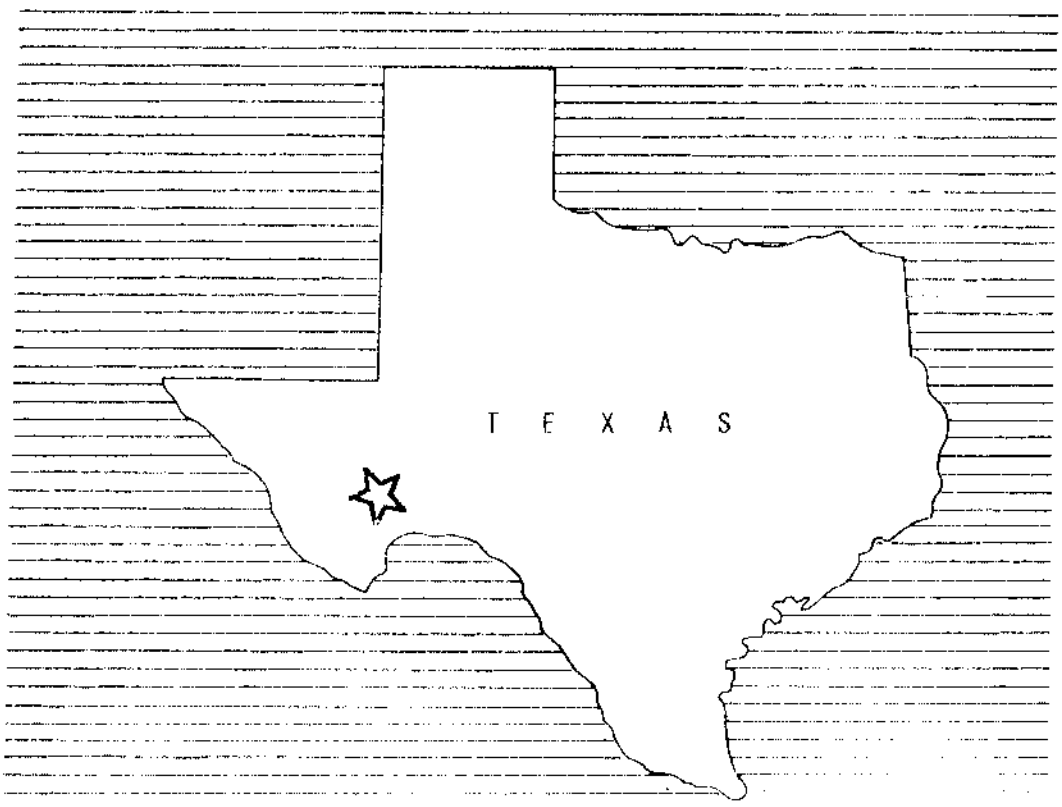
WORK PLAN

FOR WATERSHED PROTECTION
AND FLOOD PREVENTION

MIMMS DRAW WATERSHED

PRESIDIO COUNTY, TEXAS



March 1960

WATERSHED WORK PLAN AGREEMENT

between the

Highland Soil Conservation District
Local Organization

City of Marfa
Local Organization

Presidio County Commissioners Court
Local Organization

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

and the

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

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Mimms Draw Watershed, State of Texas under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended by the Act of August 7, 1956 (Public Law 1018, 84th Congress; 70 Stat. 1088); and

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

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

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan will be installed, within 5 years, and operated and maintained substantially in accordance with the terms, conditions, and stipulations provided for therein.

It is mutually agreed that in installing and operating and maintaining the works of improvement described in the watershed work plan:

1. The Sponsoring Local Organization will acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with the works of improvement. (Estimated cost $ 2,615 .)

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

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

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
1 **Floodwater Retarding Structure**	0	100	53,878

The Sponsoring Local Organization will pay all of the costs allocated to purposes other than flood prevention, and irrigation, drainage, and other agricultural water management.

4. The Service will bear the cost of all installation services applicable to works of improvement for flood prevention. (Estimated cost $ 13,894 .)

   The Service will bear - percent of the cost of installation services applicable to works of improvement for agricultural water management and the Sponsoring Local Organization will bear - percent of the cost of such services. (Estimated cost $ - .)

   The Sponsoring Local Organization will bear the cost of all installation services applicable to works of improvement for nonagricultural water management. (Estimated cost $ - .)

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

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

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

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

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

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

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

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

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

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

Highland Soil Conservation District
Local Organization

By Russell F. Nichols

Title Vice-chairman

Date June 6, 1960

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

adopted at a meeting held on January 4, 1960

R. J. Johnson
(Secretary, Local Organization)
Member Board of Supervisors HSCD

Date June 6, 1960

City of Marfa
Local Organization

By W. C. Caffield

Title Mayor

Date June 6, 1960

The signing of this agreement was authorized by a resolution of the gover
ing body of the City of Marfa
Local Organization

adopted at a meeting held on Jan 6, 1959

Mary Taylor
(Secretary, Local Organization)

Date 6-6-60

Presidio County Commissioners Court
Local Organization

By W B Johnson

Title County Judge

Date June 6, 1960

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

adopted at a meeting held on February 10, 1958

Della Bond COUNT
(~~Secretary, Local Organization~~)

Date June 6, 1960

Soil Conservation Service
United States Department of Agricultu

By
State Conservationist

Date

WORK PLAN

FOR

WATERSHED PROTECTION AND FLOOD PREVENTION

MIMMS DRAW WATERSHED
Presidio County, Texas

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

Prepared By: Highland Soil Conservation District
(Cosponsor)

City of Marfa
(Cosponsor)

Presidio County Commissioners Court
(Cosponsor)

With Assistance By:

U. S. Department of Agriculture
Soil Conservation Service
March 1960

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WATERSHED WORK PLAN

MIMMS DRAW WATERSHED
Presidio County, Texas
March 1960

SUMMARY OF PLAN

General Summary

The work plan for watershed protection and flood prevention for Mimms Dra watershed was prepared by the Highland Soil Conservation District, the city of Marfa, Texas and the Commissioners Court of Presidio County, as cosponsoring local organizations. Technical assistance was provided by t Soil Conservation Service of the United States Department of Agriculture.

The primary objective of the project is to provide flood protection for t portion of the city of Marfa subject to flood damage from Mimms Draw. Th local sponsoring organizations determined that the watershed protection a flood prevention program most nearly met their needs.

The watershed covers an area of 7.07 square miles, or 4,525 acres in Presidio County, Texas. Approximately 4 percent of the watershed is crop land, 86 percent rangeland, and 10 percent is in miscellaneous uses, such as towns, industrial areas, roads, stream channels, and railroads.

There are no Federal lands in the watershed.

The work plan proposes installing, in a 5-year period, a project for the protection and development of the watershed at a total estimated installa tion cost of $81,051. The share of this cost to be borne by Public Law 566 funds is $67,772. The share to be borne by other than Public Law 566 funds is $13,279. In addition, the local interests will bear the entire cost of operation and maintenance.

Land Treatment Measures

The cost for land treatment measures is estimated to be $10,164 of which the other than Public Law 566 share is $10,164. The work plan includes only the land treatment that will be installed during the 5-year project period.

Structural Measures

The structural measures included in the plan consist of one floodwater retarding structure having a total sediment storage and floodwater detention capacity of 884 acre-feet. The total cost of structural measures

is $70,887 of which the local share is $3,115 and the Public Law 566 shar is $67,772. The local share of the costs of structural measures includes land, easements, and rights-of-way, 84 percent, and administering contrac 16 percent. The one floodwater retarding structure will be installed dur a 1-year period.

Damages and Benefits

The estimated average annual floodwater, sediment, and indirect damages without the project total $9,137 at long-term price levels. The estimate average annual floodwater, sediment, and indirect damages with the projec installed, including land treatment and structural measures amount to $26 a reduction of approximately 97 percent.

The average annual primary benefits accruing to structural measures are $7,964, which are distributed as follows:

Floodwater damage reduction	$7,224
Sediment damage reduction	16
Indirect damage reduction	724

The ratio of the average annual benefits ($7,964) to the average annual cost of structural measures ($2,679) is 3.0 to 1.

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

Provisions for Financing Construction

The city of Marfa has powers of taxation and eminent domain under applica ble State laws. Adequate funds are available from the city of Marfa gene fund for financing the local share of the structural costs.

Operation and Maintenance

Land treatment measures for watershed protection will be operated and mai tained by the landowners or operators of the farms and ranches on which t measures will be installed, under agreement with the Highland Soil Conse vation District.

The city of Marfa will be responsible for the operation and maintenance o the floodwater retarding structure. Money from the general fund is avail able and adequate for this purpose. The estimated average annual cost of operation and maintenance of this structure is $180.

DESCRIPTION OF WATERSHED

Physical Data

Mimms Draw heads approximately 3.5 miles northwest of Marfa, Presidio Cou Texas and flows generally in a southwesterly direction through Marfa to i confluence with Alamito Creek, about 1.5 miles south of town. The princi pal tributaries join to form the mainstem approximately 0.5 mile northwes of Marfa and a third tributary enters the mainstem from the west just sou of the city limits. The drainage area of the watershed is 7.07 square mi (4,525 acres).

The topography ranges from steeply sloping in the western portion to gent sloping along and adjacent to the valley floor. Elevations range from 4,645 feet at the lower end of the watershed to more than 4,950 feet abov mean sea level along the upper portion of the watershed divide. Mimms Dr and its tributaries have broad oval shaped valley floors with almost no natural development of stream channels.

The entire watershed is in the Trans-Pecos Land Resource Area and is mair underlain by volcanic ash, tuff, agglomerate, and basalt and lava flows o the Tertiary system. There is a small area of Quaternary alluvium in the southern portion.

