WORK PLAN

FOR

WATERSHED PROTECTION, FLOOD PREVENTION, DRAINAGE, AND RECREATION IMPROVEMENT

BAYOU BONNE IDEE WATERSHED

Morehouse Parish, Louisiana

WATERSHED WORK PLAN

BAYOU BONNE IDEE WATERSHED

Morehouse Parish, Louisiana

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

Prepared by:

Bonne Idee Gravity Drainage District

Morehouse Parish School Board

Morehouse Soil and Water Conservation District

With assistance by:

United States Department of Agriculture
Soil Conservation Service
Forest Service

United States Department of the Interior
Fish and Wildlife Service

and the

State of Louisiana

Wild Life and Fisheries Commission
Department of Public Works

August 1974

BAYOU BONNE IDEE WATERSHED

Louisiana

ADDENDUM

to the

WATERSHED WORK PLAN

Phase-In of Principles and Standards for
Planning Water and Related Land Resources

August 1974

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CONTENTS OF ADDENDUM

BAYOU BONNE IDEE WATERSHED

Louisiana

Section 1 - Benefit-Cost Ratio of the Selected Alternative

On the basis of a discount rate of 5.875 percent and new prices for general recreation days, the average annual benefits are estimated to be $1,101,000. Based upon 1973 construction costs, the average annual project costs are estimated to total $372,500. The total benefit-cost ratio is 3 to 1.

SECTION 2

SELECTED ALTERNATIVE
NATIONAL ECONOMIC DEVELOPMENT
Bayou Bonne Idee Watershed, Louisiana

Components	Measure of Effects[a/] (Dollars)
The value to users of increased outputs of goods and services	
Beneficial effects:	
1. Flood prevention	$415,200
2. Drainage	370,600
3. Recreation	107,400
Total beneficial effects	$893,200
The value of resources required for a plan	
Adverse effects:	
1. Multiple-purpose channel work for drainage, flood prevention, and recreation, single-purpose structures for water control and a development for recreation, and mitigation measures	
Project installation	$231,700
Project Administration	37,300
OM&R	88,500
Total adverse effects	$357,500
Net beneficial effects	$535,700

a/ Average annual based on 5.5-percent interest

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT
Bayou Bonne Idee Watershed, Louisiana

Components	Measures of Effects[a/] (Dollars) State of Louisiana	Rest of Nation
A. Income:		
Beneficial effects:		
1. The value of increased output of goods and services to users residing in the region		
a. Flood prevention	$ 415,200	-
b. Drainage	370,600	-
c. Recreation	107,400	-
2. Secondary	162,000	-
Total beneficial effects	$1,055,200	-
Adverse effects:		
1. The value of resources contributed from within the region to achieve outputs		
a. Multiple-purpose channel work for drainage, flood prevention, and recreation, single-purpose structures for water control and a development for recreation, and mitigation measures		
Project installation (structural measures) (structural measures)	$ 97,700	$ 134,000
Project administration	2,000	35,300
OM&R	88,500	-
Total adverse effects	$ 188,200	$ 169,300
Net beneficial effects	$ 867,000	$-169,300
a/ Average annual based on 5.5-percent interest		
B. Employment:		
Beneficial effects:		
1. Increase in the number and types of jobs		
a. Employment in recreation service sector	3 permanent seasonal semi-skilled jobs	-
b. Employment for structural measures construction	25 man-years of employment over a 6-year period	-
c. Employment for land treatment construction	75 man-years of employment over a 10-year period	-
d. Employment for OM&R of channel work	2 man-years of employment annually for the life of the project	-
Total beneficial effects	3 permanent seasonal semi-skilled jobs 100 man-years of employment during the project installation period	-
	2 man-years of employment annually for 50 years	-
Adverse effects:		
1. Decrease in the number and types of jobs	-	-
Total adverse effects	-	-
Net beneficial effects	3 permanent seasonal semi-skilled jobs	-
	100 man-years of employment during the project installation period	-
	2 man-years of employment annually for 50 years	-

SECTION 2

SELECTED ALTERNATIVE
REGIONAL DEVELOPMENT ACCOUNT
Bayou Bonne Idee Watershed, Louisiana

Components	Measure of Effects: State of Louisiana	Measure of Effects: Rest of Nation
C. Population Distribution:		
Beneficial Effects:	The project will cause an increase in annual average farm income of about $1,700 per farm and should help slow the trend of decreasing number of farms and out-migration. The project will create a need for three permanent seasonal semi-skilled jobs, 100 man-years of employment during the project installation period, and 2 man-years of employment annually for 50 years in a parish which had a net out-migration of 6,586 persons from 1960 to 1970.	-
Adverse effects:	-	-
D. Regional Economic Base and Stability		
Beneficial effects:	The project will provide a 3-year level of flood protection and drainage to agricultural lands. Average annual net farm income will increase $746,700. The project will create a need for 3 permanent seasonal semi-skilled jobs, 100 man-years of employment during the project installation period, and 2 man-years of employment annually for 50 years. Flood protection and improved drainage are essential to continued agricultural productivity and the prevention of loss of farm income in the watershed.	-
Adverse effects:	-	-

SELECTED ALTERNATIVE
ENVIRONMENTAL QUALITY ACCOUNT
Bayou Bonne Idee Watershed, Louisiana

Components	Measure of Effects
Beneficial and adverse effects:	
A. Areas of Natural Beauty	1. Better drainage and reduced flooding will allow crop and pasture vegetation to grow more uniform.
	2. The revegetation of channels, berms, and spoil, which has been shaped, will reduce erosion. This will reduce scaring of channel and spoil slopes.
	3. The clearing in Bayou Bonne Idee and the installation and modification of water control structures-type 1 will improve the appearance of the existing 1,400 acres of permanent water and create an additional 500 acres of permanent water in sections presently having only intermittent flow.
	4. The creation or deepening of 38 miles of ponded water on channels, other than Bayou Bonne Idee, will reduce requirements for maintenance in the channel bottom and will provide water areas for use by streamside wildlife in previously dry channels.
	5. The tranquility of rural environment will by disrupted by 97,200 visitor days of fishing, boating, and hunting.
B. Quality consideration of water, land, and air resources	1. Sheet erosion will be reduced from an average of 3.0 tons to 2.2 tons per acre per year over the entire watershed.
	2. Sediment delivered to Boeuf River via Bayou Bonne Idee will be reduced from 26,000 tons to 11,000 tons per year after installation of project measures.
	3. Turbidity will be decreased.
	4. Forest land will continue to receive fire protection.
	5. Sediment yields will increase temporarily during excavation of channels.

SELECTED PLAN
ENVIRONMENTAL QUALITY ACCOUNT (continued)
Bayou Bonne Idee Watershed, Louisiana

Components	Measure of Effects
Beneficial and adverse effects:	
C. Biological resources and selected ecosystems	1. Create and improve fisheries to accomodate about 105 boat and 40 bank fishermen per day.
	2. Improve the quality of the fishery in Bayou Bonne Idee by removing undesirable vegetation, providing more open water, and establishing better access.
	3. Creation of open areas by project installation will result in increased mourning dove and bobwhite quail populations of 0.2 percent and 0,3 percent, respectively.
	4. Increase the wildlife carrying capacity on 250 acres of forest land by about 10 percent because of forest land treatment.
	5. Maintain wood duck populations by replacing natural tree cavities removed with nesting boxes.
	6. Project installation will result in habitat losses which would support 19 deer, 265 squirrels, 22 rabbits, and 29 waterfowl.
	7. Temperature will increase by about 5 degrees Fahrenheit in some of the ponded water areas.
D. Irreversible or Irretrievable commitments	1. About 500 acres of land within Bayou Bonne Idee Channel will be committed to permanent water whereas presently it is in intermittent water.
	2. About 70 acres of cropland and 40 acres of forest land will be committed to the main recreational facility.
	3. About 3 acres of miscellaneous land along the banks of Bayou Bonne Idee will be required for the boat launching areas.
	4. The total monetary value which will be expended for project installation amounts to $7,182,150
	5. Salvage of archaeological materials, if encountered, will be irreversible.

SECTION 2

SELECTED ALTERNATIVE
SOCIAL WELL-BEING ACCOUNT
Bayou Bonne Idee Watershed, Louisiana

Components	Measures of Effects
Beneficial and adverse effects:	
A. Real income distribution	1. Create three seasonal permanent, low to medium income jobs for area residents. Average annual net farm income will increase by $1,700 per farm.
B. Life, health, and safety	1. Providing a 3-year level of agricultural drainage and flood protection will reduce road flooding which will allow better vehicular traffic. 2. With the increased and more stable income, farmers will be afforded the opportunity to improve their living conditions.
C. Recreational opportunities	1. Create 97,200 recreational visitor-day activities consisting of hunting, fishing, boating, camping, and picnicking.

SECTION 3

ADDENDUM TO BAYOU BONNE IDEE
WATERSHED WORK PLAN
Phase-In of Principles and Standards

ENVIRONMENTAL QUALITY PLAN
(Abbreviated)

ENVIRONMENTAL PROBLEMS

The two major problems affecting the quality of the human environment in this watershed are flooding and inadequate drainage. An additional problem is a shortage of recreational facilities. Flooding and drainage problems, throughout the watershed, act in combination and are considered inseparable because of the nearly level terrain which is readily inundated by the accumulation of direct precipitation and overflow from inadequate channels. These problems occur on approximately 94,600 acres. The quality and quantity of cotton, soybeans, grain sorghum, and rice are adversely affected. Pastureland forage contains excessive undesirable grasses and water tolerant weeds which reduce livestock carrying capacity.

Roads require additional maintenance because of flooding. Flooded roads hinder traffic to and from businesses and schools. During and immediately after large rainstorms, medical attention may be delayed which could mean the difference between life and death. Unpaved roads are a source of air pollution.

Sheet erosion is the major form of erosion within the watershed. Sediment damage on agricultural land is minor in the watershed. Sediment is deposited downstream in the Boeuf River which contributes to lowering the water quality. It is causing turbidity, eutrophication, and pesticide accumulations.

A lack of high quality fishing waters and recent land use changes are problems concerning fish and wildlife. The conversion of land use has caused a reduction in some wildlife populations. The major portions of Bayou Bonne Idee which hold permanent water have a low usefulness as a fishery. Heavy infestations with aquatic weeds, trees, brush, and trash and raw sewage disposal in the Bayou cause this low usefulness. Recreational use is restricted.

Lack of cover in the cultivated fields, especially where fall and winter plowing occurs, is detrimental to wildlife. The practice of fall and winter plowing contributes to the sediment load and reduces the fisheries.

COMPONENT NEEDS

Component needs for solving problems relating to specific environmental conditions in the watershed are as follows:

1. Reduce flooding and drainage problems on approximately 94,600 acres of cropland and pastureland.
2. Provide and improve the quality of water for fish habitat and recreation use.
3. Reduce deposition of sediment in channels.
4. Reduce water-borne pollutants in general.
5. Increase the use of game management practices being utilized in the watershed.
6. Improve, maintain, and develop wildlife habitat.
7. Reduce cost of road maintenance by reducing flood damage.
8. Pave roads to reduce air pollution.
9. Reduce the deposition of trash and litter.
10. Maintain and improve the aesthetic value of the watershed.
11. Accelerate the land treatment program to provide adequate drainage and soil protection.

PLAN ELEMENTS

Elements Which Would Be Installed Under PL-566

The installation of 202 miles of channels including reworking of 166 miles that are manmade are previously modified, 21 miles of natural channels, and excavation of 15 miles of new channels would provide a level of protection for reduction in flood damage and for drainage improvements to crop and pasture. Water control structures would be installed where laterals enter project channels to prevent erosion and insure proper functioning of the channels. Grade stabilization structures would be installed to protect the channels and main outlets from excessive sedimentation.

The recreational needs within the watershed would be provided with the installation of three water control structures and the development of a main recreational facility and three boat launching areas with ramps. These installations would improve fish habitat for 1,400 acres in Bayou Bonne Idee and also provide an additional 500 acres. About 1,430 acres of forest land would be made available for recreational use.

All project measures would be installed in a manner which would minimize damages to fish and wildlife. Mitigation of damages to fish and wildlife would be accomplished by the installation of water control structures, establishment of wildlife areas, and placement of wood duck nesting boxes.

The total estimated cost for the installation of the above planned elements would be $4,554,350.

Conservation land treatment measures would be installed throughout the watershed to strive towards adequately treating over 124,000 acres of cropland, pastureland, and "other land." During the project installation period, an estimated 34,000 acres would receive conservation treatment resulting in 40 percent of the watershed being adequately treated.

The forest land would continue to receive fire protection under the Cooperative Forest Fire Control Program. Land treatment could include improvement cutting of 250 acres of forest and 3,000 acres of forest management practices.

The estimated accelerated cost for land treatment measures and technical assistance would be $2,627,800.

Elements Which Would Be Installed Under Institutional Arrangements Other Than PL-566

About 170 miles of gravel and dirt roads would be hard surfaced. The paving would be done by the Louisiana Department of Highways, private contractors, and local police jury at an estimated cost of $3,060,000.

An increase in forest management practices would be utilized on the 16,400 acres of forest land to provide improved wildlife habitat within these areas. Practices such as proper harvesting to encourage growth of browse, stacking tops to provide cover, and planting of logging roads to provide food and cover would be followed. The creation of openings during harvesting would provide areas for food plantings including grasses, small grain and other seed plants, and mast-producing trees. Livestock exclusion would be accomplished on bottom land hardwoods. The improvement of this wildlife habitat would be accomplished whenever forest management practices are applied. Livestock exclusion by fencing would be provided by pasture management practices. An additional $374,000 would be needed for wildlife food plantings and stacking tree tops.

Wildlife habitat improvement on open land could be accomplished by planting field borders, hedge rows, odd areas, and harvested fields. Allowing fence lines to grow into brush would provide additional habitat. The flooding of rice and soybean fields would provide crawfish and waterfowl feeding areas. Planting of duck foods in areas to be flooded would provide additional feeding areas. Farmers would leave the edges of their fields of rice, soybeans, and grain sorghum unharvested for wildlife food and cover. An estimated $494,000 would be needed to provide this wildlife habitat improvement.

The improvement of wildlife within the watershed would be primarily by private landowners. Obtaining areas sufficiently large for management and leasing for hunting would require cooperation of groups of farmers. Landowners would receive assistance from the Louisiana Wild Life and Fisheries Commission, the Agricultural Stabilization and Conservation Service, the Soil Conservation Service, and professional consultants.

Passing and enforcing ordinances against trash dumping and littering would be necessary to reduce the problem. Existing trash would be removed and sanitary dumps established at suited locations.

Adequate solid waste disposal systems at individual residences would be installed to reduce dumping raw sewage in channels.

ENVIRONMENTAL EFFECTS

Areas of Natural Beauty

Improved drainage and reduced flooding in the rural areas would improve the landscape. Plants and grasses would be healthier and debris deposition would be reduced. More uniform growth of crops and grasses would occur presenting more pleasing pastoral scenes. The acceleration in establishment of conservation practices would protect agricultural resources and improve the environment.

Removal of existing trash and litter and prevention of any further dumping in the vicinity where channels cross roads would improve the aesthetics of the landscape. The elimination of dust from gravel and dirt roads would eliminate the deposition of dust on grass, shrubs, automobiles, and buildings, thus presenting a cleaner, more pleasing appearance.

Installation of structural measures would temporarily bare the soil in construction areas. Planting of grasses and trees would revegetate these areas soon after construction.

Removal of undesirable aquatic vegetation would improve the fishery habitat and scenery. Increased surface acres of ponded water would also be aesthetically pleasing. Increased accessibility of Bayou Bonne Idee by water would provide more opportunities for nature study and sight-seeing.

SECTION 3

Quality Consideration of Water, Air, and Land Resources

The application of land treatment measures would reduce erosion, which would conserve soil and reduce water turbidity. Installation of structures for water control (weirs) would increase water areas by about 511 acres. Hard surfacing roads would reduce air pollution. Odors from areas where raw sewage is disposed would be eliminated.

Reduced flooding and better drainage would allow better use of natural resources presently committed to production of food and fiber. A decrease in the number of replantings and the elimination of extra cultural practices would reduce the need for additional fuel, seed, and agricultural chemicals.

Turbidity would temporarily increase during project construction. Sediment delivered to the Boeuf River would be reduced 20,000 tons annually. About 295 acres of cropland, 193 acres of wooded channel banks, and 95 acres of forest land not presently occupied by channels would be temporarily disturbed by the project.

Biological Resources and Selected Ecological Systems

Installation of land treatment practices for wildlife upland and wetland habitat management would improve habitat for wildlife. Leaving field edges of unharvested soybeans would leave food and cover which is presently being eliminated. Forest management practices would eliminate the poorer trees, making room for the more productive trees to grow. Under improved harvesting and management practices, some of the better trees for mast production would be left.

Installation of water control structures would increase the present fishery in channels from 1,505 acres of ponded water to 2,016 acres. Land treatment reducing sheet erosion by 18 percent would improve water quality. Tailwater from the increase in ponded water would provide habitat for wading birds.

Inconveniences caused by road flooding would be reduced. Installation of better solid waste disposal systems would improve sanitary conditions and reduce the likelihood of water pollution from these sources.

Installation of this plan would have adverse effects on some ecosystems. The food chain of aquatic populations would be temporarily disrupted during construction. Approximately 228 acres of rabbit habitat would be lost as a result of the project. Deer and squirrel populations would be reduced by the loss of 554 acres of forest land habitat. Dove and quail would increase by improvement of 288 acres of habitat. Occasional periods of noxious aquatic weed growth would occur in the permanent pools of water.

Irreversible and Irretrievable Effects

An additional 511 acres of land within the banks of Bayou Bonne Idee would be committed to ponded water. All other channel work would preclude the use of 583 acres of land for any other purpose for at least the life of the project. Dumps for trash disposal would require additional land.

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WATERSHED WORK PLAN AGREEMENT

between the

MOREHOUSE SOIL AND WATER CONSERVATION DISTRICT
Local Organization

BONNE IDEE GRAVITY DRAINAGE DISTRICT
Local Organization

MOREHOUSE PARISH SCHOOL BOARD
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of Louisiana

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 Bayou Bonne Idee Watershed, State of Louisiana, under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress; 68 Stat. 666), as amended; and

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

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

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about 10 years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Bonne Idee Gravity Drainage District will acquire such land rights as will be needed in connection with the works of improvement. The percentages of this cost to be borne by the Bonne Idee Gravity Drainage District and the Service are as follows:

Works of Improvement	Bonne Idee Gravity Drainage District (percent)	Service (percent)	Estimated Land Rights Cost (dollars)
Recreational facilities			
Payment to landowners for about 113 acres	50	50	45,200
All other structural measures	100	0	634,200

The Bonne Idee Gravity Drainage District and the Morehouse Parish School Board agree that all land acquired or improved with P. L. 566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

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

	Bonne Idee Gravity Drainage District (percent)	Service (percent)	Relocation Payment Costs (dollars)
Relocation Payment	55	45	-0- 1/

1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

3. The Bonne Idee Gravity Drainage District 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 operations of the works of improvement.

4. The percentages of construction costs of structural measures to be paid by the Bonne Idee Gravity Drainage District and by the Service are as follows:

Works of Improvement	Bonne Idee Gravity Drainage District (percent)	Service (percent)	Estimated Construction Cost (dollars)
Channel Work			
Bayou Bonne Idee Channel	33.33 1/	66.66 1/	540,000
All Other Channels	25	75	1,561,650
Water Control Structures- Type 1			
No. 1, No. 2, and No. 3	50	50	379,600
No. 4	25	75	102,000
Recreational Facilities			
Maintenance Building and Equipment	100	0	27,000
All Other Facilities	50	50	275,900
Water Control Structures- Type 2	25	75	141,950
Wood Duck Nesting Boxes	25	75	3,100
Wildlife Areas	25	75	2,000

1/ Rational repeating decimals which amount to one-third and two-thirds when expressed in fractional form.

5. The percentages of the engineering costs to be borne by the Bonne Idee Gravity Drainage District and the Service are as follows:

Works of Improvement	Bonne Idee Gravity Drainage District (percent)	Service (percent)	Estimated Engineering Cost (dollars)
Recreation Facilities	50	50	19,300
All Other Structural Measures	0	100	191,650

6. The Bonne Idee Gravity Drainage District and the Service will each bear the costs of Project Administration which incur, estimated to be $33,170 and $597,630, respectively.

7. The Morehouse Soil and Water Conservation District will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.

8. The Morehouse Soil and Water Conservation District will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.

9. The Bonne Idee Gravity Drainage District 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 is not a fund-obligating document. 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.

    A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. 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 except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the

Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties. An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the Sponsor having specific responsibilities for the particular structural measure involved.

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

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

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

BONNE IDEE GRAVITY
DRAINAGE DISTRICT
Local Organization

By Elmer Wimberly

Courthouse Building
Bastrop, Louisiana 71220
Address Zip Code

Title Chairman

Date 10-4-74

The signing of this agreement was authorized by a resolution of the governing body of the Bonne Idee Gravity Drainage District
Local Organization
adopted at a meeting held on October 4, 1974

[illegible]
Secretary, Local Organization

Mer Rouge, Louisiana 71261
Address Zip Code

Date 10/4/74

MOREHOUSE PARISH SCHOOL BOARD
Local Organization

By [illegible]

714 S. Washington Street
Bastrop, Louisiana 71220
Address Zip Code

Title President

Date 10-3-74

The signing of this agreement was authorized by a resolution of the governing body of the Morehouse Parish School Board
Local Organization
adopted at a meeting held on October 1, 1974

[illegible]
Secretary, Local Organization

Old Monroe Road
Bastrop, Louisiana 71220
Address Zip Code

Date 10-3-74

MOREHOUSE SOIL AND WATER CONSERVATION DISTRICT
Local Organization

609 E. Madison Street
Bastrop, Louisiana 71220
Address Zip Code

By Clint Shipard

Title CHAIRMAN

Date 10-3-74

The signing of this agreement was authorized by a resolution of the governing body of the Morehouse Soil & Water Conservation District
Local Organization

adopted at a meeting held on October 1, 1974

B. F. Lucas
Secretary, Local Organization

609 E. Madison Street
Bastrop, Louisiana 71220
Address Zip Code

Date 10-3-74

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

Allen Mangum
State Conservationist

October 11, 1974
Date

SUMMARY

WATERSHED WORK PLAN

BAYOU BONNE IDEE WATERSHED

Morehouse Parish, Louisiana

August 1974

SUMMARY OF PLAN

The watershed is in the northeastern part of Louisiana. It contains 157,500 acres (246 square miles), all of which are in Morehouse Parish. Approximately 70 percent of the area is cropland; 10 percent is pastureland and grassland; 10 percent is forest land; and 10 percent is in other uses such as roads, channels, bayous, lakes, communities, and farmsteads. The local Sponsors are the Morehouse Soil and Water Conservation District, the Bonne Idee Gravity Drainage District, and the Morehouse Parish School Board. Technical assistance was furnished by the Soil Conservation Service and the Forest Service of the U.S. Department of Agriculture, the U.S. Fish and Wildlife Service of the U.S. Department of the Interior, and the Louisiana Wild Life and Fisheries Commission and Department of Public Works.

The principal problems are flooding, poor drainage, and lack of recreation. Flooding and drainage problems in the watershed are generally inseparable. Frequent inundation and prolonged wetness cause untimely planting and cultivation of crops, increased production costs, and lower yields and quality. The land, having a moderately to highly productive potential, needs a comprehensive system of channels to provide the needed drainage and flood protection. The supply of recreation facilities in the area fall short of the demand.

The purposes of the project are watershed protection, flood prevention, drainage, and recreation. Analyses of various levels of protection to achieve these purposes were conducted by evaluation units. The alternative which will generally provide a 3-year level of flood protection and drainage to agricultural land was chosen. This level of protection does not eliminate all out-of-bank flow from the 3-year storm. It provides for the runoff from such a storm to be back within banks 24 hours after the rain ceases. Flood damages will be reduced by about 78 percent.

The recreation development will provide about 97,200 visitor days of recreation annually. It meets about 75 percent of the needs of an area within a 10-mile radius from the main facility.

Of the total 223 miles of existing channels investigated, about 36 miles proved adequate and about 187 miles will require work. Of this 187 miles, about 59 miles will be cleared and 128 miles will be excavated. An additional 15 miles of new channels will also be excavated which gives a total of 202 miles of channel work. Of the 59 miles to be cleared, 57 miles are

in Bayou Bonne Idee and 2 miles are in other channels. About 12 miles of the main channel in Bayou Bonne Idee will be totally cleared leaving trees and low shrubs along the bank. Clearing in the remaining 45 miles will range from 60 to 80 percent to provide open water areas.

Of the total 202 miles of channels to receive work, about 126 miles (63 percent) have ephemeral flow, 45 miles (22 percent) have ponded water, and 31 miles (15 percent) have intermittent flow; about 21 miles (10 percent) are classified as unmodified, well-defined natural channels, 166 miles (82 percent) are manmade or previously modified channels, and 15 miles (8 percent) are now nonexisting or have practically no-defined channels. The channel excavation and clearing, along with appurtenant grade stabilization and water control structures, will serve flood prevention and drainage.

Recreation measures include one water control structure to be installed in Bayou Bonne Idee and two existing ones will be modified. The clearing in Bayou Bonne Idee, a main recreation facility, and three boat access areas will also serve for recreation. Mitigation measures consist of 1 water control structure-type 1, 16 water control structures-type 2, 3 wildlife areas, and about 310 wood duck nesting boxes. Nonstructural measures consist of 3 public use areas (1,430 acres of forest) made available to the public for outdoor recreation.

About 1,500 persons in farm households will benefit from the increased income generated by the project. The other 3,700 watershed residents, as well as surrounding area residents, will benefit from increased volume of business generated by the higher incomes, decreased flooding of roads and bridges, and the recreation afforded by the development. Fish habitat will be enhanced.

Wildlife damages incurred by the project during construction will consist of clearing 554 acres of mixed hardwoods for channel rights-of-way and 1,550 acres of scattered cypress trees in Bayou Bonne Idee main stem. As mitigation for wildlife, 16 1-acre wildlife openings will be created on 2 sections (1,280 acres) of forest land. Wood duck boxes will be erected along the edges of Bayou Bonne Idee to replace the natural tree cavities lost due to removing the cypress trees.

The work plan proposes an installation period of 6 years for structural measures and 10 years for land treatment measures. The total installation cost is estimated to be $7,182,150 of which Public Law 566 funds will bear $3,264,205 (about 45 percent), and the remaining $3,917,945 (55 percent), will be borne by other funds.

Landowners and operators cooperating with the Morehouse Soil and Water Conservation District and the Louisiana Forestry Commission will install land treatment measures that reduce floodwater and sediment damages and improve drainage conditions. This is dependent, to a large extent, on the installation of project-type outlets. The cost of these land treatment measures is estimated to be $2,627,800. Of this total, Public Law 566 funds will provide $396,900 for accelerated technical assistance, and $2,230,900 will be provided by other funds. The cost of applying land treatment measures will be borne by the landowners and operators with aid from Federal and State programs.

The estimated cost of structural measures is $4,554,350 of which Public Law 566 funds will bear $2,867,305 and other funds will bear $1,687,045.

Average annual benefits amount to $1,055,200 including secondary benefits estimated to be $162,000 annually. The average annual cost, including amortization of installation cost plus operation and maintenance, is $357,500. A comparison of benefits and costs shows a benefit-cost ratio of 3.0 to 1.

