

Supplement To

WORK PLAN

BRADY CREEK WATERSHED
Of the Middle Colorado River Watershed
Concho, McCulloch, Menard and San Saba Counties, Texas

Supplement to Plan prepared and works of improvement to be installed under the authority of the Flood Control Act of 1936, as amended and supplemented.

Participating Agencies

City of Brady
Concho Soil Conservation District
San Saba-Brady Soil Conservation District

Prepared By:

Soil Conservation Service
U. S. Department of Agriculture
Temple, Texas
October 1960

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INTRODUCTION

Following approval of the Brady Creek Work Plan and prior to installation of the watershed project, the sponsoring local organizations expressed the desire to add municipal water supply to the original project purpose of flood prevention.

Investigations were completed relative to the addition of municipal water supply as a purpose to the approved watershed project. Consequently, this supplement provides for the inclusion of the added project purpose. It shows also the current status of development for the flood prevention aspect of the project.

SUPPLEMENT TO
WATERSHED WORK PLAN

for

FLOOD PREVENTION AND NON-AGRICULTURAL WATER MANAGEMENT

BRADY CREEK WATERSHED
of the Middle Colorado Watershed
Concho, McCulloch, Menard and San Saba Counties, Texas
October, 1960

SUMMARY OF PLAN

Description:

Size: 541,500 acres - 846 square miles

Land Use:

Cultivation	106,629 acres
Pasture and Range	428,243 acres
Miscellaneous	6,628 acres

Flood Plain area: 26,330 acres

Soil Conservation Districts:

Concho	329,500 acres
San Saba-Brady	212,000 acres

No Federal lands involved.

Flood Frequency:

Total of 76 floods during 20-year period of study (1923 through 1942),
of which eight inundated more than half the flood plain area.

Land Treatment:

<u>Practice</u>	<u>Unit</u>	<u>Applied to Date</u>	<u>To Be Applied Installation Period</u>
Contour Farming	Acre	54,000	6,400
Cover Cropping	Acre	8,600	3,900
Rotation Hay and Pasture	Acre	12,500	13,200
Crop Residue Use	Acre	25,000	6,600
Deferred Grazing	Acre	105,000	60,000
Proper Range Use	Acre	116,000	90,000
Range Seeding	Acre	2,000	1,400
Brush Control	Acre	35,200	13,600
Terracing	Mile	1,600	88
Diversion Construction	Mile	75	4
Pond Construction	No.	80	50

Structural Measures:

Multiple-Purpose Structure	No.	0	1
Floodwater Retarding Structures	No.	39	2
Channel Improvement	Mile	-	42

Total Cost:

<u>Item</u>	<u>Federal (dollars)</u>	<u>Non-Federal (dollars)</u>	<u>Total (dollars)</u>
Land Treatment	42,000	855,400	897,400
Structural Measures	<u>5,454,335</u>	<u>2,216,974</u>	<u>7,671,309</u>
Total	5,496,335	3,072,374	8,568,709

Damages and Benefits:

<u>Item</u>	<u>Without Project (dollars)</u>	<u>With Project (dollars)</u>	<u>Average Annual Monetary Benefits, Structures (dollars)</u>
Floodwater Damage	383,989	37,881	315,970
Erosion Damage	3,576	52	3,334
Indirect Damage	47,492	4,684	39,041
Total	<u>435,057</u>	<u>42,617</u>	<u>358,345</u>
Changed Land Use			22,217
More Intensive Land Use			20,241
Benefits Outside Project Area			14,750
Non-agricultural Water Management			<u>40,968</u>
Total			456,521

Benefit-Cost Ratio - Structural Measures

Average Annual Cost - Structures	\$300,383
Average Annual Benefits - Structures	456,521
Benefit-Cost Ratio	1.5:1

Operation and Maintenance:

Land Treatment Measures:

Concho Soil Conservation District
San Saba-Brady Soil Conservation District

Structural Measures:

City of Brady
Concho Soil Conservation District
San-Saba-Brady Soil Conservation District

Annual Cost	\$23,142
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DESCRIPTION OF WATERSHED

Physical Data

Brady Creek heads approximately 10 miles west of Eden, Concho County, and flows in an easterly direction through Concho, McCulloch and San Saba Counties for a distance of about 93 stream miles to enter the San Saba River approximately 10 miles south of Richland Springs, Texas. The major tributaries are Little Brady, Onion and Reubes Creeks, South Fork of Brady Creek and Hardin and Maverick Branches. The watershed ranges from 9 to 17 miles in width. It has an area of 541,500 acres (846 square miles), most of which is in farms and ranches.

The topography of the watershed ranges from rolling to hilly with narrow bands of gently rolling to nearly level land in the larger stream valleys. The watershed is well drained and has local relief of 50 to 200 feet. Most of the tributary drainage systems are deeply incised, especially near the outer edge of the watershed. The lower stream channel of Brady Creek, from about one mile east of Brady to its confluence with the San Saba River, flows in a gorge section. In the central section of the watershed the flood plain ranges from one-half to one mile in width.

The higher flatter part of the drainage area in Concho County occupies the upland developed on the Edwards Limestone of Lower Cretaceous Age. In central McCulloch County, the margin of the plateau has been deeply notched by erosion along the main valleys. A wide variety of rock formations, ranging in age from Cambrian to Lower Cretaceous, occur in the Brady Creek drainage area. Most of the formations are well indurated and relatively resistant. Consequently, erosion has produced rugged, bluff-like valley rims, irregular spurs and promontories and canyons along some main streams.

Outcrops in the Brady Creek valley from Eden eastward include Permian limestone and red shales, Pennsylvanian sandstones and shales with some interbedded limestones, Lower Pennsylvanian and Mississippian shales and marbles and Cambro-Ordovician limestones. The latter formation, the Ellenburger limestone, occurs only in very limited outcrops outside of the Llano Basin area. Most of the formations, except the younger Pennsylvanian strata west of Brady, have been affected somewhat by faulting, channeling and solution by ground water so that springs occur along the bluff lines and in the canyons. The quality of the ground water generally is good.

The Brady Creek watershed lies entirely in the Edwards Plateau Land Resource Area.

Soils generally are in fair condition. Considerable amounts of small grains and high-residue producing crops are grown on the cropland and aid in the prevention of rapid deterioration of the soil. In some sections significant amounts of cropland have been shifted to grass. Rangeland areas have shown considerable improvement during the past few years due to the better moisture conditions. In general, the hydrologic cover is fair with some small areas good and poor.

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

<u>Land Use</u>	<u>Acres</u>	<u>Percent</u>
Cultivation	106,629	20
Range	428,243	79
Miscellaneous ^{1/}	6,628	1

^{1/} Includes roads, railroads, urban areas, etc.

The flood plain consists of 26,330 acres and is that area which will be inundated by the runoff from the largest storm considered in the 20-year

series. This storm produced 7.72 inches of rain and resulted in 1.56 inches of runoff. At the present time about 57 percent of the flood plain is in cultivation, 41 percent is in pasture and 2 percent is in miscellaneous uses.

The average annual rainfall for the watershed is 25 inches, but the annual rainfall has varied from 11 to 49 inches. Precipitation generally is the greatest during the spring and fall months; however, individual flood producing storms have occurred in all seasons.

The climate is temperate and dry sub-humid. It is characterized by erratic distribution of rainfall, moderate winters with sudden temperature changes and long summers. The average minimum temperature for January is 33.4 degrees Fahrenheit, and the average maximum temperature for July is 95.2 degrees. However, temperatures as low as 2 degrees below zero, and as high as 109 degrees above zero have been recorded. The average frost-free period of 233 days extends from March 26 to November 14, although frost has occurred as late as April 30 and as early as October 19.

Surface runoff is the principal source of water for livestock; however, many farmers and ranchers depend on wells for domestic and livestock water. Most of these wells range from 100 to 350 feet in depth. Brady Creek and its tributaries have intermittent water holes which supply stock water through part of the year. The cities of Brady, Eden and Melvin obtain water from deep wells.

Economic Data

The economy of the watershed depends largely upon its farms and ranches. Major crops grown are cotton, grain sorghum, wheat, oats, barley, corn and hay.

The average size operating farm and ranch unit is 900 acres, with \$45,000 the average value per unit for land and buildings (1955 Census of Agriculture). The most common form of tenure is the part-owner type where the operator owns a portion of the land he operates and rents or leases the remainder.

Brady, the county seat of McCulloch County, and Eden, located in central Concho County, are important shipping points for cotton, wool, mohair and cattle. Industries in Brady include two cottonseed mills, a cotton compress, cheese plant, creamery, feed mill, wool scouring plant, and mattress factory. Rochelle, in east McCulloch County, and Melvin, in the western part, are local trade centers.

Status of Conservation Work in Watershed

The watershed is served by Soil Conservation Service work units at Brady and Eden, which are assisting the San Saba-Brady and Concho Soil Conservation Districts. These units have assisted farmers and ranchers in preparing 370 water and soil conservation plans on 323,900 acres (60 percent of the agricultural land) within the watershed, and in furnishing technical guidance for establishing and maintaining planned measures. Approximately 35 percent of the land treatment measures have been applied and maintained for as long as 3 years resulting in average crop and pasture yields increasing by about 20 percent in the areas treated. Land treatment measures applied to date are shown in Table 1A.

WATERSHED PROBLEMS

The watershed problems described below are those prevailing prior to the development of the original plan for flood prevention. Installation of

approximately 35 percent of the planned land treatment and 39 of 42 planned floodwater retarding structures has alleviated, to a considerable extent, the floodwater and sediment damage problems described below.