Most of the soils are deep, fine textured, and moderately permeable. Approximately 35 percent of the soils are shallow or very shallow and gravelly. Nearly all soils within the watershed are unnamed.

There are two range sites, each occupying approximately 50 percent of the rangeland. In general the range cover is in good condition on the Gravel Hills site and fair condition on the Deep Upland site. The predominant vegetation is blue grama.

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

Land Use	Acres	Percent
Rangeland	3,889	85.9
Cropland	162	3.6
Miscellaneous 1/	474	10.5
Total	4,525	100.0

1/ Includes urban areas, roads, highways, railroad rights-of-way, etc.

The flood plain, as described herein, is the area inundated by a 100-year frequency storm runoff. Approximately 261 acres of the watershed, exclud stream channels, is flood plain. Land use in the flood plain is 73.9 per cent urban, 10.4 percent pasture, and 15.7 percent irrigated temporary pasture.

The mean annual rainfall is 14.80 inches, as recorded at U. S. Weather B gage at Marfa. The monthly average ranges from 0.31 inch in March to 2. inches in August. Average temperatures range from 76.8 degrees Fahrenhe the summer to 46.6 degrees in the winter. The normal frost-free period 227 days extends from April 1 to November 14.

Water for livestock and rural domestic use is obtained from surface pond and wells. Municipal water for the city of Marfa is obtained from wells and is adequate for all anticipated needs.

Economic Data

The economy of the watershed is almost entirely dependent upon productio of beef cattle. All of the agricultural land in the watershed is rangel except 162 acres which is utilized for irrigated temporary pasture. Bee cattle produced in this area are of unusually high quality and consisten bring premium prices when marketed as feeder calves. Most of the calves yearling cattle are shipped to feeders in the corn belt feeding areas.

All of the agricultural land is owned and operated by three owners. No ranch is located entirely within the watershed and the average size of t three ranches is 12,873 acres, which is sufficient for an economic unit i this area.

Marfa, with a population of 3,600, is the county seat of Presidio County and the only town or community in the watershed. It also is the banking and commercial center for a wide ranching area, with a market territory extending into northern Mexico.

The watershed is adequately served by approximately 12 miles of Federal, State and County roads, of which 6 miles are hard surfaced. In addition there are numerous private roads serving the ranches in the watershed and the suburban areas of Marfa. Adequate rail service is provided by the Texas and New Orleans Railroad with good loading and shipping facilities at Marfa.

WATERSHED PROBLEMS

Floodwater Damage

Flooding occurs very frequently in the watershed and causes moderate to severe damage to the urban area of Marfa. Small overflows into the residential and business areas are almost an annual occurrence. Damage from these smaller floods is relatively minor and consists primarily of damage to streets and the necessary removal of debris. Large floods whic inundate up to 50 blocks of the urban area to a relatively shallow depth, occur on the average of once every five years. Floods of this magnitude, or greater, cause severe damage to streets, residential units and busines establishments, (Figure 1).

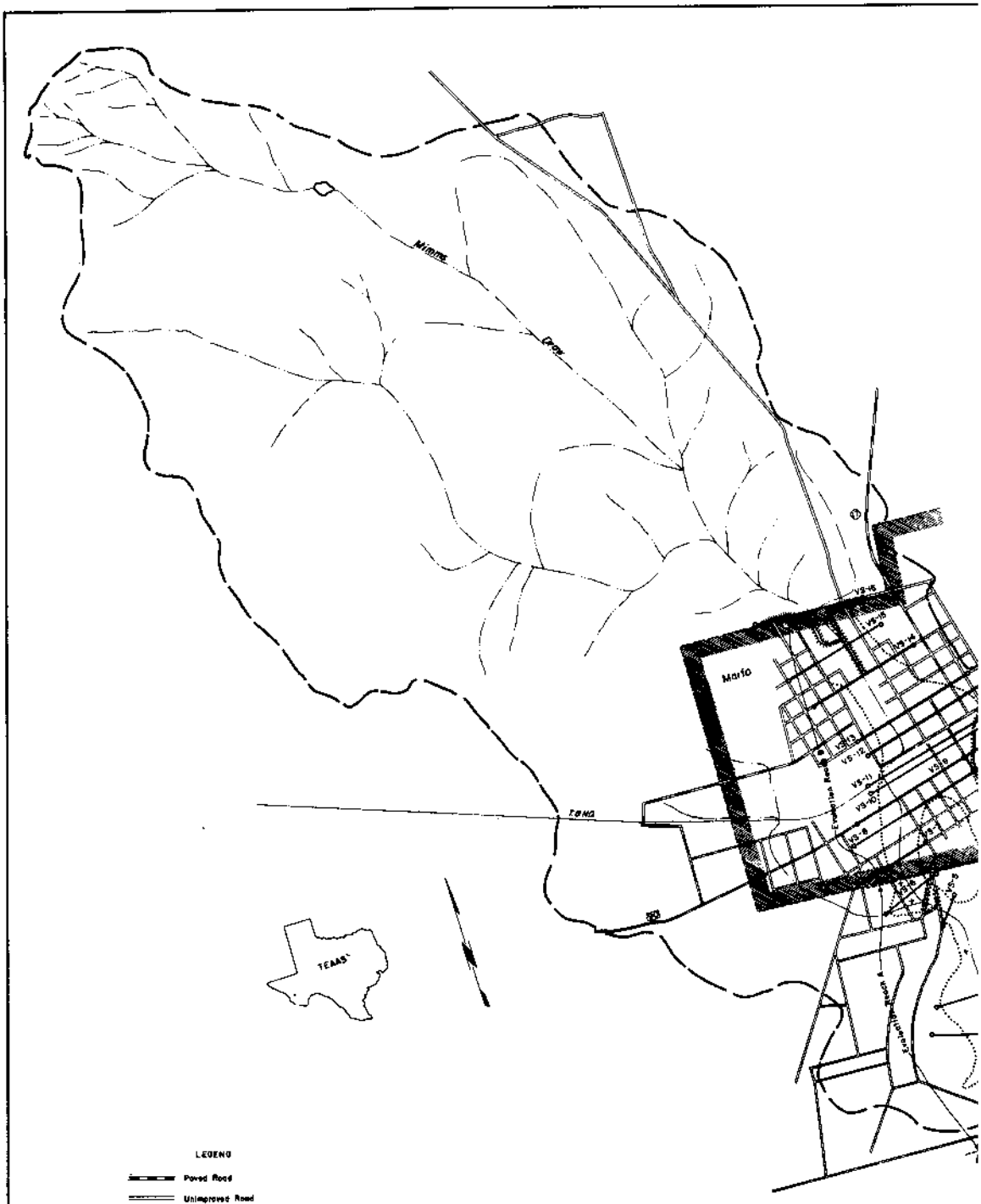

Figure 1

PROBLEM LOCATION
MIMMS DRAW WATERSHED

Presidio County, Texas

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

0 1/4 1/2 Mile

Approximate Scale

Approximate Area - 4325 acres

Compiled from photos CTE-6-65, CTE-9-66, and CTE-13-32

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The most damaging flood in recent years occurred May 9, 1949 and inundat practically all of the 261 acres of flood plain of which approximately 1 acres was in the city of Marfa. Direct floodwater damage from this floo is estimated at $68,000 at 1949 price levels. Approximately $66,000 of this damage occurred within the city of Marfa.

For the floods expected to occur during the evaluation period, which inc floods up to 100-year frequency, the total direct floodwater damages are estimated to average $8,282 annually, at long-term price levels, of whic $124 is crop and pasture damage, $259 is other agricultural damage, $173 nonagricultural damage to roads and bridges and $7,726 is urban and subu damage.

Indirect damages such as interruption of travel, losses sustained by business establishments, disruption of utility services and similar losse are estimated to average $831 per year.

Sediment Damage

Because of the low erosion rates existing, sediment damage is low. The majority of the damage is caused by deposition on the flood plain below Marfa.

Approximately 27 percent of the agricultural land in the flood plain is damaged by sediment. Deposition of sandy silt with fine gravel, averagin 4 inches in depth, has damaged approximately 22 acres an estimated 10 per cent, and 1 acre 20 percent in terms of reduced productivity. This amoun to an average annual monetary damage of $24 at long-term price levels.

The estimated annual sediment yield above the planned floodwater retardin structure is 0.83 acre-foot. The estimated average annual rate of sedime accumulation in the structure is 0.24 acre-foot per square mile of waters area.

Erosion Damage

Erosion rates in the watershed are low. This is due primarily to almost all of the watershed being in rangeland with good cover, the erosion resistant soils, and the low annual rainfall. Of the estimated total gro erosion under present conditions, 89 percent is derived from sheet erosio and 11 percent from isolated areas of stream channel erosion. Gully eros and flood plain scour are negligible.

Problems Relating to Water Management

There is no activity relative to drainage and very little activity relati to irrigation in the watershed. Irrigation is being applied to temporary pasture and on approximately 162 acres from a combination of wells and fr the effluent of the Marfa sewerage system.

EXISTING OR PROPOSED WORKS OF IMPROVEMENT

The watershed is served by the Soil Conservation Service work unit at Ma This work unit has assisted the ranchers in preparing three soil and wat conservation plans on 4,051 acres (100 percent of the agricultural land) within the watershed and has given technical assistance in establishing maintaining planned measures. Approximately 90 percent of the planned practices have been applied.

Efforts to control or prevent flooding of urban areas within the city of Marfa have been extensive through the use of improved channels and levee These efforts have had some effect in reducing flood damages from the sm flows. The channel through the urban area was enlarged and levees were structed to provide increased capacity for flood flows. At the upper en the enlarged channel the levees were constructed in such a manner to pro a temporary storage basin with outlet structure. This detention of floo waters along with the improvement to the channel has decreased the damag urban property.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures for Watershed Protection

An effective conservation program based upon the use of each acre of agri tural land within its capabilities and its treatment in accordance with needs, such as is now being carried out by the Highland Soil Conservation District is necessary for a sound watershed protection and flood preventi program on the watershed. Basic to reaching this objective is the establ ment and maintenance of all applicable soil and water conservation and pl management practices essential to proper land use.

