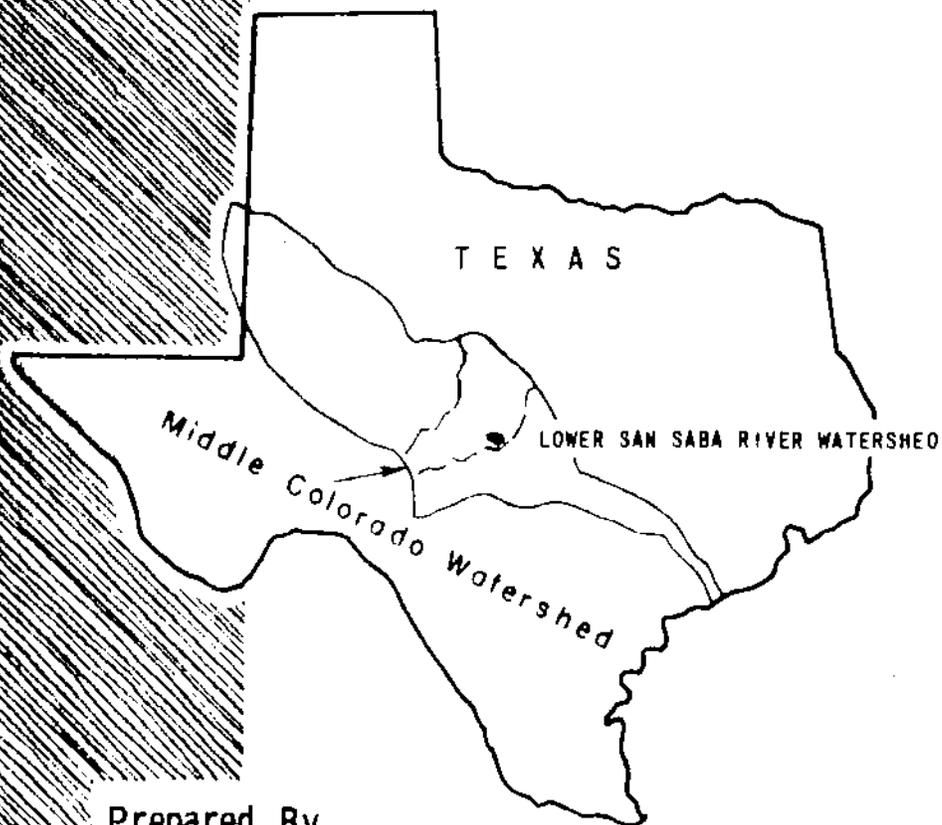


Study

SUPPLEMENTAL WORK PLAN

LOWER SAN SABA RIVER
WATERSHED

OF THE MIDDLE COLORADO RIVER WATERSHED
SAN SABA, McCULLOCH, MASON, AND
MENARD COUNTIES, TEXAS



Prepared By
SOIL CONSERVATION SERVICE
U. S. DEPARTMENT OF AGRICULTURE
Temple, Texas
December 1967

SUPPLEMENTAL
WATERSHED WORK PLAN AGREEMENT

between the

San Saba-Brady Soil and Water Conservation District
(Local Organization)

(Hereinafter referred to as the District)

San Saba County Commissioners Court
(Local Organization)

(Hereinafter referred to as the County)

In the State of Texas

and the

United States Department of Agriculture
Soil Conservation Service

(Hereinafter referred to as the Service)

Whereas, the District has heretofore entered into a Flood Control Supplemental Memorandum of Understanding with the Soil Conservation Service for assistance in constructing Works of Improvement for the prevention of floods in the Lower San Saba River Watershed, State of Texas, under the authority of the Flood Control Act of 1944 (58 Stat. 887).

Whereas, the responsibility for carrying out all or a portion of the works of a Department on the Watershed has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the District and the Service a mutually satisfactory Supplemental plan for Works of Improvement for the Lower San Saba River Watershed, State of Texas, hereinafter referred to as the Supplemental Watershed Work Plan;

Whereas, the County will benefit from the carrying out of the plan for Works of Improvement through the reduction of damages to property, including County roads and bridges in the County that are located within the flood plain of the watershed;

Now, therefore, in view of the foregoing consideration, the District and the County and the Secretary of Agriculture, through the Service, hereby agree on the Supplemental Watershed Work Plan, and further agree that the works of improvement set forth in said plan can be installed in about two 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 supplemental watershed work plan.

1. The District and the County will acquire without cost to the Federal Government all land, easements, and rights-of-way needed for installation of structural works of improvement (estimated at \$32,780).

<u>Works of Improvement</u>	<u>District and County</u> (percent)	<u>Service</u> (percent)	<u>Estimated Land, Easements, and Rights-of-Way Cost</u> (dollars)
Floodwater Retarding Structures	100	0	1/ 32,780

Includes legal fees of \$2,980.

2. The Service will provide all construction costs.

<u>Works of Improvement</u>	<u>District and County</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Floodwater Retarding Structures	0	100	379,550

3. The Service will provide all installation services and costs therefor.

<u>Works of Improvement</u>	<u>District and County</u> (percent)	<u>Service</u> (percent)	<u>Estimated Installation Service Cost</u> (dollars)
Floodwater Retarding Structures	0	100	82,950

4. The District will obtain agreements from owners of not less than 65 percent of the land above each floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.

5. The District will provide assistance to landowners and operators to assure installation of the land treatment measures shown in the watershed work plan.

6. The District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

7. The District and the County will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or contracting for such work in accordance with an Operation and Maintenance Agreement which is to be entered into.

8. 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.

9. 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 (7C F.R. Sec. 15.1-15.13), which provide that

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.

10. No member of Congress, or resident commissioner, shall be admitted to any part 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 provision for its general benefit.

San Saba-Brady Soil and Water Conservation District
(Local Organization)

By Kenneth Kugenshall
Title Chairman
Date 5/10/68

Signing of this agreement was authorized by a resolution of the governing body of the San Saba-Brady Soil and Water Conservation District adopted at a meeting

5/10/68 San Saba

B. L. Miller
(Secretary, Local Organization)

Date 5/10/68

San Saba County Commissioners Court
(Local Organization)

By John R. McRae
Title County Judge
Date 5/13/68

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 5-10-68.

