349	3,632	2.30:1
18. Floodwater retarding structure No.21	6,389	178	317	688	1,169	8,741	2,552	3.43:1
19. Floodwater retarding structure No.22	2,279	63	113	246	417	3,118	2,484	1.26:1
20. Floodwater retarding structure No.23	7,448	207	370	802	1,362	10,189	4,854	2.10:1

TABLE 5 - BENEFIT COST ANALYSIS (Continued)

Cummins Creek Watershed, Texas

Measures	Floodwater	Sediment	Erosion	Indirect	Change of Land Use	Total	Average Annual Cost	Benefit-Cost Ratio
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
STRUCTURAL MEASURES FOR FLOOD PREVENTION								
Waterflow Control								
21. Floodwater retarding structure No.24	1,731	48	86	187	316	2,368	1,970	1.20:1
22. Floodwater retarding structure No.25	2,990	83	148	322	547	4,089	1,962	2.08:1
23. Floodwater retarding structure No 26	1,357	38	67	146	248	1,857	1,591	1.17:1
24. Floodwater retarding structure No.27	5,206	145	258	561	952	7,122	2,487	2.86:1
25. Floodwater retarding structure No.28	1,569	44	78	169	287	2,147	1,537	1.40:1
26. Floodwater retarding structures No. 29 and 30	8,768	243	435	945	1,604	11,995	4,947	2.42:1
27. Floodwater retarding structure No.31	7,834	218	388	844	1,433	10,717	3,687	2.91:1
Subtotal	146,490	4,077	7,264	15,783	26,794	200,408	82,046	2.44:1
TOTAL STRUCTURAL MEASURES FOR FLOOD PREVENTION	146,490	4,077	7,264	15,783	26,794	200,408	82,046	2.44:1
GRAND TOTAL	146,490	4,077	7,264	15,783	26,794	200,408	82,046	2.44:1

TABLE 6 - STRUCTURE DATA
Preliminary Estimates for Floodwater Retarding Structures
Cummins Creek Watershed, Texas

Site No.	Drainage Area	STORAGE CAPACITY								SURFACE AREA		Max. Ht. of Dam	Volume of Fill	PRINCIPAL SPILLWAY	
		Sed. Pool	Sed. Reserve	Det. Pool	Total	Sed. Pool	Sed. Reserve	Det. Pool	Total	Top Sed. Pool	Top Det. Pool			Size	Max. Disch. Cap.
	sq.mi.	acre-feet				inches				acres		ft.	cu. yd.	sq.ft.	cfs
1	8.59	200	75	3,720	3,995	0.44	0.16	8.12	8.72	110	731	22	144,836	2.64	43
2	2.87	92	0	989	1,081	0.60	0.00	6.46	7.06	46	196	20	150,928	1.58	14
3	6.08	194	0	2,063	2,257	0.60	0.00	6.36	6.96	64	387	23	101,144	1.97	30
4	4.24	113	0	1,454	1,567	0.50	0.00	6.43	6.93	40	205	29	143,154	1.58	21
5	5.41	173	0	1,875	2,048	0.60	0.00	6.50	7.10	54	328	22	146,642	1.97	27
6	2.99	80	0	1,024	1,104	0.50	0.00	6.40	6.90	24	122	26	89,106	1.58	15
7	6.15	200	62	2,098	2,360	0.61	0.19	6.40	7.20	70	330	24	183,508	2.64	31
8	2.22	200	1	730	931	1.69	0.01	6.16	7.86	49	136	23	141,662	1.58	11
9	3.11	133	0	1,072	1,205	0.80	0.00	6.46	7.26	38	204	24	83,994	1.58	16
10 1/	6.06	200	91	2,011	2,302	0.62	0.28	6.22	7.12	72	330	25	137,560	1.97	30
11	2.00	85	0	677	762	0.80	0.00	6.35	7.15	23	111	25	71,474	1.58	10
12	2.87	122	0	933	1,055	0.80	0.00	6.10	6.90	25	128	30	98,310	1.58	14
13	5.93	200	274	2,008	2,482	0.63	0.87	6.35	7.85	40	249	33	164,398	1.97	30
14 1/	2.99	200	103	1,005	1,308	1.25	0.65	6.30	8.20	43	133	29	83,186	1.58	15
15	2.48	200	24	858	1,082	1.52	0.18	6.50	8.20	45	134	27	123,832	1.58	12
16 1/	5.27	200	278	1,714	2,192	0.71	0.99	6.10	7.80	54	242	29	182,478	1.97	26
17	1.57	117	0	527	644	1.40	0.00	6.30	7.70	16	56	39	83,298	1.58	8
18	2.88	154	0	983	1,137	1.00	0.00	6.40	7.40	31	114	32	120,334	1.58	14
19	2.42	200	19	809	1,028	1.55	0.15	6.27	7.97	37	118	31	116,338	1.58	12
20	4.90	200	61	1,672	1,933	0.77	0.23	6.40	7.40	59	212	30	178,838	1.97	25
21	5.13	200	238	1,750	2,188	0.73	0.87	6.40	8.00	44	242	30	115,140	1.97	26
22	1.83	146	0	594	740	1.50	0.00	6.10	7.60	27	74	33	131,876	1.58	9