Land treatment measures will be maintained by the landowners and operators of the farms on which the measures are installed. Structural measures will be operated and maintained by the Bonne Idee Gravity Drainage District. Estimated annual operation and maintenance cost of structural measures based on current prices is $88,500.

The Louisiana Department of Public Works has agreed to assist in sharing the local cost of the structural measures contingent on the appropriation of funds for this purpose by the Louisiana Legislature. The Sponsors recognize additional funds may be needed to finance project installation and will be responsible for obtaining additional financing as necessary.

WATERSHED RESOURCES

ENVIRONMENTAL SETTING[1/]

Physical Data

The Bayou Bonne Idee Watershed, encompassing 157,500 acres, is located in northeast Louisiana in the eastern part of Morehouse Parish. The watershed is an elongated area bounded on the east and south by Boeuf River, on the west by Bayou Bartholomew and a meander line roughly paralleling Bayou Bonne Idee. The project area terminates on the north at the Louisiana-Arkansas state line. The entire population of the watershed is rural. Bonita, with a population of 533, the only village in the watershed, is located in the northwestern portion along U.S. Highway 165. Jones, a small community, is located 3 miles north of Bonita. Bastrop, a town of about 14,713 population, the parish seat of Morehouse Parish, and Mer Rouge, a small town of less than 1,000 population, are situated outside the project area about 10 miles and 3 miles, respectively, west of the central portion. Oak Ridge, another small town, is located 4 miles west of the southern tip of the watershed. Oak Grove, the parish seat of West Carroll Parish, is located about 14 miles to the east.

Bayou Bonne Idee Watershed is located in the Ouachita River Basin of the Lower Mississippi Region.[2/] It is fairly typical of other flatland watersheds in the alluvial valley of this region.

The watershed lies in the Southern Mississippi Valley Alluvium Land Resources Area. These soils were formed from braided stream and river meander belt deposits which are Recent Alluvium formations of the Quaternary System of the Cenozoic Era.[3/]

The soil capability classification system groups soils with regard to their suitability for most kinds of farming. Such groups are based on limitations of the soils, damage risk, and response to treatment. Class I soils have very few limitations, a wide range of agricultural uses, and

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1/ All information and data, except as otherwise noted by reference to source, were collected or compiled during watershed planning investigations by the Soil Conservation Service and the Forest Service, U.S. Department of Agriculture.

2/ U.S. Department of Agriculture, Soil Conservation Servie, Atlas of River Basins of the United States (2nd edition; Washington: U.S. Government Printing Office, 1970), map no. 15.

3/ Rufus J. LeBlanc, Geologic Map of Louisiana, a map compiled from several sources of data, Baton Rouge, Louisiana, 1948.

the least risk of damage. Capability Class II soils have some limitations but not too severe. Capability Class III denotes soils with severe limitations that reduce the choice of plants and/or require special conservation practices. Capability Class IV soils have very severe limitations. The subclass designation "w" means that water in or on the soil is the primary limitation and "e" means that erosion is the main limitation.4/

The principal soil associations are Perry-Portland, Hebert-Rilla-Sterlington, and Forestdale-Perry-Dexter. Perry-Portland, comprising approximately 42 percent of the area, is dominant. These soils are located on the low areas away from the natural levees, mainly in the central and northeastern half of the watershed. They are moderately productive, nearly level, poorly drained, slowly permeable, and are difficult to manage because of the clay texture and excessive wetness. The soils in this association being used for agriculture are in Capability Class IIIw. Adequate drainage is necessary for them to be productive.

The Hebert-Rilla-Sterlington Association comprises approximately 40 percent of the area. These soils occur mainly on the level gently sloping natural levee of Bayou Bonne Idee or other abandoned channels of the Arkansas River. The Class IIw and IIIw Hebert soils are somewhat poorly drained, and the Class I and IIe Rilla and Sterlington soils are moderately well drained to well drained. Soils in this association are easy to work and can be cultivated over a fairly wide range of moisture content. However, if worked when wet, clodding will occur. High yields are obtained under good management and fertilization. Adequate drainage is needed for the Hebert soils.

The Forestdale-Perry-Dexter Association comprises approximately 18 percent of the area. They occur on low terraces or areas away from natural levees. They are located in the southeastern quarter of the watershed. The Class IIIw Forestdale and Perry soils are poorly drained and require an extensive drainage system. The Class I and IIe Dexter soils, representing approximately 20 percent of the association and found on the small ridges, are well drained.

The topography is level to nearly level with slopes generally less than 1 percent. Elevations range from 85 feet above mean sea level in the southern portion to 110 feet above mean sea level in the northern portion.

The average annual rainfall is about 52 inches. Seasonal distribution is as follows: winter - 31 percent; spring - 28 percent; summer - 22 percent; fall - 19 percent. The average temperature is 65 degrees Fahrenheit.5/ The average monthly temperature in January and July is

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4/ U.S. Department of Agriculture, Soil Conservation Service, The Measure of Our Land, Pamphlet,No. 128 (Washington: U.S. Government Printing Office, 1969), pp. 2-10.

5/ U.S. Department of Agriculture, Soil Conservation Service, Letter to the States about ENG - Hydrology - Directives - Chapter 21, National Engineering Handbook - Section 4 - Hydrology - Part I (South Regional Technical Service Center, Engineering and Watershed Planning Unit), September 16, 1965.

about 47 degrees and 82 degrees Fahrenheit, respectively.[6] The average frost-free period of 230 days extends from March 20 to November 5.[7]

There are three potential ground water aquifers in Morehouse Parish: the Sparta Sand, the Cockfield Formation of the Tertiary, and the Quaternary Alluvial deposits.[8] There are no known mineral deposits in the watershed, except possibly for clays.

The present land use and percent distribution are:

Land Use	Acres	Percent
Cropland	108,800	70
Grassland	16,000	10
Forest[a]	16,400	10
Other[b]	16,300	10
Total	157,500	100

a/ Includes 3,370 acres of wildlife wetlands, Types 1 and 7
b/ Includes roads, channels, bayous, lakes, communities, farmsteads, and 1,250 acres of wildlife wetlands, Types 3 and 5

Large tracts of crop and pasture with a few relatively small interspersed forest land plots are located in the water problem area. This is typical of the whole watershed. Hardwoods are the climax vegetation of the natural areas. Principal species in the overstory are hackberry, elms, hickories, green ash, and oaks. The understory consists of reproduction from plants in the overstory, briers, vines, grasses, ferns, and forbs. Transitional vegetation consists of a mixture of the overstory and understory. This condition is found on the borders where forest land and cropland or pastureland meet. The 16,400 acres of forest land is bottom land hardwood in an unmanaged condition. Most of the area has been repeatedly cut over with little regard for the future. The cutting practices have resulted in stands of poor quality.

Boeuf River is the drainage outlet. Principal water courses in the watershed carrying water to this outlet are Bayou Bonne Idee, Camp Bayou

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6/ U.S. Department of Agriculture, Forest Service, A Forest Atlas of the South (Southern Forest Experiment Section - New Orleans, Louisiana and Southeastern Forest Experiment Station - Asheville, North Carolina, 1969), pp. 22 and 23.

7/ U.S. Department of Agriculture, Climate and Man - 1941 Yearbook of Agriculture (Washington: U.S. Government Printing Office, 1941), pp. 900-901.

8/ J. R. Rollo, Ground Water in Louisiana, Water Resources Bulletin No. 1 (Baton Rouge: Department of Conservation, Louisiana Geological Survey, and Louisiana Department of Public Works, August 1960), pp. 27, 32, 42.

Canal, Coffee Bayou, Cypress Bayou, and Turkey Bayou. Generally, these water courses drain south and then turn in an easterly direction to Boeuf River.

These principal channels and their laterals and other smaller channels were divided to form five evaluation units. Turkey Bayou (Channel M-2), and Channels M-3, M-4, M-5, and M-6 form Evaluation Unit I. Cypress Bayou (Channel M-7 system) forms Evaluation Unit II. Channel M-8, Coffee Bayou (Channel M-9), and Channel M-10 form Evaluation Unit III. Camp Bayou Canal (Channel M-11 system) forms Evaluation Unit IV. Bayou Bonne Idee (Channel M-1 system) forms Evaluation Unit V (see Figure 8, Project Map).

Bayou Bonne Idee is a high-bank stream located in an ancestral Arkansas River meander belt ridge.[9/] Because of the geology of the area, the higher, better drained soils are usually located along the banks of old streams that at one time carried large volumes of water. The lower, poorly drained soils are usually located away from these streams. This is explained by the fact that during flooding as the streams flowed over the banks, the coarser, heavier particles of sediment were the first to settle. This usually happened in close proximity to the stream. As the water flowed further back away from the stream, the velocity decreased and the finer particles settled. Bayou Bonne Idee's high banks and wide bed indicate that at one time it was a stream that had a much larger drainage area. Relatively recent diversion of water has increased the drainage area slightly. Several natural drains have been diverted into it. Such was the case with the land drained by Channels L-1D and L-1E and their laterals. Also, farm ditches have been cut against grade into the bayou in an effort to drain the land adjacent to the bayou. At the time this occurred, it was the most practical alternative, since most of the natural outlets were located in extensively forested areas. The area diverted into the bayou has increased the drainage area from about 36,000 acres to the present 45,800. The Bayou's total length is 64 miles.

Prior to 1957, Bayou Bonne Idee did not have permanent water in any of its total 64-mile length and annually would become a dry stream bed during low rainfall months. Large cypress and other water tolerant species of trees, brush, and undesirable aquatic weed growth have grown in the bayou channel and have greatly hampered the stream from becoming a high value fishery.

A water control structure was constructed in the bayou in 1957 which altered the stream's natural flow conditions. In 1959, the construction

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9/ Harold N. Fisk, Geological Investigation of the Alluvial Valley of the Lower Mississippi River, (A report conducted for the Mississippi River Commission, Vicksburg, Mississippi, by Harold N. Fisk, Ph.D., Associate Professor of Geology, Louisiana State University Consultant, 1944), p. 30.

of another such structure further modified the stream. These two structures caused the impoundment of 45 miles of permanent water where it was previously an intermittent stream.

The other major channels are not high-bank streams. These bayous, mainly Camp Bayou Canal, Cypress Bayou, Coffee Bayou, and Turkey Bayou, are either previously modified or manmade. Most of the work done on these channels occurred around 1950 or earlier. Since that time, large acreages of forest have been cleared and converted into cropland. The need for additional drainage has stimulated periodic enlargement and maintenance of the existing channels.

Stream classification shows that there are about 19 miles of Bayou Bonne Idee and about 21 miles of other channels which are classed as unmodified, well-defined natural streams. Of the remaining miles of channels, there are about 183 which are classed as manmade or previously modified and about 15 which are classed as nonexistent or practically undefined. Of the 223 miles of existing channels, 141 have ephemeral flows, 32 have intermittent flows, and 50 have ponded water. There are no perennial streams. Ephemeral channels are those that have flow only during periods of surface runoff; otherwise they are dry. Intermittent channels are those that have continuous flow during some seasons of the year but little or no flow during other seasons. Channels with ponded water are those with no noticeable flow caused by lack of an outlet or a high ground water table. The average annual temperature of water in channels is about 65 degrees Fahrenheit. The average sediment load in the segments of Bayou Bonne Idee holding ponded water is about 300 mg/l. Average sediment in the 5 miles of ponded water in the other channels is about 1,200 mg/l. The water in the Bayou Bonne Idee is transparent and brownish in color. In some sections, such as above existing Water Control Structure No. 3 which is illustrated in the picture on page 9, vegetative infestation is not a major problem. The Bayou has a relatively high aesthetically pleasing appearance in these areas. The waters draining from and contained in the remaining drainage channels are murky, cloudy, and turbid with a very low aesthetic value as illustrated by Channel M-7 in the picture on page 9.

The Louisiana Stream Control Commission has described portions of interstate streams, coastal waters, and streams discharging into coastal waters in the State according to present use. The Commission has also established quality standards which will apply to these streams and their intrastate navigable tributaries and water bodies. Boeuf River, which is illustrated by the picture on page 10, is the only stream classified by the Commission which is applicable in this watershed. This river, the outlet for this watershed, is a medium sized, perennial stream. It originates in extreme southeast Arkansas, flows through the northeastern part of the State, and empties into the Ouachita River near Harrisonburg in east-central Louisiana. Boeuf River has previously been modified. It carries a high sediment load and the water quality is poor because of turbid water conditions and lack of in-channel and bank cover. It does not contain a high fishery resource. No major sources of pollution discharges are known, but occasionally less than desirable levels of

Bayou Bonne Idee Above Existing Water Control Structure No. 3

Cypress Bayou Designated Channel M-7

Boeuf River Above Louisiana Highway No. 2

Boeuf River Below Louisiana Highway No. 2

dissolved oxygen are noted. These seem to be due to heavy organic loads following periods of overflow.[10]

The Division of Water Pollution Control of the Louisiana Wild Life and Fisheries Commission has monitored water quality in Boeuf River since 1968. Water samples used in their tests were obtained monthly at the Louisiana Highway 15 crossing near Alto. This is approximately 20 miles below the watershed. Data collected is exhibited in the table on the following page.

One of the major problems affecting the Boeuf River aquatic ecosystem is excessive turbidities. Results of a study[11] on the effects of turbidity indicate that maximum production occurs where the average turbidity is less than 25 JTU.[12] Between 25 and 100 JTU's, fish yield dropped 41.7 percent and where it exceeded 100 JTU's, the yield dropped 81.8 percent. Of the 72 monthly readings obtained on Boeuf River, 32 percent were less than 25 JTU's, 39 percent were between 25 and 100 JTU's, and 29 percent were over 100 JTU's.

The present uses of Boeuf River's water is for irrigation and watering of livestock, propagation of aquatic life, recreation, and carriage of minor amounts of treated municipal and industrial wastes. Anticipated future uses are municipal and industrial water supplies and considerable increase of most existing uses. General criteria for quality standards state: "No waste after discharge to the Boeuf River shall create conditions which will adversely affect public health or the use of its water for municipal and industrial supplies, propagation of aquatic life, recreation, agriculture, and other legitimate uses."[13]

Of the several small lakes in the area, Horseshoe Lakes No. 1 and No. 2 are the largest, having sizes of about 175 and 250 acres, respectively. Crane Lake, 15 acres in size, is the largest natural lake. Most of the other lakes or ponds are manmade. The next largest lake to the Horseshoes, is a private lake of 60 acres. It is located near Bonita. There are about seven other small lakes ranging in size from 5 to 30 acres.

10/ State of Louisiana, Stream Control Commission, Water Quality Criteria and Plan for Implementation (Unpublished report, 1968) p. 69.

11/ I. H. Buck, "Effects of Turbidity on Fish and Fishing," Twenty-first North American Wildlife Conference Transactions, (Washington, D. C.: Wildlife Management Institute, 1956) p. 249.

12/ Jackson Turbidity Units.

13/ State of Louisiana, Stream Control Commission, p. 69.

Mean, Maximum, and Minimum Values of Water Quality Data at Louisiana Highway 15 Crossing of Boeuf River 1968-73

Year	Value	WATER QUALITY DATA															
		pH	Dissolved Oxygen	O_2 Saturation	Temperature	Total Alkalinity	Total Hardness	Turbidity	Spec. Conductance	Sulfates	True Color	Chlorides	Sodium	Dissolved Solids	Suspended Solids	Total Solids
		UNITS	PPM	PERCENT	°C	PPM	PPM	UNITS	UMHOS/CM²	PPM	UNITS	PPM	PPM	PPM	PPM	PPM
1968	Mean	7.0	4.4	44	19	63	75	92	276	13	43	15	13	311	73	385
	Maximum	7.8[a]	7.8[a]	75[a]	28[d]	119[a]	141[a]	350[b]	522[d]	31[c]	65[c]	29[d]	25[d]	1332[d]	366[b]	1402[b]
	Minimum	6.5[b]	0[d]	0[d]	4[b]	21[c]	23[c]	30[a]	107[b]	1[c]	20[d]	3[b]	1[b]	62[b]	8[a]	170[a]
1969	Mean	7.1	5.3	53	16	92	99	60	341	21	37	30	18	209	59	268
	Maximum	8.2[a]	8.0[b]	74[b]	24[d]	173[a]	220[a]	100[c]	570[a]	32[a]	80[c]	61[a]	37[a]	354[a]	166[b]	354[a]
	Minimum	6.2[b]	2.6[b]	23[b]	10[b]	31[b]	13[d]	30[a]	190[c]	7[c]	20[a]	11[c]	10[b]	96[c]	0[a]	172[c]
1970	Mean	7.0	4.9	52	20	69	81	70	249	13	41	21	19	207	52	259
	Maximum	7.9[a]	9.8[b]	74[a]	32[d]	152[a]	165[a]	280[c]	500[a]	35[b]	95[a]	54[a]	54[d]	468[c]	166[c]	468[c]
	Minimum	6.1[c]	2.1[d]	25[d]	3[b]	20[b]	21[c]	18[a]	70[b]	2[a]	20[b]	5[b]	6[c]	38[c]	0[d]	134[d]
1971	Mean	7.5	5.0	51	18	91	107	68	262	22	47	32	16	208	62	270
	Maximum	7.9[a]	7.3[b]	65[a]	29[a]	202[a]	230[a]	190[b]	580[a]	31[a]	80[d]	90[a]	36[b]	414[b]	206[d]	434[b]
	Minimum	6.9[d]	1.8[c]	19[c]	8[b]	32[c]	36[c]	4[a]	90[c]	3[a]	15[b]	7[b]	9[d]	50[a]	6[a]	56[a]
1972	Mean	7.5	5.7	60	20	91	98	59	257	10	47	66	18	234	38	271
	Maximum	8.0[c]	9.4[b]	77[d]	30[a]	161[a]	164[a]	110[c]	520[c]	22[a]	85[c]	200[d]	36[d]	488[c]	96[b]	538[c]
	Minimum	6.8[d]	2.0[d]	25[d]	7[b]	32[d]	25[b]	10[d]	60[c]	0[a]	5[d]	10[b]	4[b]	68[c]	0[a]	112[b]
1973	Mean	7.3	5.3	52	19	62	70	82	160	8	59	15	7	177	35	212
	Maximum	8.7[c]	12.4[b]	95[b]	29[d]	138[a]	141[d]	160[b]	330[d]	25[d]	100[b]	42[d]	23[d]	316[c]	94[c]	360[b]
	Minimum	6.0[b]	0.2[d]	2[d]	4[b]	15[d]	35[b]	5[d]	60[c]	1[d]	10[a]	4[c]	0[c]	10[b]	2[d]	46[b]

Source: Unpublished Data, Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control

a/ Value obtained during fall. b/ Value obtained during the winter. c/ Value obtained during the spring. d/ Value obtained during the summer.

SETTING

There are 4,620 acres of wetland types in the watershed as described in the U.S. Department of the Interior Circular No. 39.[14] Descriptions and acreages of the different wetland types are listed in the Wildlife Resources section.

Economic Data

There are three broad categories of industries in the economy of any region: first are the basic industries such as farming, mining, and forestry which are based on natural resources; second are the processing industries such as cotton gins, grain elevators, petroleum refining plants, and lumber mills which depend on the basic industries; and third are the service industries such as wholesale and retail stores, communications, transportation, medicine, etc., which are based on the other two industries as well as its own members.[15]

The major basic industry is farming. There are practically no forest resources remaining and there are no known mineral deposits in the watershed. However, other surrounding areas do have this type of employment and some watershed residents are employed in them. Using 1970 census data for Morehouse Parish, it was determined that 16 percent are employed in agriculture, 3 percent are employed in forestry and fisheries, and 1 percent is employed in mining. Manufacturing and construction employ 27 percent and 6 percent, respectively. The remaining 47 percent of the employed labor force work in the service industries.

In 1970, the watershed population was approximately 5,200, all of which was classified as rural. This was approximately 30 percent of the parish rural population and 16 percent of the total parish population. An estimated 75 percent of the watershed residents lived along the banks of Bayou Bonne Idee. Approximately 29 percent of the watershed population constituted the work force of which 7.3 percent were unemployed. The median family income was about $5,270.[16]

The major farm and ranch enterprises are soybeans, cotton, rice, grain sorghum, and cattle. Farm related industries include cotton gins, grain elevators, and agricultural flying services. Feed mills and pelletizing plants, tractor and equipment dealers, a cotton compress, and other agricultural related industries are located in the nearby towns and cities.

14/ U.S. Department of the Interior, Fish and Wildlife Service, Wetlands of the United States, Circular No. 39 (Washington: U.S. Government Printing Office, 1956), pp. 20-22.

15/ Gerald A. Doeksen, Robert E. Daugherty, and Charles H. Little, "Multiplier Effects of Agriculture and Other Industries," OSU Extension Facts (Stillwater: Oklahoma State University) Science Serving Agriculture No. 808, p. 808 and 808.1.

16/ These statistics are based on data from the 1970 Census for Morehouse Parish.

SETTING

Soybean acreage in the problem area amounted to approximately 66,500 acres in 1971. Most of these acres have been converted from forest land or pastureland since 1960. Other important crops grown in the water problem area are 7,200 acres of rice, 7,900 acres of cotton, and 3,300 acres of grain sorghum. The "without project" yields are approximately 18 bushels of soybeans, 750 pounds of lint cotton, 33 barrels of rice, and 33 hundred weights of grain sorghum per acre.

There are 16,400 acres of forest land in the watershed. Due to poor management and following cutting practices with little regard for future use, stands are composed primarily of poor species of low quality. Stands will require conversion to better species of higher quality if any merchantability is expected in the future. About 1,430 acres of forested land are owned by the Morehouse Parish School Board. There are eight other forested tracts ranging in size from one to three sections. The remainder is in small privately owned scattered tracts and borders along streams and swampy areas. Most of these areas yield an average annual net return per acre of less than $3.50. Only one tract of about 250 acres of school board land has fair quality, small sawtimber of about 2,000 to 3,000 board feet per acre.

While markets for pulpwood and sawtimber are active for the area, there is very little demand for this low grade type hardwood pulpwood. The sawtimber in this watershed brings only $10 to $30 per thousand board feet. Landowners in the area generally feel that the forest products that they have sold in the past have not given sufficient returns to pay for the effort of selling. Therefore, the remaining forest land is left as an incidental rather than a planned program.

Using data from the 1969 Census of Agriculture, it was estimated that there were 440 farms averaging about 335 acres in size. Crop and pasture averages about 290 acres per farm. An estimated 90 percent of the farms are family types distributed uniformily throughout the watershed.

Land values for agricultural purposes range from $200 per acre to $400 per acre. These values generally depend on location, soil type, and degree of conservation measures applied.

Public land consists of 2,620 acres administered by the Morehouse Parish School Board of which approximately 1,190 acres are in cropland and 1,430 acres are in forest land.

The watershed is located within the Lower Mississippi Region Comprehensive Study Area. The work plan was coordinated with data furnished for that report.

There are approximately 200 miles of State and parish roads in the watershed. About 50 miles are hard surfaced and 150 miles are graveled. Parts of some roads are under water after heavy rainfall; otherwise farm to market and travel routes are adequate. The railroad providing service has loading facilities at several points.

SETTING

Fisheries

Fisheries are of moderate value. Bayou Bonne Idee, Horseshoe Lakes No. 1 and 2, Crane Lake, farm ponds, and unnamed small lakes are the major fisheries. Borrow pits dug for highway construction and stream cutoffs add some additional fishing outlets. One hundred and twenty pounds of fish per acre are estimated for Bayou Bonne Idee. Bayou Bonne Idee currently has 45 miles of permanent water with a total of 1,400 surface acres. The principal outlet, Boeuf River, has a lower fisheries than Bayou Bonne Idee. The fisheries in Boeuf River are composed primarily of carp, gars, shad, catfishes, and various minnows. Game fish populations are very low and the diversity of species found in Bayou Bonne Idee is absent in the Boeuf River.

For a description of fisheries by reaches of channels, the project area can be divided into two distinct areas, Bayou Bonne Idee and associated aquatic environments and the remaining channels. Of all the channels, Bayou Bonne Idee contains the most significant fisheries. Average standing crops in the portions sampled were 182 pounds per acre. Game fishes composed 42 pounds or 27 percent of this total. Samples in other sections of Bayou Bonne Idee were not taken due to lack of open water. The area sampled represents the highest fisheries on the bayou. Important game and commercial fish species are bream, crappie, bass, shad, carp, gar, buffalo, and catfish. Bayou Bonne Idee contains a greater diversity of fish species, (bass, crappie, bream, pickerel, carp, buffalo, shad, catfish, bowfin, madtom, shiners, and minnows) than the other channels which have a preponderance of commercial fish species (carp, gar, shad, and catfish). Water quality is higher in Bayou Bonne Idee compared to other channels. The other channels contain only a minor portion of the total fisheries in the project since most have either ephemeral or intermittent flow.

The fishing value and aesthetic value of Bayou Bonne Idee and Horseshoe Lake No. 1 will be increased if debris, aquatic weeds, and excessive woody growth were removed and controlled. Additional enhancement would occur if trash dumping and domestic waste disposal were eliminated. Bayou Bonne Idee has a much greater potential as a fishing area than what it is currently providing.

An area of about 390 acres located from the mouth of Bayou Bonne Idee to existing Water Control Structure No. 2, a distance of about 10 miles, currently has no permanent water. About 45 acres of this section of the bayou has intermittent flow characteristics with little fisheries. The primary fisheries occur during periods of high flows when fish from Bayou Bonne Idee and Boeuf River are exchanged in this area. An estimated 70 pounds per acre exists in this reach in winter and spring during periods when water is flowing.

The area between Water Control Structure No. 2 and Water Control Structure No. 3, a reach of about 17 miles, contains approximately 670 acres of permanent water. This section of the bayou has an average standing crop of 182 pounds per acre.

Permanent water above Water Control Structure No. 3 totals about 28 miles in length and about 730 acres. About 65 pounds of fish per acre are estimated to be the average standing crop value.

Fish populations in other existing drainage channels typified by the pictures on page 17 are low to nonexistent. Rights-of-way of these channels contain woody growth of varying species, densities, and diameters. Willow is the dominant species in the channel proper. The majority of the channels have been previously modified.

Channels L-1B, L-1D, L-1E, and L-1F contain a total of about 5 miles of ponded water. Channels M-7 and M-11 (Cypress Bayou and Camp Bayou Canal) contains a total of 18 miles of intermittent flow in addition to the 14 miles in Bayou Bonne Idee.

Standing crop values of 75 pounds of fish per acre are estimated for the channels that have ponded water or intermittent flows. The majority of this poundage would be commercial fish species such as carp, shad, buffalo, and catfish. The low standing crop values result from turbid water conditions, shallow water, and lack of cover. The remaining 141 miles of channels have ephemeral flows (flows only during periods of surface runoff) with little fishery value. However, a limited production of fish food organisms such as crawfish and larval forms of various insects occur in these channels.

Public access availability to the existing fisheries is generally at road crossings and in some cases, from the banks. Generally, landowners will grant people permission to fish if they are consulted beforehand. Trafficability and fishing on Bayou Bonne Idee is hindered by aquatic weeds, brush, and trash in the water. Cleaning out logs, dense growths of woody vegetation, and aquatics in Bayou Bonne Idee would also improve boat access and use.

Access to Horseshoe Lakes No. 1 and No. 2 is available through all-weather roads and boat launching ramps. Crane Lake and unnamed natural lakes have poor access due to lack of all-weather roads. Access to the other bayous is available primarily at road crossings.

