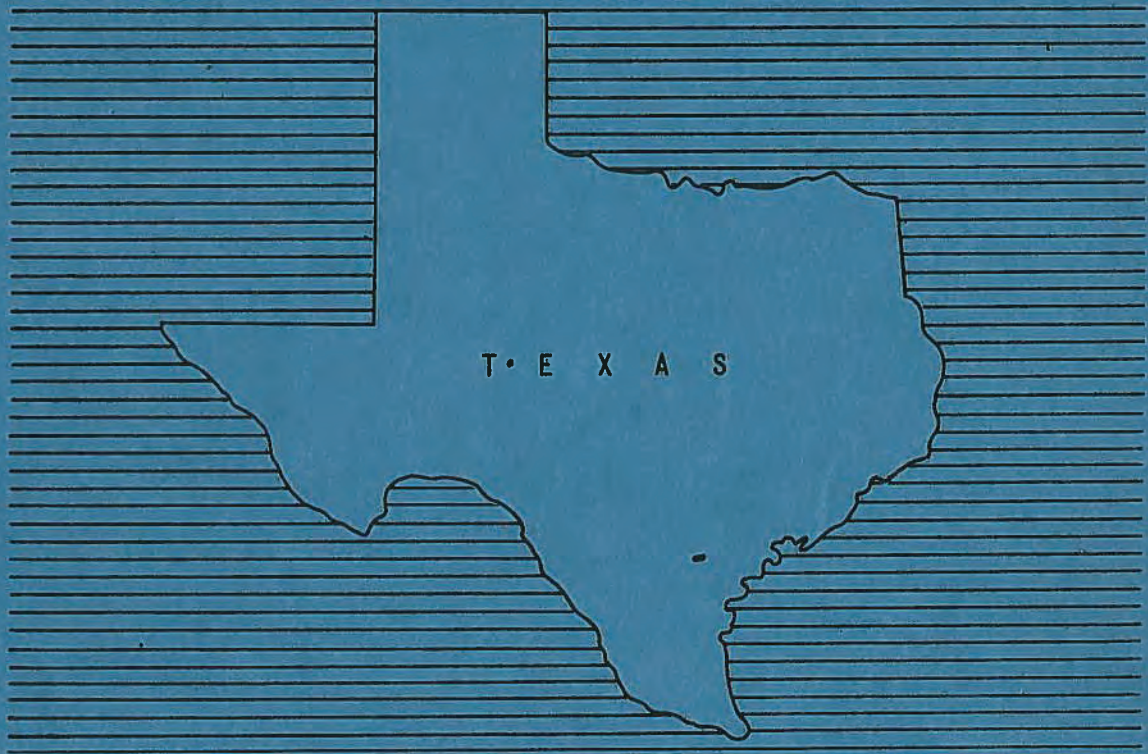
OFFICIAL COPY

WORK PLAN

For Watershed Protection, Flood Prevention, and Agricultural Water Management

HONDO CREEK WATERSHED

KARNES COUNTY, TEXAS



July 1963

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WATERSHED WORK PLAN AGREEMENT

between the

Karnes-Goliad Soil Conservation District
Local Organization

Hondo Creek Watershed Improvement District
Local Organization

_____
Local Organization

_____

_____

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

and the

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

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

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

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

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about 6 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The percentage of cost to acquire land, easements, or rights-of-way needed in connection with the works of improvement to be borne by the Sponsoring Local Organizations and the Service is as follows:

Works of Improvement	Sponsoring Local Organizations (percent)	Service (percent)	Land, Easements, and Rights-of-Way Cost (dollars)
3 Floodwater Retarding Structures	**100**	**0**	**49,844**

2. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to State law as may be needed in the installation and operation of the works of improvement.

3. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
3 Floodwater Retarding Structures	**0**	**100**	**255,234**

4. The percentages of the cost for installation services to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Installation Service Cost (dollars)
3 Floodwater Retarding Structures	**0**	**100**	**60,651**

5. The Sponsoring Local Organization will bear the costs of administering contracts. (Estimated cost $ 1,500 .)

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50% of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.

10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.

11. This agreement does not constitute a financial document to serve as a basis for the obligation of Federal funds, and financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the appropriation of funds for this purpose.

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

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated, only by mutual agreement of the parties hereto.

13. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

Karnes-Goliad Soil Conservation District
Local Organization

By Clarence Schendel
Clarence Schendel

Title Chairman

Date 9-26-63

The signing of this agreement was authorized by a resolution of the governing body of the **Karnes-Goliad Soil Conservation District**
Local Organization

adopted at a meeting held on 9-26-63

Sol Parks
(Secretary, Local Organization)
Sol Parks

Date 9-26-63

Hondo Creek Watershed Improvement District
Local Organization

By L. L. Reasoner

Title President

Date 9-26-63

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

adopted at a meeting held on 9-26-63

Thomas B. Baker
(Secretary, Local Organization)
Thomas B. Baker

Date 9-26-63

_____
Local Organization

By _____

Title _____

Date _____

The signing of this agreement was authorized by a resolution of the governing body of the _____
Local Organization

adopted at a meeting held on _____

_____
(Secretary, Local Organization)

Date _____

Soil Conservation Service
United States Department of Agriculture

By _____
Administrator

Date _____

WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

HONDO CREEK WATERSHED
Karnes County, Texas

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

Prepared By:

Karnes-Goliad Soil Conservation District
(Sponsor)

Hondo Creek Watershed Improvement District
(Sponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
June 1963

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

ADDENDUM

Since the preparation of this watershed work plan, the Federal interest rate for benefit and cost evaluations has been increased from 2.875 percent to 3.0 percent.

As a result, annual equivalent costs for the installation of these structural measures will increase from $11,215 to $11,623. The average annual cost of structural measures (amortized total installation cost, plus operation and maintenance costs) will be increased to $12,073. Average annual benefits from structural measures will be reduced from $1.32 for each dollar of cost to $1.28, maintaining the original benefit-cost ratio of 1.3 to 1.

WATERSHED WORK PLAN

HONDO CREEK WATERSHED
Karnes County, Texas
June 1963

SUMMARY OF PLAN

General Summary

The work plan for watershed protection and flood prevention for Hondo Creek watershed was prepared by the Karnes-Goliad Soil Conservation District and the Hondo Creek Watershed Improvement District as sponsoring local organizations. Technical assistance was provided by the Soil Conservation Service of the United States Department of Agriculture.

The objectives of the project are to provide proper land use and treatment in the interest of soil and water conservation and flood protection for the flood plain lands along Hondo Creek and its tributaries. The project as formulated meets these objectives. Sponsoring local organizations determined that no organized group was interested in including additional water storage for any agricultural or nonagricultural water management purposes.

The watershed covers an area of 45.95 square miles, or 29,408 acres, in Karnes County, Texas. Approximately 55 percent of the watershed is cropland, 42 percent is pasture and rangeland, and 3 percent is in miscellaneous uses such as roads, railroad rights-of-way, communities, farmsteads, and stream channels.

There are no Federal lands in the watershed.

The work plan proposes installing in a 6-year period, a project for the protection and development of the watershed at a total estimated installation cost of $703,263. The share of the cost to be borne by Public Law 566 funds is $328,785. The share to be borne by other than Public Law 566 funds is $374,478. In addition, local interests will bear the entire cost of operation and maintenance.

Land Treatment Measures

Landowners and operators will establish land treatment which will help accomplish the project objectives. Primarily this treatment will consist of measures, or combinations of measures, which contribute directly to watershed protection, flood prevention, and sediment control. Acres to be treated, by land use, during the 6-year project installation period are listed in table 1.

The cost for land treatment is estimated to be $336,034 of which $323,134 will be borne by other than Public Law 566 funds. This amount includes expected reimbursements from Agricultural Conservation Program Service and $16,600 to be spent by the Soil Conservation Service for technical assistance under its going program during the project installation period. The Public Law 566 share, consisting entirely of accelerated technical assistance, is $12,900.

Structural Measures

The structural measures included in the plan consist of 3 floodwater retarding structures having a total sediment storage and floodwater detention capacity of 6,220 acre-feet. The total cost of structural measures is $367,229, of which the local share is $51,344 and the Public Law 566 share is $315,885. The local share of the cost of structural measures consists of land, easements, and rights-of-way ($49,844) and administering contracts ($1,500). The 3 floodwater retarding structures will be installed during a 2-year period.

Damages and Benefits

The reduction in floodwater, sediment, flood plain erosion, and indirect damages will directly benefit owners and operators of 32 farms in the watershed as well as the owners and operators of the farms on the San Antonio River flood plain immediately below the watershed.

The estimated average annual floodwater, sediment, flood plain erosion, and indirect damages without the project total $18,713 at long-term price levels. With the proposed land treatment and structural measures installed, damages from these sources are estimated to be $6,171, a reduction of 67 percent.

The average annual primary benefits accruing to structural measures are $14,084, which are distributed as follows:

Damage reduction benefits	$12,023
Benefits from changed land use	347
Benefits from incidental recreation	1,130
Benefits outside project area (Damage reduction on San Antonio River flood plain below watershed)	584

Secondary benefits of $1,361 annually will result from the project.

The ratio of the total annual project benefits ($15,445) to the average annual cost of structural measures ($11,665) is 1.3 to 1.

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

Provisions for Financing Local Share of Installation Cost

The Hondo Creek Watershed Improvement District has powers of taxation and eminent domain under applicable State laws. A special district tax has been voted for the purpose of securing bond funds in the amount of $40,000 to finance the local share of installation costs of works of improvement for flood control. Revenue from the sale of these bonds is available and will be adequate for financing the local share of installation costs.

Operation and Maintenance

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

The Hondo Creek Watershed Improvement District and the Karnes-Goliad Soil Conservation District will be responsible for the operation and maintenance of the 3 floodwater retarding structures included in this plan. Funds for this purpose will be provided by the Hondo Creek Watershed Improvement District. Revenue from a special district tax for operation and maintenance is adequate and available for this purpose. The estimated average annual cost of operation and maintenance of these structural measures is $450.

DESCRIPTION OF WATERSHED

Physical Data

Hondo Creek watershed lies within the Rio Grande Plain Land Resources Area and covers 45.95 square miles or 29,408 acres in southeastern Karnes County, Texas. The main stream originates about 3 miles south of Kenedy and meanders about 20 miles toward the east to its confluence with the San Antonio River. Major tributaries which join Hondo Creek in the middle reaches are Rock Hollow, Carr, Vine and Live Oak Creeks. Cottonwood Creek is the largest tributary and joins Hondo Creek about 1.5 miles upstream from the mouth of the watershed.

Gentle to rolling topography has developed on southeasterly dipping geologic strata. These strata are progressively younger toward the Gulf of Mexico. The Oakville formation of the Miocene system consists of sandstones, sands and clays and is exposed in the upper or western end of the watershed. It is overlapped by the Lagarto formation, which covers most of the watershed. The Lagarto, of the Pliocene system, is similar

in character to the Oakville but is distinguished by a greater proportion of clay. The Goliad formation of the Pliocene system overlies the Lagarto along the southern edge of the watershed and consists of sands and gravels impregnated with caliche. Pleistocene terrace deposits and Recent alluvium consisting of silts and loams deposited by the San Antonio River are found at the lower end of the watershed. This area occupies about 3 percent of the watershed and is characterized by very gentle topography with deep fertile soils. Elevations in the watershed range from about 180 to 510 feet above mean sea level, with the areas of greater relief developed on the more weather-resistant beds of the Oakville formation.