Of the total watershed area of 4,525 acres, 2,720 acres lie above the planned floodwater retarding structure. Land treatment is especially imp tant for protection of these watershed lands to support and supplement th structural measure. Land treatment constitutes the only planned measures for the remaining upland area.

The amounts and estimated costs of the measures that will be installed by the landowners are shown in table 1. The estimated total cost of plannin and installing these measures is $10,164. The total cost will be borne b other than Public Law 566 funds and includes expected reimbursements from ACPS, based on current program criteria, and $991 to be spent by the Soil Conservation Service in providing technical assistance under its going program to the district during the project installation period. Landowne will maintain these measures in accordance with provisions of the farmer-district cooperative agreements with the Highland Soil Conservation Distr

Continued application of recurring and maintenance of non-recurring land treatment measures which are applied will stabilize erosion damage and sediment production by providing improved soil cover conditions. These

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST 1/

Minns Draw Watershed, Texas
Price Base: 1960

Installation Cost Item	Unit	No. to be Applied Non-Federal Land	Estimated Cost Public Law 566 Funds (dollars)	Other Funds (dollars)	
LAND TREATMENT FOR					
Watershed Protection					
Soil Conservation Service					
Proper Use	Acre	3,889	-	NC	
Deferred Grazing	Acre	3,889	-	2,333	
Rotation Hay and Pasture	Acre	134	-	6,030	
Crop Residue Utilization	Acre	162	-	810	
Conservation Cropping System	Acre	162	-	NC	
Technical Assistance			-	991	
SCS Subtotal			-	10,164	1
TOTAL LAND TREATMENT			-	10,164	1
STRUCTURAL MEASURES					
Soil Conservation Service					
Floodwater Retarding Structure No.		1	53,878	-	5
SCS Subtotal			53,878	-	5
Subtotal - Construction			53,878	-	5
Installation Services					
Soil Conservation Service					
Engineering Services			9,698	-	
Other			4,196	-	
SCS Subtotal			13,894	-	1
Subtotal - Installation Services			13,894	-	1
Other Costs					
Land, Easements & R/W			-	2,615	
Administration of Contracts			-	500	
Subtotal - Other			-	3,115	
TOTAL STRUCTURAL MEASURES			67,772	3,115	7
TOTAL PROJECT			67,772	13,279	8
SUMMARY					
Subtotal SCS			67,772	13,279	8
TOTAL PROJECT			67,772	13,279	8

1/ No Federal lands involved.

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measures include conservation cropping system, use of rotation hay and pasture, crop residue utilization for cropland, and proper use and deferr grazing of grasslands to provide improvement, protection, and maintenance grass stands. These measures also effectively improve soil conditions wh allow rainfall to soak into the soil at a more rapid rate.

Structural Measures

One floodwater retarding structure will be installed to afford the needed protection to flood plain lands which cannot be provided by land treatmer measures alone.

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

The location of the structural measures is shown on Planned Structural Measures, figure 3.

This structure will temporarily detain runoff from approximately 60 perce of the entire watershed and 90 percent of the area above Marfa. The floc water retarding structure will have a floodwater detention capacity of 83 acre-feet and will temporarily detain 3.68 inches of runoff from the wate shed area. This is the equivalent of 2.21 inches of runoff from the enti 4,525-acre watershed.

The total estimated cost of establishing these works of improvement is $70,887 of which $3,115 will be borne by local interest and $67,772 by Public Law 566 funds (table 1). The average annual equivalent cost is estimated to be $2,499 for installation and $180 for operation and mainte nance, making a total annual cost of $2,679.

Sufficient detention storage can be developed at this structure site to make possible the use of a vegetative spillway, thereby effecting a substantial reduction in cost over concrete or similar types of spillways

All applicable State water laws will be complied with in design and const tion of the floodwater retarding structure.

BENEFITS FROM WORKS OF IMPROVEMENT

With the installation of the combined program of land treatment and the structural measure described above, the estimated average annual monetary floodwater, sediment, and indirect damages within the watershed will be reduced from $9,137 to $260, a 97 percent reduction. About 90 percent of the expected reduction will result from the floodwater retarding structur

Average annual flooding will be reduced from 128 acres to 45 acres. The urban area of Marfa will be flood-free from all storms up to a 100-year frequency event.

The area on which sediment damage from overbank deposition will occur

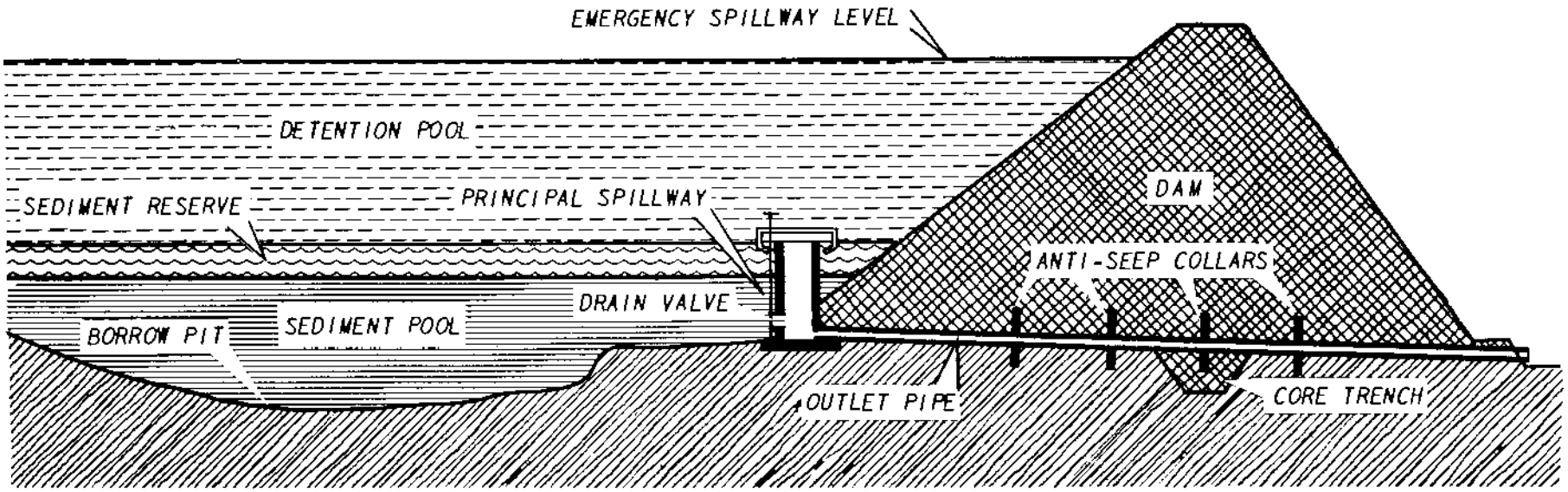
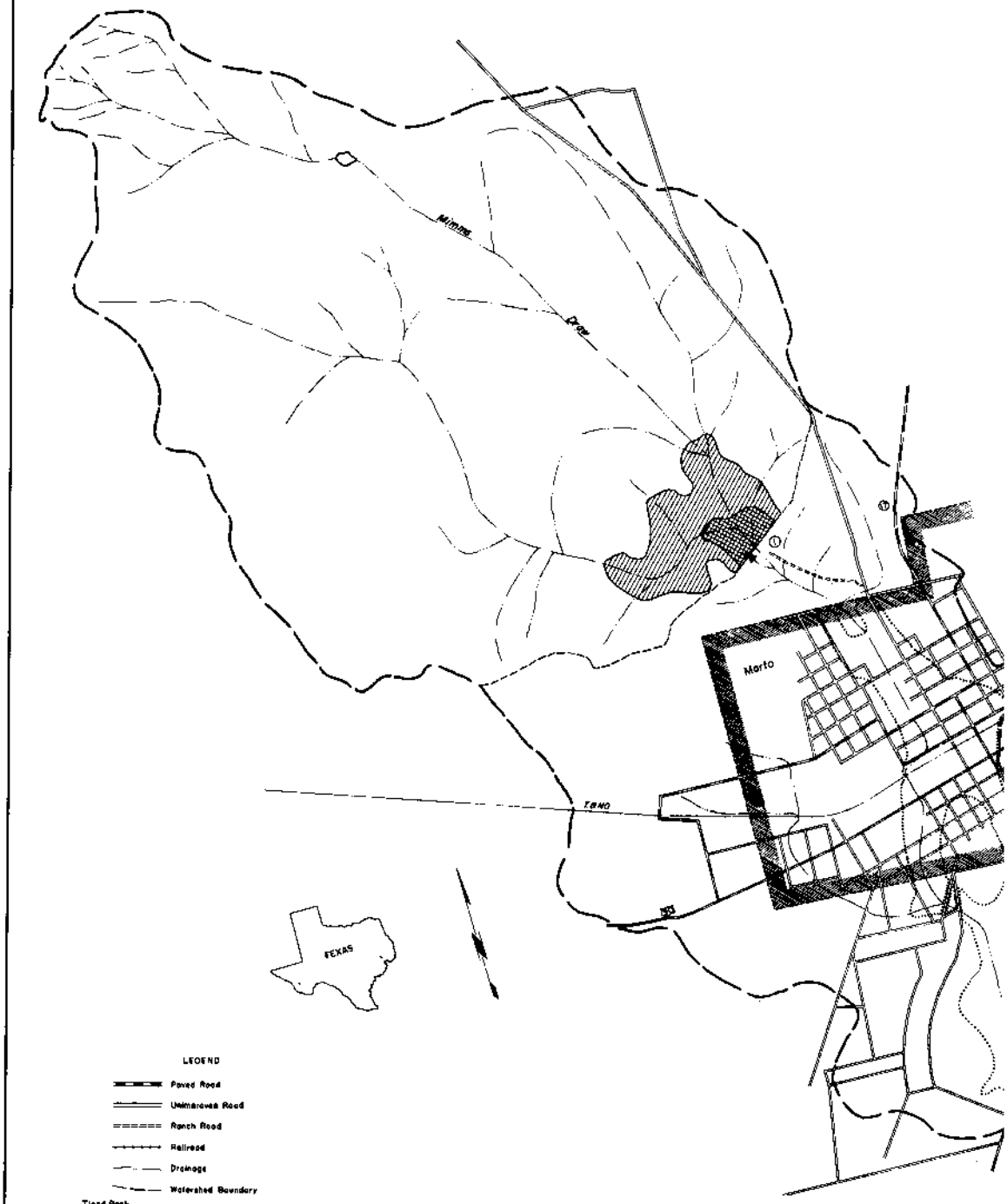