Utilization of the existing fisheries by local residents is high. The sport fishery is utilized more than the commercial fishery. Sport fishing and the limited commercial fishing are important assets to the local economy through sales of boats, motors, and other fishing equipment.

Wildlife Resources

There are basically three types of wildlife habitat. These are forest, open land, and wooded channel banks. Typical examples are illustrated in the following photographs on pages 18 and 19.

Forest land in the watershed totals 16,400 acres. Forest game species associated with this habitat are white-tailed deer, squirrels,

Ponded Water in Channel

Intermittent Flow in Camp Bayou Canal Designated Channel M-11

Forest Land Habitat

Open Land Habitat

Wooded Channel Bank

rabbits, and waterfowl on the forested wetlands. Other species such as doves and quail use the edges for nesting and escape cover. The forest land is also potential wild turkey habitat. Non-game animals and birds also utilize the forests for food and cover requirements. Various species of mammals, amphibians, reptiles, and birds are found in the project area, however, it is beyond the scope of this report to list them all.

Presently, forest game populations are below carrying capacity of the habitat. Also, the habitat is below its potential because it occurs in small, scattered blocks and the highest quality mast trees have been removed. Populations of forest game species are kept low by the tremendous hunting pressure that is placed on the small amount of habitat remaining. Game animal populations are shown in the tabulation on the following page.

SETTING

Species	Estimated Total Animals[a/]
Dove (Migratory)	31,200
Quail	2,490
Squirrel	4,310
Deer	520
Rabbit	13,785
Waterfowl (Resident)	953
Waterfowl (Migratory)	9,495

a/ Data developed in cooperation with the Louisiana Wild Life and Fisheries Commission.

Large acreages of hardwood have been cleared and converted to cropland. This reduction in habitat has proved detrimental to forest game species. An estimated 80,000 acres have been cleared in the project area since 1960. This caused an 83 percent reduction in forest game habitat. About 16,400 acres of hardwoods remain in the project area. There are 1,120,000 acres of bottom land hardwoods within a 60-mile radius of the watershed. Clearing forest land has been beneficial to open land species such as doves and quail by creating more of their habitat type.

Open land, which includes cropland, fallow fields, and pastureland furnishes primary habitat for doves, quail, and rabbits. Other game species utilize open land to a lesser extent. Current populations are below the potential this habitat is capable of supporting. This is due primarily to the practice of "clean farming." This situation occurs where the majority of grasses, forbs, and brush are removed from fence rows and other places. Very little cover or food is left after the crops are harvested. As a result, open land game populations are moderate.

Low to moderate wood duck habitat currently exists from the mouth of Bayou Bonne Idee to the location of Water Control Structure No. 2 (existing). The bayou contains woody, understory vegetation and some overstory species. Vegetative cover in the channel proper ranges from 50 to 75 percent and contains buttonbush, willow, cypress, and tupelo gum.

From Water Control Structure No. 2 (existing) to Water Control Structure No. 3 (existing), limited wood duck habitat is currently available. The lower 14 miles are poor while the upper 3 miles are good wood duck habitat.

Above Water Control Structure No. 3 there are about 28 miles or 730 acres of permanent water surface. This entire length is good wood duck habitat.

SETTING

A total of 4,620 acres of various wetlands occur in the project area. The description and acreages of the different wetland types are as follows:

Type	Description	Acreage	Percent
1	Seasonally flooded bottom land hardwoods	1,700	37
3	Inland, shallow fresh marshes	290	6
5	Open lakes and ponds up to 10 feet deep	960	21
7	Cypress and tupelo gum brakes	1,670	36
	Total	4,620	100

The Project Map, Figure 8, shows the location of those wetland areas that are over 80 acres in size. These wetland areas are the prime waterfowl habitat that is currently available. The majority of this occurs in the western half of the project area. Within a 60-mile radius of the project area, there are about 140,000 acres of wetlands or 32 times that which exists in the project area.

Fallow fields currently are furnishing some of the best open land habitat. The vegetative cover associated with these idle fields is beneficial during the early stages of plant succession. After 3 years, the quality of the habitat starts declining and continues to decline until the soil is disturbed again.

Small trees and shrubs which have grown up on spoil and channel banks also provide cover and nesting areas for wildlife which feed in the open land. This habitat is referred to as "wooded channel banks" in the plan. There are approximately 380 acres of this type habitat.

Numerous landowners plant fields of winter wheat, ryegrass, and oats for supplemental cattle grazing, grain, and soil protection. This practice is very beneficial to rabbits and deer, especially if the fields are adjacent to forested tracts.

Utility rights-of-way traversing forest land supply food and cover for various wildlife species such as deer, quail, and rabbits. In the forested tracts, these rights-of-way supply the "edge effect" which is beneficial to nearly all wildlife species.

Wetlands provide feeding, nesting, and roosting habitat for both resident and migratory waterfowl. Furbearers such as raccoon, mink, bobcat, and fox also utilize wetlands for partial fulfillment of their habitat requirements.

Access to the existing wildlife resources is good. The Morehouse Parish School Board owns 1,430 acres of forest land. This property has all-weather roads for access. Other open land and forest land is posted;

this limits public access. However, the majority of open land and forest land is accessible by all-weather roads and is open to the public for hunting by obtaining permission from the landowners.

Recreational Resources

A 1970 inventory conducted by the Louisiana State Parks and Recreation Commission lists 15 recreational sites for Morehouse Parish. According to the Bureau of Outdoor Recreation's land classes, 13 of these were recreation and 2 were natural environment. Three sites are located in the watershed. One of the sites includes the Bonita Recreation Area having one baseball diamond and two tennis courts. The other two sites are boat ramps; one is located on Horseshoe Lake No. 1 and the other is located on Horseshoe Lake No. 2. Some bank fishing and limited boating occurs on Bayou Bonne Idee.

There are no known major pollution problems in the area. The pollution that does occur is mainly from sediment carried by runoff from cultivated land, trash dumping, and domestic waste disposal.

Public access to outdoor recreational facilities is good and use is moderate. Boat access to Bayou Bonne Idee is limited.

Archaeological and Historical Values and Unique Scenic Areas

The locations of nine archaeological sites were obtained from the Curator of Anthropology of Louisiana State University. None of the sites were classified according to their nature. To enhance preservation of the sites, the Curator requested that their location not be published until further study. The Louisiana Historical Preservation and Cultural Commission was contacted. They identified no places of historical importance in the area. A check of the National Register of Historic Places also failed to reveal places of value.

Soil, Water, and Plant Management Status

Soybeans became a popular crop in the watershed in the early 1960's. Planted acreages in the problem and nonproblem areas increased each year from about 15,000 in 1962 to about 78,000 acres in 1971. This increase has caused a reduction in forest land and pasture. Approximately 80,000 acres of forest land have been cleared since 1960. Much of the remaining 16,400 acres of forest land consists of relatively small scattered wood lots averaging less than 20 acres in size. There are several larger tracts ranging from one to three sections in size. All forest land is privately owned except for the 1,430 acres administered by the Morehouse Parish School Board. Future changes in land use are expected to be small.

The watershed is in the Morehouse Soil and Water Conservation District. Soil and water conservation plans have been prepared for 333 operating units covering about 107,500 acres (about 68 percent of the watershed).

An estimated 26 percent of the needed conservation measures have been applied. Land treatment has been applied to problem areas as well as non-problem areas. During the last 10 years, landowners have applied measures costing approximately $632,500 (see table 1A). Much of this was applied in areas with a water problem.

The water bank program was introduced in Morehouse Parish in 1972. This program was created by the Water Bank Act whose purpose is "To provide for conserving surface waters; to preserve and improve habitat for migratory waterfowl and other wildlife resources; to reduce runoff, soil, and wind erosion, and contribute to flood control; and other purposes." Wetlands designated as eligible in Morehouse Parish are types 3, 4, and 5. Of the 1,250 acres of types 3 and 5 which exist in the watershed, 173 are enrolled in the program.

The Soil Conservation Service district conservationist works closely with the soil and water conservation district in establishing priorities of work to be done. They are actively involved in promoting good conservation. Through the use of a newsletter, radio announcements, and newspaper articles, the district announces important activities and publicizes results of these activities. They employ one technical aid and one part-time filing clerk to assist Soil Conservation Service field office personnel. As Sponsors of this watershed project, they are actively involved in planning.

The Louisiana Forestry Commission, in cooperation with the U.S. Forest Service through the various Federal-State cooperative forestry programs, is providing forest management assistance, marketing assistance, forest fire prevention and suppression, distribution of planting stock, and forest pest control assistance to private landowners. There are no lands administered by the U.S. Forest Service within the watershed. The watershed is protected from wildfire by the Louisiana Forestry Commission, whose 1971 fire loss index goal is 0.25 percent. The 1966-1970 burn record reports no fires for that period. The present level of protection is considered adequate to meet present and future hazards and risks.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment

Soils in the watershed have comparatively low erosion rates. Fertility is moderate to high but because of the generally flat terrain, high rainfall, and the medium-to-fine texture of the soils, a severe wetness problem exists. This problem has kept income at such a level that farmers have not been able to comprehensively treat their land. For instance, a farmer may have several low places on his land from which he is losing production. He cannot afford to eliminate these lows by land leveling because it is too costly a practice relative to his limited income. Instead, he tries to alleviate the problem by ditching. This may improve the production somewhat, but it will not eliminate the problem completely. These ditches will remove the water from the small rains. However, they will not adequately remove the water from the large rains, because the outlet ditches are full or overflowing. The inadequate surface water removal prevents establishment of necessary vegetative practices and soil and water conservation. If problems were eliminated, farm income would increase and the farmer would more readily apply land treatment measures.

Floodwater Damages

The average annual rainfall is approximately 52 inches. Rainfall of at least 3.1 inches in a 48-hour period occurs on an average of 2 times a year, 4.2 inches once each year, and 5.9 inches once in 3 years. Generally, total damages caused by all small floods which occur annually are greater than the total damage resulting from larger but less frequent floods. Damaging out-of-bank flows in portions of the area occur about two times yearly. Peaks from the 3-year frequency storm on Boeuf River get high enough to back water into the low areas adjacent to it. However, Boeuf River peaks and tails off relatively fast. During the cropping season, the 3-day maximum stages resulting from the 5-year storm on Boeuf River would inundate less than 1,500 acres. Cropping season is defined as March 1 through November 15. This is the period of time in which good drainage and flood prevention is essential for normal crop production. Because there is so little elevation differential in the watershed, especially along Boeuf River, storms of a greater magnitude than the 5-year storm would cause more backwater flooding in Evaluation Units II and III than in Evaluation Unit I. Water backing into Channel M-11, the outlet for Evaluation Unit IV, would spill over in Evaluation Unit III further complicating the problem. Evaluation units are defined on page 7 and delineated on the Project Map, Figure 8.

Backwater flooding during the noncropping season is more intense. Damages are usually low since the areas flooded are not in crop production at this time.

PROBLEMS

In this watershed, there is no defined flood plain. Flooding and drainage problems are inseparable in most areas. Frequent out-of-bank flows result in delayed planting, cause replanting resulting in the use of additional cultural practices in production, and cause problems in harvesting resulting in use of additional equipment and labor. The quality and quantity of cotton, soybean, grain sorghum, and rice are adversely affected when normal harvesting is delayed.

Land use changes from noncropland to cropland have occurred rapidly. An estimated 80,000 acres of forest have been cleared and gone into production since 1960. During this same period, approximately 10,000 acres of pasture have also gone into crop production. The drainage systems on these lands are inadequate for efficient crop production. The increased runoff from this land overtaxes previously-worked channels and causes problems on other lands.

Soybean lands best illustrate the severity of the problem since it represents the largest acreage and suffers the most damages. The driest months are October, September, August, and June, in that order. Rainfall is highest in winter and lowest in late summer and early fall. Relatively little land preparation can be accomplished in early spring because of the flooding and wetness problems. Consequently, much of the crop is not planted until the end of May or the beginning of June and often as late as the first of July. Since June is one of the drier months, much difficulty is encountered in establishing a good stand. The low moisture content of the soil prevents germination and allows a black mold to form around the seed causing it to rot.

The root system of these late soybeans is not as extensively developed as the earlier beans. Therefore, their growth is affected more by lack of moisture in the dry months of August, September, and October than they would have been if they had been planted early. These late soybeans are not ready for harvest until late October, November, or early December. The sum of the average rainfall for November and December exceeds the sum of the average rainfall for August, September, and October by 20 percent. Thus, much of the harvest is delayed or performed under highly unfavorable conditions. Almost every year, some crops are not harvested because of the wet condition of the soil.

The delays, because of wetness, cause the beans to mildew in the pod and retain more moisture than is desirable. The longer harvest is delayed, the greater the loss from pods shattering. When the ground is wet, the cutter bar of the harvester cannot be lowered as close to the ground as is desirable because the machine sinks and bogs. Therefore, soybeans are left in the field that would have been harvested had a better condition existed. The harvested beans have to be hauled from the combine to the truck by tractor and grain cart instead of the combine emptying directly into the truck. Harvesting a given acreage requires about twice as much time under these adverse conditions.

Other crops in the problem areas are affected similarly. Farmers are faced with an annual cycle of uneconomic conditions. They are forced to plant late because they cannot get the seedbed prepared early

enough. Because of this they have to harvest late. The late harvest is excessively costly and produces lower quality products. Instead of leaving crop residues on the ground or planting cover crops to protect the soil from the high intensity winter rains, farmers attempt to fall or winter plow. This early plowing speeds up seedbed preparation in the spring or early summer when time is so critical. If good drainage was provided, the farmers would be more apt to maintain a good soil cover in winter because they would have more time for seedbed preparation in the spring.

Roads require additional maintenance because of flooding. Extra gravel, fill material, equipment, time, and labor are needed to keep roads open and passable. When roads are flooded, sections of school bus routes have to be omitted. Children then either miss school or have to be transported to the nonflooded roads by tractor. In instances where the assistance of a doctor would be required, a flooded road or nonflooded road may mean the difference between life and death.

Average annual floodwater damages amount to $492,200. Of this amount, $434,600 are crop and pasture damages, $27,700 road and bridge damages, $25,000 sediment damages, and $4,900 indirect damages.

Erosion Damage

Sheet erosion is the major form of erosion within the watershed. While other forms of erosion such as gully, streambank, roadside, etc., are present, they are relatively insignificant. The problem of sheet erosion can best be discussed by dividing the watershed into two areas: Evaluation Unit V, consisting of the Bayou Bonne Idee system, and Evaluation Units I, II, III, and IV consisting of the remainder of the watershed.

Most of the soils of the Hebert-Rilla-Sterlington Association are located in Evaluation Unit V. These soils range from a very fine sandy loam to a silt loam (80 to 100 percent of material passes a No. 200 sieve) with solum thickness ranging from 36 to 72 inches. These natural levee soils were created by the old Arkansas River of which Bayou Bonne Idee is an old remnant. The surface layer of these soil profiles are strongly acid. The slope is approximately 1 percent and the slope length is approximately 300 feet.[1/] The adjusted erosion rate, without regard to cover or to land treatment measures, amounts to approximately 6.4 tons per acre per year.

Evaluation Units I, II, III, and IV essentially consist of soils of the Perry-Portland Association. About 95 to 100 percent of this material will pass a No. 200 sieve. The average slope is approximately 0.5 percent and the slope length averages approximately 100 feet. These

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1/ U.S. Department of Agriculture, Soil Conservation Service, National Cooperative Soil Survey, Soil Survey Interpretations (Fort Worth, Texas, Cartographic Unit--South Regional Technical Service Center; Hebert Series, Rilla Series, and Sterlington Series.

soils are silty clays to clays with the Perry Series being montmorillonitic. Thickness of the solum ranges from 30 to 60 inches. These are the "backswamp" soils formed along the Arkansas River. The upper portion of these soils are frequently highly acid.2/ The adjusted annual erosion rate, without regard to cover or to land treatment measures, amount to approximately 2.5 tons per acre.

Due to the low relief of the land and the erosive resistance of the soils, the annual sheet erosion at the present time amounts to approximately 3 tons per acre across the entire watershed. This is a very small soil loss. It is equivalent to a surface degradation of .0012 feet of soil. Not all of this soil is "loss" but simply transported from one area in the watershed to another.

Some erosion is present where field ditches intercept lateral and main ditches. Minor sloughing of side slopes on some channels is evident. While these are a noticeable form of erosion, they are small compared to the sheet erosion. This is due primarily to improper placement of spoil causing excessive loads on side slopes and ground water seepage.

Sediment Damage

Sediment damage on agricultural land is minor and swamping is not an indentifiable damage. Due to the fine grain size of the sediment, most of it remains in colloidal suspension and does not create a major problem in channel maintenance. Some maintenance, of course, is necessary. Sediment bars will develop where ditches juncture and where vegetation or debris interrupt the velocity in the channel. While some of this sediment is due to a decrease in velocity, some is due to chemical changes and local concentrations.

Sediment from this watershed is deposited in Boeuf River on which the U.S. Corps of Engineers have done work. At the present time, Boeuf River receives an average annual suspended sediment load of about 1,200 ppm from the Bayou Bonne Idee Watershed exclusive of the Bayou Bonne Idee system. The Bayou Bonne Idee system has an average annual rate of about 2,900 ppm.

It is to be noted that these suspended sediment rates are average annual rates and as such do not reflect normal flow conditions. During or after heavy rains, the sediment concentration will be many times greater. During low flow periods, the concentrations will be much less. Since the Bayou Bonne Idee Watershed is only about 20 percent of the drainage area of Boeuf River, these amounts of sediment are minor when compared to the total load carried by Boeuf River.

Sediment removal from the river is a problem. The cost of removing that portion deposited from this watershed is estimated to be $25,000 annually.

2/ Ibid., Perry Series and Portland Series.

PROBLEMS

Drainage

One of the primary needs of the low-lying land is adequate drainage outlets. These are necessary for efficient production of the crops grown in the area. Flooding and drainage problems are inseparable on most of the area. Therefore, many of the problems discussed in Flood Damages section are common to those due to lack of drainage. Lack of these facilities are causing farmers to have increased costs of production, increased levels of risk, reduced efficiency of farm equipment, reduced quality and quantity of harvested crops, and the inability to install needed land treatment measures. Some landowners and operators have installed on-farm and group drainage systems with the help of the soil and water conservation district. The main channels which provide outlets for many of these systems are no longer adequate to dispose of the surplus water because of changed land use and increased runoff.

Local organizations, in cooperation with the Louisiana Department of Public Works, have worked to reduce the problems of inadequate outlets; however, the problems are so widespread and the solution so involved that no adequate means have been provided at this time. Most of the existing systems have been installed in a piecemeal manner due to lack of funds necessary to develop and install a comprehensive plan giving appropriate consideration for the environment.

Irrigation

Rice is the only crop which is being irrigated regularly. About 25 percent of the acreage is irrigated with water from Boeuf River and Bayou Bonne Idee. The remainder is irrigated with water from deep wells. Some farmers have installed wells to irrigate other crops such as cotton and soybeans, but their use is not regular.

An average of about 2.5 inches of rainfall per month occurs during the droughty months. The uncertainty of the time that this rainfall occurs has played a major role in keeping irrigation at its low level. By chance, it seems that most farmers with an irrigation system have experienced going through the expense of setting up their equipment just prior to a rain. Often they may have just completed an irrigation when the rain comes. In areas where inadequate drainage is evident, irrigation may have caused more harm than good. Consequently, they often delay irrigating in anticipation of rain. This situation has kept the profitability of irrigating crops other than rice on a marginal basis. An estimated 10 percent of the cropland is irrigated.

Of the three potential ground water aquifers, the Quaternary Alluvial deposits are the most likely suitable source of any future water. Because of its shallow depth, irrigation wells in this formation cause a large drawdown cone that interferes with smaller wells in the vicinity.

Water from the Cockfield Formation ranges from soft to very hard with excessive iron content. The water is suitable for irrigation. The difficulty with obtaining irrigation water from the Cockfield is its relatively small

specific yield. Water from the other formation, the Sparta Sand, has too high a concentration of dissolved sodium salts to be suitable for irrigation.

The flat clayey soils of the Perry-Portland Association are especially suitable for the surface-type irrigation used in rice culture. Soils of the Forestdale-Perry-Dexter Association are less suited to this type irrigation because of small localized ridges. Sprinkler-type irrigation has been tried on these soils with limited success. Landforming would make this soil suitable for surface irrigation. The sandier soils along the natural levee of Bayou Bonne Idee, the Hebert-Sterlington-Rilla Association, are well-suited for furrow-type irrigation since the land slopes uniformly away from the Bayou. In some locations, landforming may be required in this type soil, also.

Municipal and Industrial Water

The same three aquifers serving as a source of irrigation water could also serve as a source for municipal and industrial water if a greater need arose. The only village in the watershed, Bonita, gets its water supply from the Cockfield Formation. At the present time, this source is adequate although high in minerals. Population projections show a decrease of about 14 percent for Morehouse Parish from 1970 to 1985. Since the watershed is all rural, the decrease in it will probably be greater than 14 percent. Present sources should be adequate for future demands unless irrigation use rises sharply.

Recreation

The 1970 population within a 50-mile radius of the watershed, which includes the Monroe Metropolitan Area, was estimated to be 290,000. By the year 2020, it is expected to be 380,000, representing a 31 percent increase in the 50-year period. The recreational demand based on the present population is 715 tent camping sites, 1,100 trailer camping sites, 1,390 picnicking sites, and 290 boating ramps. After subtracting the present supply from total demand, there remains a need for 598 tent camping sites, 1,010 trailer camping sites, 1,070 picnicking sites, and 247 boating ramps.[3/] Thus, many new facilities will have to be installed before even the present demand can be met.

Most of the land within the 50-mile radius is flat and the area is poor in the quantity of water available for fishing and water sports. Bussey Brake, Horseshoe Lake No. 1, and Horseshoe Lake No. 2, surface area 1,800 acres, 150 acres, and 240 acres, respectively, are the only lakes within the area of influence. D'Arbonne Lake and several cutoffs on the Mississippi River are on the outer periphery of the 50 miles.

Local interest in developing new recreational areas is high. The local people recognize the present shortage of facilities and realize that if potential areas are not developed this shortage will become more critical in the future.

3/ Based on State Comprehensive Outdoor Recreation Plan for 1970-1975.

PROBLEMS

Fish and Wildlife

Lack of high quality fishing waters and recent land use changes are two of the major problems concerning fish and wildlife. The major portions of Bayou Bonne Idee which hold permanent water have a low usefulness as a fishery. The reason for this is that they are heavily infested with aquatic weeds, trees, brush, and trash as illustrated in the pictures on page 31. The predominant aquatic weeds are duckweed and water hyacinth. Cleaning these portions of the Bayou and creating permanent water in the intermittent portions would greatly enhance the fishery.

The clearing of large acreages of hardwoods in recent years has reduced populations of deer, squirrels, and swamp rabbits. Approximately 16,400 acres of forest are left. Although of low quality for timber production, these hardwoods hold the key to future populations of forest game.

Lack of cover in the cultivated areas, especially where fall or winter plowing occurs, is a problem for quail production. Protective and nesting cover is void on the majority of this acreage.

The current practice of fall or winter disking of large acreages of harvested beans and cotton land is detrimental to fish and wildlife. It adds to the sediment load in the streams and destroys wildlife cover. Planting more winter cover crops or leaving the crop residues would benefit fish and wildlife resources.

Economic and Social

The level of income necessary for surviving on a minimum diet with none of the amenities of prosperity has been determined by the Social Security Administration.[3/] An individual is considered poor if his personal income or the income of the family to which he belongs inadequately provides for his subsistence. In 1960, by this definition, 46 percent of all the families in Morehouse Parish were classified as poor; 14.5 percent were white and 31.5 percent were nonwhite. In 1966, 35.2 percent were classified as poor. This was an improvement of approximately 11 percent since 1960. However, 84 percent of all the counties in the United States still had a smaller proportion of poor families. One percent of the families in the State of Louisiana live in Morehouse Parish. However, 1.2 percent of all the poor families in the State reside in this parish. It has a greater than proportionate share of poor families.

According to the 1970 census for Morehouse Parish, there were 7,804 families with a median income of $5,708. Of the total families, 3,656

3/ James R. Robo and Dean R. Dudley, Statistical Abstract of Louisiana, (4th ed.; New Orleans: Division of Business and Economic Research, College of Business Administration, Louisiana State University at New Orleans, 1971), p. 172.

A Portion of Bayou Bonne Idee Infested with Aquatic Weed

A Portion of Bayou Bonne Idee Infested with Woody Vegetation

were urban with a median income of $6,278; 3,605 were rural nonfarm with a median income of $5,539; and 543 were rural farm with a median income of $3,494. About 30 percent of the urban families had incomes less than the poverty level, while 34 percent of the rural nonfarm and 46 percent of rural farm families had incomes less than the poverty level. Since the watershed population is all rural, it is estimated that 36 percent of its population is below the poverty level.

The parish economic conditions are below the State average. For example, 11 percent of the families in the parish have a female as the head of the household compared with 8.6 percent in the State. Compared with State averages, Morehouse Parish has 28 percent more females as heads of households with family members under 18 years; 22 percent more primary individuals which are 65 years of age and over; 35 percent more occupied households which average 1.51 or more persons per room; and 125 percent more occupied households lacking complete plumbing facilities.

Old age assistance and aid to dependent children are the two largest recipient groups of welfare aid in Morehouse Parish. Of the total public welfare assistance grants made in fiscal year 1966-67, 63 percent was for old age assistance, 26 percent was for aid to dependent children, 8 percent was for disability assistance, 2 percent was for general assistance, and 1 percent was for aid to needy blind. About 45 percent of the parish population was under 18 years old and 8 percent was 65 years old and over. Since 2,079 children received welfare assistance that year, this represented 14 percent of the population under 18 years of age.

Information from the 1970 census reveals that 4.4 percent of the people 25 years of age and older had never completed 1 year of school, and 31.5 percent were high school graduates. The median for years of school completed was 9.

Since the watershed has a larger percentage of poor families than the parish, it is reasonable to believe that its economic and social conditions would be lower than the preceding figures.

According to 1969 Census of Agriculture data, there are 726 farms in Morehouse Parish. This was a decrease of about 28 percent in number of farms from 1964 to 1969. The average size of a farm was 370 acres in 1969, as compared to 203 acres in 1964. In 1969, 31 percent of the farms were less than 50 acres and 49 percent were less than 100 acres. Farm operations in the watershed are continually decreasing in number and increasing in size. Due to the increasing cost of production inputs and the relatively static prices of agricultural products over the past 20 years, farmers are faced with a "cost-price" squeeze. Decreased net returns per acre resulting from this situation have caused the small operators to either leave the farm, expand their enteprises into economic size units, or seek employment elsewhere using farm returns as supplementary income. From 1950 to 1970, the number of farm operators has decreased by approximately 75 percent and size of farms has increased by approximately 500 percent. Many of the small farmers have either sold or rented their land. The majority of the remaining small farmers are employed off the farm and are not

primarily dependent on the farm for their livelihood. According to the 1969 Census of Agriculture data, about 41 percent of the farms in the parish had sales of less than $2,500, about 58 percent had sales less that $5,000, and about 68 percent had sales less than $10,000.

Projections show that the trend of decreasing number of farms and increasing size will continue in the future. Farmers are trying to raise their income and, consequently, are compensating for low net returns per acre by farming more acres. In order to accomplish this, they have to use larger, more expensive labor-saving equipment.