Clavin Letbetter
(Secretary, Local Organization)

Date may 13, 1968

Soil Conservation Service
United States Department of Agriculture

By _____

Date _____

SUPPLEMENTAL

WORK PLAN

**LOWER SAN SABA RIVER WATERSHED
of the Middle Colorado River Watershed
San Saba, McCulloch, Mason, and Menard Counties, Texas**

**Supplement to 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

Soil Conservation Service

Prepared By:

**Soil Conservation Service
U. S. Department of Agriculture**

December 1967

SUPPLEMENTAL

WATERSHED WORK PLAN

**LOWER SAN SABA RIVER WATERSHED
of the Middle Colorado River Watershed
San Saba, McCulloch, Mason, and Menard Counties, Texas**

December 1967

Purpose

The purpose of this supplement is to modify the work plan to include structural works of improvement for watershed protection and flood prevention on Wallace and China Creeks, tributary streams of the Lower San Saba River.

Change in Major Features

This supplement will add three floodwater retarding structures on Wallace Creek, and one on China Creek, to the 12 planned and constructed on Richland Creek and Jerry's Branch, for a total of 16 structures for the watershed.

Change in Estimated Costs

Installation costs of structural measures will be increased from \$964,610 to \$1,459,880. The Federal share of the cost of structural measures will increase from \$867,673 to \$1,330,170. The local share will increase from \$96,937 to \$129,710.

Changes in Sponsoring Local Organizations

The San Saba County Commissioners Court is added as a sponsor.

SECTION 1

SUPPLEMENTAL WATERSHED WORK PLAN

LOWER SAN SABA RIVER WATERSHED
of the Middle Colorado River Watershed
San Saba, McCulloch, Mason, and Menard Counties, TexasSUMMARY OF PLANGeneral Summary

Change fourth paragraph to read: The work plan proposes a 12-year project for protection and development of the watershed at a total estimated installation cost of \$2,562,459. The local or non-Federal share of this cost will be \$1,232,289. In addition, local interests will bear the entire cost of operation and maintenance. This cost for the structural measures is estimated to be \$2,219 annually. The Federal share of the installation cost will be \$1,330,170.

Structural Measures

Change the first paragraph to read: After thorough investigation, it was found that in the Lower San Saba River watershed, there were four tributaries (Richland Creek, Jerry's Branch, Wallace Creek, and China Creek) where structural measures could be justified economically.

The second paragraph is modified to read: The structural measures included in the plan consist of nine floodwater retarding structures on Richland Creek, three on Jerry's Branch, three on Wallace Creek, and one on China Creek, having a total storage capacity of 18,071 acre-feet, of which 15,922 acre-feet is for floodwater detention, and 2,149 acre-feet is for sediment storage. The installation cost of these measures is estimated to be \$1,459,880, of which \$1,330,170 is the Federal share, and \$129,710 is the local or non-Federal share. In addition, local interests will bear the cost of operation and maintenance, estimated at \$2,219 annually.

Damages and Benefits

This section is modified as follows: The average annual damage, without the project, is \$86,387. The average annual damage, with the project, is \$28,317. The average annual benefits accruing to structural measures is \$71,752, which is distributed as follows:

Item	: Richland : Creek (dollars)	: Jerry's : Branch (dollars)	: Wallace : Creek (dollars)	: China : Creek (dollars)	: Total (dollars)
Damage Reduction					
Benefits	30,619	6,698	11,773	1,493	50,583
Changed Land Use					
Intensification	7,697	1,815	2,234	1,001	12,747
Incidental	-	-	240	75	315
Main Stem and Outside					
Watershed	2,764	206	2,396	327	5,693
Secondary	-	-	1,972	442	2,414
TOTALS	41,080	8,719	18,615	3,338	71,752

The ratios of the average annual benefits to the average annual costs are as follows:

Item	: Richland : Creek	: Jerry's : Branch	: Wallace : Creek	: China : Creek	: Total
Average Annual Costs	30,827	5,748	15,158	2,373	54,106
Average Annual Benefits	41,080	8,719	18,615	3,338	71,752
Benefit-Cost Ratio	1.3:1	1.5:1	1.2:1	1.4:1	1.3:1

Average annual damage reduction benefits resulting from land treatment measures were estimated to be \$7,487. The total benefits of land treatment were not evaluated in monetary terms since experience has shown that these soil and water conservation measures produce benefits in excess of their cost.

Operation and Maintenance

This section is modified as follows: Land treatment will be established and maintained by the landowners or operators of the farms and ranches on which the measures are installed under agreement with the San Saba-Brady, Concho, Menard County, and Mason County Soil and Water Conservation Districts. The 16 floodwater retarding structures will be operated and maintained by the San Saba-Brady Soil and Water Conservation District and the San Saba County Commissioners Court. The San Saba County Commissioners Court will be responsible for the maintenance of those structures within San Saba County.

WATERSHED PROBLEMS

Floodwater Damage

The first sentence is modified to add Wallace and China Creeks.

In the fifth sentence, change \$48,040 to \$69,526, and \$29,567 to \$38,992.

In the last sentence, change \$5,688 to \$7,853.

Sediment Damage

Add Wallace and China Creeks to the first sentence.

Erosion Damage

The third paragraph, next to last sentence, should be modified to read: The estimated annual damage from flood plain scour is \$9,008.

WORKS OF IMPROVEMENT TO BE INSTALLED

The first paragraph is modified. A system of nine floodwater retarding structures on Richland Creek, three on Jerry's Branch, three on Wallace Creek, and one on China Creek will be installed to assist in providing the needed protection to flood plain lands along these tributaries that cannot be provided by land treatment alone.

The second paragraph is modified to read: Sites for the floodwater retarding structures will be provided by local interests at no cost to the Federal government. The value of these sites is estimated to be \$117,040, based on market values furnished by real estate dealers and other local people.

The third paragraph is modified to read: The location of the floodwater retarding structures are shown on figure 3. The total estimated cost of establishing these works of improvement is \$1,459,880, of which \$129,710 will be borne by non-Federal interests, and \$1,330,170 by the Federal government.

BENEFITS FROM WORKS OF IMPROVEMENT

The first paragraph is modified to read: The combined program of land treatment and structural measures for the four tributary streams involved would prevent damage from 17 of the 111 storms, such as occurred in this watershed from 1916 through 1955. Of the 38 major floods, 29 would be reduced to minor floods. Average annual flooding on the four tributary streams considered feasible for structural works of improvement would be reduced from 8,360 acres to about 3,535.

Secondary benefits were not included in the original work plan. Local secondary benefits were considered to be equal to 10 percent of the direct primary benefits plus 10 percent of the increased costs that primary producers will incur in connection with increased production.

