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WATERSHED WORK PLAN FOR WATERSHED PROTECTION, AND FLOOD PREVENTION, POND CREEK WATERSHED, BELL, FALLS, AND MILAM COUNTIES, TEXAS



PREPARED BY THE SOIL CONSERVATION SERVICE, DEPARTMENT OF AGRICULTURE, IN ACCORDANCE WITH THE PROVISIONS OF PUBLIC LAW 83-566

COMMITTEE ON PUBLIC WORKS
UNITED STATES SENATE

FEBRUARY 1971

SERIAL NO. 92-6



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LETTER OF SUBMITTAL

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

December 23, 1970

Honorable Spiro T. Agnew
President of the Senate
Washington, D. C. 20510

Dear Mr. President:

Pursuant to the authority vested in the President by section 5 of the Watershed Protection and Flood Prevention Act, as amended (16 U.S.C. 1005), and delegated to the Director of the Office of Management and Budget by Executive Order No. 10654 of January 20, 1956, there are transmitted herewith the following plans for works of improvement which have been prepared under the provisions of that Act:

State	Watershed
Alabama	Tallaseehatchie Creek*
Texas	Ecleto Creek*
Texas	Pond Creek
Texas	Sanderson Canyon*
Virginia	Ni River*

Each of the above listed plans involves at least one structure which provides more than 4,000 acre-feet of total capacity.

Sincerely,

Caspar W. Weinberger
Acting Director

Note: Referred to the Committee on Public Works by the Secretary of the Senate on December 30, 1970, Executive Communication No. 125.
*Printed separately.

ENVIRONMENTAL STATEMENT

POND CREEK WATERSHED, TEXAS

1. The Environmental Impact of the Proposed Project.

Conservation land treatment of watershed lands will increase farm production and income, reduce erosion and provide protection to wildlife nesting and breeding areas. Annual erosion rates range from 10 tons per acre to more than 20 tons per acre under present watershed conditions. The average rate of loss will be reduced by about 34 percent as a result of conservation land treatment. In addition, sediment deposits in the existing Rosebud Lake will be significantly reduced by land treatment.

Extensive flooding of more than half of the 15,300 acre-floodplain occurs at least once each year and, in recent times, as many as five times in one year. Overbank sediment deposition has damaged more than 1,700 acres. Floodplain erosion has removed from one to four feet of top soil on about 1,680 additional acres. These floodwater and physical land damages averaging over $250,000 annually will be reduced by nearly 75 percent with the installation of the project, which includes 22 floodwater retarding structures, 9 grade stabilization structures, and about 32 miles of channel improvement.

The sediment pools of the floodwater retarding structures will provide about 637 surface acres of water of high value for recreation, fish and wildlife habitat and general enhancement of the environment. It is expected that about 13 of the floodwater retarding structures will be used for these purposes, until the pools are filled with sediment, as they are

designed to do over the life of the project. Adequate sanitary facilities will be provided at each site in accordance with State health regulations and recommendations prior to its being used for public recreational purposes. The sponsors have been assured these sanitary facilities will be installed.

II. Adverse Environmental Effects

The disturbance of vegetative cover during construction will unavoidably result in some temporary loss of crop and pasture production and fish and wildlife habitat. Revegetation of these disturbed areas will take place immediately after construction.

III. Alternatives to the Proposed Action

There are few alternatives to the planned action in this watershed. Because of the agricultural nature of the area and the probability that it will remain in this use, the only alternatives to the action available are different combinations of floodwater retarding structures and channel improvement. Due to the limited number of feasible sites and the inundation of valuable cropland and improvements, it was necessary to consider a system that included a minimum number of structures and least amount of channel improvement. This plan represents the most feasible combination of structural measures to meet project objectives.

IV. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivety.

The economic base of this watershed is, and is expected to continue, in agriculture. The proposed project will meet the immediate needs for flood protection while preserving the land for future generations.

V. Irreversible and Irretrievable Commitments of Resources.

The embankments, spillways and sediment pools of planned floodwater retarding structures will occupy about 640 acres, now being used for crops and pasture.

VI. Problems and Objections Raised by Reviewing Federal Agencies and State and Local Entities.

Interested Federal, State and local agencies have reviewed the work plan in accordance with standard procedures and regulations. The Department of the Interior expressed concern with water quality in and around the floodwater retarding structures and downstream from the Town of Rosebud. The plan provides for meeting State and local health agency requirement, including water quality standards. To protect water quality from excess sediment pollution during construction, all contractors will be required to adhere to guidelines for minimizing soil erosion and water and air pollution as set forth in Soil Conservation Service, "Engineering Memorandum 66".

COMMENTS OF THE STATE OF TEXAS

PRESTON SMITH
GOVERNOR



EXECUTIVE DEPARTMENT
AUSTIN, TEXAS 78711
March 20, 1970

Mr. Kenneth E. Grant
Administrator
United States Department
of Agriculture
Soil Conservation Service
Washington, D. C. 20250

Dear Mr. Grant:

The work plan for the Pond Creek watershed has been received by the Division of Planning Coordination, Office of the Governor (the State Planning and Development Clearinghouse). The draft of this work plan was favorably reviewed by the State Clearinghouse on December 30, 1969, and by the metropolitan and regional clearinghouses concerned (the Heart of Texas Council of Governments and the Central Texas Council of Governments, respectively).

As there appears to be no substantive change between the draft and final work plans, and since no unfavorable information concerning the project has been received subsequent to our review of the draft work plan, the State Clearinghouse finds the work plan to be consistent with planning and development policies and objectives of the State of Texas.

Each phase of this project should continue to be closely coordinated with Texas State agencies, regional councils of governments, and local governments whose plans and programs are affected.

Thank you for the opportunity to review this work plan.

Sincerely,

Dan S. Petty
Director, Division of
Planning Coordination

x

DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 20310

April 13, 1970

Honorable Thomas K. Cowden
Assistant Secretary of Agriculture
Washington, D. C. 20250

Dear Dr. Cowden:

In compliance with the provisions of Section 5 of Public Law 566, 83d Congress, the Administrator of the Soil Conservation Service, by letter of 4 March 1970, requested the views of the Secretary of the Army on the work plan for Pond Creek Watershed, Bell, Falls, and Milam Counties, Texas.

We have reviewed this work plan and foresee no conflict with any projects or current proposals of this Department.

Sincerely yours,

for Robert E. Jordan, III
Special Assistant to the Secretary of the Army
(Civil Functions)

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

SOIL CONS. SERVICE

April 15, 1970

Dear Mr. Secretary:

This is in reply to letter of March 4, 1970, from the Administrator of Soil Conservation Service, submitting for our review and comment the work plan for Pond Creek Watershed, Texas. In accordance with Section 2 of Executive Order 10913 and provisions of Section 5 of the Watershed Protection and Flood Prevention Act, as amended, this work plan has been reviewed by interested agencies of the Department of the Interior and the following comments are offered.

The report states that 13 of the floodwater retarding structures will be open to the public for recreation. There are no provisions in the work plan for sanitary or recreation facilities at the structure sites. The report does state that land owners have assured the sponsors they will construct sanitary facilities prior to opening the pools to the general public for recreation. We recommend the Soil Conservation Service coordinate plans for sanitary facilities with State and local public health authorities and that operating procedures be incorporated into the operation and maintenance agreements which contain specific requirements for installation of adequate sanitary facilities at the 13 reservoirs used for recreation. Further, the SCS should coordinate its plans for sanitary facilities with the South Central Regional Office of the Federal Water Pollution Control Administration, Dallas, Texas, with respect to the performance specifications of the sanitary facilities needed at the recreation areas in this project in accordance with E.O. 11507 and E.O 11514.

The report recommends that when practicable, the floodwater retarding structures be fenced and watering devices be installed below dams and outside the reservoir areas. To prevent animal pollution and the danger of animal-borne virus diseases, we recommend the fencing and watering devices be required at the 13 reservoirs that will be open to the public.

There are no provisions in the work plan for maintaining low flows in Pond Creek. The Town of Rosebud discharges the effluent from its oxidation pond into the creek, and approximately 0.4 mgd flow is needed in the creek to maintain aerobic conditions during the summer months. To be effective at the point of need releases should be made from Structures 12, 13, or 14, or releases from a combination of these structures. As pointed out above the minimum flow below Rosebud is 0.4 mgd; therefore, to maintain this amount at the point of need a greater release than 0.4 mgd should be made due to channel and evaporation losses during periods of low flows. We recommend that the flood retarding structures to be used for this release should be changed so that a continuous release can be obtained at all times or a gated structure put in and operated during periods of low flow so that the needed flow below Rosebud can be established.

The stream channel enlargement could increase the sediment and turbidity in the project area. We suggest the channel side slopes be seeded for vegetation after the excavation is completed to minimize the bank erosion and turbidity of the stream flows. To protect water quality during the construction period, it is recommended that the contract specifications require all contractors to adhere to guidelines for minimizing soil erosion and water and air pollution during construction as set forth in Soil Conservation Service "Engineering Memorandum-66".

The project would increase the sport fishing opportunities in the watershed. However, the reservoirs would be on private lands and public access to the reservoirs necessarily would be by landowner's permission. Much of our fish and wildlife report, dated April 24, 1968, including the recommendations, on this watershed has been included in the work plan. There is, however, no indication that any of the recommendations are being adopted as a part of the project plan of development. Adoption of these recommendations as a part of the plan of development would insure mitigation of losses of wildlife habitat occurring with the project and additionally result in fish and wildlife benefits. It is requested that the enclosed fish and wildlife report accompany the work plan when it is forwarded to the Congress.

The Geological Survey stream gage, Little Pond Creek at Burlington, Texas, will be disturbed by the project. Seven thousand dollars is included in the plan for rehabilitation of the concrete weir at this site. The Texas District office of the Survey should be kept informed of the extent and timing of the disturbances to the gaging station.

We appreciate the opportunity to review and comment on this watershed work plan. If the above recommendations are considered, we will have no objections to the proposed project.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Honorable Clifford M. Hardin
Secretary of Agriculture
Washington, D.C. 20250

Enclosure

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

April 24, 1968

Mr. H. N. Smith, State Conservationist
Soil Conservation Service
P. O. Box 648
Temple, Texas 76502

Dear Mr. Smith:

The Bureau of Sport Fisheries and Wildlife in cooperation with the Texas Parks and Wildlife Department has completed a reconnaissance study of Pond Creek Watershed in Bell, Falls, and Milam Counties, Texas. The project is sponsored by the Central Texas Soil and Water Conservation District, the Pond Creek Water Control and improvement District, the Falls County Commissioners Court, and the Milam County Commissioners Court, in cooperation with your Service under the authority of the Watershed Protection and Flood Prevention Act, (68 Stat. 666, as amended, 16 U.S.C. 1008).

This report has been prepared in accordance with the provisions of Section 12 of the above Act. It has been concurred in by the Texas Parks and Wildlife Department as indicated by the enclosed copy of a letter dated February 28, 1968, signed by Executive Director J. R. Singleton.

Pond Creek Watershed comprises 146,000 acres in portions of Falls, Milam, and Bell Counties in Central Texas. Approximately 47 percent of the watershed lies in the Blackland Prairie Land Resource Area, 46 percent lies in the Texas Claypan Land Resource Area, and the remaining 7 percent is in the Southern Coastal Plains Land Resource Area. The watershed topography is slightly rolling in the upper portion, gently sloping in most areas on the northeast side of Pond Creek, and moderately rolling on the southwest side of Pond Creek and in the lower portion.

Pond Creek rises about 2 miles west of the town of Belfalls on the Bell-Falls County line and flows southeasterly about 30 miles to its confluence with the Brazos River. Its principal tributaries are Little Pond, Cottonwood, Briary, and Hog Creeks. The lower portion of Pond Creek has a permanent flow, but its tributaries are intermittent.

The upland areas of the watershed comprise about 130,000 acres. The floodplains include about 16,000 acres. About 46 percent of the upland and floodplain areas are in cultivation for cotton, corn, grain sorghums, oats, clover, and hay. The remaining 54 percent of the watershed is in pasture and miscellaneous land uses.

The natural vegetation in the watershed consists of bunch and short grasses with scattered mesquite, oak trees, and cacti. Elm, hackberry, and pecan trees predominate along the stream bottoms.

The average annual rainfall in the watershed is 35 inches. The heaviest rainfall usually occurs in April, May, and September producing flooding, rapid runoff, and subsequent soil erosion. Damaging floods occur on an average of at least once per year in the watershed.

The primary needs of the watershed are the application of additional land treatment measures on the uplands and control of floods on the bottomlands. Land treatment measures proposed include conservation cropping systems, contour farming, critical area treatment, crop residue use, diversions, farm ponds, grasses waterways, land clearing, pasture management, pasture renovation, pasture planting, terraces (gradient), terraces (parallel), and land adequately protected. In addition, the installation of 25 floodwater retarding structures is planned to control about 35 percent of the runoff in the watershed. Twenty-five miles of stream channel improvement and the construction of 34 grade stabilization structures also are being considered.

Fish habitat occurs in the lower reach of Pond Creek and in Rosebud Lake near the town of Rosebud. An artesian well just below Rosebud Lake Dam produces a constant flow of highly mineralized hot water in excess of 130° F. that enters Pond Creek a short distance away. Hot water-caused fish kills have occurred in Pond Creek from where the water enters the stream to about U. S. Highway No. 77, a distance of about 2.5 miles.

Sport fishing in Pond Creek is principally for catfishes and sunfishes. There is fishing for largemouth bass, sunfishes, channel catfish, flathead catfish, freshwater drum, buffalofishes, and carp in Rosebud Lake.

There is some commercial fishing with set lines in Rosebud Lake for freshwater drum, buffalofishes, and carp. About 300 pounds are harvested annually.

With the project, the construction of 25 floodwater retarding structures would increase sport fishing opportunities in the watershed. However, the structures would be on private lands and public access to these structures necessarily would be by landowner's permission.

Commercial fishing would not be expected to increase with the project.

Most of the watershed is in the Blackland Prairie Game Region. Only a small part of the downstream portion is in the Post Oak Belt Game Region.

Wildlife cover is scarce because of intensive agricultural and human activity. Most of the cover is confined to stream bottoms although there are a few scattered islands of trees and shrubs in the upland areas.

Wildlife species in the watershed include white-tailed deer, bobwhite, mourning dove, fox squirrel, raccoon, opossum, and waterfowl. .

About 100 white-tailed deer have become established in the northern part of the watershed between the communities of Belfalls and Durango following the introduction of a few animals as breeding stock. No deer hunting is now permitted in the watershed.

Bobwhites and mourning doves occur throughtout the watershed and are hunted heavily. A few fox squirrels occur in the sparsely timbered creek bottoms. There is little hunting for these animals.

Waterfowl populations are small in the watershed and they are found primarily on farm ponds and Rosebud Lake. Little hunting is done for them.

Raccoon and opossum populations are small. Trapping for these animals is insignificant. They are sport hunted with dogs by a few hunters.

Most of the hunting in the watershed is done by landowners and their friends. A few landowners lease hunting privileges for mourning doves.

Future populations of wildlife in the watershed would be expected to be about the same as they are now except that deer would extend their range and increase slightly in numbers.

With the project, proposed land treatment measures such as cover cropping, proper use, pasture planting, and waterway development would be beneficial for upland game. Flood protection below the proposed structures would improve the habitat for ground-nesting wildlife. The sediment pools of the floodwater retarding structures would provide watering places for wildlife and resting areas for migrating waterfowl.

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Land clearing for the floodwater retarding structures would remove some wildlife habitat. Stream channel improvement would destroy some bottom vegetation valuable to wildlife.

There are measures that should be implemented in the project plans to improve fish habitat in the floodwater retarding structures and reduce the loss of some wildlife habitat.

To promote fertility and reduce turbidity, the basins of the floodwater retarding reservoirs and barren areas draining into the reservoirs should be disked and planted to grasses or suitable small grain adaptable to the area prior to impoundment. When practicable, the floodwater retarding reservoirs should be fenced to prevent damage to the dams and muddying of the water by livestock. If required, watering devices should be installed below the dams and outside of the enclosed reservoir areas.

To prevent unbalanced fish populations due to indiscriminate fish stocking, the Texas Parks and Wildlife Department should be consulted regarding proper stocking. If channel catfish are approved for stocking, spawning devices should be installed. Sewer tiles, barrels, and old tires have been used successfully as channel catfish spawning devices.

During the construction phase of the project as much brush and timber as possible should be retained. Trees and shrubs should be left on the inside curve of the stream meanders. This practice would help prevent bank erosion and resultant siltation and also would preserve wildlife habitat. Trees and shrubs useful to wildlife as food and cover should be planted on idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

In view of the above, it is recommended that:

1. Basins of floodwater retarding reservoirs and the barren areas draining into them be planted to grasses or small grains adaptable to the area upon completion of construction and prior to water storage.

2. When practicable, floodwater retarding reservoirs be fenced and watering devices be installed below the dams and outside of the enclosed reservoir areas.

3. Floodwater retarding reservoirs be stocked with fish as recommended by the Texas Parks and Wildlife Department.

4. Spawning devices be installed in floodwater retarding reservoirs approved for channel catfish stocking.

5. Trees and shrubs be retained on the inside curve of stream meanders in the process of stream channel improvement.

6. Shrubs and trees useful to wildlife as food and cover be planted at appropriate locations such as idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

The above recommendations are in conformance with U.S.D.A. Soil Conservation Service Biology Memorandum-7 (Rev. 1), National Standards for Biology Practices. If adopted as a part of the plan of development, losses of wildlife habitat would be mitigated and fish and wildlife benefits would accrue to the project.

A detailed study of the watershed by the Bureau of Sport Fisheries and Wildlife is not deemed necessary at this time. Should the sponsors desire, our Bureau in cooperation with the Texas Parks and Wildlife Department, would be happy to be of further assistance.

Thank you for your cooperation in providing project information.

Sincerely yours,

William T. Krummes
Regional Director

Enclosure

Copies (7)

Distribution:

(5) Executive Director, Texas Parks and Wildlife Department, Austin, Texas
(1) President, Texas State Soil Conservation Board, Temple, Texas
(1) Chairman, Pond Creek Watershed Control and Improvement District, Rosebud, Texas
(1) Chairman, The Central Texas Soil and Water Conservation Districts, Rosebud, Texas
(1) County Judge, Falls County Commissioners Court, Lott, Texas

(1) County Judge, Milam County Commissioners Court, Cameron, Texas
(1) Regional Coordinator, USDI, Southwest Region, Muskogee, Oklahoma
(1) Area Director, Bureau of Mines, Area 4, Bartlesville, Oklahoma
(1) Regional Biologist, Soil Conservation Service, Fort Worth, Texas
(2) Regional Director, Bureau of Outdoor Recreation, Mid-Continent Region, Denver, Colorado
(2) Regional Director, FWPCA, South Central Region, Dallas, Texas
(2) Field Supervisor, BSFW, Division of River Basin Studies, Fort Worth, Texas

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AUSTIN, TEXAS 78701

February 28, 1968

Mr. Lewis R. Garlick
Assistant Regional Director
Bureau of Sport Fisheries and Wildlife
P. O. Box 1306
Albuquerque, New Mexico

Dear Mr. Garlick:

This is in response to your letter of February 21, 1968, and the attached review draft of a report concerning the Soil Conservation Service's proposed Pond Creek Watershed, Texas.

We have reviewed this draft and concur with the report as presented.

Yours sincerely,

J. R. Singleton

J. R. Singleton
Executive Director

JRS:KCJ:pw

cc: Mr. John Degani, Division of River Basin Studies, Fort Worth

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
ENVIRONMENTAL HEALTH SERVICE
ROCKVILLE, MARYLAND 20852

ENVIRONMENTAL CONTROL
ADMINISTRATION

April 21, 1970

Mr. Kenneth E. Grant
Administrator
U.S. Soil Conservation Service
Department of Agriculture
Washington, D.C. 20250

Dear Mr. Grant:

As requested in your letter of March 4, 1970, the Work Plan for the Pond Creek Watershed, Texas has been reviewed. The Department's concerns with this Project are summarized in the enclosed report by the Bureau of Water Hygiene of the Environmental Control Administration.

The Department of Health, Education, and Welfare has no objection to the authorization of this project insofar as departmental interests and responsibilities are concerned.

Sincerely yours,

for Raymond T. Moore, M.D.
Acting Commissioner

Enclosure

BUREAU
OF
WATER HYGIENE

HEW Agency Review of Water and Related Land Resources Projects

TITLE:

U.S. Soil Conservation Service Work Plan For the Pond Creek Watershed, Bell, Falls, and Milam Counties, Texas.

PROJECT SUMMARY:

The following is a summary of the U.S. Soil Conservation Service Report. The Bureau of Water Hygiene has not determined the validity of the indicated costs or of the benefit cost ratios:

The 228 square mile Pond Creek Watershed is located in east central Texas, about 25 miles south of the City of Waco. Principal Watershed Problems are floodwater, erosion and sediment damage. The Work Plan proposes construction of 22 single-purpose floodwater retarding structures, 166,825 feet of stream channel improvement, and 9 grade stabilization structures. The total estimated cost of all structural measures is $2,726,727. Proposed land treatment measures designed to improve soil condition and cover will cost an estimated $1,861,845. The benefit cost ratio for all works of improvement is 1.4 to 1.0.

DISCUSSION OF HEALTH-RELATED FEATURES OF THE PROJECT:

Although recreation is not included in the Work Plan as a Project purpose it is expected that more than one-half of the 22 reservoirs will be opened to the general public for recreational activity. Recreational benefits claimed in the Work Plan are estimated at $8,502 annually. The report indicates that sponsors have been assured by landowners and other private interests that recreation facilities will be developed, including sanitary facilities meeting State and local health agencies' requirements, prior to making the sites available to the general public for recreational uses.

We recommend that the planning, development, construction, maintenance, and operation of the project have the full cognizance and approval of the Texas State Department of Health, and that the DHEW-PHS publication "Prevention and Control of Vector Problems Associated with Water Resources" dated January 1965, be used as a guide.

RECOMMENDATIONS ON PROPOSED PROJECT:

Recommend HEW concurrence in proposed project.

12 April 1970
Date,

James E. Warren
Staff Engineer

ENDORSEMENT:

HEW concurrence recommended.

16 April 1970
Date

for Director,
Bureau of Water Hygiene

WATERSHED WORK PLAN

POND CREEK WATERSHED

BELL, FALLS, AND MILAM COUNTIES, TEXAS

WATERSHED WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

POND CREEK WATERSHED
Bell, Falls, and Milam Counties, 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:

Pond Creek Watershed Authority

Central Texas Soil and Water Conservation District

Falls County Commissioners Court

Milam County Commissioners Court

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
June 1968

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WATERSHED WORK PLAN AGREEMENT

between the

Pond Creek Watershed Authority
Local Organization

Central Texas Soil and Water Conservation District
Local Organization

Falls County Commissioners Court
Local Organization

Milam County Commissioners Court
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 Pond 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 Pond 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 ten 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 Sponsoring Local Organization will acquire without cost to the Federal Government such land rights as will be needed in connection with the works of improvement. (Estimated cost $ 488,155 .)

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)
22 Floodwater Retarding Structures	-	100.00	1,163,600
9 Grade Stabilization Structures	-	100.00	97,350
Stream Channel Improvement	-	100.00	480,100

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

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Engineering Service Cost (dollars)
22 Floodwater Retarding Structures	-	100.00	91,038
9 Grade Stabilization Structures	-	100.00	13,629
Stream Channel Improvement	-	100.00	29,428

5. The Service will be the contracting agency and will advertise, award, and administer contracts for structural measures. The Sponsoring Local Organization and the Service will each bear their costs for project administration, estimated at $14,400 and $349,027 respectively.