Although the population of Morehouse Parish only decreased by 1,246 persons from 1960 to 1970, it had a net out-migration of 6,586 persons. This was a 16.9 percent decrease in the expected 1970 population. The expected 1970 population was calculated by adding births from 1960 to 1970 to the 1960 population and then subtracting deaths which occurred during that same time period. Of the total net out-migration, 83 percent were nonwhite and 17 percent were white. Many of the young adults are leaving the farm to seek employment elsewhere. Increased efficiency of remaining labor through greater mechanization is necessary for survival of the farm family.

It is estimated that only 10 percent of the farms use 1 1/2 man-years or more of hired labor. These farms are scattered throughout the watershed are not confined specifically to any area.

Other

Water for human consumption is obtained from wells. Livestock water is from bayous, channels, stock ponds, and wells. These sources are adequate except for the shallow wells which are sometimes affected by the drawdown caused by irrigation wells.

PROJECTS OF OTHER AGENCIES

This watershed is in the Boeuf River sub-unit of the Mississippi River and Tributaries Project Basin Study Area of the U. S. Corps of Engineers. The improvement of the portion of Boeuf River which serves as the outlet for the watershed was completed in 1957.

In 1950, the Louisiana Department of Public Works, cooperating with the local organizations, installed a partial system of channels. Due to subsequent changes in land use and normal deterioration of the channels, they are no longer adequate to provide the needed protection. They have also installed two water level control structures in Bayou Bonne Idee (see Project Map, Figure 8 - Water Control Structures No. 2 and No. 3).

PROJECT FORMULATION

The application for assistance was accompanied by the signatures of 89 interested individuals who believed that the project was a worthwhile undertaking. On December 16, 1968, a meeting was held to discuss the watershed project including the area, the problems, and the responsibilities of the different groups involved in planning. This meeting was attended by representatives of the Northeast Soil and Water Conservation District (later divided into three districts, one of which is the Morehouse Soil and Water Conservation District), the Morehouse Parish Police Jury (later withdrew and was replaced by the Bonne Idee Gravity Drainage District), the Louisiana Department of Public Works, the Soil Conservation Service, and a number of Morehouse Parish farmers. The Bastrop Daily Enterprise of December 17, 1968, printed detailed coverage of this meeting. Several other later newspaper articles publicized the project.

A series of public meetings were conducted by the project Sponsors in Morehouse Parish to acquaint watershed residents and interested citizens and groups with the proposed project. Three meetings (April 16, 1970, April 28, 1970, and June 16, 1970) were held at the Agricultural Auditorium in Bastrop. Publicity was provided through notices to landowners mailed by the Agricultural Extension Service and by newspaper publicity. A map of the area was published in the local newspaper so the public would fully understand the project location.

Two other meetings were held with Sponsors, local leaders, and interested wildlife groups. The purposes of these meetings were to discuss planning progress and problems.

On October 5, 1971, a fourth public meeting was held at the Agricultural Auditorium in Bastrop. The purpose of this meeting was to explain the plan and give the public an opportunity to express their opinions and ideas.

Personnel of the Soil Conservation Service and the Louisiana Wild Life and Fisheries Commission made three joint field trips to the watershed during planning to study possible effects of proposed project measures on fish and wildlife. Personnel of the U.S. Fish and Wildlife Service were present during two of these. Both the U.S. Fish and Wildlife Service and the Louisiana Wild Life and Fisheries Commission assisted in formulating the plan.

Objectives

The cropland and pastureland are farmed intensively. The landowners and operators through their application and interest displayed at meetings have indicated a strong desire to improve the economic condition of the watershed by maximum management of resources. They requested a project be formulated that would allow the development of all possible soil and water resources presently or potentially available.

Problems discussed under WATERSHED PROBLEMS are of deep concern to the residents. The Sponsoring Local Organization and the Service agreed to the following objectives:

(1) Provide improved farming conditions to increase farm family incomes and improve living conditions.

(2) Reduce average soil loss to the minimum consistent with sound conservation farming methods.

(3) Provide agricultural land a level of protection which would allow runoff from a storm with an average frequency occurrence of once every 3 years to be back within banks 24 hours after the rainfall ceases.

(4) Provide additional permanent water and improve the quality of existing water in Bayou Bonne Idee to enhance its use for recreation.

(5) Facilitate achieving the preceding objectives by providing acceleration of the going land treatment program so that about 40 percent of the agricultural land will be adequately treated by the end of the project installation period.

(6) Provide local people water-based recreational facilities which will meet the needs of the watershed residents.

(7) Install project measures in a manner which will not damage wildlife. If damages should occur, measures will be constructed which will mitigate losses.

Environmental Considerations

Possible effects of the project on fish and wildlife habitat were primary considerations in this plan. Improved drainage may possibly encourage the clearing of some remaining blocks of forest. To discourage such clearing, channels were designed in such a way that forest is not provided sufficient protection for conversion to cropland. The design procedure is explained in the Hydraulic and Hydrologic Investigations section. Three different levels of protection were studied to observe effects this would have on the environment.

Some existing channels pass through wetland areas valuable for wildlife habitat. To avoid further draining these areas, project channels were terminated at the point of entrance. In other areas the wetlands' natural drainage courses outlet into existing channels which provide outlets for on-farm drainage. In order to discourage draining of these wetlands where project channels will provide outlets, enlargement will be terminated at a safe distance, usually one-fourth to one-half mile from the entrance of the wetlands. The first case is exemplified by Channels L-1E and L-1F and the second case is exemplified by Channels L-1A, L-1C, L-7I, and L-7I-1A. The installation of Water Control Structure No. 4 will more than mitigate the

effects of reduced flooding on 105 acres of seasonally flooded wetlands along channels.

Valuable wildlife and fish habitat along or in channels requiring excavation work will be partially or totally preserved by working from only one side. This will minimize wildlife habitat disturbance. The side on which habitat will be preserved will be determined at the time of construction by a Soil Conservation Service biologist in consultation with the Louisiana Wild Life and Fisheries Commission and the U.S. Fish and Wildlife Service.

Sediment and turbidity in channel waters caused or accelerated by project action were also important considerations. Several measures are incorporated into the plan to reduce these effects. Short sections of channels will be made deeper for sediment interception where needed at the junctions of principal laterals with the main channel. Vegetation on berms, spoil, and channel side slopes will be reestablished as quickly as possible. Lime will be applied at the time these areas are seeded to flocculate sediment and reduce turbidity in the channel waters. Grade stabilization structures (figure 4) and water control structures - type 2 (figure 5) and type 3 (figure 7) will be installed in the channels. The grade stabilization structures and the water control structures - type 3 will trap sediment and reduce downstream turbidity. The water control structures - type 2 will trap sediment and create 38 miles of water in project channels other then Bayou Bonne Idee.

The clearing in Bayou Bonne Idee will be done selectively so that valuable wood duck habitat will be preserved. This and the replacement of tree cavities removed with nesting boxes will be sufficient to maintain the wood duck population at or near its present level.

Clearing of 554 acres of trees and woody vegetation in the forest and along wooded channel banks for rights-of-way will be mitigated by creating 16 wildlife openings in 2 sections of forest land administered by the Morehouse Parish School Board. The two 640-acre sections and a portion of another measuring 150 acres will be available to the public for hunting.

Alternatives

Land Treatment Only. Needed land treatment can only be applied by some combination of structural measures. The inadequacy of present outlets for on-farm drainage systems would prevent land treatment measures alone from alleviating existing problems.

Flood Area Zoning. Because the watershed terrain is so flat, it would be difficult to define the flood plain accurately enough to zone it. Since the majority of the land is already in agricultural production and since most ordinances approved are not retroactive in authority, flood plain zoning would have little or no effect.

Floodwater Retarding Structures. The flat terrain provides no sites for the construction of floodwater retarding structures.

Floodproofing. Since the topography of the area is relatively flat and the flood plain is not accurately definable, the problems are located in a large contiguous area. The establishment of levees around individual farms or fields is a physical possibility although not practical. Since this is a high rainfall area, pumps would have to be installed to remove runoff from within the leveed area. In order to prevent impounding of water from abnormally high direct precipitation within the levee system, the capacity of the pumps required would be large and a system of channels would still be required outside the leveed area to remove the water from the pumpoff. Otherwise, flooding would be induced on other areas. Backwater flooding from Boeuf River is not a serious problem except during infrequent storms. Therefore, flooding which has to be contended with is headwater flooding from the drainage area within the watershed.

Channel Work. Various sizes and lengths of channels were studied to determine which level of protection - the 1.5 year, 3-year, or 5-year - is most desirable. These levels of protection evaluated were held constant for each channel because the intensity of land use is about the same throughout the entire area. The effects that these three levels of protection would have on preproject conditions were evaluated. The effects of the 1.5 year and 5-year are explained in this section; the 3-year is explained in the EFFECTS OF WORKS OF IMPROVEMENT section.

Channel Work Required to Provide the 1.5-Year Level of Protection. This alternative would require work on about 201 miles of channels at a total installation cost of about $2,789,400. The annual cost of this alternative including operation and maintenance would amount to about $216,900. This alternative would offer an estimated 64 percent reduction in damages. The work would require about 2,264,000 cubic yards of excavation.

Land used for channels would change in the following manner:

1. Land within channels would increase by about 8 percent or 90 acres over the present acreage.

2. Land used for berms would increase by about 83 percent or 217 acres.

3. Land used for spoil would decrease by about 61 percent or 450 acres.

Land occupied by spoil will decrease because existing and project created spoil will be spread for channels located in open land and for some located in wooded channel banks.

Type of habitat in which channels are located was categorized according to examples shown in the Wildlife Resources section. Channels located on cropland or pastureland which had no trees or brush on the berms and spoil were categorized as open land channels. Channels located in cropland or pastureland having narrow strips of trees or brush on the berms and spoil were categorized as wooded channel bank. Channels located in forests were categorized as such. Land used for channels, berms, and spoil within these three categories would change in the following manner:

1. Open land acres occupied would decrease by 12 percent or 122 acres.

2. Wooded channel bank acres occupied would decrease by 11 percent or 104 acres.

3. Forest land acres occupied would increase by about 35 percent or 83 acres.

The decrease in wooded channel bank acreage would be a loss in wildlife habitat because the adjacent areas would either be cultivated or grazed and the maintenance program will not permit them to grow back into woody vegetation. The acres of spoil disturbed in forest land would be allowed to grow back into trees by natural plant succession. About 1,550 acres will be cleared within Bayou Bonne Idee and 12 acres of trees and brush would be cleared within other channel beds.

Channel Work Required to Provide the 5-Year Level of Protection. About 202.5 miles of channel work at a total installation cost of about $3,594,700 would be required. Annual cost of this alternative including operation and maintenance would amount to about $264,400. This alternative would offer an estimated 84 percent reduction in damages. The work would require about 3,497,000 cubic yards of excavation.

Land used for channels would change in the following manner:

1. Land within channels would increase by about 15 percent or 176 acres.

2. Land used for berms would increase by about 85 percent or 222 acres.

3. Land used for spoil would decrease by about 58 percent or 430 acres.

Land used for channels and berms will increase because of channel enlargement and leaving wider berms to serve as maintenance access. Land occupied by spoil will decrease because existing and project created spoil will be spread for channels located in open land and for some located in wooded channel banks.

Land used for channels, berms, and spoil within the three categories, open land, wooded channel banks, and forests, would change in the following manner:

1. Open land acres occupied would decrease by 8 percent or 84 acres.

2. Wooded channel bank acres occupied would decrease by about 6 percent or 57 acres.

3. Forest acres occupied would increase by about 46 percent or 109 acres.

The decrease in wooded channel bank acreage would be a loss to wildlife habitat because the adjacent areas would either be cultivated or grazed and the maintenance program will not permit it to grow back into woody vegetation. The acres of spoil disturbed in forest land would be allowed to grow back into trees by natural plant succession.

About 1,550 acres of trees will be cleared within Bayou Bonne Idee and 12 acres of scattered trees and brush would be cleared within channel beds.

Two other alternatives were studied. The construction of levees and floodgates to prevent backwater flooding is an increment which could have been added to supplement the channel work. Routing Channels M-4 and M-7 to outlet into Channel M-2 is an alternative way of achieving the channel work in Evaluation Units I and II.

Construction of Levees and Floodgates to Prevent Backwater Flooding from Boeuf River. Construction of levees and floodgates along the west side of the Boeuf River was investigated as a possible solution to prevent backwater flooding. Peaks on the Boeuf River from a 3-year frequency storm produced stages high enough to back water into the low adjacent areas. The hydrograph for this storm rises and falls rapidly. Backwater flooding produced is of short duration and occurs largely in the noncropping season. The Bayou Bonne Idee Watershed area is small (19 percent) compared to the Boeuf River drainage area and correlation between stages on the Boeuf River and rainfall on the watershed is practically nonexistent. The cost of such a system would exceed the benefits.

Evaluation Unit II was chosen as the test for this alternative. Compared to the other units, it had the largest area subject to backwater flooding and appeared to be the most feasible. Benefits resulting from the installation of these floodgates and levees would amount to about $8,400 annually. Costs of installing the floodgates (levee cost not included) would be about $30,000 annually giving a benefit-cost ratio of 0.3 to 1.

Routing Channels M-4 and M-7 to Outlet into Channel M-2. This alternative would divert runoff from approximately 59,000 acres from entering the Boeuf River at mile posts 168 and 160 and cause it to enter at mile post 154. Approximately 8.3 million cubic yards of excavation would be required. Appurtenant measures and excavation, at a cost of about 5 million dollars, would be required to construct this diversion. The 3-year level of protection as previously defined in the objectives would be provided. About 1,690 acres of right-of-way, which is an additional 540 acres over planned comparable measures, would be required to construct the diversion and associated laterals. Primary agricultural benefits expected from this alternative would amount to approximately $490,000 annually. Annual cost including operation and maintenance would be about $520,000. The benefit-cost ratio would be 0.9 to 1.

Reasons for Selecting Works of Improvement

The following tables furnish data to compare the effects of three different levels of protection on land area occupied by channels before and after project construction.

Level of Protection	Land Used By All Channels			
	Channel	Berm	Spoil	Total
	acres			
Existing	1,162	262	738	2,162
1.5-year	1,252	479	288	2,019
3.0-year	1,299	483	297	2,079
5.0-year	1,338	484	308	2,130

Level of Protection	Land Use by All Channels			
	Open Land	Wooded Channel Banks	Forest Land	Total
	acres			
Existing	989	936	237	2,162
1.5-year	867	832	320	2,019
3.0-year	887	859	333	2,079
5.0-year	905	880	345	2,130

Sediment and turbidity produced during construction by the three levels of protection would not be significantly different. Even though the cross-sectional area changes with a corresponding level of protection provided, it is accomplished by a change in bottom width. This results in a small change in exposed channel perimeter. For example, at one design point the cross-sections necessary to provide the three levels of protection studied would result in wetted perimeters of 30, 32, and 34 feet.

The 3-year level of protection requires 202 miles of channel work, 1 mile more than the 1.5-year level of protection and 0.5 mile less than the 5-year level of protection. It requires about 2,904,000 cubic yards of excavation, 640,000 (22 percent) more than the 1.5-year level of protection and 593,000 (20 percent) less than the 5-year level of protection. Clearing of trees within channels is essentially the same for the three levels of protection.

Wildlife habitat changes and effects on animal populations for the three levels of protection studied and preproject and postproject standing fish crops are shown in the following table.

HABITAT ACRES AND POPULATIONS OF WILDLIFE SPECIES AND EFFECTS FOR THE THREE LEVELS OF PROTECTION

SPECIES	Animal Acre Ratio	Preproject		1.5-Yr. Level of Protection		3-Yr. Level of Protection		5-Yr. Level of Protection	
		Acres	Total Animals	Acres a/	Animals a/	Acres a/	Animals a/	Acres a/	Animals a/
Dove (Migratory)	1:4	124,800	31,200	+312	+89	+288	+72	+264	+64
Quail	1:50	124,800	2,490	+312	+ 6	+288	+ 6	+264	+ 5
Squirrel	b/	13,080	4,310	-540	-260	-554	-265	-569	-270
Deer	c/	13,080	520	-540	-19	-554	-19	-569	-20
Rabbit	1:10	137,880	13,785	-223	-22	-228	-22	-235	-24
Waterfowl (Resident)	1:150	142,505	953	-398	-2	-407	-2	-419	-2
Waterfowl (Migratory)	1:15	142,505	9,495	-398	-27	-407	-27	-419	-28

a/ Indicates change due to project.
b/ One squirrel per 3 acres of forest land.
c/ One squirrel per 5 acres of wooded channel banks.
c/ One deerper 25 acres of forest land.
One deer per 50 acres of wooded channel banks.

ESTIMATED STANDING CROPS OF FISHES

Channels	Preproject		Postproject	
	Pounds Per Acre	Total Pounds	Pounds Per Acre	Total Pounds
Bayou Bonne Idee Proper	120	173,340	155	284,250
All Other b/	75	4,500	75	8,700
Total		177,840		292.950

a/ Three year level of protection.
b/ Channels with ponded water and/or intermittent flows.

The estimated reduction in damages for the 1.5-, 3-, and 5-year level of protection is 64, 78, and 84 percent, respectively.

The alternative of providing a 3-year level of protection by diverting Channels M-4 and M-7 to outlet into Channel M-2 would require about three times more excavation for the installation of those three channels. This and an additional 540 acres of right-of-way make the benefit-cost ratio unfavorable.

Another alternative considered was the construction of levees and floodgates to prevent backwater. The cost of installing these measures also exceeded the benefits.

After due consideration and analysis of alternatives, a system of structural measures as shown on the Project Map, Figure 8, providing a 3-year level of protection was selected. This plan provides the best combination of land treatment measures, structural measures, and recreation facilities needed to obtain the balance between environmental and economic factors necessary to achieve the project objectives. The mean income deficit for rural-farm families below the poverty level was about $1,600 in 1970. Increases in average annual income per farm are expected to be about $1,500, $1,700, and $1,800 for the 1.5-, 3-, and 5-year levels of protection, respectively. The 3-year level of protection will increase income to a point slightly higher than the deficit.

Changes in wildlife populations for any of the three levels of protection are small. However, the 3-year level of protection seems to be the most favorable because it causes proportionately less changes in wildlife populations than the other two alternatives. Fish habitat, aesthetics, health, and water quality will be improved by the project. Wildlife habitat will be affected as illustrated in the preceding table.

FORMULATION

The land treatment measures included in the plan are those necessary to achieve project objectives in reducing the soil loss on cropland. The recreational measures were also selected because they are the most practical means of achieving the objectives.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

The effective soil and water conservation program, planned by the Morehouse Soil and Water Conservation District, is based on proper use of the land and the establishment and maintenance of adequate flood prevention and water management structural measures. To install such a conservation program, 34,250 acres of crop, pasture, forest, and other land will have all the necessary conservation practices, individually or in combination, established on them. The remainder of the acreage will have a complete soil and water conservation program underway. Appropriate land treatment measures to be installed and their functions will include but are not limited to:

Land Treatment Measure	Function
Conservation Cropping System	Using rotations that contain grasses and legumes as well as rotations in which the desired benefits are achieved without the use of such crops.
Crop Residue Use	Using plant residues to protect cultivated fields during critical erosion periods.
Drainage Land Grading (Land Forming)	Reshaping the surface of the land to be drained by grading to planned slopes.
Drainage Main or Lateral	Constructing open drainage ditches to a designed size and grade to remove surface water for maximum plant growth.
Grade Stabilization Structure	Stabilizing the grade or controlling head cutting to reduce sediment in natural or artificial channels.
Pasture and Hayland Management	Proper using or treating of pasture-land and hayland to provide maximum livestock forage and to control erosion.

IMPROVEMENT

Land Treatment Measure	Function
Pasture and Hayland Planting	Establishing and reestablishing long-term stands of adapted species of perennial, biennial, or reseeding forage plants for livestock forage and to control erosion.
Forest Land Management	Proper using and protecting of forest land to provide increased realization of wildlife, recreation, timber, and watershed benefits through multiple use.
Improved Cutting Practices	Harvesting and treating of forest stands to minimize disturbance, encourage growth of a new stand, and improve species composition.
Wildlife Wetland Habitat Management	Retaining, creating, or managing wetland habitat for wildlife to provide maximum food and cover.
Wildlife Upland Habitat Management	Retaining, creating, or managing wildlife habitat other than wetland to provide maximum food and cover.

These are the basic soil and water conservation practices required to obtain an adequate land treatment program in this watershed. However, the structural measures will have to be installed before most of the land treatment measures can be applied.

Adequately treated land is defined as land used within its capability and on which the conservation practices that are essential to its protection and planned improvement have been applied. Providing necessary drainage and maintaining proper ground cover are the most important practices to consider in treating land adequately in this watershed. These measures are necessary in order to remove surface water at such a rate that healthy plant growth will be sustained and erosion kept to a minimum.

With improved drainage, the plants will utilize more of the fertilizer applied, grow larger, and provide better ground cover. Erosion and consequent sediment will be reduced by the application of land treatment measures such as conservation cropping systems and crop residue use. Reductions in sediment will improve the environment since, nationwide, it is recognized as a major pollutant which adversely affects water quality and fish and wildlife habitat by: (1) being a carrier of harmful chemicals if such are present, (2) reducing spawning success if concentrations are high enough and, (3) reducing the production of basic food chain organisms and consequently affecting dependent higher organisms.

The assurance of optimum growth conditions will permit planting of recommended vegetation for ground cover and subsequent production of maximum residues. On-farm mains and laterals and project-type outlets are necessary to provide drainage and flood protection to grow the basic agricultural crops economically.

Most of the cropland and pastureland already have drainage systems, but most of them are not adequate to provide the appropriate environmental features and to allow application of other land treatment practices. These measures will decrease erosion and sediment yield and assure the realization of the benefits used in project justification.

Planning is prerequisite to the application of a successful soil and water conservation program. Technical assistance will be provided to soil and water conservation district cooperators for planning and applying soil and water conservation programs on their farms. These plans will contain the required number and types of conservation measures to provide adequate land treatment. The resulting farm conservation plans will be in accordance with needs for sustained productive land use on individual farms.

Of the total 34,250 acres to be adequately treated during the installation period, 29,000 are cropland, 4,000 are pastureland, 250 are forest, and 1,000 are other. These acres will receive all the conservation practices necessary during the project installation period to be classe as adequately treated. In addition, a conservation plan will have been prepared and land treatment begun on about 61,000 acres of cropland, about 8,000 acres of pastureland and about 3,000 acres of forest land. The conservation measures to be planned and applied on cropland include conservation cropping systems, crop residue use, land grading and smoothing, drainage mains or laterals, grade stabilization structures, or other practices necessary for adequate conservation treatment. Control of headcut and channel bank erosion where concentrations of water enter deeper channels will be accomplished through the installation of side inlets. (See Structures for Water Control - Type 3, Figure 7.) Those areas with drainage areas larger than 30 acres will be included in the project structural measures. The application of these measures on cultivated land will enhance periodic use of high residue-producing and soil-conditioning crops, provide controlled disposal of excess surface water, and increase infiltration in the soil and reduce sheet and gully erosion.

The 4,000 acres of pasture that will be fully treated and the 8,000 acres where treatment will have begun will contribute materially to the establishment of a sound livestock grazing program, facilitate more uniform distribution of grazing, and permit management which will provide effective ground cover for runoff and erosion control. The treatment will include the proper application of the following conservation practices; pasture and hayland planting, pasture and hayland management, drainage mains or laterals, and other practices needed to provide adequate treatment.

Approximately 9,000 acres of multiple-use wildlife habitat on cropland and 1,000 acres on other land will be maintained, created, or improved during the installation of land treatment measures by establishing perennial, biennial, or annual plants for wildlife food or cover, and disking

and installing water control structures on wetlands. Farmers and landowners who want to install measures for wildlife habitat improvement and harvest, install commercial recreation enterprises, and manage fish ponds will be able to obtain technical assistance through the soil and water conservation district. About 35 commercial recreation enterprises will be established. These enterprises pertain mostly to hunting on the 10,000 acres to be treated for wildlife habitat. The fee arrangement will be according to landowners' preference.

The forest land will continue to receive fire protection under the Cooperative Forest Fire Control Program. The land treatment program will consist of improvement cutting practices applied on 250 acres and an accelerated technical assistance effort consisting primarily of multiple-use forest management plan development and application. The landowners will be assisted by planners in bringing about 3,000 acres of forest land under forest management during the installation period. The utilization of proper forest management practices on 250 acres will enhance wildlife habitat. Periodic timber thinnings will open up the canopy stimulating browse and mast production.

Even under intensive management, the hydrologic conditions of the forest soils are expected to improve very little. Although these areas are adequately stocked with fair humus building species and every effort to improve the species composition will be made, the humus build-up will be slow largely due to the inherently poor humus development capability of the heavy forest soils in the watershed.

The water bank program has been introduced in Morehouse Parish. The Morehouse Soil and Water Conservation District and Agricultural Stabilization and Conservation Service County Committee have the responsibility for administering this program. They will continue trying to expand the program and encourage wetland owners to enroll.

The acres to be treated and the estimated costs of the treatment to be applied are shown in table 1. These measures will be installed during a 10-year period. Installation and maintenance of needed land treatment measures will continue after project installation.

By accelerating the present rate of technical assistance, it is expected that during the 10-year installation period, the following accomplishments will be made:

1. Two hundred and thirty-three new cooperative agreements will be signed by landowners or operators who will become soil and water conservation district cooperators.

2. Two hundred and thirty soil and water conservation plans will be developed with land users who are now or will become soil and water conservation district cooperators.

3. One hundred and seventy conservation plans now in use will be updated.

4. Soil surveys will be made on the remaining 105,420 acres which have not yet been surveyed.

5. Completed land treatment measure programs will be installed on 34,250 acres and treatment begun an additional 72,000 acres.

Structural Measures

Measures in this plan are comprehensive in nature and encompass the multiple-use concept of resource planning. The primary benefits that will accrue as a result of project installation will be from flood reduction and drainage and recreation. Prevention of damages to fish and wildlife and subsequent mitigation measures are also major project objectives. For purposes of discussion, the measures were grouped into three categories - channel work, recreational development, and mitigation measures.

Channel Work consists of the clearing in Bayou Bonne Idee proper and installation of all other channel work including appurtenances. About 187 miles of the 233 miles of existing channels will require work. Of this 187 miles, about 59 miles will be cleared of brush and debris with little or no soil disturbance and 128 miles will be excavated. An additional 15 miles of new channels will also be excavated giving a total of 202 miles of channel work. The 31 miles of channels which do not require work will require maintenance.

Of the 202 miles of channel work, about 126 miles (63 percent) have ephemeral flow, 45 miles (22 percent) have ponded water, and 31 miles (15 percent) have intermittent flow. After project installation, 126 miles (63 percent) will have ephemeral flow, 55 miles (27 percent) will have ponded water, and 21 miles (10 percent) will have intermittent flow. The 10-mile change from intermittent flow to ponded water will result from the construction of Water Control Structures No. 1 and No. 4 on Bayou Bonne Idee proper.

Of the 202 miles of channel work, about 21 miles are classified as unmodified, well-defined, natural channels, 166 miles are manmade or previously modified channels, and 15 are non-existing or practically no-defined channels. All of these will be modified by the project. Of the 21 miles of natural channel, about 10 miles in Bayou Bonne Idee will be changed from intermittent flow with a wooded channel bed to ponded with a cleared channel bed. Another 2-mile section of natural channel in the bayou will be cleared and remain intermittent. The remaining 9 miles of natural channels have ephemeral flows. These will be excavated.