The first sentence of the second paragraph is changed to read: The average annual floodwater and erosion damage stemming from these four tributaries would be reduced from \$86,387 to \$28,317, or a reduction of 67 percent.

The last sentence in the third paragraph is changed from \$9,512 (long term prices) to \$12,747.

In the first sentence of the fourth paragraph, change \$2,970 to \$5,693.

Change figures in the fifth paragraph as follows: \$55,697 changed to \$79,239; and \$49,799 changed to \$71,752, including \$2,414 as secondary benefits.

COMPARISON OF BENEFITS AND COSTS

Average annual benefits from structural measures, excluding secondary benefits, are estimated to be \$69,338. The average annual cost of these structural measures (amortized from total installation cost plus operation and maintenance) is estimated to be \$54,106, providing a benefit-cost ratio of 1.28:1.0. Total benefits, including secondary benefits, from structural measures will provide a benefit-cost ratio of 1.33:1.0 (table 8).

ACCOMPLISHING THE PLAN

Structural Measures for Flood Prevention

In the first sentence, first paragraph, change the figure 12 to 16.

The second paragraph is modified: The San Saba-Brady Soil and Water Conservation District and the San Saba Commissioners Court will furnish the land, easements, and rights-of-way for all the structural measures at no cost to the Federal government.

PROVISIONS FOR OPERATION AND MAINTENANCE

Structural Measures for Flood Prevention

The first paragraph is modified. The 16 floodwater retarding structures will be maintained by the San Saba-Brady Soil and Water Conservation District and the San Saba County Commissioners Court. The Commissioners Court will be responsible for the maintenance of those structures within San Saba County. The estimated annual cost of this work is \$2,219.

In the Third paragraph 12 is changed to 16.

Delete fourth paragraph.

SECTION 2**INVESTIGATION, ANALYSES, AND SUPPORTING TABLES**

Tables 1, 2, 3, 4, 5, 6, 7, and 8, dated December 1956, are modified by the same numbered tables included in this supplement. Tables 8a and 9 are deleted, and table 7a is added.

**TABLE 1 - ESTIMATED PROJECT INSTALLATION COST 1/
Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas**

Item	Unit	: Number : : to be :	Estimated Cost		Total
			Federal	Non-Federal	
			(dollars)	(dollars)	(dollars)
TOTAL LAND TREATMENT	-	-	-	1,102,579	1,102,579
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structures					
	No.	16	1,046,990	-	1,046,990
Subtotal - Construction			1,046,990	-	1,046,990
Installation Services					
Soil Conservation Service					
Engineering Services					
	-	-	172,530	-	172,530
Other					
	-	-	110,650	-	110,650
Subtotal - Installation Services			283,180	-	283,180
Other Costs					
Land, Easements, and R/W					
	-	-	-	117,040	117,040
Legal Fees and Other					
	-	-	-	12,670	12,670
Subtotal - Other	-	-	-	129,710	129,710
TOTAL STRUCTURAL MEASURES	-	-	1,330,170	129,710	1,459,880
TOTAL PROJECT	-	-	1,330,170	1,232,289	2,562,459
SUMMARY					
Subtotal - SCS	-	-	1,330,170	1,232,289	2,562,459

1/ Price base: 1955 for structures 1 through 12 constructed prior to 1960.

Price base: 1966 for structures 13 through 16.

Modifies table 1, dated December 1956.

December 1967

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION 1/
 Lower San Saba River Watershed
 of the Middle Colorado River Watershed, Texas
 (dollars) 2/

Structure Number: or Name	Federal Installation Cost			Non-Federal Installation Cost			Total					
	Construction	Installation Services:	Engineering:	Other	Federal	Total	Easements:	and Rights:	Legal Fees:	Total	Installation	Costs
1 through 12, previously constructed	667,440	121,350	78,880		867,670	87,240			9,690	96,930		964,600
13	112,010	14,560	9,650		136,220	8,100			810	8,910		145,130
14	116,920	15,200	10,070		142,190	10,600			1,060	11,660		153,850
15	106,490	13,480	8,520		128,490	3,000			300	3,300		131,790
Subtotal - Wallace Creek	335,420	43,240	28,240		406,900	21,700			2,170	23,870		430,770
16	44,130	7,940	3,530		55,600	8,100			810	8,910		64,510
Subtotal - Wallace and China Creeks	379,550	51,180	31,770		462,500	29,800			2,980	32,780		495,280
GRAND TOTAL	1,046,990	172,530	110,650		1,330,170	117,040			12,670	129,710		1,459,880

1/ Modifies table 2, dated December 1956.

2/ Price base: Sites 1-12, 1956; Sites 13-16, 1966.