Floodwater Damage

Brady Creek has flooded frequently and caused high annual damage. During the 20-year period, 1923 to 1942, inclusive, there were eight floods the runoff from which inundated more than half of the flood plain. Four of the larger floods occurred during the spring months, causing damage to young growing crops. Four floods occurred in the early fall, prior to harvest, and too late for planting alternate crops, thus destroying the entire crop for that season.

The business district of the City of Brady is largely within the flood plain of Brady Creek. The current value of urban property subject to flood damage is estimated to be \$10,000,000. Intangible damages, such as loss of life and social security, would be great in case of a large flood. Forty-nine percent of the average annual flood damage in the watershed occurs within the town.

Damages caused by the July 1938 flood were estimated to be as follows (1957 Long Term Prices):

Direct Damages		
Crop and Pasture		\$863,174
Other Agricultural		573,292
Nonagricultural		
Roads, Bridges and Railroads		106,992
Urban		462,202
	Subtotal	<u>\$2,005,660</u>
Indirect Damages		220,622
	Total	<u>\$2,226,282</u>

For the floods experienced during the period studied, the total direct agricultural and nonagricultural floodwater damages under present conditions were estimated to average \$383,989 annually at long-term price levels. Of this amount, \$104,557 is crop and pasture damage; \$80,403 is other agricultural damage; and \$199,029 is nonagricultural damage, such as damage to roads, railroads, bridges and urban property. Indirect damages, such as interruption of travel, loss of business, breakdown of utility service and similar losses are estimated to average \$47,492. The average annual monetary flood damages are summarized in Table 5.

Erosion Damages

Damage by sheet scour to the flood plains of the watershed has reduced the productive capacity of 3,843 acres 15 to 40 percent. Scour channels generally are not continuous, but affected areas are found throughout the stream valleys. The channels average one to three feet in depth and usually have gently sloping sides. These scour channels remain wet longer after rains than does the uneroded bottomland. A total of 280 acres have been damaged 25 to 50 percent by scouring. Of the total area affected, about 80 percent is cropland. The average annual damage from scour is estimated to be \$3,576 under present conditions. Total land damage from streambank erosion is minor and occurs in small isolated areas throughout the watershed.

Sediment Damage

Sediment damage to the flood plain is minor. The deposits range from a few inches to about one foot in thickness and generally are in the form of uniform valley-wide accumulations. Damages in terms of reduced soil

productivity is minor and the total annual damages in dollars is not significant.

Problems Relating to Water Management

There is no need for drainage and very little activity has been shown relative to irrigation in the watershed. At the present time, there is no interest in providing storage in any of the structures for irrigation, fish and wildlife development or recreation. The water supply of the City of Brady is inadequate for future needs according to the report of their consulting engineer.

Existing or Proposed Works of Improvement

The City of Brady constructed a flood wall prior to 1938 which was ineffective against the July, 1938, flood. The Corps of Engineers has made several surveys in and around Brady in the interest of flood damage reduction; however, at the present time, no projects by that agency are pending approval or authorization.

The Soil Conservation Service, in cooperation with the Concho and San Saba-Brady Soil Conservation Districts, has installed 39 floodwater retarding structures under authorization of the Flood Control Act of 1936, as amended and supplemented.

The San Saba-Brady and Concho Soil Conservation Districts have been active in establishing land treatment measures and in initiating flood prevention work. The districts have directed their efforts toward a high degree of participation by the farmers, ranchers and other interested parties in the watershed.

WORKS OF IMPROVEMENT REMAINING TO BE INSTALLEDLand 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 two soil conservation districts serving the watershed, is essential for a sound flood prevention program on the watershed. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and management practices necessary to proper land use. Emphasis will be placed on accelerating the establishment of land treatment measures which have a measurable effect on reducing floodwater and sediment damages.

The amounts and estimated cost of establishing the needed measures that will be installed by landowners during the remainder of the installation are shown on Table 1. The estimated cost of planning and installing these measures, exclusive of expected reimbursement from ACPS ~~or other~~ Federal funds, is \$257,000, based on current program criteria. In addition, prior to this supplement, landowners and operators have established land treatment measures at an estimated non-Federal cost of \$598,400 (Table 1A). Also, prior to this work plan supplement, \$30,000 of Federal funds were used for the acceleration of technical assistance by the Soil Conservation Service to landowners and operators. This acceleration of technical assistance will be continued during the remaining installation period at a cost of \$12,000.

Most of the land treatment measures will function principally to decrease erosion damage to fields and pastures by providing improved soil-cover conditions. These measures include cover cropping, rotation hay and pasture, crop residue use for croplands and proper use and

deferred grazing to provide improvement, protection and good maintenance of grass stands on the rangelands. They also include brush control, to allow grass stands to improve for replacement of the poor cover afforded by brushy pastures; the construction of farm ponds to provide adequate numbers and locations of watering places to prevent cover-destroying, seasonal concentrations of livestock; and range seeding to establish good cover of grasses. These measures, especially the cropland measures and range seeding, also effectively improve soil conditions which allow larger amounts of rainfall to soak into the soil.

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

Structural Measures

A system of 41 floodwater retarding structures, together with the multiple-purpose structure (Brady Reservoir) and 42 miles of channel improvement will be required to afford the degree of protection to flood plain lands desired by the local people. Storage in the floodwater retarding structures, installed and planned for construction, ranges from 3.53 to 7.34 inches of runoff, depending on local conditions. The proposed multiple-purpose structure (Brady Reservoir) has a flood detention capacity of 4.20 inches from the uncontrolled area above this structure. Thirty-nine of the planned floodwater retarding structures have been installed to date.

Item	: Floodwater : Retarding : Structures	: Brady : Reservoir	: : :	: Combined : Programs
Drainage Area - Square Miles	287.12	267.86		554.98
Control - Percent	33.94	31.66		65.60
Flood Storage - Acre Feet	83,520	60,000		143,520
Storage from Drainage Area of Structures - Inch	5.45	4.20		4.85
Equivalent Storage Entire Watershed - Inch	1.85	1.33		3.18

Figure 1 shows a section of a typical floodwater retarding structure. The locations of structural measures are shown in Figure 2.

Land rights, which include land, easements and rights-of-way, have been obtained for the two planned floodwater retarding structures remaining to be installed. Land rights for the multiple-purpose structure (Brady Reservoir) and planned channel improvement will be provided by local interests at no cost to the Federal Government. The value of land rights, for the improved channel and Brady Reservoir, together with the cost for legal fees and relocation of roads, railroads, utilities and other improvements, is estimated to be \$1,289,144, based on current market values.

The estimated cost of establishing the works of improvement, installed and planned, is \$7,671,309, of which \$2,216,974 will be borne by local interests, and \$5,454,335 by flood prevention funds.

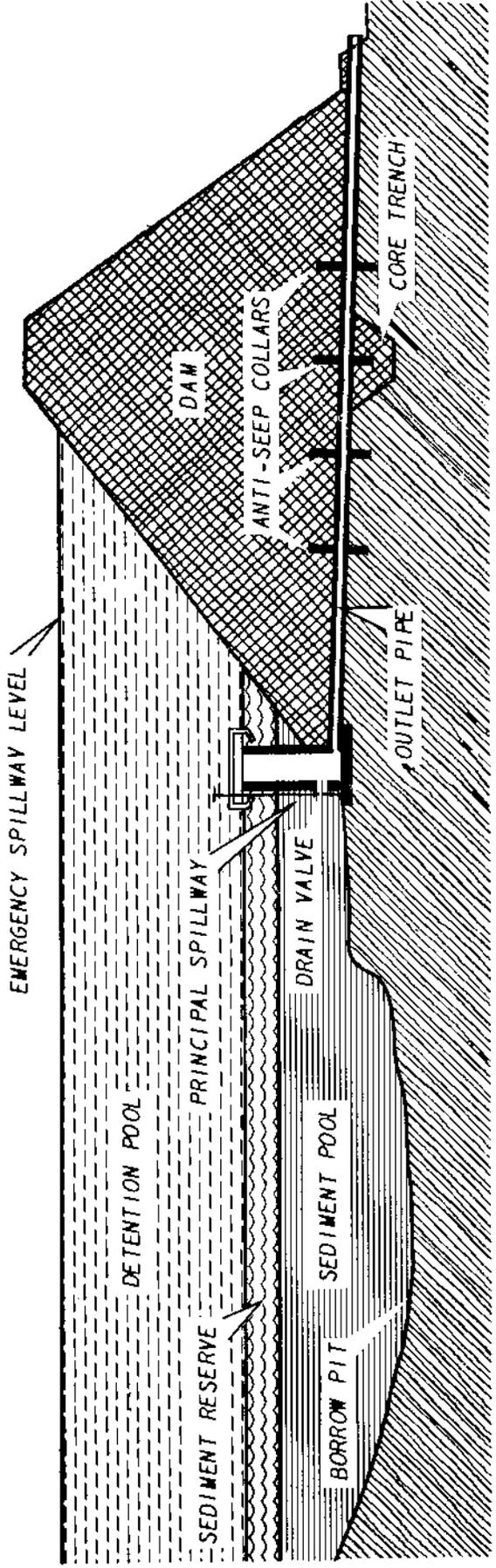
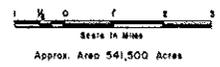
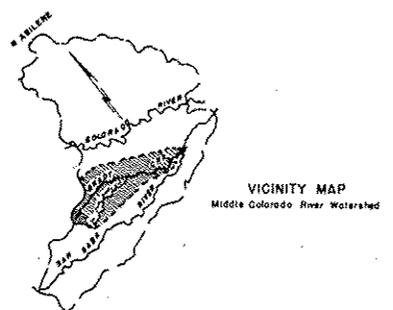
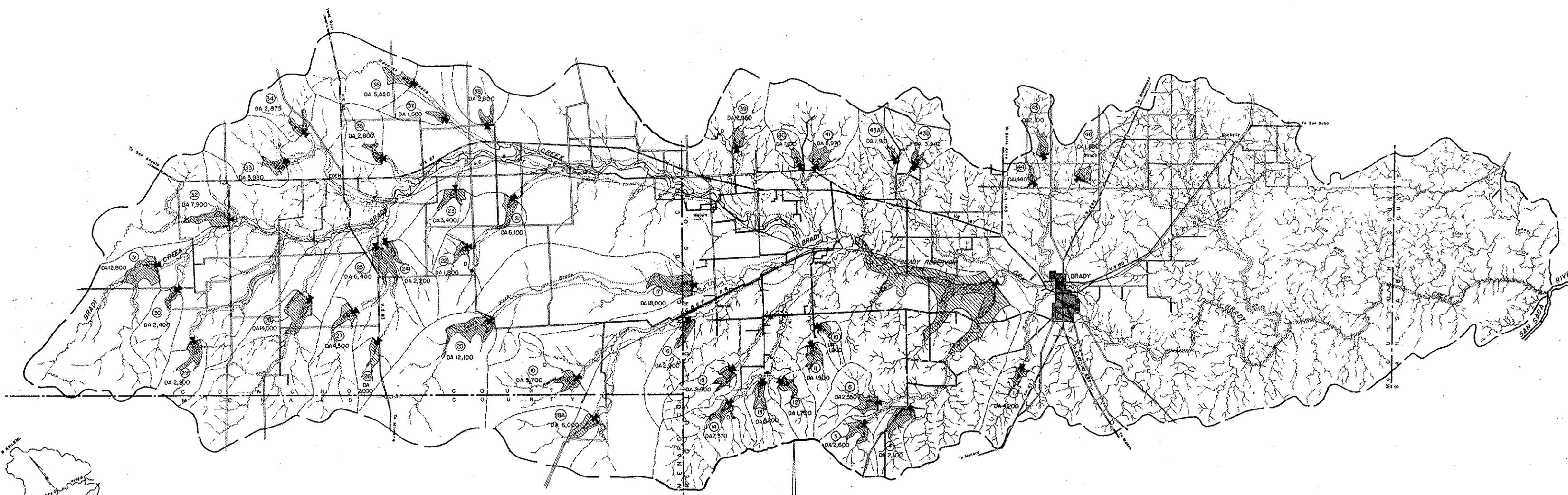