TABLE 6 - STRUCTURE DATA (Continued)
Preliminary Estimates for Floodwater Retarding Structures
Cummins Creek Watershed, Texas

Site No.	Drainage Area	Storage Capacity: Sed. Pool	Storage Capacity: Sed. Reserve	Storage Capacity: Det. Pool	Storage Capacity: Total	Storage Capacity: Sed. Pool	Storage Capacity: Sed. Reserve	Storage Capacity: Det. Pool	Storage Capacity: Total	Surface Area: Top Sed. Pool	Surface Area: Top Det. Pool	Max. Ht. of Dam	Volume of Fill	Principal Spillway: Size	Principal Spillway: Max. Disch. Cap.
	sq.mi.	acre-feet				inches				acres		ft.	cu.yd.	sq.ft.	cfs
23	5.98	200	310	1,964	2,474	0.63	0.97	6.16	7.76	42	248	33	245,604	1.97	30
24	1.39	104	0	458	562	1.40	0.00	6.20	7.60	18	67	30	103,216	1.58	7
25	2.40	90	0	802	892	0.70	0.00	6.27	6.97	17	82	33	100,334	1.58	12
26	1.09	70	0	362	432	1.20	0.00	6.21	7.41	19	59	26	80,882	1.58	5
27	4.18	200	23	1,436	1,659	0.90	0.10	6.45	7.45	45	185	30	122,490	1.58	21
28	1.26	74	0	434	508	1.10	0.00	6.47	7.57	19	61	28	79,886	1.58	6
29	1.05	62	0	347	409	1.10	0.00	6.20	7.30	15	51	26	70,286	1.58	5
30 1/	5.99	200	55	1,980	2,235	0.63	0.17	6.20	7.00	34	199	40	191,372	1.97	30
31	6.29	200	169	2,130	2,499	0.60	0.50	6.35	7.45	43	212	35	183,714	2.64	31
Total	117.62	4,809	1,783	40,479	47,071					1,263	5,946		3,969,820		

1/ Excluding the area from which runoff is controlled by a floodwater retarding structure in series.

Note: 1. Acres of flood plsin area inundated: Site No. 31, 20 acres under sediment pool.
2. Vegetative emergency spillway provided for all structures.