The soils are mostly fine sandy loams and sandy clay loams of the Runge, Engle, and Delfina series, but heavy clays of the Monteola series occur in small areas. Shallow and very shallow soils of the Goliad and Zapata series are found on steeper slopes and ridges. Permeability rates range from moderate to slow.

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

Land Use	Acres	Percent
Cropland	16,072	54.7
Pasture	5,484	18.6
Rangeland	6,940	23.6
Miscellaneous 1/	912	3.1
Total	29,408	100.0

1/ Includes roads, highways, railroad rights-of-way, communities, farmsteads, stream channels, etc.

The hydrologic cover condition on rangeland is mostly poor. Periods of long droughts and overgrazing have decreased the stands of climax grasses to such an extent that considerable soil erosion has taken place. As a result, grasslands have become infected with numerous species of brush, weeds, and poor quality grasses. The most desirable grasses include little bluestem, plains bristlegrass, Arizona cottontop, Texas wintergrass, and sideoats grama. Elm, hackberry, and pecan trees are abundant along larger streams. Vegetation which invades the rangeland following overuse includes threeawn, red grama, Texas grama, grassburs, mesquite, agrito, guajillo, kidneywood, liveoak, spiny hackberry, lote, and blackbrush. Range sites within the watershed are Mixed Loam, Tight Sandy Loam, Rolling Blackland, Bottomland, Hardland, Shallow Ridge, and Deep Sand.

The climate is warm and sub-humid. Mean monthly temperatures range from 54 degrees Fahrenheit in January to 84 degrees in July. The normal growing season, extending from February 10 to December 1, is 294 days. The average annual rainfall is 31 inches. Rainfall is generally well

distributed throughout the year, with the heaviest during April, May, June, and September.

Water for livestock and rural domestic use is obtained from wells and surface ponds and is generally of good quality. No water for municipal or industrial purposes is obtained within the watershed.

Economic Data

The economy of the watershed is dependent entirely on its agricultural production. Production and sale of cash crops and livestock is the primary source of farm income. The most important crops produced for direct sale are flax, cotton, corn, and grain sorghum. Oats and forage sorghums are grown primarily in support of livestock enterprises.

The average size farm in the watershed is approximately 175 acres. This reflects a significant increase during recent years. In Karnes County, for instance, the average size of farm increased about 40 percent between 1949 and 1959. This has resulted in an increased emphasis on livestock production and a decrease in production of cash crops. The majority of the farms are owner-operated, and the average value of land and buildings per farm is about $17,500 (1959 agricultural census). The estimated current value of flood plain land is $150 to $200 per acre. Upland ranges from $60 to $150 per acre.

Choate is the only community in the watershed and provides limited marketing and supply facilities to the lower part of the watershed. Kenedy, population 4,301, is located two miles north of the upper portion of the watershed. This trade center provides excellent marketing, supply, cultural, and educational facilities for the inhabitants of the area.

The watershed is served adequately by approximately 60 miles of Federal, State, and county roads, of which 24 miles are hard surfaced. Adequate rail facilities are provided at Kenedy.

Land Treatment Data

The Soil Conservation Service work unit at Kenedy is assisting the Karnes-Goliad Soil Conservation District. Of the 164 farms and ranches in the watershed there are 150 operating units. The work unit has assisted 113 Soil Conservation District cooperators in preparing 116 soil and water conservation plans and has given technical assistance in establishing and maintaining planned measures. Current revision is needed on 60 conservation plans. Satisfactory soil surveys have been made on 3,220 acres, leaving 26,188 acres needing standard soil surveys.

Approximately 40 percent of needed land treatment practices for the 28,496 acres of agricultural land have been applied and about 25 percent of the agricultural land is considered to be treated adequately.

WATERSHED PROBLEMS

Floodwater Damage

An estimated 1,946 acres of the watershed, excluding stream channels, is flood plain (plate 1). As described herein the flood plain is the area that will be inundated by the runoff from the largest storm considered in the 25-year series used for evaluation. The runoff from this storm approximates the 25-year frequency of recurrence. At the present time land use in the flood plain is 45 percent cropland, 52 percent range and pasture, and 3 percent miscellaneous uses.

Flooding occurs frequently and causes severe damage to growing crops, other agricultural properties, roads and bridges. In addition, damage to flood plain lands from deposition of sediment and flood plain erosion has resulted in appreciable reductions in crop yields.

The largest flood in recent years occurred October 25, 1960. This flood inundated the entire flood plain. Crops had been harvested, and most of the cultivated land was bedded. As a result, damage to crops was light, but erosion of flood plain land was extremely severe. Deposition of damaging sediment was extensive. Based on information obtained from landowners and operators, more than 23 miles of fence was destroyed. Loss of livestock and damage to other agricultural properties was high. In addition, damage to roads, bridges, and other nonagricultural property was in excess of $7,500.

During the 25-year period studied, 1935 through 1959, a period considered to be representative of normal rainfall in the area, there were 10 major floods that inundated more than half the flood plain as well as 42 minor floods that inundated less than half the flood plain. All of the major floods and 31 of the minor floods occurred during the spring, summer, or early fall months when most of the crops are highly susceptible to damage. Cumulative totals of recurrent flooding cause an average annual flooding of 955 acres during the period studied.

Based on the floods experienced during the period studied, the total direct floodwater damage is estimated to average $12,167 annually at long-term price levels (table 5). Of this amount, $5,594 is crop and pasture damage; $4,777 is other agricultural damage; $1,738 is nonagricultural damage to roads and bridges; and $58 is damage to other nonagricultural properties.

Indirect damages such as interruption of travel, re-routing of school bus and mail routes, losses sustained by businesses in the area, and similar losses are estimated to average $1,864 annually.

Sediment Damage

Damage by overbank deposition of sediment is moderate. An estimated 376 acres have been damaged by deposition of silty sand and fine to medium sand. The deposits range from 0.5 foot to 4.0 feet deep and have reduced the productive capacity of flood plain soils as follows: 153 acres, 10 percent; 11 acres, 20 percent; 130 acres, 30 percent; 74 acres, 40 percent; 4 acres, 50 percent; and 4 acres, 90 percent. The average annual monetary value of this damage is estimated to be $2,244 at long-term price levels (table 5).

The estimated average annual sediment yield at the mouth of the watershed is 43 acre-feet. This is equivalent to an average annual sediment production rate of 0.94 acre-foot per square mile.

Erosion Damage

The estimated average annual rate of gross erosion is 2.66 acre-feet per square mile. About 35 percent of this material is transported out of the watershed. The remainder is deposited enroute as colluvium at the base of slopes, on the flood plain, and in channels. Stream channels are stable under present conditions.

Sheet erosion accounts for 79 percent, gully erosion 2 percent, streambank erosion 3 percent, and flood plain scour 16 percent of the total annual erosion. The installation of terraces, use of close growing crops, and the planting of temporary pastures have been effective in reducing erosion on cropland. At present, the most rapid rate of erosion is from sheet erosion occurring on badly depleted brushy rangeland.

Gully erosion is not a major problem, but there are a few small areas of active gullying. The most severe of these is just upstream from State Highway 239 on Cottonwood Creek. This condition apparently is caused by a limited area of dispersed soils. A more stable condition exists where gullying has advanced into the surrounding non-dispersed area.

It is estimated that material derived from sheet erosion causes 70 percent of overbank deposition damage to flood plain lands. Streambank and gully erosion account for only a minor part of total erosion but cause an estimated 25 percent of the overbank deposition damage. Flood plain scour is the source of approximately 5 percent of the damage.

Sediment and scour damage - Yields on an estimated 783 acres of flood plain land are reduced annually from damage of this nature.

Flood plain erosion is moderate. Most of the damaged areas range from broad sheet scour depressions to channels four to five feet deep. There are some small areas of severe damage with narrow channels as deep as 12 feet. It is estimated that the productive capacity of 407 acres has been reduced as follows: 98 acres, 10 percent; 242 acres, 20 percent; 53 acres, 30 percent; 9 acres, 40 percent; 1 acre, 60 percent; and 4 acres, 80 percent. The average annual monetary value of this damage is estimated to be $2,438 at long-term price levels (table 5).

Problems Relating to Water Management

Surface drainage of agricultural land is not a problem and irrigation activity is of minor importance in the watershed. At the present time there is no known local interest in providing additional storage in any of the planned floodwater retarding structures for agricultural or nonagricultural water management purposes.

PROJECTS OF OTHER AGENCIES

There are no existing or proposed water resource development projects of any other agency within the watershed.

The works of improvement included in this plan will have no known detrimental effects on any existing or proposed downstream works of improvement.

BASIS FOR PROJECT FORMULATION

An initial study was made by representatives of the Soil Conservation Service and sponsoring local organizations to determine watershed problems and possible solutions.

Meetings were held with the sponsoring local organizations to discuss existing problems and to formulate project objectives. Watershed protection and flood prevention were the desired objectives to be considered.

The following specific objectives were agreed to:

1. Establish land treatment measures which contribute directly to watershed protection and flood prevention.

2. Attain a reduction of 65 to 70 percent in average annual flood damages.

In selecting sites for floodwater retarding structures, consideration was given to locations which would provide the agreed upon level of protection to areas subject to damage. The size, number, design, and cost of the structures was influenced by the physical, topographic, and geologic conditions in the watershed.

Because of the small amount of damage on flood plain lands of tributaries, the recommended system of structures was limited to those which would materially benefit the mainstem. The recommended system of structural measures meet the project objectives by providing the desired level of protection to agricultural flood plain lands at least cost. The floodwater retarding structures also provide incidental recreation benefits at no additional cost.

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 for protection and improvement, such as is now being carried out by the Karnes-Goliad Soil Conservation District, is necessary for a sound watershed protection and flood prevention program on the

watershed. Basic to reaching this objective is the establishment and maintenance of all applicable soil and water conservation and plant management practices essential to proper land use. Emphasis will be placed on the establishment of land treatment practices which have a measurable effect on the reduction of floodwater, sediment, and erosion damages.

Of the total watershed area of 29,408 acres, 12,538 lie above planned floodwater retarding structures. Land treatment measures will help structural measures to function more efficiently by reducing runoff and sediment. They are the only measures planned for the remaining upland area. Land treatment measures on the agricultural land within the 1,796 acres of the flood plain that will not be inundated by pools of the planned floodwater retarding structures also are important in reducing floodwater, sediment, and erosion damages.

The acres to be treated by landowners and operators and the estimated cost of treatment during the 6-year installation period are shown in table 1. Farmers and ranchers will continue to install and maintain land treatment measures needed in the watershed after the installation period.

Land treatment measures will decrease erosion and sediment production rates by providing improved soil-cover conditions. These measures include conservation cropping systems, cover and green manure crops, and crop residue use for cropland. Proper use, renovation, rotation grazing, and pasture planting are included to establish good cover on grassland and formerly cultivated land. Also included are proper use, deferred grazing, range seeding, and brush control to improve grass cover on rangeland. Construction of farm ponds will provide adequate watering places for livestock and encourage uniform distribution of grazing. These measures also effectively improve soil conditions which allow rainfall to infiltrate the soil at a more rapid rate.

In addition to the soil improving and cover measures, land treatment includes contour farming, gradient and level terraces, diversions, and grassed waterways, all of which have a measurable effect in reducing peak discharge by slowing runoff water from fields and in reducing erosion damage and sediment production.