Lower San Saba River Watershed of the Middle Colorado River Watershed, Texas											
Item	Unit	STRUCTURE NUMBER								Total - All Structures	
		13	14	15	16	16	16	16	16		
Class of Structure		A	A	A	A	A	A	A	A	xxx	xxx
Drainage Area	Sq. Mi.	11.00	12.00	3.25	3.75	30.00	30.00	83.58	83.58	xxx	xxx
Curve No. (1-day) (AMC II)		77	77	77	77	77	77	77	77	xxx	xxx
IC	Hrs.	2.0	3.4	1.4	1.6	xxx	xxx	xxx	xxx	xxx	xxx
Elevation Top of Dam	Ft.	1502.6	1531.7	1396.5	1298.0	xxx	xxx	xxx	xxx	xxx	xxx
Elevation Crest Emergency Spillway	Ft.	1494.0	1524.0	1389.6	1293.2	xxx	xxx	xxx	xxx	xxx	xxx
Elevation Crest - Principal Spillway	Ft.	1457.6	1497.7	1362.5	1282.0	xxx	xxx	xxx	xxx	xxx	xxx
Maximum Height of Dam 1/	Ft.	64	61	46	26	xxx	xxx	xxx	xxx	xxx	xxx
Volume of Fill	Cu. Yds.	150,000	154,400	215,000	60,000	579,400	579,400	1,913,529	1,913,529	xxx	xxx
Total Capacity	Ac. Ft.	2,329	2,419	693	824	6,265	6,265	18,071	18,071	xxx	xxx
Sediment Submerged 1st 50 Years	Ac. Ft.	112	122	40	50	324	324	1,614	1,614	xxx	xxx
Sediment Submerged 2nd 50 Years	Ac. Ft.	111	122	40	58	331	331	331	331	xxx	xxx
Sediment Aerated	Ac. Ft.	17	18	7	16	58	58	204	204	xxx	xxx
Retarding	Ac. Ft.	2,089	2,157	606	700	5,552	5,552	15,922	15,922	xxx	xxx
Surface Area	Acres	17	20	7	21	65	65	445	445	xxx	xxx
Sediment Pool-Principal Spillway Crest	Acres	132	192	45	129	498	498	1,999	1,999	xxx	xxx
Retarding Pool										xxx	xxx
Principal Spillway										xxx	xxx
Rainfall Volume (areal) (1-day) 2/	In.	7.25	7.25	7.30	7.30	xxx	xxx	xxx	xxx	xxx	xxx
Rainfall Volume (areal) (10-day) 2/	In.	11.80	11.80	11.80	11.80	xxx	xxx	xxx	xxx	xxx	xxx
Runoff Volume (10-day)	In.	5.11	5.11	5.76	5.82	xxx	xxx	xxx	xxx	xxx	xxx
Capacity (Maximum)	cfs	132	152	62	75	xxx	xxx	xxx	xxx	xxx	xxx
Frequency Operation - Emer. Spillway 3/	% Chance	3.5	3.6	3.8	4.0	xxx	xxx	xxx	xxx	xxx	xxx
Size of Conduit	In.	30	30	24	24	xxx	xxx	xxx	xxx	xxx	xxx
Emergency Spillway										xxx	xxx
Rainfall Volume (ESH) (areal) 4/	In.	6.50	6.50	6.65	6.60	xxx	xxx	xxx	xxx	xxx	xxx
Runoff Volume (ESH)	In.	3.90	3.90	4.05	4.12	xxx	xxx	xxx	xxx	xxx	xxx
Type		Rock	Rock	Rock	Veg.	xxx	xxx	xxx	xxx	xxx	xxx
Bottom Width	Ft.	200	180	100	100	xxx	xxx	xxx	xxx	xxx	xxx
Velocity of Flow (Ve) 5/	Ft./Sec.	3.1	3.5	6.9	2.4	xxx	xxx	xxx	xxx	xxx	xxx
Slope of Exit Channel	Ft./Ft.	.040	.040	.080	.040	xxx	xxx	xxx	xxx	xxx	xxx
Maximum Water Surface Elevation 5/	Ft.	1494.3	1525.0	1391.1	1293.8	xxx	xxx	xxx	xxx	xxx	xxx
Freeboard										xxx	xxx
Rainfall Volume (FH) (areal) 6/	In.	13.50	13.50	13.80	13.60	xxx	xxx	xxx	xxx	xxx	xxx
Runoff Volume (FH)	In.	10.47	10.47	10.77	10.73	xxx	xxx	xxx	xxx	xxx	xxx
Maximum Water Surface Elevation 5/	Ft.	1502.6	1531.7	1396.5	1298.0	xxx	xxx	xxx	xxx	xxx	xxx
Capacity Equivalents										xxx	xxx
Sediment Volume	In.	0.41	0.41	0.50	0.62	xxx	xxx	xxx	xxx	xxx	xxx
Retarding Volume	In.	3.56	3.37	3.50	3.50	xxx	xxx	xxx	xxx	xxx	xxx
Spillway Storage 7/	In.	2.43	2.77	1.82	4.04	xxx	xxx	xxx	xxx	xxx	xxx

Modifies table 3, dated December 1956
(See footnotes on next page)

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURES - Contd.
Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas

- 1/ Measured from centerline of stream channel to effective top of dam.
- 2/ Value of P taken from Technical Paper No. 49, U. S. Weather Bureau, 1964.
- 3/ Based on minimum detention requirements as set forth in Washington Engineering Memorandum 27 (Rev.) and Chapter 21, Section 4, Hydrology, Part 1 - Watershed Planning of the National Engineering Handbook.
- 4/ Value of P taken from plate 2-a1, Spillway Design Storm, Engineering-Hydrology Memorandum TX-1.
- 5/ Maximum during passage of hydrograph.
- 6/ Value of P taken from plate 2-a2, Freeboard Storm, Engineering-Hydrology Memorandum TX-1.
- 7/ Storage from emergency spillway crest to top of dam.

December 1967

TABLE 4 - SUMMARY OF PHYSICAL DATA
Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas

Item	Unit	Quantity Without Program	Quantity With Program
Watershed Area	Sq. Mi.	878	xxx
Watershed Area	Acres	561,920	xxx
Area of Cropland	Acres	71,126	71,126
Area of Grassland	Acres	479,566	479,566
Overflow Area Subject to Damage by Design Storm	Acres	6,598	4,613
Area Damaged Annually by:			
Sediment	Acres	xxx	xxx
Flood Plain Scour	Acres	2,147	483
Sheet Erosion	Acres	261,322	81,819
Average Annual Rainfall	Inches	27	xxx

Modifies table 4, dated December 1956.

December 1967

TABLE 5 - SUMMARY OF PLAN DATA
Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas

Item	Unit	Quantity
Years to Complete Program	Year	12
Total Installation Cost		
Federal	Dollar	1,330,170
Non-Federal	Dollar	1,232,289
Annual O & M Cost		
Federal	Dollar	xxx
Non-Federal	Dollar	2,219
Average Annual Monetary Benefits	Dollar	71,752
Agricultural	Percent	88
Nonagricultural	Percent	12
Structural Measures		
Floodwater Retarding Structures	Each	16
Surface Area		
Sediment Pool	Acre	445
Detention Pool	Acre	1,999
Watershed Area Above Structures	Acre	53,487
Reduction of Floodwater Damage	Dollar	45,706
By Land Treatment Measures for Watershed Protection	Percent	8
By Structural Measures	Percent	58
Reduction of Erosion Damage	Dollar	7,086
By Land Treatment Measures for Watershed Protection	Percent	8
By Structural Measures	Percent	73
Flood Prevention Benefit from Changed Land Use	Dollar	12,747

Modifies table 5, dated December 1956.

December 1967

TABLE 6 - ANNUAL COSTS ^{1/}
Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas
(dollars)

Evaluation Unit	: Amortization : of Installa- : tion Costs ^{2/}	: : : Operation and: : Maintenance :	: Total
Floodwater Retarding Structures 1 through 12, constructed prior to 1966	35,104	1,471 ^{3/}	36,575
Wallace Creek Structures, Sites 13, 14, and 15	14,597	561	15,158
China Creek Structure, Site 16	2,186	187	2,373
Subtotal - Wallace and China Creeks	16,783	748 ^{4/}	17,531
TOTAL - ALL STRUCTURES	51,887	2,219	54,106

^{1/} Does not include work plan preparation costs.