Figure 2

SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE



LEGEND

- Paved Road
- Unimproved Road
- Ranch Road
- Railroad
- Drainage
- Watershed Boundary
- Flood Pool
- Sediment Pool
- Floodwater Retarding Structure
- Drainage Area Boundary
- ① Structure Site Number
- Outline of Floodwater and Sediment Damage Area

SITE NO.	DRAINAGE AREA ACRES
①	2,720

Figure 3

PLANNED STRUCTURAL MEASUR
MIMMS DRAW WATERSHED

Presidio County, Texas

U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
TEMPLE TEXAS

0 1/4 1/2 Mile

Approximate Scale

Approximate Area - 4525 acres

Compiled from photos ETE-8-65, ETE-9-65, and CEE-13-32

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annually is expected to be reduced from 23 to 7 acres, a reduction of 70 percent. About 6 percent of the expected reduction will result from land treatment and 94 percent from the floodwater retarding structure. Produc vity can be restored within a relatively short time since overbank deposi will be greatly reduced.

The general locations of the benefits from reduction in flooding from the combined program of land treatment and structural measure are presented i the following tables:

Average Annual Area Inundated

Evaluation Reach (Figure 1)	Location	Without Project (acres)	With Project (acres)	Reductio (percent
A	Mimms Draw Below Marfa	74	45	39
B	City of Marfa	54	0	100
	Total	128	45	65

Average Annual Damages

Evaluation Reach (Figure 1)	Location	Without Project (dollars)	With Project (dollars)	Reducti (percen
A	Mimms Draw Below Marfa	1,349	260	81
B	City of Marfa	7,788	0	100
	Total	9,137	260	97

The total flood prevention benefits as a result of structural measure are estimated to be $7,964 annually.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of the structural measure (converted from total installation cost, plus operations and maintenance) is estimated to be $2,679. The structural measure is expected to produce average annual benefits of $7,964, or $2.97 for each dollar of cost. In addition to the direct monetary benefits, there are other substantial values which will accrue from the project such as a greatly increased sense of security, better living conditions, and improved wildlife conditions, none of which have been used for project justification.

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

ACCOMPLISHING THE PLAN

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

Land Treatment Measures

The land treatment measures itemized in table 1 will be established by farmers and ranchers over a 5-year period in cooperation with the Highlan Soil Conservation District, which is giving technical assistance in the planning and application of these measures under their going program.

The Highland Soil Conservation District with the assistance of the city o Marfa and the Commissioners Court of Presidio County will assume aggressi leadership in extending the land treatment program. The landowners withi the watershed will be encouraged to apply and maintain soil and water con vation measures on their ranches. District-owned equipment will be made available to the landowners in accordance with existing arrangements for equipment usage in the district. The Soil Conservation Service will prov technical assistance to the Highland Soil Conservation District to assist landowners cooperating with the district in the preparation and applicati of soil and water conservation plans.

The soil and water conservation loan program of the Farmers Home Administ tion is available to all eligible farmers and ranchers in the area. Educ tional meetings will be held in cooperation with other agencies to outlin the services available and eligibility requirements.

The county ASC Committees will cooperate with the governing body of the soil conservation district by selecting and providing financial assistanc for those ACPS practices which will accomplish the conservation objective in the shortest possible time.

The Extension Service will assist with the educational phase of the progr by conducting general information and local farm meetings, preparing radi television and press releases, and using other methods of getting informa to landowners and operators in the watershed. This activity will help to the project for watershed protection and flood prevention carried out.

Structural Measure for Flood Prevention

The city of Marfa has the right of eminent domain under applicable State laws and will obtain the necessary land, easements,and rights-of-way, will provide necessary legal, administrative, and clerical personnel, facilitie supplies and equipment to advertise, award and administer contracts; and will determine the legal adequacy of easements and permits for constructic of the floodwater retarding structure. Funds for the local share of the project cost including land, easements, rights-of-way, and administration

of contracts are available from the existing general fund which is create by a city tax and is adequate for these purposes.

The easements will be dedicated jointly to the city of Marfa and the High Soil Conservation District. The city of Marfa will provide for the neces improvement of low water crossings on Columbia, El Paso, Dallas, Galvesto and Waco streets to make them passable during prolonged release flow from structure or permit the inundation of the street crossings where equal al routes are designated for use during periods of inundation.

All land, easements, and rights-of-way will be obtained before Public Law funds are made available.

The estimated schedule of obligation for the complete 5-year installation period, covering installation of both land treatment and structural measu is as follows:

Fiscal Year	Measure	Public Law 566 Funds	Other Funds	Total
		(dollars)	(dollars)	(dollars
1st	Site 1	67,772	3,115	70,887
	Land Treatment	0	2,033	2,033
2nd	Land Treatment	0	2,033	2,033
3rd	Land Treatment	0	2,033	2,033
4th	Land Treatment	0	2,033	2,033
5th	Land Treatment		2,032	2,032
Total		67,772	13,279	81,051

The structural measure will be constructed during a 1-year installation p pursuant to the following conditions:

1. The required land treatment in the drainage area above the structure has been applied.

2. The necessary land, easements, rights-of-way, and permits have been obtained.

3. Provisions have been made for improving low water crossings on the city streets or permission obtained to inundate temporarily the low water crossings provided equal alternate routes are available for use by all people concerned during periods when these crossings are impassable due to prolonged flow from the principal spillway of the floodwater retarding structure. If equal alternate routes are not available, the provisions will specify that necessary improvements will be made, at no cost to the Federal Government, to make the crossings passable during prolonged periods of release flows from the structure.

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

5. Operation and maintenance agreements have been executed.

6. The project agreements have been executed.

7. Public Law 566 funds are available.

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

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

PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

Land treatment measures will be maintained by landowners of the ranches o which the measures are applied, under agreements with the Highland Soil Conservation District. Representatives of the soil conservation district will make periodic inspections of the land treatment measures to determin maintenance needs and encourage landowners and operators to perform manag ment practices and maintenance. They will make district-owned equipment available for this purpose.

Structural Measure for Flood Prevention

The floodwater retarding structure will be operated and maintained by the city of Marfa. The estimated average annual operation and maintenance co of the structural measure is $180 based on long-term prices. Funds for this purpose will come from the general fund which is available and adequ for this purpose. The city also will establish a permanent reserve fund $1,000. This reserve fund will be kept available for abnormally costly maintenance activities that may result from excessive storms or other cau When it becomes necessary to use any of the reserve fund for maintenance expenditures, the city will take appropriate action to replenish the fund

The floodwater retarding structure will be inspected at least annually an after each heavy rain by representatives of the city of Marfa and the Highland Soil Conservation District. A Soil Conservation Service represe tative will participate in these inspections at least annually. For the floodwater retarding structure, items of inspection will include, but wil not be limited to, the conditions of the principal spillway and its appurtenances, the emergency spillway, the earth fill, the vegetative cov of the earth fill and the emergency spillway, and fences and gates instal

as part of the floodwater retarding structure.

The Soil Conservation Service, through the Highland Soil Conservation District, will participate in operation and maintenance activities only to the extent of furnishing technical assistance.

Provisions will be made for free access of representatives of the cosponsoring organizations and Federal agencies to inspect and provide maintenance for the structural measure and its appurtenance at any time.

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

The cosponsoring local organizations fully understand their obligations for maintenance and will execute specific maintenance agreements prior to the issuance of invitation to bid on the construction of the structure.

The necessary maintenance work will be accomplished either by contract, force account, or equipment available to or owned by the city of Marfa.

COST SHARING

Land treatment measures will be installed through funds other than Public Law 566 at an estimated cost of $10,164 (table 1). This cost includes ACPS payments based on present program criteria and technical assistance under the going district program. The required local costs for the structural measure consisting of the value of the land, easements, and rights-of-way ($2,615) and the cost of administering contracts ($500), ar estimated at $3,115.

The entire construction cost for the floodwater retarding structure, amounting to $53,878 will be borne by Public Law 566 funds. In addition, the installation services cost of $13,894 will be a Public Law 566 expense. This is a total Public Law 566 cost of $67,772 for the installa tion of the structural measure.

The total project cost of $81,051 will be shared 83.6 percent ($67,772) by Public Law 566 funds,and 16.4 percent ($13,279 by other than Public Law 566 funds.

CONFORMANCE OF PLAN TO FEDERAL LAWS AND REGULATIONS

This project plan conforms to all Federal laws and regulations and will have no known detrimental effects on any downstream projects which are no in existence or that might be constructed in the future.

