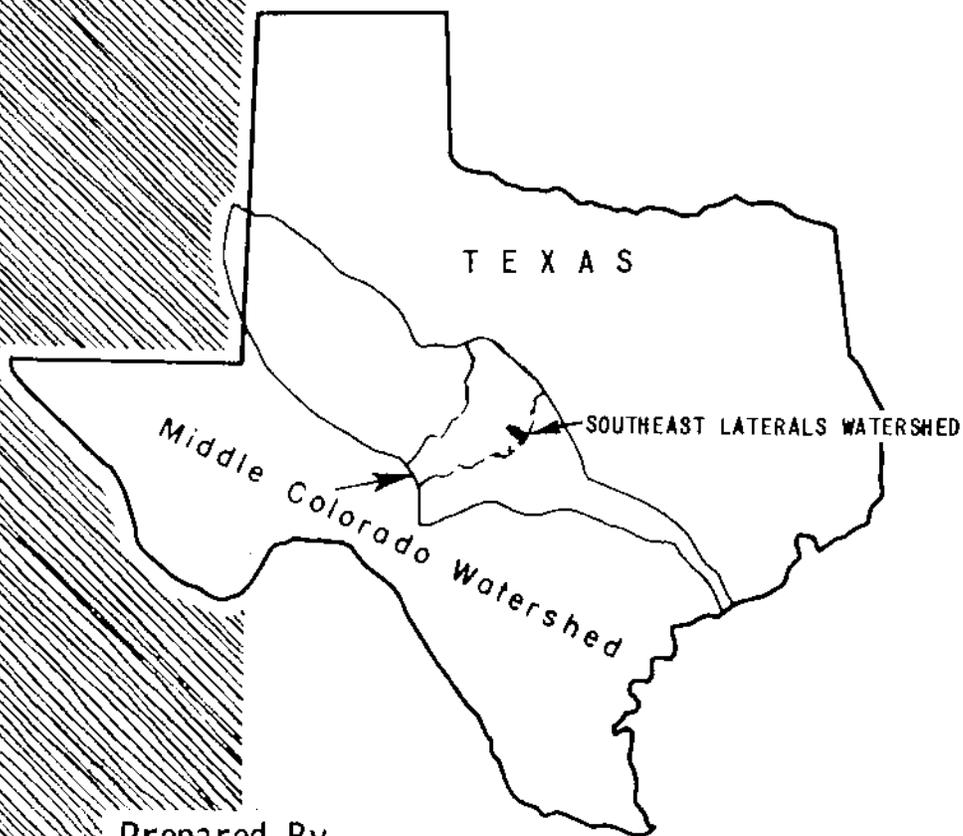


SUPPLEMENTAL
WORK PLAN II

SOUTHEAST LATERALS WATERSHED

OF THE MIDDLE COLORADO RIVER WATERSHED
SAN SABA COUNTY, TEXAS



Prepared By
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Temple, Texas
September 1972

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SUPPLEMENTAL WATERSHED WORK PLAN AGREEMENT NO. II

Between the

San Saba-Brady Soil and Water Conservation District
Local Organization

San Saba 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 the Southeast Laterals Watershed, State of Texas, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 2nd day of May 1967; and

Whereas, the Supplemental Watershed Work Plan Agreement for the Southeast Laterals Watershed, State of Texas, executed by the Sponsoring Local Organization named therein and the Service, became effective on the 23rd day of September 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 been found necessary to modify the Watershed Work Plan to delete 2.0 miles of stream channel improvement, redesign 0.5 miles of stream channel improvement, delete floodwater retarding structure Nos. 8 and 11, and add floodwater retarding structure No. 8A-1.

Whereas, it has been necessary to modify the Watershed Work Plan to reflect current policy and terminology relative to engineering and project administration cost; and

Whereas, a Supplemental Watershed Work Plan which modifies the watershed work plan dated August 1966 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:

1. Paragraph numbered 3 is modified to read as follows:

The percentage of the engineering cost to be borne by the Sponsoring Local Organization and the Service is as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
Floodwater Retarding Structures and Stream Channel Improvement	0	100	48,350

2. A paragraph numbered 12 is added to read as follows:

The Sponsoring Local Organization and the Service will each bear the cost of Project Administration which it incurs, estimated to be \$5,500 and \$121,320 respectively.

3. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.
4. 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.

San Saba-Brady Soil and Water Conservation District
Local Organization

By Kenneth Kuykendall

Title Chairman

Address Cherokee, Tex. 76832
Zip Code

Date 7/16/73

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

adopted at a meeting held on July 16 1973

Jack Edmister
(Secretary, Local Organization)

Address Voca Texas 76887
Zip Code

Date July 16 1973

San Saba County Commissioners Court
Local Organization

By M. N. Jusley

Title County Judge

Address San Saba, Tex 76877
Zip Code

Date July 20, 1973

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

adopted at a meeting held on July 20, 1973
Local Organization

Blovis Letbetter
(Secretary, Local Organization)

Address San Saba, Texas 76877
Zip Code

Date July 20, 1973

Soil Conservation Service
United States Department of Agriculture

By Harold Baker, Acty
State Conservationist

Date 8-2-73

SUPPLEMENTAL WORK PLAN NUMBER II

SOUTHEAST LATERALS WATERSHED
of the Middle Colorado River Watershed
San Saba County, Texas

Plan Prepared and Works of Improvement
to be Installed Under the Authority
of the Flood Control Act of 1944
as Amended and Supplemented

Participating Agencies:

San Saba-Brady Soil and Water Conservation District

San Saba County Commissioners Court

Prepared by:

Soil Conservation Service
U. S. Department of Agriculture

September 1972

SUPPLEMENTAL WORK PLAN NO. II

SOUTHEAST LATERALS WATERSHED of the Middle Colorado River Watershed San Saba County, Texas

September 1972

PURPOSE OF THE SUPPLEMENTAL WORK PLAN

It has become necessary to modify the watershed work plan dated August 1966 because of the developments that have occurred at planned construction sites and pool areas of Floodwater Retarding Structure Nos. 8 and 11. These structures will be deleted from the plan, and Floodwater Retarding Structure No. 8A-1 will be added upstream from Site 8.

The channel work in the original work plan was redesigned to meet current stability criteria. It is necessary to delete 2.0 miles of the 2.5 miles of planned channel work because of the high cost of providing stabilization measures to install a stable channel. The remaining 0.5 miles of channel work is needed to provide for release flows from Floodwater Retarding Structure Nos. 9 and 10.

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 1971 price levels to reflect current cost estimates and reaffirm economic feasibility. All damages and benefits were updated from long-term prices as projected by USDA, ARS-AMS, September 1957, to adjusted normalized prices, "Water Resources Council, April 1966."

WATERSHED PROBLEMS

The average annual floodwater, sediment, erosion and indirect damages are updated from long-term prices September 1957 to adjusted normalized prices April 1966, and are reflected in Table 5 of this supplement.

BASIS FOR PROJECT FORMULATION

The Sponsoring Local Organization has changed their specific objective to obtain approximately 60 percent over all reduction in average annual flood damages. This change is necessary due to developments that have occurred at the dam sites and in the flood pool areas of planned Floodwater Retarding Structures No. 8 and 11.

With the excessive cost of the channel work compared with benefits derived the Sponsoring Local Organization has agreed to eliminate the channel work with the exception of 0.5 miles needed to carry release flows of Floodwater Retarding Structures Nos. 9 and 10.

WORKS OF IMPROVEMENT TO BE INSTALLED

Structural Measures

By adding Floodwater Retarding Structure No. 8A-1 and deleting planned Floodwater Retarding Structure Nos. 8 and 11 and 2.0 miles of the channel work, the plan will consist of 10 floodwater retarding structures and approximately 0.5 miles of channel work.

Nine of the ten planned floodwater retarding structures have been constructed. The remaining structural measures to be installed are Floodwater Retarding Structure No. 8A-1 and 0.5 miles of channel work.

