

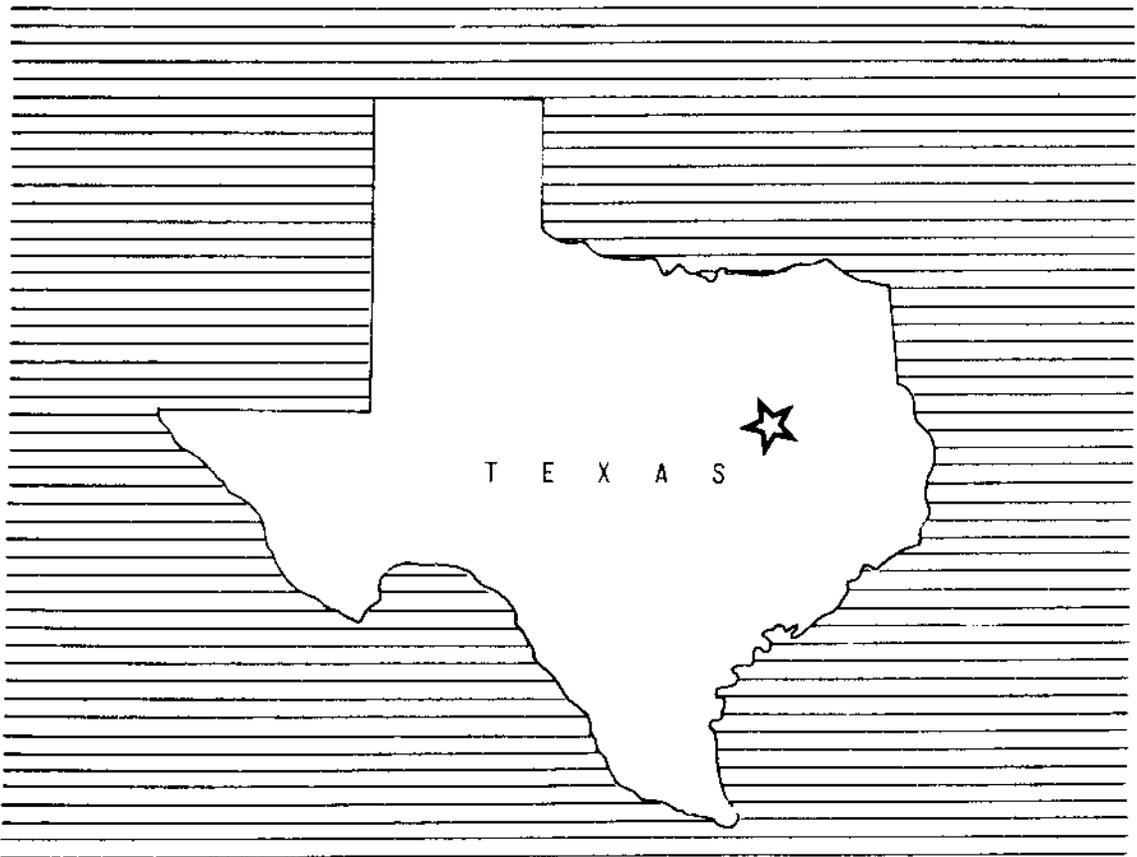
SUPPLEMENTAL  
WORK PLAN No. III

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

**TEHUACANA CREEK**

**WATERSHED**

MCLENNAN, HILL AND LIMESTONE COUNTIES, TEXAS



September 1973

SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NUMBER III

Between the

McLennan County Soil and Water Conservation District  
Local Organization

Hill County-Blackland Soil and Water Conservation District  
Local Organization

Limestone-Falls Soil and Water Conservation District  
Local Organization

McLennan and Hill Counties Tehuacana Creek Water Control and  
Improvement District No. 1  
Local Organization

McLennan County Commissioners Court  
Local Organization

Hill 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, the Watershed Work Plan Agreement for Tehuacana Creek Watershed, State of Texas, executed by the Sponsoring Local Organizations named therein and the Service, became effective on the second day of September, 1959; and

Whereas, the Supplemental Watershed Work Plan Agreement Number I executed by the Sponsoring Local organizations named herein and the Service, became effective on the 18th day of March, 1960; and

Whereas, the Supplemental Watershed Work Plan Agreement Number II executed by the Sponsoring Local Organizations named herein and the Service became effective on the 30th day of August, 1971; and

Whereas, in order to carry out the Watershed Work Plan, as supplemented, for said watershed, it has become necessary to modify said Watershed Work Plan Agreement, as supplemented; and

Whereas, it has become necessary to modify the Watershed Work Plan, as supplemented, by deleting Floodwater Retarding Structures Nos. 3, 3A, 4, 5, and 27, adding

Floodwater Retarding Structure No. 5A, adding 32 grade stabilization structures, and modifying the work plan to reflect the effects of a reservoir installed on Trading House Creek by the Texas Power & Light Co.; and

Whereas, it has become necessary to modify the Watershed Work Plan, as supplemented, to reflect current policy and terminology relative to engineering and project administrative costs; and

Whereas, a Supplemental Watershed Work Plan No. III, which modifies the Watershed Work Plan dated November 1958, as supplemented, for said watershed, has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service, which plan is annexed to and made a part of this agreement;

Now, therefore, the Sponsoring Local Organization and the Service hereby agree upon the following modifications of the terms, conditions, and stipulations of said Watershed Work Plan Agreement, as supplemented:

1. The sponsoring local organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	35.90	64.10	5,010

2. Paragraph numbered 3 in the Watershed Work Plan Agreement is modified to read as follows:

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

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
27 Floodwater Retarding Structures	0	100	2,210,000
11.7 miles of Stream Channel Improvement	0	100	760,900
32 Grade Stabilization Structures	0	100	195,500

3. Paragraph numbered 4 in the Watershed Work Plan Agreement is modified to read as follows:

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

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
27 Floodwater Retarding Structures	0	100	205,980
11.7 miles of Stream Channel Improvement	0	100	63,500
Grade Stabilization Structures	0	100	27,340

4. Paragraph numbered 5 in the Watershed Work Plan Agreement is modified to read as follows:

The Sponsoring Local Organization and the Service will each bear the costs of project administration which it incurs, estimated to be \$16,100 and \$750,320, respectively.

5. The Sponsoring Local Organization and the Service further agree to all other terms, conditions, and stipulations of said Watershed Work Plan Agreement, as supplemented, not modified herein.

McLennan County Soil and Water Conservation District  
Local Organization

By David Simmons

Title Chairman

Address Rt. 6, Box 175, Waco, TX 76706  
Zip Code

Date December 11, 1973

The signing of this agreement was authorized by a resolution of the governing body of the McLennan County Soil and Water Conservation District  
Local Organization  
adopted at a meeting held on December 11, 1973

Rene Kompton  
(Secretary, Local Organization)

Address 1711 Rambler Dr., Waco, TX 76710  
Zip Code

Date December 11, 1973

Hill County-Blackland Soil and Water Conservation District  
Local Organization

By Ray Damm

Title Chairman

Address Rt. 1, Hillsboro, TX 76645  
Zip Code

Date December 3, 1973

The signing of this agreement was authorized by a resolution of the governing body of the Hill County-Blackland Soil and Water Conservation District  
Local Organization  
adopted at a meeting held on December 3, 1973

Clayton F. Brown  
(Secretary, Local Organization)

Address Rt. 1, Bynum, TX 76631  
Zip Code

Date December 3, 1973

Limestone-Falls Soil and Water Conservation District  
Local Organization

By *[Signature]*

Title Chairman

Address 501 E. Farrow St., Groesbeck, TX 76642

Date \_\_\_\_\_ Zip Code \_\_\_\_\_

Date December 19, 1973

The signing of this agreement was authorized by a resolution of the governing body of the Limestone-Falls Soil and Water Conservation District Local Organization

adopted at a meeting held on December 19, 1973

*[Signature]*  
(Secretary, Local Organization)

Address Thornton, TX 76687 Zip Code \_\_\_\_\_

Date December 19, 1973

McLennan and Hill Counties Tehuacana Creek Water Control and Improvement District No. 1  
Local Organization

By *[Signature]*

Title President

Address 5024 Lake Highlands, Waco, TX 76710

Date December 4, 1973

The signing of this agreement was authorized by a resolution of the governing body of the McLennan and Hill Counties Tehuacana Creek Water Control and Improvement District No. 1 Local Organization

adopted at a meeting held on December 4, 1973

*[Signature]*  
(Secretary, Local Organization)

Address P. O. Box 1488, Waco, TX 76703 Zip Code \_\_\_\_\_

Date December 4, 1973

McLennan County Commissioners Court  
Local Organization

By *D. L. Thomas*

Title County Judge

Address Courthouse, Waco, TX 76701  
Zip Code

Date December 12, 1973

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

Local Organization

adopted at a meeting held on December 12, 1973

FRANK DENNY, County Clerk  
(Secretary, Local Organization)

By *Marianne J. Berkeley, deputy*

Address P. O. Box 1727, Waco, TX 76703  
Zip Code

Date December 12, 1973

Hill County Commissioners Court

Local Organization

By *Paul R. Subank*

Title County Judge

Address Box 457, Hillsboro, TX 76645  
Zip Code

Date December 10, 1973

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

Local Organization

adopted at a meeting held on December 10, 1973

*Glen Morgan*  
(Secretary, Local Organization)

Address Box 398, Hillsboro, TX 76645

Date December 10, 1973

Soil Conservation Service  
United States Department of Agriculture

By *John A. Aron*

State Conservationis ~~Noting~~

Date January 4, 1974

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SUPPLEMENTAL

WATERSHED WORK PLAN NO. III

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

TEHUACANA CREEK WATERSHED

McLennan, Hill, and Limestone 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:

McLennan County Soil and Water Conservation District

Hill County-Blackland Soil and Water Conservation District

Limestone-Falls Soil and Water Conservation District

McLennan and Hill Counties Tehuacana Creek  
Water Control and Improvement District No. 1

McLennan County Commissioners Court

Hill County Commissioners Court

With Assistance By:

U. S. Department of Agriculture  
Soil Conservation Service  
September 1973

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SUPPLEMENTAL  
WATERSHED WORK PLAN NO. III

TEHUACANA CREEK WATERSHED  
McLennan, Hill, and Limestone Counties, Texas  
June 1973

PURPOSE OF THE SUPPLEMENTAL WORK PLAN

It has become necessary to modify the watershed work plan, as supplemented, for Tehuacana Creek watershed to make the following changes:

1. Delete floodwater retarding structures Nos. 3, 3A, 4, and 5, and add floodwater retarding structure No. 5A. Since the completion of the work plan, State Farm Road 2114 has been constructed in the detention pool of floodwater retarding structure No. 5. It would require extensive modification of the road in order to install the structure as planned. At the time of work plan development extensive obstacles and improvements were located within the area of floodwater retarding structure No. 4 which precluded the developing of needed detention capacity for the total drainage area at a cost which would be economically feasible. Floodwater retarding structures Nos. 3 and 3A in series with No. 4 were then planned as the least costly alternative of providing needed control. Recently most of the obstacles and improvements in the area of floodwater retarding structure No. 4 have been removed or abandoned. Under conditions that now exist, the most feasible alternative is the installation of one floodwater retarding structure (No. 5A) at the location of No. 4 with appropriate design features to control the runoff from the drainage areas of floodwater retarding structures Nos. 3, 3A, 4, and 5 plus an additional 0.68 square mile of drainage area previously uncontrolled (see Figure 4, Project Map). The current estimated installation cost of both Public Law 566 and other funds will be appreciably less than that of the floodwater retarding structures deleted.
2. Delete floodwater retarding structure No. 27 from the plan. The work plan provides for modifying Mart Lake into a multiple-purpose structure by adding detention storage. The installation of the Trading House Creek reservoir by the Texas Power & Light Co. has eliminated the need for a floodwater retarding structure at this location.
3. Add 32 grade stabilization structures to the work plan. The original work plan included plans for installing 29 grade stabilization measures with other than Public Law 566 funds. However, installation of these measures is not being accomplished due to the excessive costs to the small landowners. The treatment of these critical sediment source areas above floodwater retarding structures has not progressed as rapidly as is needed to permit the steady and continuing progress desired in connection with installation of the

remaining structural measures. The installation of needed grade stabilization measures is essential to the proper functioning of the floodwater retarding structures and the completion of a successful project, as well as the application of needed land treatment measures with a stable outlet system.

The work plan is also modified to reflect the effects of the installation of the reservoir on Trading House Creek, a tributary of Tehuacana Creek, by the Texas Power & Light Co. This necessitated the modification of floodwater retarding structure No. 29, which has been constructed.

In order to simplify cost-sharing arrangements, it is necessary to modify the watershed work plan, as supplemented, to reflect current terminology relative to engineering and project administration costs. Cost of all structural measures not constructed and for technical assistance for installation of planned land treatment measures are updated to 1972 price levels to reflect current cost estimates and reaffirm economic feasibility. Also, all damages and benefits were updated from long-term prices as projected by USDA, ARS-AMS, September 1957, to adjusted normalized prices, "Interim Price Standards for Planning and Evaluating Water and Land Resources," Water Resources Council, April 1966.

The following are changes and modifications made in appropriate parts of the work plan, as supplemented.

#### Projects of Other Agencies

Texas Power & Light Co. has constructed a reservoir on Trading House Creek, a tributary of Tehuacana Creek. The reservoir is used in producing electricity. This reservoir inundated about 754 acres of flood plain and required modification of outlet works for floodwater retarding structure No. 29, which has been constructed.

The Service worked with the power company in developing an operation plan for the service spillway gates. The plan of operation provides that a 3- by 4-foot gated conduit having a capacity of about 447 c.f.s. will be opened when the reservoir stage exceeds elevation 447.0 and that the service spillway gates will not be opened until the reservoir stage reaches elevation 447.5. The operation plan, in conjunction with constructed floodwater retarding structures Nos. 25, 26, 28, and 29, will provide detention capacity for about 1.6 inches of runoff from the drainage area below the floodwater retarding structures.

#### Works of Improvement To Be Installed

The supplemental watershed work plan agreement provides for the substitution of floodwater retarding structure No. 5A for floodwater retarding structures Nos. 3, 3A, 4, and 5, the deletion of floodwater retarding structure No. 27, and the addition of 32 grade stabilization structures.

Floodwater retarding structure No. 5A will be located across Brookeen and Brushy Creeks just above State Farm Road 308. The total drainage area of

the structure is 24.37 square miles. This is the same area that would have been controlled by the four structures being deleted plus .68 square mile of drainage area. The total storage capacity in the floodwater retarding structure will be 7,865 acre-feet, consisting of 2,280 acre-feet for sediment and 5,585 acre-feet for floodwater. A combination of principal spillway capacity and retarding storage will assure that the emergency spillway will have less than 4 percent chance of use at the end of its design life. A principal spillway will be constructed in each arm of the reservoir to facilitate a more economical and feasible design. One will be installed on the Brookeen Creek arm and one will be installed on the Brushy Creek arm. The principal spillways will be the drop inlet type with a cantilever outlet. The elevation of the crest will be at the elevation of the 50-year submerged sediment capacity. The principal spillways will be ported at the 200 acre-foot capacity.

Thirty-two grade stabilization structures will be installed with Public Law 566 funds in order that farm operators can install needed land treatment measures on their land. Twenty-seven of the structures will be the earth dam type and five will be concrete drop structures. Three of the five concrete structures will be the chute type and two will be the straight drop type. The earth dam type structures will have a drop inlet type principal spillway and a vegetated emergency spillway. All structures are designed to pass the 100-year frequency storm without overtopping. The elevation of the crest of the earth dam principal spillways and concrete structures was set at the top of the overfall or on a projected non-silting grade for the channel.