Of the 166 miles of channels which are manmade or previously modified, about 19 have intermittent flow, 102 miles have ephemeral flow, and 45 miles have ponded water. The project will not change the type of flows presently existing in these channels. Of the 19 miles with intermittent flow, about 1 mile will be cleared and 18 will be excavated. Of the 102 miles which have ephemeral flows, about 1 mile will be cleared and 101 miles will be excavated. The 45 miles of existing ponded water will be cleared ranging from 60 to 80 percent.

Bayou Bonne Idee (Channel M-1): Approximately 57 miles of this stream will be selectively cleared for flood prevention, drainage, and recreation. Clearing will be accomplished in such a manner that the refuse will be pressed into the soil in the bayou bottom. Large, aesthetically desirable trees will be left in the channel. Due to previous alterations, only 12 of these 57 miles can be considered in a natural condition, and these have intermittent flows. About 12 miles of the main channel in Bayou Bonne Idee will be cleared leaving only trees and low shrubs along the bank. The remaining 45 miles will require clearing ranging from 60 to 80 percent to provide open water areas.

At present there are two type 1 water control structures (No. 2 and No. 3) in the bayou. These two structures created approximately 45 miles (1,400 acres) of water within the bayou's total 64 miles length (see figure 6). Before the two existing structures were installed, the bayou was an intermittent stream with sections having only ephemeral flows.

After Water Control Structures No. 1 and No. 4 are installed, the bayou will have 55 miles (1,900 acres) of permanent water. Structures No. 1 and No. 4 will change 370 acres and 130 acres, respectively, of intermittent water to permanent water. An additional 260 acres of existing permanent water presently above Water Control Structure No. 3 will be increased in depth by 2 feet by Water Control Structure No. 4. Water control structure locations are shown in figure 8. Maximum depths of Pools 1, 2, 3, and 4 will be 13 feet 13 feet, 10 feet, and 6 feet, respectively; and average depths will be 6.6 feet, 7.2 feet, 5.3 feet, and 3.1 feet, respectively. A profile of Bayou Bonne Idee and corresponding pool levels is shown in figure 6.

Of the 370 acres (9.6 miles) of permanent water created above Water Control Structure No. 1, all the vegetation will be cleared up to the permanent water line on 323 acres. The other 47 acres immediately below Water Control Structure No. 2 will be left undisturbed.

Of the 670 acres behind Water Control Structure No. 2, 530 will be cleared. Clearing will be done in the middle of the bayou in the deeper water. About 140 acres of vegetation, predominately buttonbush and cypress located in shallow water along the banks, will be left undisturbed.

After Water Control Structure No. 4 is built, Water Control Structure No. 3 will control about 15 miles or 470 acres of permanent water. About 370 acres of vegetation in the middle of the bayou will be cleared, and about 100 acres of vegetation within the channel along the edges will be left undisturbed.

Of the 390 acres of land under permanent water above Water Control Structure No. 4, about 280 acres will be cleared of vegetation and 110 acres will be left undisturbed preserving the vegetation within the channel along the edges.

Figure 1 shows a typical profile and cross section of a channel. Excavation of Channels L-1A, L-1C, L-7I, and L-7I1A will be terminated before they reach wetlands. Channel excavation on L-1E and 1-1F will be terminated as they reach wetlands. Although little interest was shown during project formulation, these preserved wetlands provide opportunities for the establishment of commercial hunting enterprises. Maintaining these wetlands will also preserve water quality by allowing flow to filter through the natural undisturbed areas.

Water control structures-type 3 (figure 7) will be installed to prevent erosion and thus protect the channel from excessive sedimentation, reduce maintenance cost, and insure proper functioning of the channels. These structures are similar to grade stabilization structures except that they are on a smaller scale, less complex, and are located on laterals entering project channels. They are considered appurtenant measures and will be installed on channels with a drainage area greater than 30 acres. A sample survey of channels showed that an average of one such structure will be needed on each 1.7 miles of project channels to be improved. Erosion problems caused by small drainage areas of less than 30 acres will be remedied through the land treatment program.

Grade stabilization structures (figure 4) are considered integral parts of project channels and will be installed as needed. They will protect the channels and main outlets from excessive sedimentation, thereby reducing downstream turbidities and maintenance. Preliminary studies indicate that five grade stabilization structures are needed. The exact location of the structures will be determined during the operations stage when additional survey data and foundation investigations are obtained.

Approximately 2,083 acres of rights-of-way will be disturbed because of other channel work. This 2,083 acres includes 1,020 acres of open land, 815 acres of wooded channel bank, and 248 acres of forest land. Two miles of channels require only clearing as a project measure. This clearing will be accomplished within the channel and on the berms as required for maintenance access. The refuse and debris will be stacked along side of this berm. Clearing of brush and trees on 128 miles of channels requiring excavation will be necessary to allow for channel enlargement, berms, and spoil placement. Excavation in most cases will be accomplished from one side of the channel. Consequently, disturbance of habitat along the channels will be minimized.

Ditch side slopes, berms, and spoil will be seeded to grasses. The planted cover will provide food, cover, and protection of wildlife and also prevent erosion, thus reducing sedimentation turbidity in channel waters. The spoil will be allowed to revegetate to forbs, shrubs, and hardwoods by natural plant succession. These areas, in various stages of plant succession, are beneficial to wildlife such as deer, quail, and rabbits by providing food and cover.

Several alternatives for establishing vegetative cover on the disturbed areas were evaluated by the Louisiana Wild Life and Fisheries Commission, U.S. Fish and Wildlife Service and Soil Conservation Service. Due consideration was given toward providing the most expedient method of reestablishing vegetation to prevent erosion and provide food and cover for wildlife. The most practical approach would be to establish a ground cover and allow natural plant succession to occur.

All channel slopes which are treatable will be limed and seeded the same day of construction (see figure 1 for limits of revegetation). Berms will be limed and seeded immediately after heavy or plant destroying equipment has ceased traveling on the berm. Spoil on open land in most cases will be spread. Depending on the season of the year and the crops being grown, spreading of the spoil may or may not be accomplished soon after construction. If the spoil is not to be spread, it will be shaped, limed, and seeded. The spoil from Channel M-11 will be placed in a continuous row on the south side of the channel, shaped, and seeded. It will serve as a barrier which will reduce and retard spillover of floodwater from large storms into Evaluation Unit III. Spoil in forest land will be stacked, shaped, limed, and seeded. Depending upon soil type and season of the year, species such as the following can be used: common Bermudagrass, Pensacola bahiagrass, browntop millet, ryegrass, and fescue. When spoil is spread on pasture, the same type vegetation as presently exists will be planted if the owner so desires.

Alterations, modifications or reconstruction of some existing facilities will be necessary to insure proper functioning of planned structural measures. These include, but are not limited to, replacing or changing 9 bridges and 3 culverts on State and Federal highways, 50 bridges and 20 culverts on parish and private roads, pipelines at 8 locations, and utility lines and fences at about 35 locations.

The required capacity which will be used for culverts is 125 percent of the design channel flow with a head loss of approximately 0.2 foot. Bridges will be required to allow passage of the flow from the channel cross-section and still have the appropriate freeboard allowance.

All bridge and culvert changes will be coordinated with the responsible agencies at the construction design stage. This will insure compliance with their standards and specifications. Structural measure installations are expected to be completed in a 6-year period.

Recreation Development consists of installing two new water control structures-type 1 (figure 2), modification of two existing ones, three access points (boat launches), and a recreational facility (figure 3). The Type 1 Water Control Structures will allow the passage of the 100-year frequency stormflow and will be equipped with drawdown structures with stoplog inlets (figure 2) capable of drawdown from the top of the stream, providing for aquatic vegetative control and fish management.

Water Control Structure No. 1 - This structure will be located about one-half mile above the mouth of Bayou Bonne Idee. It will cause water to be stored in the bayou as far upstream as Water Control Structure No. 2. This water will serve the purpose of recreation and fish and wildlife. A drawdown facility for the purpose of fishery management will be installed to allow the water to be lowered at the rate of about 4 inches per day.

Water Control Structure No. 2 - In 1957, a low level water control structure known locally as the "Barham Weir" (see Project Map) was constructed. This structure will be modified by the installation of a drawdown facility to permit water level control for fishery management. Its drawdown capability will be the same as Water Control Structure No. 1.

Water Control Structure No. 3 - In 1959, another low level water control structure was installed approximately 1 1/2 miles south of Louisiana Highway No. 2 (see Project Map). This structure is known locally as "The Goatwalk." It impounds water up to approximately 1 mile south of Bonita. This structure will also be modified by the installation of a drawdown facility to permit water level control for fishery management. Its drawdown capability will be the same as Water Control Structure No. 1.

Recreational Facilities - Three access points (boat launching areas) will be installed at an approximate midpoint of the pools formed by Water Control Structures No. 1, No. 2, and No. 4 (see Project Map). A parking area, trash receptacles, a boat launching ramp and dock, and a pit toilet will be provided at each of these three areas.

The main recreational facility (figure 3) will be located on a 110 acre peninsula formed by Bayou Bonne Idee approximately 1 1/2 miles south of Louisiana Highway No. 2 near Water Control Structure No. 3 (see Project Map). Approximately half of the area is wooded and will be left in the natural state as nearly as possible commensurate with priority usage. Activities will include picnicking, camping, fishing, boating, bicycling, and nature study. Facilities will include access roads, parking areas, a boat launching ramp, boat docks for the safe loading and unloading of passengers, a supply of freshwater, sanitary facilities, nature and bicycle trail, picnicking and camping sites, maintenance headquarters and shelters. Sanitary facilities include flush toilets and septic tanks. The soils in these areas are loamy and will support septic tank systems.

The septic tanks and disposal fields will be constructed in accordance with the Louisiana Health Department's requirements and the U.S. Department of Health, Education, and Welfare recommendations as outlined in its Manual of Septic Tank Practice. They will be located in the center of the area, the furthest distance from the banks of the bayou, and at the highest elevation. Water wells will be located away from the septic tanks and disposal fields and will not be closer than the minimum required distance recommended by the Department of Health, Education, and Welfare in its publication, Environmental Health Practice in Recreational Areas.

The recreational facilities will provide 75 percent of the needs for an area within a 10-mile radius of the main facility. The population within this area is about three times greater than in the watershed.

Mitigation Measures consist of Water Control Structure No. 4-Type 1, water control structures-type 2, wildlife areas, and wood duck nesting boxes.

Water Control Structure No. 4 - This type 1 structure will be located in Bayou Bonne Idee south of Cherry Hill Church No. 2. It will back shallow water to Highway 599 in Bonita. This additional water created will consist of 130 acres of new permanent water and an increase in depth by 2 feet of an additional 260 acres. The possibility of accomplishing the same effect by increasing the height of Structure No. 3 was investigated. This was not feasible since it would adversely affect land drainage above Structure No. 3. Construction of a new structure was the best alternative for this purpose.

The purpose of this structure is to mitigate loss of fishery and wildlife habitat caused by work on channels. A facility capable of water drawdown from the top of the pool will be installed for fishery management.

These mitigation features will provide more assurance of preserving the wetlands through project development since they are an integral part of the plan. They are not subject to change due to private ownership as is the case with the remaining wetlands.

Water Control Structure-Type 2 - About 16 of these structures (figure 5) will be installed in the major channels as appurtenances. They will create 38 miles (115 acres) of ponded water in channels. The water held by these structures will mitigate fish damages and will also lower maintenance cost. This will be accomplished by:

1. Improving water quality by trapping sediment and the resulting chemicals which it transports.

2. Preventing vegetation from growing in the channel, thus reducing the need for chemical vegetative control.

3. Side slopes being more stable will cause less channel maintenance.

4. Providing a dependable source of drinking water for wildlife.

Wildlife Areas - The Morehouse Parish School Board administers approximately 1,430 acres of forest land in the watershed. This forest land is located in three tracts, two of 640 acres each and one of 150 acres (see Public Use Areas, Project Map, Figure 8). In certain locations on the two 640-acre sections, fairly dense stands

of smaller diameter hardwoods exist.

Some of these dense stands will be cleared at random spacings to create 16 small openings approximately 1 acre in size each. These cleared areas will be maintained as natural openings consisting of native vegetation. Openings of this type in forest land create an "edge effect" which is beneficial to nearly all wildlife species. To keep them in the weed and brush stage of plant succession, they will be disked or bushhogged about every 3 years. The increased carrying capacity occasioned by these wildlife openings will help mitigate the browsing areas which will be lost by channel improvement for flood prevention and drainage.

Wood Duck Nesting Boxes - The clearing in Bayou Bonne Idee will remove some trees with cavities which can be used by wood ducks for nesting. Approximately 310 boxes will be installed along the 31 miles of the bayou that have adequate brood cover. A Soil Conservation Service biologist will evaluate the use of these boxes. If this evaluation reveals that this number is insufficient, more will be added.

Construction sites for channel work will consist of narrow strips along the channels. These channel locations are sparsely located throughout the watershed area thereby dispersing construction activity away from any one concentrated area. This condition will keep noise and air pollution down to a minimum. Water pollution from erosion at the construction site will be minimized by the planned revegetation measures.

The disposing of all clearing waste and construction debris will be accomplished by burning, burying, or removal from the construction site. Specifically, material cleared from the designated areas will be disposed by one of the following methods:

a. By piling and burning to a state of loose ashes. Debris which cannot be burned shall be buried as directed by the construction supervisor.

b. By burying. When cleared material is permitted to be buried, it will be buried with the tip of the debris approximately 2 feet below normal ground level and shall be covered by at least 2 feet of earth. Cleared material shall not be covered by spoil banks.

c. By piling behind spoil banks when written permission is obtained from the landowner.

The clearing in the main channel of Bayou Bonne Idee will be accomplished by draining the existing water areas and using a "tree crusher" to push the tree down and bury the debris. This can be accomplished with little or no burning and be least damaging to the natural vegetation on the channel side slopes. Burying will also prevent the smoke pollution that burning would cause. The burning

operation, if necessary shall be conducted in accordance with the Louisiana Air Control Commission regulations and other applicable laws governing such operations. Noise levels will be monitored, and standards set by the Occupational Safety and Health Act will be followed.

A letter from the Curator of Anthropology, at Louisiana State University, dated October 8, 1971, indicates that two archaeological sites are in close proximity to project channels, but to the best knowledge presently available, these will not be disturbed. No other known site of historical or archaeological importance is endangered. The known sites will be kept under close observation during construction.

Additionally, the Soil Conservation Service and Northeast Louisiana University have entered into a cooperative agreement whereby the University will furnish qualified archaeologists who will make the survey of archaeological resources within the area committed to project installation. Should the report indicate adverse effects to resources with archaeological or historical importance, they will be salvaged or project measures will be relocated or modified prior to installation to insure their preservation.

Nonstructural Project Measures

The Morehouse Parish School Board desires to make the 1,430 acres of forest land which it administers available for the enjoyment of the citizens of the parish and surrounding areas. These forested tracts have a high value as wildlife habitat because of the scarcity of hardwoods in the watershed and because timber is old enough to produce mast. Hunting, hiking, tent camping, and bird watching will be the primary forms of recreation afforded by these areas (see Project Map, Figure 8, Public Use Areas).

EXPLANATION OF INSTALLATION COSTS

The total installation cost of the project is estimated to be $7,182,150, of which $3,264,205 will be borne by Public Law 566 funds and $3,917,945 by other funds (see table 1). Included in the total project cost is $2,627,800 for land treatment measures and $4,554,350 for structural measures.

Land Treatment Measures

Installation costs for needed land treatment measures are to be borne by individual landowners and operators. The cost of installing these measures is estimated to be $2,063,200. This includes $91,700 for land treatment measures for the multiple-use of cropland and other land as wildlife habitat. The installation of these practices will insure the timely realization of project benefits and will provide for proper treatment of the land for protection and improvement. This plan provides for installation of these measures within a 10-year project installation period.

Technical assistance to continue and accelerate the going program of installing land treatment measures is estimated to be $564,600 during the 10-year installation period. Of this amount, $396,900 will be provided by Public Law 566 for acceleration of the going program. The remaining $167,700 will be furnished by other funds including a going program input of $166,400 and accelerated assistance input of $1,300. The $166,400 of going program consists of $159,000 provided through the soil and water conservation district program, $2,400 provided through the Cooperative Forest Management Program, and $5,000 provided through the Cooperative Fire Control Program. The $1,300 of accelerated funds to be provided from other than Public Law 566 funds will come from the Louisiana Forestry Commission for supervision of practice installation.

Structural Measures

Channel Work - The total cost of channel work is $2,867,270. Of this total, $2,101,650 is for construction, $147,320 is for engineering services, and $618,300 is for land rights.

Bayou Bonne Idee Proper - The clearing will equally serve flood prevention, drainage, and recreation. The total cost, $720,600, of clearing was allocated equally to the three purposes. Of this total, $540,000 is for construction, $38,000 is for engineering services, and $142,600 is for land rights.

All Other Channel Work - The cost of this work, which includes excavation, clearing, appurtenant grade stabilization structures, water control structures-type 3, and vegetative plantings is shown as a single line

item in tables 1 and 2A. Grade stabilization structures, water control structures-type 3, and vegetative plantings will protect the channel from excessive erosion, reduce sediment, protect the adjacent land, and facilitate maintenance; therefore, they are considered appurtenances to the channel work.

The total installation cost of all other channel work is $2,146,670 of which $1,561,650 is for construction, $109,320 is for engineering services, and $475,700 is for land rights.

The estimated cost of excavation and clearing is $1,805,919 of which $1,243,211 is for construction, $87,008 is for engineering services, and $475,700 is for land rights. The land rights cost consists of $119,550 for the value of land, surveys and legal fees; $42,100 for modification or replacement of 9 State and Federal bridges, $152,900 for 50 parish and private bridges, $9,900 for 3 State culverts, $25,250 for 20 parish and private culverts; $126,000 for alterations, modification, or reconstruction of existing miscellaneous facilities such as pipelines, utilities, etc.

Preliminary studies indicate that five grade stabilization structures will be needed. The estimated cost of installing these structures is $49,110 of which $45,880 is for construction and $3,230 is for engineering services.

The estimated cost of installing the appurtenant water control structures-type 3 is $47,520 for construction and $3,327 for engineering services.

The estimated cost of establishing the vegetative plantings is $225,039 for establishment and $15,755 for technical services.

No additional land rights are considered necessary for the installation of water control structures-type 3, grade stabilization structures, and vegetative plantings. They will be installed in the channel rights-of-way.

The grade stabilization structures and the excavation and clearing together with the water control structures-type 2 and type 3 and vegetative measures are all multiple-purpose measures serving both flood prevention and drainage. The cost of these channels was allocated between these two purposes in accordance with standard procedures. This results in 50 percent of the cost being allocated to flood prevention and a like amount to drainage.

Recreation Development - The total cost of the recreation development which includes Water Control Structures No. 1, No. 2, and No. 3 and the recreational facilities is $787,900. This includes $682,500 for construction, $45,900 for engineering, and $59,500 for land rights.

Water Control Structure No. 1 (Type 1) will cost about $301,900 of which $273,600 is for construction, $19,200 is for engineering services, and $9,100 is for land rights.

Water Control Structure No. 2 (Type 1) will cost about $61,950 of which $57,600 is for construction, $4,000 is for engineering services, and $350 is for land rights. This is for modification of the existing structure.

Water Control Structure No. 3 (Type 1) will cost about $52,150 of which $48,400 is for construction, $3,400 is for engineering services, and $350 is for land rights. This is for modification of the existing structure.

Recreational Facilities consist of the main recreational facility and three boat launching areas. The total cost of installing these is $371,900 of which $302,900 is for construction, $19,300 is for engineering services, and $49,700 is for land rights.

The total cost of installing the "main facility" is $328,900 of which $263,900 is for construction, $16,600 is for engineering services, and $48,400 is for land rights. About $27,000 of the construction cost is for the maintenance workshop and equipment which is not cost sharable. Land rights cost consists of $44,000 for the value of land, and $4,400 for surveys and legal fees.

The cost of installing each of the three "boat ramps" will be about equal. Total cost of these three boat launching areas is $43,000 of which $39,000 is for construction costs, $2,700 for engineering services, and $1,300 for land rights. The land rights cost is for the value of land, surveys, and legal fees.

Mitigation Measures - These measures will be installed to mitigate damages to fish and wildlife caused by channel work. The total cost of installing these measures is $268,380 of which $249,050 is for construction, $17,730 for engineering, and $1,600 is for land rights. These costs were allocated in the same manner as the cost of channel work.

Water Control Structure No. 4 (Type 1) - The cost of installing this measure is $109,900. It consists of $102,000 for construction, $7,200 for engineering services, and $700 for land rights.

Water Control Structures - Type 2 - An estimated cost of $151,880 of which $141,950 is for construction and $9,930 is for engineering services will be required for the installation of these structures. No additional land rights cost is necessary since they will be constructed in the channel rights-of-way.

Wildlife Areas - This land, administered by the Morehouse Parish School Board, is located in three different tracts--two consist of 640 acres each and another consists of 150 acres. The measures planned for these areas is to create 16 wildlife openings on Areas 1 and 2. These openings will enhance carrying capacity and will replace some of the habitat damaged or destroyed by the channel work. Total cost of installing these openings is $3,100 of which $2,000 is for construction, $200 is for engineering services, and $900 is for land rights. Land rights cost was assessed only on the 16 wildlife openings since no loss of income or value is involved on the remaining acreage.

EXPLANATION

Wood Duck Nesting Boxes: The total cost of installing these boxes is $3,500 of which $3,100 is for construction materials and $400 is for technical assistance. No additional land rights will be needed since these will be installed in the right-of-way obtained for Bayou Bonne Idee channel.

The cost of all engineering services includes the direct costs of work to be done by engineers and technicians in relation to structural measures. The work consists of surveys, investigations, designs, and preparation of plans and specifications including vegetative requirements. The cost of these services will be paid by Public Law 566 funds except for $9,650 or 50 percent of engineering services for the recreational developments that is the responsibility of the Sponsors.

No relocation payments are considered to be required at this time. If they are subsequently required, they will be funded in accordance with paragraph 2 of the Watershed Work Plan Agreement.

The Service and the Sponsoring Local Organization will be responsible for the cost of items of project administration that each incurs. These costs (estimated to be $630,800) are the administrative costs associated with the installation of structural measures. The Sponsors will bear costs for administration of contracts ($30,045) and for such inspections ($3,125) they believe necessary to insure themselves the work is being done in their interest. The Service will bear the costs of inspections ($300,425) that are necessary to protect the interest of the Federal Government and will prepare certificates of completion. It will also bear the cost of Government representatives and other project administration services it incurs ($297,205). A project agreement will be entered into between the Service and the affected Sponsors before any work is begun.

The costs of measures were estimated using current prices of work of comparable size and complexity and adjusted to local conditions. This was further modified by adding a contingency of about 20 percent to provide a reasonable margin to cover unexpected costs.

A Schedule of Obligations for the 10-year installation period, including both land treatment and structural measures, is exhibited on page 61.

Nonstructural Project Measures

The Morehouse Parish School Board will make the 1,430 acres of forest land available for recreation at no cost. This is reasonable since no loss in value or income is involved.

EXPLANATION

BAYOU BONNE IDEE WATERSHED
SCHEDULE OF OBLIGATIONS
(Dollars) 1/

Year	Measures	PL-566 Funds	Other Funds	Total Funds
1st	Construction	360,000	180,000	540,000
	Engineering Services	74,950	1,350	76,300
	Land Rights	600	326,600	327,200
	Project Administration	12,850	1,150	14,000
	Land Treatment	-	234,000	234,000
	Soil Surveys	12,400	1,000	13,400
	Technical Assistance	44,200	17,300	61,500
2nd	Construction	399,525	146,175	545,700
	Engineering Services	67,500	8,300	75,800
	Land Rights	22,000	183,600	205,600
	Project Administration	119,680	6,720	126,400
	Land Treatment	-	212,800	212,800
	Soil Surveys	12,400	1,000	13,400
	Technical Assistance	37,500	17,300	54,800
3rd	Construction	749,875	359,125	1,109,000
	Engineering Services	25,900	-	25,900
	Land Rights	-	9,300	9,300
	Project Administration	204,175	10,425	214,600
	Land Treatment	-	211,900	211,900
	Soil Surveys	12,400	1,000	13,400
	Technical Assistance	37,000	17,200	54,200
4th	Construction	187,325	185,775	373,100
	Engineering Services	32,950	-	32,950
	Land Rights	-	137,300	137,300
	Project Administration	142,150	8,150	150,300
	Land Treatment	-	250,700	250,700
	Soil Surveys	12,400	1,000	13,400
	Technical Assistance	46,500	17,200	63,700
5th	Construction	349,050	116,350	465,400
	Project Administration	87,800	4,400	92,200
	Land Treatment	-	254,500	254,500
	Technical Assistance	47,200	17,200	64,400
6th	Project Administration	30,975	2,325	33,300
	Land Treatment	-	205,200	205,200
	Technical Assistance	32,500	15,500	48,000
7th	Land Treatment	-	200,100	200,100
	Technical Assistance	31,400	15,500	46,900
8th	Land Treatment	-	192,800	192,800
	Technical Assistance	31,400	15,500	46,900
9th	Land Treatment	-	151,700	151,700
	Technical Assistance	20,200	15,500	35,700
10th	Land Treatment	-	149,500	149,500
	Technical Assistance	19,400	15,500	34,900
	Total	3,264,205	3,917,945	7,182,150

1/ Price base 1973

August 1973

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention and Drainage

The Boeuf River outlet has been improved by the Corps of Engineers. The improvement of upstream waterways in the watershed will increase the discharge rate but not the runoff volume into the Boeuf River. The drainage areas of the channels to be improved constitute a small portion of the total drainage area of the outlet. Present and with project hydrographs for downstream areas have been studied, and induced downstream changes are insignificant. The increases in stage are so small that it is difficult to illustrate them graphically. For example, a historical event of 5.2 inches of rainfall was routed from Channel M-11 downstream. The effect produced by improving Channel M-11 is an increase of 0.3 percent in the peak discharge and a stage increase of less than 0.1 foot on Boeuf River. The next major area downstream is Channel M-7. The effect of the Channel M-11 improvement at this point is practically non-existent due to attentuation by the Boeuf River. A larger event of 8.2 inches of rainfall produced an increase of 2.7 percent in peak discharge on the Boeuf River and a stage increase of less than 0.2 foot. Attenuation by the Boeuf River reduced this increase by more than one-third as it moved downstream to Channel M-7. Downstream from this watershed, the drainage area of the Boeuf River becomes indeterminate. At this point, any changes in discharge or stage are so small that they cannot be measured. The effect of the other channels which have much smaller drainage areas is negligible. Bayou Bonne Idee has a large drainage area, but the time at which it peaks is delayed such that it does not coincide with the Boeuf River peak.

The project will provide protection to agricultural land from the storm which is expected to occur on an average frequency of once every 3 years. This does not mean that the runoff from this storm will be contained wholly within banks. Rather, it means that the runoff from the storm will be back within banks 24 hours after the storm ceases. Runoff from storms of greater magnitude will inundate land for periods longer than 24 hours. However, the period of inundation will be shorter than it would be under present conditions, thereby reducing the probability of crop loss. Spillover flooding from Channel M-11 into Evaluation Unit III will be reduced due to spoil placement on Channel M-11. The reduction in time of flooding on roads will reduce the amount of materials, equipment, and labor required for their maintenance.