SECTION 2

INVESTIGATIONS, ANALYSES, AND SUPPORTING TABLES

INVESTIGATIONS AND ANALYSES

Project Formulation

The local sponsors held meetings with representatives of various governmental agencies to determine the most desirable course of action to take in alleviating the flood problem in the city of Marfa. After consideratio of information obtained from these representatives, they decided that a program of cooperation of watershed landowners and operators, and the inst lation of floodwater retarding structures would most nearly meet their nee A representative of the Corps of Engineers informed them that it appeared that the project was better fitted to the Public Law 566 program than to the local protection program of the Corps of Engineers. Floodwater retard tion would also provide protection to agricultural lands that would not be afforded by a system of channels and levees through the urban area. For these reasons, the sponsors made application for assistance under provisio of Public Law 566.

Project Objectives

Flood problems and project objectives were reviewed with representatives o the Highland Soil Conservation District, the city of Marfa, and the Commissioners Court of Presidio County. The project objectives desired by the local cosponsoring organizations were to provide flood-free protection to the urban area of Marfa from a storm such as occurred on May 9, 1949, and provide a degree of flood protection that would result in a reduction of existing damages to other than the urban area of at least 75 percent.

Subsequent hydrologic investigations revealed that the May 9, 1949 storm approximated 50-year frequency occurrence. To meet the criteria as set forth in Section 21, Watershed Protection Handbook, it was determined that the possibility of providing protection to Marfa from a 100-year frequency occurrence would be investigated.

The local cosponsors considered the incorporating of storage for municipal water supply, irrigation and fish and wildlife development in any floodwate retarding structures that might be included in the plan. They decided that none of the purposes should be included since the city of Marfa has an adequate municipal water supply for present and anticipated future needs, the dependable water yield from the watershed is questionable, and funds for carrying out local cost of these purposes are not available.

Land Treatment Measures

The needed land treatment for the watershed, as shown in Table 1, was

developed by the soil conservation district assisted by personnel from th Soil Conservation Service at Marfa. Conservation needs data were compile from existing conservation plans within the watershed for each land treat ment practice which contributes directly to flood prevention to be applie during the 5-year installation period. The hydraulic, hydrologic, sedime tion and economic investigations provided data as to the effects of these measures in terms of the reduction of flood damages resulting from land treatment. Although significant benefits would result from increased eff tiveness of the land treatment measures, it was apparent that other flood prevention measures would be required to attain the degree of watershed protection and flood damage reduction desired by the local people.

Structural Measures

Structural measures for flood prevention needed to attain the project objectives that could not be accomplished by land treatment measures alor were then determined. The study and the procedures used in that determir tion were as follows:

1. A base map of the watershed was prepared showing watershed boundary, drainage pattern, system of roads, and other pertinent information. Three probable floodwater retarding structure sites were located by field inspection and use of a stereoscopic study of 4-inch consecutive aerial photographs. Valley cross sections were selected to adequately represent the hydraulic characteristics of the flood plain and stream channel. Surveys were made of the valley cross sections at these selected locations. Data developed from these valley cross sections permitted the computation of peak discharge-damage relationships for various flood flows. A map was prepared of the flood plain on which land use, valley cross section locations, and other pertinent information were recorded.

2. Three sites were selected for detailed survey. These consisted of one site located below the confluence of the two principal tributaries above Marfa and one site on each of the two tributaries above this confluence. Plans of a floodwater retarding structure, typical of the one planned for the watershed, are illustrated by Figures 4 and 4A.

3. A topographic map was made of the pool, dam, and spillway areas of the proposed sites to determine the storage capacity of the sites, the estimated cost of the dam including spillway, the pool areas, and the area involved in the dam and spillway. From these data it was determined that the one site below the confluence of the tributaries was the most economical and feasible site. The height of the dam and the size of the pools were determined by the

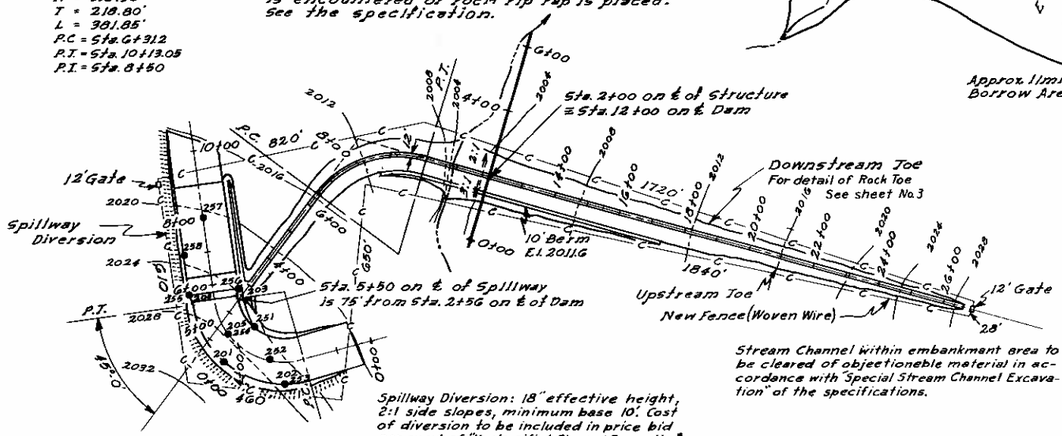
Clay
Silt
Limestone
Flagstone & Cobbles
Lime

C.	Clay	Clayey	Cal.	Calcareous
Si.	Silt	Silty	Vug.	Vuguler
Ch.	Chalk	Chalky	Fc.	Fractured
S.	Sandy	Sandy	Fri.	Friable
Gr.	Gravel	Gravelly	Fi.	Firm
M.	Marl	Marly	Vy.	Very
Ls.	Limestone		So.	Soft
Flg.	Flagstone		H.	Hard
Mas.	Massive		Cob	Cobbles
Mat	Matrix			

LEGEND OF BORINGS

EMBANKMENT CURVE DATA
Δ = 69°-0'
D = 18°-04.3'
R = 318.3G'
T = 218.80'
L = 381.85'
P.C = Sta. G+31.2
P.T. = Sta. 10+13.05
P.I. = Sta. 8+50

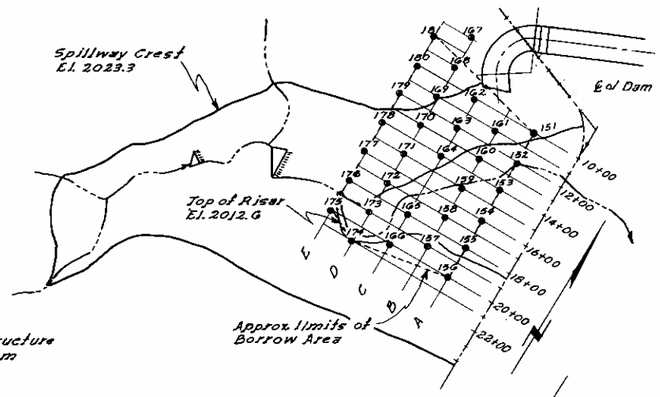
A minimum of G" of topsoil to be placed in spillway and on all embankment, dike, spillway slopes and waste area except where rock is encountered or rock rip rap is placed. See the specification.



Spillway Diversion: 18" effective height, 2:1 side slopes, minimum base 10'. Cost of diversion to be included in price bid per cu yd. of "Unclassified Channel Excavation".

PLAN OF EMBANKMENT AND SPILLWAY

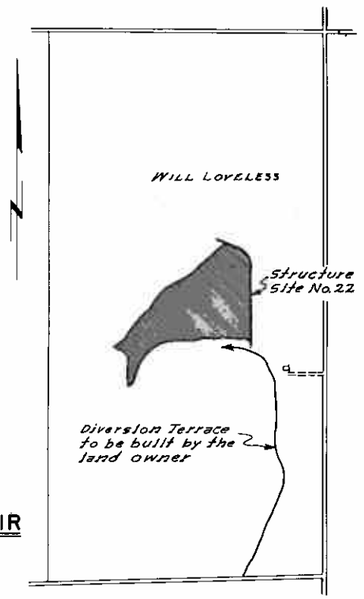
0 200 400 1000
SCALE IN FEET



GENERAL PLAN OF RESERVOIR

0 400 800 1600
SCALE IN FEET

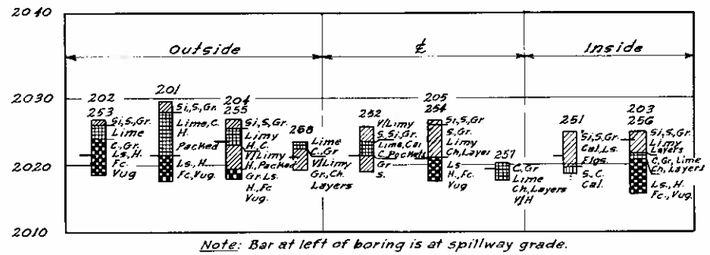
Stream Channel within embankment area to be cleared of objectionable material in accordance with "Special Stream Channel Excavation" of the specifications.