Site 5A and all of the grade stabilization structures are located on the soft shale bedrock of the Ozan Formation (lower Taylor marl). The foundation and principal spillways will be on yielding alluvial clay and residual clay soils which have developed from the soft shale bedrock. The borrow materials are dominantly clay (CL and CH) with high shrink-swell characteristics.

The installation of floodwater retarding structure No. 5A will require that one county road be closed and a portion of a powerline and telephone line be abandoned.

The installation of floodwater retarding structure No. 5A will result in the apparent displacement of one tenant and contents of several barns. No other displacements or relocations are apparent. However, if other relocations become necessary, relocation payments will be cost-shared in accordance with the established percentage.

All applicable state water laws will be complied with in the design and construction of the structural measures as well as those pertaining to storage, maintenance of quality, and use of water. All state and local health requirements will be complied with in the installation, operation, and maintenance of the structures.

### Explanation of Installation Costs

The total installation cost of structural measures as revised is estimated to be \$5,046,410. The Public Law 566 cost will be \$4,216,750, and the local cost will be \$829,660.

The local cost consists of \$811,760 for land rights, \$1,800 for relocation payments, and \$16,100 for project administration. The local cost for project administration includes sponsors' costs relative to contract administration, overhead and organizational costs, whatever construction inspection they desire to make at their own expense, and all relocation advisory assistance costs. Land rights costs consist of legal fees, land surveys, value of easements, and modification of fixed improvements.

Public Law 566 project administration costs consist of construction inspection, maintenance of records and accounts, contract administration, and assistance in providing relocation.

Engineering services costs consist of, but are not limited to, detailed surveys, geologic investigations, laboratory analyses, reports, designs, and cartographic services.

The total cost for apparent eligible relocation payments resulting from dislocations indicated under "Works of Improvement To Be Installed" are estimated to be \$5,010. The share of the costs to be borne by Public Law 566 funds will be 64.1 percent and the share to be borne by other funds will be 35.9 percent, and are based on the ratio of Public Law 566 funds and other funds to the total project costs less relocation payments as shown on table 1 of the original work plan.

### Effects of Works of Improvement

The installation of the grade stabilization structure will provide outlets for waterways and terrace systems and will enable farm operators to apply and maintain needed land treatment measures on about 4,396 acres in the drainage area above them. This will result in a more stable income for those operators and will conserve these lands for the use of future generations.

The installation of these structures and the needed land treatment measures will also assure proper functioning of the floodwater retarding structures by reducing the amount of sediment delivered to the reservoirs.

The effects of installation of the project were re-evaluated, under without and with project conditions, considering the Texas Power & Light Co. reservoir installed on Trading House Creek. The reservoir inundated about 754 acres of flood plain in evaluation reach A and would have reduced flood damages downstream on Trading House Creek by about 8 percent if it had been installed before the watershed project was installed. The reservoir would not have affected the without project conditions in evaluation reach C because of the relatively large channel capacities and the small amount of floodwater storage provided in the reservoir. The following tabulation shows the pertinent data concerning the benefited flood plain:

Item	Evaluation Reach (Figure 1)					Total
	A1/	B	C	D	E2/	
<u>Average Annual Area Flooded</u>						
Without Project (acres)	1,473	3,354	8,120	6,489	8,028	27,464
With Project (acres)	603	880	571	932	2,461	5,447
Percent Reduction	59	74	93	86	69	80
<u>Acres Flooded By Largest Storm</u>						
Without Project (acres)	967	2,352	4,012	2,950	5,215	15,496
With Project (acres)	645	1,123	2,420	1,572	2,900	8,660
Percent Reduction	33	52	40	47	44	44
<u>Average Annual Damages<sup>3/</sup></u>						
Without Project (dollars)	27,032	44,641	141,505	60,823	133,945	407,946
With Project (dollars)	6,155	6,731	6,270	4,742	25,935	49,833
Percent Reduction	77	85	96	92	81	88

1/ Excludes 754 acres inundated by Trading House Creek reservoir.

2/ Excludes 30 acres of flood plain that will be inundated by floodwater retarding structure No. 5A.

3/ Does not include land depreciation damage.

### Project Benefits

The estimated average annual monetary damage (table 5) will be reduced from \$494,560 to \$49,833, or 90 percent. Crop and pasture damages will be reduced from \$239,853 to 29,065, or 88 percent. Other agricultural damage, such as loss of fences, farming equipment, livestock, and other property, will be reduced from \$20,094 to \$1,313, or 93 percent. Road and bridge damage will be reduced from \$44,131 to \$3,558, or 92 percent. The overbank deposition of damaging sediment on flood plain soils, now occurring at the rate of \$55,729 annually, will be reduced to \$10,230, or 82 percent. Flood plain scour damages will be reduced from \$11,053 to \$1,136, or 90 percent.