FIGURE 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE
Revised 10-24-57 4-1-10,071

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE
WASH. D. C. 20250



Compiled by the Cartographic Division, Region 4, Ft. Worth, Texas, March 1, 1949.
Portion in San Saba - Brady Soil Conservation District from aerial photograph. Remainder from uncontrolled photo base, sheets and General Highway Planning Survey.

- LEGEND**
- Watershed Boundary
 - Paved Road
 - Dirt Road
 - Railroad
 - County Line
 - Drainage
 - River
 - Cities or Towns
 - Shall Towns
 - Waterflow Retarding Structure
 - Floodwater Diversion
 - Floodway Improvement
 - Drainage Area Boundary - Special Structures
 - Acres Drainage Area
 - Outline of Flood and Sediment Damage Areas
 - Site Number

**PLANNED STRUCTURAL MEASURES
BRADY CREEK WATERSHED
OF THE MIDDLE-COLORADO RIVER WATERSHED
TEXAS**

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

The estimated annual equivalent cost of installation, \$277,241, plus an estimated annual operation and maintenance cost of \$23,142, makes a total annual cost of \$300,383.

Sufficient detention storage can be developed at all structure sites to make possible the use of rock or vegetative spillways, thereby effecting a substantial reduction in cost over concrete or similar type of spillway. All applicable State water laws have been and will be complied with in the design and construction of the floodwater retarding structures.

BENEFITS FROM WORKS OF IMPROVEMENT

The evaluation storm series for the period 1923 through 1942 contained 76 storms which would cause flooding under conditions existing prior to the installation of any of the planned works of improvement. The effect of the combined program of land treatment and structural measures is shown in Table 5.

The combined program of land treatment and structural measures installed and planned for construction on the watershed will eliminate all urban damages from floods of 50-year frequency of occurrence. A 100-year frequency storm would cause some flooding in that area lying between the Brady Creek channel and Main Street in the City of Brady. This should be kept in mind in planning future development.

Under conditions existing before project development, 26,330 acres of flood plain would be flooded by runoff from the largest storm which occurred during the 20-year period of evaluation (1.56 inches runoff). If such a rain were to occur after the application of needed land treatment, it is estimated that the area inundated would be reduced to 25,803 acres. With structural measures installed supplementing land treatment, 15,000 acres would be flooded.

The land treatment measures would reduce the average annual sediment yield of 0.50 acre-foot per square mile from the watershed of the 42 planned structures by 22 percent.

Owners and operators of flood plain lands say that they will restore some formerly cultivated land to crop production with adequate flood protection. It is estimated that net income from such restoration will amount to \$4,500 annually (long-term prices). This loss from original production has been considered a crop and pasture damage and its restoration a benefit in Table 5.

It is expected that landowners will convert 1,070 acres of pastureland to cropland which will result in an increase of \$20,300 in net annual income. Increased income from changed use of urban land will amount to \$1,917 annually, while more intensive use of 4,050 acres will produce an additional net income of \$20,241. The land being converted to cropland will be used to produce small grains, grain sorghums and forage crops. The more intensively used lands will consist of increased crop and pasture yields on protected flood plain as a result of increased intensity of production inputs.

The estimated average annual floodwater, erosion and indirect damages will be reduced from \$435,057 to \$42,617, a 90 percent reduction. Approximately 91 percent, \$358,345, of the expected reduction will result from the system of structural measures.

The total flood prevention benefits resulting from structural measures are estimated to be \$415,553 annually.

The local sponsors estimated the annual benefits from municipal water storage to be \$40,968 (long-term prices).

COMPARISON OF BENEFITS AND COSTS

The annual equivalent cost of structural measures (converted from total installation cost) plus the annual operation and maintenance cost, is estimated to be \$300,383. When the project is installed completely, it is expected to produce annual benefits of \$456,521. The installed project, therefore, will produce \$1.52 for each dollar of cost. Other substantial benefits will accrue as a result of the project, such as increased opportunity for recreation, improved wildlife habitat and an increased sense of security, none of which have been used for project justification.

ACCOMPLISHING THE PLAN

Federal assistance for carrying out the works of improvement as described in this plan will be provided under the Flood Control Act of 1936, as amended and supplemented.

Land Treatment Measures

Land treatment measures itemized in Table 1, will be established by farmers and ranchers in cooperation with the Concho and San Saba-Brady Soil Conservation Districts during the remaining installation period. 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 or other Federal programs. The amount of reimbursement to be expected has been estimated, based on current program criteria, and this amount has not been included in the total estimated non-Federal cost for land treatment listed in Table 1. The soil conservation districts are giving assistance in the planning and application of these measures under their going programs. This assistance will be continued to assure applica-

tion of the planned measures within the remaining installation period of the project.

The governing bodies of the soil conservation districts will continue to arrange for meetings according to definite schedules. By this means and by individual contacts they will encourage the landowners and operators within the watershed to adopt and carry out soil and water conservation plans on their farms. District-owned equipment will be made available to the landowners in accordance with the existing arrangements for equipment usage in the district. 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 work units will continue to assist landowners and operators cooperating with districts in accelerating the preparation of soil and water conservation plans and the application of conservation practices.

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

The County ASC committees will cooperate with the governing bodies of the soil conservation districts by selecting and recommending for financial assistance those ACPS practices which will accomplish the conservation objectives in the shortest possible time.

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

Structural Measures for Flood Prevention

The Soil Conservation Service has contracted for and supervised the construction of 39 floodwater retarding structures, and, likewise, will contract for the construction of Structures Nos. 17 and 18A, and the stream channel improvement. It also will provide technical specialists to prepare plans and specifications, supervise construction, prepare contract payments estimates, make contract payments, make final inspections, certify completion and perform related duties for the installation of these structural measures.

The City of Brady recognizes the expenses necessary to provide legal, administrative, and clerical personnel, facilities, supplies, and equipment to advertise for bids, and to award and administer the contract for the Brady Reservoir. Funds for the local share of the project cost, including land rights, all costs allocated to non-agricultural water management and administration of contracts, will be raised through the sale of bonds, to be retired by a city-wide water tax. The annual amount of this tax is insufficient to provide the lump-sum payments needed at the time required. Since there are no local sources from which loans of this type are made, city officials have consulted with Farmers Home Administration personnel

and a letter of intent has been filed with that agency, together with an application for a watershed loan to assist in financing local costs associated with development of the non-agricultural water management phase of the project.

The City of Brady, in cooperation with the Concho and San Saba-Brady Soil Conservation Districts, will furnish the land rights, including the arrangements for road, railroad, utility and improvement changes for all the structural measures at no cost to the Federal government.