6. The Sponsoring Local Organization will obtain agreements from owners of not less than 50 percent 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.

14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving Federal financial assistance.

Pond Creek Watershed Authority
Local Organization

By A. T. Garrett
A. T. Garrett

Title Chairman

Address Rt. 3
Rosebud, Texas 76570
Zip Code

Date December 10, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Pond Creek Watershed Authority
Local Organization
adopted at a meeting held on December 10, 1969

Thomas J. Hickerson
(Secretary, Local Organization)
Thomas J. Hickerson, Rt. 3

Address Rosebud, Texas 76570
Zip Code

Date December 10, 1969

Central Texas Soil and Water Conservation District
Local Organization

By Edwin F. Fischer
Edwin F. Fischer

Title Chairman

Address Buckholts, Texas 76518
Zip Code

Date December 10, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Central Texas Soil and Water Conservation District
Local Organization
adopted at a meeting held on November 18, 1969

B. G. Welch
(Secretary, Local Organization)
B. G. Welch

Address Rt. 1, Moody, Texas 76557
Zip Code

Date December 10, 1969

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Falls County Commissioners Court
Local Organization

By R. W. Hailey Sr.
R. W. Hailey Sr.

Title County Judge

Address Lott, Texas 76656
Zip Code

Date December 10, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Falls County Commissioners Court
Local Organization

adopted at a meeting held on November 13, 1969

Margaret W. Denard
(Secretary, Local Organization)
County Clerk

Address Marlin, Texas 76661
Zip Code

Date December 10, 1969

Milam County Commissioners Court
Local Organization

By O. B. Harden
O. B. Harden

Title County Judge

Address Box 508, Cameron, Texas 76520
Zip Code

Date December 10, 1969

The signing of this agreement was authorized by a resolution of the governing body of the Milam County Commissioners Court
Local Organization

adopted at a meeting held on November 20, 1969

Wayne B. Weiss
(Secretary, Local Organization)
County Clerk

Address Cameron, Texas 76520
Zip Code

Date December , 1969

Soil Conservation Service
United States Department of Agriculture

By Norman A. Berg
Acting Administrator
Soil Conservation Service

Date

WATERSHED WORK PLAN

POND CREEK WATERSHED
Bell, Falls, and Milam Counties, Texas
June 1968

SUMMARY OF PLAN

General Summary

The work plan for watershed protection and flood prevention for the Pond Creek watershed has been prepared by the Pond Creek Watershed Authority, the Commissioners Courts of Falls and Milam Counties, and the Central Texas Soil and Water Conservation District as the local sponsoring organizations. Technical assistance has been provided by the Soil Conservation Service of the U. S. Department of Agriculture. The Bureau of Sport Fisheries and Wildlife of the U. S. Department of the Interior collaborated with the Texas Parks and Wildlife Department in the preparation of a reconnaissance report on the fish and wildlife aspects of the watershed. Financial assistance for development of the work plan was provided by the Texas State Soil and Water Conservation Board and the Soil Conservation Service.

Pond Creek watershed, comprising an area of 228.125 square miles (146,000 acres), is located about 25 miles south of Waco, Texas. It is in the Brazos River basin and it drains portions of eastern Bell, southern Falls, and northern Milam Counties. Approximately 59 percent of the watershed is cropland, 35 percent is grassland, and 6 percent is in miscellaneous uses such as roads, railroads, towns, and farmsteads.

There is no Federal land in the watershed.

The principal problems in the watershed are frequent damages from floodwater, sediment and scour which occur on approximately 15,313 acres of highly productive flood plain. This is the acreage expected to be inundated by the 100-year frequency flood.

The estimated average annual floodwater, sediment, erosion, and indirect damages without a project total $254,540 at adjusted normalized prices. The objectives of the project are to provide proper land use and treatment for both uplands and bottom lands in the interest of soil and water conservation and protection for the flood plain lands in the watershed. The project, as formulated, meets these objectives.

The work plan proposes the installation, during a 10-year period, of a project for the protection and development of the watershed at a total estimated installation cost of $4,588,572. The share of this cost to be borne by Public Law 566 funds is $2,336,952. The share to be borne by other than Public Law 566 funds is $2,251,620. In addition, the local interests will bear the entire cost of operation and maintenance.

Land Treatment Measures

Landowners and operators will establish and maintain needed land treatment measures on 10,748 acres of cropland and 20,281 acres of grassland at an accelerated rate during the 10-year installation period in addition to the maintenance of those measures already applied. These measures will improve the hydrologic condition of both cropland and grassland. This improvement in soil condition and cover will reduce sediment to floodwater retarding structures and will effect some reduction in flooding.

The installation cost of these land treatment measures is estimated to be $1,861,845, of which $1,749,065 will be from funds other than Public Law 566. Public Law 566 funds will provide $112,780 in order to accelerate technical assistance needed for the application and maintenance of these measures.

Structural Measures

The structural measures included in the plan consist of 22 floodwater retarding structures, 166,825 feet of stream channel improvement, and 9 grade stabilization structures. The estimated total cost of structural measures is $2,726,727, of which the local share is $502,555, and the Public Law 566 share is $2,224,172. The local share of the cost consists of land rights and project administration (table 1).

Benefits

The reduction in floodwater, sediment, and erosion will directly benefit the owners and operators of about 258 farms located on the flood plain and about 27 upland farm operators, who will be able to establish badly needed land treatment measures as the result of the installation of grade stabilization structures. Project installation will prolong the flow of high quality water in Pond Creek. Water is pumped from Pond Creek into Rosebud Lake, the municipal water supply reservoir for the city of Rosebud. This will benefit slightly over 2,000 residents of the city. About 14,803 acres of the flood plain will receive flood protection benefits. Damages after project installation will be reduced from $254,540 annually to $68,895, or 73 percent. The average annual primary benefits accruing to structural measures are estimated to be $194,038, of which $171,907 is from damage reduction, $13,629 is from more intensive land use, and $8,502 is from incidental recreation. Secondary benefits will amount to $19,415 in the immediate locale. The ratio of the total annual benefits ($213,453) resulting from the installation of the structural measures to the annual cost ($143,665) is 1.5 to 1.0.

Provisions for Financing Local Share of Installation Cost

Funds for the local share of the cost of installing the structural measures will be provided by the Pond Creek Watershed Authority. A $200,000

bond issue has been approved by the watershed residents, and a tax is now being collected for the retirement of these bonds.

Operation and Maintenance

Land treatment measures for watershed protection will be operated and maintained by landowners or operators of the farms upon which the measures will be installed under agreements with the Central Texas Soil and Water Conservation District. The Pond Creek Watershed Authority will have operation, maintenance, inspection, and coordination responsibility for all structural measures; but accomplishment and financing will be the responsibility of the commissioners courts of the counties in which the structure is located.

The estimated average annual value of operation, maintenance, and replacement is $12,399.

DESCRIPTION OF THE WATERSHED

Physical Data

Pond Creek watershed lies 25 miles south of Waco, Texas. It is in the Brazos River basin and drains portions of eastern Bell, southern Falls, and northern Milam Counties. Pond Creek heads 3 miles northwest of the community of Belfalls in Bell County. It flows southward across Falls County, passes by the western edge of the town of Rosebud, and enters the Brazos River in northeastern Milam County. Little Pond Creek is the largest tributary. It lies to the south and southwest of the mainstem and joins the mainstem in Milam County. Other important tributaries lying along the northeast side include Live Oak Creek, Cactus Branch, Cottonwood Creek, Big Briary Creek, and Hog Creek. The total drainage area is 146,000 acres or 228.125 square miles.

The watershed lies within the Black Prairie physiographic area. The topography reflects a southward migration of the stream system on the underlying, gently southeastward dipping sedimentary rocks. The topography in the upper portion and on the northern side of Pond Creek is gently rolling and has long narrow stream drainage systems. The topography for the balance of the watershed is moderately to steeply rolling and has short stream drainage systems. Elevations above mean sea level range from 635 feet on the upper watershed divide to 300 feet on the flood plain near the Brazos River.

The watershed is underlain by soft sedimentary rocks ranging from the Upper Cretaceous (Gulf) to Recent age. Cretaceous marls and chalk of the Taylor group crop out over the upper and central parts. Soft shales, sandy shales, and sands of the Navarro group crop out in a wide northeast-southwest trending band southeast of Rosebud. Eocene sands and soft sandy shales of the Midway and Wilcox groups are confined to the lower portion. Quaternary age sandy terrace deposits more than 100 feet above the present

Brazos River flood plain occur along the northeastern watershed divide. Clayey low terrace and alluvial deposits occur along the major streams.

The soils of three land resource areas, the Texas Blackland Prairie, the Texas Claypan Area, and the Southern Coastal Plain, occur in the watershed. Dark-colored, heavy clay soils of the Texas Blackland Prairie in the upper central reaches cover 47 percent of the watershed. The Houston Black and Heiden series predominate. This area is extensively cultivated except in the steeply rolling areas along the south sides of Pond and Little Pond Creeks. This portion has been converted to grassland because of severe past erosion. Loamy soils with clayey subsoils of the Texas Claypan Area occur on 46 percent of the watershed area, extending from the upper central part into the lower parts. The Wilson and Crockett series, with surface textures ranging from clay loams to fine sandy loams, predominate. The land use in this area has been changed from extensive cultivation to grassland in recent years. Sand and sandy loam soils of the Southern Coastal Plain constitute 7 percent of the watershed and occur as sandy terrace deposits along the eastern divide. These consist of fine sandy loams and loamy fine sands of the Freestone, Stidham, and Eufaula series. Cultivation in this area is limited to truck crop type farming on small areas. The flood plain soils are mainly of the Trinity series, Texas Blackland Prairie, and are extensively cultivated.

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

Land Use	Acres	Percent
Cultivated	85,554	59
Grassland	51,808	35
Miscellaneous 1/	8,638	6
Total	146,000	100

1/ Roads, railroads, towns, and farmsteads.

Average annual rainfall is 34.5 inches. The months of April and May normally receive the greatest amounts; however, rainfall is fairly well distributed throughout the year. Mean maximum temperatures for July and mean minimum temperatures for January are 96° Fahrenheit and 38° Fahrenheit, respectively.

The average date of the last killing frost in the spring is March 13 and that of the first killing frost in the fall is November 25, resulting in an average growing season of 257 days.

Economic Data

The economy of the watershed depends almost entirely on agriculture. About half of the agricultural income is derived from livestock and its associated products and the balance from crops, primarily cotton, grain sorghum, hay, and small grain. Corn, clover, vetch, vegetables, and fruit are also grown throughout the watershed, although to a lesser degree.

The flood plain lands are used as follows: sorghum for hay and grazing, 28 percent; grain sorghum, 16 percent; cotton, 5 percent; oats, 4 percent; corn, 1 percent; pasture, 45 percent; and miscellaneous uses, 1 percent. For many years, through the early 1950's, flood plain lands were farmed more intensively than at present. The combination of scarcity of labor, increased costs of equipment and supplies, and the ever-present flood threat, however, have forced farm operators to manage these lands less intensively.

There are approximately 1,104 farms, averaging about 125 acres in size, in the watershed. All of these farms, with the exception of three or four, are family-type farms employing less than one and one-half man-years of outside labor. About 258 of these suffer damage from floods. About 20 percent, or 220, of the farms are low-income producing units, primarily because of insufficient acreage to provide an adequate income to meet the family's needs. About 275 operators work off their farms from 50 to 75 percent of the time. In some cases operators supplement their incomes by leasing, either on a day or season basis, hunting rights for bobwhite and mourning doves.

The cities of Rosebud and Lott are located within the watershed and provide adequate hospitals, schools, churches, services, and supplies for residents of this area. Communities of importance to residents include Belfalls, Westphalia, Barclay, and Burlington. Good highways link these cities and communities with other population and marketing centers in all directions. Approximately 108 miles of paved roads and several hundred miles of all-weather roads serve the watershed residents. Railway facilities are available from the city of Rosebud to the south.

Land Treatment Data

The Soil Conservation Service Work Units at Rosebud and Temple assist the Central Texas Soil and Water Conservation District. This was one of the early districts to be organized and as such was one of the pioneers of the movement for soil and water conservation in the state of Texas. The district, with technical assistance provided by work unit personnel, has aided owners and operators of watershed lands in the development of basic soil and water conservation plans and the application of needed land treatment measures.

There are 1,104 operating units located wholly or partially within the

watershed. Basic soil and water conservation plans have been developed on 472 of these, representing 64 percent of the agricultural land in the watershed.

A special ACP project has been completed in the watershed on Chechnie Creek through the Agricultural Stabilization and Conservation Service. Special cost sharing was provided to expedite the installation of needed land treatment. A second special ACP project, comprising an area of approximately 8,000 acres in an area formerly known as Poverty Flats, has recently been approved for accelerating the land treatment needs.

It is estimated that 60 percent of needed land treatment has been applied. Table 1A lists these measures and the amounts which have been applied. The total cost of this application is estimated at $2,285,315.

Fish and Wildlife Resource Data

The fish and wildlife habitat, species, and populations in the watershed are described by the Bureau of Sport Fisheries and Wildlife as follows:

> The natural vegetation in the watershed consists of bunch and short grasses with scattered mesquite, oak trees, and cacti. Elm, hackberry, and pecan trees predominate along the stream bottoms.
>
> The average annual rainfall in the watershed is 35 inches. The heaviest rainfall usually occurs in April, May, and September producing flooding, rapid runoff, and subsequent soil erosion. Damaging floods occur on an average of at least once per year in the watershed.
>
> . . . . . .
>
> Fish habitat occurs in the lower reach of Pond Creek and in Rosebud Lake near the town of Rosebud. An artesian well just below Rosebud Lake Dam produces a constant flow of highly mineralized hot water in excess of 130° F. that enters Pond Creek a short distance away. Hot water-caused fish kills have occurred in Pond Creek from where the water enters the stream to about U. S. Highway No. 77, a distance of about 2.5 miles.
>
> Sport fishing in Pond Creek is principally for catfishes and sunfishes. There is fishing for largemouth bass, sunfishes, channel catfish, flathead catfish, freshwater drum, buffalo-fishes, and carp in Rosebud Lake.
>
> There is some commercial fishing with set lines in Rosebud

Lake for freshwater drum, buffalofishes, and carp. About 300 pounds are harvested annually.

. . . . . .

Commercial fishing would not be expected to increase with the project.

Most of the watershed is in the Blackland Prairie Game Region. Only a small part of the downstream portion is in the Post Oak Belt Game Region.

Wildlife cover is scarce because of intensive agricultural and human activity. Most of the cover is confined to stream bottoms although there are a few scattered islands of trees and shrubs in the upland areas.

Wildlife species in the watershed include white-tailed deer, bobwhite, mourning dove, fox squirrel, raccoon, opossum, and waterfowl.

About 100 white-tailed deer have become established in the northern part of the watershed between the communities of Belfalls and Durango following the introduction of a few animals as breeding stock. No deer hunting is now permitted in the watershed.

Bobwhites and mourning doves occur throughout the watershed and are hunted heavily. A few fox squirrels occur in the sparsely timbered creek bottoms. There is little hunting for these animals.

Waterfowl populations are small in the watershed and they are found primarily on farm ponds and Rosebud Lake. Little hunting is done for them.

Raccoon and opossum populations are small. Trapping for these animals is insignificant. They are sport hunted with dogs by a few hunters.

Most of the hunting in the watershed is done by landowners and their friends. A few landowners lease hunting privileges for mourning doves.

Future populations of wildlife in the watershed would be expected to be about the same as they are now except that deer would extend their range and increase slightly in numbers.

WATERSHED PROBLEMS

Floodwater Damage

Extensive damage occurs on 15,313 acres of agricultural land along Pond and Little Pond Creeks and their tributaries. Damage to other agricultural property such as fences, equipment, and livestock is also quite high, as is damage to roads and bridges. Mail and school bus routes are frequently inundated and often have bridges washed away. Children throughout the watershed have missed many days of schooling because of these conditions.

Major floods inundating more than half the flood plain are almost an annual occurrence. Floods of this nature have occurred as often as four or five times during years of above normal rainfall.

The most recent major floods were in 1951, 1952, 1953, 1955, 1957, 1959, 1963, 1965, and 1966. Minor floods occur several times a year during periods of above average rainfall. This is the result of inadequate channel capacities. The most recent minor floods were in the fall of 1967 and spring of 1968. The mainstem of Pond Creek has changed its course because of the frequent flooding and sediment deposition in channels.



Road damage to County road across Little Pond Creek resulting from a 3 inch rain during the night of April 22, 1957. The estimated average annual direct monetary damage to road and bridge is $18,284. In addition to monetary damages, students throughout the watershed miss many days of school during the course of a normal year.

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This constant flood threat and the resulting flood plain erosion damages have caused operators of agricultural lands to manage and expect yields well below the actual potential of the soil itself. The value of this land, marketwise, varies from $100 to $300 per acre and the net value of production varies from $4.50 to $70 or more per acre. The city of Rosebud pumps water from Pond Creek, during periods of high flows, into Rosebud Lake for municipal usage. Sediment from the unprotected watershed above is reducing the lake capacity, although no attempt has been made to evaluate this damage in monetary terms.

Under nonproject conditions the estimated average annual direct monetary damage by floodwater is $182,527. Of this amount, $140,773 is crop and pasture; $23,470, other agricultural; and $18,284, road and bridge.

Indirect damage, such as interruption of travel, re-routing of school buses and mail routes, interruption of livestock feeding and management regimen, losses sustained by business establishments of the area, and similar losses, is estimated at $23,140 annually.



Flood damages were extensive along Cottonwood Creek on April 23, 1957.

Floodwater Damages

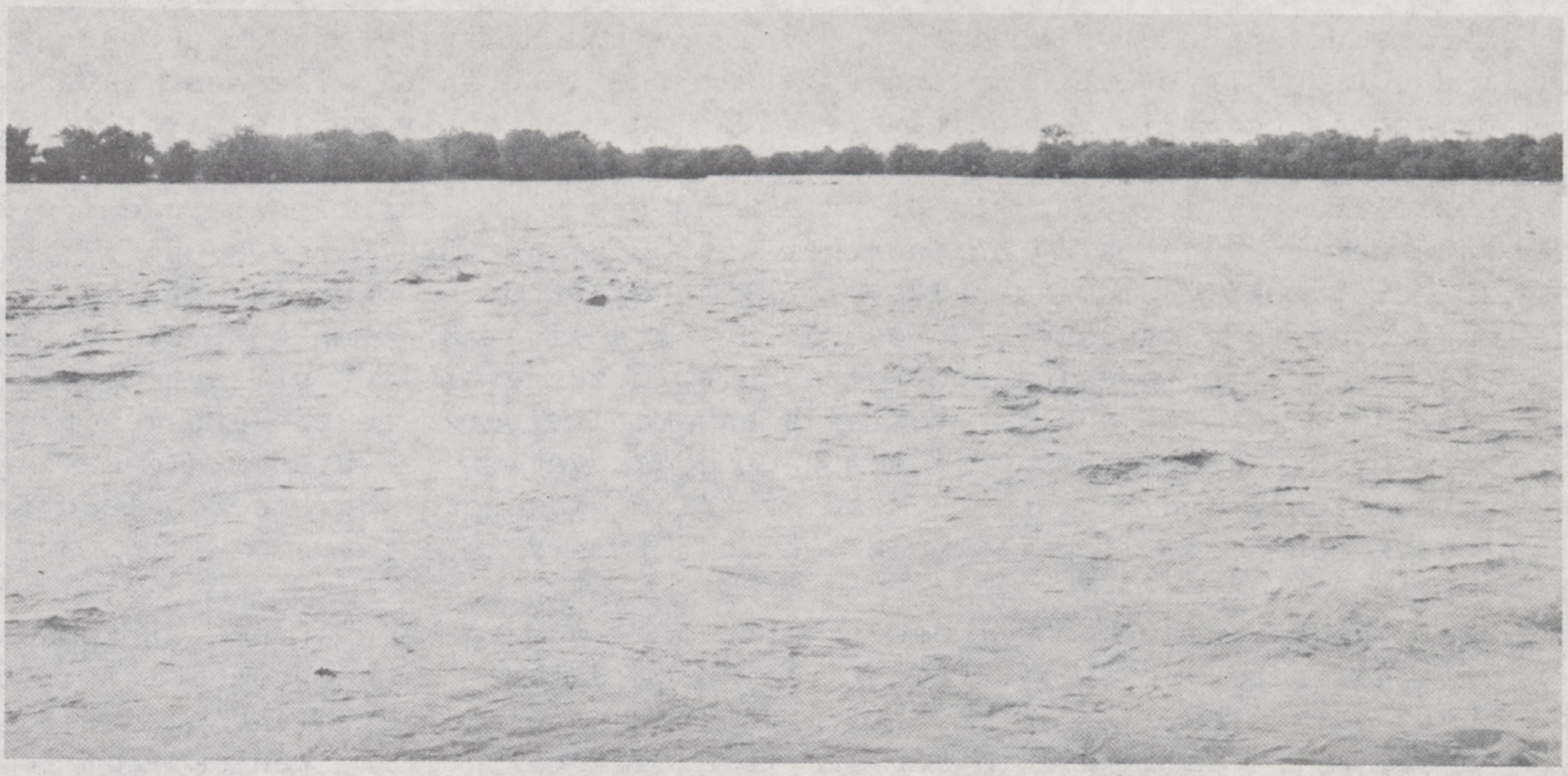


Total crop loss and physical damage to the soil from flood of May 23, 1940. This was the second crop and land damage to occur that year on this field.



Fence damage from the flood of July 1955. The estimated average annual direct monetary damage to other agricultural property is $23,470.

Floodwater Damages



The flood of April 27, 1966 inundated and did extensive damage to this field 1 mile west of Rosebud, Texas.



This fertile bottomland field is typical of the land along the flood plain. Fields such as these flood on average of 3 or 5 times per year during years of normal rainfall. The estimated average annual damage by floodwater is $182,527.

Erosion Damage

Excessive sheet erosion is a problem on approximately 55,000 acres of inadequately protected upland soils in the watershed. The most severe damage is occurring on cultivated land on moderately to steeply rolling areas lying along the south side of Little Pond and Pond Creeks. Approximately 10,000 acres of this land has soil loss rates exceeding 20 tons per acre annually and another 25,000 acres have rates ranging from 10 to 20 tons. Smaller areas of the severely damaged soils have been converted to grassland. However, the establishment of a good protective grass cover for erosion control is slow because of lack of fertility. Drainageways with active overfalls have contributed to the erosion problem by hindering the application of conservation measures and damaging some established measures. Most of this inadequately protected land is located on small, low-income producing, family-type farms.

Flood plain scour has removed from 1 foot to more than 4 feet of topsoil of 1,688 acres of flood plain soils. The damage to the productivity of these soils, however, is moderate due to the great depth and natural fertility. The damage in terms of reduced productivity ranges from 10 to 40 percent. Another damage resulting from scouring is the temporary ponding of floodwaters in the scour depressions. This causes delay of tillage operations after floods and also results in drowning out and damage to growing crops not destroyed by floods. The average annual damage from flood plain scour is $26,670.

Active valley trenching and streambank erosion, which began at the Brazos River years ago, are destroying 1.44 acres of productive flood plain land each year. This damage is caused by new channel formation in deep scour channels located on either side of the original sediment filled main channel. Unstable side inlets are created as this erosion moves upstream. Streambank erosion is severe in the newly formed channel until vegetation and bank sloughing form stable banks. The average annual damage from valley trenching and streambank erosion is $809.