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TABLE 6A - STRUCTURE DATA

Estimated Structure Cost Distribution
Cummins Creek Watershed, Texas

Site No.	FEDERAL INSTALLATION COST: Contract	Installation Services	Contingencies	Adm. and Misc.	Total Federal	NON-FEDERAL INSTALLATION COST: Contract	Installation Services	Easements and R/W	Contingencies	Total Non-Federal	Estimated Total Cost
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
1	49,288	10,139	4,929	3,403	67,759	1,405	300	16,093	140	17,938	85,697
2	42,172	10,565	4,217	3,546	60,500	10,654	300	3,996	1,065	16,015	76,515
3	36,643	7,975	3,664	2,677	50,959	3,238	300	9,628	324	13,490	64,449
4	42,263	10,581	4,226	3,552	60,622	10,641	300	4,043	1,064	16,048	76,670
5	44,599	11,021	4,460	3,699	63,779	10,505	300	5,027	1,051	16,883	80,662
6	25,455	6,237	2,546	2,094	36,332	5,731	300	3,014	573	9,618	45,950
7	55,776	13,966	5,578	4,688	80,008	14,052	300	5,423	1,405	21,180	101,188
8	41,401	10,476	4,140	3,517	59,534	10,982	300	3,379	1,098	15,759	75,293
9	26,010	6,160	2,601	2,068	36,839	4,788	300	4,186	479	9,753	46,592
10	49,811	12,196	4,981	4,093	71,081	11,163	300	6,237	1,116	18,816	89,897
11	20,605	5,003	2,061	1,681	29,350	4,409	300	2,619	441	7,769	37,119
12	32,948	6,882	3,295	2,309	45,434	1,461	300	10,121	146	12,028	57,462
13	56,425	11,508	5,642	3,863	77,438	1,114	300	18,974	111	20,499	97,937
14	29,343	6,655	2,934	2,234	41,166	3,932	300	6,273	393	10,898	52,064
15	38,783	8,668	3,878	2,910	54,239	4,558	300	9,043	456	14,357	68,596
16	67,755	14,598	6,776	4,900	94,029	5,235	300	18,833	524	24,892	118,921
17	23,610	6,055	2,361	2,032	34,058	6,664	300	1,386	666	9,016	43,074
18	35,491	8,857	3,549	2,973	50,870	8,796	300	3,490	880	13,466	64,336
19	34,010	8,144	3,401	2,734	48,289	6,708	300	5,104	671	12,783	61,072
20	54,396	13,009	5,440	4,367	77,212	10,646	300	8,428	1,065	20,439	97,651
21	38,675	8,200	3,867	2,752	53,494	2,324	300	11,304	233	14,161	67,655
22	36,088	9,231	3,609	3,099	52,027	10,068	300	2,398	1,007	13,773	65,800
23	72,915	17,192	7,291	5,772	103,170	13,045	300	12,661	1,305	27,311	130,481
24	28,117	7,337	2,812	2,463	40,729	8,569	300	1,054	857	10,780	51,509

Date: May 1955

TABLE 6A - STRUCTURE DATA (Continued)

Estimated Structure Cost Distribution
Cummins Creek Watershed, Texas

Site No.	FEDERAL INSTALLATION COST					NON-FEDERAL INSTALLATION COST					Estimated Total Cost
	Contract	Installation Services	Contingencies	Adm. and Misc.	Total Federal	Contract	Installation Services	Easements and R/W	Contingencies	Total Non-Federal	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
25	28,046	7,261	2,805	2,435	40,547	8,263	300	1,345	826	10,734	51,281
26	23,185	5,788	2,319	1,944	33,236	5,753	300	2,170	575	8,798	42,034
27	36,941	8,574	3,694	2,877	52,086	5,932	300	6,963	593	13,788	65,874
28	22,334	5,592	2,233	1,877	32,036	5,626	300	1,991	563	8,480	40,516
29	19,776	5,060	1,978	1,699	28,513	5,524	300	1,172	552	7,548	36,061
30	52,728	13,396	5,273	4,497	75,894	14,252	300	4,114	1,425	20,091	95,985
31	55,166	13,280	5,516	4,458	78,420	11,235	300	8,102	1,123	20,760	99,180
GRAND TOTAL	1,220,755	289,606	122,076	97,213	1,729,650	227,273	9,300	198,571	22,727	457,871	2,187,521