The cooperating parties have agreed on a 3-year installation period. The tentative schedule of obligations for the complete project installation period, including installation of both land treatment and structural measures, is as follows:

Fiscal Year	Structure Numbers	Federal Cost (dollars)	Non-Federal Cost (dollars)	Total Cost (dollars)
Completed	1, 4 through 16, 19 through 41, 43A, 43B, 44 through 46	3,446,998	1,064,216	4,511,214
First	17, 18A	379,738	1,197,700	1,577,438
Second	Brady Reservoir	853,836	724,858	1,578,694
Third	Channel Improvement	815,763	85,600	901,363

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

The structural measures will be constructed pursuant to the following conditions:

1. The required land treatment in the drainage area above structures has been installed or is in the process of being installed.

2. All land rights have been secured.
3. Operations and maintenance agreements have been executed.
4. Flood prevention funds are available.
5. The City of Brady, as contracting agency for the Brady Reservoir, is equipped to handle its responsibilities.
6. The local share of the cost for the non-agricultural water management structure is available.
7. Water rights have been obtained.

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 operated and maintained by the owners and operators of the farms and ranches on which the measures are installed under agreements with the Concho and San Saba-Brady Soil Conservation Districts. Representatives of these soil conservation districts will make periodic inspections of the land treatment measures to determine maintenance needs and to encourage landowners and operators to perform maintenance. They will make district-owned equipment available for this purpose.

Structural Measures

The 41 floodwater retarding structures and the 42 miles of channel improvement will be maintained by the Concho and the San Saba-Brady Soil Conservation Districts. The City of Brady will operate and maintain the Brady Reservoir.

The estimated annual operation and maintenance cost of the 41 floodwater retarding structures and the 42 miles of channel improvement is \$13,822, based on long-term price levels. The estimated annual operation and maintenance cost of the Brady Reservoir is \$9,320, based on long-term price levels.

All floodwater retarding structures, including the Brady Reservoir, will be inspected at least annually, and after each heavy stream flow. Items of inspection will include, but not be limited to, the condition of the principal spillway and its appurtenances, the emergency spillway, the earth fill, the vegetative cover of the earth fill, 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 and work done, and will make these records available to Soil Conservation Service representatives.

Provisions will be made for free access of City, District and Federal representatives to inspect the floodwater retarding structures, the channel improvement and the Brady Reservoir, at any time.

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

COST SHARING

Federal funds are expected to provide technical assistance in the amount of \$12,000 during the installation period to accelerate the installation of land treatment measures included in the plan for reduction of erosion and peak rates of runoff. Private interests will install these measures at an estimated cost of \$257,000, exclusive of expected reimbursement from ACPS or other Federal funds (Table 1).

The required local cost for the remaining structural measures consists of the value of land rights, the value of water rights, administration of contracts for the Brady Reservoir and the costs allocated to non-agricultural water management. These costs are estimated to be \$1,751,158.

The entire cost of constructing the remaining structural measures, except that portion of the Brady Reservoir allocated to non-agricultural water management, will be borne by the Federal government. This includes \$1,741,828 for construction costs and \$295,509 for installation services. This is a total Federal cost of \$2,037,337 for the installation of the structural measures.

The Brady Reservoir will be a dual-purpose structure for flood prevention and non-agricultural water management. The 39 floodwater retarding structures that have been constructed, the 2 remaining to be built and the channel improvement will be constructed for flood prevention only.

The Separable Costs-Remaining Benefits Method of Cost Allocation described in the Watershed Protection Handbook, Section 6, V, B, was used in allocating the \$2,423,850 installation cost of the Brady Reservoir among purposes. Consideration was given to providing an alternate structure for the single purpose of providing municipal water.

Cost estimates of the various single purpose structures considered and the multiple-purpose structure were provided by the engineering firm employed by the City of Brady. The installation cost of a structure designed for flood prevention alone at the site of the multiple-purpose Brady Reservoir would be \$2,105,500. The cost of a structure designed for the storage of 24,000 acre feet of municipal water is \$1,996,850. Analysis of the saving from the multiple-purpose structure showed that

\$1,574,828, or 64.97 percent of the total installation cost should be allocated to flood prevention. The remaining \$849,022 (35.03 percent) was allocated to non-agricultural water management. Details of this analysis are shown on Table 8.

It should be noted on Table 9 that the cost of the multiple-purpose reservoir will be shared \$849,836 (35.06 percent) Federal and \$1,574,014 (64.94 percent) non-Federal. This high non-Federal cost arises because of the extensive railroad and highway relocations involved in obtaining land rights, a required local cost.

The total project cost, \$8,568,709, will be shared 64.14 percent, (\$5,496,335) by Federal funds, and 35.86 percent (\$3,072,374) by non-Federal funds.

CONFORMANCE OF PLAN TO FEDERAL LAWS AND REGULATIONS

The installation of the watershed protection and flood prevention project on the Brady Creek Watershed will make a substantial contribution to the objectives of the overall Middle Colorado River development program.

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

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST ^{1/}

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Item	Unit	Number To Be Applied	Installation Period October, 1960 - July, 1964		
			Estimated Cost ^{2/}		Total
			Federal	Non-Federal	
<u>LAND TREATMENT FOR</u>					
<u>Watershed Protection</u>					
Soil Conservation Service					
Contour Farming	Acre	6,400	-	6,400	6,400
Cover Cropping	Acre	3,900	-	15,600	15,600
Rotation Hay and Pasture	Acre	13,200	-	71,400	71,400
Crop Residue Use	Acre	6,600	-	6,600	6,600
Deferred Grazing	Acre	60,000	-	24,000	24,000
Proper Range Use	Acre	90,000	-	36,000	36,000
Range Seeding	Acre	1,400	-	7,000	7,000
Brush Control	Acre	13,600	-	64,000	64,000
Terracing	Mile	88	-	5,200	5,200
Diversion Construction	Mile	4	-	800	800
Pond Construction	No.	50	-	20,000	20,000
Technical Assistance (Accel.)			12,000	-	12,000
SCS Subtotal			12,000	257,000	269,000
<u>TOTAL LAND TREATMENT</u>			12,000	257,000	269,000
<u>STRUCTURAL MEASURES</u>					
Soil Conservation Service					
Brady Reservoir	No.	1	797,858	430,142	1,228,000
Floodwater Retarding Structures	No.	2	306,156	-	306,156
Stream Channel Improvement	Mile	42	637,814	-	637,814
SCS Subtotal			1,741,828	430,142	2,171,970
Subtotal - Construction			1,741,828	430,142	2,171,970
<u>Installation Services</u>					
Soil Conservation Service					
Engineering Services			209,693	28,022	237,715
Other			85,816	-	85,816
SCS Subtotal			295,509	28,022	323,531
Subtotal - Installation Services			295,509	28,022	323,531
<u>Other Costs</u>					
Land Rights			-	1,289,144	1,289,144
Administration of Contracts			-	500	500
Water Rights			-	3,350	3,350
Subtotal - Other			-	1,292,994	1,292,994
<u>TOTAL STRUCTURAL MEASURES</u>			2,037,337	1,751,158	3,788,495
<u>TOTAL PROJECT</u>			2,049,337	2,008,158	4,057,495
<u>SUMMARY</u>					
Subtotal SCS			2,049,337	2,008,158	4,057,495
<u>TOTAL PROJECT</u>			2,049,337	2,008,158	4,057,495

^{1/} Does not include prior expenditures of flood prevention funds or accomplishments resulting therefrom (see Table 1A).

^{2/} Excludes cost that will be reimbursed from other Federal funds.

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT ^{1/}

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Item	Unit	Number Applied	Estimated Cost		Total
			Federal ^{2/}	Non-Federal ^{3/}	
			(dollars)	(dollars)	
Prior to October 1960.					
<u>LAND TREATMENT FOR</u>					
<u>Watershed Protection</u>					
Soil Conservation Service					
Contour Farming	Acre	54,000	-	54,000	54,000
Cover Cropping	Acre	8,600	-	34,400	34,400
Rotation Hay and Pasture	Acre	12,500	-	67,600	67,600
Crop Residue Use	Acre	25,000	-	25,000	25,000
Deferred Grazing	Acre	105,000	-	42,000	42,000
Proper Range Use	Acre	116,000	-	46,400	46,400
Range Seeding	Acre	2,000	-	10,000	10,000
Brush Control	Acre	35,200	-	176,000	176,000
Terracing	Mile	1,600	-	96,000	96,000
Diversion Construction	Mile	75	-	15,000	15,000
Pond Construction	No.	80	-	32,000	32,000
Technical Assistance (Accel.)			30,000	-	30,000
SCS Subtotal			30,000	598,400	628,400
<u>TOTAL LAND TREATMENT</u>			30,000	598,400	628,400
<u>STRUCTURAL MEASURES</u>					
Soil Conservation Service					
Floodwater Retarding Structures	No.	39	2,786,502	-	2,786,502
Stream Channel Improvement	Mile	-	-	-	-
SCS Subtotal			2,786,502	-	2,786,502
<u>Subtotal - Construction</u>			2,786,502	-	2,786,502
<u>Installation Services</u>					
Soil Conservation Service					
Engineering Services			359,450	-	359,450
Other			271,046	-	271,046
SCS Subtotal			630,496	-	630,496
<u>Subtotal - Installation Services</u>			630,496	-	630,496
<u>Other Costs</u>					
Land Rights			-	465,816	465,816
Administration of Contracts			-	-	-
Water Rights			-	-	-
<u>Subtotal - Other</u>			-	465,816	465,816
<u>TOTAL STRUCTURAL MEASURES</u>			3,416,998	465,816	3,882,814
<u>TOTAL PROJECT</u>			3,446,998	1,064,216	4,511,214
<u>SUMMARY</u>					
Subtotal SCS			3,446,998	1,064,216	4,511,214
<u>TOTAL PROJECT</u>			3,446,998	1,064,216	4,511,214

^{1/} At time of work plan supplement.