Sediment Damage

Large volumes of sediment have been deposited on the flood plain and in the channels of the watershed. Deposits of clay, clay loam, loam, and sandy loam, ranging in depth from a few inches to four feet, derived from accelerated erosion in the uplands, have covered extensive areas of the original clay and clay loam flood plain soils. Damage in terms of reduced productivity, however, is not severe and ranges from minor to 15 percent. Large volumes of non-damaging clays and clay loams are derived from productive cropland by sheet erosion. Highly damaging materials are derived from small areas of severely eroded, steep upland soils, gullies, and unstable upland stream channels. These materials are low in organic matter and available plant nutrients. Approximately 5 percent damage has occurred on 1,204 acres, 10 percent on 515 acres, and 15 percent on 26 acres. The average annual value of this damage is $8,664.

Severe sedimentation and filling of stream channels upstream from Rosebud have increased flooding and scouring on the flood plain. Active valley trenching is occurring on the flood plain of Pond Creek downstream from Rosebud.

Of the total sediment load carried out of the watershed, 84 percent is derived from sheet erosion, 11 percent from valley trenching, 3 percent from gully erosion, and 2 percent from streambank erosion.

Problems Relating to Water Management

Water for urban and rural domestic and livestock uses is obtained from surface, deep artesian well, and shallow well sources. The city of Rosebud and the community of Westphalia have developed water systems with loans and grants from the Farmers Home Administration. Rosebud pumps water from the Brazos River for storage in Rosebud Lake until used. The city of Lott and the community of Westphalia obtain water from deep artesian wells in the Lower Cretaceous Trinity aquifer. Other rural residents and communities obtain water supplies from farm ponds and small capacity, shallow wells. Opportunities for water-based recreation are available at the Brazos River, Lake Waco, and sediment pools of floodwater retarding structures built in nearby watersheds.

There is no known irrigation in the watershed; however, both the soils and the water are generally suited for irrigation.

Sediment is the main source of pollution in the watershed. Sediment produced in the upper portion of the watershed not only causes problems within the watershed, but also contributes to the sediment problems along the Brazos River. An artesian well just below Rosebud Lake produces a constant flow of highly mineralized hot water with a temperature in excess of 130° Fahrenheit.

PROJECTS OF OTHER AGENCIES

The city of Rosebud presently gets its water supply from a small lake on an unnamed tributary of Pond Creek.

The city supplements this supply by pumping flood flows from Pond Creek into its reservoir. It also has a pipeline to the Brazos River and can obtain water from this source during droughts. There are no other projects of other agencies for water resource development which will affect or be affected by the works of improvement in the plan.

BASIS FOR PROJECT FORMULATION

A reconnaissance and preliminary investigation of the watershed were made by representatives of the Soil Conservation Service and the sponsoring local organizations to determine the location and severity of watershed problems. A map was prepared to show the location of the land being damaged by floodwater, erosion, and sediment. Meetings were held with the

sponsors to discuss their problems, possible solutions, watershed resource development needs, and the formulation of project objectives. Initially the sponsors listed the following objectives:

1. Immediate establishment and maintenance of land treatment measures which contribute directly to watershed protection.

2. Reduction in flood, sediment, and erosion damages by 70 to 75 percent.

It was agreed that the following steps would be taken in order to reach these objectives:

1. The establishment and maintenance of at least 80 percent of needed land treatment measures by the end of the installation period.

2. The installation of those structural measures needed for detention, orderly release, and disposal of floodwaters.

The location, number, design, and cost of structural measures were determined by the physical, topographic, and geologic conditions in the watershed. Other influencing factors were improvements, land use, and the location of damage areas.

The proposed project will meet the flood prevention objectives of the sponsors. Various combinations of waterflow control structures were analyzed to determine a system which would economically accomplish the project objectives. No floodwater retarding structures were planned on the Little Pond Creek portion of the watershed because feasible sites which would meet the flood reduction objectives were not available. Investigations indicated, however, that improvement of the stream channel to carry the peak discharge from a flood with an average recurrence interval of two years would meet the sponsors' objectives.

Watershed topography hampers the multiple-purpose development of structures. An objective of the sponsors, however, is that of encouraging individual landowners to avail themselves of the opportunities offered by sediment pools of floodwater retarding structures for the development of income producing recreation as either a primary or supplemental farm enterprise.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

The use of each acre of land within its capabilities and its treatment in accordance with its needs has long been accepted as one of the foundations for the building of a strong and free community, state, or nation. Sponsors of this project are keenly aware of this concept and deem the installation and maintenance of needed land treatment measures as essential.

Soil surveys have been completed on 90 percent of the watershed. Approximately $1,420 of Public Law 566 funds will be provided for the accelerated completion of these surveys during the first 2 years of the 10-year installation period.

In addition to effectively maintaining those land treatment measures already established (table 1A), additional soil and water conservation measures, or combinations of measures, to be applied on cropland include conservation cropping system, contour farming, crop residue management, grassed waterways, terraces, and diversions. Conservation measures which will be applied on grassland include brush control, pasture planting, and pasture management. Marginal cropland will also be sodded or seeded to adapted grasses. The proper management of these pastures, when combined with the construction of farm ponds for better grazing distribution and the treatment of critical sediment producing areas, will result in the production of large quantities of nutritious grasses on a sustained yield basis. The application of these planned land treatment measures will improve both soil cover and condition. This improvement will reduce soil and water losses, will assure proper functioning of floodwater retarding structures and stream channel improvement, will reduce flooding, and will help raise the incomes of operators of agricultural land.

Structural Measures

A system of 22 floodwater retarding structures and approximately 166,825 feet of stream channel improvement will be installed to provide flood protection to the flood plain lands of Pond Creek and its tributaries. In addition, 9 grade stabilization structures will be installed to stabilize active overfalls in order to achieve project objectives for application and maintenance of land treatment measures. The locations of the planned structural measures are shown on the project map (figure 5).

Runoff from 34 percent of the watershed will be detained by the floodwater retarding structures. The storage capacity of the floodwater retarding structures is 29,459 acre-feet, of which 8,697 acre-feet are sediment storage and 20,762 acre-feet are floodwater detention storage. These structures will detain an average of 5.11 inches of runoff from the drainage area above them. In addition, an average of 2.12 inches of storage has been allocated for the expected 100-year accumulation of sediment. The principal spillway crest elevation for each structure will be set at the 50-year sediment capacity. The principal spillway for structures Nos. 1, 2, 10, 11, and 12 will be ported at the 200 acre-foot capacity. The principal spillway for structure No. 16 will be ported at elevation 350.2 at the sponsors' request.

A combination of principal spillway capacity and retarding storage will assure that vegetated emergency spillways of floodwater retarding structures will have a maximum of 4 percent chance of use at the end of their design life.

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Contour farming, terraces, and grassed waterways reduce upland erosion and maintain soil fertility. Conservation does not cost, it pays!



High residue crops, such as hubam clover improve soil structure and fertility. Future generations must depend upon our use of our natural resources today!

Two of the nine grade stabilization structures will be the formless concrete chute type. These structures will pass the 100-year design storm without overtopping. The remaining seven grade stabilization structures will be the earth dam type. The vegetated emergency spillways for the grade stabilization structures will have no greater than a 10 percent chance of use at the end of their design life.

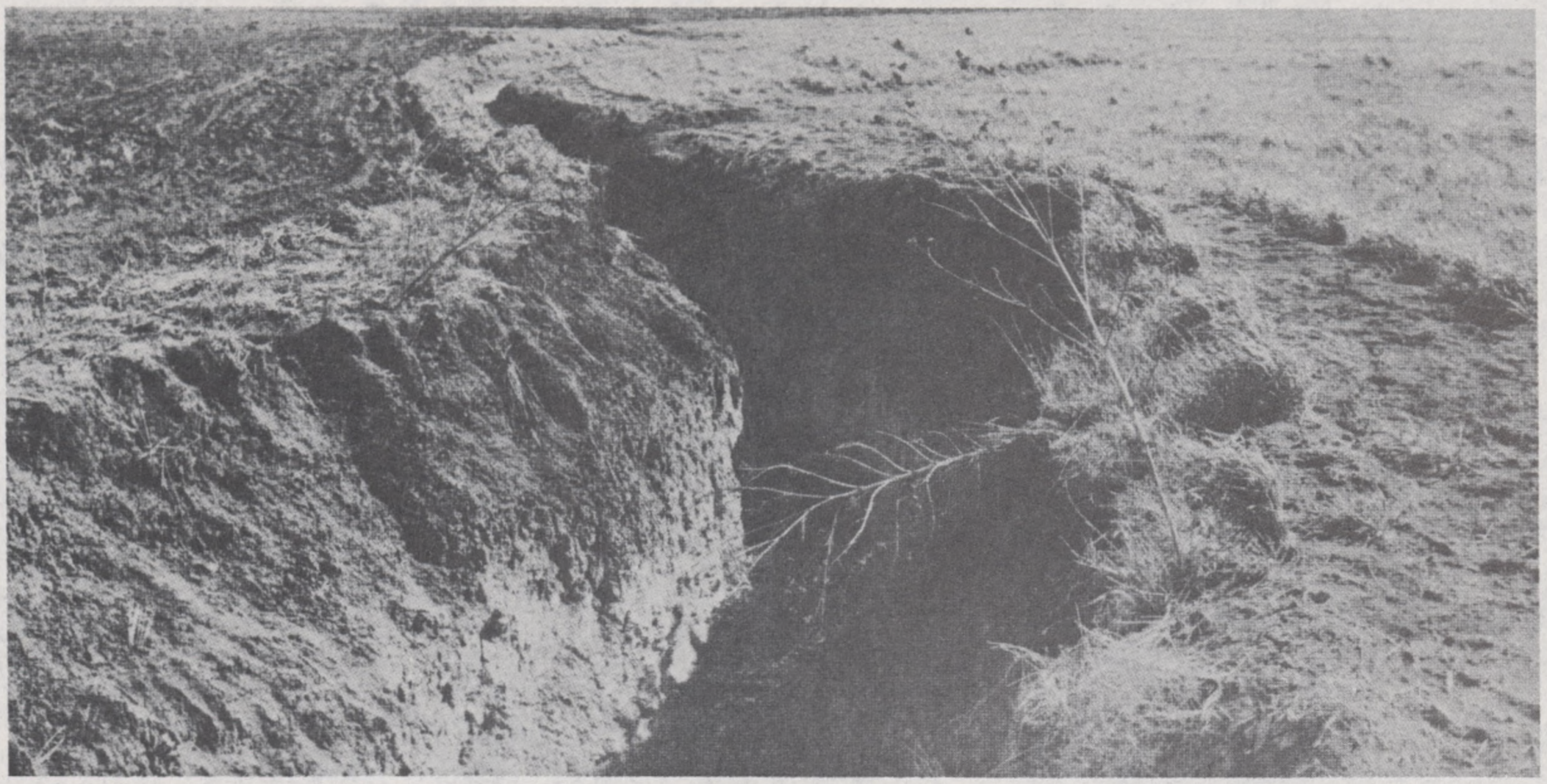
The bedrock of the sites consists mainly of soft marls and shales with some sandy marls and sand. The beds dip to the southeast at less than 100 feet per mile and have a simple structure except for faulting in the valley at Site 11. The foundations and principal spillways are on yielding materials. The borrow materials are dominantly clayey (CL and CH) except for small amounts of sandy materials (SC and SM) at a few sites.

Stream Channel Improvement

The stream channel improvement on Little Pond, Keys, and Brushy Creeks will carry the peak discharge resulting from the 2-year frequency flood. The stream channel improvement on the mainstem will carry the peak discharge resulting from the 1-year frequency flood. The improved channels were aligned to eliminate short radius curves caused by meandering of low flows or by obstructions. Trees and woody growth will be left on the outside of curves and on the upper half of the channel section wherever possible to reduce possible erosion of the banks immediately following construction. Side slopes of channels where curves occur in the vicinity of bridges, pipelines, etc., will be protected by riprap or other permanent protection as detailed in final design stage. Where necessary, sediment clogged channels draining hill land will be graded into the larger and deeper improved channels. Grade stabilization structures will be installed as appurtenances to the improved channels where necessary to prevent erosion and head cutting. It is estimated that an average of 7 such structures will be needed per mile of improved stream channel. The exact number and location of these structures will be determined during design phase and will be designed and installed in accordance with standards and specifications contained in the Work Unit Technical Guide. The spoil from the improved channels will be placed within the right-of-way area in accordance with Service criteria.

The improved channels are located in clayey alluvium (CH and CL) overlying marly and shaly bedrock. Design velocities in straight segments of the mainstem are less than the estimated non-scour velocities of 5.5 to 6.0 feet per second with suspended load in the moderately to highly cohesive clays. Investigations indicate that the improved stream channels will be stable under aged conditions. Some soil loss is expected to occur on the side slopes during the aging period following construction should bank-full flow occur. However, erosion on the side slopes will occur slowly in the highly cohesive soils.

It will be necessary to modify or relocate a number of roads, utility lines, and pipelines in order to install the structural measures. The county roads in the pool areas of structures Nos. 1, 9, 12, 19, 20, and 22 will be raised above the elevation of the emergency spillway crest or the maximum elevation attained by the water surface during passage of the emergency spillway hydrograph, whichever is greater.



Typical of areas which will be benefited by installation of grade stabilization structures. This eroding gully had cut into wheat field approximately 30 feet since wheat was harvested.

The county road in the pool area of structure No. 13 will be closed permanently. The power line in the pool area of structure No. 10 will be relocated and other utility line rights-of-way will be temporarily flooded in structures Nos. 1, 9, 12, 13, 14, and 22. Roads crossing the improved stream channel will be altered or replaced where necessary. One railroad bridge crossing Little Pond Creek stream channel improvement will require reinforcement because of deepening the existing stream channel. It will be necessary to drive two additional pilings in five bents and replace five caps in the 255 foot packed chord trestle. The concrete weir at the USGS-Texas Water Development Board's gaging station on Little Pond Creek at U.S. Highway 77 will require rehabilitation to insure continued hydrologic measurements, which are extremely valuable in planning land and water resource developments in the area. The pipelines affected by the stream channel improvement will be modified. Figures 1, 2, 2A, 3, and 3A show structures which are typical of those planned for this watershed. Tables 3, 3A, and 3B show details on quantities and design features.

All applicable state water laws will be complied with in design and construction of structural measures and all applicable state water laws will be complied with in storage and use of the water.

EXPLANATION OF INSTALLATION COSTS

Land treatment measures listed in table 1 will be applied by local interests at an estimated cost of $1,861,845. This includes funds for Public Law 46 and Public Law 566 technical assistance to be provided by the Soil Conservation Service and cost sharing in the establishment of approved conservation measures under the Agricultural Conservation Program as administered by the Agricultural Stabilization and Conservation Service. Included in the above

sum is $112,780 of Public Law 566 funds to accelerate technical assistance in order that planning and application of needed land treatment measures included in this plan may be accomplished by the end of the 10-year installation period. Included in the $112,780 of Public Law 566 funds is $1,420 for the completion of soil surveys during the first two years of project installation. The estimated cost for application of the various measures is based on current prices being paid by landowners and operators in the area.

The total installation cost of the structural measures is estimated to be $2,726,727. The Public Law 566 cost will be $2,224,172 and the local cost will be $502,555.

The local cost includes $452,280 for the value of land, easements, and rights-of-way, $14,400 for project administration, $8,125 for legal fees, $1,000 for relocation of the power line at structure No. 10, $2,250 for raising the county roads in the pool areas of structures Nos. 1, 22, and 117, and $11,500 and $13,000, respectively, for modification of county road bridges and pipelines associated with the stream channel improvement.

The construction costs consist of the engineer's estimate and contingencies. Included are an estimated $3,781 for reinforcing the piers of the railroad bridge crossing the improved channel of Little Pond Creek and $7,000 for rehabilitation of the concrete weir at USGS-Texas Water Development Board's gaging station on Little Pond Creek. These costs will be borne by Public Law 566 funds. It is not anticipated that any costs not associated with structural stability of the railroad bridge will be incurred. Any costs necessary for ballast, rails, ties, telegraph lines, power lines, signal systems, temporary re-routing of traffic, providing flagmen, or other features not directly associated with structural stability of the bridge and approaches, will be borne by the sponsors. The engineer's estimate is based on the unit cost of construction items planned for each structural measure. The unit cost is based on actual cost of structural measures in similar areas modified to conditions found in this watershed. Ten percent of the engineer's estimate was added as a contingency to provide funds for unpredictable construction costs.

Engineering and project administration costs are based on Service experience in similar watersheds. The engineering costs consist of, but are not limited to, detailed surveys, geological investigations, laboratory reports, designs, and cartographic services. Project administration costs consist of construction inspection and supervision, contract administration, maintenance of State Office records and accounts, and Washington Office and Engineering and Watershed Planning Unit costs. The sponsors' cost for land rights is based on the appraised value of the land, the number of easements required, and the estimated cost of road and utility modifications. The local cost of project administration is based on the sponsors' experience in other watersheds and includes costs for their contract administration, overhead and administrative costs, and whatever construction inspection they desire to make at their own expense. The estimated schedule of obligations for the installation period, covering installation of land treatment and structural measures, is as follows:

Schedule of Obligations

Fiscal Year	Measures	PL 566 Funds (dollars)	Other Funds (dollars)	Total (dollars)
1st	Land Treatment	11,278	175,000	186,278
	All Grade Stabilization Structures	143,135	5,415	148,550
2nd	Land Treatment	11,278	175,000	186,278
	Segment 2 of Little Pond Creek Stream Channel Improvement	281,978	41,300	323,278
3rd	Land Treatment	11,278	175,000	186,278
	Segment 1 of Little Pond Creek, Keys Creek, Brushy Creek and Mainstem, Pond Creek Stream Channel Improvement	309,549	30,600	340,149
4th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 17, 18, 19, and 21	239,444	65,430	304,874
5th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 15, 16, and 22	116,036	22,450	138,486
6th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 3, 4, and 11	223,196	43,960	267,156
7th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 5, 6, 7, 8, and 9	325,478	68,830	394,308
8th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 10, 12, 13, and 14	253,475	73,420	326,895
9th	Land Treatment	11,278	175,000	186,278
	Floodwater Retarding Structures Nos. 1 and 2	231,463	96,600	328,063
10th	Land Treatment	11,278	174,065	185,343
	Floodwater Retarding Structure No. 20	100,418	54,550	154,968
Total		2,336,952	2,251,620	4,588,572

EFFECTS OF WORKS OF IMPROVEMENT

About 258 farms, all family-type with the exception of three or four, will benefit directly from reduced flooding as the result of installation of structural measures. The installation of all measures, both land treatment and structural, will benefit well over 600 landowners and operators. Slightly over 2,000 residents of the city of Rosebud will benefit from prolonged flows of higher quality water in Pond Creek. This water is pumped into Rosebud Lake for municipal use. About 11,587 acres of valuable flood plain land will be protected by floodwater retarding structures and 3,216 acres will be protected by stream channel improvement. About 162 acres of flood plain and 487 acres of upland, most of which is pasture, are located below the lowest ungated outlet of floodwater retarding structures. About 130 acres of cultivated flood plain and 1,217 acres of cultivated upland located above the lowest ungated outlet of floodwater retarding structures are expected to be converted to pasture. There will be no agricultural production from that acreage located below the lowest ungated outlet; however, pastureland located above the lowest ungated outlet is expected to be highly productive.

The following tabulation shows acreage expected to be inundated by floods having 50, 20, and 4 percent chances of recurrence:

Evaluation Reach	50 Percent Chance of Occurrence		20 Percent Chance of Occurrence		4 Percent Chance of Occurrence	
	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)	Without Project (acres)	With Project (acres)
A	133	17	383	225	724	623
B	1,575	560	1,820	151	1,950	1,900
C	1,655	480	2,450	1,445	3,005	2,750
D	1,500	620	1,670	1,245	1,830	1,700
E	235	0	540	17	860	492
F[1/]	240	235	323	318	485	480
G	514	168	704	381	890	670
H	1,256	162	1,985	1,030	2,850	2,615
I	262	63	466	190	708	430
J	215	140	271	210	355	295
K	59	47	99	84	157	127
L	56	22	90	50	130	94
M	89	0	171	10	245	145
TOTAL	7,789	2,514	10,972	5,356	14,189	12,321

1/ Reach F is located above floodwater retarding structure No. 1. 625 acres of flood plain located in pool areas of floodwater retarding structures Nos. 1, 12, 17, and 20 are not included in above figures.

Average annual flooding in the benefited area will be reduced from 11,327 acres to 3,236 acres or 71 percent. This will result in the reduction of damages by 71 percent for crop and pasture; 76 percent for other agricultural; and 74 percent for roads and bridges. The application of planned land treatment measures is expected to reduce upland erosion rates by 34 percent. This is in addition to the reduction which has been attained due to treatment now established. Overbank deposition damage will be reduced by 44 percent. Flood plain scour damage will be reduced by 73

percent. Flood plain scour will be reduced by 73 percent. Land now being damaged is expected, in most cases, to recover its former productivity.

It is expected that about 1,373 acres of pastureland, now producing little in the way of palatable livestock forage, will be managed more intensively. Proper fertilization, weed control, and efficient management of livestock will result in increased income of a more stable nature to farm operators. It is not expected that there will be a net increase of flood plain cropland, nor is it expected that the project will cause an increase in the acreage of crops in surplus supply.

The installation of grade stabilization structures will provide outlets for waterways and will enable farm operators to apply needed land treatment measures on approximately 2,119 acres in the drainage areas above the grade stabilization structures. This will result in a more stable income for these operators, and will conserve these lands for the use of future generations.

Excellent opportunities for the development of on-farm income producing recreation will become available at and in the vicinity of floodwater retarding structures. The water in the sediment pools will be of adequate quality for the intended uses. It is expected that 13 of these pools will be open to the general public. Landowners and other private interests have assured the sponsors that they will develop some recreational facilities, including sanitary facilities meeting State and local health agencies' requirements, prior to making the sites available to the general public for recreational uses. Water-based recreation such as fishing, hunting, picnicking, and camping are extremely popular at such facilities and are used heavily by youth organizations such as Boy Scouts, Girl Scouts, and church groups. These facilities are expected to provide 15,456 visitor-days of recreation annually. Most of this usage will occur from April through September; however, some use will be made of them throughout the year.

The installation of structural measures will have no adverse effect on, nor will they be affected by, any known mineral resources within the watershed.

The effects of works of improvement on fish and wildlife habitat are described by the Bureau of Sport Fisheries and Wildlife as follows:

> With the project, the construction of 22 floodwater retarding structures would increase sport fishing opportunities in the watershed. However, the structures would be on private lands and public access to these structures necessarily would be by landowner's permission.
>
> . . . . . .
>
> With the project, proposed land treatment measures such as cover cropping, proper use, pasture planting, and waterway development would be beneficial for upland game. Flood protection below the proposed structures would improve the habitat for ground-nesting wildlife. The sediment pools of the floodwater retarding structures would provide watering

places for wildlife and resting areas for migrating waterfowl.

Land clearing for the floodwater retarding structures would remove some wildlife habitat. Stream channel improvement would destroy some bottom vegetation valuable to wildlife.

There are measures that should be implemented in the project plans to improve fish habitat in the floodwater retarding structures and reduce the loss of some wildlife habitat.

To promote fertility and reduce turbidity, the basins of the floodwater retarding reservoirs and barren areas draining into the reservoirs should be disked and planted to grasses or suitable small grain adaptable to the area prior to impoundment. When practicable, the floodwater retarding reservoirs should be fenced to prevent damage to the dams and muddying of the water by livestock. If required, watering devices should be installed below the dams and outside of the enclosed reservoir areas.