Damage reduction benefits by type for each evaluation reach are indicated in the following table:

Benefits from Reduction in Damage<sup>1/</sup>

Type of Damage	Evaluation Reach					
	A		B		C	
	Total : Project : (dollars)	Structural : Measures : (dollars)	Total : Project : (dollars)	Structural : Measures : (dollars)	Total : Project : (dollars)	Structural : Measures : (dollars)
Crop and Pasture	12,338	11,612	19,844	18,452	97,676	90,313
Other Agricultural	1,002	816	4,195	3,691	1,996	1,765
Non-Agricultural	1,896	1,650	4,993	4,380	5,479	4,842
Overbank Deposition	3,190	2,179	4,184	2,456	15,060	9,988
Flood Plain Scour	553	377	1,248	1,080	2,730	2,429
Indirect	1,898	1,663	3,446	3,006	12,294	10,934
<b>Total</b>	<b>20,877</b>	<b>18,297</b>	<b>37,910</b>	<b>33,065</b>	<b>135,235</b>	<b>120,271</b>
Percent of Damage Reduction by Structural Measures		87.64		87.22		88.93
Percent of Damage Reduction by Land Treatment Measures		12.36		12.78		11.07

(See footnote at end of table)

Benefits from Reduction in Damage<sup>1/</sup> - continued

Type of Damage	Evaluation Reach				Total - All Reaches	
	D		E		Total	Structural
	Structural	Measures	Structural	Measures	Project	Project
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Crop and Pasture	28,710	26,779	52,220	46,814	210,788	193,970
Other Agricultural	6,109	5,438	5,479	4,601	18,781	16,311
Non-Agricultural	8,504	7,609	19,701	17,398	40,573	35,879
Overbank Deposition	6,142	3,928	16,923	9,927	45,499	28,478
Flood Plain Scour	1,518	1,346	3,868	3,306	9,917	8,538
Indirect	5,098	4,510	9,819	8,204	32,555	28,317
<b>Total</b>	<b>56,081</b>	<b>49,610</b>	<b>108,010</b>	<b>90,250</b>	<b>358,113</b>	<b>311,493</b>
Percent of Damage Reduction by Structural Measures		88.46		83.56		86.98
Percent of Damage Reduction by Land Treatment Measures		11.54		16.44		13.02

<sup>1/</sup> Does not include land depreciation damage.

Future damages having a present equivalent value of \$78,740 annually from land depreciation above planned grade stabilization structures will be prevented.

Although not considered pertinent from a national viewpoint, secondary benefits will amount to \$39,258 annually in the immediate locale, excluding indirect benefits in any form.

#### Project Installation

The McLennan and Hill Counties Tehuacana Creek Water Control and Improvement District No. 1 has the right of eminent domain under applicable state laws and will obtain the necessary land rights for all of the structural measures.

The WCID has assumed responsibility for providing relocation advisory assistance services and relocation costs and through its own facilities and staff will: (1) Provide personally, or by first class mail, written notice of displacement and appropriate application forms to each displaced person or business; (2) give displaced persons notice to vacate at least 90 days prior to the date they must move; (3) assist in filing applications; (4) review and approve application for relocation assistance; (5) review and process grievances in connection with displacements; and (6) make relocation payments.

The WCID, having responsibility for furnishing relocation advisory assistance services, will provide such measures, facilities, or services as may be necessary or appropriate in order to: (1) Determine the need, if any, of displaced persons for relocation assistance; (2) provide current and continuing information on the availability, prices, and rentals of comparable decent, safe, and sanitary sale and rental housing, and of comparable commercial properties and locations for displaced businesses and farm operations; (3) assure that within a reasonable period of time prior to displacement replacement dwellings will be available; (4) assist a person displaced from his business or farm operation in obtaining and becoming established in a suitable replacement location; (5) supply information concerning housing programs, disaster loan programs, and other federal and state programs offering assistance to displaced persons; (6) provide other advisory services to displaced persons in order to minimize hardships to such persons in adjusting to relocation; (7) advise displaced persons that they should notify the displacing agency before they move; and (8) prior to initiation of acquisition, provide persons from whom it is planned to acquire land a brochure or pamphlet outlining the benefits to which they may be entitled.

Construction of any floodwater retarding structure causing a displacement will not be initiated until decent, safe, and sanitary replacement housing is available for all displaced persons.

#### Provisions for Operation and Maintenance

The McLennan and Hill Counties Tehuacana Creek Water Control and Improvement District No. 1 will be responsible for operation and maintenance of the grade stabilization structures and floodwater retarding structure No. 5A in accordance with the provisions of a separate operation and maintenance agreement.

The structures will be inspected annually or after each heavy rain or streamflow. Items of inspection and maintenance will include, but will not be limited to, principal spillways, earth fills, emergency spillways, vegetative cover, fences, gates, and other appurtenances. The estimated average annual operation, maintenance, and replacement cost of the grade stabilization structures and floodwater retarding structure No. 5A is \$3,160 and \$300, respectively. The \$3,160 includes \$1,560 for replacement of corrugated metal pipes which will require replacement before the end of the 50-year evaluation period.

The necessary maintenance work will be accomplished through the use of contributed labor and equipment, by contract, by force account, or by a combination of these measures.

REVISED TABLE 1 - ESTIMATED PROJECT INSTALLATION COST  
Tehuacana Creek Watershed, Texas