The installation of the combined program of land treatment and structural measures will directly benefit about 94,600 acres of crop and pasture. The remaining 29,540 acres of crops and pasture are located on the loamy soils of the natural levee of Bayou Bonne Idee. These soils are better drained and not in need of project type action. Also included are the clay soils which are adequately drained according to Soil Conservation Service criteria or which could not be drained by project action because of ownership restrictions. Although benefits were not calculated on these areas, they will benefit from the accelerated installation of land treatment measures and by rotational systems allowable because of flood prevention and drainage provided the other lands by the project.

EFFECTS

The project will accelerate the establishment of conservation practices and increase the effectiveness of applied ones. These practices will protect the agricultural resources of the area and improve the environment. Landowners and operators will construct and maintain adequate on-farm and group drainage facilities with the assurance that the desired benefits will accrue.

Approximately 1,500 people including farmers, their families, and their employees will benefit from the installation of project measures. Other persons dependent on farm trade will also benefit.

Land use in the whole watershed from without project to with project conditions is expected to be as follows:

	FUTURE WITHOUT		FUTURE WITH	
LAND USE	Acres	Percent	Acres	Percent
Cropland	108,000	69	108,140	69
Grassland	16,000	10	16,000	10
Forest Land	16,400	10	16,234	10
Other[a/]	17,100	11	17,126	11
Total	157,500	100	157,500	100

a/ Includes roads, channels, bayous, lakes, communities, farmsteads, right-of-ways, etc.

The preceding table reflects only permanent land use changes from one category to another. For instance, 1,550 acres of trees and brush within the channel of Bayou Bonne Idee will be cleared. This is not shown in the table because the bayou is in the "Other" land category before construction and will still be in it after construction. Some temporary disturbances will occur during construction. About 100 acres in small 1- to 2-acre plots will be needed for parking and servicing the construction equipment. These will be located in open land so that wildlife habitat will not be damaged. An additional 40 acres, most of which will be located in open land, will be required for trash or residue disposal caused by construction. About 30 acres will be disturbed during the construction of the water control structures on the bayou. These changes, except for the clearing in the bayou, are temporary. After construction (within 1 year) the land will revert back to its previous use.

The 110 acres required for the main recreation facility will be a permanent change in which 70 acres of cropland and 40 acres of forest land will change to the "Other" land category. The 40 acres of forest land will be selectively cleared of brush and small trees as necessary for installation of roads, camping spurs, and nature trails. Larger, more valuable trees will be left undisturbed. About 3 acres of land will be needed for the three boat launching areas. This is not a land use change since this land is already in the "Other" category.

EFFECTS

About 2,083 acres of land will be disturbed for the installation of all Other Channel Work. About 295 acres of cropland, 193 acres of wooded channel bank and 95 acres of forest land not presently occupied by channels, berms, and spoil will be disturbed during construction. Of this 2,083 acres, 1,500 acres are already in existing channel rights-of-way. Of this 1,500 acres, 558 acres are occupied by existing spoil which will be spread along with the new spoil from construction. This means that spoil will occupy less land with the project than without the project. After the spreading of spoil in open land is accomplished, remaining spoil in the forest land and channels and berms will occupy 1,417 acres, 83 acres less than was originally taken up in channel miscellaneous.

Cotton, soybeans, rice, grain sorghum, and other minor crops make up 15, 68, 9, 3, and 5 percent respectively of the cropland. Floodwater and drainage effects are discussed together because the problems are inseparable. Channels which remove floodwater also remove drainage water. The gross value of crop and pasture lost due to inseparable flood prevention and drainage is estimated to be $1,645,000 annually. Although all crops will be affected, soybeans will be used as an example to illustrate the extent.

A research report entitled The Effects of Production Practices on Soybean Yields, Costs and Returns in the Mississippi River Delta of Louisiana was published by the Department of Agricultural Economics and Agribusiness of Louisiana State University. One of the key points made in this report is that there seemed to be a direct relationship between planting dates and soil type, surface and subsurface drainage, and land forming (drainage land grading), and yield per acre. Low yield producers, with less favorable soil types, drainage, and land forming practices planted a greater percentage of soybeans at a later date than high yield producers, probably to a great extent, out of necessity. The following tabulation is a summary of production practices considered in the study.

A Percentage Comparison of Production Practices for Soybeans by Yield Groups, Mississippi River Delta Area, Louisiana, 1970

Item	Unit	Yield Group		
		Low	Medium	High
Average number of acres planted	acres	597.4	815.4	636.6
Heavy soil type	percent	78.1	70.2	50.5
Very good surface drainage	percent	6.7	9.6	25.7
Very good subsurface drainage	percent	00.0	4.8	3.7
Land forming practices	percent	7.6	15.4	29.3
Liming	percent	12.4	34.6	22.9
Fall plowing	percent	72.4	73.1	91.8

(continued)

(continued) - A Percentage Comparison of Production Practices for Soybeans by Yield Groups, Mississippi River Delta Area, Louisiana, 1970.

Item	Unit	Yield Group		
		Low	Medium	High
Deep Tillage	percent	48.6	55.8	64.2
Planting on a bed	percent	38.1	51.0	50.5
Planting on 40-inch rows	percent	50.5	37.5	57.8
Completed planting by May 21	percent	59.4	86.5	85.3
Double-disc opener planter	percent	51.4	38.5	46.8
Sword-type planter	percent	48.6	61.5	53.2
Use of preemergence herbicides	percent	74.3	81.7	80.7
Four cultivations	percent	27.6	41.3	31.2
Use of postemergence herbicides	percent	40.0	43.3	41.3
Hand hoeing	percent	32.4	50.0	57.8
Flame cultivation	percent	3.8	7.7	4.6
Use of lay-by herbicides	percent	10.5	13.5	5.5
Complete weed control program	percent	9.5	17.3	21.1
Fields free of weeds	percent	25.7	37.5	59.6
Use of insecticides	percent	33.3	39.4	22.0
Average or better weather conditions	percent	10.5	37.2	53.2

Several important implications from the Summary of Study are as follows:

1. that the number of acres of soybeans produced was not a factor limiting the yield of soybeans for any one group;

2. that low yield producers can increase average yields and returns through increased crop rotation programs, whenever possible, primarily by helping control weed infestation;

3. that low yield producers can increase yields and returns through more intensive drainage and land forming practices;

4. that low yield producers with careful variety selection based on soil type, date of planting, maturity dates and specific soil physical characteristics can increase yields and incomes;

5. that low yield producers can generally increase yields by planting approximately one bushel of certified, high quality seed per acre before May 31 and that early maturing varieties (Hill, Dare, and Hood) suffer more from later planting dates than medium and late maturing varieties (Davis, Bragg, Lee and Lee 68);

6. that low yield producers can increase yields and returns by a more complete weed control program (both chemical and conventional) where weed and grass infestation is a problem; and

7. that low yield producers can lower costs of production for soybeans by the use of six-row equipment over four-row equipment with at least 600 - 800 acres and with careful consideration of the age of present four-row equipment, timeliness of operations, labor availability, etc., before changing to six-row equipment.

The project will have a definite bearing on implementation of these necessary changes. The installation of structural and land treatment measures will provide flood protection and improve drainage. This will decrease soil wetness, improve field conditions, and allow better timing and more time to perform needed practices. This means that land treatment practices can be applied at a faster rate. The decreased wetness will make herbicides more effective and allow more cultivations which will decrease weed infestations. Farmers will be more apt to leave more crop residues on the ground, do less fall plowing, and rotate other crops in the problem areas because of decreased wetness. This will conserve soil fertility, reduce erosion, improve wildlife habitat, and also help control weeds. Planting will be accomplished at more opportune dates. The more level, better drained fields will allow for utilization of larger, labor saving, and cost reducing equipment.

In general, the project will break the cycle of uneconomic conditions in which the farmers are now entwined. They will be able to:

1. Plant earlier thus getting better plant populations.

2. Control weeds and grasses better.

3. Harvest at more opportune times.

4. Produce higher quality and higher yielding crops.

This will increase their incomes and encourage them to apply soil and water conservation practices which otherwise would be beyond their financial means.

Other crops will be affected in a similar manner. Yields will be increased because of higher and healthier plant populations which will have to compete less with weeds. Pasture will also be affected. Grasses will grow faster providing more forage. Unpalatable water tolerant weeds will not thrive under better drained conditions. Stocking rates will increase. The land will be used nearer to its potential because less grazing days will be lost.

Reduction in time necessary for land preparation, reduction in frequency of replanting and cultivation, more effective weed control measures, and more efficient harvesting will reduce the per acre cost of production. These reductions in production costs total about $155,800 annually. Longer

periods of time will be available during critical production periods for maximum utilization of equipment and other factors of production. Reductions in flooding and increased timeliness or operations will also increase the quality of products. These benefits amount to approximately $83,800 annually. Cotton, soybeans, rice, and grain sorghum yields are expected to increase 18 percent, 28 percent, 6 percent, and 28 percent, respectively.

Improved soil conditions produced under proper management and protection will increase infiltration rates and water storage capacity. Watershed needs and objectives will receive primary consideration in the forest management and land treatment program.

The management plans for the remainder of the forest land will help improve the stands and increase productivity and economic returns from the land. Forest lands will be managed to fulfill timber, wildlife, and recreation needs to the extent that such management is compatible with sound watershed management.

It is estimated that farmers will increase their use of chemical fertilizers by 2,200 tons annually. This amount would be less if research presently being conducted proves successful. This research deals with the time release of nutrients such as nitrogen, which do not remain in the soil for long periods of time. Soil fertility will decline without further use of fertilizers. Fertilizers now account for approximately one-third of our total food supply, and increases in use will probably be necessary to obtain the higher yields of the future. Nitrogen and phosphorus are the mineral elements usually limiting green plant growth. Vigorously growing crops are able to absorb more fertilizer than plants that are barely surviving. Studies indicate that with good management the amount of nutrients entering water from fertilizers is low. Phosphate is the ion that usually controls aquatic plant growth. Most soils have a strong "fixing" capacity for phosphorus. Leaching of phosphates is slight. Most of the loss to streams and lakes would be through erosion. Data on sources of phosphates in water is difficult to obtain, but there is evidence that the principal sources generally are detergents, municipal sewage, and sediment.1/

Since the majority of the soils in the watershed are clayey, leaching is not a large problem. Where adequate amounts of nitrogen are applied at the proper time, most of the nitrate is absorbed by the growing crop. For these two reasons, little, if any, nitrates are lost from the watershed. Leaching may be rapid in sandy soils but is slowed as the clay content increases.

1/ George E. Smith "Water Pollution From Agriculture", Missouri's All Employee Training Conference - Frame Work for the Future (Columbia: U.S. Department of Agriculture, Soil Conservation Service, 1972) pp. 46-48.

EFFECTS

The best control methods for preventing fertilizer nutrients from entering water supplies is to apply only the amount needed at the proper time and to use management practices that will reduce erosion to a minimum. The project will be conducive to such practices. Potash is not considered to be significant enough to be a pollutant.

Erosion and Sediment

Erosion and the resulting sedimentation and turbidity will decrease with the installation of planned project measures. Future sheet erosion over the entire watershed will be reduced from 3.0 tons per acre per year without the project to 2.2 tons per acre per year under future conditions with the project completed. This reduction in sheet erosion will cause an 18 percent reduction in sediment. These reductions will be brought about by land treatment measures.

Sediment derived from sheet erosion is being delivered from Evaluation Units I, II, III, and IV to Boeuf River at the rate of about 26,000 tons annually. This rate will increase to 27,000 tons annually for future without project conditions. The 27,000 ton yield will be reduced to 22,000 tons per year after the installation of project measures. This 5,000 ton reduction will result in 18 percent less sediment delivered to Boeuf River from these evaluation units. The soils in this portion of the watershed are primarily Perry Clay. This soil has a very fine grained texture and is montmorrillonitic. This type material, when eroded, results in a high percentage of suspended matter causing high intensity of turbidity. With the installation of planned project measures, the average suspended sediment will be reduced from about 1,200 ppm to 1,000 ppm.

In Evaluation Unit V, which contains Bayou Bonne Idee, there are approximately 25,000 tons of sediment per year now being delivered to the Boeuf River via the Bayou Bonne Idee Channel. This rate will increase to 26,000 tons for future without project conditions. The 26,000 tons per year yield will be reduced to 11,000 tons per year after installation of project measures. Of the 15,000 tons per year reduction, about 11,000 tons per year is directly attributable to the two additional water control structures planned and 4,000 tons per year is attributable to land treatment measures. The estimated average annual suspended sediment will be reduced from about 2,900 ppm to approximately 1,300 ppm. This is a reduction of 58 percent from the future without project conditions.

The U.S. Corps of Engineers has an authorized project on the Boeuf River. The reduction in sediment delivered to the Boeuf River as a result of planned structural measures will in turn reduce the maintenance required on Boeuf River. This will reduce the frequency of maintenance and subsequent increase in turbidity resulting from maintenance excavation. The net effect is improved quality of water in Boeuf River.

During project installation, excavation of project channels will cause approximately 10,000 tons of sediment to be delivered to Beouf River. This figure is based on an estimate of 0.1 foot of erosion taking place on 80 percent of the raw construction surface with vegetative practices becoming effective in 90 days. The 10,000 tons will be offset by reductions

obtained from land treatment and structural measures. The construction is scheduled so that sediment induced during this period will not increase the Future With Project sediment yields to levels higher than the Future With Land Treatment Only Condition or Future Without Project Condition. The graph on page 70 and the table below illustrate this statement.

Sediment in tons delivered to Boeuf River versus years of the installation period is plotted on the graph. The tons of sediment computed for the various conditions are derived from: (1) the erosion which will occur under the various conditions, and (2) the sediment yield to Boeuf River from this erosion. Erosion computations are based on the "Musgrave Equation" (see Sedimentation Investigations section of this report). The sediment yield from this erosion is based on information developed by the Soil Conservation Service during reservoir sedimentation studies. The upper line represents the future without project sediment delivered to Boeuf River. The upward trend is based on estimates of land now in conservation use programs being placed in agricultural production. The present rate of applying land treatment measures is also incorporated in this rate. The dashed line represents the decrease in sediment due to project land treatment measures. This decrease is a result of the accelerated application of land treatment measures. The lower line on the graph illustrates the additional reductions in sediment due to the structures. The grain size of the material being eroded was the primary factor used as the basis for estimating the trap efficiency of these structures. The shaded areas above the lower line show the sediment produced by channel construction.

Bayou Bonne Idee Watershed

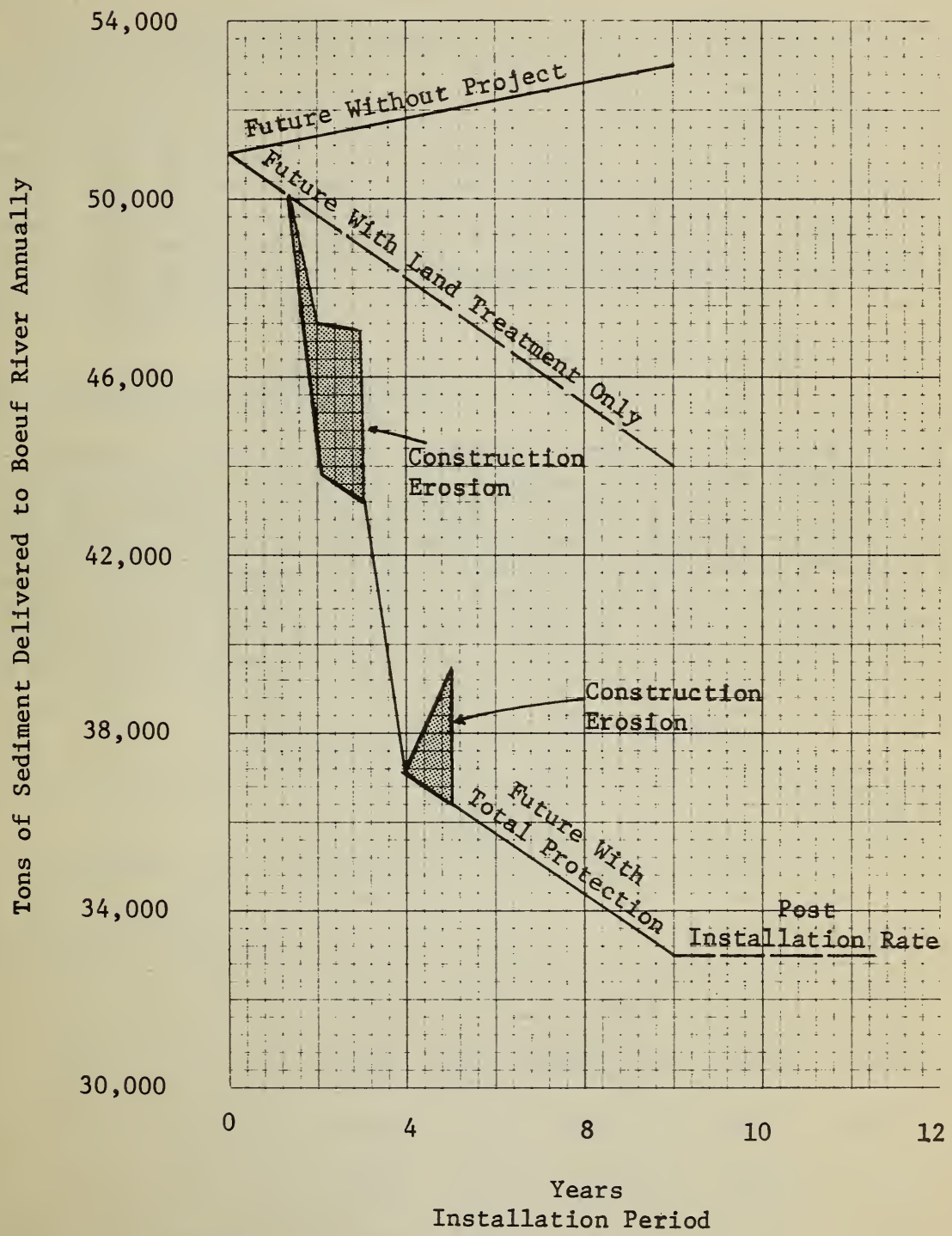
Sediment Yield to Boeuf River During the Project Installation Period

Year	Future Without Project (tons)	Future With Project Excluding Construction (tons)	Construction (tons)	Future With Project Including Construction (tons)	Reduction (tons)
0	51,000	51,000	0	51,000	0
1	51,200	50,200	0	50,200	1,000
2	51,400	44,000	3,200	47,200	4,200
3	51,600	43,200	4,000	47,200	4,400
4	51,800	37,000	0	37,000	14,800
5	52,000	36,400	3,000	39,400	12,600
6	52,200	35,600	0	35,600	16,600
7	52,400	35,000	0	35,000	17,400
8	52,600	34,300	0	34,300	18,300
9	52,800	33,600	0	33,600	19,200
10	53,000	33,000	0	33,000	20,000
TOTAL	572,000	433,300	10,200	443,500	128,500

A summation of 128,500 tons reduction in sediment is illustrated in the table. It shows the increments of sediment from the watershed by years being delivered to Boeuf River during the installation period. This table illustrates the same data as the graph, but in tabular form.

Bayou Bonne Idee Watershed

Sediment Yield to Boeuf River



EFFECTS

Lime will be spread on the channel slopes at the rate of 3 tons per acre during the process of seeding the slopes. This lime will serve a multiple purpose. The soils are acid and the lime will assist in getting a better vegetative stand. Since the soils are acid, the sediment and waters will be slightly acid to neutral. The lime will locally raise the pH of the water and thereby assist in the flocculation of the suspended sediment and decrease turbidity.

Several other design features and construction methods have been instituted to reduce erosion and sedimentation from the channels. Channel design has been restricted to velocities which are commensurate with the materials to be encountered during construction. Channel side slopes will be used which will insure stable banks. Construction will generally disturb only one bank. When channel design and layout were developed, special consideration was given to emptying channels into old undisturbed vegetated channels which will act as filtering agents. Details of these measures are enumerated in the Engineering Investigation and Analyses section of the work plan.

Fish and Wildlife, and Recreation

Reduced sediment and turbidity and removal of decaying debris and undesirable aquatic vegetation will improve the fishery habitat in Bayou Bonne Idee Channel. Damage which will result from construction in all other channels will be more than adequately mitigated by the new water created by Water Control Structure No. 4 in Bayou Bonne Idee and water control structures-type 2. The following tabulation shows acres, average pounds per acre, and total pounds of fish by reaches in Bayou Bonne Idee and all other channels for preproject and postproject conditions.

ESTIMATED STANDING CROPS OF FISHES

Channel	Preproject			Postproject		
	Acres	Pounds Per Acre	Pounds	Acres	Pounds Per Acre	Pounds
Bayou Bonne Idee Water Control Str. No.						
1	45	70	3,150	370	200	74,000
2	670	182	121,940	670	200	134,000
3	470	75	35,250	470	100	47,000
4	260	50	13,000	390	75	29,250
All Other Channels a/	60	75	4,500	116	75	8,700
Total	1,505		177,840	2,016		292,950

a/ Channels with ponded water and/or intermittent flows

EFFECTS

The area behind Water Control Structure No. 1 will change from an intermittent stream to a 370-acre permanent water area. Fish populations are anticipated to rise from the current 70 pounds per care during periods of flow to an estimated 200 pounds per acre as a result of the project. Populations in the 670 acres controlled by Water Control Structure No. 2 are expected to increase from the current 182 pounds per acre to 200 pounds per acre as a result of project action. An increase from the current 75 pounds per acre to 100 pounds per acre following project action is anticipated for the 470 acres controlled by Water Control Structure No. 3. Water Control Structure No. 4 will control 390 acres. Fish populations are expected to increase from the current 50 pounds on the existing 260 acres to 75 pounds per acre on the total 390 acres. The shallow water will also provide feeding areas for ducks.

Type of flows, other than for 10 miles in Bayou Bonne Idee and the 38 miles created by water control structures-type 2, will not be changed by the project. For example, channels with ephemeral flows before the project will still have ephemeral flows after the project. However, the length of time that water will flow will be decreased and some potholes will be eliminated. Channels presently with permanent water will have permanent water after the project is installed.

Increases of about 5 degrees Fahrenheit will occur on ponded water channels where bank and in-channel cover is removed. Fish populations consisting primarily of carp, shad, gars, and catfishes are in these channels. They are not expected to change since they are warm water species and will tolerate these temperature changes. There are no known rare or endangered species of fish occurring in this watershed.2/

The problem of pesticides as pollutants is complex. There is little evidence that the proper use of pesticides is creating water pollution problems. On a nationwide basis many causes of fish kills have been traced to dumping or improper use. No such cases have been known to occur in the watershed.

Reports of a study show that gross indicators such as vital statistics from the State Board of Health and success from fishing and hunting do not indicate any detrimental contamination of the environment in Louisiana from chlorinated hydrocarbon pesticides. The results of the study agree reasonably well with findings expected on the basis of the amount of insecticide used in a given area. Residues were quite low in the control area (mostly forest land) and higher in areas of heavy pesticide usage (agricultural land). The data from this study did not indicate extensive build-up of pesticide residues in the Louisiana environment. The only animals

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2/ Robert R. Miller, "Threatened Freshwater Fishes of the United States," Transactions of American Fisheries Society, No. 2. (Lawrence, Kansas: Allen Press, 1972), pp. 239-252.

sampled that showed consistently high residues were fish. Residue levels were found to be related to pesticide usage.3/

Published data on quantitative and qualitative analyses of water quality in the watershed is limited. The Soil Conservation Service has developed a monitoring program for this watershed to determine preproject and postproject water quality conditions. This program will include a close study of the activity and land use changes that occur in the drainage area above each sampling location. These studies will include quantitative analyses and determine as near as possible the source and cause of identifiable pollutants.

The monitoring program will measure fish population in channels, pesticides in the water, channel soil, and fish tissue. Fertilizer residue in the channel water will be measured to identify nitrogen, potash, and phosphate. A coliform count will be made. Water samples will be analyzed to determine the ppm of suspended sediment.

The project will be monitored a minimum of 2 years preproject and 5 years postproject. If during this time it is determined that the project will cause significant increases in deterioration of water quality, appropriate modifications in the planned measures will be made. This program will be conducted jointly with the Louisiana Wildlife and Fisheries Commission, the U.S. Fish and Wildlife Service, the Louisiana Board of Health, the Agricultural Research Service-Louisiana State University Feed and Fertilizer Section, the U.S. Geological Survey, and the Soil Conservation Service.

Disturbances in channel rights-of-way during construction will cause losses in wildlife habitat. These will be partially offset by the vegetation established on the channel side slopes, berms, spoils, and wildlife openings on the school board land. The table on page 74 illustrates changes because of project in terms of acres and number of animals.

Mourning doves and bobwhite quail will experience increases of about 288 acres in habitat. This will result in a 0.2 percent increase in mourning dove population and a 0.3 percent increase in bobwhite quail. Deer and squirrel will be adversely affected by the project. Habitat losses consisting of wooded channel banks and forest land amount to 554 acres resulting in a 6.1 and 3.6 percent decrease in squirrel and deer population, respectively. Rabbit habitat loss will amount to 228 acres resulting in a 0.2 percent decrease in population. Clearing of wooded channel banks will decrease waterfowl habitat by about 407 acres which will cause a 0.2 and 0.3 percent decrease in resident and migratory waterfowl, respectively. The decrease in squirrel and deer habitat represents the largest change of any of the other species. This decrease amounts to about 4.0 percent of the habitat in the watershed and 0.0005 percent of the habitat within a 60 mile radius.

3/ E. A. Epps, Frances L. Bonner, L. D. Newsom, Richard Carlton, a and R. O. Smitherman, "Preliminary Report on a Pesticide Monitoring Study in Louisiana," Bulletin of Environmental Contamination and Toxicology, Vol. 2, No. 6 (New York: Springer Verlog, Inc., 1967) pp. 333-339.

PREPROJECT AND POSTPROJECT
HABITAT ACRES AND POPULATIONS OF WILDLIFE SPECIES

Species	Animal-Acre Ratio[a/]	Preproject Total Acres	Preproject Total Animals	Changes Due to Project Acres	Changes Due to Project Animals
Dove (Migratory)	1:4	124,800	31,200	+288	+72
Quail	1:50	124,800	2,490	+288	+6
Squirrel	b/	13,080	4,310	-554	-265
Deer	c/	13,080	520	-554	-19
Rabbit	1:10	137,880	13,785	-228	-22
Waterfowl (Resident)	1:150	142,505	953	-407	-2
Waterfowl (Migratory)	1:15	142,505	9,495	-407	-27

a/ Data developed in corporation with the Louisiana Wild Life and Fisheries Commission.
b/ One squirrel per 3 acres of forest land.
One squirrel per 5 acres of wooded channel banks.
c/ One deer per 25 acres of forest land.
One deer per 50 acres of wooded channel banks.

About 2 percent of the total wetlands in the watershed will be a affected by the project. This 2 percent represents 0.00075 percent of the total wetlands within a 60-mile radius of the project area. The effect on this 105 acres (2 percent) of type 1 wetlands will be a reduction in the amount and duration of flooding. These changes will adversely affect waterfowl populations. This reduction in flooding will not affect other game species habitat requirements. This will be mitigated by the construction of Water Control Structure No. 4 on Bayou Bonne Idee.