To prevent unbalanced fish populations due to indiscriminate fish stocking, the Texas Parks and Wildlife Department should be consulted regarding proper stocking. If channel catfish are approved for stocking, spawning devices should be installed. Sewer tiles, barrels, and old tires have been used successfully as channel catfish spawning devices.

During the construction phase of the project as much brush and timber as possible should be retained. Trees and shrubs should be left on the inside curve of the stream meanders. This practice would help prevent bank erosion and resultant siltation and also would preserve wildlife habitat. Trees and shrubs useful to wildlife as food and cover should be planted on idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

The benefits from damage reduction in the watershed will result in improved living standards for residents of the watershed. This improvement will be reflected in local support of schools and churches, both so essential to the well-being of present and future generations. In addition to the aforementioned benefits, there are intangible benefits which will accrue. Residents will feel more secure knowing that the fruits of their labors and investments are not so likely to be washed away at the whim of Mother Nature. They will also appreciate the fact that here is an excellent environment in which to rear their families, in direct contrast to the pitiful slum areas found in practically all heavily populated areas. These benefits, although real and extremely important, have not been evaluated, nor have they been used for project justification in any way.

Secondary benefits will accrue to the trade area as a result of increased purchases from those supplying farm equipment, petroleum products, seeds, feeds, fertilizers, and the various services associated with a farming and ranching community.



Grade stabilization structure following rain. Grade has been taken out of channel and sediment has been deposited at upper end. Future land voiding has been eliminated, and needed land treatment measures may be applied above now that adequate terrace outlets have been provided.

PROJECT BENEFITS

The estimated average annual monetary damage (table 5) within the watershed will be reduced from $254,540 to $68,895, or 73 percent. Crop and pasture damages will be reduced from $140,773 to $40,233, or 71 percent. Other agricultural damage, such as loss of fences, farming equipment, livestock, and other property, will be reduced from $23,470 to $5,650, or 76 percent. Road and bridge damage will be reduced from $18,284 to $4,830, or 74 percent. The overbank deposition of damaging sediment upon flood plain soils, now occurring at the rate of $8,664 annually will be reduced to $4,845, or 44 percent. Flood plain scour damages will be reduced from $26,670 to $7,074, or 73 percent. Streambank erosion damage, now occurring at the rate of $558 annually, will be eliminated, as will valley trenching, now occurring at the rate of $251 annually.

Future damages having a present equivalent value of $12,730 annually from land depreciation above planned grade stabilization structures will be prevented.

Benefits from intensification of land use, primarily by fertilization, weed control, and pasture management, are expected to accrue at the rate of $13,629 annually. These benefits were discounted to reflect an expected 5-year lag in accrual of full level benefits.

The use of the sediment pools of floodwater retarding structures open to the general public is expected to produce incidental recreation benefits of $8,502 after deduction of associated costs for sanitary and other facilities, cleanup, repair, replacements, and the value of liability insurance. A gross value of $1 per visitor-day was used for evaluation. Benefits, expected to accrue at full level for the first 40 years of the project, diminish to zero by the end of the 50th year, and to be nonexistent thereafter, are discounted accordingly.

None of the counties in which the watershed is located have been designated as eligible for assistance under the Economic Development Act. Consequently, no redevelopment benefits were considered.

Although not considered pertinent from a national viewpoint, secondary benefits will amount to $19,415 annually in the immediate locale. This amount, excluding indirect benefits in any form, results from $22,637 in benefits stemming from the project and a loss of $3,222 as the result of reduced inputs for production for agricultural lands going into pool areas.

Other substantial benefits will accrue to the project, such as an increased sense of security, a more satisfying environment in which to work and rear a family, and a deeper sense of well-being, secure in the knowledge that at least some of the hazards involved in wresting a livelihood from the land have been alleviated. These benefits, although extremely important, have not been evaluated in monetary terms, nor have they been used for project justification.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures (amortized total installation cost, plus operation, maintenance, replacement, and other economic costs) is $143,665. These measures are expected to produce average annual primary benefits of $194,038. The benefit-cost ratio without secondary benefits is 1.4 to 1.0. The ratio of total annual project benefits accruing to structural measures, $213,453, to the average annual cost of structural measures, $143,665, is 1.5 to 1.0 (table 6).

PROJECT INSTALLATION

The project installation period will be 10 years. The general sequence of installation is shown under the schedule of obligations, "EXPLANATION OF INSTALLATION COSTS."

Planned land treatment (table 1) will be accomplished by farm and ranch operators in cooperation with the Central Texas Soil and Water Conservation District during the 10-year installation period. The goal is the adequate treatment of 10,748 additional acres of cropland and 20,281 additional acres of grassland by the end of the installation period. This goal, in addition to the maintenance of those measures already applied, will be achieved as follows:

Land Use	Fiscal Year 1st	2nd	3rd	4th	5th	6th
	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)
Cropland	1,075	1,075	1,075	1,075	1,075	1,075
Grassland	2,029	2,028	2,028	2,028	2,028	2,028
Total	3,104	3,103	3,103	3,103	3,103	3,103

Land Use	Fiscal Year (continued) 7th	8th	9th	10th	Total
	(acres)	(acres)	(acres)	(acres)	(acres)
Cropland	1,075	1,075	1,074	1,074	10,748
Grassland	2,028	2,028	2,028	2,028	20,281
Total	3,103	3,103	3,102	3,102	31,029

The governing body of the soil and water conservation district will assume aggressive leadership in accelerating the land treatment program now being applied.

The Soil Conservation Service will provide additional technical assistance to the soil and water conservation district to accelerate the planning and application of soil, plant, and water conservation measures.

The Agricultural Stabilization and Conservation Service will provide financial assistance for the application of those measures which will accomplish the conservation objectives in the shortest possible time. The Extension Service will assist in the educational phase of the program by holding local farm meetings, preparing press, radio, and television releases, and using other methods of getting information to landowners

and operators in the watershed. Soil and water conservation loans available through the Farmers Home Administration will be given special emphasis. Present FHA clients in the watershed will be encouraged to cooperate in the program.

Technical assistance needed to install the structural measures will be provided by the Soil Conservation Service.

The Soil Conservation Service will be the contracting agency and will advertise, award, and administer all contracts for construction of structural measures.

The Pond Creek Watershed Authority will:

1. Obtain all land rights needed for construction.

2. Designate in writing an individual to serve as liaison between the sponsors and the Service during the construction (including vegetation) of works of improvement.

3. Determine the legal adequacy of land rights and use its power of eminent domain to obtain all land rights not donated.

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

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

2. All land rights have been obtained for all structural measures or the Pond Creek Watershed Authority has furnished a written statement to the effect that they have the means of securing land rights and the exact date by which all land rights will have been obtained. Following is a schedule, by 6-month periods, for obtaining needed land rights:

1st 6-month period	9 grade stabilization structures
2nd 6-month period	All stream channel improvement
3rd 6-month period	Floodwater retarding structures 15, 16, 17, 18, 19, and 21
4th 6-month period	Floodwater retarding structures 3, 4, 11, and 22
5th 6-month period	Floodwater retarding structures 5, 6, 7, 8, 9, 10, and 14
6th 6-month period	Floodwater retarding structures 1, 2, 12, 13, and 20

3. Court orders have been obtained from the Falls County Commissioners Court stating that:

   a. The county roads affected by the pool areas of floodwater retarding structures Nos. 1, 9, 12, 19, and 20 will be raised above the elevation of the emergency spillway crest at no expense to the Federal government.

   b. The county road affected by the pool areas of floodwater retarding structure No. 13 will be closed.

   c. Permission has been granted to modify or replace bridge structures affected by stream channel improvement at no expense to the Federal government.

4. Court orders have been obtained from the Milam County Commissioners Court stating that:

   a. The county road affected by the pool areas of floodwater retarding structure No. 22 will be raised to 2 feet above the emergency spillway crest elevation at no expense to the Federal government.

   b. Permission has been granted to modify or replace bridge structures affected by stream channel improvement at no expense to the Federal government.

5. Agreement has been reached with the State Highway Department on modification of bridge structures on state roads affected by stream chammel improvement.

6. Agreement has been reached with the Southern Pacific Railroad Company for modifying bridge affected by stream channel improvement.

7. Utilities, such as powerlines, telephone lines, and pipelines, have been relocated or permission has been obtained to inundate the properties involved.

8. Project agreements have been executed.

9. Operation and maintenance agreements have been executed.

10. Public Law 566 funds are available.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the 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 cost of installing the needed land treatment measures during the 10-year installation period will be borne by the landowners and operators of the land on which these measures are installed.

The Agricultural Stabilization and Conservation Service will provide financial assistance for the installation of those land treatment measures which are eligible for this assistance. The Farmers Home Administration, local banks, and other lending institutions can arrange financing for the landowners and operators' share of the cost.

The Soil Conservation Service will provide funds in the amount of $229,862 to finance the cost of technical assistance in planning and application of the land treatment measures. This consists of $112,780 of Public Law 566 funds and $117,082 to be provided from Public Law 46 funds (table 1).

It is anticipated that 75 percent of the easements to be acquired will be donated. Out-of-pocket costs for land rights and project administration are expected to be $140,000.

Funds for the local share of the cost of installing the structural measures will be provided by the Pond Creek Watershed Authority. A $200,000 bond issue has been approved by the watershed residents and a tax is now being levied for the purpose of retiring this indebtedness. The Pond Creek Watershed Authority plans on obtaining a loan from the Farmers Home Administration. Negotiations, including the filing of a letter of intent, are underway with the State Director of the Farmers Home Administration.

Financial and other assistance to be furnished by the Soil Conservation Service is contingent on the appropriation of funds for this purpose. In addition, all prerequisite conditions will be met before Federal funds will be made available for the installation of the structural measures.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by the landowners and operators of farms and ranches on which the measures are installed under agreements with the Central Texas Soil and Water Conservation District. Representatives of the district will make periodic inspections of the completed land treatment measures to determine maintenance needs.

The Pond Creek Watershed Authority will have operation, maintenance, inspection, and coordination responsibility for all structural measures but accomplishment and financing will be the responsibility of the commissioners court of the county in which the structure is located.

Falls County Commissioners Court will be responsible for the following structural measures:

Floodwater retarding structures Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 18, and 20

Debris basin No. 201

Grade stabilization structures Nos. 101, 102, 103, 104, 1-1, 11-1, 11-2, and 11-3

Stream channel improvement on Pond Creek, Keys Creek, Brushy Creek, Little Pond Creek to Milam County line (station 582+00)

Milam County Commissioners Court will be responsible for the following structural measures:

Floodwater retarding structures Nos. 15, 16, 17, 19, 21, and 22

Grade stabilization structure No. 105

Stream channel improvement on Little Pond Creek to Falls County line (station 582+00)

An operation and maintenance agreement will be executed by the parties hereto prior to the signing of the initial project agreement and the issuance of invitations to bid on construction of the structural measures. The agreement will set forth specific details on procedures in line with recognized assignments of responsibility.

The estimated average annual value of operation, maintenance, and replacement is $12,399, based on adjusted normalized prices. This consists of $4,902 for the floodwater retarding structures, $6,300 for the stream channel improvement, and $1,197 for the grade stabilization structures. The estimated average annual value of operation, maintenance, and replacement is $8,719 for those structural measures located in Falls County and $3,680 for those measures located in Milam County.

The Service and the sponsors will make a joint inspection annually, or after unusually severe floods, or in the event of other unusual conditions that may adversely affect the works of improvement, for three years following installation of each structure. Inspection after the third year will be made annually by the sponsors. The Service will participate in annual inspections as often as it elects to do so after the third year. Inspection items are those items which may need maintenance. For

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floodwater retarding structures, items of inspection will include, but will not be limited to, condition of the principal spillways, earth fills, emergency spillways, vegetative cover, fences, gates, and vegetative growth in reservoirs. For improved channels, items of inspection will include, but will not be limited to, degree of scour and sediment deposits, bank erosion, obstructions to flow, weeds and woody plant growth, and condition of fences, gates, and other appurtenances installed as a part of the improved channel.

Upon acceptance of completed works of improvement from the contractors, the Commissioners Court of the appropriate county will be totally responsible for all maintenance. Maintenance will be performed promptly as the need arises.

The Soil Conservation Service, through the soil and water conservation districts, will participate in operation and maintenance by furnishing technical assistance to aid in inspections and technical guidance and information necessary for the operation and maintenance program.

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

The Pond Creek Watershed Authority will prepare a report of all maintenance inspections. A copy of this report will be submitted to the Service representatives. The watershed authority will keep summary control records in support of proper maintenance having been performed on these works of improvement.

An operation and maintenance agreement will be executed by the parties hereto prior to the signing of the initial project agreement and the issuance of invitations to bid on construction of the structural measures. The agreement will set forth specific details on procedure in line with recognized assignments of responsibility.

The necessary maintenance work will be accomplished either by contract, force account, or equipment owned by the respective county commissioners courts.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Pond Creek Watershed, Texas

Installation Cost Item	Unit	Number To Be Applied	Estimated Cost (Dollars) 1/ Public Law 566 Funds	Other	Total
LAND TREATMENT					
Soil Conservation Service					
Cropland	Acre	10,748	-	483,253	483,253
Grassland	Acre	20,281	-	1,148,730	1,148,730
Technical Assistance			112,780	117,082	229,862
SCS Subtotal			112,780	1,749,065	1,861,845
TOTAL LAND TREATMENT			112,780	1,749,065	1,861,845
STRUCTURAL MEASURES					
Construction					
Soil Conservation Service					
Floodwater Retarding Structures	No.	22	1,163,600	-	1,163,600
Grade Stabilization Structures	No.	9	97,350	-	97,350
Stream Channel Improvement	Feet	166,825	480,100	-	480,100
SCS Subtotal			1,741,050	-	1,741,050
Subtotal - Construction			1,741,050	-	1,741,050
Engineering Services					
Soil Conservation Service					
Floodwater Retarding Structures	No.	22	91,038	-	91,038
Grade Stabilization Structures	No.	9	13,629	-	13,629
Stream Channel Improvement	Feet	166,825	29,428	-	29,428
Subtotal - Engineering			134,095	-	134,095
Project Administration					
Soil Conservation Service					
Construction Inspection			190,519	-	190,519
Other			158,508	14,400	172,908
Subtotal - Administration			349,027	14,400	363,427
Other Costs					
Land Rights			-	488,155	488,155
Subtotal - Other			-	488,155	488,155
TOTAL STRUCTURAL MEASURES			2,224,172	502,555	2,726,727
TOTAL PROJECT			2,336,952	2,251,620	4,588,572
SUMMARY					
Subtotal SCS			2,336,952	-	2,336,952
TOTAL PROJECT			2,336,952	2,251,620	4,588,572

1/ Price Base: 1967

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
Pond Creek Watershed, Texas

Measure	Unit	Applied to Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Cropland			
Conservation Cropping System	Acre	46,331	46,331
Contour Farming	Acre	21,703	10,852
Crop Residue Management	Acre	46,497	46,497
Diversion	Foot	180,393	21,647
Grassed Waterways	Acre	1,431	143,100
Terraces (Gradient)	Foot	4,565,047	228,252
Terraces (Parallel)	Foot	583,580	40,851
Grassland			
Land Clearing	Acre	1,393	69,650
Pasture Planting	Acre	19,893	596,790
Pasture Renovation	Acre	6,648	199,440
Pasture Management	Acre	36,323	181,615
Farm Pond	No.	1,725	690,000
Critical Area Treatment	Acre	147	10,290
TOTAL			2,285,315

1/ Price Base: 1967

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Pond Creek Watershed, Texas
(Dollars)[1/]

Item	Installation Cost - PL 566 Funds			Installation Cost - Other Funds		Total Installation Cost
	Construction	Engineering	Total PL 566	Land Rights	Total Other	
Floodwater Retarding Structures:						
No. 1	98,300	6,881	105,181	74,050	74,050	179,231
No. 2	86,100	6,027	92,127	21,550	21,550	113,677
No. 3	32,800	3,280	36,080	5,910	5,910	41,990
No. 4	45,100	3,608	48,708	9,810	9,810	58,518
No. 5	64,900	4,543	69,443	24,260	24,260	93,703
No. 6	72,400	5,068	77,468	14,410	14,410	91,878
No. 7	32,300	3,230	35,530	6,350	6,350	41,880
No. 8	43,000	3,440	46,440	10,485	10,485	56,925
No. 9	42,200	3,376	45,576	10,825	10,825	56,401
No. 10	66,600	4,662	71,262	31,490	31,490	102,752
No. 11	96,500	6,755	103,255	26,740	26,740	129,995
No. 12	62,600	4,382	66,982	26,540	26,540	93,522
No. 13	45,100	3,608	48,708	9,050	9,050	57,758
No. 14	24,100	2,651	26,751	4,340	4,340	31,091
No. 15	25,100	2,761	27,861	5,350	5,350	33,211
No. 16	20,200	2,222	22,422	6,610	6,610	29,032
No. 17	65,000	4,550	69,550	28,010	28,010	97,560
No. 18	45,100	3,608	48,708	14,685	14,685	63,393
No. 19	37,600	3,760	41,360	11,300	11,300	52,660
No. 20	80,000	5,600	85,600	54,050	54,050	139,650
No. 21	36,900	3,690	40,590	9,435	9,435	50,025
No. 22	41,700	3,336	45,036	8,990	8,990	54,026
Subtotal	1,163,600	91,038	1,254,638	414,240	414,240	1,668,878
Stream Channel Improvement:						
Pond Creek	79,200	5,544	84,744	9,700	9,700	94,444
Little Pond Creek - Segment 1	138,200	8,292	146,492	13,400	13,400	159,892
Little Pond Creek - Segment 2	235,400	11,770	247,170	40,800	40,800	287,970
Keys Creek	16,800	2,352	19,152	3,600	3,600	22,752
Brushy Creek	10,500	1,470	11,970	1,900	1,900	13,870
Subtotal	480,100	29,428	509,528	69,400	69,400	578,928
Grade Stabilization Structures:						
1-1	13,700	1,918	15,618	1,150	1,150	16,768
11-1	16,280	2,279	18,559	975	975	19,534
11-2	8,800	1,232	10,032	180	180	10,212

(See footnotes at end of table 2)

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION - (continued)
Pond Creek Watershed, Texas
(Dollars)[1/]

Item	Installation Cost - PL 566 Funds			Installation Cost - Other Funds		Total Installation Cost
	Construction	Engineering	Total PL 566	Land Rights	Total Other	
Grade Stabilization Structures: (continued)						
11-3	12,400	1,736	14,136	380	380	14,516
101	9,900	1,386	11,286	250	250	11,536
102	9,900	1,386	11,286	800	800	12,086
103	9,570	1,340	10,910	380	380	11,290
104	7,200	1,008	8,208	200	200	8,408
105	9,600	1,344	10,944	200	200	11,144
Subtotal	97,350	13,629	110,979	4,515	4,515	115,494
Subtotal - Watershed	1,741,050	134,095	1,875,145	488,155	488,155	2,363,300
Project Administration	xxx	xxx	349,027	xxx	14,400	363,427
GRAND TOTAL	1,741,050	134,095	2,224,172	[2/]488,155	502,555	2,726,727

1/ Price Base: 1967
2/ Includes $ 8,125 for legal fees,
1,000 for relocation of power line, and
26,750 for relocation or modification of fixed improvements

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES
Pond Creek Watershed, Texas

ITEM	UNIT	STRUCTURE NUMBER 1	2	3	4	5	6	7	8	9	10	11	2/ 12
Class of Structure		A	A	A	A	A	A	A	A	A	A	A	A
Drainage Area	Sq. Mi.	15.64	4.48	0.72	1.51	4.53	2.72	0.62	1.17	1.30	4.66	5.63	4.40
Curve No. (1-day AMC II)		83	82	82	82	83	83	83	83	83	83	83	82
Tc	Hrs.	3.32	1.37	0.66	1.02	1.47	1.38	0.68	0.82	0.91	1.86	1.63	1.47
Elevation Top of Dam	Ft.	521.3	507.6	507.7	485.7	515.1	474.4	484.6	519.9	489.0	484.3	457.6	411.0
Elevation Crest Emergency Spillway	Ft.	516.5	502.6	504.9	482.3	510.5	470.4	482.1	516.7	485.5	480.8	453.1	407.6
Elevation Crest Principal Spillway	Ft.	504.8	489.0	494.3	469.9	499.2	455.5	474.9	508.3	476.9	470.5	439.4	396.4
Elevation Crest Lowest Ungated Outlet	Ft.	497.2	488.0	494.3	469.9	499.2	455.5	474.9	508.3	476.9	469.5	434.8	392.8
Maximum Height of Dam	Ft.	42	40	25	35	29	34	20	23	24	26	37	28
Volume of Fill	Cu.Yd.	211,600	220,200	54,400	93,900	147,800	146,700	52,800	85,200	81,300	220,400	240,700	132,400
Total Capacity	Ac.Ft.	6,340	1,746	366	741	1,529	994	258	515	562	1,817	2,606	2,166
Sediment Pool Lowest Ungated Outlet 1/	Ac.Ft.	200	198	74	150	138	109	35	79	87	199	198	199
Sediment Submerged 1st 50 years	Ac.Ft.	1,093	251	74	150	138	109	35	79	87	253	501	460
Sediment Submerged 2nd 50 years	Ac.Ft.	1,051	241	71	144	130	104	34	76	84	244	484	443
Sediment Aerated	Ac.Ft.	150	36	10	21	19	15	5	12	11	35	69	66
Retarding	Ac.Ft.	4,046	1,218	211	426	1,242	766	184	348	380	1,285	1,552	1,197
Surface Area													
Sediment Pool Lowest Ungated Outlet	Acres	51	43	15	26	45	24	12	26	26	51	49	54
Sediment Pool Principal Spillway Crest	Acres	205	50	15	26	45	24	12	26	26	61	86	88
Retarding Pool	Acres	760	183	43	74	212	118	46	81	83	268	231	230
Principal Spillway													
Rainfall Volume (areal 1-day)	Inches	7.72	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90
Rainfall Volume (areal 10-day)	Inches	13.08	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20	13.20
Runoff Volume (10-day)	Inches	7.82	8.24	8.86	8.59	8.28	8.64	9.00	9.00	8.82	8.37	8.37	8.24
Capacity (Maximum)	C.F.S.	285	122	28	28	100	74	13	28	28	107	120	144
Frequency Operation - Emer. Spillway	%Chance	3.7	2.9	2.3	3.9	3.7	3.4	4.0	4.0	3.7	3.7	3.7	3.2
Size of Conduit	Inches	42	30	24	24	30	24	18	24	24	30	30	30
Emergency Spillway													
Rainfall Volume (ESH areal)	Inches	7.08	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.30
Runoff Volume (ESH)	Inches	5.10	5.20	5.20	5.20	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.20
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.
Bottom Width	Ft.	200	100	50	100	100	100	50	50	50	200	200	200
Velocity of Flow (V_e)	Ft./Sec.	0	0	0	0	0	0	0	0	0	0	0	0
Slope of Exit Channel	Ft./Ft.	0.073	0.097	0.066	0.046	0.030	0.028	0.026	0.030	0.022	0.017	0.062	0.037
Maximum Water Surface Elevation	Ft.	516.5	502.5	504.4	482.1	510.5	470.1	481.8	516.4	485.3	480.8	453.1	406.6
Freeboard													
Rainfall Volume (FH areal)	Inches	14.45	14.90	14.90	14.90	14.90	14.90	14.90	14.90	14.90	14.90	14.90	14.90
Runoff Volume (FH)	Inches	12.25	12.55	12.55	12.55	12.70	12.70	12.70	12.70	12.70	12.70	12.70	12.55
Maximum Water Surface Elevation	Ft.	521.3	507.6	507.7	485.7	415.1	474.8	484.6	519.9	489.0	484.3	457.6	411.0
Capacity Equivalents													
Sediment Volume	Inches	2.75	2.21	4.05	3.91	1.19	1.57	2.23	2.67	2.63	2.14	3.51	4.13
Retarding Volume	Inches	4.85	5.10	5.50	5.30	5.14	5.28	5.58	5.58	5.48	5.17	5.17	5.10

Footnotes 1/ and 2/ are shown at end of second sheet.