Installation Cost Item	Unit	Number		Estimated Cost (Dollars) 1/				Total
		Federal Land	Non-Federal Land	PL-566 Funds	Non-Federal Land SCS2/	Non-Federal Land SCS2/	Other	
LAND TREATMENT				138,744		1,530,834		1,669,578
<b>STRUCTURAL MEASURES</b>								
<b>Construction</b>								
Floodwater Retarding Structures	No.	27		2,210,000				2,210,000
Grade Stabilization Structures	No.	32		195,500				195,500
Channel Work (N) (1) 2/	Ft.	61,780		760,900				760,900
Subtotal - Construction				3,166,400				3,166,400
<b>Engineering Services</b>								
Floodwater Retarding Structures	No.	27		205,980				205,980
Grade Stabilization Structures	No.	32		27,340				27,340
Channel work	Ft.	61,780		63,500				63,500
Subtotal - Engineering				296,820				296,820
Relocation Payments				3,210		1,800		5,010
<b>Project Administration</b>								
Construction Inspection				392,140		3,100		395,240
Other				358,180		12,500		370,680
Relocation Advisory Assistance Services						500		500
<b>Other Costs</b>								
Land Rights						811,760		811,760
Subtotal - Other						811,760		811,760
<b>TOTAL STRUCTURAL MEASURES</b>				4,216,750		829,660		5,046,410
<b>TOTAL PROJECT</b>				4,355,494		2,360,494		6,715,988

1/ Price Base: Actual costs for 23 floodwater retarding structures (1, 1A, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, and 29) already constructed or under contract; floodwater retarding structures 2, 5A, 9, and 13, all grade stabilization structures, and channel work at 1972 prices.

2/ Type of channel before project:

(N) - An unmodified well-defined natural channel or stream with intermittent flow conditions

(I) - Intermittent - continuous flow through some seasons of the year but little or no flow through other seasons

REVISED TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Tehuacana Creek Watershed, Texas  
(Dollars)<sup>1/</sup>

Item	Installation Cost - Public Law 566 Funds			Installation Cost - Other Funds			Total Installation Cost
	Construction	Engineering	Relocation	Land Rights	Payments	Other	
Floodwater Retarding Structures (Constructed) Nos. 1, 1A, 6, 7, 8, 10, 3/ 11, 12, 14 thru 26, 28, 29 <sup>3/</sup>	1,683,460	176,070	-	494,500	-	494,500	2,353,970
Floodwater Retarding Structures	96,900	6,170	-	15,500	-	15,500	118,570
5A	204,800	10,240	3,210	127,700	1,800	129,500	347,750
9	115,300	6,920	-	49,500	-	49,500	171,720
15	109,600	6,580	-	43,700	-	43,700	159,880
Subtotal - Floodwater Retarding Structures	2,210,000	205,980	3,210	730,900	1,800	732,700	3,151,890
Channel Work	760,900	63,500	-	58,400	-	58,400	882,800
Grade Stabilization Structures	5,300	740	-	6,040	-	690	6,730
2-1	12,200	1,710	-	13,910	-	2,850	16,760
5-1	4,500	630	-	5,130	-	390	5,520
5-2	4,300	600	-	4,900	-	340	5,240
5-3	8,400	1,180	-	9,580	-	950	10,530
5-4	3,700	520	-	4,220	-	140	4,360
5-5	3,400	480	-	3,880	-	400	4,280
5-6	4,100	570	-	4,670	-	270	4,940
5-7	5,100	710	-	5,810	-	730	6,540
5-8	3,100	430	-	3,530	-	970	4,500
5-9	8,200	1,150	-	9,350	-	470	9,820
6-1	9,100	1,270	-	10,370	-	280	10,650
6-2	7,600	1,060	-	8,660	-	500	9,160
7-1	7,500	1,050	-	8,550	-	1,720	10,270
9-1	6,000	840	-	6,840	-	170	7,010
9-2	4,800	670	-	5,470	-	330	5,800
9-3	6,500	880	-	7,180	-	630	7,810
9-4	3,600	500	-	4,100	-	280	4,380
9-5	6,400	900	-	7,300	-	190	7,490
9-6	9,300	1,300	-	10,600	-	490	11,090
9-7	8,100	1,130	-	9,230	-	280	9,510
9-8	4,000	560	-	4,560	-	350	4,910

(See footnotes at end of table)

REVISED TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION - continued  
 Tarrant County Watershed, Texas  
 (Dollars)<sup>1/</sup>

Item	Installation Cost - Public Law 566 Funds			Installation Cost - Other Funds		
	Construction	Engineering	Relocation	Construction	Engineering	Relocation
			Payments			Payments
			2/			2/
			566			Other
			Total			Total
			Public Law			Installation
			566			Cost
*Grade Stabilization Structures - continued						
13-1	9,100	1,270	-	10,370	380	10,750
13-2	6,600	920	-	7,520	280	7,800
13-3	4,000	560	-	4,560	260	4,820
13-4	3,300	460	-	3,760	120	3,880
13-5	3,600	500	-	4,100	200	4,300
101	5,700	800	-	6,500	2,380	8,880
102	5,700	800	-	6,500	310	6,810
103	11,000	1,540	-	12,540	3,120	15,660
104	5,500	770	-	6,270	580	6,850
105	6,000	840	-	6,840	1,410	8,250
Subtotal - Grade Stabilization Structures	195,500	27,340	-	222,840	22,460	245,300
Subtotal - Watershed	3,166,400	296,820	3,210	3,466,430	811,760	4,278,190
Project Administration	xxx	xxx	xxx	750,320	xxx	766,420
GRAND TOTAL	3,166,400	296,820	3,210	4,216,750	811,760	5,028,510

<sup>1/</sup> Price Basis: Actual costs for 23 floodwater retaining structures (1, 1A, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, and 29) already constructed or under contract; floodwater retaining structures 2, 5A, 9, and 13, all grade stabilization structures, and channel work at 1972 prices.

<sup>2/</sup> Relocation payments for displacements prior to July 1, 1972 will be shared as provided in paragraph number 1 of Supplemental Work Plan Agreement No. II in accordance with FL 91-646.