Floodwater Retarding Structure No. 8A-1 will have capacity below the principal spillway crest to store the expected 100-year sediment volume. This principal spillway will not be ported at the expected 50-year sediment volume elevation as the previously constructed structures. The principal spillway will be ported at the 200 acre-feet elevation. This change is due to modification in structural criteris. A telephone line and two county roads will need to be modified before the floodwater retarding structure is constructed. The county road on the east side will be raised to the 2.0 feet depth-of-flow elevation. The county road in the upper portion of the pool area will be closed permanently.

The 0.5 miles of channel work is designed as a sodded grass waterway to carry release flows. The grass waterway is to be sodded with Bermuda grass with a two-year establishment period. Ground water conditions will enhance the plant establishment. The low velocities of the release flows and their flow duration will not have any detrimental effects. The construction season should coincide with the local growing seasons.

The following tabulation reflects the degree of control, detention storage in acre-feet and inches, and the equivalent detention storage for Wilbarger and Antelope Creeks.

	:	:
	:	:
	Unit	Amount
Drainage Area of Wilbarger and Antelope Creeks	Sq.Mi.	81.38
Drainage Area Controlled by Structures	Sq.Mi.	29.06
Drainage Area Controlled by Structures	Percent	35.71
Detention Storage	Ac.-Ft.	6,497
Capacity Equivalent - Area Controlled	Inch	4.19

The 0.5 miles of channel work in conjunction with the floodwater retarding structures will provide flood protection to the flood plain lands of Sand Branch. The capacity of the improved channel will carry the combined release flows from the floodwater retarding structures. Inlets will be installed as appurtenances to conduct local runoff into the improved channel. The county road at the upper end of the proposed channel work is to be raised to the 1309.5 elevation and installing two 24-inch diameter pipes. This work will be completed before the proposed channel work is installed.

The total area of the sediment pool, including the reserve pools is 326 acres. The detention pools will temporarily inundate an additional 688 acres.

Investigation has disclosed that under present conditions the acquisition of land rights needed for the installation of Floodwater Retarding Structure No. 8A-1 and the 0.5 miles of channel work will not result in the displacement of any person, business or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown in the Work Plan Agreement as Supplemented.

EXPLANATION OF INSTALLATION COSTS

The estimated cost of installing the 10 floodwater retarding structures and the 0.5 miles of stream channel work is \$939,070. Of this amount, \$133,510 will be borne by local interests, and \$805,560 by flood prevention funds, of which \$635,890 is construction costs, and \$169,670 is for engineering services and project administration.

Land rights, relocation of roads, bridges and utilities, and other improvements for floodwater retarding structures and channel work will be provided by the San Saba Commissioner Court at no cost to the Federal Government. These improvements have a value estimated to be \$126,910, based on current market value estimated by local organizations. An additional \$1,100 of non-Federal funds will be provided for legal and other services required in obtaining land rights. Non-Federal funds for project administration amounts to \$5,500.

Engineering services and project administration costs were based on an analysis of previous work in similar areas. Engineering services costs consist of, but are not limited to, detailed surveys, geologic investigations, laboratory analysis, reports, designs and cartographic services.

Federal cost for project administration consists of construction inspection, contract administration, assistance to the Sponsoring Local Organization in providing relocation advisory assistance and maintenance of the Service records and accounts. The local costs for project administration includes costs for overhead and organizational administrative costs and whatever construction inspection the Sponsors desire to make at their own expense.

EFFECTS OF WORKS OF IMPROVEMENT

After installation of the combined program of land treatment and structural measures the average annual flooding will be reduced from 3,851 acres to 2,522 acres.

It is estimated that approximately 1,279 acres will be farmed more intensively with flooding reduced.

Incidental recreation benefits will be derived from the 10 floodwater retarding structures. The surface area of the sediment pools of the 10 floodwater retarding structure is 217 acres. It is expected that the project will provide an average use of approximately 3,910 visitor days.

Sediment pools of the 10 floodwater retarding structures will provide a more dependable water supply for livestock.

The annual sediment yield to the mouth of the watershed is expected to be reduced from 281,000 tons to 205,370 tons with the project installed. The complete program will result in an annual sediment reduction of 19 acre-feet to Lake Buchanan.