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - (continued)
Pond Creek Watershed, Texas

ITEM	UNIT	STRUCTURE NUMBER 2/ 13	14	15	16	17	18	19	20	21	22	TOTAL
Class of Structure		A	A	A	A	A	A	A	A	A	A	
Drainage Area	Sq. Mi.	0.95	0.62	0.55	0.67	6.39	2.45	1.62	12.69	1.84	1.65	76.81
Curve No. (1-day AMC II)		82	82	82	82	83	83	83	81	83	79	
Tc	Hrs.	0.73	1.09	0.32	0.36	2.64	1.48	1.05	4.00	1.23	1.34	
Elevation Top of Dam	Ft.	411.0	409.1	383.4	364.9	384.6	419.4	390.2	412.1	361.4	352.4	
Elevation Crest Emergency Spillway	Ft.	407.6	406.5	380.9	362.5	380.5	415.7	386.6	407.8	357.7	348.3	
Elevation Crest Principal Spillway	Ft.	398.1	397.8	371.3	354.8	365.7	404.2	376.5	392.2	344.3	336.5	
Elevation Crest Lowest Ungated Outlet	Ft.	398.1	397.8	371.3	350.2	365.7	404.2	376.5	392.2	344.3	336.5	
Maximum Height of Dam	Ft.	26	23	29	20	29	24	22	31	29	34	
Volume of Fill	Cu.Yds.	84,800	31,300	52,300	38,300	138,200	73,600	69,300	149,200	62,400	86,100	2,472,900
Total Capacity	Ac.Ft.	488	192	289	349	2,086	826	564	3,817	683	525	29,459
Sediment Pool Lowest Ungated Outlet 1/	Ac.Ft.	101	35	61	14	153	64	48	196	76	80	2,494
Sediment Submerged 1st 50 years	Ac.Ft.	101	35	61	73	153	64	48	196	76	80	4,117
Sediment Submerged 2nd 50 years	Ac.Ft.	98	34	58	70	150	61	47	190	72	76	3,962
Sediment Aerated	Ac.Ft.	11	5	9	10	21	10	7	61	10	25	618
Retarding	Ac.Ft.	278	118	161	196	1,762	691	462	3,370	525	344	20,762
Surface Area												
Sediment Pool Lowest Ungated Outlet	Acres	21	9	14	7	44	18	16	48	19	19	637
Sediment Pool Principal Spillway Crest	Acres	21	9	14	21	44	18	16	48	19	19	893
Retarding Pool	Acres	66	30	36	59	255	136	98	529	76	57	3,671
Principal Spillway												
Rainfall Volume (areal 1-day)	Inches	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.81	7.90	7.90	
Rainfall Volume (areal 10-day)	Inches	13.20	13.20	13.20	13.20	13.90	13.20	13.20	13.13	13.20	13.20	
Runoff Volume (10-day)	Inches	8.86	8.86	8.86	8.86	8.37	8.64	8.73	7.64	8.73	8.07	
Frequency Operation - Emer. Spillway	% Chance	2.8	4.0	4.0	4.0	4.0	3.3	2.5	3.2	2.4	4.0	
Size of Conduit	Inches	24	24	18	18	30	24	24	42	24	24	
Emergency Spillway												
Rainfall Volume (ESH areal)	Inches	7.30	7.30	7.30	7.30	7.30	7.30	7.30	7.19	7.30	7.30	
Runoff Volume (ESH)	Inches	5.20	5.20	5.20	5.20	5.30	5.300	5.30	4.98	5.30	4.86	
Type		Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	Veg.	
Bottom Width	Ft.	200	100	50	50	250	50	50	250	100	100	
Velocity of Flow (V_e)	Ft./Sec.	0	3.27	0	0	0	0	0	0	0	3.49	
Slope of Exit Channel	Ft./Ft.	0.037	0.064	0.067	0.063	0.080	0.041	0.020	0.030	0.059	0.105	
Maximum Water Surface Elevation	Ft.	406.6	407.2	380.6	362.2	380.5	415.5	386.3	407.3	357.2	349.1	
Freeboard												
Rainfall Volume (FH areal)	Inches	14.90	14.90	14.90	14.90	14.90	14.90	14.90	14.68	14.90	14.90	
Runoff Volume (FH)	Inches	12.55	12.55	12.55	12.55	12.70	12.70	12.70	12.19	12.70	12.13	
Maximum Water Surface Elevation	Ft.	411.0	409.1	383.4	364.9	384.6	419.4	390.2	412.1	361.4	352.4	
Capacity Equivalents												
Sediment Volume	Inches	4.14	2.23	4.36	4.28	0.95	1.03	1.18	0.66	1.61	2.06	
Retarding Volume	Inches	5.50	3.58	5.49	5.49	5.17	5.29	5.35	4.98	5.35	3.91	

1/ Volume included in submerged sediment 1st 50 years.
2/ Structures nos. 12 and 13 have a common emergency spillway.

TABLE 3A - STRUCTURE DATA-CHANNELS[1/]
Pond Creek Watershed, Texas

Channel Name	Station Numbering for Reach: Station (100 ft.)	Station (100 ft.)	Drainage Area (sq.mi.)[2/]	Capacity (c.f.s.): Req'd.	Capacity (c.f.s.): Design	Water Surface Elev. (ft.)[2/]	Hydraulic Gradient (ft./ft.)	Channel Dimensions: Bottom (ft.)	Channel Dimensions: Depth (ft.)	Velocities: Aged	Velocities: As Built	Excavation (cu.yds.)
Pond Creek												
MS-1	308+75	441+00	33.02	1,710	1,696	387.8	.0016	10	12.0	5.05	8.12	
	441+00	444+00			Transition Section							
MS-2	444+00	488+00	33.40	2,230	2,249	382.0	.0011	16	13.3	4.70	7.54	
MS-3	488+00	509+00	36.68	2,330	2,316	379.6	.0011	16	13.5	4.73	7.59	
	509+00	511+00			Transition Section							
MS-4	511+00	588+90	43.74	2,441	2,432	371.1	.0011	16	13.8	4.80	7.69	
											Subtotal	356,000
Little Pond Creek												
Segment 1												
LP-1	100+00	136+00	4.43	600	604	476.5	.0025	26	4.4	4.21	6.80	
	136+00	138+00			Transition Section							
LP-2	138+00	211+20	5.28	740	730	457.6	.0025	32	4.4	4.30	6.92	
	211+20	213+00			Transition Section							
LP-3	213+00	305+30	11.43	974	998	437.8	.0021	36	5.2	4.39	7.04	
	305+30	309+30			Transition Section							
LP-4	309+30	466+00	14.30	2,070	2,090	415.2	.0014	50	7.5	4.55	7.31	
	466+00	468+00			Transition Section							
LP-5	468+00	503+00	18.70	2,455	2,458	410.0	.0014	50	8.2	4.80	7.70	
	503+00	505+00			Transition Section							
LP-6	505+00	554+00	21.14	2,625	2,608	402.8	.0014	50	8.5	4.87	7.83	
	554+00	556+00			Transition Section							
LP-7	556+00	615+00	23.35	2,810	2,819	389.4	.0014	50	8.9	5.00	8.04	
											Subtotal	587,000
Segment 2												
LP-7	615+00	650+00	23.35	2,810	2,819	389.4	.0014	50	8.9	5.00	8.04	
	650+00	652+00			Transition Section							
LP-8	652+00	696+00	24.22	2,895	2,875	382.9	.0014	50	9.0	5.03	8.08	
	696+00	698+00			Transition Section							
LP-9	698+00	766+85	25.87	3,058	3,051	373.1	.0014	50	9.3	5.13	8.23	
	766+85	768+85			Transition Section							
LP-10	768+85	934+50	29.56	3,400	3,388	346.4	.0016	50	9.5	5.55	8.90	
	934+50	936+50			Transition Section							
LP-11	936+50	1040+00	34.80	3,600	3,630	329.4	.0016	54	9.5	5.60	8.98	
	1040+00	1042+00			Transition Section							
LP-12	1042+00	1212+30	39.98	3,675	3,672	308.6	.0012	58	10.0	5.03	8.07	
											Subtotal	1,123,000

TABLE 3A - STRUCTURE DATA-CHANNELS[1/] - (continued)
Pond Creek Watershed, Texas

Channel Name	Station Numbering for Reach: Station (100 ft.)	Station (100 ft.)	Drainage Area (sq.mi.)[2/]	Capacity (c.f.s.): Req'd.	Capacity (c.f.s.): Design	Water Surface Elev. (ft.)[2/]	Hydraulic Gradient (ft./ft.)	Channel Dimensions: Bottom (ft.)	Depth (ft.)	Velocities: Aged	Velocities: As Built	Excavation (cu.yds.)
Brushy Creek												
BR-1	209+00	228+00	2.55	475	478	458.7	.0027	16	4.8	4.30	6.89	
	228+00	229+00			Transition Section							
BR-2	229+00	300+00	3.72	525	517	439.2	.0027	16	5.0	4.40	7.04	
	300+00	305+50			Transition Section							
											Subtotal	30,000
Keys Creek												
K-1	287+00	402+00	2.84	420	420	428.9	.0026	14	4.8	4.13	6.65	
	402+00	406+00			Transition Section							
K-2	406+00	451+00	3.39	420	428	420.0	.0018	26	4.0	3.34	5.44	
	451+00	466+30			Transition Section through Bridge to Confluence							
											Subtotal	46,000
											Total Excavation	2,142,000

1/ Side slopes of 1.5:1 are planned for all stream channel improvement. Roughness coefficients (Manning's "n") for aged conditions of .040 and for as built conditions of .025 were used for design of the stream channel improvement.

2/ Drainage area and water surface elevation apply to lower end of reach.

TABLE 3B - STRUCTURE DATA - GRADE STABILIZATION STRUCTURES

Pond Creek Watershed, Texas

Structure Number	Drainage Area (acres)	Detention Capacity Principal Spillway (inches)	Detention Capacity Principal Spillway (acre-foot)	Elevation Principal Spillway (m.s.l.)	Elevation Emergency Spillway (m.s.l.)	Top of Dam (m.s.l.)	Principal Spillway Capacity (Maximum) (c.f.s.)	Volume of Fill (cu. yd.)
101	86	0.70	5.0	508.0	512.7	514.7	70	12,000
102	145	0.25	3.0	458.0	465.2	467.2	73	7,300
103	65	0.72	3.9	447.0	449.5	451.5	62	9,400
1-1	278	0.99	22.9	542.0	547.4	549.4	94	15,600
11-1	198	0.40	6.6	509.5	514.8	516.8	57	21,740
11-2	53	0.58	0.8	496.0	499.8	501.8	50	5,600
11-3	86	1.00	7.2	458.0	460.8	462.8	48	17,000

Structure Number	Drainage Area (acres)	Drop (feet)	Concrete (cu.yds.)	Structure Type
104	576	14.6	49	Concrete Chute
105	632	16.1	54	Concrete Chute

TABLE 4 - ANNUAL COST
Pond Creek Watershed, Texas
(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost 2/	Operation and Maintenance Cost	Other Economic Cost 3/	Total
22 floodwater retarding structures; 166,825 feet of stream channel improvement; 9 grade stabilization structures and 1 debris basin	110,508	12,399	3,764	126,671
Project Administration	16,994	xxx	xxx	16,994
GRAND TOTAL	127,502	4/ 12,399	3,764	143,665

1/ Price Base: Installation 1967, O & M adjusted normalized prices.
2/ 100 years at 4.625 percent interest.
3/ Excess of production loss in pool areas over appraised market value.
4/ Includes value for replacement of those structural appurtenances expected to have a useful life shorter than the 100-year evaluation period.

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Pond Creek Watershed, Texas

(Dollars) 1/

Item	Estimated Average Annual Damage: Without Project	With Project	Damage Reduction Benefit
Floodwater			
Crop and Pasture	140,773	40,233	100,540
Other Agricultural	23,470	5,650	17,820
Non-Agricultural			
Road and Bridge	18,284	4,830	13,454
Subtotal	182,527	50,713	131,814
Sediment			
Overbank Deposition	8,664	4,845	3,819
Erosion			
Flood Plain Scour	26,670	7,074	19,596
Streambank Erosion	558	0	558
Valley Trenching	251	0	251
Land Depreciation 2/	12,730	0	12,730
Subtotal	40,209	7,074	33,135
Indirect	23,140	6,263	16,877
TOTAL	254,540	68,895	185,645

1/ Price Base: Adjusted normalized prices.

2/ Includes only that acreage evaluated above grade stabilization structures.

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Pond Creek Watershed, Texas
(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS[1]					Average Annual Cost[2]	Benefit-Cost Ratio
	Damage Reduction	More Intensive Land Use	Incidental Recreation	Secondary	Total		
22 floodwater retarding structures; 166,825 feet of stream channel improvement; and 9 grade stabilization structures[3]	171,907	13,629	8,502	19,415	213,453	126,671	1.7:1.0
Project Administration	xxx	xxx	xxx	xxx	xxx	16,994	xxx
GRAND TOTAL[4]	171,907	13,629	8,502	19,415	213,453	143,665	1.5:1.0

1/ Annual benefits and operation and maintenance costs based on adjusted normalized prices; construction costs based on 1967 prices.
2/ From table 4.
3/ Interrelated measures.
4/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of 13,738 annually.

INVESTIGATIONS AND ANALYSES

Land Use and Treatment

The status of land treatment measures for the watershed was developed by supervisors of the Central Texas Soil and Water Conservation District with assistance from the personnel of the Soil Conservation Service Work Units located at Rosebud and Temple, Texas. Representative basic soil and water conservation plans were analyzed both in the office and on the land. These findings were expanded for the entire watershed.

This analysis provided pertinent data on total conservation needs, accomplishments to date, and remaining needs, and was used in the establishment of priorities for planning, application, and maintenance of needed land treatment measures.

The need for funds for accelerated technical assistance represents the difference in the amount of funds which would normally be spent in the watershed under nonproject conditions and those which will be required in order to meet the project goal of the application of 80 percent of all needed land treatment by the end of the 10-year installation period.

Engineering Investigations

The procedures used to determine the most feasible plan of structural measures to meet the objectives of the sponsoring local organizations that could not be accomplished by land treatment measures were as follows:

1. A base map of the watershed was prepared showing watershed boundary, drainage pattern, systems of roads and railroad, utility lines, pipelines, and other pertinent information.

2. Stereoscopic photo and topographic map studies and field examinations were made to determine location of possible structural measures which would provide protection to the problem areas. Preliminary stage-capacity and area information at floodwater retarding structure sites was prepared from USGS topographic maps. These were used for review with the local sponsors and to select sites for surveys.

3. Surveys - Engineering surveys were made after preliminary agreement was reached with the sponsoring local organizations on locations of structural measures to be studied. The ownership and property lines for the land involved in each of the structural measures were located by the sponsors.

   a. Horizontal control - Scales of aerial photographs were determined by using the tellurometer and by chaining between identifiable points.

b. Vertical control - Existing U.S. Geodetic Survey and U.S. Coast and Geodetic Survey bench marks were supplemented with temporary bench marks set at strategic locations for use in making structural surveys.

c. Floodwater retarding structures - Preliminary field surveys were made at 27 potential structure site areas. Topographic maps were made of the reservoir areas. Surveys were made of roads, pipelines, and utility lines located within the reservoir areas. After preliminary layouts were reviewed and accepted by the local sponsors, detailed topographic maps with a contour interval of 2 feet and a scale of 1 inch to 100 feet were made of emergency spillway areas at the 22 sites selected for detailed study. A profile survey was made of the centerline of each structure. Contour lines of elevations at the lowest ungated outlet, the 50-year sediment pool, the principal spillway crest, the emergency spillway crest, and 2 feet above the emergency spillway crest were located on the ground and recorded on the photo map. These surveys provided the data necessary to determine if required sediment and floodwater detention storage capacities could be obtained, determine the most economical design for each structure, estimate the installation cost, and make land rights maps. Criteria for accuracy of surveys as outlined in Watersheds Memorandum TX-2 were used.

d. Stream channel improvement - Stream channel improvement surveys were made in accordance with procedures outlined in Watersheds Memorandum TX-1. Surveys consisted of 31.6 miles of profiles and cross sections of existing channels.

e. Grade stabilization structures - Topographic maps were made of the reservoir area. Profile and cross section surveys were made of the existing stream channel in order to establish the elevation of the spillway for the structure.

4. Designs - Designs of structural measures were initiated as survey data for individual or related groups of structures were completed.

a. Floodwater retarding structures - Criteria used in design equal or exceed that required in Engineering Memorandum-27 (Rev.).

The principal spillways were designed to empty the detention pools in 10 days. The percent chance of use of the emergency spillway was determined by procedures outlined in NEH 4 and Technical Release 33. Structures were classified for limiting criteria for design according to the damage that would result from a sudden breach. Breach studies indicated that no undue

hazard to life or property would result from a sudden breach. All structures were classified as "a."

Detention capacity was provided in 20 of the 22 structures to contain the emergency spillway hydrograph. Because of this, the freeboard hydrograph was used to proportion the emergency spillway.

The emergency spillway and freeboard hydrographs were developed by using procedures given in NEH 4, chapter 21. Hydrograph computations and flood routings were performed by digital computer.

b. Stream channel improvement - Design of the improved stream channel was based on the procedures outlined in USDA Technical Release No. 25, "Planning and Design of Open Channels," December 15, 1964.

The retardance values used for design of the stream channel were determined by using recommendations contained in NEH Section 5, Supplement B, Hydraulics.

The following estimates were made of the channel conditions in order to arrive at design retardance values:

	Aged	As Built
Basic "n"	.020	.020
Irregularity	.010	.005
Variation	.000	.000
Obstruction	.000	.000
Vegetation	.010	.000
"n"	.040	.025

No adjustments were made for meandering.

c. Grade stabilization structures - The selection of the type of grade stabilization structure depended upon the type of structure which would give the most economical construction and maintenance costs. The elevation of the emergency spillway crest and top of dam elevation were established for the earth dam grade stabilization structures by flood routing. The concrete chute spillways were designed in accordance with Section 14, National Engineering Handbook.

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5. Cost estimates - Construction costs were based on unit prices being expended at similar sites, Soil Conservation Service experience, and values furnished by local organizations and companies. Economic evaluation of different systems of floodwater retarding structures and channels having different capacities was made to determine the least costly system in order to reach project objectives. Alternate dam site locations were analysed to determine the least costly combinations of emergency spillways and embankments. The adjusted long-term average annual cost of maintaining the structures with detention storage is based on the following equation:

$$M = .87 (\$40 + \$10V + \$15F)$$

Where .87 = factor to adjust 1967 prices to adjusted normalized prices
M = the cost of maintenance
V = the number of acres to be vegetated on the dam and in the emergency spillway
F = the percent chance of use of the emergency spillway (table 3)
or F = the average number of times the emergency spillway is expected to function in a 100-year period

The cost of maintaining the stream channel improvement and appurtenances was estimated at $200 per mile based on the best available information. The replacement cost of appurtenances is based on replacing them at their original cost at the end of 50 years. The cost of maintaining the concrete drop structures was estimated at $50 per year per structure. Operation and maintenance cost of the earth dam type grade stabilization structures includes replacement of those structures having an expected life shorter than the 100-year evaluation period.

Hydraulic and Hydrologic Investigations

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

1. Rainfall frequency data for the watershed were obtained from U.S. Weather Bureau Technical Paper No. 40, "Rainfall Frequency Atlas for the United States." Data contained in Texas Water Commission Bulletin No. 6311, "Floods in Texas," were used to determine frequency of peak flows for the watershed. These were compared with values obtained from routings.

2. The without project hydrologic conditions were determined from a 10 percent sampling of soil and cover conditions. The with project hydrologic conditions were determined by considering the

effect of changed land use and treatment expected to occur during the installation period.

3. The area subject to damage from flooding was determined by stereoscopic photo study, supplemented with information obtained from field investigations and from residents of the watershed.

4. Engineering surveys were made of 103 valley cross sections to represent the stream hydraulics and flood plain area. Preliminary locations for sections were made on aerial photos, giving due consideration to the needs of the geologist and the economist. The final locations were selected on the ground.

5. Stage-discharge relationships were developed for the valley cross sections by use of Manning's formula.

6. The relationship of peak discharge to runoff was developed at each proposed floodwater retarding structure site and at each valley cross section by flood routing. Various combinations of structural measures were analyzed to determine the most feasible system of structural measures which would accomplish the project objectives.

7. Stage-area inundated curves were developed for each portion of the agricultural flood plain represented by a single cross section. Area inundated depths of 0-1, 1-3, and 3 feet plus depth increments were determined for selected floods. Composite runoff-area inundated curves were developed for without project conditions and to reflect the effect of the planned works of improvement.

8. Design storm hydrographs for floodwater retarding structures were developed by use of Engineering-Hydrology Memoranda TX-1, August 1965, and TX-2, November 1965, and Engineering Memorandum-27 (Rev.), March 1965.

9. The required channel capacities for stream channel improvement were determined from routings described in item 6. The increase in peak discharges resulting from stream channel improvement was determined by using an equation based on change in time of concentration.

Sedimentation Investigations

Sedimentation investigations were made in accordance with procedures outlined in EWP Technical Guide No. 12, South Regional Technical Service Area, revised October 1967. Types of investigations made and procedures utilized are as follows:

1. The 100-year sediment storage requirements for all floodwater

retarding structures were determined. The following field and office studies were made:

a. A 10 percent sample of the watershed was selected, by soils areas, for field mapping of land use and land treatment-cover conditions. The Musgrave equation was applied to this data to estimate gross erosion for both without and with project conditions. Adjustment factors for cover conditions, land treatment, etc., and the use of this equation are presented in chapters VII and X of the guide. The gross erosion data was summarized into rates for five "homogenous" areas for use in expanding these rates to the appropriate area or areas within each floodwater retarding structure drainage area.

b. The estimated gross erosion expected to occur within the drainage area of each structure was adjusted for expected delivery ratio and trap efficiency of the reservoir. The sediment delivery ratio (based on size of drainage area) and trap efficiency (90 percent) were obtained from chapter VIII.

c. Allowances for differences in soil and sediment densities were based on the following:

Land Resource Area	Soil in Place (lbs./cu.ft.)	Sediment (lbs./cu.ft.)
Texas Blackland Prairie	81	51
Texas Claypan Area	83	52
Southern Coastal Plain	94	62

d. Sediment allocation to pools was made as follows:

Period of Deposition	Pool	Condition	Percent
First 50 Years	Sediment	Submerged	45
Second 50 Years	Sediment	Submerged	45
	Detention	Aerated	10

2. Sediment and scour damage investigations were made by the cross section method. Evaluations of soil productivity loss by scouring of the topsoil and deposition of low productivity materials over the topsoil were made similar to procedures suggested in chapter XI of the guide. Land destruction by valley trenching was substantiated by studies of aerial photographs.

Channel Stability Studies

Field investigations were made of the geology, soils, depth, and nature of the alluvium, types of bedload carried, present stability, and the nature of the channels to be improved. The field investigations indicated that all stream channel improvement will be located in clayey alluvium (CH and CL) underlain by dominantly shaly bedrock. Detailed investigations with drilling equipment were not needed for planning or design of a stable channel in these materials. Velocities for design of the channels were obtained from the suggested velocities for CH and CL materials with a P.I. greater than 20 in chapter 6 of Technical Release No. 25, "Planning and Design of Open Channels," USDA, SCS, December 15, 1964.