Located 5½ mi. East and 4 mi. South of Eden, Concho County, Texas

VICINITY MAP

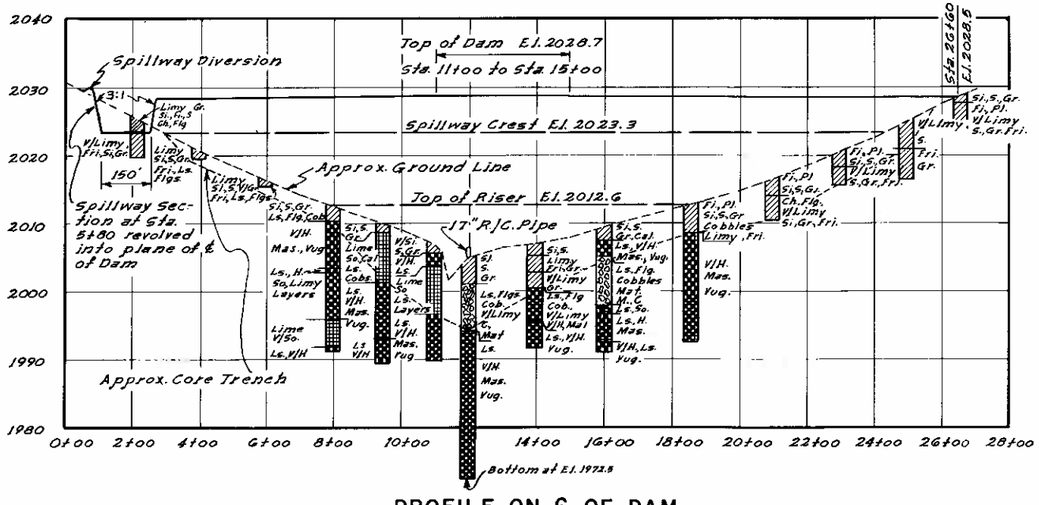
0 ¼ ½ 1
SCALE IN MILES



Note: Bar at left of boring is at spillway grade.

LOG OF SPILLWAY BORINGS

SEE PLAN OF EMBANKMENT AND SPILLWAY



PROFILE ON ℄ OF DAM

Elevation	Surface Acres	Storage Acre Ft.	Storage Inches
2012.6	16.84	51.70	0.50
2016.0	30.76	132.66	1.28
2020.0	54.21	302.60	2.92
2023.3	74.94	515.68	5.00
2024.0	79.33	569.68	5.50
2028.0	108.17	944.68	9.13

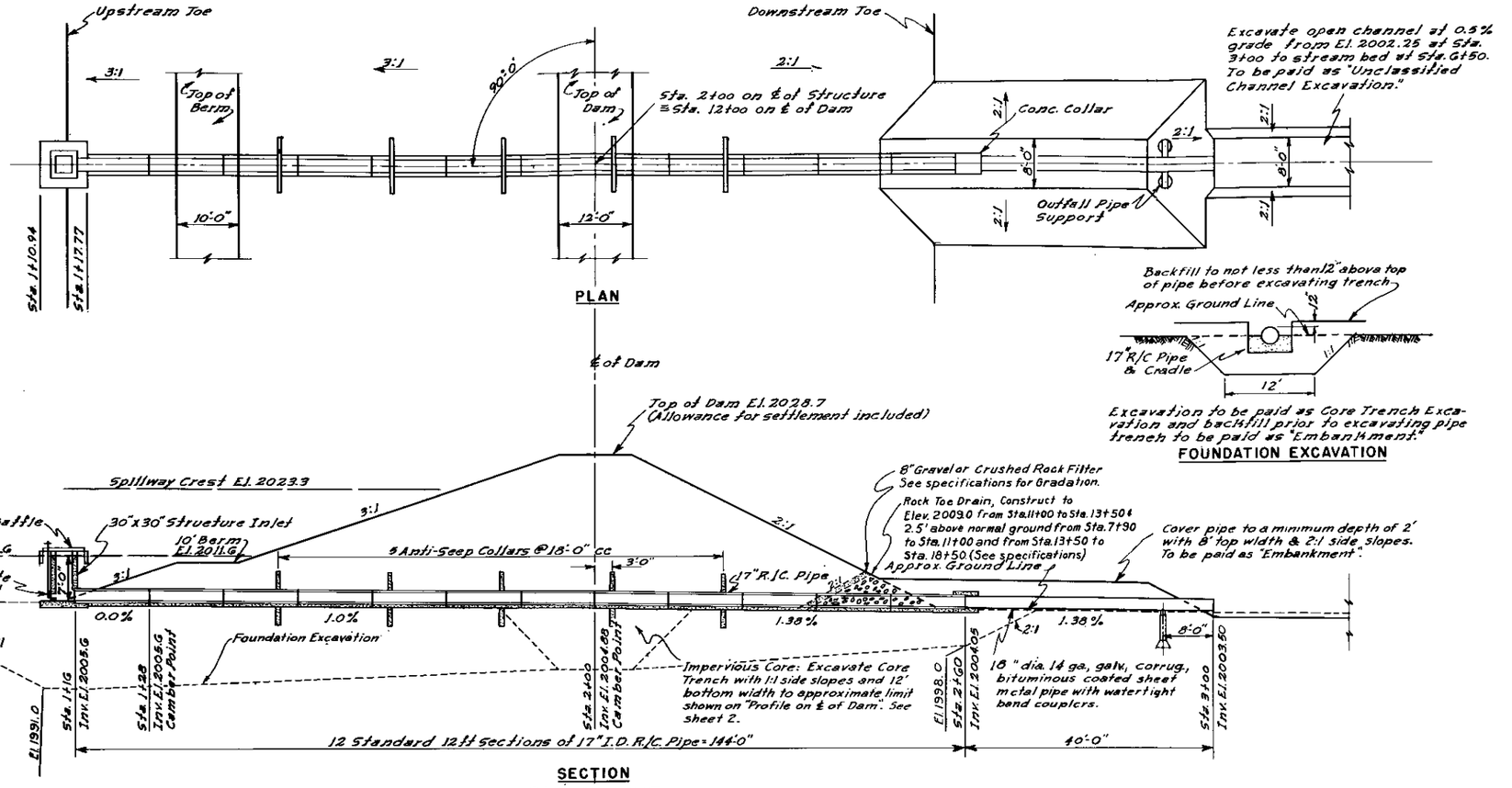
Top of Dam (Effective) Elev.	2028.5
Spillway Crest Elev.	2023.3
Top of Riser Elev.	2012.6
Sediment Pool Elev.	2012.6
Drainage Area, Acres	1242.0
Sediment Storage, Ac. Ft.	51.7
Floodwater Storage, Ac. Ft.	466.0

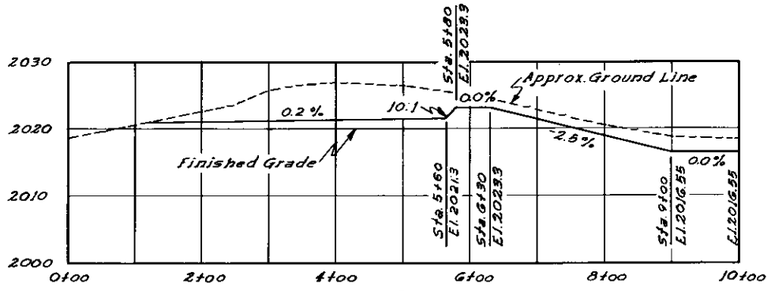
Figure 4
TYPICAL
FLOODWATER RETARDING STRUCTURE
PLAN AND PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

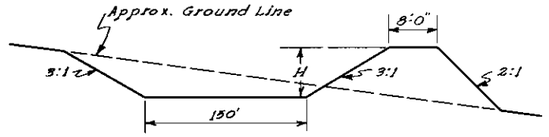
Designed	H.C.N.	Date 8-56	Approved by W. M.
Drawn	H.C.N. & G.R.	8-56	SCS ENGINEERING & HYDRAULIC PLANNING UNIT FORT WORTH, TEXAS
Traced	G.R.	8-56	STATE CONSERVATIONIST GOOLSBY, N.C.S. TEMPLE, TEXAS
Checked	H.C.N. & H.H.L.	9/56	Sheet No. 2 of 7

Drawing No. 4-E-ID,760





PROFILE ON ℄ OF SPILLWAY



Top of Dike, El. 2028.55 from Sta. 5+00 to Sta. 6+30 12 ft. top width with 10:1 end slope. Transition from El. 2028.55 at Sta. 6+30 to 4 ft. height at Sta. 7+00, top width 8 ft. H = 4 ft. from Sta. 7+00 to Sta. 9+00, top width 8 ft. with 10:1 end slope.

TYPICAL SPILLWAY SECTION

Figure 4A
TYPICAL
FLOODWATER RETARDING STRUCTURE
STRUCTURE PLAN AND SECTION

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed H.C.N.	Date 8-56	Approved by W.M.	AREA ENGINEERING & WATERSHED PLANNING UNIT FORT WORTH, TEXAS
Drawn H.C.N. & G.R.	8-56	STATE CONSERVATION ENGINEER, S.C.S. TEMPLE, TEXAS	
Traced G.R.	8-56	Sheet No. 3 of 7	Drawing No. 4-E-10,760
Checked H.C.N. & H.H.L.	8/56		

criteria outlined in Washington Engineering Memorandum, SCS-27, and Texas State Manual Supplement 2441. The limits of the detention and sediment pools of the proposed floodwater retarding structure and the flood plain of the stream were drawn to scale on a copy of the base map.

Structure data tables were developed to show for the proposed structure, the drainage area, the capacity needed for floodwater detention and for sediment storage in acre-feet and in inches of runoff from the drainage area, the release rate of the principal spillway, the area of flood plain and upland inundated by the sediment and detention pools, the volume of fill in the dam, the estimated cost of the structure, and other pertinent data (tables 2, 3, and 5).

4. A detailed investigation was made of city streets having low-water crossings on the channel below the floodwater retarding structure. Improvements required to provide passage over Columbia Street during periods of prolonged floodwater release from the structure were determined.

5. The local cosponsoring organizations or other interests did not desire to incorporate additional water storage for any agricultural or nonagricultural purposes.

6. Damages resulting from floodwater and sediment were determined from damage schedules, surveys of sample areas, and flood routings under present conditions. Reductions in these damages resulting from the proposed works of improvement were estimated on the basis of reduction in peak discharges as determined by flood routings under future conditions for which it was assumed that the proposed works of improvement had been installed. Benefits so determined were allocated to individual measures on the basis of the effects of each on reduction of damages. In this manner it was determined that the floodwater retarding structure could be economically justified.