^{2/} Structures 1 through 12 at 2-1/2 percent for Federal and 4 percent for Non-Federal for 50-year period. Structures 13, 14, 15, and 16 amortized at 3-1/4 percent for 100-year period.

^{3/} Based on long-term prices as projected by ARS, June 1956.

^{4/} Based on Adjusted Normalized Prices - Water Resources Council, April 1966.

Modifies table 6, dated December 1956.

December 1967

TABLE 7 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
 Lower San Saba River Watershed 1/
 of the Middle Colorado River Watershed, Texas
 (dollars) 2/

Item	: Estimated Average Annual Damage:		Damage Reduction Benefits
	: Without Project	: With Project	
Crop and Pasture	29,567	11,109	18,458
Other Agricultural	12,211	2,950	9,261
Nonagricultural Road and Bridge	6,262	1,705	4,557
Subtotal	48,040	15,764	32,276
Erosion Flood Plain Scour	8,845	1,834	7,011
Indirect	5,688	1,760	3,928
TOTAL	62,573	19,358	43,215

1/ Richland Creek and Jerry's Branch Tributaries only.

2/ Price base: Long-term price as projected by ARS, June 1956.

December 1967

TABLE 7a - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS
 Lower San Saba River Watershed ^{1/}
 of the Middle Colorado River Watershed, Texas
 (dollars) ^{2/}

Item	: Estimated Average Annual Damage:		: Damage : Reduction : Benefits
	: Without : Project	: With : Project	
Crop and Pasture	9,425	3,501	5,924
Other Agricultural	6,823	2,160	4,663
Nonagricultural			
Road and Bridge	5,238	2,395	2,843
Subtotal	21,486	8,056	13,430
Erosion			
Flood Plain Scour	163	88	75
Indirect	2,165	815	1,350
TOTAL	23,814	8,959	14,855

^{1/} Wallace Creek and China Creek Tributaries only.

^{2/} Price base: Adjusted Normalized Prices - Water Resource Council,
 April 1966.

December 1967

TABLE 8 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Lower San Saba River Watershed
of the Middle Colorado River Watershed, Texas
(dollars)

Evaluation Unit	AVERAGE ANNUAL BENEFITS 1/						Average: Benefit- Annual : Cost	Ratio
	Changed :	Mainstem & : Land Use :	Outside : Intensi- : Incidental 2/ :	Watershed : Secondary 3/ :	Total :	Cost :		
Structures Nos. 1 through 12, completed prior to 1966	37,317	9,512	-	2,970	-	49,799	36,575	1.3:1
Structures Nos. 13 through 15 (Wallace Creek)	11,773	2,234	240	2,396	1,972	18,615	15,158	1.2:1
Structure No. 16 (China Creek)	1,493	1,001	75	327	442	3,338	2,373	1.4:1
GRAND TOTAL	50,583	12,747	315	5,693	2,414	71,752	54,106	1.3:1

1/ Price base: Long-term prices, as projected by ARS, June 1956, Structures 1 - 12. Adjusted Normalized Prices, Water Resources Council, April 1966, Structures 13 - 16.
2/ Includes \$240 benefits from livestock water and \$75 benefits from recreation.
3/ Includes \$4,047 benefits from reduction of flood damage to Lower San Saba River, \$1,481 from mainstem of the Colorado River and \$165 from reduction of sediment damage to Lake Buchanan.
4/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$7,487 annually.
Modified table 8, dated December 1956.

December 1967

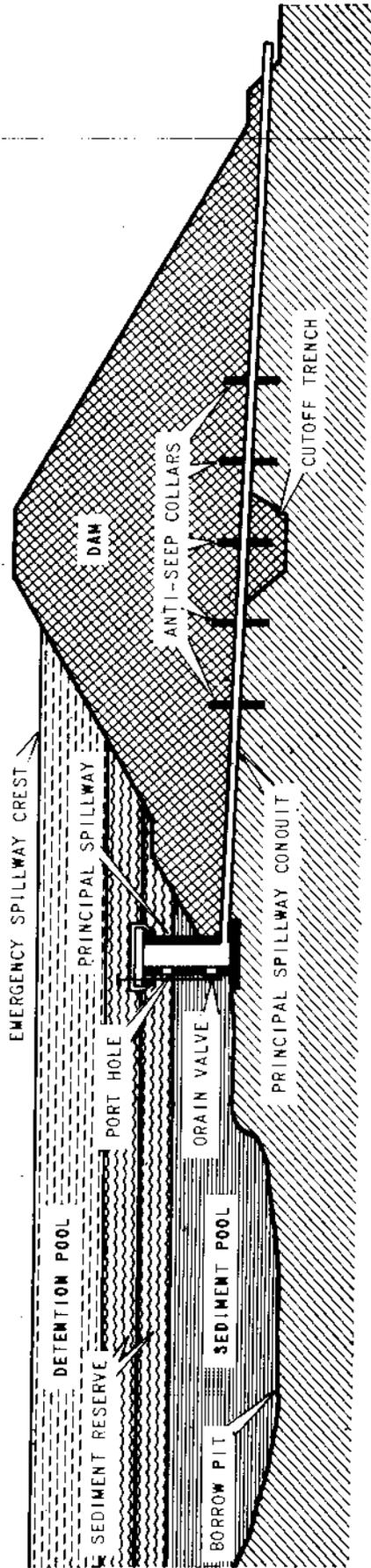
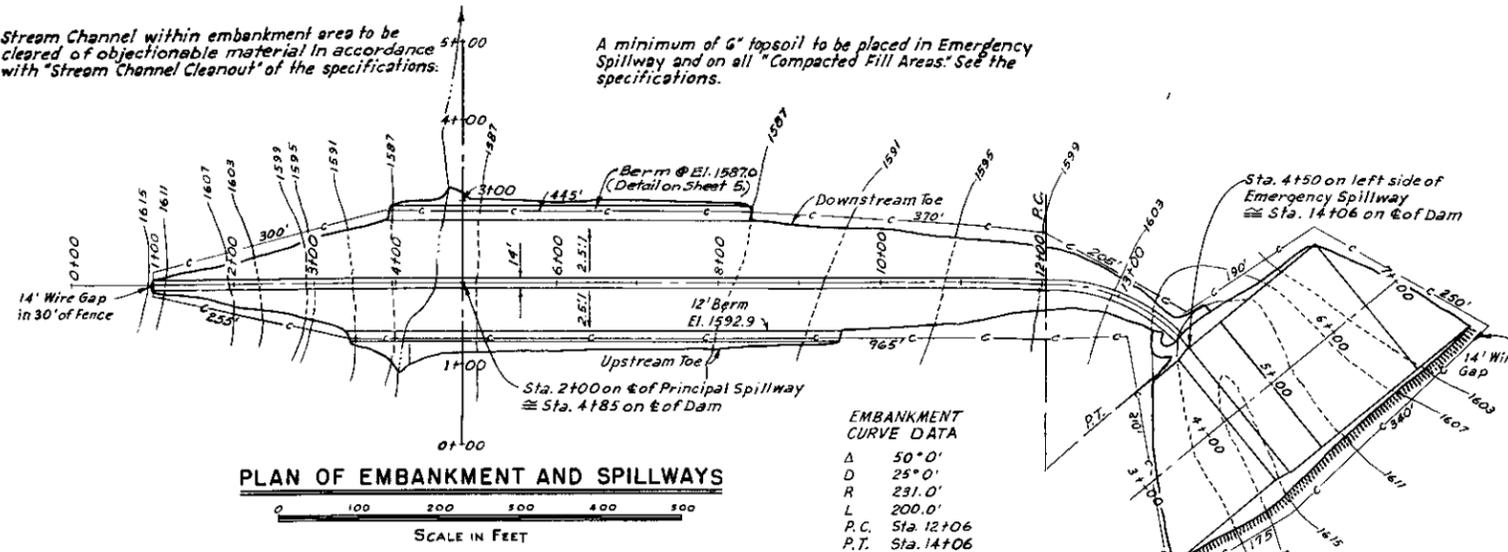