Date: May 1955

TABLE 7 - SUMMARY OF PHYSICAL DATA

Cummins Creek Watershed, Texas

Item	Unit	Quantity Without Program	Quantity With Program
Watershed area	Sq. Mi.	320.15	xxx
Watershed area	Acres	204,896	xxx
Area of cropland	Acres	54,777	62,848
Area of grassland	Acres	101,090	107,395
Area of woodland	Acres	44,569	30,193
Overflow area subject to damage by design storm	Acres	11,655	8,491
Annual rate of erosion			
Sheet	Tons/yr.	1,732,712	1,081,398
Gully	Tons/yr	6,340	4,438
Streambank	Tons/yr	71,943	71,343
Scour	Tons/yr	240,669	48,134
Area damaged annually by			
Sediment	Acres	1,143	434
Flood plain scour	Acres	839	168
Swamping	Acres	--	--
Streambank erosion	Acres	3.7	3.7
Sheet erosion	Acres	144,845	61,794
Sediment production	Tons/Ac./yr.	1.75	0.66
Average annual rainfall	Inches	38	xxx

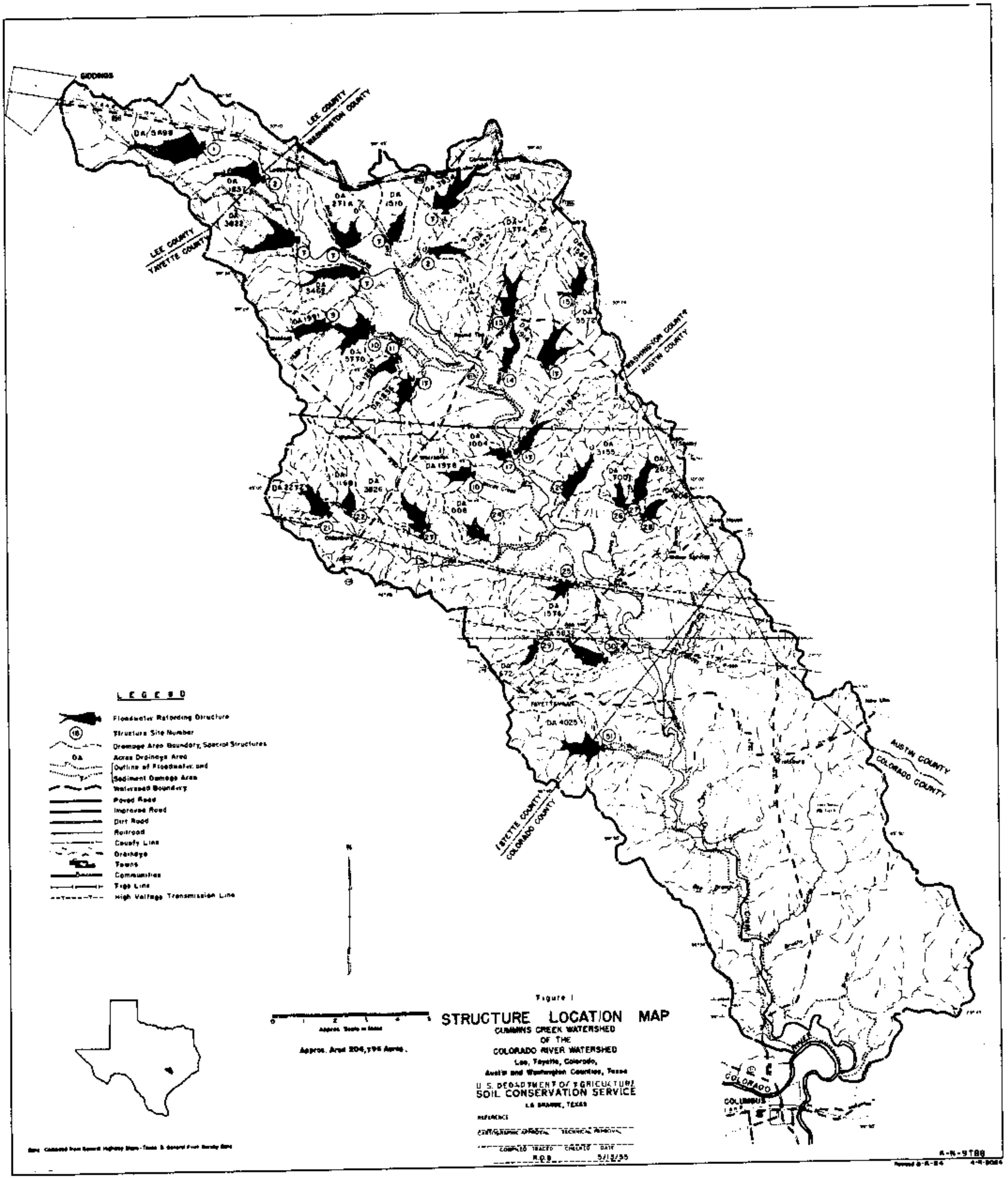
Date: May 1955

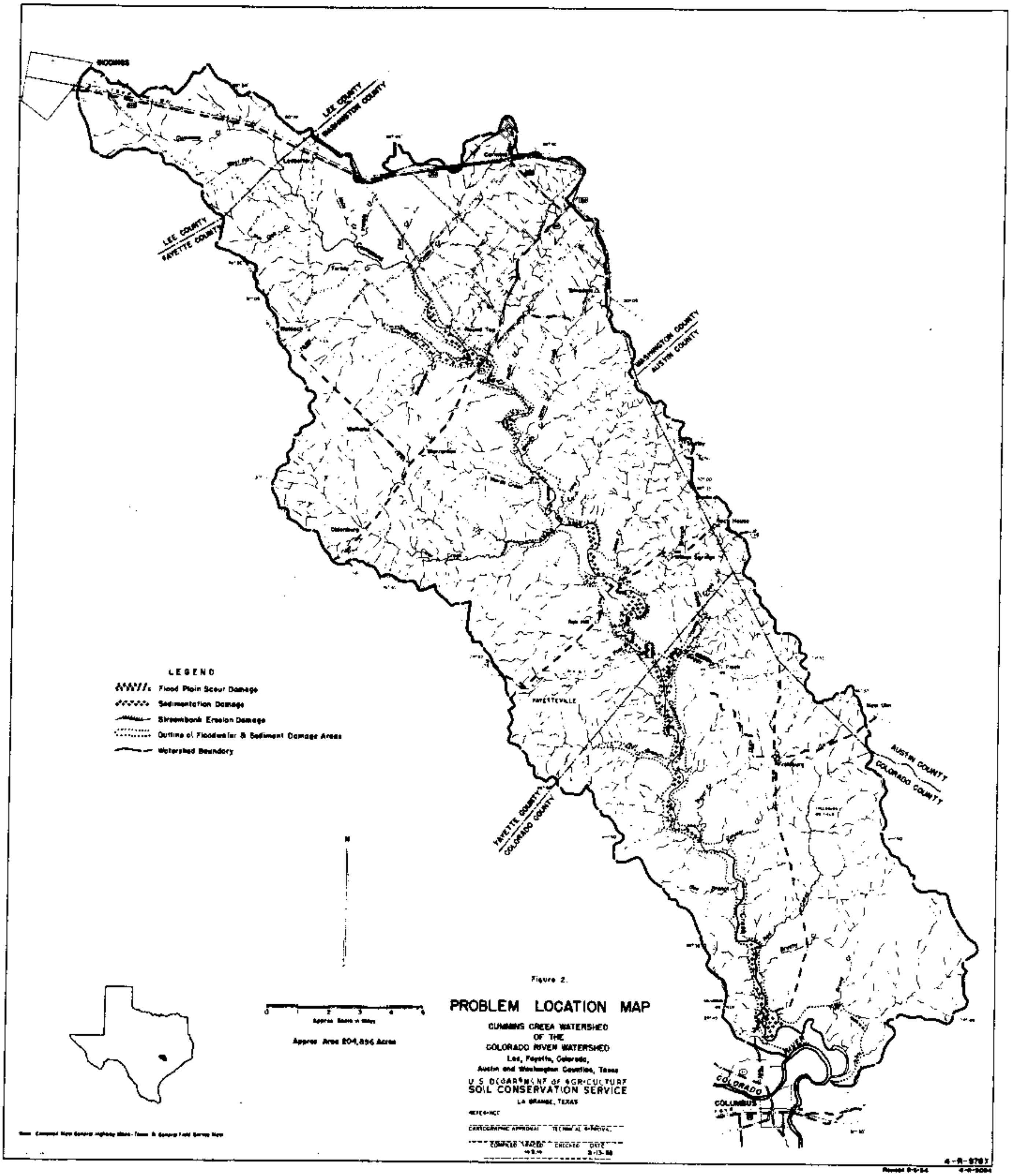
TABLE 8 - SUMMARY OF PLAN DATA

Cummins Creek Watershed, Texas

Item	Unit	Quantity
Years to complete program	Year	10
Total installation cost		
Federal	Dollar	1,857,500
Non-Federal	Dollar	2,825,451
Annual O. and M. cost		
Federal	Dollar	-