<sup>3/</sup> Actual total cost of 23 floodwater retaining structures (1, 1A, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, and 29).

REVISED TABLE 3 - STRUCTURAL DATA - STRUCTURES WITH PLANNED STORAGE CAPACITY

Tehuacana Creek Watershed, Texas

Item	Unit	Structure No.	Other Structures	Total
Class of Structure				
Drainage Area	Sq. Mi.	A	XXX	XXX
Controlled	Sq. MI.	24.37	152.15	176.52
Curve No. (1-Day) (AWC II)			1.46	1.46
Tc	hr.	79	XXX	XXX
Elevation Top of Dam		3.89	XXX	XXX
Elevation Crest Emergency Spillway	Ft.	530.8	XXX	XXX
Elevation Crest Principal Spillway	Ft.	525.5	XXX	XXX
Elevation Crest Lowest Ungated Outlet	Ft.	1/513.2, 515.5	XXX	XXX
Maximum Height of Dam	Ft.	1/506.2, 507.2	XXX	XXX
Volume of Fill	Cu. Yd.	41	XXX	XXX
Total Capacity	Ac. Ft.	431,900	4,037,400	4,469,300
Sediment Pool (Lowest Ungated Outlet) <u>2/</u>	Ac. Ft.	7,865	61,505	69,370
Sediment Submerged (50 Years)	Ac. Ft.	200, 200	4,658	4,858
Sediment Aerated	Ac. Ft.	927, 1,204	11,817	13,948
Retarding Pool	Ac. Ft.	149	1,480	1,629
Surface Area	Ac. Ft.	5,585	48,208	53,793
Sediment Pool (Lowest Ungated Outlet)	Acre	65, 61	XXX	XXX
Sediment Pool (Principal Spillway Crest)	Acre	147, 184	2,095	2,426
Retarding Pool	Acre	730	6,124	6,854
Principal Spillway				
Rainfall Volume (Areal) (1-Day)	Inch	7.62	XXX	XXX
Rainfall Volume (Areal) (10-Day)	Inch	12.96	XXX	XXX
Runoff Volume (10-Day)	Inch	6.91	XXX	XXX
Capacity (Maximum)	C.F.S.	360	XXX	XXX
Frequency Operation - Emergency Spillway	% Chance	3.6	XXX	XXX
Size of Conduit	Inch	1/36, 36	XXX	XXX
Emergency Spillway				
Rainfall Volume (ESH) (Areal)	Inch	6.62	XXX	XXX
Runoff Volume (ESH)	Inch	4.24	XXX	XXX
Type		Vcg.	XXX	XXX
Spillway Width		400	XXX	XXX
Velocity of Flow (Vc)	Ft./Sec.	0	XXX	XXX
Slope of Exit Channel	Ft./Ft.	0.040	XXX	XXX
Maximum Water Surface Elevation	Ft.	524.9	XXX	XXX
Freeboard				
Rainfall Volume (FH) (Areal)	Inch	13.79	XXX	XXX
Runoff Volume (FH)	Inch	11.04	XXX	XXX
Maximum Water Surface Elevation	Ft.	530.8	XXX	XXX
Capacity Equivalents				
Sediment Volume	Inch	1.75	XXX	XXX
Retarding Volume	Inch	4.30	XXX	XXX

1/ Two separate principal spillways are required.

2/ Volume is included in sediment submerged (50 years).

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TABLE 30 - STRUCTURAL DATA - GRADE STABILIZATION STRUCTURES  
Tehuacana Creek Watershed, Texas

Structure Number	Drainage Area (acres)	Detention Capacity		Elevation			Principal Spillway Capacity (c.f.s.)	Volume of Fill (cu. yd.)
		(inches)	(acre-feet)	Principal Spillway (m.s.l.)	Emergency Spillway (m.s.l.)	Top of Dam (m.s.l.)		
2-1	350	0.39	11.3	575.0	578.0	580.0	180	5,761
5-1	920	0.87	66.7	628.0	634.0	636.0	272	18,218
5-2	100	0.96	8.0	631.0	635.0	637.0	62	7,345
5-3	75	0.50	3.1	641.0	644.0	646.0	63	5,753
5-4	533	0.25	11.1	599.3	602.0	604.0	336	5,396
5-6	104	0.27	2.4	578.0	580.0	582.0	92	3,106
5-7	133	0.20	2.2	581.7	584.0	586.0	107	2,515
5-5	149	0.13	1.6	578.0	581.9	583.9	154	1,603
5-8	132	0.37	4.1	561.0	563.0	565.0	120	6,019
5-9	110	1.88	17.3	558.0	563.0	565.0	28	5,311
5-10	470	0.17	6.7	538.0	542.0	546.0	300	3,910
6-2	318	0.19	5.0	560.0	562.7	565.7	242	4,402
7-1	448	0.35	12.5	524.0	527.0	530.0	174	8,270
9-2	276	0.11	2.5	582.0	584.0	586.0	334	2,836
9-3	317	0.30	7.7	583.0	587.0	589.0	192	3,214
9-4	109	0.17	1.6	576.0	578.0	581.0	106	2,472
9-5	258	0.05	1.1	581.0	583.0	585.0	254	3,587
9-6	564	0.26	12.3	573.9	576.0	578.0	384	6,493
9-8	163	0.20	2.8	560.0	562.0	564.0	153	3,061
13-3	74	0.23	1.4	530.0	532.0	534.0	86	0,572
13-4	122	0.06	0.7	526.0	528.0	531.0	106	1,699
13-5	70	0.06	0.5	490.0	492.0	495.0	100	2,723
101	292	1.59	38.7	554.0	558.0	560.0	107	9,135
102	90	0.44	3.3	513.0	516.0	518.0	142	7,133
103	424	2.58	92.2	510.0	517.0	519.0	118	21,806
104	134	1.65	11.7	497.0	502.0	504.5	115	6,679
105	346	2.87	53.9	496.5	506.0	508.0	173	6,734