The 0.5 miles of channel work is planned for a channel with ephemeral flow and therefore will have no effect on fishery resources.

PROJECT BENEFITS

The estimated average annual monetary damages (Table 5) for Wilbarger and Antelope Creeks will be reduced from \$58,820 to \$24,600, a reduction of 58 percent. Crop and pasture damage will be reduced from \$19,220 to \$7,720 a reduction of 60 percent. Other agricultural damage, such as loss of fences, farm equipment, livestock and other property will be reduced from \$11,260 to \$3,830, or 66 percent. Road and bridge damage will be reduced from \$15,640 to \$8,470, or 46 percent. Flood plain sediment will be reduced from \$3,690 to \$1,060, or 71 percent. Flood plain scour damage will be reduced from \$3,660 to \$1,280, or 65 percent.

Of the \$34,220 damage reduction benefits attributable to the project, \$30,820, or 90 percent, are the result of structural measures, with the remaining 10 percent the result of land treatment.

The estimated net farm income due to restoration of former productivity will amount to \$4,870 annually. The loss of the original productivity of this land has been included in the crop and pasture damage and the restoration as benefits in Table 5. The net increase in income due to more intensive use of flood plain lands will amount to \$10,610 annually.

Benefits from reduction of floodwater and sediment damages outside the project area are estimated to average \$1,010 annually. These include \$590

from reduction of flood damage along the Colorado River main stem below the watershed, and \$420 from sediment reduction to Lake Buchanan.

Benefits incidental to project purposes will amount to \$2,970 annually. These include \$1,540 for recreation, and \$1,430 for livestock water.

The monetary value of secondary benefits is estimated to be \$5,490 annually.

The total average annual benefits from structural works of improvement are estimated to be \$50,900.

COMPARISON OF BENEFITS AND COSTS

The total average annual cost of structural measures is \$31,980. These measures are expected to produce average annual benefits, excluding secondary benefits, of \$45,410, resulting in a benefit-cost ratio of 1.4:1.0.

The ratio of total average annual project benefits, including secondary benefits, accruing to the structural measures is \$50,900 to the average annual cost of structural measures \$31,980 is 1.6:1.0 (Table 6).

PROVISIONS FOR OPERATION AND MAINTENANCE

Structural Measures

The 10 floodwater retarding structures and the 0.5 miles of channel work will be operated and maintained in accordance with the provisions of a separate operation and maintenance agreement by the San Saba County Commissioners Court and the San Saba-Brady Soil and Water Conservation District.

The estimated average annual operation and maintenance cost is \$1,100 based on adjusted normalized prices.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
 Southeast Laterals Watershed, Texas
 (Middle Colorado River Watershed)

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/			Total
			Federal Funds		Other	
			Non-Federal	Federal	Non-Federal	
LAND TREATMENT						
Soil Conservation Service						
Cropland	Acre	13,855	-	354,314	354,314	
Grassland	Acre	38,110	-	56,860	56,860	
Technical Assistance (Accelerated)			5,000	-	5,000	
TOTAL LAND TREATMENT			5,000	411,174	416,174	
STRUCTURAL MEASURES						
<u>Construction</u>						
Floodwater Retarding Structures	No.	10	611,900	-	611,900	
Channel Work 2/	Mile	0.5	23,990	-	23,990	
Subtotal - Construction			635,890	-	635,890	
<u>Engineering Services</u>			48,350	-	48,350	
<u>Project Administration</u>						
Construction Inspection			69,250	1,100	70,350	
Other			52,070	4,400	56,470	
Subtotal - Administration			121,320	5,500	126,820	
<u>Other Costs</u>						
Land Rights			-	128,010	128,010	
TOTAL STRUCTURAL MEASURES			805,560	133,510	939,070	
TOTAL PROJECT			810,560	544,684	1,355,244	

1/ Price Base: Actual costs for Floodwater Retarding Structure Nos. 1, 2, 3, 4, 5, 6, 7, 9 & 10 which are constructed; Floodwater Retarding Structure No. 8-A-1 and channel work at 1971 prices.