According to the limiting velocity table, figure 6-1 in TR-25, for this type of soil and plasticity index, the allowable velocity is 7.5 feet per second for the mainstem of Pond Creek. This velocity is for a suspended load condition with corrections being made as required. The allowable velocity varies on Little Pond, Brushy, and Keys Creek tributaries from 6.30 feet per second to 7.50 feet per second. Actual design velocities for the mainstem and in straight sections are well within the allowable, ranging from 4.70 feet per second to 5.05 feet per second for aged conditions. The as built velocities with a roughness coefficient (Manning's "n") of .025 and bank-full flow are slightly higher than the allowable, ranging from 7.54 to 8.12 feet per second in straight sections.

Allowable velocities in the curve sections are somewhat lower than 7.5 feet per second and range from 5.25 to 6.85 feet per second for the mainstem of Pond Creek. Similar reductions are evident for Little Pond and other tributaries. In order to counteract this problem, the alignment of the channels was adjusted to eliminate as many of the critical curves as possible.

Geologic Investigations

Preliminary geologic dam site investigations were made at the floodwater retarding structure sites and reports prepared in accordance with procedures outlined in chapter 6, EWP Technical Guide No. 4, South Regional Technical Service Area, June 1967. These investigations included studies of valley slopes, alluvium, channel banks, and exposed geologic formations.

All sites are located on soft sedimentary rocks which range from Upper Cretaceous age to Recent. The structure is simple with dip to the southeast of less than 100 feet per mile. Faulting occurs in the stream valley at Site 11. The borrow of most sites is clayey (CH and CL) except for some sands (SC and SM) at a few sites. The location of all sites in relation to geologic unit(s) is as follows:

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System	Formation	Site No.
Upper Cretaceous	Lower Taylor Marl	1
	Wolfe City Sand	1,2,3,4,5
	Pecan Gap Chalk	6,8,9,11
	Upper Taylor Marl	7,10,11,12,13,14
	Neylandville Marl	15,18
	Nacatoch Sand	20
	Kemp Clay	16,17,19
Eocene	(Midway Group)	21,22
Quaternary	Terrace Deposits	20

Detailed investigations, including explorations with core drilling equipment, will be made at each floodwater retarding structure site prior to construction to determine the suitability and methods of handling foundation and embankment materials.

Economic Investigations

Basic methods used in the economic investigations and analyses are outlined in the "Economics Guide for Watershed Protection and Flood Prevention," USDA, Soil Conservation Service, March 1965. The selection of evaluation reaches is based upon damageable values and flood plain characteristics.

Agricultural damage calculations were based upon information obtained in interviews with owners and operators of flood plain lands. Schedules covered past, present, and intended future land use; crop distribution under normal conditions; planting dates; harvesting dates; yields; and historical data on flooding and resultant damages to crops and pastures and to other agricultural property. The views of experienced local agricultural workers were also obtained and considered in estimating future yields and land use changes. The land use of the entire flood plain was obtained by field mapping.

Floodwater damages and reductions were calculated by use of the frequency method.

Grade stabilization structures were evaluated by comparing the net returns to be expected by the farm operator of those lands affected by the structures under both without and with project conditions. The difference in average annual net return, with consideration of all associated costs, for the two conditions is regarded as the amount of average annual depreciation without project. The land use and capability, as well as the amount of needed land treatment which work unit personnel expect to be able to apply

during the next 5 to 10 years, was considered in the evaluation. Benefits were discounted for an expected 5-year lag in accomplishment.

The monetary value of the physical damage from flood plain scour was based upon production lost and the net loss to the farm operator. The value of recovery from this damage was discounted in accordance with the time required for and the extent of recovery.

Road and bridge damage estimates for without project conditions were based on interviews with county commissioners and with residents of the watershed concerning damages to roads and bridges from specific flood events. Estimated benefits were based upon expected reduction of flooding as a result of project installation. Indirect damages were estimated to approximate 10 percent of direct damages.

Incidental recreation benefits were evaluated for sediment pools of floodwater retarding structures expected to be open to the general public either on a fee or free basis. A value of $1 per visitor-day was used for evaluation in accordance with recommendations in Watersheds Memorandum-57, October 3, 1962. Associated costs, including development costs of sanitary and recreational facilities, liability insurance, and operation and maintenance, were deducted from the gross value of benefits. Benefits were calculated allowing for full level of use for 40 years, with a gradual diminishing of attractiveness and use during the next 10 years, to zero by the end of the 50th year and thereafter.

More intensive management, fertilization, and weed control are expected on about 1,373 acres of pastureland as the result of reduced flooding following project installation. Expected monetary benefits were discounted to allow for a lag in accrual of full level benefits.

Secondary benefits stemming from the project were estimated to amount to 10 percent of direct damage reduction benefits, incidental recreation, and more intensive use benefits as outlined in chapter 11 of the Economics Guide. Secondary benefits induced by the project were estimated to amount to 10 percent of increased expenditures associated with intensification of land use and recreation development.

The value of easements was determined by local appraisal, giving full consideration to current real estate market values. A comparison of the net value of agricultural production lost as the result of the installation of structural measures, to the amortized value of the easements, showed the former to be greater. The net value of production lost was therefore used in economic evaluation.

Fish and Wildlife Resource Investigations

The Bureau of Sport Fisheries and Wildlife, in cooperation with the Texas Parks and Wildlife Department, has completed a reconnaissance survey of the Pond Creek watershed. This report was invaluable in work plan

development pertaining to fish and wildlife resources. In addition to data presented under "DESCRIPTION OF THE WATERSHED" and "EFFECTS OF WORKS OF IMPROVEMENT," the following recommendations are reproduced from the report:

> To promote fertility and reduce turbidity, the basins of the floodwater retarding reservoirs and barren areas draining into the reservoirs should be disked and planted to grasses or suitable small grain adaptable to the area prior to impoundment. When practicable, the floodwater retarding reservoirs should be fenced to prevent damage to the dams and muddying of the water by livestock. If required, watering devices should be installed below the dams and outside of the enclosed reservoir areas.
>
> To prevent unbalanced fish populations due to indiscriminate fish stocking, the Texas Parks and Wildlife Department should be consulted regarding proper stocking. If channel catfish are approved for stocking, spawning devices should be installed. Sewer tiles, barrels, and old tires have been used successfully as channel catfish spawning devices.
>
> During the construction phase of the project as much brush and timber as possible should be retained. Trees and shrubs should be left on the inside curve of the stream meanders. This practice would help prevent bank erosion and resultant siltation and also would preserve wildlife habitat. Trees and shrubs useful to wildlife as food and cover should be planted on idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.
>
> In view of the above, it is recommended that:
>
> 1. Basins of floodwater retarding reservoirs and the barren areas draining into them be planted to grasses or small grains adaptable to the area upon completion of construction and prior to water storage.
>
> 2. When practicable, floodwater retarding reservoirs be fenced and watering devices be installed below the dams and outside of the enclosed reservoir areas.
>
> 3. Floodwater retarding reservoirs be stocked with fish as recommended by the Texas Parks and Wildlife Department.
>
> 4. Spawning devices be installed in floodwater retarding reservoirs approved for channel catfish stocking.

5. Trees and shrubs be retained on the inside curve of stream meanders in the process of stream channel improvement.

6. Shrubs and trees useful to wildlife as food and cover be planted at appropriate locations such as idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

The above recommendations are in conformance with U.S.D.A. Soil Conservation Service Biology Memorandum-7 (Rev. 1), National Standards for Biology Practices. If adopted as a part of the plan of development, losses of wildlife habitat would be mitigated and fish and wildlife benefits would accrue to the project.

A detailed study of the watershed by the Bureau of Sport Fisheries and Wildlife is not deemed necessary at this time. Should the sponsors desire, our Bureau in cooperation with the Texas Parks and Wildlife Department, would be happy to be of further assistance.

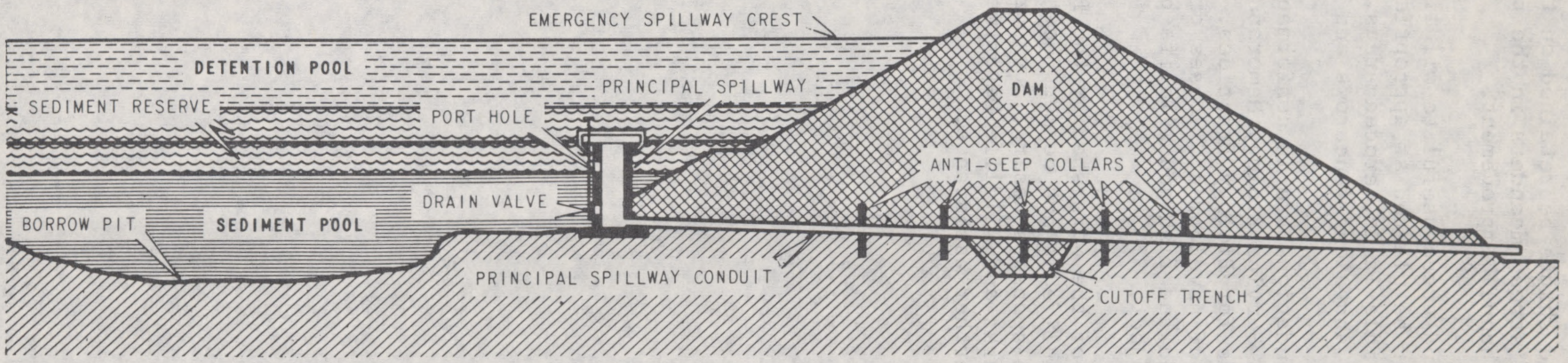
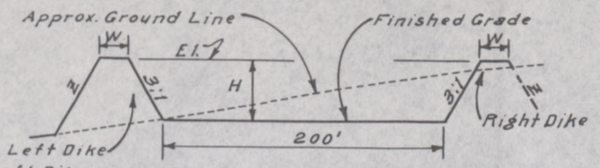


Figure 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE



Left Dike:
From Sta. 4+30 to Sta. 5+00-El.=1962.2, W=16.0', Z=2.5:1
From Sta. 5+00 to Sta. 5+50 - a transition section.
From Sta. 5+50 to approx. Sta. 6+30-W=10.0', Z=3:1, H=4.5'.
Right Dike:
From Sta. 4+30 to Sta. 5+00-El.=1962.2, W=16.0', Z=2.5:1
From Sta. 5+00 to Sta. 5+50 - transition to W=10.0', Z=3:1, H=4.5'.
Material forming dikes shall be placed and paid as "Earth Fill, Embankment".

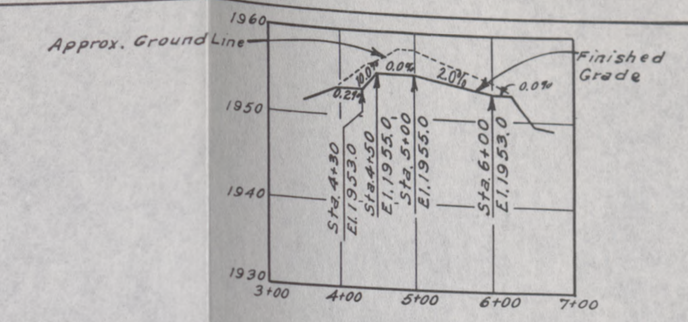
TYPICAL SECTION — EMERGENCY SPILLWAY

Emergency Spillway Diversions and Stub Diversions (S.D.): 18" effective height, 3:1 side slopes and 13 ft., minimum base, shall be constructed at the approximate locations shown on the plans. Final locations of the Stub Diversions shall be determined by the Engineer (See Construction Specification 5).

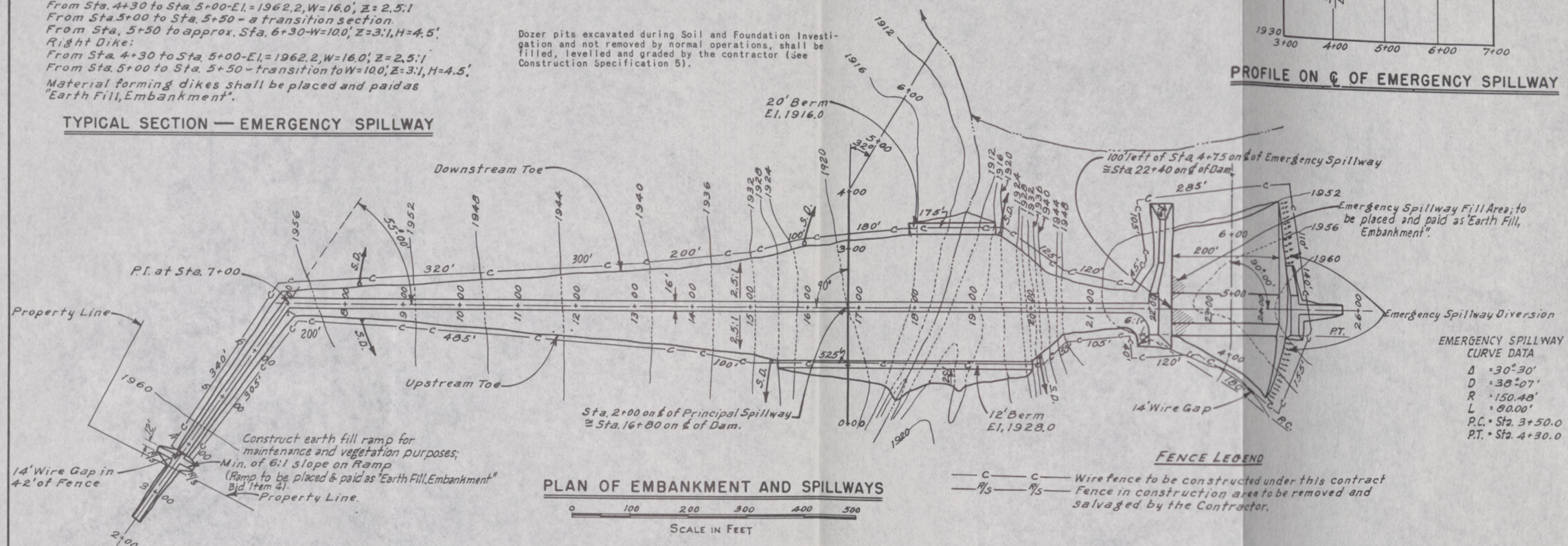
A minimum of 6" topsoil shall be placed in Emergency Spillway and on all Earth Fill Areas (See Construction Specification 20C).

Stream Channel within embankment area shall be shaped and cleared of objectionable material (See sheet 12 and Construction Specification 4).

Dozer pits excavated during Soil and Foundation Investigation and not removed by normal operations, shall be filled, levelled and graded by the contractor (See Construction Specification 5).



PROFILE ON ℄ OF EMERGENCY SPILLWAY

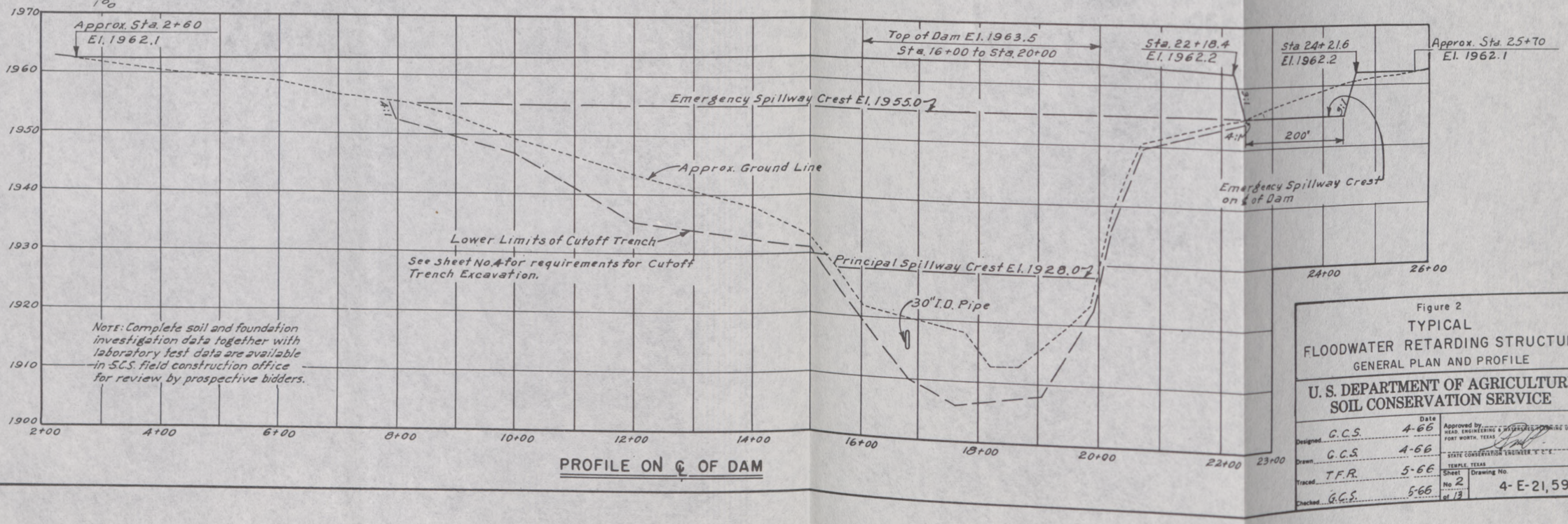


PLAN OF EMBANKMENT AND SPILLWAYS

0 100 200 300 400 500
SCALE IN FEET

EMERGENCY SPILLWAY CURVE DATA
Δ = 30°-30'
D = 38°-07'
R = 150.48'
L = 80.00'
P.C. = Sta. 3+50.0
P.T. = Sta. 4+30.0

FENCE LEGEND
—C—C— Wire fence to be constructed under this contract
—R/S—R/S— Fence in construction area to be removed and salvaged by the Contractor.



NOTE: Complete soil and foundation investigation data together with laboratory test data are available in S.C.S. field construction office for review by prospective bidders.

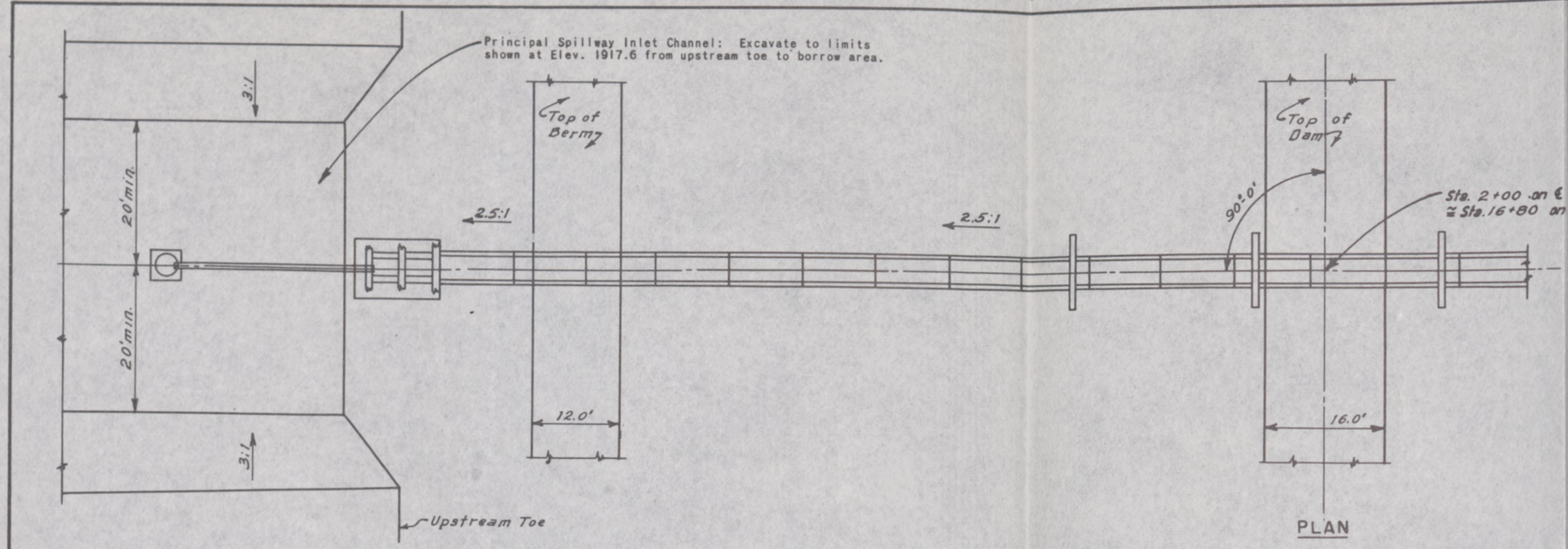
PROFILE ON ℄ OF DAM

Figure 2
TYPICAL
FLOODWATER RETARDING STRUCTURE
GENERAL PLAN AND PROFILE

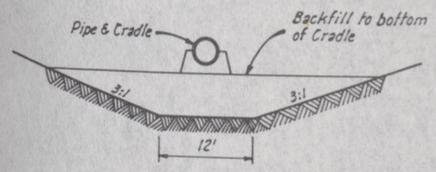
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date	
Designed G.C.S.	4-66	Approved by HEAD, ENGINEERING & DESIGNED DRAWING UNIT, FORT WORTH, TEXAS
Drawn G.C.S.	4-66	STATE CONSERVATION ENGINEER, S.C.S. TEMPLE, TEXAS
Traced T.F.R.	5-66	Sheet No. 2 of 13
Checked G.C.S.	5-66	Drawing No. 4-E-21,594

56-935 O-71 (Face p. 56) No. 1



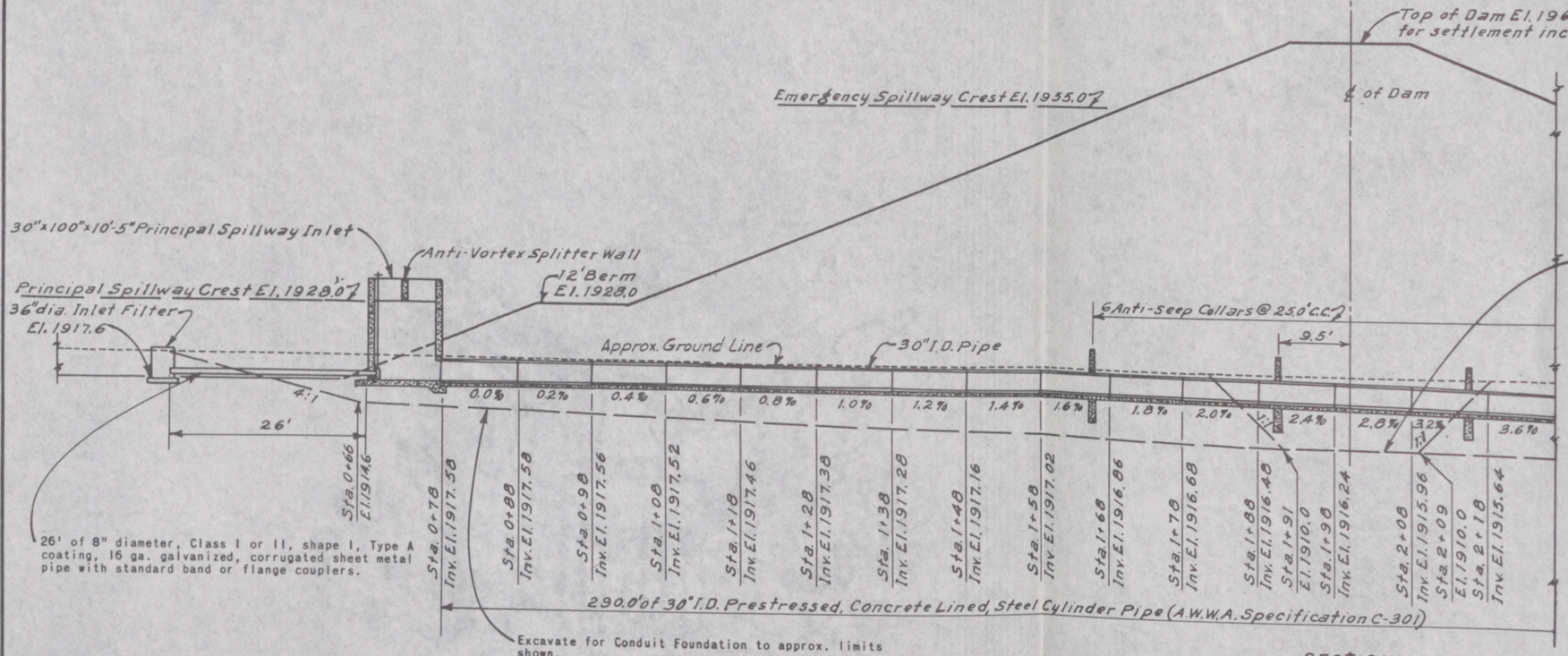
PLAN



Excavation to be paid as "Excavation, Unclassified".