Structure Number	Drainage Area (acres)	Drop (feet)	Concrete (cu. yds.)	Structure Type
6-1	682	6.4	51.83	CU
9-1	120	6.0	40.83	SD
9-7	805	10.0	62.38	CU
13-1	377	6.0	57.07	SD
13-2	439	6.6	40.50	CU

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REVISED TABLE 4 - ANNUAL COST  
Tehuacana Creek Watershed, Texas

(Dollars)<sup>1/</sup>

Evaluation Unit	: Amortization : of : Installation : Cost <sup>2/</sup>	: Operation : and : Maintenance: : Cost	: Total
27 floodwater retarding structures; 61,780 feet of channel work; and 32 grade stabilization structures	154,157	14,610	168,767
Project Administration	27,525	xxx	27,525
<b>GRAND TOTAL</b>	<b>181,682</b>	<b>14,610</b>	<b>196,292</b>

1/ Price Base: Actual cost for 23 floodwater retarding structures (1, 1A, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, and 29) constructed or under contract; floodwater retarding structures 2, 5A, 9, 13, and all grade stabilization structures and channel work at 1972 prices.

2/ Site 5A and 32 grade stabilization structures - 50 years at 3.25 percent interest; all other structural measures at 2.50 percent interest.

3/ Includes replacement costs of \$1,560 for any structure or appurtenance requiring replacement before end of 50-year evaluation period.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Tehuacana Creek Watershed, Texas  
(Dollars)<sup>1/</sup>

Item	Estimated Average Annual Damage		Damage
	Without	With	Reduction
	Project	Project	Benefit
<b>Floodwater</b>			
Crop and Pasture	239,853	29,065	210,788
Other Agricultural	20,094	1,313	18,781
Non-Agricultural			
Road and Bridge	44,131	3,558	40,573
Subtotal	304,078	33,936	270,142
<b>Sediment</b>			
Overbank Deposition	55,729	10,230	45,499
<b>Erosion</b>			
Flood Plain Scour <sup>2/</sup>	11,053	1,136	9,917
Land Depreciation <sup>2/</sup>	78,740	0	78,740
Subtotal	89,793	1,136	88,657
Indirect	44,960	4,531	40,429
<b>TOTAL</b>	<b>494,560</b>	<b>49,833</b>	<b>444,727</b>

1/ Price Base: Adjusted normalized prices.

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

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REVISED TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES  
 Tehuacana Creek Watershed, Texas  
 (Dollars)<sup>1/</sup>

Evaluation Unit	AVERAGE ANNUAL BENEFITS			Total	Average Annual Cost	Benefit-Cost Ratio
	Damage Reduction	More Intensive Land Use	Other <sup>2/</sup> Secondary			
27 floodwater retarding structures, 61,780 feet of channel work; 32 grade stabilization structures <sup>4/</sup>	398,107	19,637	2,609	459,611	168,767	2.7:1.0
Project Administration	xxx	xxx	xxx	xxx	27,525	xxx
<b>GRAND TOTAL<sup>5/</sup></b>	398,107	19,637	2,609	459,611	196,292	2.3:1.0

<sup>1/</sup> Price Base: Annual benefits and operation and maintenance costs based on adjusted normalized prices; construction costs based on actual cost for 23 floodwater retarding structures (1, 1A, 6, 7, 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, and 29) constructed or under contract; floodwater retarding structures 2, 5A, 9, 13, and all grade stabilization structures and channel work at 1972 prices.

<sup>2/</sup> Benefit to Brazos River flood plain.

<sup>3/</sup> From table 4.

<sup>4/</sup> Interrelated measures.

<sup>5/</sup> In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$46,620 annually.

- LEGEND**
- S Highway
  - State Highway
  - State Right-of-Way
  - Platted Road
  - Unplatted Road
  - County Line
  - Township Boundary
  - Section Boundary
  - Section Number
  - Drainage Area Control by Structure
  - Channel Improvement (Planned)
  - Grade Stabilization Structure (Planned)
  - Floodwater Retarding Structure (Completed or Under Construction)
  - Floodwater Retarding Structure (Planned)
  - Area Being Filled
  - Site Number

**SITE NUMBERS AND DRAINAGE AREAS IN ACRES**

No.	Acres	No.	Acres
1A	2606	16	8208
1	2112	18	1536
2	1559T	19	9304
3A	4378	20	1165
3	1736	21	5171
4	1990	22	5248
5	8992	23	512
6	2332	24	304D
7	5735	25	6298
8	5795	26	1551
9	7424	28	3923
10	1862	29	3776
11	3680		



**PROJECT MAP**  
 TEHUACANA CREEK WATERSHED  
 44th District, Tarrant County, Texas  
 U.S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE  
 FORM 1-7-65