Structural Measures

A system of 3 floodwater retarding structures will be installed to afford the needed protection to flood plain lands at an estimated cost of $367,229.

Plate 2 shows a section of a typical floodwater retarding structure.

The location of structural measures is shown on the Project Map (plate 4).

Vegetated natural drainage waterway in pastureland. Reduces erosion and delivery of sediment.

Coastal Bermuda waterway serving system of terraces on cropland. Reduces peak discharge by slowing runoff from fields and reduces erosion damage and sediment production.

4-18071 7-63

Improved pasture properly maintained by fertilization, seasonal mowing, and controlled grazing.

Brush control and range seeding improves grass stands and is effective in slowing runoff and reducing soil erosion.

This system of structures will detain runoff from approximately 43 percent of the watershed area included in this plan. The 3 floodwater retarding structures will have a total floodwater detention capacity of 4,056 acre-feet and will detain an average of 3.88 inches of runoff from the watershed area above them.

Sufficient detention storage can be developed at all structure sites to make possible the use of vegetated spillways, thereby effecting a substantial reduction in cost over concrete or similar types of spillways.

All applicable State water laws will be complied with in design and construction of the planned structural measures.

Refer to tables 1, 2, and 3 for details on quantities, costs, and design features of the structural measures.

EXPLANATION OF INSTALLATION COST

Public Law 566 funds will provide technical assistance in the amount of $12,900 during the 6-year installation period to accelerate the application of the planned land treatment for watershed protection. This amount includes $2,100 for completion of standard soil surveys. These Public Law 566 funds will be in addition to $16,600 of Public Law 46 funds provided under the going program. Local interests will apply the planned land treatment at an estimated cost of $306,534, which includes reimbursements from Agricultural Conservation Program Service funds based on present program criteria (table 1). The costs are based on present prices being paid by landowners or operators to establish the individual measures in the area. The number of land treatment measures necessary to reach treatment goals and the unit cost of each measure was estimated by the Karnes-Goliad Soil Conservation District.

The required local cost for structural measures consisting of the value of land easements ($32,524); change in utilities ($220) and roads ($16,500); legal fees ($600); and administration of contracts ($1,500) is estimated at $51,344. The Board of Directors of the Hondo Creek Watershed Improvement District provided estimates of these costs.

Secondary costs associated with reduced agricultural production within pool areas were calculated. However, it was found that the appraised value of land easements exceeded both these costs and the value of production lost.

The entire construction cost for structural measures, amounting to $255,234, will be borne by Public Law 566 funds. In addition, the installation services cost of $60,651 will be a Public Law 566 expense. This is a total Public Law 566 cost of $315,885 for the installation of structural measures.

Construction costs include the engineers' estimate and contingencies. The engineers' estimates were based on the unit costs of floodwater retarding structures in similar areas modified by special conditions inherent to each individual site location. They include such items as permeable foundation conditions and site preparation. Geologic investigations consisted of surface observations, hand auger borings, and laboratory analyses of samples of foundation and embankment materials. Ten percent of the engineers' estimate was added as a contingency to provide funds for unpredictable construction costs.

Installation services include engineering and administrative costs. These estimates were based on an analysis of previous work in similar areas.

The estimated schedule of obligations for the 6-year installation period covering installation of both land treatment and structural measures is as follows:

Schedule of Obligations

Fiscal Year	Measures	Public Law 566 Funds	Other Funds	Total
		(dollars)	(dollars)	(dollars)
1	Site 1	116,606	34,363	150,969
	Land Treatment	2,150	53,856	56,006
2	Sites 2 and 3	199,279	16,981	216,260
	Land Treatment	2,150	53,856	56,006
3	Land Treatment	2,150	53,856	56,006
4	Land Treatment	2,150	53,856	56,006
5	Land Treatment	2,150	53,855	56,005
6	Land Treatment	2,150	53,855	56,005
	Total	328,785	374,478	703,263

This schedule may be adjusted from year to year 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.

EFFECTS OF WORKS OF IMPROVEMENT

This project will directly benefit the owners and operators of 32 farms in the watershed. In addition, the owners and operators of the farms along the San Antonio River immediately below Hondo Creek will receive some benefit from the project.

The combined program of land treatment and structural measures will prevent flood damage to the flood plain below the proposed floodwater retarding structures from 23 of the 52 floods such as occurred in the watershed from 1935 through 1959. Of the 10 major floods that inundated more than half of the total flood plain, 9 would be reduced to minor floods inundating less than half the flood plain. In the flood plain area below floodwater retarding structures, all major floods would be reduced to minor floods. Average annual flooding in the watershed will be reduced from 955 acres to 451 acres, a reduction of 53 percent. This includes the flooding on the flood plain of Cottonwood Creek for which no structural measures are planned and on the flood plain above floodwater retarding structures. Average annual flooding on the flood plain below floodwater retarding structures will be reduced from 726 acres to 233 acres, a reduction of 68 percent.

Under present conditions 1,796 acres of flood plain, excluding stream channels and pool areas of the planned floodwater retarding structures, have been inundated by runoff from the largest storm considered during the 25-year period, 1935-1959. It is estimated that the area inundated by a similar flood would be reduced to 1,012 acres following the installation of the planned land treatment and structural measures. For the flood plain below floodwater retarding structures, flooding would be reduced from 1,466 acres to 684 acres.

Reduction in area inundated varies with respect to location within the watershed. The general locations and reductions in inundation are shown in the following tabulation:

General Location of Reduction in Area Inundated

Item	Evaluation Reach (Plate 1) A	B 1/	C	D 2/	Total
Average Annual Area Inundated					
Without Project-Acres	93	176	633	53	955
With Project-Acres	59	168	174	50	451
Percent Reduction	37	5	73	6	53
Area Inundated by Largest Flood					
Without Project-Acres 3/	175	205	1,291	125	1,796
With Project-Acres	100	204	584	124	1,012
Percent Reduction	43	0	55	1	44
Number of Floods Inundating More than One-half of Flood Plain					
Without Project	17	19	8	7	10
With Project	9	19	0	6	1

1/ No structural control planned.
2/ Above planned floodwater retarding structures.
3/ Excludes 150 acres of flood plain within pool areas of planned floodwater retarding structures.

The area on which sediment damage from overbank deposition will occur is expected to be reduced from 376 acres to 88 acres, a reduction of 77 percent. The area on which flood plain scour will occur is expected to be reduced from 407 acres to 163 acres, a reduction of 60 percent.

Planned land treatment will reduce the average annual gross erosion from 122 acre-feet to 113 acre-feet per year. Sediment transported from the watershed will be reduced from 43 to 26 acre-feet annually as a result of the combined program of land treatment and structural measures.

Owners and operators of flood plain land say that if adequate flood protection is provided, they will convert about 88 acres of brushy and unimproved pasture to improved pasture and grazing crops. This land is well suited for more intensive use but has never been improved because of frequent flooding. With the project installed, flooding will not be a deterrent to more intensive use.

Benefits will accrue to the planned structural measures in the watershed from reduction of floodwater damages on the mainstem flood plain of the San Antonio River immediately below its confluence with Hondo Creek. If, at some future time, the proposed Goliad Reservoir is constructed on the San Antonio River, the structural measures proposed in this plan will reduce sediment deposition in that reservoir by about 14 acre-feet annually.

Incidental recreational benefits will result from the installation of the three floodwater retarding structures included in this plan. Sediment pool elevations of these structures are at the 50-year sediment storage level or 200 acre-feet capacity, whichever is less. The sediment pools cover 117 surface acres. These pools are located within easy driving distants of most of the 44,000 inhabitants of Karnes, Goliad, and Bee Counties and will serve as year-round outdoor recreational facilities for fishing, swimming, hunting, boating, and picnicking. Judging from the experience to date on the adjoining Escondido Creek watershed project and the opinion of the sponsors, it appears that the pools will be open to the general public or to organized groups such as boy scouts. Access to some possibly will be free. At others a small fee will be charged. It is estimated that these pool areas will attract at least 1,700 visitors annually.

Secondary benefits stemming from the project will accrue to trade area businesses through increased net income from sales and services resulting from the increased production as a result of project installation. Benefits induced by the project will result from the expenditures associated with incidental recreation and from the increased cost of production of the additional commodities produced.

PROJECT BENEFITS

The estimated average annual monetary floodwater, sediment, erosion, and indirect damages (table 5) within the watershed will be reduced from $18,713 to $6,171 by the proposed project. This is a reduction of 67 percent, 96 percent of which will result from the system of floodwater retarding structures.

Reduction in monetary flood damages varies with respect to locations within the watershed. The following tabulations show the general locations of damage reduction benefits attributed to the combined program of land treatment and structural measures:

General Location of Reduction in Monetary Damage

Item	Evaluation Reach (Plate 1) A	B 1/	C	D 2/	Total
Average Annual Damage					
Without Project-Dollars	1,643	1,275	15,038	757	18,713
With Project-Dollars	924	1,209	3,333	705	6,171
Percent Reduction	44	5	78	7	67
Direct Floodwater Damage by Largest Flood 3/					
Without Project-Dollars	1,599	2,476	28,282	992	33,349
With Project-Dollars	992	2,420	8,627	970	13,009
Percent Reduction	38	2	69	2	61

1/ No structural control planned.
2/ Above planned floodwater retarding structures.
3/ Summer flood at long-term price levels.

It is estimated that the net increase in income from changed land use will amount to $347 (at long-term price levels) annually.

Benefits averaging $584 annually will accrue to the planned structural measures from reduction of floodwater damages on the main stem of the San Antonio River below the watershed.

The annual net monetary value of the incidental recreational benefits from use of the sediment pools of the floodwater retarding structures is estimated to be $1,130. This is based on an estimated gross value of $1.00 per visitor day less associated cost to be incurred by the landowners.

It is estimated that the project will produce local secondary benefits averaging $1,361 annually. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation.

Since the watershed is not located in an area designated by the Secretary of Agriculture under the Area Redevelopment Act, no redevelopment benefits were included.

The total annual flood prevention benefits from structural measures are estimated to be $15,445. In addition to the monetary benefits, there are other substantial benefits which will accrue to the project such as an increased sense of security, better living conditions, and improved wildlife conditions. None of these additional benefits were evaluated in monetary terms nor have they been used for project justification.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures (amortized total installation cost, plus operation and maintenance) is estimated to be $11,665. The structural measures are expected to produce average annual primary benefits of $14,084, or $1.21 for each dollar of cost.

The ratio of the total average annual project benefits ($15,445) to the average annual cost of structural measures ($11,665) is 1.3 to 1 (table 6).

PROJECT INSTALLATION

Land Treatment Measures

Planned treatment (table 1) will be established by farmers and ranchers during a 6-year period in cooperation with the Karnes-Goliad Soil Conservation District. Technical assistance in the planning and application of land treatment measures is provided under the going program of the district. A standard soil survey is in progress and has been completed on 3,220 acres. There are 26,188 acres needing standard soil survey.

The governing body of the Karnes-Goliad Soil Conservation District will assume aggressive leadership in getting an accelerated land treatment program underway. The landowners and operators within the watershed will be encouraged to apply and maintain soil and water conservation measures on their farms and ranches. District owned equipment will be made available to the landowners in accordance with existing arrangements for equipment usage in the district. The Soil Conservation Service will provide additional technical assistance to the soil conservation district to assist landowners and operators cooperating with the district in accelerating the planning and application of soil, plant, and water conservation measures, including treatment of gullied areas. Additional technical assistance will be provided to the district to accelerate the completion of the standard soil survey.