Prior to placing backfill around the structure, the surface layer of the in-place fill material shall be reworked as necessary, and to the depth necessary, to restore and satisfy the density and moisture requirements specified for that fill material.

TYPICAL CONDUIT FOUNDATION EXCAVATION



Excavate Cutoff Trench with 1:1 side slopes and 18 ft. bottom width to approximate limit shown on "Profile on Centerline of Dam" from Sta. 8+00 to approximate sta. 19+75.

Remove all of the slide rock, boulders, flags, cobbles, common and organic material to hard unfragmented rock in preparation for base of dam on the right abutment, approx. Sta. 19 75 to Sta. 22 40. Remove the right abutment scarp and slope to not steeper than 2 horizontal to 1 vertical. (See Construction Spec. 4).

SECTION

PRINCIPAL SPILLWAY

Figure 2a

TYPICAL

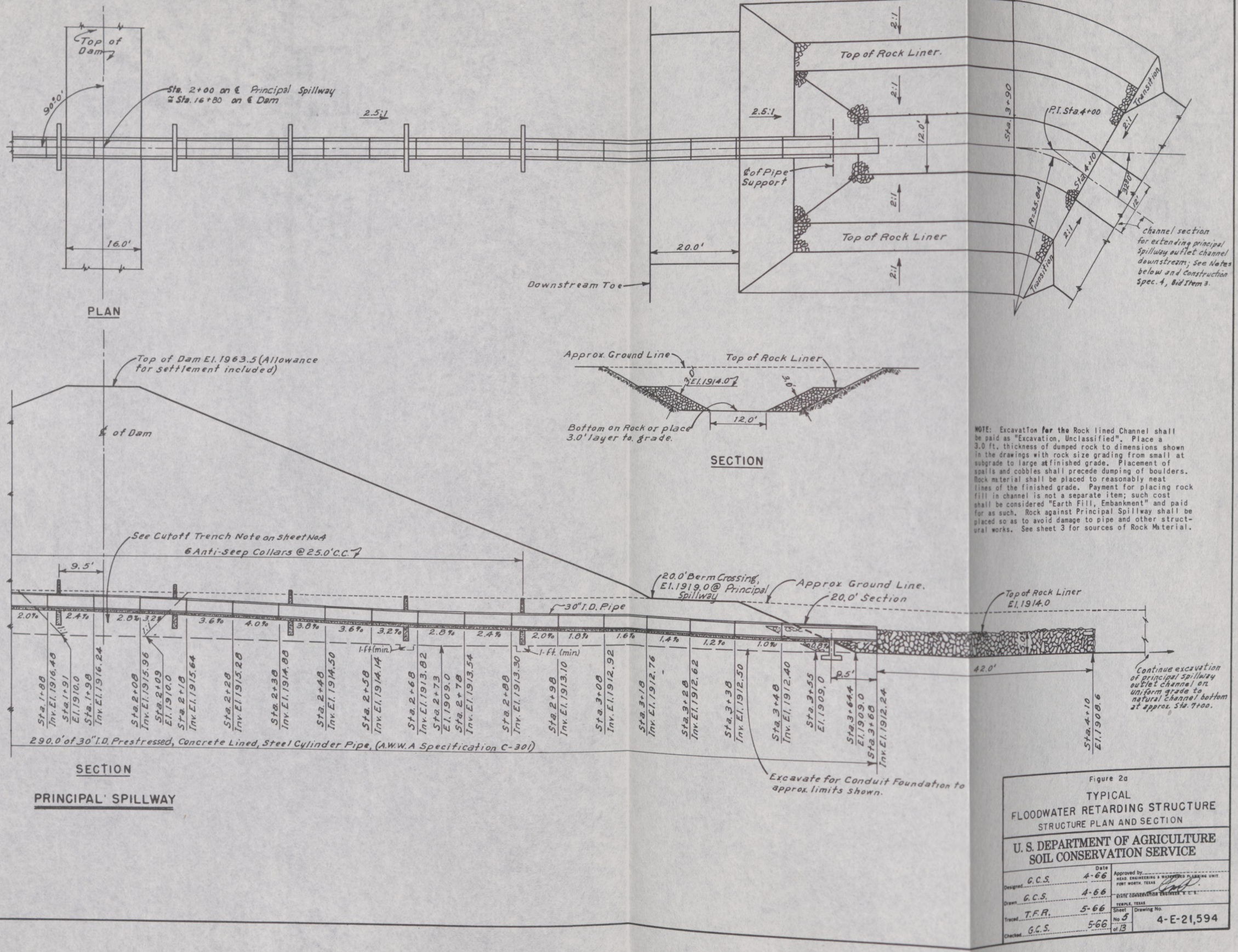
FLOODWATER RETARDING STRUCTURE

STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	Approved by: HEAD, ENGINEERING & WATERSHED PLANNING UNIT, FORT WORTH, TEXAS
Designed	G.C.S.	4-66	
Drawn	G.C.S.	4-66	STATE CONSERVATION ENGINEER, S. C. S., TEMPLE, TEXAS
Traced	T.F.R.	5-66	Sheet No 4 of 13
Checked	G.C.S.	5-66	Drawing No. 4-E-21,594

56-935 O-71 (Face p. 56) No. 2



NOTE: Excavation for the Rock lined Channel shall be paid as "Excavation, Unclassified". Place a 3.0 ft. thickness of dumped rock to dimensions shown in the drawings with rock size grading from small at subgrade to large at finished grade. Placement of spalls and cobbles shall precede dumping of boulders. Rock material shall be placed to reasonably neat lines of the finished grade. Payment for placing rock fill in channel is not a separate item; such cost shall be considered "Earth Fill, Embankment" and paid for as such. Rock against Principal Spillway shall be placed so as to avoid damage to pipe and other structural works. See sheet 3 for sources of Rock Material.

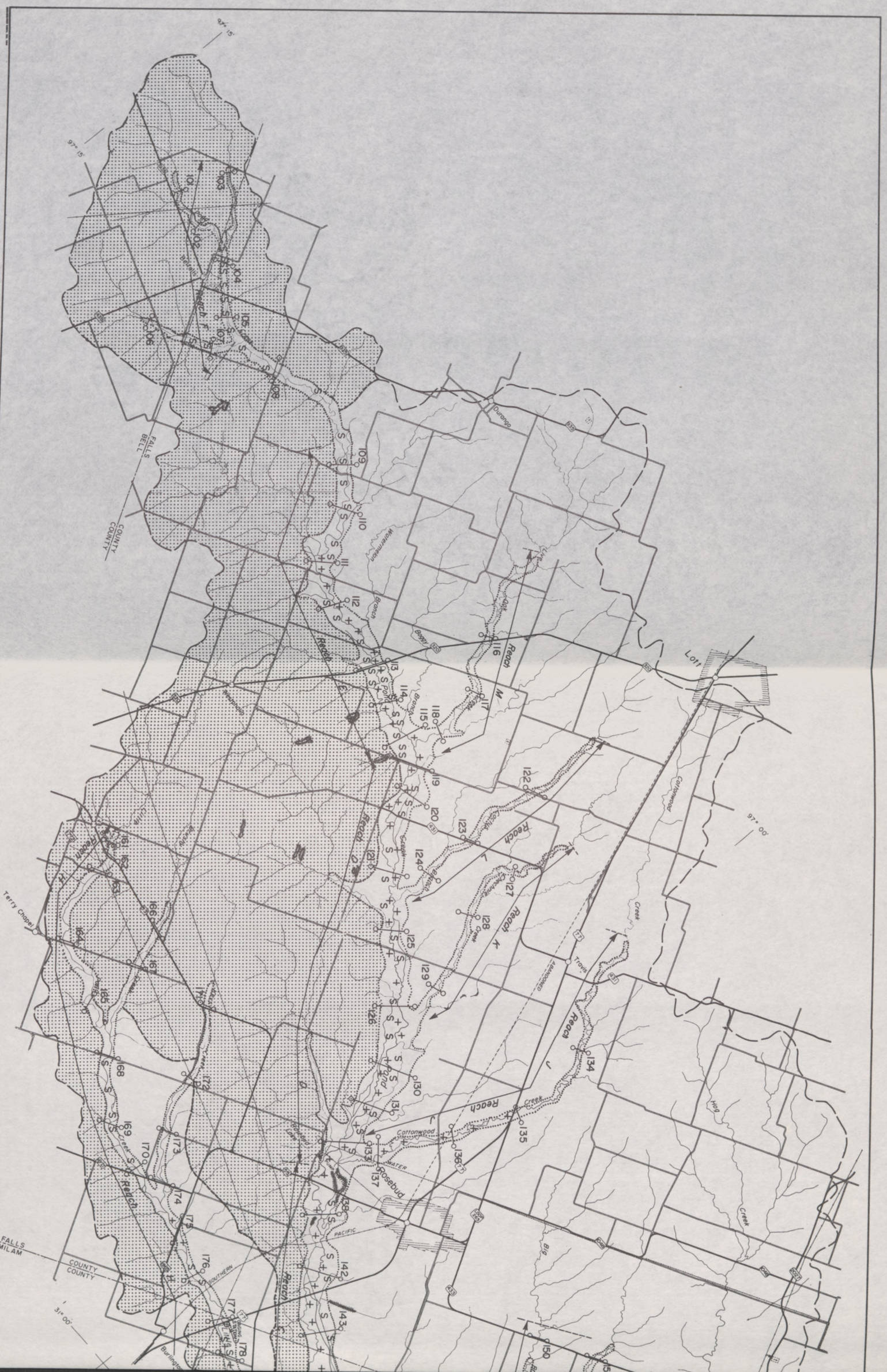
Figure 2a

TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	G.C.S.	4-66	Approved by: HEAD, ENGINEERING & WATERSHED PLANNING UNIT, FORT WORTH, TEXAS
Drawn	G.C.S.	4-66	STATE CONSERVATIONIST, S.C.S.
Traced	T.F.R.	5-66	TEMPLE, TEXAS
Checked	G.C.S.	5-66	Sheet No. 5 of 13 — Drawing No. 4-E-21,594

56-935 O-71 (Face p. 56) No. 3


97° 15'
97° 00'
31° 00'
BELL COUNTY
FALLS COUNTY
MILAM COUNTY
Durango
Lott
Troy
Terry Chapel
Rosebud
Cottonwood
Reach
Creek
Branch
Water
Pacific
Southern
Burlington
Santa Fe
Gulf
Big
Hog
Waterman
Lime
Cedar
Elm
Chatt
Cemetery
Grandview
Cornerwood
Hackberry
Lake
Pond
Spring
Gully
Fork
Bend
Flat
Ridge
Hill
Mountain
Valley
Canyon
Prairie
Woods
Orchard
Church
School
Park
Bridge
Dam
Tank
Well
Windmill
Cemetery
Airport
Railroad
Highway
Road
Trail
Boundary
Survey
Section
Block
Abstract
Grant
Patent
Lease
Field
Pipeline
Power
Telephone
Transmission
Substation
Tower
Pole
Line
Fence
Gate
Cattle
Guard
Cross
Arm
Insulator
Conductor
Ground
Wire
Span
Anchor
Guy
Brace
Crossarm
Crossbar
Crossbrace
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Crossarm
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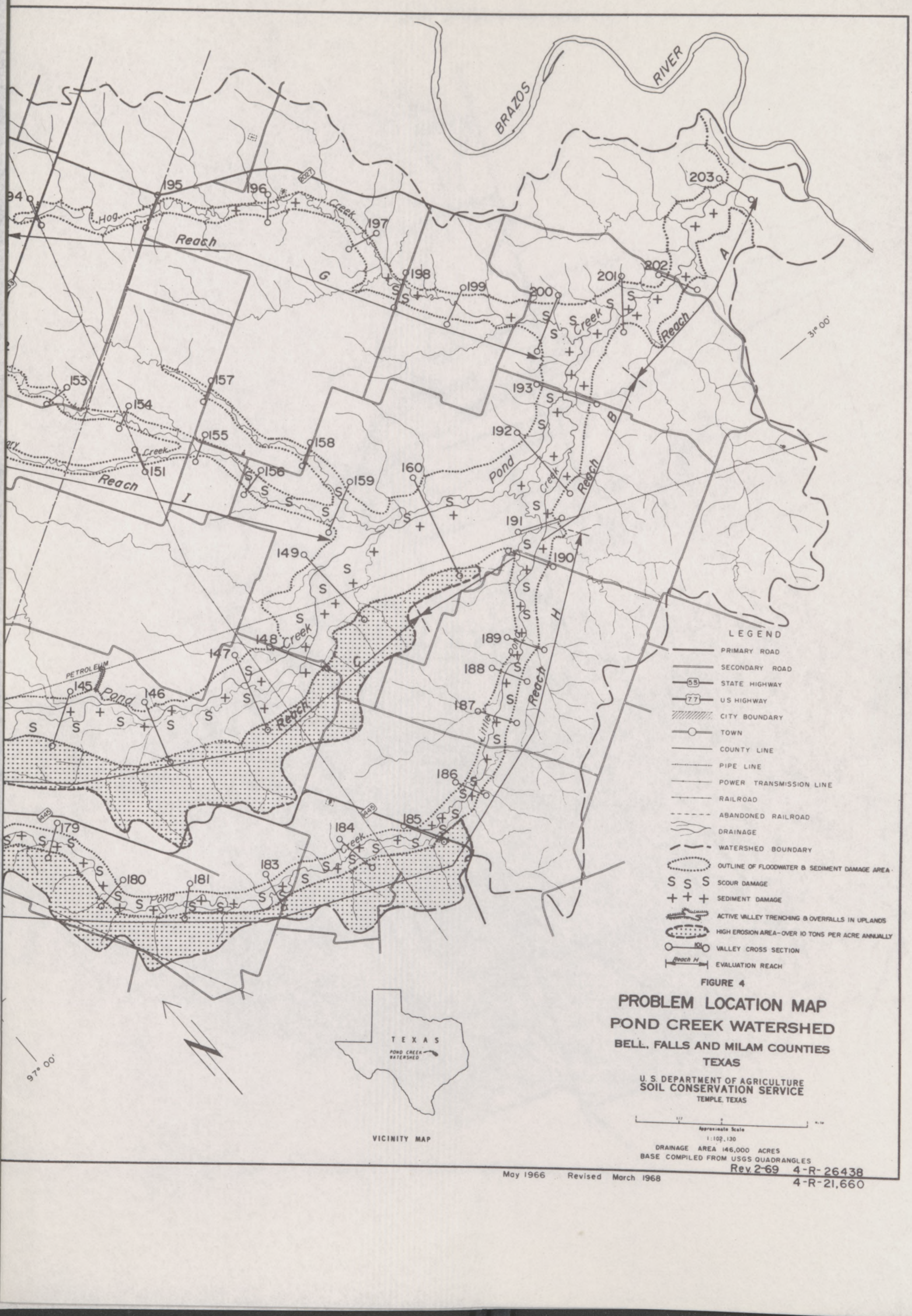
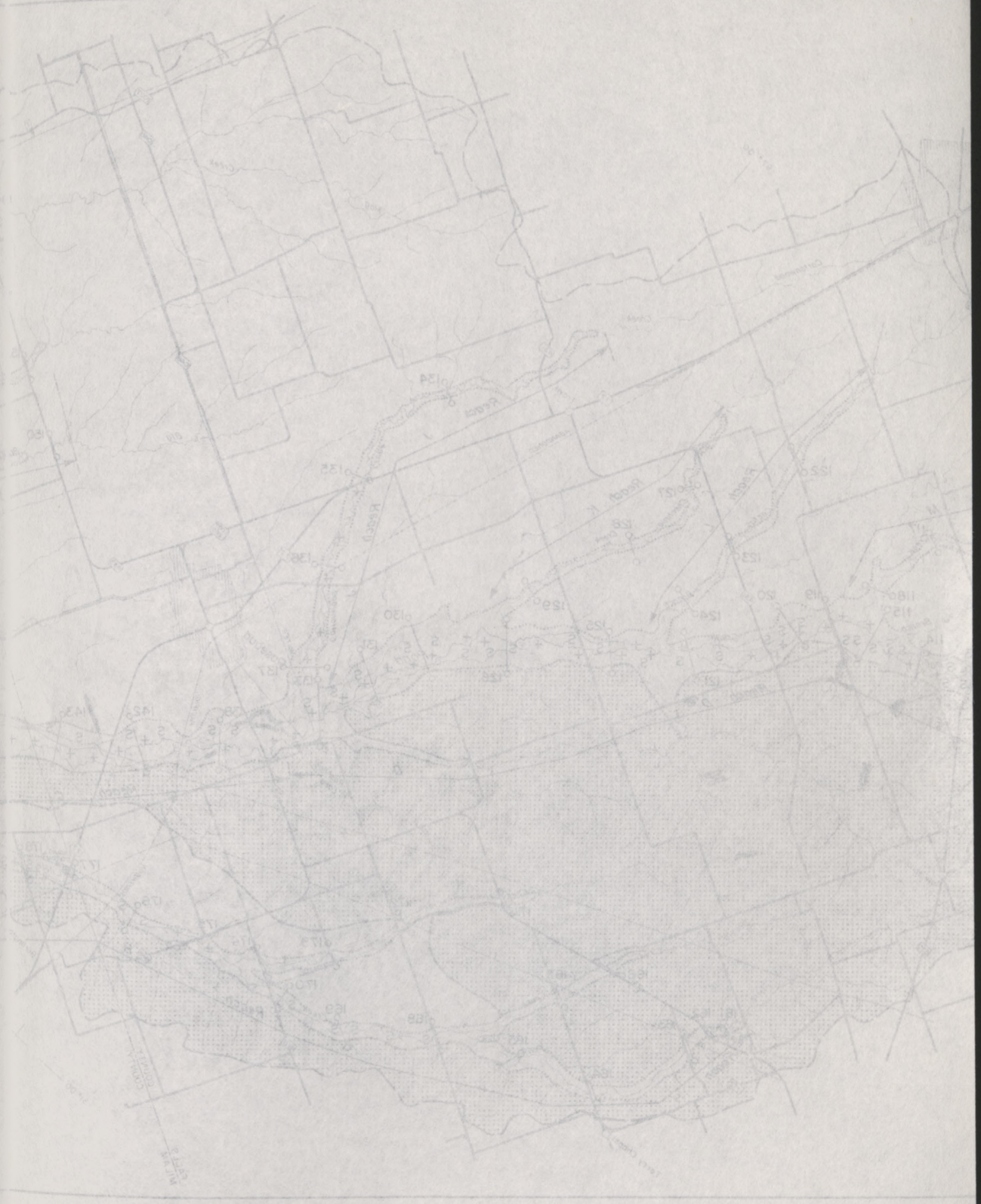
Crossbrace
Crossarm
Crossbar
Crossbrace
Crossbr

56-935 O-71 (Face p. 58) No. 1


BRAZOS RIVER
Hog Creek
Reach G
Creek
Pond
Reach I
Reach H
Reach A
Reach B
Reach
Creek
Pond
Creek
Pond
Creek
Pond



SITE NUMBERS AND DRAINAGE AREAS

NUMBER	AREA ACRES	NUMBER	AREA ACRES
1	10,010	12	2,816
2	2,867	13	608
3	460	14	397
4	966	15	352
5	2,899	16	429
6	1,740	17	4,090
7	397	18	1,568
8	749	19	1,037
9	832	20	8,122
10	2,982	21	1,178
11	3,603	22	1,056