Wood duck populations in Bayou Bonne Idee Channel after project installation will be at or near present levels. The most valuable wood duck habitat in the bayou, 47 acres immediately below Water Control Structure No. 2, will be left undisturbed. Cover and den trees will be left in the sections of the Bayou as described under the Planned Project section. Natural tree cavities removed during construction will be replaced with boxes to assure sufficient nesting sites. The installation of these nesting boxes will be a rewarding and educational experience for the Oak Ridge Boy Scouts. It will provide them an opportunity to learn to improve their environment for wildlife as well as for man.

The threatened and status undetermined species listed in the Fisheries and Wildlife Resources sections will not be affected because of their wide in territory and small habitat changes due to the project.

The recreational facilities located near Water Control Structure No. 3 (Goat Walk) will provide recreational opportunities for boating, fishing,

camping, picnicking, nature study, and other activities. The three other access points or boat launching areas will provide opportunities for fishing, hunting, and boating. About 1,430 acres of forested school board land will be opened to the public for hunting and recreation. Preservation of this diminishing resource assures children yet unborn that they will be able to hunt and experience life in these areas as their forefathers did in similar areas.

The daily design capacity of the recreation facilities are: boat launching - 246; camping - 240; picnicking - 440; nature study - 200. The greatest amount of use is expected to occur during the summer recreational season, Memorial Day through Labor Day; however, some use is expected year round because of the mild climate. Peak daily use on the average high-use day during the heavy-use season (usually the average summer Sunday), is estimated to be 763. Average annual use is estimated to be 38,200 visitor days.

The clearing of Bayou Bonne Idee and the additional permanent water created will increase the accessibility of the bayou. Presently, little of the bayou is trafficable by boat. After the project is installed, all of the permanent water areas will be accessible by boat. Quality of fisheries will be improved by removing undesirable vegetation providing more open water, and establishing better access. The resulting resource will constitute a long narrow water body largely protected from excessive wind action by wooded strips along the banks. This resource will provide fisheries for about 105 boat and 40 bank fishermen per day.

General recreation activities related to the 10 mile portion of Bayou Bonne Idee classified as natural channel between Water Control Structures No. 1 and No. 2 will change. Boating an canoeing which are presently limited because of the dense vegetation and intermittent flow, will be increased by the clearing and construction of Water Control Structure No. 1. Although the areas for activities such as picnicking and hiking will be reduced, areas for such activities will still be available in the corridors of natural vegetation left on each side of the bayou. These areas reduced by the project have no value for picnicking and hiking; therefore, these activities will not be affected.

Although the total waterfowl population within the watershed will decrease slightly, hunting occasions will increase by about 500 because of increased accessibility and increased water areas. Approximately 59,000 visitor days of fishing, boating, and hunting will result annually from the improvements on the bayou.

Recreational opportunities will be available to the 5,200 people residing in the watershed and about 4,000 people from surrounding areas. The proposed facilities will make water related recreational activities more available to local families.

Recreational opportunities will be provided for residents of Bastrop, Mer Rouge, Oak Grove, Oak Ridge, and other towns in the parish. Residents of the City of Monroe and the surrounding parishes will also be provided additional recreational opportunities by the project.

EFFECTS

The improved aesthetic appearance, higher quality water, and increased water areas in Bayou Bonne Idee could lead to development of summer houses and camps along some portions of this channel. The 9.6 miles of new permanent water created above Water Control Structure No. 1 and the existing 17 miles above Water Control Structure No. 2 will be the better locations since these are the areas of deeper water more conducive to this type development. The shoreline along this section of the bayou amounts to about 53 miles and is all privately owned. About 7 miles of this 53-mile section parallel a road within a few to several hundred feet. These would be the areas most likely to be developed since they are more accessible. Other areas would be less likely to be developed because of the higher expense of providing access.

The development of summer houses and camps along the banks of the bayou could deteriorate the quality of water in this channel if appropriate preventive measures are not employed. The project Sponsors will be responsible for providing the necessary ordinances regulating the buildup along Bayou Bonne Idee so that its water quality will be protected. These ordinances would include building codes to insure the proper installation and functioning of sewage systems so that discharge would not enter into the bayou. These codes would also contain provisions for preventing sediment from entering the bayou during construction of house and associated facilities.

Bayou Bonne Idee is a natural high bank stream with the adjacent land grade sloping away from the stream. This natural condition greatly reduces potential adverse effects that could be induced by buildup. The grade would enable field lines and surface discharge to drain away from the bayou.

Archaeological, Historic, and Scientific

A listing of the locations of archaeological sites of importance for this area was obtained from the Curator of Anthropology of Louisiana State University. These site locations were studied with reference to the locations of planned structural measures. Two sites are in close proximity to project channels, but to the best knowledge presently available, these will not be disturbed. Results of the study being conducted by Northeast Louisiana University will indicate effects the project will have on any known archaeological or historic site. If adverse effects should occur, the report will suggest mitigative or preventive measures.

Economic and Social

The economic base of the watershed, agriculture, will be enhanced. The project will increase agricultural development with consequent higher net returns, which in turn, will stimulate the business and increase the profits of processors and sellers of agricultural products as well as other goods. The economy of the area will be enhanced by the higher salaries of those presently employed and those hired to do the additional work.

The gross sales of farm products are expected to increase from about $7,066,000 without the project to $8,711,000 with the project. This is

an increase of approximately 23 percent. Increase in certain production inputs required to obtain these higher gross sales are expected to increase from about $1,359,459 annually without the project to $1,714,916 annually with the project. This is an increase of approximately 26 percent.

The greater level of protection along with the reduced cost of production and increased quality of products will give farmers an incentive to increase production inputs. They will buy better quality seed and will use more fertilizer and lime. It is expected that they will spend $158,000 buying fertilizer which will be necessary to attain the higher yields of the future as discussed under the Flood Prevention and Drainage section beginning on page . This is estimated to be 2,200 tons of fertilizer annually. There will be increases in expenditures for products which will be used in harvesting and hauling the product to market. This will stimulate economic activity within the watershed as well as the surrounding areas. More jobs will be created in the processing and service industries. The value of property will increase which will provide for a higher tax base. Thus, the parish will have more funds to develop health, recreational, and educational facilities.

Installation of the project will create about 100 man-years of local labor. Of this total, 75 man-years will be created from the installation of land treatment measures and 25 man-years will be created from structural measures.

The project will help slow the trend of decreasing number of farms and increasing size of farms. With the project, larger, labor-saving equipment will be more efficiently used on the farms. This and other factors which will decrease cost, increase yields, and increase net returns will increase the profitability of farming. This will cause farming to be more competitive with other industries inducing more people to remain on the farm. The out-migration trend may also be slowed.

The average annual overall net farm income will increase about $1,700 per farm. With this increased and more stable income, the farmer may improve his house or buy a better automobile. He will be able to afford better dental and health care, more insurance, better clothes, and other amenities of life for his family. He will be able to pay his employees higher wages who in turn will improve their living conditions.

The problems of watershed residents caused by flooded roads and damaged bridges will be reduced. School buses will be able to travel their scheduled routes more regularly which will in turn improve school attendance. The general public will be better able to utilize the roads for farming operations and marketing, and for commuting to places of employment and business during wet periods.

Local secondary benefits will accrue after the installation of project measures. The values added to the immediate products and services as a result of activities stemming from or induced by the project will enhance the overall local economy. The increased production of goods stemming from the project will place new demands on the transporting and marketing industries within the area. Because processing facilities

are limited mostly to cotton gins, the effect on local processing facilities will be less than on the transporting and marketing sectors. Processors, business establishments, and other individuals not directly benefited will profit from increased sales of their agricultural and recreational associated goods and products. Suppliers of the needed materials and services required to make possible the benefits expected from installation of the project will realize an increased net income. The goods and services produced by the project will tend to stimulate local economic activity on a more permanent basis. Because most of the products produced are processed out of the watershed, economic activity in the region will also be increased.

PROJECT BENEFITS

Project benefits will total about $1,055,200 annually. Of this total $378,200 are from flood damage reduction, $74,000 from more intensive land use, $333,600 from drainage, $107,400 from recreation, and $162,000 from local secondary benefits. The flood damage reduction benefits are estimated to be $339,100 to crop and pasture, $25,100 to roads and bridges, and $14,000 to sediment reduction. The drainage benefits include $155,800 for decreased cost of production, $83,300 for increased quality of product, and $94,500 for increased production.

Secondary benefits from a national viewpoint will accrue to this project, but these were not evaluated. There are other benefits which will accrue in the watershed as indicated in the EFFECTS OF WORKS OF IMPROVEMENT section. However, no attempt was made to attach monetary value to these.

COMPARISON OF BENEFITS AND COSTS

Project benefits from structural measures are estimated to be $1,055,200. The average annual cost of structural measures (amortized installation cost plus operation and maintenance) is estimated to be $357,500, providing a benefit-cost ratio of 3.0 to 1. Total average annual benefits excluding secondary benefits are estimated to be $893,200, providing a benefit-cost ratio of 2.5 to 1.

PROJECT INSTALLATION

This project will be carried out over a 10-year period. Forest land treatment will be installed in the first 5 years of the installation period, and other land treatment over 10 years. The structural measures will be over the first 6 years. The Sponsoring Local Organization understands its obligations and has agreed to carry out the work during this period.

The Morehouse Soil and Water Conservation District will provide the overall leadership necessary for the application of the land treatment measures. Landowners and operators will be encouraged to apply and maintain all needed measures on their land. A study of completed projects with purposes similar to this plan shows that land treatment planned during the project installation period can be accomplished. Plans for their installation and maintenance will be outlined with each landowner. The agreed-to items will be identified in a conservation plan which will be executed between the individual and the soil and water conservation district.

Forest landowners will be encouraged to apply and maintain the recommended forestry measures on their lands. Technical assistance, now provided by the Louisiana Forestry Commission in cooperation with the U.S. Forest Service under the Cooperative Forest Management Program, will be increased to accelerate the installation of forestry measures. A forester will be assigned to the project to guide and assist the landowners on installation of planned forestry measures. He will assist in the preparation of forest management plans based upon multiple-use of forested lands as part of the conservation farm plans.

The Oak Ridge troop of the Boy Scouts of America working through the Bonne Idee Gravity Drainage District, the legal Sponsors, will construct, install, and maintain the wood duck nesting boxes in Bayou Bonne Idee as one of their conservation projects. The drainage district will furnish building materials, and the biologists of the Louisiana Wild Life and Fisheries Commission and the Soil Conservation Service will assist the troop by counseling with them on design and location of boxes. The cost of the building materials will be cost-shared since these are for mitigation. The wood duck boxes will replace natural tree cavities removed during construction.

The Bonne Idee Gravity Drainage District will be responsible for installing all other structural measures. They will be responsible for the local share of the cost of construction, acquiring necessary land rights, obtaining improvement changes to all roads, bridges, culverts, utilities, and other existing improvements which are needed, and advertising, awarding, and administering contracts. The Bonne Idee Gravity Drainage District has power of expropriation and has agreed to use this power as necessary to obtain needed land, easements, and rights-of-way.

The Morehouse Parish School Board will enter into a written agreement with the Bonne Idee Gravity Drainage District allowing them to maintain the wildlife opening on the property the board administers.

The channel work normally will progress in an upstream direction. At present, the only condition foreseen where this will not happen is when sections of streams thickly vegetated are left as buffers to absorb sediment from construction. When construction upstream is completed, the buffer zone downstream would be eliminated. Care will be exercised to insure the modification or reconstruction of bridges, culverts, or other existing facilities to occur either before or concurrently with channel improvement. This way they will not be a deterrent to the proper functioning of planned measures.

FINANCING PROJECT INSTALLATION

Federal assistance will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; Stat. 666) as amended. This assistance is subject to appropriation of funds.

The cost of applying land treatment measures will be borne by the owners and operators of the land with aid from Federal and State programs. Technical assistance to the landowners and operators will be provided by the Soil Conservation Service and the U.S. Forest Service under going programs. Funds for the acceleration of technical assistance necessary to insure timely installation of land treatment measures and for soil surveys will be provided by Public Law 566.

The Louisiana Department of Public Works has agreed to provide funds for the local share of cost of structural measures contingent on the appropriation of monies for this purpose by the Louisiana Legislature. The Sponsors recognize, however, that these funds may not be available or that additional funds may be required. They will be responsible for obtaining additional financing as necessary through normal funding procedures such as taxes or bond issues.

PROVISIONS FOR OPERATION AND MAINTENANCE

Operation and maintenance of all phases of the completed project will be the responsibility of the Sponsors. The Morehouse Soil and Water Conservation District, obtaining help from available sources and working with individual landowners and operators, will have the responsibility for maintaining land treatment measures. The Louisiana Forestry Commission, in cooperation with the U.S. Forest Service, will furnish the technical assistance necessary for maintaining the forest land treatment measures under the going Cooperative Forest Management Program. The Federal-State Cooperative Fire Control Program will continue to furnish fire protection for the watershed area. The Morehouse Soil and Water Conservation District, with technical assistance from the Soil Conservation Service, will assist and encourage landowners to install and maintain land treatment measures. The objectives will be to maintain adequate drains, ground cover, and other practices which will protect and conserve soil and water resources.

Operation and maintenance of all phases of the completed structural measures will be the responsibility of the Bonne Idee Gravity Drainage District. In addition to maintaining the structural measures proposed in the plan, the drainage district will continue to maintain channels that are now adequate, as indicated on the Project Map, Figure 8. The methodical operation and maintenance of structural measures will insure proper functioning of these measures and realization of effects.

The present district funds for drainage are considered adequate for maintaining channels and associated works. If these funds should prove inadequate, the financial arrangements discussed under FINANCING PROJECT INSTALLATION will be used to provide capital for operation and maintenance of these measures. Annual expenses, including the replacement of worn out or obsolete parts as well as regular operation and maintenance, are estimated to be $88,500. This includes $26,800 for maintenance of the recreational facilities.

Channel maintenance includes such activities as periodic cleanouts necessary to restore channels to their planned capacities, patching of eroded areas or washouts on channel banks, control of aquatic weeds that would reduce channel capacities, and repair or replacement of side inlets and other structures. Maintenance of water control structures and grade stabilization structures includes repairing rills around headwalls or wingwalls, maintaining or replacing vegetation on fills, repairing or replacing worn or broken parts, replacing short life parts and all other activities essential to the safety and functioning of the structure. The wildlife openings in the Public Use Areas (Wildlife Areas) will be disked or bush-hogged every 3 years to keep them in the weed and brush stage of plant succession. Maintenance and improvement of the general attractiveness or beauty of the channel and structure sites shall be considered an important feature of the maintenance program.

Operation of the water control structures-type 1 will be the responsibility of the Bonne Idee Gravity Drainage District. They will obtain assistance from the Louisiana Wild Life and Fisheries Commission on the technical aspects of managing the structures. The drainage district will also have the responsibility of maintaining the wood duck nesting boxes. The Boy Scouts will do the work.

Existing public roads, farm roads, turn rows, trails, open areas, and other existing facilities will be used for maintenance equipment to reach the channels. If none are existing, travel ways will be provided. Sufficient access is available to properly maintain all channels. The channels will be kept clear of excessive vegetation by mowing, hand labor, and use of approved herbicides. Herbicides will be used in areas where mowing and hand labor are not practical. Herbicides such as ammonium sulfamate, bromacil, and others registered with the Environmental Protection Agency (EPA) will be applied in a manner consistent with their labeling. Pesticides presently approved will not preclude the use of other EPA registered pesticides during the life of the project. Spraying will be accomplished in the low rainfall months when the ephemeral channels and most of the intermittent channels have no standing water. Spraying during these months will lower the possibility of runoff carrying undegraded herbicides into other areas. Eroded banks, side inlets, and other appurtenances will be repaired when in need. Sediment accumulations (mud bars) will be removed periodically by mechanical means.

Provisions will be made for representatives of the Soil Conservation Service, the Louisiana Department of Public Works, and the Sponsors to have free access to all portions of the works of improvement at any reasonable time for the purpose of inspection, repair, and maintenance. The Sponsors, together with representatives of the Soil Conservation Service, will make a joint inspection annually, after severe storms, and after the occurrence of any other unusual condition that might adversely affect the structural measures. Regular inspection of the recreational development will be performed year round with emphasis during the peak-use period.

Items which will be given special attention during these inspections are the three pit toilets at the access points (boat launching areas) and the flush toilets and septic tanks at the main recreational facility. Planned use of pit toilets is anticipated to be at a level which would not lead to accumulations of effluent in excess of that amount which the ambient soil can safely degrade. If use exceeds expectations and effluent accumulates in amounts which can not be safely degraded, pits will be periodically pumped and wastes disposed at a facility capable of safely processing it.

The septic tanks at the main facility will be operated and maintained according to the Louisiana Health Department and the U. S. Department of Health, Education, and Welfare. As necessary, tanks will be pumped and the wastes disposed in the same manner as that from the pit toilets.

These joint inspections will continue for 3 years following completion of installation of the structural measures. Inspection after the third year will be made by the Sponsors. They will prepare an annual report and send a copy to the Soil Conservation Service. Items of inspection will

include, but will not be limited to, conditions of vegetative cover and growth, need for removal of sediment bars and debris accumulations, and brush control in channels and general condition and need for repair of facilities in the recreational development.

The operation and maintenance cost of the recreational facilities represents items such as salaries for personnel for custodial and policing at the main facility and for sanitation and up-keep at the main facility and the boat ramps; contract services such as repair and sealing of paved areas and pumping septic tanks; and materials, equipment, and supplies such as fertilizer, seed, paint, fuel, parts, utilities, etc. Replacement of the recreational facilities and maintenance equipment whose life expectancies are shorter than the evaluation period are also calculated into the operation and maintenance cost. Items such as the picnic shelter, comfort stations, boat docks, barriers, and fencing are expected to need replacement about every 20 years. Other items such as tables, grills, garbage receptacles, and some maintenance equipment will need replacing about every 10 years. Other maintenance equipment will need replacing every 5 years. The recreational development will be operated and maintained in accordance with State and local health laws and regulations.

Financing of the recreational facilities will be partly accomplished through admission fees charged at the main facility at Water Control Structure No. 3. There will be no fees charged at the boat ramps located away from the main recreational facility. The admission fees will be limited to that needed to amortize the initial investment and to provide funds for adequate operation and maintenance.

The Sponsoring Local Organization fully understands its obligations for operation and maintenance and will execute a specific operation and maintenance agreement with the Soil Conservation Service prior to the execution of the project agreement for the installation of works of improvement.

The project Sponsors will be responsible for providing the necessary ordinances required to protect the water quality in the bayou from effluent, sediment, and other contaminants that may result from buildup along the Bayou banks.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Bayou Bonne Idee Watershed, Louisiana

Installation Cost Item	Unit	Number Non-Federal Land	Estimated Cost (Dollars) 1/ P.L. 566 Funds SCS 3/	P.L. 566 Funds FS 3/	P.L. 566 Funds Total	Other SCS 3/	Other FS 3/	Other Total	TOTAL
Land Treatment									
Land Areas 2/									
Cropland	Acres	29,000	-	-	-	1,855,500	-	1,855,500	1,855,500
Pastureland	to be	4,000	-	-	-	205,500	-	205,500	205,500
Forest Land	treated	250	-	-	-	-	500	500	500
Other Land		1,000	-	-	-	1,700	-	1,700	1,700
Technical Assistance			390,100	6,800	396,900	159,000	8,700 6/	167,700	564,600
Total Land Treatment	XXXX	XXXX	390,100	6,800	396,900	2,221,700	9,200	2,230,900	2,627,800
Structural Measures									
Constrcution									
Channel Work 4/									
Bayou Bonne Idee Channel									
N	Miles	12	81,600	-	81,600	40,800	-	40,800	122,400
M	Miles	45	278,400	-	278,400	139,200	-	139,200	417,600
All Other Channel Work									
N	Miles	9	99,825	-	99,825	33,275	-	33,275	133,100
M	Miles	121	1,020,638	-	1,020,638	340,212	-	340,212	1,360,850
O	Miles	15	50,775	-	50,775	16,925	-	16,925	67,700
Water Control Structures - Type 1	No.	4	266,300	-	266,300	215,300	-	215,300	481,600
Recreation Facilities	No.	4	137,950	-	137,950	164,950	-	164,950	302,900
Water Control Structures - Type 2	No.	16	106,462	-	106,462	35,488	-	35,488	141,950
Wildlife Areas	No.	3 5/	1,500	-	1,500	500	-	500	2,000
Wood Duck Nesting Boxes	No.	310	2,325	-	2,325	775	-	775	3,100
Subtotal - Construction			2,045,775	-	2,045,775	987,425	-	987,425	3,033,200

1/ Price base 1973

2/ Includes only areas estimated to be adequately treated during the project installation period. Treatment will be accelerated throughout the watershed, and dollar amounts apply to total land areas, not just to adequately treated areas.

3/ Federal agency responsible for assisting in installation of works of improvement.

4/ Type of channel before the project: (N) - an unmodified, well-defined natural channel or stream; (M) - manmade ditch or previously modified channel; (O) - none or practically no defined channel.

5/ There are three wildlife areas but cost is only incurred on two.

6/ Includes $5,000 for Cooperative Forest Fire Control.

(continued)

(continued) TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Bayou Bonne Idee Watershed, Louisiana

Installation Cost Item	Unit	Number Non-Federal Land	Estimated Cost (Dollars) 1/ P.L. 566 Funds SCS 3/	FS 3/	Total	Other SCS 3/	FS 3/	Total	TOTAL
Engineering Services			201,300	-	201,300	9,650	-	9,650	210,950
Relocation Payments			-	-	-	-	-	-	-
Project Administration									
Construction Inspection			300,425	-	300,425	-	-	-	300,425
Other			297,205	-	297,205	33,170	-	33,170	330,375
Relocation Assistance Advisory Services			-	-	-	-	-	-	-
Subtotal - Administration			597,630	-	597,630	33,170	-	33,170	630,800
Other Costs									
Land Rights			22,600	-	22,600	656,800	-	656,800	679,400
Subtotal - Other			22,600	-	22,600	656,800	-	656,800	679,400
TOTAL STRUCTURAL MEASURES			2,867,305	-	2,867,305	1,687,046	-	1,687,045	4,554,350
TOTAL PROJECT			3,257,405	6,800	3,264,205	3,908,745	9,200	3,917,945	7,182,150

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TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT

Bayou Bonne Idee Watershed, Louisiana

	Unit	Applied To Date	Total Cost (Dollars) 1/
LAND TREATMENT			
Recreation Developments	Number	5	15,000
Conservation Cropping System	Acres	4,400	4,400
Crop Residue Management	Acres	2,170	5,400
Farm Ponds	Number	4	1,000
Grade Stabilization Structure	Number	50	17,500
Drainage Land Grading	Acres	3,000	210,000
Drainage Main or Lateral	Feet	800,000	160,000
Wildlife Wetland Habitat Management	Acres	900	9,000
Pasture Hayland Planting	Acres	6,000	210,000
Tree Planting	Acres	7	200
TOTAL			632,500

1/ Price Base: 1973 August 1973

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Bayou Bonne Idee Watershed, Louisiana
(Dollars) 1/

Item	Installation Cost - P.L. 566 Funds				Installation Cost - Other Funds				Total Installation Cost
	Construction	Engineering	Land Rights	Total Public Law 566	Construction	Engineering	Land Rights	Total Other	
Channel Work 2/									
Evaluation Unit I									
(N)	40,050	3,770	-	43,820	13,350	-	7,800	21,150	64,970
(M)	118,838	11,100	-	129,938	39,612	-	40,400	80,012	209,950
(O)	50,775	4,700	-	55,475	16,925	-	5,700	22,625	78,100
Subtotal - Unit I	209,663	19,570	-	229,233	69,887	-	53,900	123,787	353,020
Evaluation Unit II									
(N)	53,175	5,000	-	58,175	17,725	-	14,700	32,425	90,600
(M)	471,450	44,000	-	515,450	157,150	-	125,000	282,150	797,600
(O)	42,225	3,900	-	46,125	14,075	-	17,000	31,075	77,200
Subtotal - Unit II	566,850	52,900	-	619,750	188,950	-	156,700	345,650	965,400
Evaluation Unit III									
(N)	6,600	650	-	7,250	2,200	-	11,400	13,600	20,850
(M)	54,000	5,000	-	59,000	18,000	-	36,600	54,600	113,600
Subtotal - Unit III	60,600	5,650	-	66,250	20,200	-	48,000	68,200	134,450
Evaluation Unit IV									
(M)	254,025	23,700	-	277,725	84,675	-	89,300	173,975	451,700
Subtotal - Unit IV	254,025	23,700	-	277,725	84,675	-	89,300	173,975	451,700
Evaluation Unit V									
Bayou Bonne Idee Channel									
(N)	81,600	8,600	-	90,200	40,800	-	37,000	77,800	168,000
(M)	278,400	29,400	-	307,800	139,200	-	105,600	244,800	552,600
All Other Channel Work									
(N)	-	-	-	-	-	-	7,000	7,000	7,000
(M)	80,100	7,500	-	87,600	26,700	-	120,800	147,500	235,100
Subtotal - Unit V	440,100	45,500	-	485,600	206,700	-	270,400	477,100	962,700
Subtotal - Channel Work	1,531,238	147,320	-	1,678,558	570,412	-	618,300 3/	1,188,712	2,867,270

1/ Price base 1973

2/ Type of channel before the project: (N) - an unmodified, well defined natural channel or stream; (M) - manmade ditch or previously modified channel; (O) - none or practically no defined channel.

3/ Includes $262,150 for value of land, legal fees and surveys; $230,150 for replacement or modification of bridges and culverts; and $126,000 for modification of pipelines, utility lines and miscellaneous facilities.

4/ Includes value of land, legal fees and surveys only.