The soil and water conservation loan program of the Farmers Home Administration is available to all eligible farmers and ranchers in the area. Educational meetings will be held in cooperation with other agencies to outline

the services available and eligibility requirements. Present FHA clients will be encouraged to cooperate in the program.

The County Agricultural Stabilization and Conservation committee will cooperate with the governing body of the soil conservation district by selecting and providing financial assistance for those 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.

Structural Measures

The Hondo Creek Watershed Improvement District has the right of eminent domain under applicable State law and has financial resources to fulfill its responsibilities.

The Hondo Creek Watershed Improvement District will:

1. Obtain the necessary land, easements, and rights-of-way and permits for floodwater retarding structures 1, 2, and 3 to be dedicated jointly to the Hondo Creek Watershed Improvement District and the Karnes-Goliad Soil Conservation District;

2. Provide for the relocation or modification of utility lines and systems, roads, and privately owned improvements;

3. Provide for the necessary improvement of low water crossings on private and public roads to make them passable during prolonged release flows from the structures or obtain permission to inundate such roads where equal alternate routes are designated for use during periods of inundation.

4. Provide the necessary legal, administrative and clerical personnel, facilities, supplies, and equipment to advertise, award, and administer contracts;

5. Determine the legal adequacy of the easements and permits for construction; and

6. Be the contracting agency, and let and service all contracts.

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

The three floodwater retarding structures will be constructed in numerical sequence during a 2-year installation period.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out works of improvement described in this work plan will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended.

The voters of the Hondo Creek Watershed Improvement District have approved a tax which is being levied and collected annually to secure bond funds in the amount of $40,000 for the local share of the project installation cost. Revenue from the sale of these bonds is available and will be adequate for financing the share of project installation costs to be borne by local interests.

It is anticipated that approximately 80 percent of the easements will be donated. The out-of-pocket cost of easements which will not be donated, relocation of utilities, roads and improvements, legal services, and administration of contracts is estimated by the sponsors to be $15,000.

The sponsoring local organizations do not plan to use loan provisions of the Act.

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

1. The requirements for land treatment in the drainage area above the floodwater retarding structures have been satisfied.

2. All land, easements, rights-of-way, and permits have been obtained for all structural measures or a written statement is furnished by the Hondo Creek Watershed Improvement District that its right of eminent domain will be used, if needed, to secure any remaining land, easements, or rights-of-way within the project installation period; and that sufficient funds are available for purchasing those easements and rights-of-way.

3. A court order has been obtained from the Karnes County Commissioners Court showing that the county road affected by the pools of floodwater retarding structure 1 will either be raised two feet above emergency spillway crest elevation or relocated at no expense to the Federal Government or closed.

4. Provisions have been made for improving low water crossings or bridges and/or culverts on public and private roads or court orders or necessary permits obtained granting permission to temporarily inundate the crossings, providing equal alternate routes are available for use by all people concerned, during periods when these crossings are impassable due to prolonged flow from the principal spillways of the floodwater retarding structures. If equal alternate routes are not available, the provisions will specify that necessary improvements will be made, at no cost to the Federal Government, to make the crossings passable during prolonged periods of release flows from the structures.

5. Utilities, such as power lines and pipeline, have been relocated or permission has been obtained to inundate the properties involved.

6. The contracting agency is prepared to discharge its responsibilities.

7. The project agreements have been executed.

8. Operation and maintenance agreements have been executed.

9. Public Law 566 funds are available.

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

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by landowners and operators of the farms and ranches on which the measures are applied under agreement with the Karnes-Goliad Soil Conservation Districts. Representatives of the soil conservation district will make periodic inspections of the land treatment measures to determine maintenance needs and encourage landowners and operators to perform maintenance. They will make district-owned equipment available for this purpose in accordance with existing working arrangements.

Structural Measures

The Hondo Creek Watershed Improvement District and the Karnes-Goliad Soil Conservation District will be responsible for the operation and maintenance of the 3 floodwater retarding structures.

Funds for this purpose will be provided by the Hondo Creek Watershed Improvement District which has authority to levy a maintenance tax not to exceed $0.25 on each $100 of assessed property valuation.

The estimated average annual cost of operation and maintenance of all structural measures is $450. Revenue from the maintenance tax will be available and adequate for this purpose.

The three floodwater retarding structures will be inspected at least annually and after each heavy rain by representatives of the Hondo Creek Watershed Improvement District and representatives of the Karnes-Goliad Soil Conservation District. A Soil Conservation Service representative will participate in these inspections at least annually. Items of inspection will include, but will not be limited to, the condition of the principal spillway and its appurtenances, the vegetative cover of the earth fill and the emergency spillway, and fences and gates installed as a part of the structure. The items of inspection are those most likely to require maintenance.

The Soil Conservation Service, through the Karnes-Goliad Soil Conservation District, will participate in operation and maintenance only to the extent of furnishing technical assistance to aid in inspection and furnishing technical guidance and information necessary for the operation and maintenance program.

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

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

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

The necessary maintenance work will be accomplished either by contract, force account, or equipment owned by or made available to the Hondo Creek Watershed Improvement District.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Hondo Creek Watershed, Texas

Installation Cost Items	Unit	No. to be Applied Non-Federal Land 2/	Estimated Cost (Dollars) 1/ Public Law 566 Funds	Other Funds	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Acre	11,251	-	174,630	174,630
Pastureland	Acre	2,841	-	68,307	68,307
Rangeland	Acre	2,097	-	63,597	63,597
Technical Assistance			12,900	16,600	29,500
SCS Subtotal			12,900	323,134	336,034
TOTAL LAND TREATMENT			12,900	323,134	336,034
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures	No.	3	255,234	-	255,234
SCS Subtotal			255,234	-	255,234
Subtotal - Construction			255,234	-	255,234
Installation Services					
Soil Conservation Service					
Engineering Services			38,285	-	38,285
Other			22,366	-	22,366
SCS Subtotal			60,651	-	60,651
Subtotal - Installation Services			60,651	-	60,651
Other Costs					
Land, Easements and Rights-of-Way			-	49,844	49,844
Administration of Contracts			-	1,500	1,500
Subtotal - Other			-	51,344	51,344
TOTAL STRUCTURAL MEASURES			315,885	51,344	367,229
TOTAL PROJECT			328,785	374,478	703,263
SUMMARY					
Subtotal SCS			328,785	374,478	703,263
TOTAL PROJECT			328,785	374,478	703,263

1/ Price Base: 1962.

2/ For Land Treatment: Acres to be treated during project installation period.

June 1963

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan Preparation)

Hondo Creek Watershed, Texas

Measures	Unit	Number Applied To Date 1/	Total Cost (Dollars) 2/
LAND TREATMENT			
Soil Conservation Service			
Cropland Treated	Acre	2,882	128,111
Pastureland Treated	Acre	1,000	56,143
Rangeland Treated	Acre	2,067	68,500
SCS Subtotal			252,754
TOTAL LAND TREATMENT			252,754
STRUCTURAL MEASURES		None	
TOTAL	xxx	xxx	252,754

1/ Acres considered adequately treated. Additional acres are partially treated.

2/ Price Base: 1962

June 1963

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Hondo Creek Watershed, Texas
(Dollars) 1/

Structure Site Number	Installation Cost-Public Law 566 Funds				Installation Cost-Other Funds			Total Installation Cost
	Construction	Installation Services: Engineering	Installation Services: Other	Total Public Law 566	Adm. of Contracts	Easements and R/W	Total Other	
Floodwater Retarding Structures								
1	94,217	14,133	8,256	116,606	500	33,863	34,363	150,969
2	85,516	12,827	7,494	105,837	500	10,098	10,598	116,435
3	75,501	11,325	6,616	93,442	500	5,883	6,383	99,825
GRAND TOTAL	255,234	38,285	22,366	315,885	1,500	49,844	51,344	367,229

1/ Price Base: 1962

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES

Hondo Creek Watershed, Texas

Item	Unit	STRUCTURE NUMBER 1	2	3	Total
Drainage Area	Sq.Mi.	11.81	4.33	3.45	19.59
Storage Capacity					
Sediment Pool (50-year or 200 acre-feet limit)	Ac.Ft.	200	166	156	522
Sediment Reserve (Below Riser)	Ac.Ft.	1,022	159	151	1,332
Sediment in Detention Pool	Ac.Ft.	202	56	52	310
Floodwater Detention	Ac.Ft.	2,450	861	745	4,056
Total	Ac.Ft.	3,874	1,242	1,104	6,220
Surface Area					
Sediment Pool (50-year or 200 acre-feet limit)	Acre	49	28	40	117
Sediment Reserve Pool (Top of Riser)	Acre	165	52	67	284
Floodwater Detention Pool	Acre	388	129	153	670
Volume of Fill	Cu.Yd.	158,600	137,610	124,720	420,930
Elevation Top of Dam	Foot	325.9	309.4	280.7	xxx
Maximum Height of Dam	Foot	34	33	25	xxx
Emergency Spillway					
Crest Elevation	Foot	320.8	304.9	276.9	xxx
Bottom Width	Foot	400	250	250	xxx
Type		Veg.	Veg.	Veg.	xxx
Percent Chance of Use 1/		4.0	4.0	4.0	xxx
Average Curve No. - Condition II		77	75	77	xxx
Emergency Spillway Hydrograph					
Storm Rainfall (6-hour) 2/	Inch	6.37	6.80	6.87	xxx
Storm Runoff	Inch	3.81	3.97	4.25	xxx
Velocity of Flow (V_c) 3/	Ft./Sec.	1.1	0.8	1.1	xxx
Discharge Rate 3/	C.F.S.	242	100	165	xxx
Maximum Water Surface Elevation 3/	Foot	321.4	305.4	277.5	xxx
Freeboard Hydrograph					
Storm Rainfall (6-hour) 4/	Inch	15.67	16.71	16.90	xxx
Storm Runoff	Inch	12.58	13.27	13.77	xxx
Velocity of Flow (V_c) 3/	Ft./Sec.	9.6	8.9	8.2	xxx
Discharge Rate 3/	C.F.S.	11,292	5,640	4,265	xxx
Maximum Water Surface Elevation 3/	Foot	325.9	309.4	280.7	xxx
Principal Spillway					
Capacity - Low Stage	C.F.S.	118	43	35	xxx
Capacity Equivalents					
Sediment Volume	Inch	2.26	1.65	1.95	xxx
Detention Volume	Inch	3.89	3.73	4.05	xxx
Spillway Storage	Inch	3.75	2.97	3.67	xxx
Class of Structure		A	A	A	

1/ Based on regional analysis of gaged runoff and in all cases exceeds the requirements set forth in Engineering Memorandum SCS-27.

2/ 0.5 P reduced to controlling drainage area.

3/ Maximum during passage of hydrograph.

4/ 1.23 P reduced to controlling drainage area.

June 1963

TABLE 4 - ANNUAL COST

Hondo Creek Watershed, Texas

(Dollars)

Evaluation Unit	Amortization of Installation Cost 1/	Operation and Maintenance Cost 2/	Total
Floodwater Retarding Structures			
1 through 3 3/	11,215	450	11,665
TOTAL	11,215	450	11,665

1/ Price Base: 1962 prices amortized for 100 years at 2.875 percent.