Figure 1

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

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

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



Emergency Spillway Diversion: 18" effective height, 3:1 side slopes, minimum base, 13'. Cost of diversion to be subsidiary to other items of work.

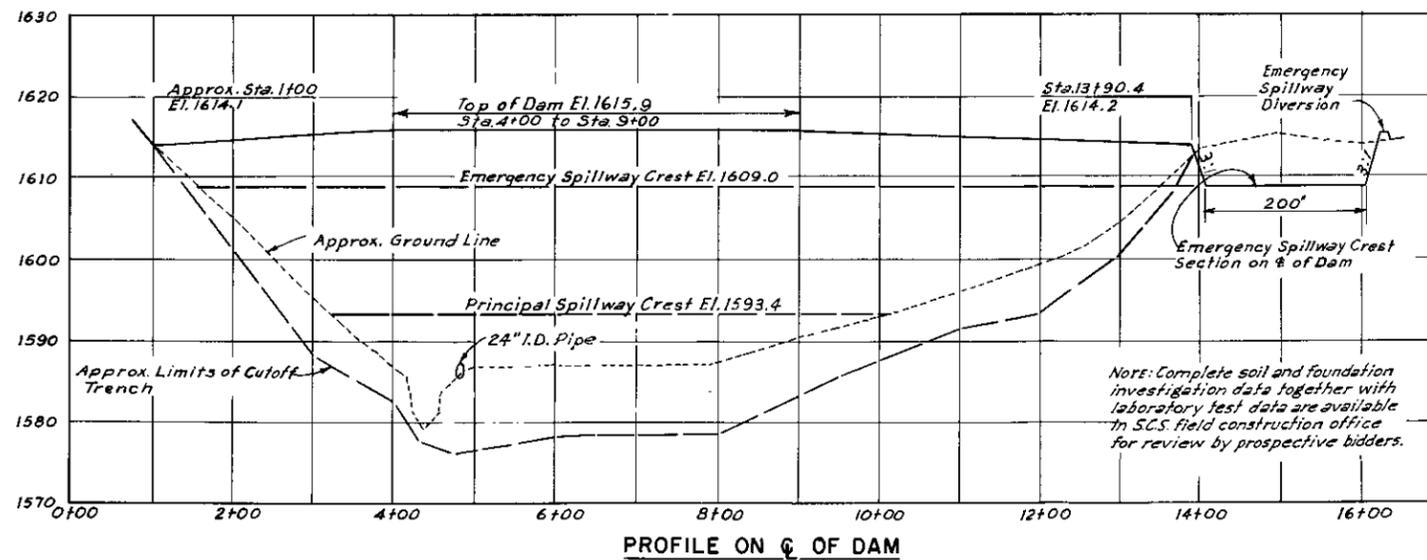
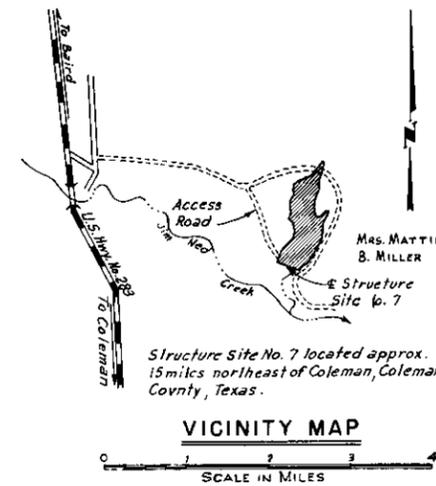
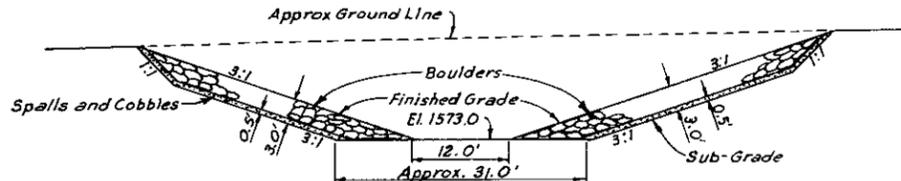
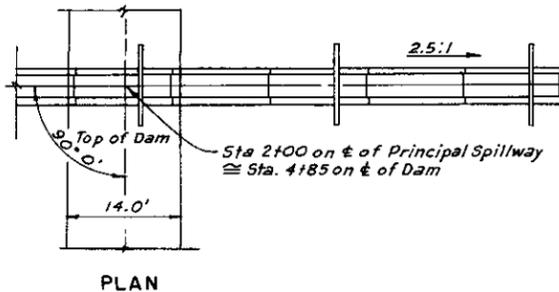


Figure 2 TYPICAL FLOODWATER RETARDING STRUCTURE GENERAL PLAN AND PROFILE			
U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE			
Designed	M.D.K.	9-61	Approved by: <i>[Signature]</i>
Drawn	M.O.K. & M.G.C.	3-61	HEAD ENGINEERING & SURVEYING TRAINING UNIT FOST WORTH TEXAS
Traced	M.G.C.	3-61	STATE CONSERVATION ENGINEERS' ASSOCIATION
Checked	M.D.K. & G.W.T.	4-61	NO. 2 Drawing No. 4-E-15,400