^{2/} Flood prevention funds, including accelerated funds.

^{3/} Excludes costs that will be reimbursed from other Federal funds.

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TABLE 1B - TOTAL ESTIMATED INSTALLATION COST ^{1/}

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Item	Unit	Number	total Project ^{1/}		
			Estimated Cost		Total
			Federal ^{2/}	Non-Federal ^{3/}	
			(dollars)	(dollars)	(dollars)
<u>LAND TREATMENT FOR</u>					
Watershed Protection					
Soil Conservation Service					
Contour Farming	Acre	60,400	-	60,400	60,400
Cover Cropping	Acre	12,500	-	50,000	50,000
Rotation Hay and Pasture	Acre	25,700	-	139,000	139,000
Crop Residue Use	Acre	31,600	-	31,600	31,600
Deferred Grazing	Acre	165,000	-	66,000	66,000
Proper Range Use	Acre	206,000	-	82,400	82,400
Range Seeding	Acre	3,400	-	17,000	17,000
Brush Control	Acre	48,800	-	240,000	240,000
Terracing	Mile	1,688	-	101,200	101,200
Diversion Construction	Mile	79	-	15,800	15,800
Pond Construction	No.	130	-	52,000	52,000
Technical Assistance (Accel.)			42,000	-	42,000
SCS Subtotal			42,000	855,400	897,400
TOTAL LAND TREATMENT			42,000	855,400	897,400
<u>STRUCTURAL MEASURES</u>					
Soil Conservation Service					
Brady Reservoir	No.	1	797,858	430,142	1,228,000
Floodwater Retarding Structures	No.	41	3,092,658	-	3,092,658
Stream Channel Improvement	Mile	42	637,814	-	637,814
SCS Subtotal			4,528,330	430,142	4,958,472
Subtotal - Construction			4,528,330	430,142	4,958,472
<u>Installation Services</u>					
Soil Conservation Service					
Engineering Services			569,143	28,022	597,165
Other			356,862	-	356,862
SCS Subtotal			926,005	28,022	954,027
Subtotal - Installation Services			926,005	28,022	954,027
<u>Other Costs</u>					
Land Rights			-	1,754,960	1,754,960
Administration of Contracts			-	500	500
Water Rights			-	3,350	3,350
Subtotal - Other			-	1,758,810	1,758,810
TOTAL STRUCTURAL MEASURES			5,454,335	2,216,974	7,671,309
TOTAL PROJECT			5,496,335	3,072,374	8,568,709
<u>SUMMARY</u>					
Subtotal SCS			5,496,335	3,072,374	8,568,709
TOTAL PROJECT			5,496,335	3,072,374	8,568,709

^{1/} Table 1, plus Table 1A.

^{2/} Flood Prevention funds, including acceleration funds.

^{3/} Excludes costs that will be reimbursed from other Federal funds.

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TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Structure Site Number	Federal Installation Costs					Non-Federal Installation Costs					Total Installation Cost		
	Construction		Installation Service			Construction		Installation				Total Non-Federal Cost	
	Engineers Estimate	Contin- gencies	Engineer- ing	Other	Total Federal	Engineers Estimate	Contin- gencies	Admin. of Contracts	Land Rights	Water Rights			
(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)		
1	I/				155,940	-	-	-	-	11,264	-	11,264	167,204
4	I/				66,779	-	-	-	-	6,424	-	6,424	73,203
5	I/				72,613	-	-	-	-	6,600	-	6,600	79,213
6	I/				50,174	-	-	-	-	8,360	-	8,360	58,534
10	I/				35,338	-	-	-	-	2,640	-	2,640	37,978
11	I/				37,859	-	-	-	-	5,192	-	5,192	43,051
12	I/				46,694	-	-	-	-	5,192	-	5,192	51,886
13	I/				73,456	-	-	-	-	5,896	-	5,896	79,352
14	I/				178,255	-	-	-	-	20,592	-	20,592	198,847
15	I/				69,846	-	-	-	-	8,096	-	8,096	77,942
16	I/				62,920	-	-	-	-	5,192	-	5,192	68,112
17	I/	214,166	21,417	32,125	21,417	289,125	-	-	-	33,968	-	33,968	323,093
18-A	I/	64,157	6,416	9,624	6,416	86,613	-	-	-	11,120	-	11,120	97,733
19	I/				111,201	-	-	-	-	15,576	-	15,576	126,777
20	I/				159,507	-	-	-	-	25,784	-	25,784	185,291
21	I/				114,852	-	-	-	-	18,480	-	18,480	133,332
22	I/				55,189	-	-	-	-	4,048	-	4,048	59,237
23	I/				168,049	-	-	-	-	9,240	-	9,240	177,289
24	I/				40,969	-	-	-	-	6,336	-	6,336	47,305

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Footnote on last page

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION - Continued

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Structure Site Number	Federal Installation Costs					Non-Federal Installation Costs					Total Installation Cost		
	Construction Engineers Estimate (dollars)	Contin- gencies (dollars)	Engineer- ing (dollars)	Other (dollars)	Total Federal (dollars)	Construction Engineers Estimate (dollars)	Contin- gencies (dollars)	Installa- tion Services (dollars)	Admin. of Contracts (dollars)	Land Rights (dollars)		Water Rights (dollars)	Total Non- Federal (dollars)
25 I/					140,411	-	-	-	-	16,984	-	16,984	157,395
26 I/					65,868	-	-	-	-	6,688	-	6,688	72,556
27 I/					150,318	-	-	-	-	11,000	-	11,000	161,318
28 I/					262,473	-	-	-	-	34,144	-	34,144	296,617
29 I/					56,788	-	-	-	-	4,752	-	4,752	61,540
30 I/					60,187	-	-	-	-	7,392	-	7,392	67,579
31 I/					180,682	-	-	-	-	33,880	-	33,880	214,562
32 I/					135,866	-	-	-	-	25,432	-	25,432	161,298
33 I/					58,386	-	-	-	-	13,288	-	13,288	71,674
34 I/					60,670	-	-	-	-	9,944	-	9,944	70,614
35 I/					55,365	-	-	-	-	6,688	-	6,688	62,053
36 I/					62,850	-	-	-	-	14,608	-	14,608	77,458
37 I/					42,788	-	-	-	-	4,752	-	4,752	47,540
38 I/					106,056	-	-	-	-	8,536	-	8,536	114,592
39 I/					63,890	-	-	-	-	7,216	-	7,216	71,106
40 I/					31,964	-	-	-	-	2,376	-	2,376	34,340
41 I/					71,627	-	-	-	-	12,408	-	12,408	84,035

Footnote on last page

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION - Continued

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)
Price Base: 1959

Structure Site Number	Federal Installation Costs				: Total (dollars)	Non-Federal Installation Costs						: Total (dollars)	
	Construction	Installation Service	Engineers	Contin-		Construction	Installation	Admin. of	Land	Water	Non-		
	Estimate	gencies	ing	Other		Estimate	gencies	Services	Contracts	Rights	Rights		Federal
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
43-A 1/					67,552	-	-	-	-	4,664	-	4,664	72,216
43-B 1/					76,264	-	-	-	-	10,208	-	10,208	86,472
44 1/					54,074	-	-	-	-	5,720	-	5,720	59,794
45 1/					67,427	-	-	-	-	7,744	-	7,744	75,171
46 1/					45,851	-	-	-	-	7,392	-	7,392	53,243
Brady Reservoir	725,089	72,769	51,978	-	849,836	390,911	39,231	28,022	500	1,112,900	3,350	1,574,014	2,423,850
Subtotal Channel Improvement	1,003,412	100,602	93,727	27,833	4,642,572	390,911	39,231	28,022	500	1,577,816	3,350	2,039,830	6,682,402
Grand Total	1,583,243	158,585	209,693	85,816	5,454,335	390,911	39,231	28,022	500	1,754,960	3,350	2,216,974	7,671,309

1/ Constructed prior to December 1960

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TABLE 3 -- STRUCTURE DATA -- FLOODWATER RETARDING STRUCTURES
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	Unit	Structure Number											
		1	4	5	6	10	11	12	13	14	15	16	
Drainage Area $\frac{1}{2}$	Sq. Mi.	7.03	3.59	4.06	4.49	1.41	2.66	2.58	3.44	11.52	4.57	3.73	
Storage Capacity													
Sediment Pool	Ac. Ft.	187	115	108	115	53	84	82	110	197	126	101	
Sediment Reserve Pool	Ac. Ft.	0	0	0	0	0	0	0	0	0	0	0	
Sediment in Detention Pool	Ac. Ft.	0	0	0	0	0	0	0	0	0	0	0	
Floodwater Detention	Ac. Ft.	2,393	863	975	1,069	337	657	642	835	4,532	1,098	911	
Total	Ac. Ft.	2,580	978	1,083	1,184	390	741	724	945	4,729	1,224	1,012	
Surface Area													
Sediment Pool	Acre	42	33	29	35	13	21	21	27	54	36	21	
Floodwater Detention Pool	Acre	215	112	122	156	47	97	97	108	413	147	96	
Volume of Fill	Cu.Yds.	243,000	145,900	109,000	88,500	68,600	92,400	74,800	115,200	367,000	149,500	132,000	
Elevation Top of Dam (MSL)	Foot	1,783.3	1,875.6	1,920.4	1,898.7	1,886.5	1,906.2	1,937.1	1,930.2	1,969.3	1,925.8	1,911.0	
Maximum Height of Dam	Foot	35	25	30	24	23	26	28	28	38	25	35	
Emergency Spillway													
Crest Elevation (MSL)	Foot	1,778.0	1,870.5	1,915.2	1,893.6	1,882.4	1,901.3	1,932.0	1,925.0	1,962.3	1,921.0	1,906.0	
Bottom Width	Foot	300	350	300	300	150	150	100	250	300	250	200	
Type	----	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	
Principal Spillway													
Capacity Maximum	c.f.s.	30	18	20	22	10	16	14	16	58	23	19	
Capacity Equivalents													
Sediment Volume	Inch	.50	.60	.50	.48	.70	.59	.59	.60	.33	.51	.51	
Sediment in Detention Pool	Inch	0	0	0	0	0	0	0	0	0	0	0	
Detention Storage	Inch	6.38	4.50	4.50	4.37	4.50	4.57	4.68	4.56	6.30	4.51	4.58	