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

3/ Interrelated measures.

June 1963

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Hondo Creek Watershed, Texas

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	5,594	2,128	3,466
Other Agricultural	4,777	1,419	3,358
Nonagricultural			
Road and Bridge	1,738	646	1,092
Other	58	0	58
Subtotal	12,167	4,193	7,974
Sediment			
Overbank Deposition	2,244	448	1,796
Erosion			
Flood Plain Scour	2,438	910	1,528
Indirect	1,864	620	1,244
TOTAL	18,713	6,171	12,542

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

June 1963

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Hondo Creek Watershed, Texas

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/ Flood Prevention: Damage Reduction	Changed Land Use: Agricultural	Incidental Recreation 2/	Other 3/	Secondary	Total	Average Annual Cost 4/	Benefit Cost Ratio
Floodwater Retarding Structures								
1 through 3 5/	12,023	347	1,130	584	1,361	15,445	11,665	1.3:1
GRAND TOTAL	12,023 6/	347	1,130	584	1,361	15,445	11,665	1.3:1

1/ Price Base: Long-term prices as projected by ARS, September 1957.
2/ Benefits from recreation incidental to installation of floodwater retarding structures.
3/ Benefits from reduction in damages to San Antonio River flood plain.
4/ From table 4.
5/ Interrelated measures.
6/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of $519 annually.

INVESTIGATIONS AND ANALYSES

Project Formulation

Land Treatment Measures

The status of land treatment for the watershed was developed by the Karnes-Goliad Soil Conservation District assisted by personnel from the Soil Conservation Service at Kenedy. Conservation needs data were compiled from existing conservation plans within the watershed and expanded to represent the conservation needs of the entire watershed. The quantity of each land treatment practice, or combination of practices, necessary for essential conservation treatment was estimated for each land use by capability class. Acres, by land use, to be treated during the 6-year installation period were estimated (table 1). The hydraulic, hydrologic, sedimentation, and economic investigations provided data as to the effects of land treatment measures in terms of the reduction of flood damage. Although measurable benefits would result from application of the planned land treatment measures, it was apparent that other flood prevention measures would be required to attain the degree of watershed protection and flood damage reduction desired by the local people.

Structural Measures

Structural measures for flood prevention needed to attain the project objectives were then determined. The study made and the procedures used in making that determination were as follows:

1. A base map was prepared to show the watershed boundary, drainage pattern, system of roads and railroads, and other pertinent information.

2. A study of aerial photographs supplemented by field examination indicated the limits of flood plain subject to flood damage.

3. All probable sites for floodwater retarding structures were located by a stereoscopic study of aerial photographs and by field examination. Sites for which it was apparent that sufficient storage capacities could not be developed were dropped from further consideration. All structure sites that could possibly be used in alternate systems to meet the project objectives were shown on a map of the watershed. This map of the watershed was submitted to the sponsoring local organizations who provided data on ownership of land apparently involved in each site location. The sponsoring organizations also provided estimates on values of easements involved in each site. Based on apparent physical, economic,

and easement feasibility, the Service and sponsoring local organizations agreed that seven possible sites for floodwater retarding structures would be investigated. Out of the seven sites investigated, a system of three sites was determined to be feasible.

4. Each site location was classified for limiting criteria for design according to the damage that would result from a sudden major breach of the embankment.

5. A topographic map (1 inch equals 660 feet and 4-foot contour interval) was developed for the pool, dam, and emergency spillway areas of each probable site. A more detailed map (1 inch equals 100 feet and 2-foot contour interval) was developed for the emergency spillway area. These maps and related surveys provided necessary information to determine if the required sediment and floodwater detention storage could be obtained, the limit of the pool areas, estimated installation costs, and the most economical design for each structure. The sediment and floodwater storage requirements, structure classification, and principal and emergency spillway layout and design meet or exceed criteria outlined in Engineering Memorandum SCS-27 and Texas State Manual Supplement 2441.

   Multiple routings of freeboard hydrographs were made for all sites to determine the spillway proportion and height of dam which would result in the most economical and feasible design of the structures.

   Plans of a floodwater retarding structure, typical of these planned for this watershed, are illustrated by plates 3 and 3A.

6. A detailed investigation was made of State, county, and farm roads having low water crossings on streams below the floodwater retarding structures. Where there were no equal alternate routes, the improvements required to provide passage during periods of prolonged floodwater release from the structures were determined.

7. The local sponsoring organizations or other interests did not desire to incorporate additional water storage for any agricultural or nonagricultural purpose.

8. Structure data tables were developed to show for each structure, the drainage area, the capacity needed for floodwater detention and for sediment storage in acre-feet and in inches of runoff from the drainage area, the release rate of the

principal spillway, acres inundated by the sediment, sediment reserve, and detention pools, the volume of fill in the dam, the estimated costs of the structure, and other pertinent data (tables 2 and 3).

9. Damages resulting from floodwater, sediment, and flood plain erosion were determined from damage schedules, surveys of sample areas, and flood routings under without project conditions. Reductions in these damages resulting from the proposed works of improvements were estimated on the basis of reduction in sediment yields and reduction of peak discharges as determined by flood routings under future conditions for which it was assumed that the proposed works of improvement had been installed. Benefits so determined were allocated to individual measures or groups of interrelated measures, on the basis of the effects of each on the reduction of damages. In this manner, it was determined that floodwater retarding structures could be economically justified. By further analysis those individual and interrelated floodwater retarding structures which had favorable benefit to cost ratios were determined. Alternate sites were investigated until the most economical and feasible system of floodwater retarding structures was developed which would provide the degree of protection desired by the sponsoring local organizations.

   The system consisted of three interrelated floodwater retarding structures necessary to provide the desired level of flood damage reduction.

When the structural measures for flood prevention had been determined, a table was developed to show the cost of the measures (table 2). The summation of the total costs for all works of improvement represented the estimated cost of the planned watershed protection and flood prevention project (table 1).

A second cost table was developed to show separately the annual installation cost, annual maintenance cost, and the total annual cost of the structural measures (table 4).

Hydraulic and Hydrologic Investigations

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

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau and Water Supply Papers, U. S. Geological Survey. These data were analyzed to determine average precipitation depth-duration

relationships, the relationships of geology, soils, and climate to runoff depth for single storm events, and the runoff-peak discharge relationship.

2. Engineering surveys were made to collect information on selected stream reaches, including valley cross sections, channel capacities, high water elevations of selected storms, bridge capacities, and other hydraulic characteristics. The valley cross sections and evaluation reaches were selected in conference with the economist and geologist.

3. Hydrologic conditions of the watershed were determined by considering such factors as climate, geology, topography, soils, land use, and vegetative cover. From this, soil cover complex data were assembled and rainfall-runoff relationships were computed for use in determining the runoff from individual storm events, using monthly soil moisture indices. These computations compared favorably with the best available gaged runoff data.

4. Rating curves for the valley cross sections were computed by Mannings formula. The theory of concordant flow was used to determine the relationship of peak discharge to volume of runoff.

5. Stage-area inundation curves were developed from field survey data for each portion of the valley represented by a valley cross section (plate 1). Area inundated, by incremental depths of inundation, was developed for each reach by routing volumes of runoff from each storm in the evaluation series, using a peak discharge-volume relationship.

6. From a tabulation of cumulative departure from normal precipitation, the period 1935 through 1959 was determined to be representative of the normal precipitation on the watershed and is the period from which the historical evaluation series was developed.

7. The area, by depth increments, that would have been inundated by each storm in the evaluation series was determined for:

    a. Without project conditions.

    b. With land treatment applied.

    c. With land treatment measures applied and floodwater retarding structures installed.

d. With alternate systems of structures.

8. The maximum release rates for the principal spillways of the floodwater retarding structures were determined by a detailed study of the stream channel and the effects of release rates on design of structures and emergency spillways. The maximum release rates for each floodwater retarding structure will be 10 csm.

9. The appropriate emergency spillway and freeboard design storm was selected from figures 3.21-1 and 3.21-4 of National Engineering Handbook, Section 4, Supplement A, in accordance with criteria contained in Engineering Memorandum SCS-27 and Texas State Manual Supplement 2441.

10. Emergency spillways were designed in accordance with Texas State Manual Supplement 2441.

Sedimentation Investigations

Sedimentation investigations were made in accordance with procedures as outlined in Watershed Memorandum EWP-7, "Sedimentation Investigations in Work Plan Development", August 21, 1959, Fort Worth, Texas, and Technical Release No. 12, "Procedure for Computing Sediment Requirements for Retarding Reservoirs", September 1959.

Sediment Source Studies

Sediment source studies to determine the 100-year sediment storage requirements were made in the drainage areas of the 3 planned floodwater retarding structures. Detailed investigations were made in 2 of these drainage areas. An estimate of the sediment production rate for the other structure was based on data gathered in a detailed investigation of a similar drainage area.

The two detailed investigations and computations included:

1. Mapping soils by units, percent slope, length of slope, land use, cover condition classes on rangeland, land treatment on cultivated land, and land capability classes.

2. Measuring lengths, widths, and depths, and estimating rates of annual lateral erosion of all gullies and stream channels affected by erosion.

3. Measuring widths and depths and comparing old and recent aerial photographs to determine the average annual headward erosion of all headcuts and overfalls.

4. Computing annual gross erosion by sources (sheet, gully, and streambank).

Field studies and computations for the planned structure not surveyed in detail included:

1. Mapping the land use.

2. Studying soils, topography, and erosion for comparison of similarity to drainage area surveyed in detail.

3. Computing annual gross erosion based on erosion rates of the detailed area.

Estimates of annual gross erosion reflect the effect of expected land treatment on drainage areas of planned structures. A gradual improvement of watershed conditions is expected as a result of the installation of planned land treatment measures.

Sediment storage requirements for planned structures were determined by adjusting average annual total erosion for expected sediment delivery rates and for trap efficiency of reservoirs.

Flood Plain Sediment and Scour Damages

The following sediment and scour damage investigations were made to determine the nature and extent of physical damage to flood plain lands:

1. Field investigations were made within representative sample areas. Factors such as depth and texture of sediment deposits, texture and condition of soils underlying sediment deposits, depth, and width of scour channels, channel degradation or aggradation, and channel bank erosion were recorded. Areas of damage were mapped.

2. Estimates of past physical flood plain damage were obtained through interviews with landowners and operators.

3. A damage table was developed to show percent damage by texture and depth increment for sediment and by depth and width for scour. Due consideration was given to the agronomic and land treatment practices, soils, crop yields, and land capabilities in assigning damage categories.

4. The areas of sediment and scour damages were measured and tabulated by percent damage categories.

5. Damages measured within sample areas were expanded, by evaluation reaches, to represent the entire flood plain.

6. Estimates of recoverability of productive capacity were developed from field studies and interviews with farmers.

7. Average annual sediment yield from each source (sheet erosion, gully erosion, streambank erosion, and flood plain scour) was estimated from detailed sediment source studies and scour damage investigations. Sediment yields to each evaluation reach were computed for without project conditions, with land treatment measures applied, and with the combined program of land treatment and structural measures installed.

   The reduction in sediment yield was adjusted to reflect the relative importance of each sediment source as a contributor of damage. The reduction of monetary damage from overbank deposition was based on the reduction in damaging sediment yield and reduction of area inundated by floodwater.

8. Estimates of the reduction of scour damage due to the installation of the project were based on reduction of depth and area inundated by floodwater.