2/ Type of channel before project: (N) - An unmodified, well defined natural channel.

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TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
 Southeast Laterals Watershed, Texas
 (Middle Colorado River Watershed)

(Dollars) 1/

Item	Construction	Engineering	Total Flood Prevention	Installation Cost-Other Funds		Total Installation Cost
				Land	Rights	
Floodwater Retarding Structure Nos. 1, 2, 3, 4, 5, 6, 7, 9, and 10	547,940	41,230	589,170	98,060	98,060	687,230
Subtotal	547,940	41,230	589,170	98,060	98,060	687,230
Floodwater Retarding Structure No. 8-A-1	63,960	4,480	68,440	19,100	19,100	87,540
Subtotal	611,900	45,710	657,610	117,160	117,160	774,770
Channel Work	23,990	2,640	26,630	10,850	10,850	37,480
Subtotal	635,890	48,350	684,240	128,010	128,010	812,250
Project Administration			121,320		5,500	126,820
GRAND TOTAL	635,890	48,350	805,560	128,010	133,510	939,070

1/ Price Base: Actual costs for Floodwater Retarding Structure Nos. 1, 2, 3, 4, 5, 6, 7, 9 & 10 which are constructed; Floodwater Retarding Structure Nos. 8-A-1 and channel work at 1971 prices.
 2/ Type of channel before project: (N) - An unmodified, well defined natural channel.

TABLE 3 - STRUCTURAL DATA
STRUCTURES WITH PLANNED STORAGE CAPACITY
 Southeast Laterals Watershed, Texas
 (Middle Colorado River Watershed)

ITEM	UNIT	STRUCTURE NUMBER	
		8A-1	Total
Class of Structure		A	XXX
Drainage Area	Sq.Mi.	5.05	29.06
Controlled	Sq.Mi.	-	XXX
Curve No. (1-day) (AMC II)		77	XXX
Tc	Hours	0.64	XXX
Elevation Top of Dam	Foot	1375.1	XXX
Elevation Crest Emergency Spillway	Foot	1370.0	XXX
Elevation Crest - Principal Spillway	Foot	1360.3	XXX
Elevation Crest Lowest Ungated Outlet	Foot	1358.6	XXX
Maximum Height of Dam	Foot	28	XXX
Volume of Fill	Cu.Yds.	93,500	890,020
Total Capacity	Ac.Ft.	1,252	8,147
Sediment Pool (Lowest Ungated Outlet) <u>1/</u>	Ac.Ft.	200	815
Sediment Submerged 100 years	Ac.Ft.	275	1,444
Sediment Aerated	Ac.Ft.	56	206
Retarding	Ac.Ft.	921	6,497
Surface Area			
Sediment Pool (Lowest Ungated Outlet)	Acres	42	217
Sediment Pool-Principal Spillway Crest	Acres	52	326
Retarding Pool	Acres	132	1,014
Principal Spillway			
Rainfall Volume (areal) (1-day)	Inch	7.30	XXX
Rainfall Volume (areal) (10-day)	Inch	11.70	XXX
Runoff Volume (10-day)	Inch	5.43	XXX
Capacity (Maximum)	C.F.S.	62	XXX
Frequency Operation - Emer. Spillway	% Chance	3.8	XXX
Size of Conduit	Inch	24	XXX
Emergency Spillway			
Rainfall Volume (ESH) (areal)	Inch	6.60	XXX
Runoff Volume (ESH)	Inch	4.00	XXX
Type	Veg.		XXX
Bottom Width	Foot	160	XXX
Velocity of Flow (V_e)	Ft./Sec.	4.2	XXX
Slope of Exit Channel	Ft./Ft.	0.046	XXX
Maximum Water Surface Elevation	Foot	1370.9	
Freeboard			
Rainfall Volume (FH)	Inch	13.60	XXX
Runoff Volume (FH)	Inch	10.57	XXX
Maximum Water Surface Elevation	Foot	1375.1	XXX
Capacity Equivalents			
Sediment Volume	Inch	1.23	XXX
Retarding Volume	Inch	3.42	XXX

1/ Volume included in Sediment Submerged, 100 Year.