(Footnote on last page)

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TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	Unit	Structure Number										
		17	18A	19	20	21	22	23	24	25	26	27
Drainage Area ^{1/}	Sq. Mi.	28.80	9.38	8.91	20.28	10.23	1.94	5.31	3.55	9.49	3.75	7.03
Storage Capacity												
Sediment Pool	Ac. Ft.	200	98	191	200	200	52	145	75	185	80	195
Sediment Reserve Pool	Ac. Ft.	76	0	0	119	0	0	0	0	0	0	0
Sediment in Detention Pool	Ac. Ft.	31	10	0	0	0	0	0	0	0	0	0
Floodwater Detention	Ac. Ft.	8,410	1,765	2,862	6,373	3,461	464	1,275	840	2,416	902	1,785
Total	Ac. Ft.	8,717	1,873	3,053	6,692	3,661	516	1,420	915	2,601	982	1,980
Surface Area												
Sediment Pool	Acre	76	43	53	55	55	17	33	20	61	24	47
Floodwater Detention Pool	Acre	590	239	301	530	365	75	176	123	324	127	204
Volume of Fill	Cu. Yds.	466,000	133,461	265,500	397,430	193,600	84,900	246,000	62,250	147,402	107,150	180,000
Elevation Top of Dam (MSL)	Foot	1,894.2	2,007.2	2,008.6	2,060.7	1,977.0	2,028.5	2,000.0	2,035.5	2,039.6	2,118.0	2,118.3
Maximum Height of Dam	Foot	36	30	28	40	30	23	28	25	21	20	33
Emergency Spillway												
Crest Elevation (MSL)	Foot	1,889.0	2,002.0	2,003.6	2,056.0	1,972.0	2,023.3	1,993.0	2,031.0	2,035.0	2,113.4	2,112.0
Bottom Width	Foot	400	350	200	250	350	150	400	200	400	250	400
Type	----	Veg	Veg	Veg	Rock	Rock	Veg	Rock	Veg	Rock	Veg	Veg
Principal Spillway												
Capacity Maximum	c.f.s.	411	94	42	123	58	11	25	29	137	31	29
Capacity Equivalents												
Sediment Volume	Inch	.18	.20	.40	.30	.37	.50	.51	.40	.36	.40	.52
Sediment in Detention Pool	Inch	.02	.02	0	0	0	0	0	0	0	0	0
Detention Storage	Inch	5.47	3.53	6.03	5.89	6.34	4.50	4.50	4.44	4.77	4.51	4.76

(Footnote on last page)

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TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	Unit	Structure Number										
		28	29	30	31	32	33	34	35	36	37	38
Drainage Area ^{1/}	Sq. Mi.	21.88	3.44	3.53	22.50	13.51	7.20	4.49	3.32	9.30	2.96	4.54
Storage Capacity												
Sediment Pool	Ac. Ft.	200	31	94	200	200	198	120	75	159	24	121
Sediment Reserve Pool	Ac. Ft.	147	0	0	156	90	0	0	0	0	0	0
Sediment in Detention Pool	Ac. Ft.	0	0	0	0	0	0	0	0	0	0	0
Floodwater Detention	Ac. Ft.	8,567	900	849	7,324	4,096	1,533	1,223	935	3,101	659	1,092
Total	Ac. Ft.	8,914	931	943	7,680	4,386	1,731	1,343	1,010	3,260	683	1,213
Surface Area												
Sediment Pool	Acre	96	14	28	79	79	59	42	20	21	9	37
Floodwater Detention Pool	Acre	681	93	139	690	500	243	184	131	311	100	157
Volume of Fill	Cu.Yds.	670,000	132,000	112,530	484,000	244,835	111,700	82,000	78,430	108,571	60,045	106,000
Elevation Top of Dam (MSL)	Foot	2,117.8	2,232.5	2,178.9	2,164.8	2,103.8	2,091.2	2,081.5	2,038.7	2,036.0	2,006.3	1,978.8
Maximum Height of Dam	Foot	38	27	22	36	29	23	26	26	30	24	25
Emergency Spillway												
Crest Elevation (MSL)	Foot	2,111.5	2,226.5	2,174.4	2,159.8	2,099.0	2,086.2	2,076.0	2,034.0	2,031.0	2,001.0	1,973.8
Bottom Width	Foot	400	250	150	400	350	200	200	200	300	200	350
Type	----	Veg	Veg	Veg	Veg	Rock	Veg	Veg	Veg	Veg	Veg	Veg
Principal Spillway												
Capacity Maximum	c.f.s.	102	16	40	110	100	96	15	16	39	15	23
Capacity Equivalents												
Sediment Volume	Inch	.30	.15	.50	.30	.40	.52	.50	.46	.33	.18	.50
Sediment in Detention Pool	Inch	0	0	0	0	0	0	0	0	0	0	0
Detention Storage	Inch	7.34	5.19	4.50	6.10	5.64	3.98	5.11	5.24	5.60	4.37	4.50

(Footnote on last page)

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TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Continued
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	Unit	Structure Number								Brady Reservoir	Total
		39	40	41	43A	43B	44	45	46		
Drainage Area ^{1/}	Sq. Mi.	4.61	1.50	8.98	2.98	6.16	2.25	3.28	2.94	267.86	554.98
Storage Capacity											
Sediment Pool	Ac. Ft.	38	6	72	86	175	86	105	94	6,000	10,983
Sediment Reserve Pool	Ac. Ft.	0	0	0	0	0	0	0	0	0	588
Sediment in Detention Pool	Ac. Ft.	0	0	0	9	12	0	0	0	0	62
Floodwater Detention	Ac. Ft.	1,097	380	2,908	567	1,336	549	787	752	60,000	143,520
Municipal Use	Ac. Ft.	0	0	0	0	0	0	0	0	24,000	24,000
Total	Ac. Ft.	1,135	386	2,980	662	1,523	635	892	846	90,000	179,153
Surface Area											
Sediment Pool	Acre	16	3	19	21	48	25	40	33	650	2,155
Floodwater Detention Pool	Acre	148	50	262	86	185	105	137	135	4,400	13,401
Volume of Fill	Cu.Yds.	170,000	80,000	230,257	130,649	133,670	85,500	150,500	110,600	2,139,000	9,289,880
Elevation Top of Dam (MSL)	Foot	1,903.0	1,869.5	1,868.0	1,883.3	1,869.0	1,792.6	1,829.4	1,813.7	1,786.0	xxx
Maximum Height of Dam	Foot	28	26	36	25	27	28	25	28	108	xxx
Emergency Spillway											
Crest Elevation (MSL)	Foot	1,897.0	1,863.0	1,862.0	1,878.3	1,863.7	1,786.0	1,822.7	1,807.0	1,762.0	xxx
Bottom Width	Foot	300	150	300	200	300	150	200	200	1,000	xxx
Type	----	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Veg	Rock	xxx
Principal Spillway											
Capacity Maximum	c.f.s.	18	8	57	29	55	14	23	15	2,668	xxx
Capacity Equivalents											
Sediment Volume	Inch	.16	.08	.15	.54	.53	.72	.60	.60	.41	xxx
Sediment in Detention Pool	Inch	0	0	0	0	0	0	0	0	0	xxx
Detention Storage	Inch	4.87	4.75	6.07	3.57	4.07	4.73	4.50	4.80	4.20	xxx

^{1/} Exclusive of Watershed from which runoff is controlled by other structures in series.