Geologic Investigations

Preliminary geologic investigations were made at each of the floodwater retarding structure sites to obtain information on the nature and extent of embankment and foundation materials, emergency spillway excavation, emergency spillway stability, and possible problems that might be encountered during construction. These investigations included surface observations of valley slopes, alluvium, channel banks, exposed geologic formations, and hand auger borings. The findings of preliminary geologic investigations were used to assure that the sites selected are feasible and in making cost estimates of structures.

Description of Problems

All three floodwater retarding structure sites are located on the outcrop of the Lagarto formation of upper Pliocene age. The formation is characterized by alternating beds of sands, calcareous clays, and some sandstones which are poorly to fairly well cemented with calcium carbonate. The general dip of the strata ranges from 20 to 40 feet per mile toward the southeast.

Foundations - The foundations at all structure sites consist of clayey sands and sandy clays underlain by clays, sands, and sandstones of the Lagarto formation. The maximum depth of alluvium ranges from 12 to 20 feet. Since permeable conditions exist in both the alluvium and the Lagarto foundation, drainage measures will be necessary to prevent saturation of portions of

the embankments and downstream areas.

At site 2, where thin beds of sandstone are underlain by clays, buckling of the sandstone was noted in the channel bed. This is probably due to saturation of the underlying clay beds causing expansion. Due to the lack of overburden, the expansion force is directed upward causing the thin sandstone beds to fracture. If this condition were to exist beneath the dam, it is believed that the weight of the embankment would be sufficient to prevent upheaval.

Emergency Spillways - Most emergency spillway excavation will be in sandy clay soil, sands, clays, and poorly cemented sandstones. Blasting should not be necessary for excavation of these materials.

Emergency spillway cuts may expose sand beds which are very susceptible to erosion. These spillways will be vegetated as soon as possible after construction.

Embankment Materials - An abundance of alluvial sandy clays and clayey sands is available within sediment pool areas. Materials to be excavated from emergency spillways are suitable for use in the embankments. Soils for embankments are mostly CL and SC, as classified in accordance with the Unified Soils Classification System.

Further Investigations

Detailed investigations, including exploration with core drilling equipment, will be made at all sites prior to construction. Laboratory tests will be made to determine the suitability of embankment and foundation materials and the methods of handling.

Economic Investigations

Selection of Evaluation Reaches

Because of the diversity of damageable values, frequency of flooding, and flood plain characteristics the flood plain was divided into 4 evaluation reaches (plate 1).

Determination of Damages

Agricultural damage estimates were based on schedules obtained in the field covering about 67 percent of the flood plain. These schedules covered land use, crop distribution, yields, and historical data on flooding and flood damages.

In the calculation of crop and pasture damage, expenses saved such as the cost of harvesting and other production inputs were deducted from the gross value of the damage. The flood plain land use was mapped in the field. Estimates of normal flood-free yields were based on data obtained from schedules and supplemented by information supplied by other agricultural workers in the area. Adjustments of present yields were made to allow for expected yield increases resulting from advances in technology during the project life.

Information on other agricultural damages such as fences, livestock, and farm equipment was obtained from schedules and correlated with size of floods.

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

Estimates of damages to roads and bridges in the flood plain were obtained from county commissioners and State highway officials and supplemented by information from local farmers. These damage estimates were related to size of floods.

Indirect damages involving such items as interruption of travel or detours due to flooding, losses sustained through inability to gain access to fields at optimum time for cultural operations, additional expense for care of livestock, and losses sustained by businesses in the area were considered. Based on analysis of these factors, it was estimated that indirect damages would approximate 10 percent of the direct agricultural damage and 20 percent of the direct nonagricultural damage.

Benefits from Reduction of Damage

Average annual damages within the watershed were calculated for conditions without a project, with land treatment installed, and after installation of the complete project. The difference between the damage after the installation of a phase of the project and that before its installation constituted the benefit from reduction of damage creditable to that phase. At each phase considered, adjustments were made to take into account the effects of recurrent flooding when more than one flood occurred during the same year.

Installation of this project will result in damage reduction benefits on the main stem flood plain of the San Antonio River. Analysis of data contained in "Survey Reports of the San Antonio River Watershed", Soil Conservation Service, November 1952, indicated that average annual damage reduction benefits of $0.154, at long-term prices, would accrue downstream from this watershed for each acre-foot of detention capacity in the proposed floodwater retarding structures. Consideration also was given to

the effects of this project on reduction in sediment deposition in the proposed Goliad Reservoir on the San Antonio River. Results of sedimentation studies indicated that the floodwater retarding structures planned in Hondo Creek watershed would reduce sediment deposition in the proposed reservoir by about 14 acre-feet annually. If this reservoir is constructed at some future date, benefits from reduction of reservoir deposition will compare favorably with benefits claimed from floodwater damage reduction on the San Antonio River flood plain.

Changed Land Use Benefits

Farmers in the flood plain were asked to state changes made in land use as a result of past flooding. Operators were also asked what changes they would make in their use of flood plain lands if flooding were reduced. Analysis of their responses indicated that land use had changed very little as a result of past flooding, but that land use changes would result from the anticipated reduction in flooding. Factors considered in this analysis were the size and location of the areas affected, land capability, reduction in frequency of flooding, and similar factors. Consideration was given to increased damage after changed land use. All benefits are net benefits remaining after production, harvesting, and all other allied costs were considered. Benefits so claimed were discounted for an expected 5-year lag in conversion. The only land use changes expected in the flood plain are those which will increase grazing capacity. Consequently, no benefits resulting from increased acreages of restricted crops have been claimed.

The effect of changed land use is shown in the following table:

Crop Distribution and Net Returns
Changed Land Use Benefits 1/ - Evaluation Reach C

Crop Distribution	Without Project			With Project			Difference in Net Return
	Acre	Yield	Net Return (dollars)	Acre	Yield	Net Return (dollars)	(dollars)
Cotton	65	325 lb.	1,816	65	325 lb.	1,816	-
Corn	72	35 bu.	1,470	72	35 bu.	1,470	-
Grain Sorghum	44	26.5 cwt	981	44	26.5 cwt	981	-
Broomcorn	34	0.3 ton	1,346	34	0.3 ton	1,346	-
Flax	110	15 bu.	2,923	110	15 bu.	2,923	-
Oats (Temporary Pasture)	48	3.75 aum	390	56	3.75 aum	455	65
Sudan (Temporary Pasture)	162	4.0 aum	1,473	192	4.0 aum	1,746	273
Hay Crops	86	2.2 ton	1,634	86	2.2 ton	1,634	-
Improved Pasture	-	-	-	50	4.5 aum	539	539
Open Pasture	136	1.5 aum	647	86	1.5 aum	409	-238
Brushy Pasture	498	1.0 aum	1,579	460	1.0 aum	1,458	-121
Miscellaneous	36			36			
Total	1,291		14,259	1,291		14,777	518

(See footnote, next page.)

Crop Distribution and Net Returns (table) - Continued

Changed Land Use Benefits - Evaluation Reach C	
Difference in Net Return	518
Less Discount for Lag in Conversion	30
Deduction for Associated Cost	121
Deduction for Added Flood Damage	20
Benefit from Land Use Change	347

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

Incidental Recreation Benefits

Recreation benefits incidental to the flood prevention purpose will accrue to the floodwater retarding structures proposed in this plan. Flood prevention was the only purpose considered in the location, capacity, and design of these structures and no additional project costs are involved in obtaining incidental benefits from recreational use of the sediment pools of the structures. When the structures are installed the sediment and sediment reserve pools will have a total surface area of 284 acres. In order to determine the minimum benefits, evaluation was limited to the pool areas that would result from the 50-year sediment storage or 200 acre-feet at each structure, whichever was less. Therefore, recreation benefits were estimated on the basis of a total surface area of 117 acres. Studies indicate that the pool areas considered will serve as desirable facilities for outdoor recreational activities. All of these pools are ideally located in relation to the population of the surrounding area. Present population within a 35-mile range of these structures is in excess of 44,000. Degree of utilization for recreation was estimated by comparing probable public access, total surface area, number and size of pools, population, and alternate facilities with Escondido Creek watershed, for which a study of recreation utilization has been made. Escondido Creek watershed is adjacent to this watershed. This fact was considered in estimating the degree of utilization that can reasonably be expected to be made of the sediment pools of the structures in the Hondo Creek watershed. It is estimated that the pool areas of the structures included in this project will attract an average of 1,700 visitors annually.

It is believed that ultimately these pool areas will have at least partially developed recreational facilities for fishing, swimming, hunting, boating, and picnicking. To assure a conservative estimate of benefits, a gross value of $1.00 per visitor day was used in the economic evaluation. Associated costs of development, including maintenance costs, were deducted from the gross value of the benefits. A five year period was considered for development and lag in utilization of these facilities. It also was considered that approximately the same level of utilization would prevail for about 50 years at which time sediment deposition would gradually reduce the attraction of the pools for recreational activities. Total annual

net benefits, discounted to present worth, were estimated to average $1,130.

Secondary Benefits

Values of local secondary benefits were calculated in accordance with the interim procedures outlined in Watershed Memorandum SCS-57, October 3, 1962.

Secondary benefits of a local nature were considered as either (1) stemming from the project, or (2) induced by the project. Benefits stemming from the project were considered to be at least 10 percent of the direct primary damage reduction benefits within the watershed. Secondary benefits resulting from primary recreational benefits and the additional production costs associated with changed land use were considered to be induced by the project. Secondary benefits were considered to be 10 percent of the annual recreation benefits and 10 percent of the average annual increased production costs associated with changed land use.

The total annual net value of secondary benefits resulting from structural measures are estimated to be $1,361 of which $1,116 stem from the project and $245 are induced by the project.

Appraisal of Land and Easement Values

Areas that will be inundated by the sediment and detention pools of the floodwater retarding structures were excluded from the damage calculation. An estimate was made, however, of the value of the production that would be lost in those areas after installation of the project. 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. The cost of land, easements, and rights-of-way for the three floodwater retarding structures was determined by individual appraisal in cooperation with representatives of the sponsoring local organizations. The floodwater retarding structure site costs were based on appraisals of the value of the easements with consideration given to the values that will remain after the land is devoted to project purposes.

The average annual net loss in production and associated secondary losses were calculated and this value compared with the amortized cost of the structure sites. The larger amount, the amortized cost, was used in the economic evaluation of the project to assure a conservative appraisal.

Details of Methodology

The evaluation of flood damages was made by flood routing a historical storm series for the period from 1935 through 1959. Details of the

procedures used in this method of evaluation are described in the Soil Conservation Service Economics Guide for Watershed Protection and Flood Prevention, December 1958.