When the structural measure for flood prevention had been determined, a table was developed to show the cost of the measure (table 2). The summation of the total costs for all works of improvement represented the estimated cost of the planned watershed protection and flood prevention project (table 1). A second cost table was developed to show separately the annual installation cost, annual maintenance cost, and total annual cost of the structural measure (table 6).

Hydraulic and Hydrologic Investigations

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

1. Basic meteorologic and hydrologic data were tabulated from Climatological Bulletins, U. S. Weather Bureau and Water Supply Papers, U. S. Geological Survey. These data were analyzed to determine average precipitation depth-duration relationships, seasonal distribution of precipitation, rainfall-runoff relationships, runoff-peak discharge relationship, and the relationship of geology, soils and climates to runoff depth for single storm events.

2. Engineering surveys were made to collect information on selected stream reaches, including valley cross sections, channel capacities, high water elevations of selected storms, bridge capacities and other hydraulic characteristics, and on the proposed floodwater retarding structure site to collect data used in design. Valley cross sections and evaluation reaches were selected on the ground in conference with the economist and sedimentation specialist.

3. Hydrologic conditions of the watershed were determined by considering such factors as climate, geology, topography, soils, land use, and cover. From this, soil-cover complex data were assembled, and rainfall-runoff relationships were computed for use in determining depth of runoff. These data were compared to the best available gaged runoff data.

4. Valley cross section rating curves were developed from field survey data collected in 2, above, by solving water surface profiles for various discharges. Water surface profiles were computed by the Doubt method described on pages 3.14-17-13, Soil Conservation Service, National Engineering Handbook, Section 4, Supplement A.

5. The period 1923 through 1958 was selected as most representative of normal precipitation in the watershed, and is the period from which the annual runoff frequency line for evaluation was developed.

6. Reference valley cross section VS-15 was used to determine the frequency at which urban damage from Mimms Draw would begin in Marfa. It was determined that urban damage would begin with an 82-percent chance storm and that this storm would produce 650 cubic feet per second at the reference section VS-15.

7. It was determined that 0.07 inch of runoff was the minimum volume that would produce flooding to a depth that would cause damage at the smallest channel cross section. Therefore no frequency runoff of less than 0.07 inch was considered for flood routing purposes. This amount of runoff would be produced by 2.20 inches of rainfall under moisture Condition I,

1.15 inches under moisture Condition II, and 0.50 inch under moisture Condition III. Runoff of 0.07 inch would produce a discharge of 322 cubic feet per second at the minimum valley cross section (VS-4). This would produce a discharge of 273 cubic feet per second at valley section VS-15 (reference section for urban damage) located along Second Street in Marfa. The channel capacity at this section is 600 cubic feet per second.

From the frequency runoff data developed, the one percent chance storm which would produce 2.8 inches of runoff, would inundate, under present conditions, 261 acres of flood plain. This is the flood plain area considered in this work plan. Of this 261 acres, 175 acres is in urban area.

8. Stage-area inundation curves were developed from field survey data for each portion of the valley represented by a cross section in agricultural evaluation Reach A (figure 1). Area inundated, by incremental depths of flooding, was developed for evaluation Reach A by routing volumes of runoff for selected frequencies using the peak discharge-volume relationship. Relationship between frequency-stage-damage was develope for the urban area represented by evaluation Reach B.

9. The area, by depth increments, that would have been inundated by the selected frequency flood events was determined for:

   a. Present condition.

   b. With land treatment measures applied.

   c. With land treatment measures applied and the floodwater retarding structure completed.

10. The appropriate design storm and storm pattern was selected from figures 3.21-1 and 3.21-4, NEH Section 4, Supplement A, in accordance with criteria contained in Washington Engineering Memorandum SCS 27, and Texas State Manual Supplement 2441.

11. A parabolic shaped section between two hills (a saddle) was selected to serve as the emergency spillway of the floodwater retarding structure. Through the use of water surface profile computations, a stage-discharge relationship was developed for this natural spillway. Spillway design storm hydrographs were developed for the floodwater retarding structure by the distribution graph method.

12. Emergency spillway capacities were designed in accordance with Washington Engineering Memorandum SCS 31 (Rev.);

Technical Release No. 2 (Tentative) Washington Design Section, dated October 1, 1956; Supplement A to Tentative Technical Release No. 2, dated May 13, 1957; Section 3.21, NEH Section 4, Supplement A; and Texas State Manual Supplement 2441.

13. The maximum release rate for the principal spillway of the floodwater retarding structure was determined by a detailed study of the stream channel, and the effect of the release rate on the design of the structure and the emergency spillway. The maximum release rate will be 10 csm for this site.

The structure classification, minimum storage required and actual floodwater storage planned for the structure is shown in the following table:

Structure Number	Classification	Minimum Floodwater Detention Required 1/ (inches)	Actual Floodwate Detention Planne (inches)
1	C	2.8	3.68

1/ For Class C structure - 100-year frequency based on regional analysi of gaged runoff.

Detention volume in excess of the minimum established by the criteria in Texas State Manual Supplement 2441 was used for the site to utilize the natural spillway afforded by the terrain. This can be done without materially increasing the cost of the structure. Good native vegetative cover exists over the entire spillway and exit channel area. Beneath this natural spillway lies a formation of volcanic tuff, well cemented. This was encountered at a depth of approximately 4 feet below the ground surface along the profile of the natural spillway.

Sedimentation Investigations

Sediment investigations for the work plan were made in accordance with procedures as outlined in Watershed Memorandum EWP-7, "Sedimentation Investigations in Work Plan Development", August 21, 1959, Fort Worth, Texas.

Sediment Source Studies

A detailed investigation of sediment sources to determine the sediment storage requirement for a 50-year period was made in the drainage area o the planned floodwater retarding structure according to the following procedures:

1. The field survey included:

   a. Mapping soil units by slope in percent, slope length, present land use, present cover condition classes on rangeland, and land capability classes.

b. Determining the lengths, widths, depths, and estimating the annual lateral erosion of all stream channels affected by erosion.

2. Office computations included summarizing erosion by sources (sheet and streambank) in order to fit these data into formul for computation of the annual gross erosion in tons. The sediment rate to the structure was determined by adjusting annual gross erosion for expected delivery rates and trap efficiency.

3. The ratio of sediment storage volume in the pools to soil in place was estimated to be 1.5 to 1 for this structure.

4. The allocation of sediment to the structure pool was based on 30 percent deposition in the detention pool and 70 percent deposition in the sediment pool.

Flood Plain Sedimentation

The following sedimentation damage investigations were made to evaluate the nature and extent of physical damage to flood plain land:

1. Borings with a hand auger were made along valley cross sectio (figure 1), making note of the depth and texture of the depos soil condition, and other pertinent factors contributing to flood plain damage (Evaluation Reach A).

2. The elevation of the original flood plain before modern deposition began was estimated for each valley section.

3. Estimates of past physical flood plain damage were obtained through interviews with landowners.

4. A damage table was developed to show percent damage by textur and depth increment. Due consideration was given to agronomi and other land treatment practices, soils, crop yields, and land capabilities in assigning damage categories based on percent loss of productivity.

5. The depth and width of modern alluvial deposits were measured and tabulated.

6. The damage areas were grouped by segments. Within each of the segments the area for each depth increment of deposition was computed.

7. The sedimentation damages were adjusted for recoverability of productive capacity. Estimates of time required for recovery

of productive capacity were developed from data obtained by field studies and interviews with landowners.

8. Using average annual erosion rates as a basis, the average annual sediment yields at selected valley sections along the flood plain were estimated for present conditions and with structural measures installed. The results were compared to show the average reduction of sediment load contributing to overbank deposition. The reduction of overbank deposition is based on this reduction of sediment load and reduction of area inundated by floodwater.

Geologic Investigations

Preliminary geologic investigations were made at the three sites conside These investigations included brief lithologic and stratigraphic studies the valley slopes, alluvium, and exposed geologic formations. Hand auge borings were made in representative areas of the spillway, borrow, and f tion of the dam sites to determine the nature and extent of embankment material, emergency spillway excavation, and possible problems that migh be encountered in construction.

Description of Problems

The selected site of the planned floodwater retarding structure is under by volcanic tuff, ash, and agglomerate of the Tertiary series. Soils fr the sediment pool area, which are calcareous, silty, sandy clays, are abundant and good quality embankment material. As classified in accorda with the Unified Soils Classification System, these soils are CL.

Detailed investigations, including exploration with core-drilling equipm will be made at the floodwater retarding structure site prior to constru tion. Laboratory tests will be made to determine the suitability and me of handling the materials to be used in the embankment and the stability foundation strata.

Economic Investigations

Determination of Annual Benefits from Reduction in Damages

Agricultural damage estimates were based upon schedules obtained in the field covering all of the agricultural flood plain area of Mimms Draw. These schedules covered land use, crop distribution, yields, and historical data on flooding and flood damages.

The basic information on urban damages was derived from schedules obtaine by the city of Marfa and supplemented by additional schedules obtained fr business men, city and other officials, and homeowners. Most of the floo damage information obtained was for the floods which occurred in 1949, 19 and 1957.

In analyzing flood plain land use, frequency of flooding, and damageable values it was found that significant variations existed with respect to location within the watershed. Therefore, the flood plain was divided i two evaluation reaches, each with its own damageable value. The locatic of the evaluation reaches are (figure 1):

Evaluation Reach A - From bottom of watershed up the flood plain to the city limits of Marfa.

Evaluation Reach B - Area within the city of Marfa subject to flood damage from Mimms Draw.

Because the floodwater damages within the watershed are primarily those sustained by residential, business and other nonagricultural property, t frequency method of analysis was used in the economic evaluation.

Areas inundated by the floods of 1949, 1952, and 1957 were ascertained through interviews with local people and delineated on a map of Marfa. Total damages from these three floods were estimated, with due considera tion given to the present state of development and damageable values. These three flood events and their estimated damage were used as the bas for the economic evaluation of urban damages.