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 rev. 10/1/60

TABLE 3A - STRUCTURE DATA
STREAM CHANNEL IMPROVEMENT
Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Channel Designation	: Station Numbering :		: Watershed :	: Required :	: Planned :	: Bottom :	: Side :	: Depth :	: Fall :	: Velocity :	: Volume :
	: For Reach :			: Channel :	: Channel :					: at Design :	
	: Station :	: Station :	: Area 1/ :	: Capacity 2/ :	: Capacity :	: Width :	: Slope :			: Section :	: Excavation :
	(From)	(To)	(Acres)	(c.f.s.)	(c.f.s.)	(Foot)	(H:V)	(Foot)	(Ft./Ft.)	(Ft./Sec.)	(1000 cu.yds.)
Trib. above Sec. 248 (Oak Creek)	415/39	429/12	1,012	880	878	60	3:1	3.0	.0036	4.24	7
Trib. above Sec. 242 (Oak Creek)	485/67	496/23	536	660	650	50	3:1	2.4	.0060	4.72	1
Trib. above Sec. 237 (Oak Creek)	518/31	532/51	2,058	1,270	1,360	80	3:1	3.0	.0050	5.10	8
	532/51	542/07	2,110	1,270	1,225	90	3:1	3.4	.0021	3.59	2
Oak Creek Tributary (Brady Creek)	384/24	421/20	2,230	960	958	60	3:1	3.0	.0043	4.63	7
	465/08	496/23	3,748	1,370	1,330	55	3:1	4.0	.0036	4.97	5
	496/23	524/60	4,548	1,550	1,555	65	3:1	4.0	.0036	5.05	21
	524/60	542/07	4,628	1,550	1,560	80	3:1	3.8	.0029	4.47	3
	542/07	557/91	6,786	2,050	2,125	150	3:1	3.2	.0029	4.16	1
	557/91	587/81	7,348	2,050	2,060	150	3:1	3.0	.0032	4.26	5
	587/81	598/37	7,382	2,050	2,090	150	3:1	3.0	.0035	4.39	5
Trib. above Sec. 214 (Brady Creek)	543/80	553/30	780	680	740	80	3:1	2.0	.0058	4.31	1
Trib. above Sec. 209 (Brady Creek)	589/20	599/76	332	530	553	23	3:1	3.0	.0083	5.59	1

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TABLE 3A - STRUCTURE DATA - Continued

STREAM CHANNEL IMPROVEMENT
Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Channel Designation	: Station Numbering :		: Watershed :	: Required :	: Planned :	: Bottom :	: Side :	: Depth :	: Fall :	: Velocity :		
	: For Reach :			: Channel :	: Channel :					: at Design :		: Volume :
	: Station :	: Station :		: Area ^{1/} :	: Capacity ^{2/} :					: Capacity :	: Width :	: Slope :
	(From)	(To)	(Acres)	(c.f.s.)	(c.f.s.)	(Foot)	(H:V)	(Foot)	(Ft./Ft.)	(Ft./Sec.)	(1000 cu.yds.)	
Trib. above Sec. 194 (Brady Creek)	668/40	682/13	1,444	1,060	1,120	100	3:1	3.0	.0022	3.42	20	
	682/13	695/86	1,892	1,230	1,280	100	3:1	3.0	.0029	3.92	11	
	695/86	705/36	1,940	1,230	1,250	100	3:1	3.4	.0018	3.33	2	
Trib. above Sec. 185 (Brady Creek)	755/00	764/50	1,512	1,130	1,158	70	3:1	3.0	.0047	4.89	6	
	764/50	772/95	1,608	1,130	1,175	80	3:1	3.2	.0030	4.10	5	
	772/95	779/81	1,648	1,130	1,170	80	3:1	2.6	.0062	5.14	5	
	779/81	790/90	1,698	1,130	1,200	100	3:1	2.8	.0032	3.95	4	
Hardin Branch (Brady Creek)	858/83	866/83	7,610	1,820	1,850	80	3:1	5.0	.0016	3.95	6	
	866/83	895/00	7,708	2,030	2,070	90	3:1	5.0	.0016	3.94	51	
Trib. above Sec. 137 (Brady Creek)	1145/16	1175/78	1,104	520	533	40	3:1	3.4	.0018	3.13	9	
	1175/78	1183/70	1,194	520	575	40	3:1	3.4	.0021	3.36	1	
Maverick Branch (Brady Creek)	1217/50	1227/99	4,328	1,200	1,240	50	3:1	4.7	.0021	4.13	3	
	1227/99	1285/08	5,004	1,300	1,300	75	3:1	4.3	.0015	3.44	4	
	1285/08	1296/17	5,883	1,380	1,370	95	3:1	3.9	.0015	3.30	1	
	1296/17	1307/26	5,883	1,380	1,340	110	3:1	3.5	.0015	3.12	2	
	1307/26	1316/76	5,883	1,380	1,365	100	3:1	3.5	.0020	3.59	1	

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TABLE 3A - STRUCTURE DATA - Continued

STREAM CHANNEL IMPROVEMENT

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Channel Designation	: Station Numbering :		: Watershed :	: Required Channel Capacity ^{2/} :	: Planned Channel Capacity ^{2/} :	: Bottom Width (Foot) :	: Side Slope (H:V) :	: Depth (Foot) :	: Fall (Ft./Ft.) :	: Velocity at Design (Ft./Sec.) :	: Volume Excavation (1000 cu.yds.) :
	: For Reach :	: Area ^{1/} (Acres) :									
	: Station (From) :	: Station (To) :									
Trib. above Sec. 104	1451/40	1459/32	1,488	1,080	1,080	60	3:1	4.0	.0020	3.76	1
Trib. above Sec. 97	1498/91	1504/72	3,530	1,660	1,660	50	3:1	5.0	.0030	5.11	2
Trib. above Sec. 92	1517/00	1529/00	5,285	2,040	2,050	90	3:1	4.0	.0034	5.03	3
Trib. above Sec. 85	1579/70	1597/65	3,600	1,680	1,660	90	3:1	4.0	.0022	4.07	9
Trib. above Sec. 63	1828/63	1844/47		840	860	80	3:1	3.0	.0020	3.22	6
	1844/47	1854/50	908	840	864	65	3:1	3.0	.0030	3.89	2
Trib. above Sec. 42	1955/24	1968/57		875	900	60	3:1	3.0	.0038	4.35	9
	1968/57	1985/99		945	985	70	3:1	3.0	.0034	4.15	18
	1985/99	2005/00	2,224	1,035	1,085	80	3:1	3.0	.0032	4.07	
Trib. above Sec. 40	2004/68	2012/08		1,760	1,770	60	3:1	4.0	.0054	6.15	8
	2012/08	2025/58	3,931	1,760	1,820	75	3:1	4.0	.0038	5.24	10
Brady Creek	523/73	553/20	6,334	1,200	1,217	75	3:1	4.0	.0017	3.50	5
	553/20	572/31	7,236	1,370	1,370	85	3:1	4.0	.0017	3.53	8

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TABLE 3A - STRUCTURE DATA - Continued

STREAM CHANNEL IMPROVEMENT
Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Channel Designation	Station Numbering :			Required	Planned					Velocity	
	For Reach	Watershed	Channel	Channel	Bottom	Side	Depth	Fall	at Design	Volume	
	Station	Station	Area ^{1/}	Capacity ^{2/}	Capacity	Width	Slope		Section	Excavation	
	(From)	(To)	(Acres)	(c.f.s.)	(c.f.s.)	(Foot)	(H:V)	(Foot)	(Ft./Ft.)	(Ft./Sec.)	(1000 cu.yds.)
Brady creek	572/31	600/82	8,446	1,370	1,390	150	3:1	3.1	.0014	2.82	8
	705/89	798/82	23,591	2,700	2,770	80	3:1	5.8	.0022	4.84	8
	798/82	875/38	24,171	2,930	2,930	80	3:1	6.0	.0021	4.97	46
	875/38	895/00	25,435	2,970	2,980	90	3:1	6.4	.0014	4.35	15
	895/00	923/90	34,831	3,150	3,150	100	3:1	6.4	.0014	4.37	24
	923/90	1069/20	39,286	3,790	3,820	100	3:1	7.0	.0014	4.51	75
	1069/20	1110/00	39,696	3,910	3,960	110	3:1	6.8	.0014	4.47	16
	1110/00	1247/06	41,983	4,030	4,050	120	3:1	6.4	.0015	4.52	60
	1247/06	1307/78	43,429	4,090	4,100	100	3:1	6.4	.0022	5.38	44
	1307/78	1372/00	50,058	4,165	4,140	120	3:1	6.8	.0013	4.33	11
	1372/00	1388/57	50,398	4,460	4,460	120	3:1	7.1	.0013	4.45	7
	1388/57	1472/51	54,784	4,660	4,700	120	3:1	7.5	.0012	4.41	27
	1472/51	1500/50	55,124	4,770	4,760	120	3:1	6.5	.0020	5.25	10
	1500/50	1529/54	58,798	5,000	5,030	120	3:1	6.7	.0020	5.35	14
	1529/54	1619/10	70,069	5,400	5,430	120	3:1	7.0	.0020	5.50	111
	1619/10	1699/55	73,997	5,700	5,750	150	3:1	7.8	.0010	4.23	187
	1699/55	1764/28	74,873	5,900	5,880	150	3:1	6.7	.0018	5.14	55
	1764/28	1856/90	78,665	6,000	6,050	150	3:1	7.5	.0013	4.67	103
	1856/90	1919/73	80,629	6,100	6,140	150	3:1	6.4	.0023	5.67	63
	1919/73	2006/85	84,192	6,200	6,280	150	3:1	7.5	.0014	4.85	211
	2006/85	2111/06	91,608	6,300	6,330	150	3:1	7.0	.0018	5.29	290
	2111/06	2231/25	92,678	6,760	6,820	150	3:1	7.7	.0015	5.11	389

^{1/} Uncontrolled drainage area

^{2/} Includes release from floodwater detention structures

October, 1960

TABLE 4 - ANNUAL COST 1/

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Measures	Amortization of Installation Cost <u>2/</u>		Operation and Maintenance Costs <u>3/</u>		Total
	Federal (dollars)	Non-Federal (dollars)	Total (dollars)	Non-Federal (dollars)	
Floodwater Retarding Structures					
1, 4 through 17, 18A, 19 through 41, 43A, 43B, 44 through 46 and Stream Channel Improvement <u>4/</u>	166,406	23,237	189,643	13,822	203,465
Brady Reservoir	30,713	56,885	87,598	9,320	96,918
TOTAL	197,119	80,122	277,241	23,142	300,383

1/ Does not include work plan preparation cost.

2/ Prices amortized for 50 years at 2-5/8 percent.

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

4/ Interrelated measures.