Non-Federal	Dollar	93,621
Annual benefits	Dollar	200,408
Structural Measures		
Floodwater Retarding Structures	Each	31
Area inundated by structures		
Flood plain		
Detention pool	Acres	0
Sediment pool	Acres	20
Upland		
Detention pool	Acres	4,446
Sediment pool (including sediment reserve)	Acres	1,480
Watershed area above structures	Acres	75,277
Reduction of floodwater damage		
Land treatment measures	Percent	18
Structural measures	Percent	56
Reduction of sediment damage		
Land treatment measures	Percent	33
Structural measures	Percent	30
Reduction of erosion damage		
Land treatment measures	Percent	18.01
Structural measures	Percent	55.68
Benefit from more intensive use of land resulting from reduction of flood hazard	Dollar	26,794
Irrigation benefits	Dollar	--
Drainage benefits	Dollar	--
Other agricultural water management		--

Date: May 1955


GIDDINGS
LEE COUNTY
WASHINGTON COUNTY
LEE COUNTY
FAYETTE COUNTY
WASHINGTON COUNTY
AUSTIN COUNTY
AUSTIN COUNTY
COLORADO COUNTY
FAYETTE COUNTY
COLORADO COUNTY
COLORADO
COLUMBUS
LEGEND
Floodwater Retarding Structure
Structure Site Number
Drainage Area Boundary, Special Structures