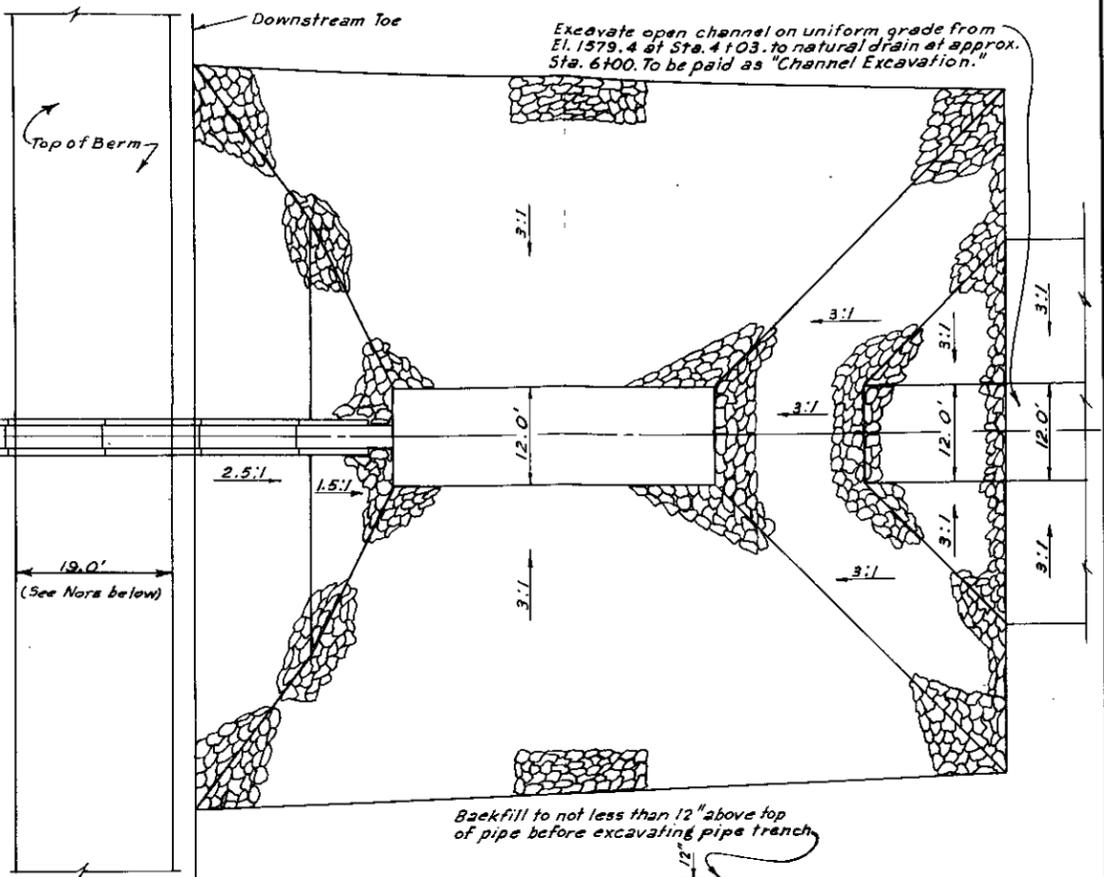


The 2.5ft. thickness of dumped rock will be placed in Plunge Basin with rock sizes grading from small at sub-grade to large at finished grade. Placement of spalls and cobbles will precede dumping and placement of boulders. Boulders will be placed to reasonable neat lines of the finished grades, as shown on drawings. Cost of excavating and preparing Plunge Basin for placement of rock will be paid as "Channel Excavation". Rock against Principal Spillway will be hand placed to avoid damage to pipe or other structural works. Any damage to pipe or other structural works caused by the Contractor during construction of the Plunge Basin shall be repaired by the Contractor without compensation. Source of rock will be from the Emergency Spillway Excavation. Rock shall be quarry-run size. Placement of the rock in the Plunge Basin is not a direct pay item; such cost is to be considered subsidiary to other items of work. Approximately 560 cu yd of rock will be required to construct the Plunge Basin.