In the calculation of crop and pasture damage, expenses saved were deduc from the gross value of the damage. The flood plain land use was mapped the field. Data on normal flood-free yields were obtained from schedule and supplemented by information obtained from other agricultural workers the area. Information on other agricultural damages, such as fences and irrigated field borders, was obtained from analysis of schedules and correlated with size of floods. The major items of nonagricultural dama other than urban, were those sustained by roads, bridges and suburban property. Estimates of these damages were based on information supplied by State Highway and U. S. Border Patrol officials and persons living in the suburban area.

The monetary value of the physical damage to the flood plain from deposi tion of sediment was based on the net value of the production lost, taki into account the time lag for recovery.

Because of the relatively shallow depths and short durations of floodwat indirect damages are somewhat less than normally sustained in an urban a Nonagricultural indirect damages include interrupted travel, loss of bus and damages sustained by urban residences as a result of temporary inter tion of utility services. Indirect damage to agricultural enterprises include extra travel time to market, extra cost for feed for livestock d and following floods, and the like. From an analysis of the data, indire damages are estimated to be 10 percent of the direct agricultural and nor agricultural damage.

Operators of agricultural flood plain lands were asked to state changes in land use as a result of past flooding. They were also asked what cha they would make if flooding were reduced. Their responses indicated tha the present use of the flood plain as irrigated pasture and range was su to their over-all ranching enterprises. Consequently, no benefits were calculated from restoration of former productivity or changed land use o agricultural land.

An estimate was made of the value of production lost in the pool areas o the floodwater retarding structure after installation of the project. I this appraisal it was considered that there would be no production in th sediment pool. The land covered by the detention pool is presently in grass and it was assumed that it will so remain. The cost of land, easements, and rights-of-way for the floodwater retarding structure was determined by appraisal in cooperation with representatives of the cospo soring organizations. The floodwater structure site cost was based on a appraisal of the value of the easement with consideration given to the value that will remain after the land is devoted to project purposes. The average annual net loss in production, based on long-term prices, within the site was calculated and this value compared with the amortize cost of the structure site. The larger amount was used in the economic evaluation of the project to assure a conservative estimate.

Details of Methodology

Details of the procedures used in the investigations are described in th Soil Conservation Service Economics Guide for Watershed Protection and Flood Prevention, December 1958.

TABLE 2 - ESTIMATED STRUCTURE COST DISTRIBUTION

Mimms Draw Watershed, Texas
Price Base: 1960

Structure Number	Installation Cost - Public Law 566 Funds					Instal. Cost - Other Funds			
	Construction		Instal. Services						
	Engineer's Estimate (dollars)	Contingencies (dollars)	Engineering (dollars)	Other (dollars)	Total Public Law 566 (dollars)	Adm. of Contracts (dollars)	Easements and R/W (dollars)	Total Other (dollars)	Total Installation Cost (dollars)
Floodwater Retarding Structure									
1	48,980	4,898	9,698	4,196	67,772	500	2,615	3,115	70,887
TOTAL	48,980	4,898	9,698	4,196	67,772	500	2,615	3,115	70,887

March 1960

TABLE 3 - STRUCTURE DATA - FLOODWATER RETARDING STRUCTURE

Mimms Draw Watershed, Texas

Item	Unit	Structure Number 1	Total
Drainage Area	Sq. Mi.	4.25	4.25
Storage Capacity			
Sediment Pool	Ac. Ft.	39	39
Sediment in Detention Pool	Ac. Ft.	11	11
Floodwater Detention	Ac. Ft.	834	834
Total	Ac. Ft.	884	884
Surface Area			
Sediment Pool (top of riser)	Acre	19	19
Floodwater Detention Pool	Acre	117	117
Volume of Fill	Cu. Yd.	93,310	93,310
Elevation Top of Dam	Foot	4748.3	xxx
Maximum Height of Dam	Foot	25	xxx
Emergency Spillway			
Crest Elevation	Foot	4742.3	xxx
Top Width (Parabolic)	Foot	550	xxx
Type	xxx	Natural Veg.	xxx
Percent Chance of Use 1/	xxx	1.0	xxx
Average Curve Number - Condition II	xx	75	xxx
Emergency Spillway Hydrograph			
Storm Rainfall (6 hour)	Inch	7.38	xxx
Storm Runoff	Inch	4.47	xxx
Velocity of Flow 2/	Ft./Sec.	1.4	xxx
Discharge Rate 3/	C.F.S.	58	xxx
Maximum Water Surface Elev. 3/	Foot	4742.9	xxx
Freeboard Hydrograph			
Storm Rainfall (2.5 x 6 hour)	Inch	18.45	xxx
Storm Runoff	Inch	14.98	xxx
Velocity of Flow (Vc) 3/	Ft./Sec.	4.4	xxx
Discharge Rate 3/	C.F.S.	8,378	xxx
Maximum Water Surface Elev. 3/	Foot	4748.3	xxx
Principal Spillway			
Capacity - Maximum	C.F.S.	42	xxx
Capacity Equivalents			
Sediment Volume	Inch	0.22	xxx
Detention Volume	Inch	3.68	xxx
Spillway Storage	Inch	4.20	xxx
Class of Structure	xxx	C	xxx

1/ Based on regional analysis of gaged runoff.
2/ Computed from water surface profiles.
3/ Maximum during passage of hydrograph.

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TABLE 4 - SUMMARY OF PHYSICAL DATA

Mimms Draw Watershed, Texas

Item	Unit	Quantity Without Project	Quantity With Project
Watershed Area	Sq. Mi.	7.07	-
Watershed Area	Acre	4,525	-
Area of Cropland	Acre	162	162
Area of Rangeland	Acre	3,889	3,870
Miscellaneous Area	Acre	474	493
Overflow Area Subject to Damage	Acre	261 1/	86 1/
Area Damaged by:			
Overbank Deposition	Acre	23 2/	7 3/
Annual Rate of Erosion			
Sheet	Ac. Ft.	2.78	2.78
Stream Channel	Ac. Ft.	0.32	0.32
Average Annual Rainfall	Inch	14.8	-

1/ Area inundated by the runoff from a 1 percent chance storm event.

2/ Acres on which some production loss is occurring each year.

3/ The area on which production loss will occur each year after all recovery has taken place and equilibrium has been reached.

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TABLE 5 - SUMMARY OF PLAN DATA

Mimms Draw Watershed, Texas

Item	Unit	Quantity
Years to Complete Project	Year	5
Total Installation Cost		
Public Law 566 Funds	Dollar	67,772
Other	Dollar	13,279
Annual O and M Cost		
Public Law 566 Funds	Dollar	0
Other	Dollar	180
Average Annual Monetary Benefits 1/	Dollar	7,964
Agricultural	Percent	3.3
Nonagricultural	Percent	96.7
Structural Measure		
Floodwater Retarding Structure	Each	1
Area Inundated by Structure		
Flood Plain		
Sediment Pool	Acre	0
Detention Pool	Acre	0
Upland		
Sediment Pool	Acre	19
Detention Pool	Acre	98
Watershed Area Above Structure	Acre	2,720
Reduction of Floodwater Damages	Dollar	8,053
By Land Treatment Measures		
Watershed Protection	Percent	10.0
By Structural Measure	Percent	87.2
Reduction of Sediment Damages	Dollar	16
By Land Treatment Measures		
Watershed Protection	Percent	66.7
By Structural Measure	Percent	4.2

1/ From Structural Measure

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TABLE 6 - ANNUAL COST

Mimms Draw Watershed, Texas

Measure	Amortization of Installation Cost 1/	Operation and Maintenance Costs 2/			Total Annual Costs
		Public Law 566	Other	Total	
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)
Floodwater Retarding Structure					
1	2,499	0	180	180	2,679
TOTAL	2,499	0	180	180	2,679

1/ Price Base: 1960 prices amortized for 50 years at 2.5 percent.

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

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TABLE 7 - MONETARY BENEFITS FROM STRUCTURAL MEASURE

Mimms Draw Watershed, Texas
Price Base: Long-Term 1/

Item	Estimated Average Annual Damage			Aver. Annu. Mone. Bene.
	Without Project	After Land Treatment for W/S Protection	With Project	
	(dollars)	(dollars)	(dollars)	(doll.
Floodwater Damage				
Crop and Pasture	124	117	70	
Other Agricultural	259	227	50	1
Nonagricultural				
Urban	7,080	6,380	0	6,3
Suburban	646	570	72	4
Road and Bridge	173	159	37	1
Subtotal	8,282	7,453	229	7,2
Sediment Damage				
Overbank Deposition	24	23	7	
Subtotal	24	23	7	
Indirect Damage	831	748	24	7
Total, All Damages	9,137	8,224	260	7,9
TOTAL FLOOD PREVENTION BENEFITS	xxx	xxx	xxx	7,9
TOTAL PRIMARY BENEFITS	xxx	xxx	xxx	7,9
TOTAL MONETARY BENEFITS	xxx	xxx	xxx	7,9

1/ As projected by ARS, September 1957.

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TABLE 8 - BENEFIT COST ANALYSIS

Mimms Draw Watershed, Texas

Measure	AVERAGE ANNUAL BENEFITS 1/ Flood Prevention				Average Annual Cost 2/	Benefit Cost Ratio
	Floodwater	Sediment	Indirect	Total		
	(dollars)	(dollars)	(dollars)	(dollars)	(dollars)	
Floodwater Retarding Structure						
1	7,224	16	724	7,964	2,679	3.0:1
GRAND TOTAL	7,224	16	724	7,964	2,679	3.0:1

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

2/ Derived from installation costs based on 1960 price level and operations and maintenance cost based on long-term price levels as projected by ARS, September 1957.

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