DA Acres Drainage Area
Outline of Floodwater and Sediment Damage Area
Watershed Boundary
Paved Road
Improved Road
Dirt Road
Railroad
County Line
Drainage
Towns
Communities
Fence Line
High Voltage Transmission Line
Approx. Area 204,196 Acres
Figure I
STRUCTURE LOCATION MAP
CUMMINS CREEK WATERSHED
OF THE
COLORADO RIVER WATERSHED
Lee, Fayette, Colorado,
Austin and Washington Counties, Texas
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LA GRANGE, TEXAS
REFERENCE
CARTOGRAPHIC APPROVAL
TECHNICAL APPROVAL
COMPILED
TRACED
CHECKED
DATE
R.O.B.
5/12/55
4-N-9788


GIDDINGS
LEE COUNTY
WASHINGTON COUNTY
LEE COUNTY
FAYETTE COUNTY
WASHINGTON COUNTY
AUSTIN COUNTY
FAYETTEVILLE
AUSTIN COUNTY
COLORADO COUNTY
FAYETTE COUNTY
COLORADO COUNTY
COLORADO
COLUMBUS
LEGEND
Flood Plain Scour Damage
Sedimentation Damage
Streambank Erosion Damage
Outline of Floodwater & Sediment Damage Areas
Watershed Boundary
N
Figure 2.
PROBLEM LOCATION MAP
CUMMINS CREEK WATERSHED
OF THE
COLORADO RIVER WATERSHED
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
LA GRANGE, TEXAS
CARTOGRAPHIC APPROVAL
TECHNICAL APPROVAL
COMPILED
TRACED
CHECKED
DATE
4-R-9787