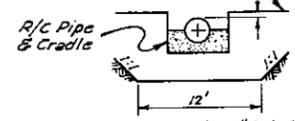
TYPICAL SECTION - PLUNGE BASIN



PLAN

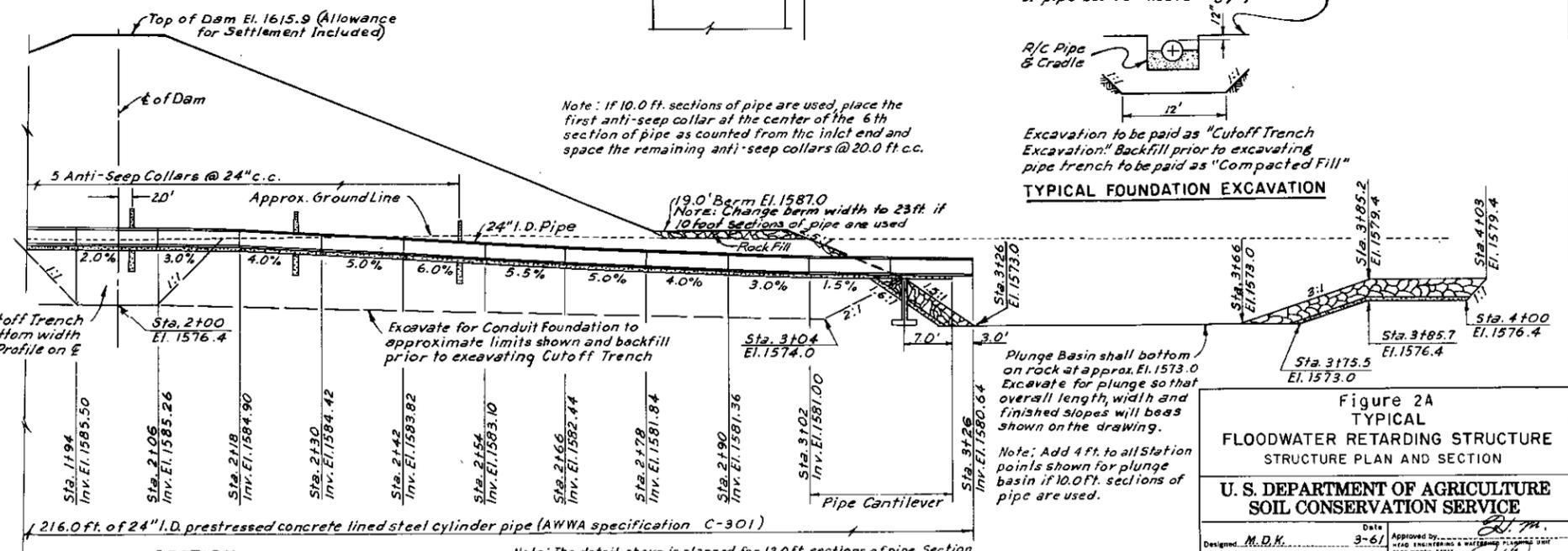


Backfill to not less than 12" above top of pipe before excavating pipe trench



Excavation to be paid as "Cutoff Trench Excavation" Backfill prior to excavating pipe trench to be paid as "Compacted Fill"

TYPICAL FOUNDATION EXCAVATION



Impervious Core: Excavate Cutoff Trench with 1:1 side slopes and 12 ft. bottom width to approximate limit shown on "Profile on E of Dam."

Excavate for Conduit Foundation to approximate limits shown and backfill prior to excavating Cutoff Trench

Note: If 10.0 ft. sections of pipe are used, place the first anti-seep collar at the center of the 6th section of pipe as counted from the inlet end and space the remaining anti-seep collars @ 20.0 ft. c.c.

Plunge Basin shall bottom on rock at approx. El. 1573.0 Excavate for plunge so that overall length, width and finished slopes will be as shown on the drawing.

Note: Add 4 ft. to all Station points shown for plunge basin if 10.0 ft. sections of pipe are used.

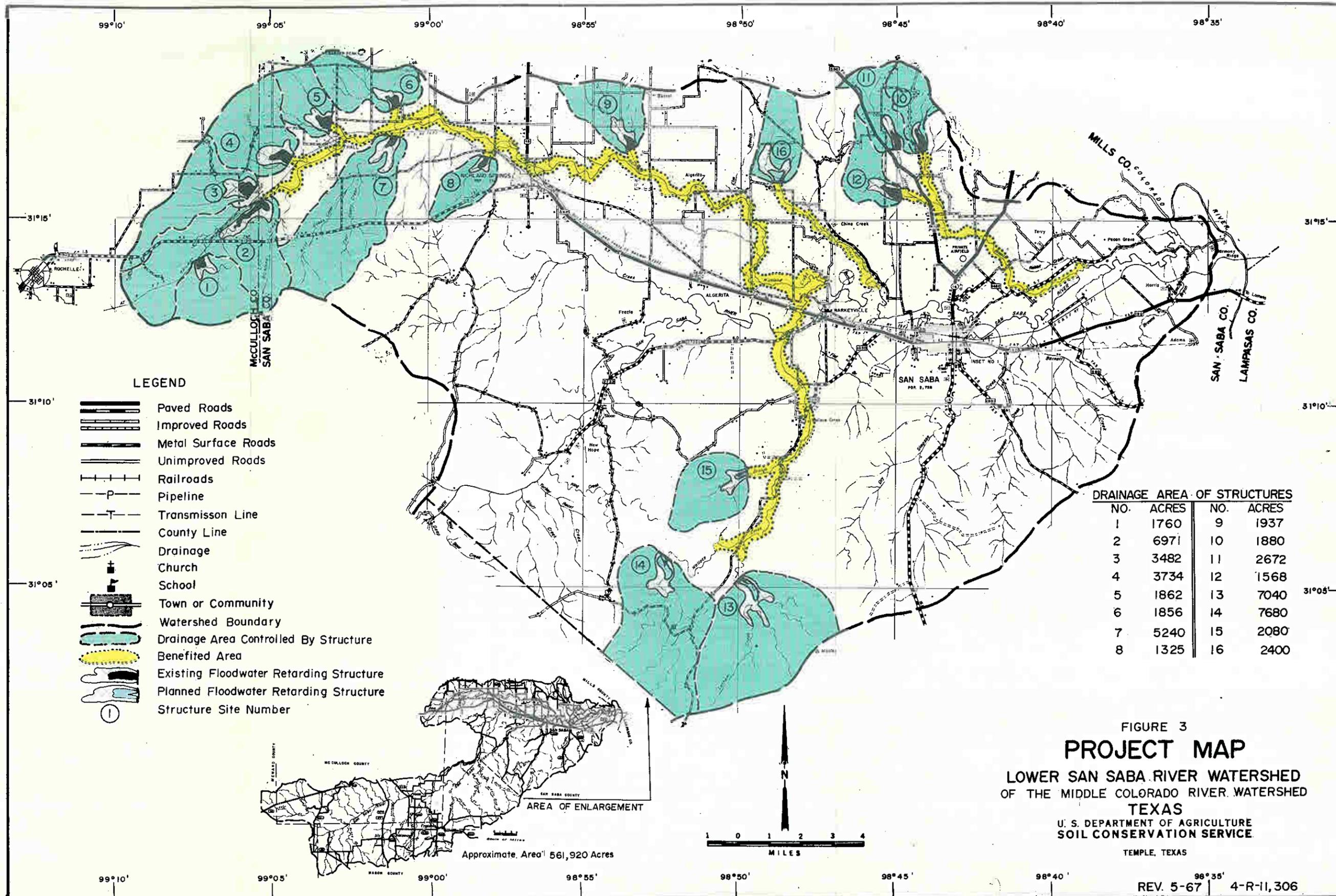
SECTION PRINCIPAL SPILLWAY

Note: The detail above is planned for 12.0 ft. sections of pipe. Section lengths of 10.0 ft. may be used with inert of joints set on grade line as established above, utilizing 220.0 ft. of pipe, ending at station 3+30. Section lengths in excess of 12.0 ft. will not be permitted.

Figure 2A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed: M.D.K.	Date: 3-67	Approved by: [Signature]
Drawn: M.D.K. & M.G.C.	Date: 3-67	Checked: [Signature]
Traced: M.G.C.	Date: 3-67	Scale: Drawing No. 4-E-15,400
Checked: M.D.K. & G.W.T.	Date: 4-67	Sheet: 10



Base from General Highway Map - Revised 1965 and 1966 - Reproduction permission granted U. S. Department of Agriculture, Soil Conservation Service, Fort Worth, Texas
 USDA-SCS-FORT WORTH, TEX. 1968