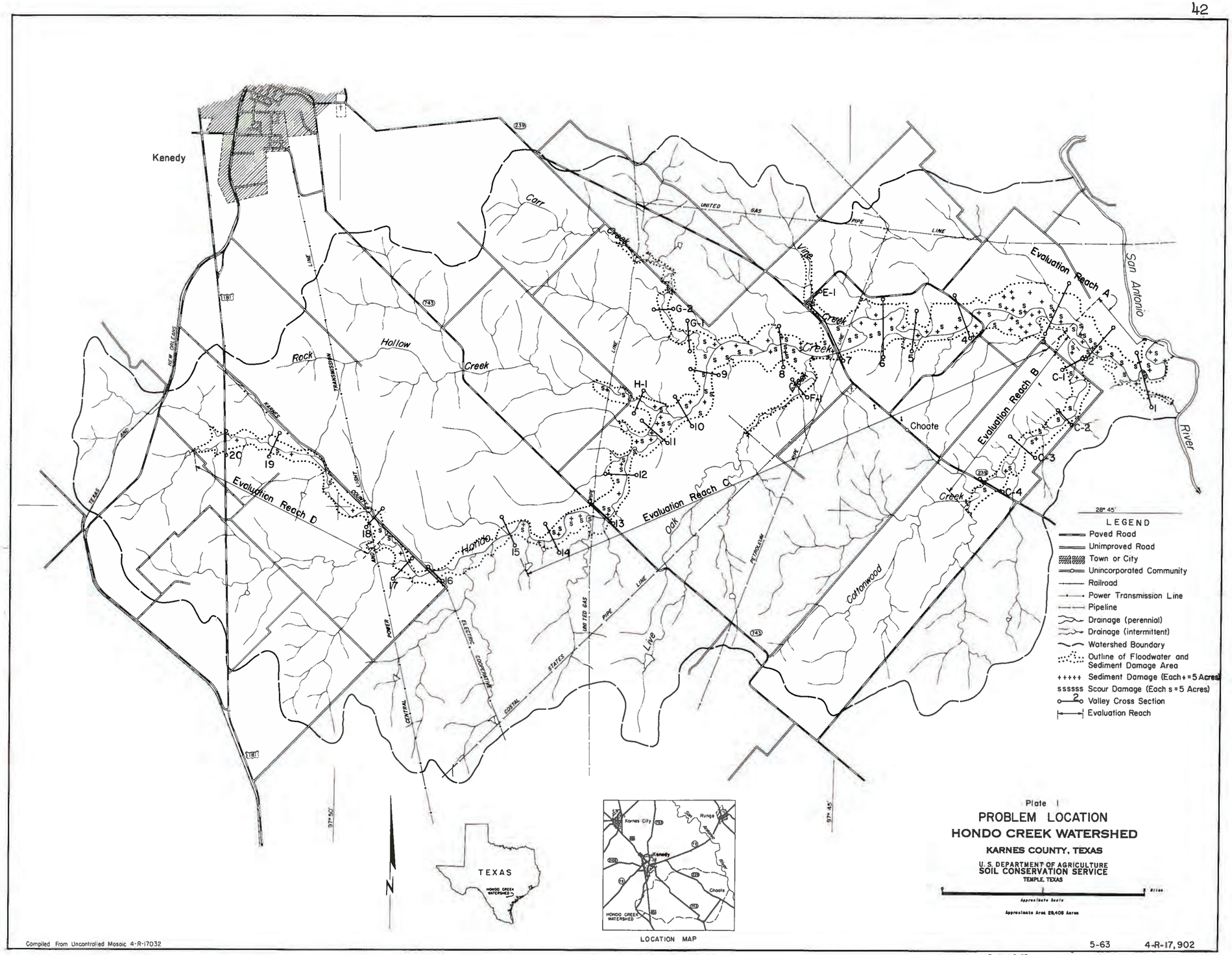


Plate I

PROBLEM LOCATION
HONDO CREEK WATERSHED
KARNES COUNTY, TEXAS

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

Approximate Scale

Approximate Area 28,408 Acres

Compiled From Uncontrolled Mosaic 4-R-17032

5-63 4-R-17,902

Revised 5-63 4-R-11429

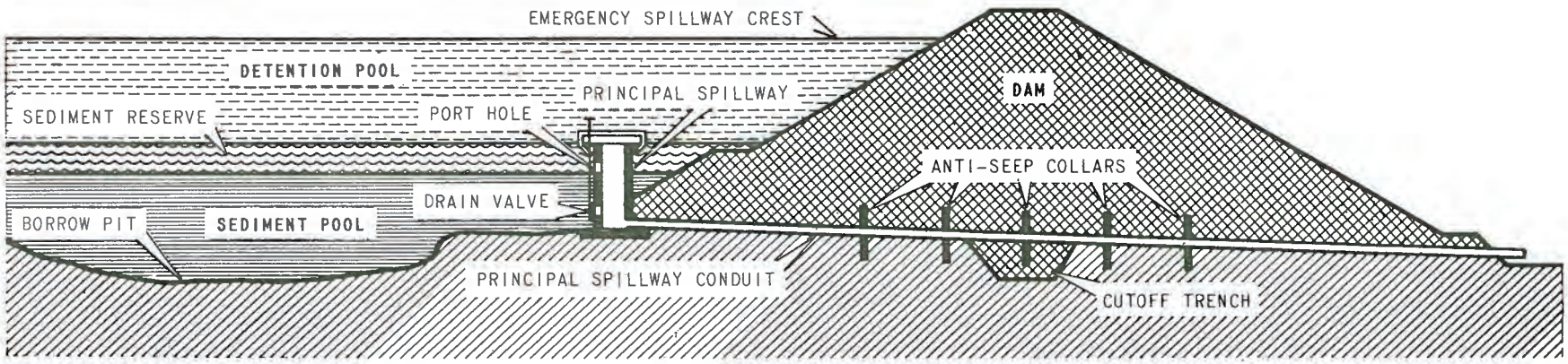


Plate 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

A minimum of 6" topsoil to be placed in Emergency Spillway and on all "Compacted Fill Areas". See the specifications.

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

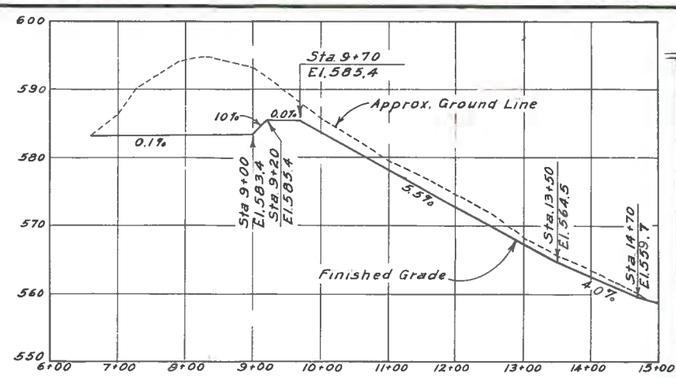
FENCE LEGEND

C——C Fence to be constructed under this contract

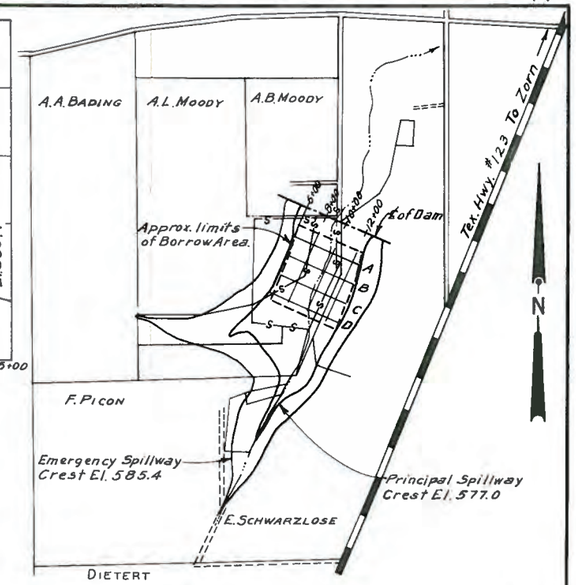
S——S Fence in the construction and borrow areas to be removed and salvaged by the contractor.

Fence Note: Pull panels to be placed at P.C. and P.T. of curve in fence on upstream berm. Fence posts in curved section to be placed in concrete.

Note: S.D. = Stub Diversion, Refer to Typical Section.



PROFILE ON ℄ OF EMERGENCY SPILLWAY

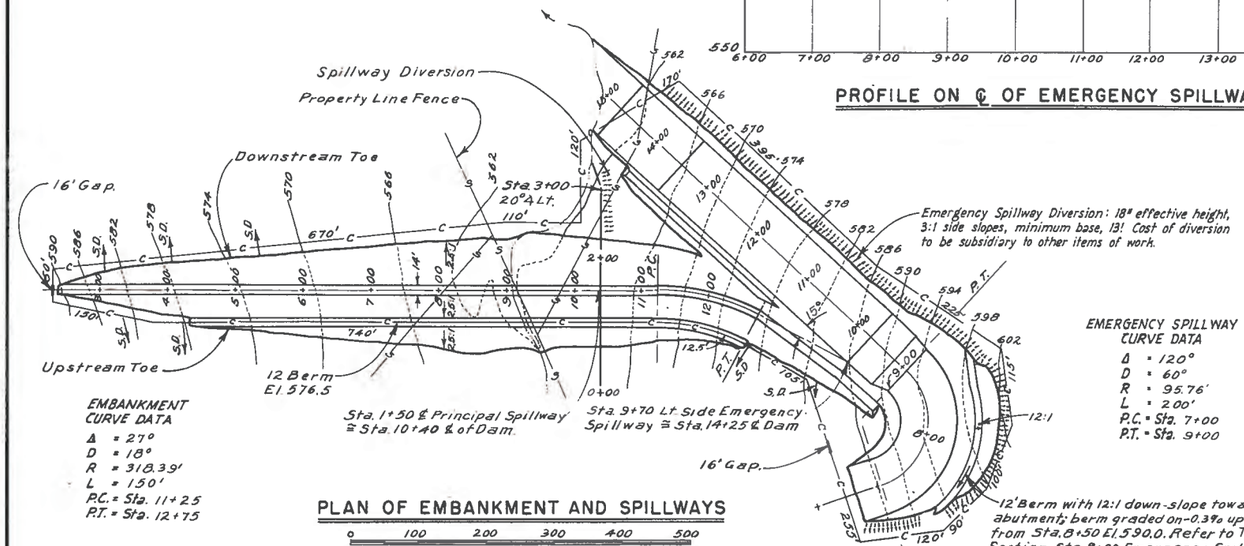


Structure located approx. 1.3 miles south and 0.6 miles west of Zorn, Guadalupe County, Texas.