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TABLE 3A
STRUCTURE DATA - CHANNEL
Southeast Laterals Watershed, Texas
(Middle Colorado River Watershed)

Channel Design	Station: Numbering for Reach	Station: Station	Watershed: Required: Acres	Channel: Planned: Capacity: Channel	Average: Bottom	Average: Side	Depth: Slope	(ft.): (H:V)	(ft./ft.): (ft./sec.)	Average: Velocity at: Design Sec.: Excavation:	Volume of	Type
			(Acres)	(cfs)	(ft.)	(ft.)	(ft.)	(ft./ft.)	(ft./sec.)	(cu.yds.)		
Sand Branch	0+00	12+70	1,680	66	72	6	2.0	4:1	.0028	2.59	9,230	veg.
	12+70	22+20	2,880	128	129	6	2.6	4:1	.0028	3.00	5,540	veg.
		TOTAL									14,770	

- 1/ The channel depth was increased by 0.6 of one foot to allow for replacing of topsoil before sodding.
- 2/ Uncontrolled drainage area.
- 3/ Release from floodwater detention structures.

Note:

- 1. Type of work: Enlargement and realignment of existing channel.
- 2. Type of channel before project: (N) - An unmodified, well defined natural channel.
- 3. Flow condition: Ephemeral - flows only during periods of surface runoff.

TABLE 4 - ANNUAL COST
 Southeast Laterals Watershed, Texas
 (Middle Colorado River Watershed)

(Dollars) 1/

Evaluation Unit	: Amortization of : Installation Cost <u>2/</u>	: Operation and : Maintenance Cost:	: Total
Ten Floodwater Retarding Structures, approxi- mately 0.5 miles of Channel Work.	26,710	1,100	27,810
Project Administration	4,170	--	4,170
GRAND TOTAL	30,880	1,100	31,980

1/ Price Base: Installation - actual costs for Floodwater Retarding Structure Nos. 1-7, 9 & 10 which are constructed; Floodwater Retarding Structures No. 8-A-1 and channel work at 1971 prices. Operation and maintenance - adjusted normalized prices - April 1966

2/ 100 years at 3-1/8 percent interest for Floodwater Retarding Structure Nos. 1 - 7, 9 & 10 and the channel work, 100 years at 3 1/2 percent interest for Floodwater Retarding Structure No. 8-A-1.

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TABLE 5
ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
Southeast Laterals Watershed, Texas
(Middle Colorado River Watershed)

(Dollars) ^{1/}

Items	Without Project (dollars)	With Project (dollars)	Damage Reduction Benefit (dollars)
Floodwater			
Crop and Pasture	19,220	7,720	11,500
Other Agricultural	11,260	3,830	7,430
Roads and Bridges	15,640	8,470	7,170
Subtotal	46,120	20,020	26,100
Sediment			
Overbank Deposition	3,690	1,060	2,630
Erosion			
Flood Plain Scour	3,660	1,280	2,380
Indirect	5,350	2,240	3,110
TOTAL	58,820	24,600	34,220

^{1/} Price Base: Adjusted normalized prices, April 1966

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TABLE 6
COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Southeast Laterals Watershed, Texas
(Middle Colorado River Watershed)

(Dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/				Total	Average Annual Cost	Benefit-Cost Ratio
	Damage Reduction	Incidental	Outside Watershed	Flood Prevention			
Ten Floodwater Retarding Structures and approximately 0.5 miles of Channel Work	30,820	10,610	2,970	5,490	1,010	50,900	1.8:1.0
Project Administration	-	-	-	-	-	4,170	-
GRAND TOTAL	30,820	10,610	2,970	5,490	1,010	50,900	1.6:1.0

1/ Price Base: Adjusted normalized prices, April 1966.

2/ Includes \$1,430 benefits from livestock water and \$1,540 benefits from recreation.

3/ Includes \$590 benefits from reduction of flood damage to the mainstem of the Colorado River, and \$420 benefits for reduction of sediment damage to Lake Buchanan.

4/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$3,400 annually.