TABLE 5 - MONETARY BENEFITS FROM STRUCTURAL MEASURES

Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)
 Price Base: Long Term 1/

Item	: Estimated Average Annual Damage :			
	: Without Project (dollars)	: After Land Treatment for W/S Protection (dollars)	: With Project (dollars)	: Average Annual Monetary Benefits (dollars)
Floodwater Damage				
Crop and Pasture	104,557	96,697	25,157	71,540
Other Agricultural	80,403	74,232	7,335	66,897
Non-agricultural				
Urban	186,151	171,304	5,145	166,159
Road, Bridge, Railroad	12,878	11,618	244	11,374
Subtotal	383,989	353,851	37,881	315,970
Erosion Damage				
Flood Plain Scour	3,576	3,386	52	3,334
Indirect Damage	47,492	43,725	4,684	39,041
Total, All Damages	435,057	400,962	42,617	358,345
Changed Land Use				
To Urban Use	XXXX	XXXX	XXXX	1,917
To Crop Production	XXXX	XXXX	XXXX	20,300
Subtotal	XXXX	XXXX	XXXX	22,217
More Intensive Use of Land				20,241
Benefits Outside Project				
Area 2/	XXXX	XXXX	XXXX	14,750
TOTAL FLOOD PREVENTION BENEFITS	XXXX	XXXX	XXXX	415,553
Municipal Water Supply	XXXX	XXXX	XXXX	40,968
TOTAL NON-AGRICULTURAL WATER MANAGEMENT BENEFITS	XXXX	XXXX	XXXX	40,968
TOTAL PRIMARY BENEFITS	XXXX	XXXX	XXXX	456,521
TOTAL MONETARY BENEFITS	XXXX	XXXX	XXXX	456,521

1/ As Projected by ARS, September 1957.

2/ Damage Reduction on San Saba River Flood Plain.

TABLE 6 - BENEFIT COST ANALYSIS

Brady Creek Watershed, Texas
(Middle Colorado River Watershed)

Measures	AVERAGE ANNUAL BENEFITS 1/							Average Annual Cost 3/	Benefit Cost Ratio	
	Flood Prevention									
	Intensification	Erosion	Indirect	Change of Land Use	Other 2/	Non-Agcul. Water Mgt.	Total			
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
Floodwater Retarding Structures										
1, 4 through 17, 18A, 19 through 41, 43A, 43B, 44 through 46 and Stream Channel Improvement 4/	274,716	20,241	3,334	32,852	20,300	-	-	351,443	203,465	1.7:1
Brady Reservoir	41,254	-	-	6,189	1,917	14,750	40,968	105,078	96,918	1.1:1
TOTAL	315,970	20,241	3,334	39,041	22,217	14,750	40,968	456,521	300,383	1.5:1

1/ Long-Term price levels as projected by ARS, September, 1957.

2/ Benefits accruing outside project area.

3/ Installation costs based on actual costs or 1959 prices; operation and maintenance on long-term prices as projected by ARS, September, 1957.

4/ Interrelated measures.

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TABLE 7 - ALLOCATION OF INSTALLATION COSTS

OF STRUCTURAL MEASURES

Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)
 Price Base: 1959

Item	Flood Prevention (dollars)	Non-Agricultural Water Management (dollars)	Total (dollars)
<u>STEP A</u>			
<u>Single Purpose</u>			
Sites 1, 4 through 17, 18A, 19 through 41, 43A, 43B, 44 through 46 and Stream Channel Improvement	5,247,459	xxxxxxx	5,247,459
<u>Multiple Purpose</u>			
Brady Reservoir	1,574,828	849,022	2,423,850
Total	6,822,287	849,022	7,671,309
<u>STEP B</u>			
Federal	5,454,335	xxxxxxx	5,454,335
Non-Federal	1,367,952	849,022	2,216,974
Total	6,822,287	849,022	7,671,309

TABLE 8 - ALLOCATION OF COSTS BETWEEN PURPOSES

Brady Reservoir
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	: Flood : Prevention (dollars)	: Municipal : Water : Supply (dollars)	: Total (dollars)
1a. Total Benefits	1,773,729 ^{1/}	1,133,460	
b. Maintenance Costs	141,406 ^{2/}	257,856 ^{3/}	
c. Remainder	1,632,323	875,604	2,507,927
2. Alternate Costs	2,105,500	1,996,850	
3. Lesser of 1c. and 2	1,632,323	875,604	2,507,927
4. Separable Costs	427,000	318,350	745,350
5. Remaining Benefits	1,205,323	557,254	1,762,577
6. Allocated Joint Costs	1,147,828	530,672	1,678,500
7. Total Allocated Costs	1,574,828	849,022	2,423,850
Percent of Total	64.97	35.03	

^{1/} Based on projected long-term prices, ARS, September 1957.

^{2/} Maintenance on flood prevention structure is \$5,380, which, at long-term prices (x.95) is \$5,111. Capitalized over 50 years at 2-5/8 percent (Factor 27.66697) is \$141,406.

^{3/} Maintenance on municipal water supply structure is \$9,810, which, at long-term prices (x.95) is \$9,320. Capitalized over 50 years at 2-5/8 percent (Factor 27.66697) is \$257,856.

October 1960

Brady Reservoir

TABLE 9 - ALLOCATION OF COST BETWEEN FUNDS

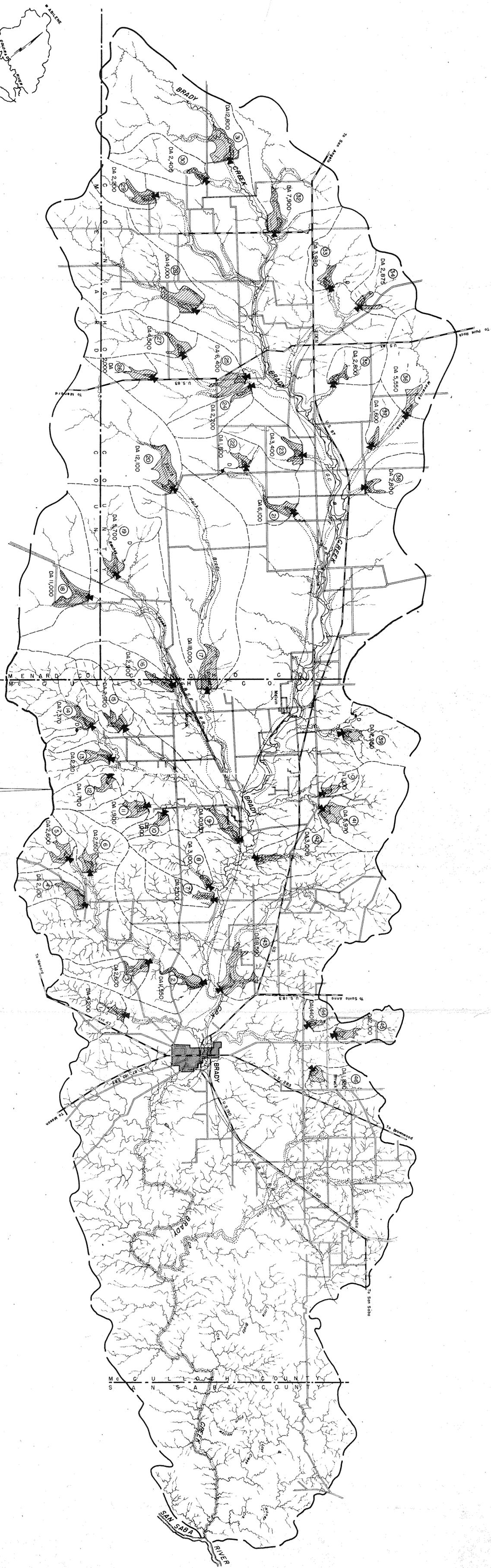
Brady Reservoir
 Brady Creek Watershed, Texas
 (Middle Colorado River Watershed)

Item	Flood Prevention		Non-Agricultural		Total	
	Federal (dollars)	Non-Federal (dollars)	Federal (dollars)	Non-Federal (dollars)	Federal (dollars)	Non-Federal (dollars)
(1) Engineer's Estimate	725,089	-	725,089	390,911	1,116,000	390,911
(2) Contingencies	72,769	-	72,769	39,231	112,000	39,231
(3) Total Construction Installation	797,858	-	797,858	430,142	1,228,000	430,142
(4) Engineering Services	51,978	-	51,978	28,022	80,000	28,022
(5) Land and Water Rights	-	724,667	724,667	390,683	1,115,350	1,115,350
(6) Administration of Contracts	-	325	325	175	500	500
(7) Total Installation Cost	849,836	724,992	1,574,828	849,022	2,423,850	1,574,014
Percent of Total			64.97217	35.02783		35.06

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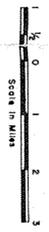


VICINITY MAP
Middle Colorado River Watershed



LEGEND

- Watershed Boundary
- Power Road
- Dir Road
- Road
- County Line
- Ditch
- River
- Chimney
- Small Towns
- Watering Structure
- Floodgate
- Flowage Impoundment
- Flowage Area Boundary - Space Structures
- Flowage Area
- Flowage Area Boundary - Space Structures
- Outline of Flood and Sediment Damage Areas
- Site Number



Approx. Area 541,500 Acres

Compiled by the Cartographic Division Region 4, Fort Worth, Texas, March 1, 1949
Part of a Soil Conservation District Survey of the Middle Colorado River Watershed
from a topographic map of the Middle Colorado River Watershed, Texas

BRADY CREEK WATERSHED
OF THE MIDDLE-COLORADO RIVER WATERSHED
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FORT WORTH, TEXAS

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