USDA-SCS-FORT WORTH, TEX. 1969

56-935 O-71 (Face p. 58) No. 2

56-935 O-71 (Face p. 58) No. 2

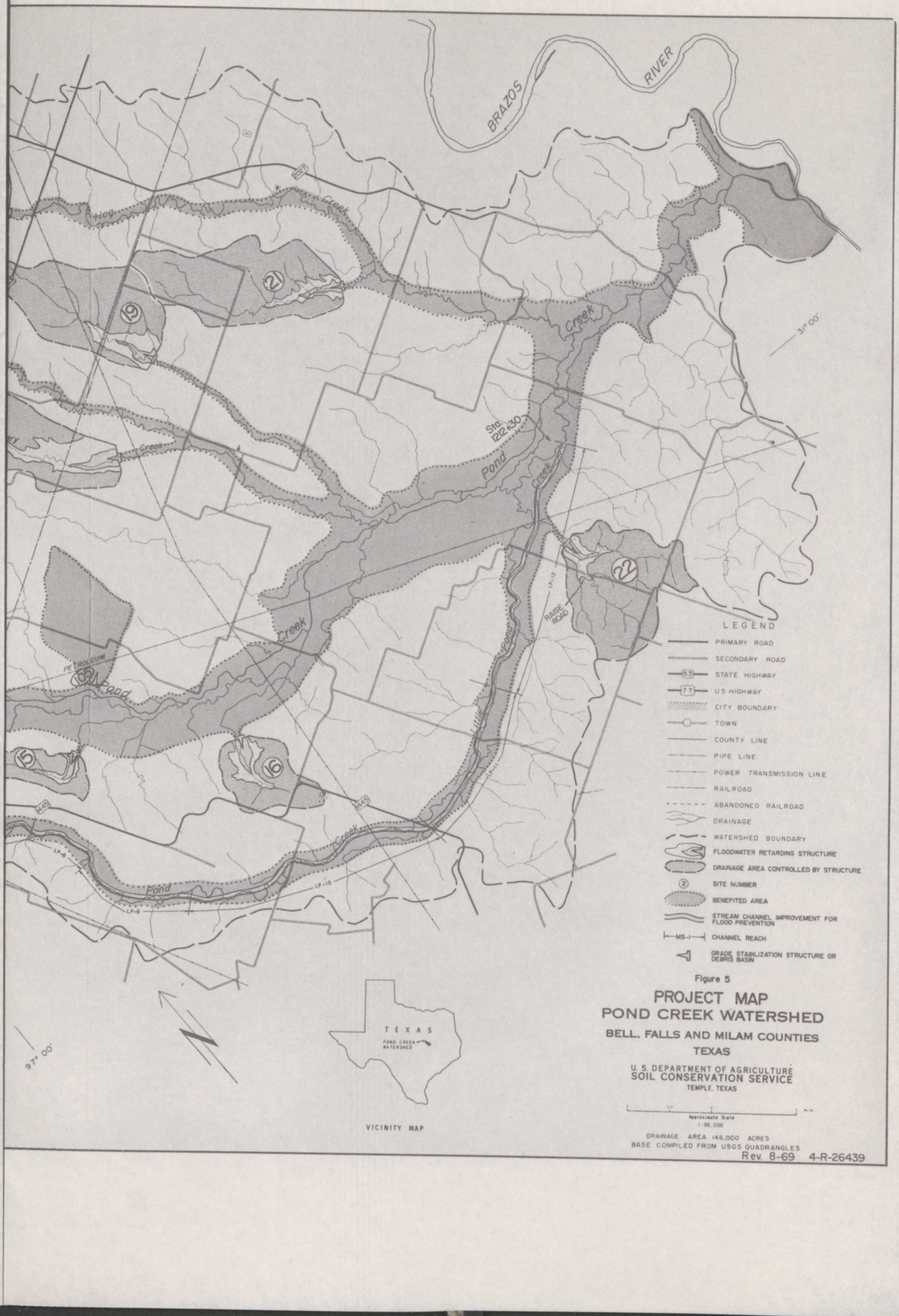


Figure 5

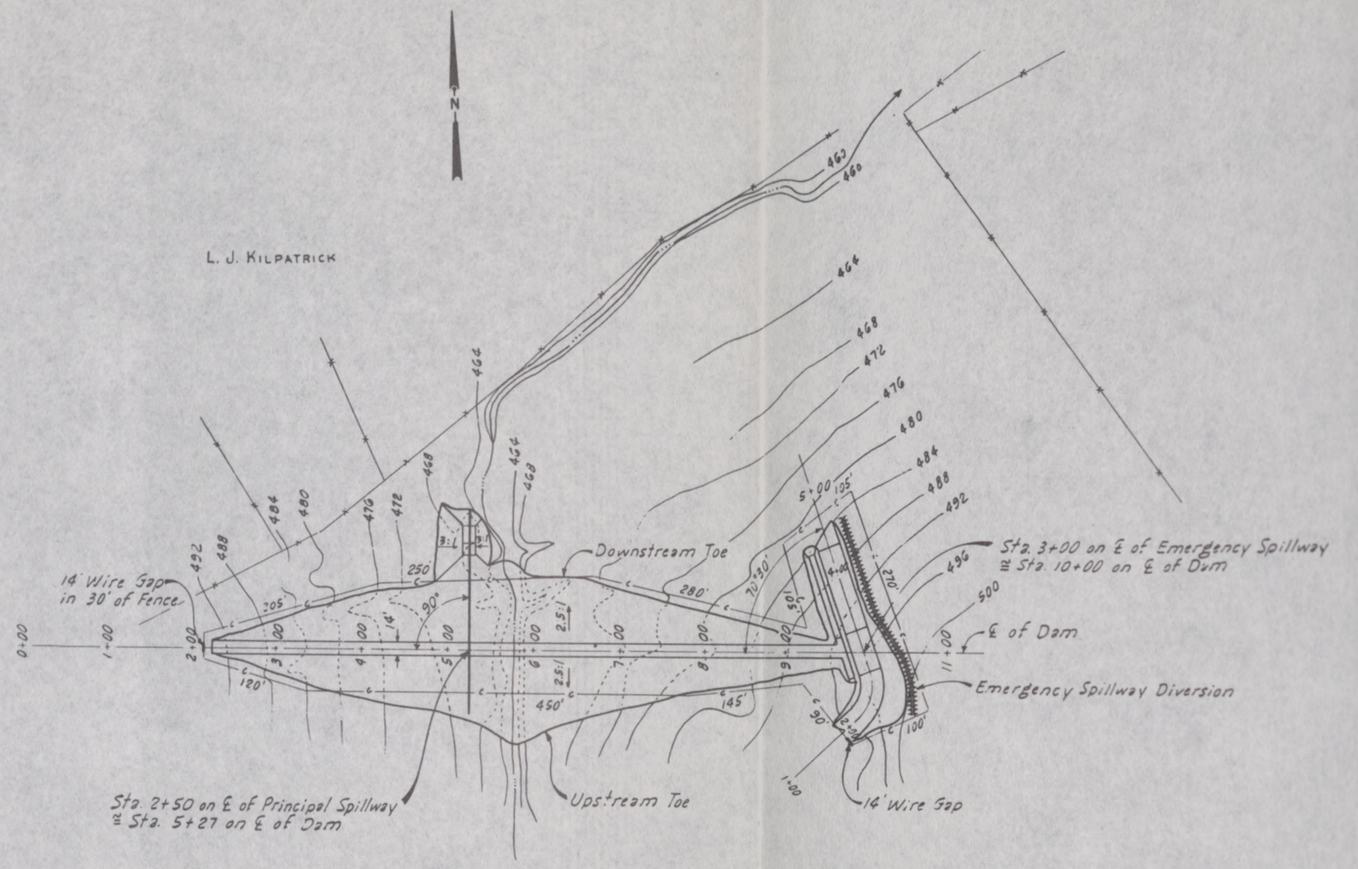
PROJECT MAP
POND CREEK WATERSHED

BELL, FALLS AND MILAM COUNTIES
TEXAS

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

Approximate Scale
1:96,000

DRAINAGE AREA 146,000 ACRES
BASE COMPILED FROM USGS QUADRANGLES
Rev. 8-69 4-R-26439

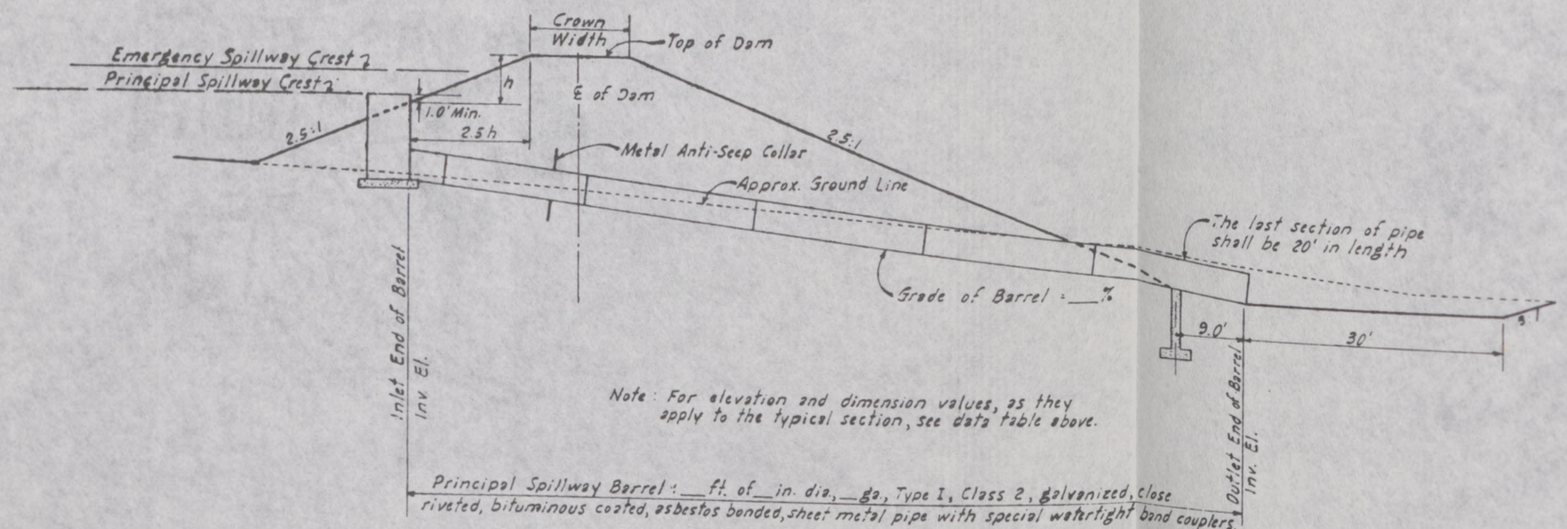


SITE 1

PLAN OF EMBANKMENTS AND SPILLWAYS

0 50 100 200 300 400 500

SCALE IN FEET



Note: For elevation and dimension values, as they apply to the typical section, see data table above.

Principal Spillway Barrel: ___ ft. of ___ in. dia., ___ ga., Type I, Class 2, galvanized, close riveted, bituminous coated, asbestos bonded, sheet metal pipe with special watertight band couplers.

TYPICAL SECTION - PRINCIPAL SPILLWAY

Figure 3
TYPICAL
GRADE STABILIZATION STRUCTURE
STRUCTURE - PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed J.A.B.	Date 4-65	Approved by: HEAD, ENGINEERING & WATERSHED PLANNING UNIT, FORT WORTH, TEXAS; STATE CONSERVATION ENGINEER, S. C. S., TEMPLE, TEXAS	
Drawn J.A.B.	4-65		
Traced C.V.C.	5-65	Sheet No 5 of 14	Drawing No. 4-E-21,303
Checked J.A.B. & G.W.T.	5-65		

56-935 O-71 (Face p. 56) No. 4

USDA-SCS-FORT WORTH, TEX. 1965

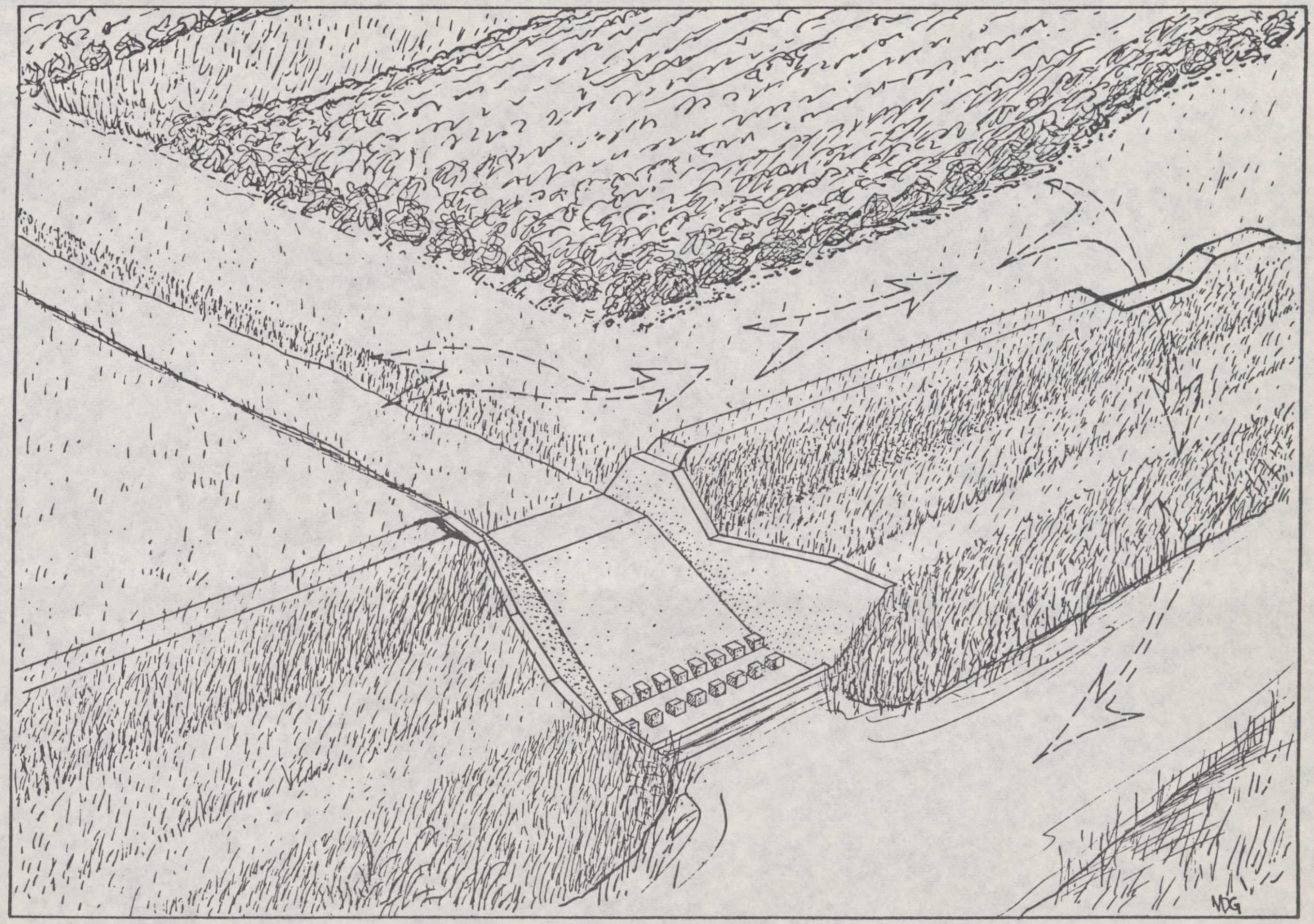


Figure 3A

FORMLESS CONCRETE CHUTE SPILLWAY

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE

USDA-SCS-FORT WORTH, TEX. 1967

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
POST OFFICE BOX 1306
ALBUQUERQUE, NEW MEXICO 87103

April 24, 1968

Mr. H. N. Smith, State Conservationist
Soil Conservation Service
P. O. Box 648
Temple, Texas 76502

Dear Mr. Smith:

The Bureau of Sport Fisheries and Wildlife in cooperation with the Texas Parks and Wildlife Department has completed a reconnaissance study of Pond Creek Watershed in Bell, Falls, and Milam Counties, Texas. The project is sponsored by the Central Texas Soil and Water Conservation District, the Pond Creek Water Control and improvement District, the Falls County Commissioners Court, and the Milam County Commissioners Court, in cooperation with your Service under the authority of the Watershed Protection and Flood Prevention Act, (68 Stat. 666, as amended, 16 U.S.C. 1008).

This report has been prepared in accordance with the provisions of Section 12 of the above Act. It has been concurred in by the Texas Parks and Wildlife Department as indicated by the enclosed copy of a letter dated February 28, 1968, signed by Executive Director J. R. Singleton.

Pond Creek Watershed comprises 146,000 acres in portions of Falls, Milam, and Bell Counties in Central Texas. Approximately 47 percent of the watershed lies in the Blackland Prairie Land Resource Area, 46 percent lies in the Texas Claypan Land Resource Area, and the remaining 7 percent is in the Southern Coastal Plains Land Resource Area. The watershed topography is slightly rolling in the upper portion, gently sloping in most areas on the northeast side of Pond Creek, and moderately rolling on the southwest side of Pond Creek and in the lower portion.

Pond Creek rises about 2 miles west of the town of Belfalls on the Bell-Falls County line and flows southeasterly about 30 miles to its confluence with the Brazos River. Its principal tributaries are Little Pond, Cottonwood, Briary, and Hog Creeks. The lower portion of Pond Creek has a permanent flow, but its tributaries are intermittent.

The upland areas of the watershed comprise about 130,000 acres. The floodplains include about 16,000 acres. About 46 percent of the upland and floodplain areas are in cultivation for cotton, corn, grain sorghums, oats, clover, and hay. The remaining 54 percent of the watershed is in pasture and miscellaneous land uses.

The natural vegetation in the watershed consists of bunch and short grasses with scattered mesquite, oak trees, and cacti. Elm, hackberry, and pecan trees predominate along the stream bottoms.

The average annual rainfall in the watershed is 35 inches. The heaviest rainfall usually occurs in April, May, and September producing flooding, rapid runoff, and subsequent soil erosion. Damaging floods occur on an average of at least once per year in the watershed.

The primary needs of the watershed are the application of additional land treatment measures on the uplands and control of floods on the bottomlands. Land treatment measures proposed include conservation cropping systems, contour farming, critical area treatment, crop residue use, diversions, farm ponds, grasses waterways, land clearing, pasture management, pasture renovation, pasture planting, terraces (gradient), terraces (parallel), and land adequately protected. In addition, the installation of 25 floodwater retarding structures is planned to control about 35 percent of the runoff in the watershed. Twenty-five miles of stream channel improvement and the construction of 34 grade stabilization structures also are being considered.

Fish habitat occurs in the lower reach of Pond Creek and in Rosebud Lake near the town of Rosebud. An artesian well just below Rosebud Lake Dam produces a constant flow of highly mineralized hot water in excess of 130° F. that enters Pond Creek a short distance away. Hot water-caused fish kills have occurred in Pond Creek from where the water enters the stream to about U. S. Highway No. 77, a distance of about 2.5 miles.

Sport fishing in Pond Creek is principally for catfishes and sunfishes. There is fishing for largemouth bass, sunfishes, channel catfish, flathead catfish, freshwater drum, buffalofishes, and carp in Rosebud Lake.

There is some commercial fishing with set lines in Rosebud Lake for freshwater drum, buffalofishes, and carp. About 300 pounds are harvested annually.

With the project, the construction of 25 floodwater retarding structures would increase sport fishing opportunities in the watershed. However, the structures would be on private lands and public access to these structures necessarily would be by landowner's permission.

Commercial fishing would not be expected to increase with the project.

Most of the watershed is in the Blackland Prairie Game Region. Only a small part of the downstream portion is in the Post Oak Belt Game Region.

Wildlife cover is scarce because of intensive agricultural and human activity. Most of the cover is confined to stream bottoms although there are a few scattered islands of trees and shrubs in the upland areas.

Wildlife species in the watershed include white-tailed deer, bobwhite, mourning dove, fox squirrel, raccoon, opossum, and waterfowl.

About 100 white-tailed deer have become established in the northern part of the watershed between the communities of Belfalls and Durango following the introduction of a few animals as breeding stock. No deer hunting is now permitted in the watershed.

Bobwhites and mourning doves occur throughtout the watershed and are hunted heavily. A few fox squirrels occur in the sparsely timbered creek bottoms. There is little hunting for these animals.

Waterfowl populations are small in the watershed and they are found primarily on farm ponds and Rosebud Lake. Little hunting is done for them.

Raccoon and opossum populations are small. Trapping for these animals is insignificant. They are sport hunted with dogs by a few hunters.

Most of the hunting in the watershed is done by landowners and their friends. A few landowners lease hunting privileges for mourning doves.

Future populations of wildlife in the watershed would be expected to be about the same as they are now except that deer would extend their range and increase slightly in numbers.

With the project, proposed land treatment measures such as cover cropping, proper use, pasture planting, and waterway development would be beneficial for upland game. Flood protection below the proposed structures would improve the habitat for ground-nesting wildlife. The sediment pools of the floodwater retarding structures would provide watering places for wildlife and resting areas for migrating waterfowl.

Land clearing for the floodwater retarding structures would remove some wildlife habitat. Stream channel improvement would destroy some bottom vegetation valuable to wildlife.

There are measures that should be implemented in the project plans to improve fish habitat in the floodwater retarding structures and reduce the loss of some wildlife habitat.

To promote fertility and reduce turbidity, the basins of the floodwater retarding reservoirs and barren areas draining into the reservoirs should be disked and planted to grasses or suitable small grain adaptable to the area prior to impoundment. When practicable, the floodwater retarding reservoirs should be fenced to prevent damage to the dams and muddying of the water by livestock. If required, watering devices should be installed below the dams and outside of the enclosed reservoir areas.

To prevent unbalanced fish populations due to indiscriminate fish stocking, the Texas Parks and Wildlife Department should be consulted regarding proper stocking. If channel catfish are approved for stocking, spawning devices should be installed. Sewer tiles, barrels, and old tires have been used successfully as channel catfish spawning devices.

During the construction phase of the project as much brush and timber as possible should be retained. Trees and shrubs should be left on the inside curve of the stream meanders. This practice would help prevent bank erosion and resultant siltation and also would preserve wildlife habitat. Trees and shrubs useful to wildlife as food and cover should be planted on idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

In view of the above, it is recommended that:

1. Basins of floodwater retarding reservoirs and the barren areas draining into them be planted to grasses or small grains adaptable to the area upon completion of construction and prior to water storage.

2. When practicable, floodwater retarding reservoirs be fenced and watering devices be installed below the dams and outside of the enclosed reservoir areas.

3. Floodwater retarding reservoirs be stocked with fish as recommended by the Texas Parks and Wildlife Department.

4. Spawning devices be installed in floodwater retarding reservoirs approved for channel catfish stocking.

5. Trees and shrubs be retained on the inside curve of stream meanders in the process of stream channel improvement.

6. Shrubs and trees useful to wildlife as food and cover be planted at appropriate locations such as idle lands, eroded areas, stream banks, gullies, and along fencerows and hedgerows.

The above recommendations are in conformance with U.S.D.A. Soil Conservation Service Biology Memorandum-7 (Rev. 1), National Standards for Biology Practices. If adopted as a part of the plan of development, losses of wildlife habitat would be mitigated and fish and wildlife benefits would accrue to the project.

A detailed study of the watershed by the Bureau of Sport Fisheries and Wildlife is not deemed necessary at this time. Should the sponsors desire, our Bureau in cooperation with the Texas Parks and Wildlife Department, would be happy to be of further assistance.

Thank you for your cooperation in providing project information.

Sincerely yours,

William T. Krummes
Regional Director

Enclosure

Copies (7)

Distribution:

(5) Executive Director, Texas Parks and Wildlife Department, Austin, Texas
(1) President, Texas State Soil Conservation Board, Temple, Texas
(1) Chairman, Pond Creek Watershed Control and Improvement District, Rosebud, Texas
(1) Chairman, The Central Texas Soil and Water Conservation Districts, Rosebud, Texas
(1) County Judge, Falls County Commissioners Court, Lott, Texas

(1) County Judge, Milam County Commissioners Court, Cameron, Texas
(1) Regional Coordinator, USDI, Southwest Region, Muskogee, Oklahoma
(1) Area Director, Bureau of Mines, Area 4, Bartlesville, Oklahoma
(1) Regional Biologist, Soil Conservation Service, Fort Worth, Texas
(2) Regional Director, Bureau of Outdoor Recreation, Mid-Continent Region, Denver, Colorado
(2) Regional Director, FWPCA, South Central Region, Dallas, Texas
(2) Field Supervisor, BSFW, Division of River Basin Studies, Fort Worth, Texas

TEXAS
PARKS AND WILDLIFE DEPARTMENT

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JOHN H. REAGAN BUILDING
AUSTIN, TEXAS 78701

February 28, 1968

Mr. Lewis R. Garlick
Assistant Regional Director
Bureau of Sport Fisheries and Wildlife
P. O. Box 1306
Albuquerque, New Mexico

Dear Mr. Garlick:

This is in response to your letter of February 21, 1968, and the attached review draft of a report concerning the Soil Conservation Service's proposed Pond Creek Watershed, Texas.

We have reviewed this draft and concur with the report as presented.

Yours sincerely,

J. R. Singleton

J. R. Singleton
Executive Director

JRS:KCJ:pw

cc: Mr. John Degani, Division of River Basin Studies, Fort Worth

WATERSHED WORK PLAN

POND CREEK WATERSHED
Bell, Falls, and Milam Counties, Texas

ADDENDUM

This Addendum shows the project costs, benefits, and benefit-cost ratio based on a 5-1/8 percent interest rate.

Annual project costs, benefits, and benefit-cost ratio are as follows:

1.	Project costs are	$ 153,071
2.	Project benefits are	212,836
3.	The project benefit-cost ratio is	1.4 to 1

Since the preparation of this watershed work plan, the Federal interest rate for benefit and cost evaluations has been increased from 4.625 percent to 4.875 percent.

As a result, annual equivalent costs for the installation of these structural measures will increase from $127,502 to $134,073. The total average annual cost of structural measures (amortized total installation cost, plus operation, maintenance, and other economic costs) will be increased to $150,236. Average annual benefits, excluding secondary benefits, accruing to structural measures will change to $193,918, resulting in a benefit-cost ratio of 1.3 to 1.0.

Total average annual project benefits, including secondary benefits, will change to $213,321, resulting in a benefit-cost ratio of 1.4 to 1.0.