VICINITY MAP & GENERAL PLAN OF RESERVOIR

0 660 1320 1980 2640

SCALE IN FEET



EMBANKMENT CURVE DATA

Δ = 27°
D = 18°
R = 318.39'
L = 150'
P.C. = Sta. 11+25
P.T. = Sta. 12+75

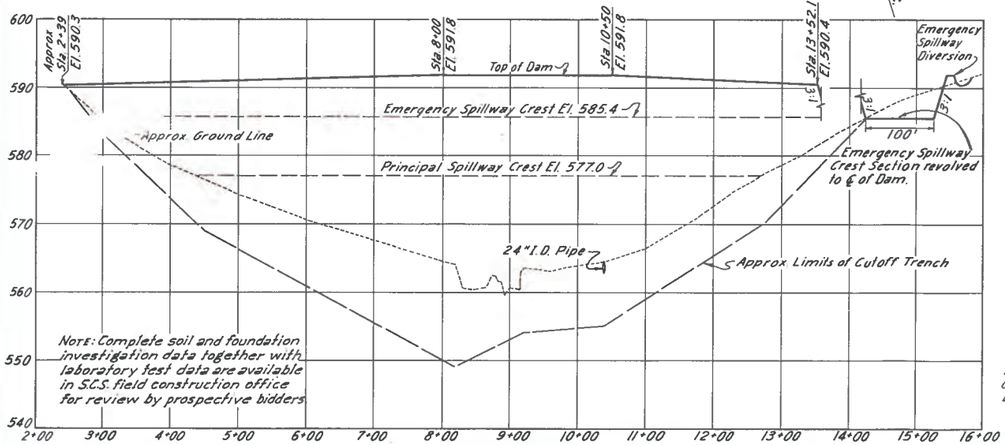
EMERGENCY SPILLWAY CURVE DATA

Δ = 120°
D = 60°
R = 95.76'
L = 200'
P.C. = Sta. 7+00
P.T. = Sta. 9+00

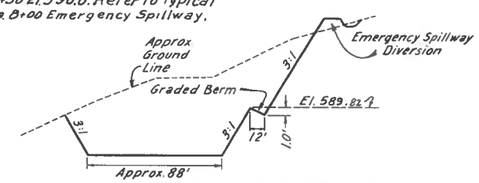
PLAN OF EMBANKMENT AND SPILLWAYS

0 100 200 300 400 500

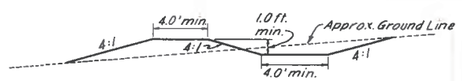
SCALE IN FEET



PROFILE ON ℄ OF DAM

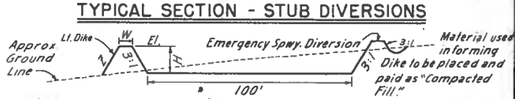


TYPICAL SECTION - STA. 8+00 EMERGENCY SPILLWAY



Stub-Diversions - S.D. will be constructed at the approx. locations shown on the PLAN OF EMBANKMENT AND SPILLWAYS. Minimum Section will be as shown above. Grade will be established by the Engineer. Stub Diversions will be placed as "Semi-Compacted Fill" and paid by the linear foot.

TYPICAL SECTION - STUB DIVERSIONS



Lt. Dike: Sta. 9+00 to approx. Sta. 11+00, El. 590.4, W = 14.0', Z = 2½:1
Approx. Sta. 11+00 to approx. Sta. 14+00, H = 3.0' above Spillway grade, Z = 3:1, W = 10'

TYPICAL SECTION - EMERGENCY SPILLWAY

Elevation	Surface Acres	Storage Acre Feet	Storage Inches
570	8	24	.27
574	17	74	.83
577	29	143	1.61
577.4	30	155	1.74
578	32	174	1.96
582	47	332	3.74
585.4	60	514	5.79
586	62	551	6.20
587.4	70	643	7.24
589.4	81	794	8.94
590	84	844	9.50

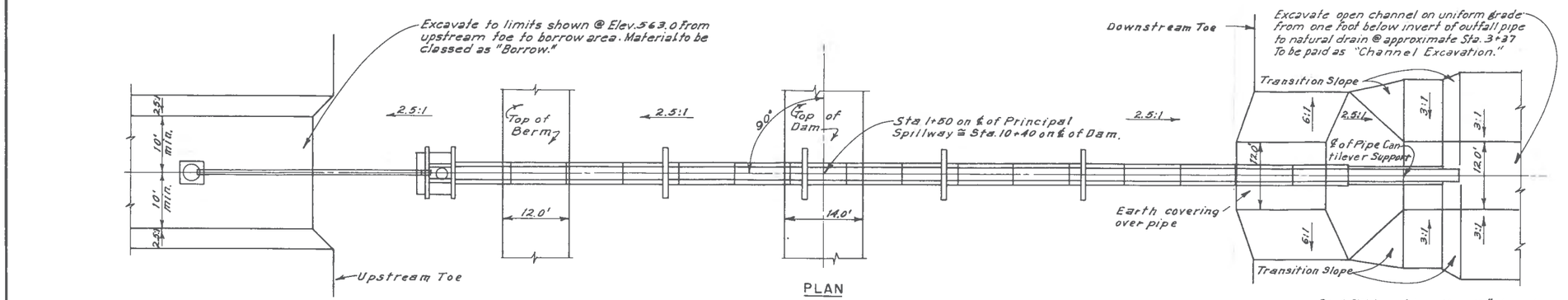
Top of Dam (Effective) Elev.	590.3
Emergency Spillway Crest Elev.	585.4
Principal Spillway Crest Elev.	577.0
Sediment Pool Elev.	577.0
Drainage Area, Acres	1,066
Sediment Storage, Acre Feet	155
Floodwater Storage, Acre Feet	359
Max. Emergency Spillway Cap., c.f.s.	1,857

Plate 3

TYPICAL FLOODWATER RETARDING STRUCTURE GENERAL PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Designed H.H.K.	Date 3-62	Approved by: HEAD, ENGINEERING & DESIGNING DRAFTING UNIT FORT WORTH, TEXAS	
Drawn H.H.K-F.I.B. & T.F.R.	3-62	STATE CONSERVATION ENGINEER, S. C. S. TEMPLE, TEXAS	
Traced F.I.B. & T.F.R.	3-62	Sheet No. 2 of 7 sheets	Drawing No. 4-E-16,470
Checked H.H.K. & G.W.T.	4-62		



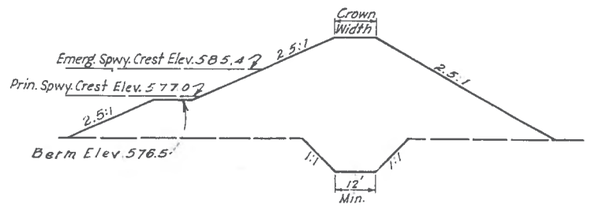
MATERIAL PLACEMENT DATA							
EMBANKMENT SECTION	SOURCE OF FILL MATERIAL		LAB. TEST	COMPACTION REQUIREMENTS			Lab. Curve
Description	Location		Modified ☑ Standard ☐ Max. Dry Den.	Opt'm Moist	Min. Dry Density Lbs. Per Cu. Ft.	Moisture Range Percent From	To	No.
Any Section	Borrow		120.5	12.0	108.5 ☑	12	16	3
Interior & Cutoff Trench Fill*	Borrow		108.0	17.0	97.0 ☐	17	21	1
	Emergency Spillway		109.5	17.0	98.5 ☐	17	21	4
	Emergency Spillway		119.0	13.0	107.0 ☐	13	17	5
Outer Sections	Borrow		108.5	17.5	103.0 ☐	16	20	2

*Cutoff Trench Excavations, similar to the materials shown for "Interior of Dam & Cutoff Trench Fill", may be used in filling the Trenches.

The Engineer will direct a selective placement of all fill materials in consideration of the preferred uses shown in the table above.

Maximum dry density, optimum moisture, minimum acceptable dry density and moisture range shown are for material particles passing the number 4 sieve. If the material being placed contains ¼" or larger rock particles, the minimum acceptable dry density and moisture range will be corrected for the presence of rock.

EMBANKMENT DATA

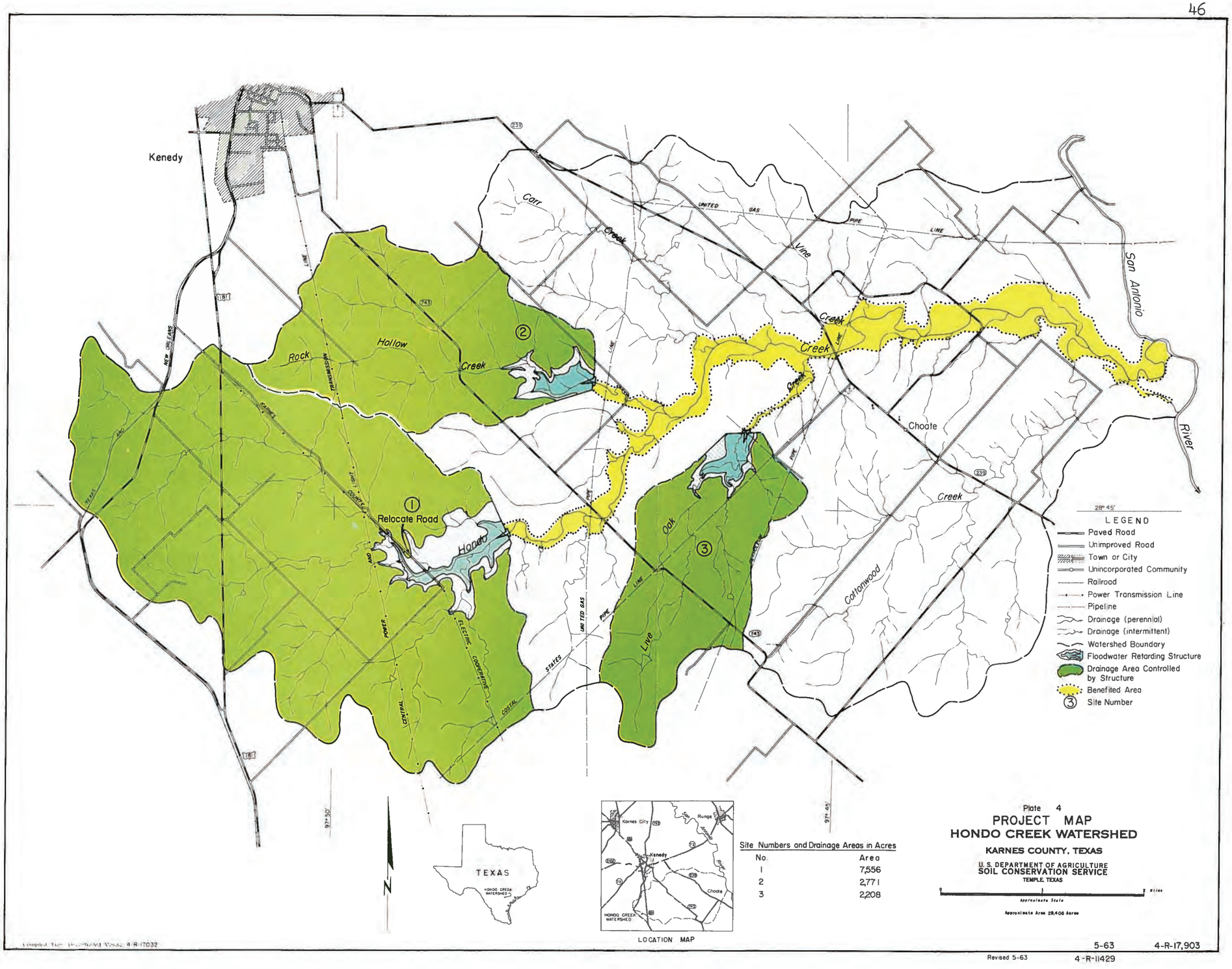


TYPICAL SECTION

Plate 3A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE - PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed H.H.K.	Date 3-62	Approved by: HEAD ENGINEERING & MECHANICS PLANNING UNIT FORT WORTH, TEXAS / STATE CONSERVATION ENGINEER, S. C. S.	
Drawn H.H.K. & T.F.R.	3-62		
Traced T.F.R.	3-62	TEMPLE, TEXAS	
Checked H.H.K.	4-62	Sheet No. 3 of 7	Drawing No. 4-E-16,470



Site Numbers and Drainage Areas in Acres

No.	Area
1	7,556
2	2,771
3	2,208

Plate 4

PROJECT MAP
HONDO CREEK WATERSHED

KARNES COUNTY, TEXAS

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

Approximate Scale

Approximate Area 29,408 Acres

Revised 5-63

5-63 4-R-17,903

4-R-11429