5/ Includes value of land, legal fees and surveys for structure for Water Control No. 4 of $700, and $900 for Wildlife Areas

(continued)

(continued) - TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Bayou Bonne Idee Watershed, Louisiana (Dollars) 1/

Item	Installation Cost - P.L. 566 Funds				Installation Cost - Other Funds				Total Installation Cost
	Construction	Engineering	Land Rights	Total Public Law 566	Construction	Engineering	Land Rights	Total Other	
Recreation Development									
Water Control Structure No. 1	136,800	19,200	-	156,000	136,800	-	9,100	145,900	301,900
Water Control Structure No. 2	28,800	4,000	-	32,800	28,800	-	350	29,150	61,950
Water Control Structure No. 3	24,200	3,400	-	27,600	24,200	-	350	24,550	52,150
Recreational Facilities Maintenance Building and Equipment	-	-	-	-	27,000	-	-	27,000	27,000
All Other Facilities	137,950	9,650	22,600	170,200	137,950	9,650	27,100	174,700	344,900
Subtotal	327,750	36,250	22,600	386,600	354,750	9,650	36,900 4/	401,300	787,900
Mitigation Measures									
Water Control Structure No. 4 (Type 1)	76,500	7,200	-	83,700	25,500	-	700	26,200	109,900
Structures for Water Control (Type 2)	106,462	9,930	-	116,392	35,488	-	-	35,488	151,880
Wildlife Area 1	750	100	-	850	250	-	450	700	1,550
Wildlife Area 2	750	100	-	850	250	-	450	700	1,550
Wood Duck Nesting Boxes	2,325	400	-	2,725	775	-	-	775	3,500
Subtotal	186,787	17,730	-	204,517	62,263	-	1,600 5/	63,863	268,380
Project Administration	XXX	XXX	XXX	597,630	XXX	XXX	XXX	33,170	630,800
GRAND TOTAL	2,045,775	201,300	22,600	2,867,305	987,425	9,650	656,800	1,687,045	4,554,350

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TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Bayou Bonne Idee Watershed, Louisiana
(Dollars) 1/

Item	Cost Allocation				Cost Sharing							
	Purpose				Public Law 566				Other			
	Flood Prevention	Drainage	Recreation	Total	Flood Prevention	Drainage	Recreation	Total	Flood Prevention	Drainage	Recreation	Total
Multiple Purpose												
Channel Work												
Bayou Bonne Idee Channel	240,200	240,200	240,200	720,600	192,667	102,667	102,666	398,000	47,533	137,533	137,534	322,600
All Other Channel Work	1,073,335	1,073,335	-	2,146,670	835,485	445,073	-	1,280,558	237,850	628,262	-	866,112
Mitigation Measures												
Water Control Structure No. 4 (Type 1)	54,950	54,950	-	109,900	54,600	29,100	-	83,700	350	25,850	-	26,200
Water Control Structures-Type 2 (16)	75,940	75,940	-	151,880	75,940	40,452	-	116,392	-	35,488	-	35,488
Wildlife Areas (2)	1,550	1,550	-	3,100	1,100	600	-	1,700	450	950	-	1,400
Wood Duck Nesting Boxes	1,750	1,750	-	3,500	1,750	975	-	2,725	-	775	-	775
Single Purpose												
Recreational Development												
Water Control Structures Nos. 1, 2, & 3	-	-	416,000	416,000	-	-	216,400	216,400	-	-	199,600	199,600
Recreation Facilities												
Maintenance Building & Equipment	-	-	27,000	27,000	-	-	-	-	-	-	27,000	27,000
All Other Facilities	-	-	344,900	344,900	-	-	170,200	170,200	-	-	174,700	174,700
TOTAL	1,447,725	1,447,725	1,028,100	3,923,550	1,161,542	618,867	489,266	2,269,675	286,183	828,858	538,834	1,653,875

1/ Price base 1973

August 1973

TABLE 2B - RECREATIONAL FACILITIES
Estimated Construction Costs
Bayou Bonne Idee Watershed, Louisiana
(Dollars) 1/

Item	Unit	Number	Estimated Unit Cost	Total Construction Cost
Clearing and Grubbing	acre	8 2/	500.00	4,000
Light Clearing	acre	20 2/	200.00	4,000
Roads and Trails				
2 lane roads - asphalt	lin. ft.	1,000 2/	7.23	7,230
1 lane roads - asphalt	lin. ft.	10,000 2/	4.87	48,700
Culverts	each	10 2/	400.00	4,000
Cattle Guard (24' wide)	each	1	1,500.00	1,500
Nature Trails - graveled	lin. ft.	5,000 2/	1.00	5,000
Parking Areas				
Paved Parking - asphalt	sq. ft.	66,640 2/	0.30	19,992
Parking Barriers	each	100 2/	40.00	4,000
Picnicking				
Tables - Concrete	each	40	250.00	10,000
Grills	each	25	60.00	1,500
Trash Receptacles	each	15 2/	50.00	750
Shelter with Fireplace	each	1	8,358.00	8,358
Comfort Station (flush type) 3/	each	1	5,000.00	5,000
Boating				
Launch Ramp	each	1	8,000.00	8,000
Boat Dock (floating)	each	2	3,200.00	6,400
Camping				
Paved spur with barrier	each	23	190.00	4,370
Trash Receptacles	each	10 2/	50.00	500
Grills	each	10	60.00	600
Comfort Station and Bath 3/	each	1	10,000.00	10,000
Comfort Station (flush type) 3/	each	1	3,000.00	3,000
Dump Station	each	1	1,000.00	1,000
Water supply and distribution	lump	1	19,200.00	19,200
Electrical Facilities	lump	1	10,000.00	10,000
Entrance Shelter	each	1	2,400.00	2,400
Landscape and Vegetation	acre	20 2/	250.00	5,000
Maintenance Workshop 4/	each	1	7,000.00	7,000
Maintenance Equipment 4/	lump	1	20,000.00	20,000
Miscellaneous (fence, signs, etc.)	lump	1	2,900.00	2,900
Access Points				
Launch Ramp	each	3	4,000.00	12,000
Paved Parking & Roadway-asphalt	sq. ft.	31,500 2/	0.30	9,450
Trash Receptacles	each	3	50.00	150
Boat Dock (fixed)	each	3	700.00	2,100
Comfort Station (pit)	each	3	3,000.00	9,000
Total				257,100
Contingencies				45,800
GRAND TOTAL				302,900

1/ Base Price 1973
2/ Estimated quantity, subject to minor variation at time of detailed planning
3/ Includes cost of septic tanks
4/ Will not be cost shared

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TABLE 3 - STRUCTURE DATA

Water Control Structures
(Type 1)

Bayou Bonne Idee Watershed, Louisiana

Site No.	Type of Structure	Drainage Area (sq. mi.)	Design Flow (cfs)	Conduit Diam. (inches)	Conduit Length (feet)	Conduit Flow Line (ft. msl.)	Weir Crest Elevation (ft. msl.)	Weir Crest Length (feet)
1	Trapezoidal Weir with Conduit and Slide Gate	71.1	5497	60	148	65	78	150
2	Existing Trapezoidal Weir with Conduit and Slide Gate added	62.4	5015	60	150	70	83	100
3	Existing Rectangular Weir with Conduit and Slide Gate added	46.4	4048	60	122	77	86	66
4	Trapezoidal Weir with Conduit and Slide Gate	37.9	3500	54	120	81	88	100

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TABLE 3A - STRUCTURE DATA

CHANNELS

Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type[1] of Work	Before Project Type of Channel[1]	Before Project Flow Condition[1]
M-1	3110+00	4.20	175	182	95.0	.0000450	A =	551	P =	254	.050	.050	.33	.33		VI	N	E
	2906+00	10.51	376	379	93.6	.0000230	A =	842	P =	319	.030	.030	.45	.45		IV	N	I
	2890+00	10.76	384	398	93.2	.0000500	A =	751	P =	316	.035	.035	.53	.53		IV	N	I
	2555+00	14.50	492	493	92.2	.0000100	A =	1589	P =	276	.049	.049	.31	.31		IV	M	S
	2365+00	35.41	1036	1067	92.0	.0000500	A =	1749	P =	366	.049	.049	.61	.61		IV	M	S
	2079+10	37.90	1096	1111	90.9	.0000200	A =	2221	P =	340	.046	.046	.50	.50		IV	M	S
	2078+90	37.90	1096	1109	90.4	.0000240	A =	2053	P =	337	.045	.045	.54	.54		IV	M	S
	1748+50	42.16	1198	1200	89.8	.0000050	A =	3530	P =	437	.039	.039	.34	.34		IV	M	S
	1426+30	46.43	1298	1325	89.4	.0000025	A =	4142	P =	505	.030	.030	.32	.32		IV	M	S
	1426+20	46.43	1298	1340	86.8	.0000150	A =	2482	P =	405	.036	.036	.54	.54		IV	M	S
	1011+00	57.60	1553	1576	86.2	.0000070	A =	3216	P =	326	.037	.037	.49	.49		IV	M	S
	541+00	62.41	1661	1743	86.0	.0000020	A =	5126	P =	478	.030	.030	.34	.34		IV	M	S
	477+50	63.28	1680	1690	81.3	.0000150	A =	3073	P =	431	.039	.039	.55	.55		VI	N	I
	313+00	66.66	1755	1779	81.0	.0000140	A =	3235	P =	372	.043	.043	.55	.55		IV	N	I
	21+00	71.42	1858	1889	80.4	.0000210	A =	2819	P =	334	.042	.042	.67	.67		IV	N	I
	0+00	71.59	1862	1875	72.0	.0050000	A =	477	P =	66	.100	.100	3.93	3.93		VI	N	I
L-1B	195+60	0.02	1	8	94.5	.00150	A =	8	P =	8	.055	.055	1.05	1.05		VI	M	E
	180+00	0.20	12	10	92.2	.00150	A =	10	P =	10	.055	.055	1.05	1.05		VI	M	E
	100+00	1.48	65	68	89.0	.00040	8	.073	4.0	1.5:1	.045	.025	1.21	2.46		II	M	E
	71+00	1.78	76	75	88.3	.00025	10	.028	4.1	1.5:1	.040	.025	1.13	2.03		II	M	E
	0+00	4.29	155	212	86.5	.00025	A =	549	P =	176	.130	.130	.39	.39	8,600	VI	N	S

1/ See Attached Coding System for Inventory of Channel Work

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(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type[1] of Work	Before Project: Type of Channel[1]	Before Project: Flow Condition[1]
L-1D	279+75	0.02	1	8	94.4	.00008	4	.008	2.5	1.5:1	.045	.025	.39	.83		II	M	E
	269+00	0.29	14	17	94.4	.00008	6	.253	3.3	1.5:1	.045	.025	.47	.97		II	M	E
	108+00	5.08	170	173	92.9	.00008	18	.019	6.3	1.5:1	.035	.0225	1.00	1.67		II	M	E
	20+00	9.98	305	341	92.2	.00008	27	.008	7.0	1.5:1	.035	.0225	1.09	1.86		II	M	E
	0+00	10.15	309	341	92.0	.00008	27	.008	7.0	1.5:1	.035	.0225	1.09	1.86	84,200	II	M	S
L-1D-1	119+10	0.79	39	47	96.1	.00035	8	.059	3.1	1.5:1	.045	.025	.99	2.08		II	M	E
	60+00	1.98	83	86	94.0	.00035	8	.059	4.4	1.5:1	.040	.025	1.34	2.39		II	M	E
	0+00	2.65	106	110	92.9	.00015	14	.028	5.0	1.5:1	.040	.025	1.02	1.79	12,500	II	M	E
L-1E	235+00	0.54	28	29	97.8	.00070	6	.098	2.5	1.5:1	.045	.025	1.21	2.60		II	M	E
	189+00	1.29	58	60	94.6	.00070	6	.098	3.6	1.5:1	.045	.025	1.46	2.99		II	M	E
	182+00	2.30	94	106	94.1	.00070	8	.071	4.1	1.5:1	.040	.025	1.83	3.29		II	M	E
	175+00	2.83	112	113	94.0	.00015	12	.100	5.4	1.5:1	.040	.025	1.04	1.81		II	M	E
	120+00	5.16	183	194	93.2	.00015	14	.034	6.3	1.5:1	.035	.0225	1.31	2.21		II	M	E
	18+00	8.13	259	1535	92.6	.00005	A =	3367	P =	635	.070	.070	.46	.46		VI	N	S
	0+00	8.24	262	344	92.2	.00025	A =	480	P =	154	.070	.070	.72	.72	29,400	VI	N	S
L-1F	220+00	0.36	20	87	102.9	.00100	A =	59	P =	23	.060	.060	1.47	1.47		VI	M	E
	165+00	1.64	71	87	97.4	.00100	A =	59	P =	23	.060	.060	1.47	1.47		VI	M	E
	115+00	2.38	94	98	96.6	.00015	12	0	5	1.5:1	.040	.025	1.00	1.76		II	M	E
	92+00	2.72	108	188	96.3	.00015	A =	355	P =	122	.070	.070	.53	.53		VI	M	E
	80+00	3.69	139	188	96.1	.00015	A =	355	P =	122	.070	.070	.53	.53		VI	N	S
	40+00	4.24	146	553	95.9	.00005	A =	2000	P =	800	.070	.070	.28	.28		VI	N	S
	27+50	4.24	146	201	95.7	.00020	A =	317	P =	130	.060	.060	.63	.63		VI	N	S
	0+00	4.53	155	170	95.1	.00020	A =	240	P =	83	.060	.060	.71	.71	8,800	VI	N	E

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(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type[1] of Work	Before Project: Type of Channel[1]	Before Project: Flow Condition[1]
M-2	397+91	0.48	27	29	92.0	.00025	8	.041	2.9	1.5:1	.045	.025	.82	1.70		II	M	E
	384+00	0.63	32	34	91.4	.00025	8	.041	3.2	1.5:1	.045	.025	.84	1.78		II	M	E
	339+50	1.05	47	60	90.3	.00025	8	.041	4.0	1.5:1	.040	.025	1.08	1.94		I	O	E
	172+08	3.24	126	123	85.8	.00025	10	.041	5.3	1.5:1	.040	.025	1.29	2.27		II	M	E
	87+00	7.20	249	258	83.7	.00025	14	.026	6.4	1.5:1	.035	.0225	1.71	2.87		II	M	E
	56+00	7.31	252	739	83.0	.00025	A =	642	P =	128	.060	.060	1.16	1.16		VI	M	E
	0+00	10.25	330	1444	74.0	.00150	A =	642	P =	128	.075	.075	2.25	2.25	33,500	VI	N	E
L-2A	104+94	0.27	17	18	85.2	.00030	4	.053	2.8	1.5:1	.045	.025	.79	1.68		II	M	E
	70+78	0.45	26	27	84.1	.00030	4	.053	3.4	1.5:1	.045	.025	.88	1.82		II	M	E
	46+00	0.83	43	45	83.4	.00030	8	.033	3.5	1.5:1	.045	.025	.98	2.02		II	M	E
	24+50	0.95	45	85	82.6	.00030	A =	137	P =	78	.060	.060	.62	.62		VI	N	E
	0+00	1.08	47	3050	73.7	.00365	A =	720	P =	151	.060	.060	4.24	4.24	1,800	VI	N	E
L-2A-1	31+25	0.04	3	14	85.4	.00040	3	.040	2.5	1.5:1	.045	.025	.83	1.79		II	M	E
	0+00	0.24	15	14	84.2	.00040	3	.040	2.5	1.5:1	.045	.025	.83	1.79	1,300	II	M	E
L-2B	69+58	0.26	16	22	90.0	.00070	4	.10	2.5	1.5:1	.045	.025	1.14	2.45		II	M	E
	23+00	1.23	59	63	86.7	.00070	6	.10	3.7	1.5:1	.045	.025	1.48	3.03		II	M	E
	0+00	1.71	80	86	85.1	.00070	6	.10	4.3	1.5:1	.045	.025	1.61	3.23	13,900	I	O	E
M-3	49+42	1.80	83	86	86.6	.00030	10	.043	4.2	1.5:1	.040	.025	1.26	2.25		I	O	E
	75+82	2.18	97	98	85.8	.00030	10	.043	4.5	1.5:1	.040	.025	1.30	2.31	13,200	I	O	E

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(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type[1/] of Work	Before Project: Type of Channel[1/]	Before Project: Flow Condition[1/]
M-4	308+50	0.86	45	48	87.5	.00010	6	.019	4.9	1.5:1	.040	.025	.73	1.30		II	N	E
	282+00	1.04	52	52	87.2	.00010	6	.019	5.1	1.5:1	.040	.025	.75	1.32		II	N	E
	235+00	1.72	80	81	86.8	.00010	10	.019	5.4	1.5:1	.040	.025	.83	1.45		I	O	E
	211+00	2.27	101	102	86.5	.00010	12	.022	5.7	1.5:1	.040	.025	.87	1.52		II	N	E
	119+95	4.19	168	171	85.6	.00010	12	.010	6.9	1.5:1	.035	.0225	1.11	1.85		II	M	E
	75+00	9.23	290	289	85.2	.00010	24	.010	6.9	1.5:1	.035	.0225	1.22	2.03		II	M	E
	40+00	9.89	310	345	84.5	.00010	24	.013	7.0	1.5:1	.030	.0225	1.43	2.05		II	N	E
	29+00	10.13	317	616	84.4	.00010	A = 357		P = 55		.030	.0225	1.73	2.31		IV	N	E
	0+00	10.86	338	1376	76.3	.00170	A = 445		P = 67		.070	.070	3.09	3.09	145,000	VI	N	E
L-4A	89+57	0.07	5	19	89.7	.00050	4	.098	2.5	1.5:1	.045	.025	.96	2.08		I	O	E
	60+00	0.56	29	33	88.3	.00050	4	.098	3.3	1.5:1	.045	.025	1.12	2.32		I	O	E
	0+00	1.05	39	43	85.3	.00050	6	.050	3.3	1.5:1	.045	.025	1.18	2.44	17,200	I	O	E
L-4B	100+43	0.25	16	17	89.9	.00030	5	.098	2.5	1.5:1	.045	.025	.77	1.65		I	O	E
	93+08	0.41	22	23	89.7	.00030	5	.098	2.9	1.5:1	.045	.025	.84	1.75		I	O	E
	33+00	1.47	59	53	87.9	.00030	5	.039	4.4	1.5:1	.045	.025	1.04	2.09		II	M	E
	0+00	3.71	122	144	86.9	.00030	8	.025	5.9	1.5:1	.040	.025	1.45	2.53	27,700	II	M	E
L-4B-1	116+71	0.19	8	16	90.1	.00020	4	.072	2.5	1.5:1	.045	.025	.64	1.30		I	O	E
	63+00	0.92	40	42	88.9	.00020	5	.027	4.3	1.5:1	.045	.025	.85	1.69		I	O	E
	17+00	1.38	49	52	88.1	.00020	5	.027	4.6	1.5:1	.040	.025	.95	1.74		II	N	E
	0+00	1.55	52	56	87.4	.00020	5	.027	4.7	1.5:1	.040	.025	.98	1.76	32,700	II	M	E
L-4C	56+47	0.13	9	10	88.1	.00010	5	.062	2.5	1.5:1	.045	.025	.44	.96		I	O	E
	0+00	0.86	45	48	87.5	.00010	6	.062	4.9	1.5:1	.040	.025	.73	1.30	13,700	I	O	E

August 1973

(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type of Work[1]	Before Project Type of Channel[1]	Before Project Flow Condition[1]
M-5	86+40	0.53	30	29	87.9	.00010	5	.036	4.3	1.5:1	.045	.025	.59	1.20		II	M	E
	15+00	1.42	67	67	87.2	.00010	9	.020	5.2	1.5:1	.045	.025	.77	1.41		II	M	E
	0+00	1.60	75	465	87.0	.00010	A =	684	P =	119	.070	.070	.68	.68	5,500	VI	N	E
M-6	169+89	0.18	12	12	88.4	.00010	5	.039	2.6	2:1	.045	.025	.45	.97		II	M	E
	133+82	0.58	32	33	88.0	.00010	10	.033	3.4	2:1	.045	.025	.57	1.19		II	M	E
	67+10	1.64	77	79	87.8	.00010	10	.033	5.0	2:1	.040	.025	.79	1.40		II	M	E
	32+00	3.26	138	150	87.0	.00010	24	.010	5.0	2:1	.040	.025	.88	1.56		II	M	E
	18+00	3.39	141	150	86.9	.00010	24	.010	5.0	2:1	.040	.025	.88	1.56		II	N	E
	0+00	3.67	151	1063	86.7	.00010	A =	1194	P =	175	.060	.060	.89	.89	89,000	VI	N	E
L-6A	105+40	0.08	6	8	90.6	.00010	4	.148	2.5	1.5:1	.045	.025	.43	.93		II	M	E
	28+49	0.81	43	45	89.5	.00010	5	.032	5.0	1.5:1	.040	.025	.72	1.28		II	M	E
	0+00	1.29	63	64	89.2	.00010	5	.021	5.9	1.5:1	.040	.025	.79	1.39	21,100	II	M	E
L-6A-1	28+18	0.16	11	10	89.8	.00010	5	.053	2.6	1.5:1	.045	.025	.45	.97		I	O	E
	0+00	0.32	20	20	89.5	.00010	5	.053	3.6	1.5:1	.045	.025	.53	1.11	4,600	I	O	E
M-7	875+00	1.04	52	50	93.9	.00025	10	.038	3.5	1.5:1	.045	.025	.93	1.90		II	M	E
	821+50	1.64	70	68	92.6	.00025	10	.038	3.9	1.5:1	.040	.025	1.10	1.98		II	M	E
	728+50	3.46	125	124	90.2	.00025	10	.130	5.3	1.5:1	.040	.025	1.30	2.27		I	O	E
	726+00	6.82	234	261	90.2	.00025	12	.130	6.8	1.5:1	.035	.0225	1.73	2.90		II	M	E
	627+00	10.63	341	340	88.7	.00015	16	.067	8.0	1.5:1	.035	.0225	1.52	2.51		II	M	E
	575+00	30.70	873	889	87.9	.00015	27	.019	9.0	1.5:1	.025	.020	2.44	3.22		II	M	E
	494+00	34.66	916	912	86.9	.00008	36	.012	9.5	1.5:1	.025	.020	1.91	2.51		II	M	E
	213+24	52.81	1306	1290	84.4	.00008	36	.010	11.5	1.5:1	.025	.020	2.11	2.76		II	M	I
	208+50	52.96	1308	2364	84.0	.00008	A =	760	P =	120	.025	.025	3.11	3.11		VI	M	I
	30+34	80.40	1853	2046	79.5	.00025	A =	660	P =	110	.025	.025	3.10	3.10	410,000	VI	M	I

(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Before Project: Type of Work	Before Project: Type of Channel 1/	Before Project: Flow Condition 1/
L-7C	133+50	2.84	119	124	85.0	.00007	15	.017	6.0	1.5:1	.036	.0225	86	1.49		II	M	E
	0+00	4.81	185	186	84.1	.00007	15	.017	7.2	1.5:1	.034	.0225	1.00	1.60	30,000	II	M	E
L-7D	201+00	0.07	5	19	96.0	.00050	4	.064	2.5	1.5:1	.045	.025	.96	2.08		I	0	E
	148+00	0.53	30	31	93.4	.00050	5	.064	3.0	1.5:1	.045	.025	1.09	2.29		I	0	E
	122+00	1.17	57	59	91.8	.00050	5	.050	4.1	1.5:1	.045	.025	1.29	2.61		II	M	E
	0+00	16.01	475	477	85.4	.00030	25	.030	6.6	1.5:1	.035	.0225	2.07	3.45	124,000	II	M	E
L-7D-2	277+00	0.34	20	21	94.0	.00050	7	.116	2.3	1.5:1	.045	.025	.97	2.18		II	M	E
	220+00	3.27	129	132	91.2	.00050	7	.093	5.2	1.5:1	.040	.025	1.72	3.03		II	M	E
	0+00	8.11	274	274	88.7	.00010	25	.010	6.6	1.5:1	.035	.0225	1.19	2.00	172,000	II	M	E
L-7H	160+00	2.04	87	90	90.3	.00020	12	.049	4.4	1.5:1	.039	.0225	1.10	2.13		II	M	E
	0+00	6.54	224	233	86.9	.00020	13	.023	6.6	1.5:1	.035	.0225	1.54	2.58	58,000	II	M	E
L-7I	360+00	2.03	69	106	101.6	.00050	A =	90	P =	29	.060	.060	1.18	1.18		VI	M	E
	349+50	2.19	75	106	101.0	.00050	A =	90	P =	29	.060	.060	1.18	1.18		VI	M	E
	313+77	2.79	98	105	99.2	.00050	9	.062	4.2	1.5:1	.039	.0225	1.63	3.18		II	M	E
	200+00	6.56	217	218	92.0	.00060	12	.062	5.1	1.5:1	.037	.0225	2.18	3.94		II	M	E
	140+50	7.81	256	256	91.1	.00015	20	.022	6.2	1.5:1	.034	.0225	1.41	2.31		II	M	E
	0+00	17.53	513	506	88.7	.00015	27	.016	7.2	1.5:1	.029	.020	1.86	2.90	144,000	II	M	E
L-7I-1	164+00	0.03	2	14	99.4	.00050	A =	22	P =	18	.060	.060	.63	.63		VI	M	E
	131+00	0.70	36	34	97.8	.00050	A =	44	P =	27	.060	.060	.77	.77		VI	M	E
	42+00	2.54	109	101	93.3	.00050	6	.105	4.7	1.5:1	.039	.0225	1.64	3.15		II	M	E
	0+00	6.78	233	242	91.2	.00050	12	.050	5.6	1.5:1	.036	.0225	2.12	3.74	17,000	II	M	E

(continued)

Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type[1/] of Work	Before Project: Type of Channel[1/]	Before Project: Flow Condition[1/]
M-9	372+50	1.28	55	640	93.2	.00010	A =	722	P =	140	.050	.050	.89	.89		VI	M	E
	192+00	5.47	175	519	91.4	.00010	A =	714	P =	187	.050	.050	.73	.73		VI	M	E
	0+00	9.33	288	480	89.5	.00010	A =	571	P =	120	.050	.050	.84	.84	0	VI	N	E
M-10	204+75	0.68	32	37	90.1	.00015	A =	67	P =	30	.055	.055	.56	.56		VI	M	E
	152+00	1.32	54	94	89.3	.00015	A =	126	P =	37	.055	.055	.75	.75		VI	M	E
	134+75	2.43	95	110	89.0	.00015	A =	107	P =	34	.038	.0225	1.03	1.74		IV	M	E
	60+00	6.09	206	206	87.9	.00015	17	.014	6.0	1.5:1	.035	.0225	1.32	2.22		II	M	E
	31+00	6.48	218	224	87.6	.00015	A =	257	P =	60	.055	.055	.87	.87		VI	M	E
	0+00	7.67	247	284	87.0	.00015	A =	214	P =	43	.040	.025	1.33	2.13	3,900	IV	M	E
M-11	430+00	34.00	926	934	95.1	.00015	27	.017	8.8	2:1	.025	.020	2.38	3.15		II	M	I
	212+35	37.08	980	995	91.4	.00015	27	.017	9.1	2:1	.025	.020	2.42	3.20		II	M	I
	69+00	57.84	1386	1411	89.2	.00015	32	.015	10.2	2:1	.025	.020	2.64	3.46		II	M	I
	45+00	72.44	1680	2942	88.2	.00025	A =	750	P =	90	.025	.020	3.93	4.91		IV	M	I
	0+00	73.19	1693	2109	87.0	.00025	A =	1110	P =	137	.050	.050	1.90	1.90	88,700	VI	M	I
L-11A	236+50	7.82	272	279	96.2	.00040	18	.049	5.3	1.5:1	.035	.0225	2.03	3.47		II	M	E
	158+00	9.84	329	339	93.1	.00040	18	.049	5.9	1.5:1	.035	.0225	2.14	3.63		II	M	E
	0+00	14.19	408	442	90.7	.00015	18	.018	8.1	1.5:1	.030	.0225	1.81	2.57	137,100	II	M	E
L-11B	207+30	1.34	62	62	95.0	.00017	10	.049	4.1	1.5:1	.040	.025	.93	1.68		II	M	E
	0+00	5.58	201	202	91.4	.00017	12	.021	6.6	1.5:1	.035	.0225	1.40	2.35	66,500	II	M	E
L-11C	388+00	1.33	62	65	100.7	.00050	12	.096	3.1	1.5:1	.045	.025	1.26	2.63		II	M	E
	276+50	5.63	207	206	95.2	.00050	12	.178	5.4	1.5:1	.040	.025	1.90	3.32		II	M	E
	151+00	10.05	321	324	92.7	.00020	14	.062	7.6	1.5:1	.035	.0225	1.68	2.77		II	M	E
	0+00	13.83	390	397	91.9	.00005	24	.012	9.1	1.5:1	.030	.0225	1.16	1.63	162,500	II	M	E

(continued)
Table 3A - Structure Data Channels
Bayou Bonne Idee Watershed, Louisiana

Channel	Station	Drainage Area Sq. Mi.	Capacity cfs Req'd	Capacity cfs Design	Water Surface Elev.	Hydraulic Gradient (ft/ft)	Channel Dimensions: Bottom Width (ft)	Bottom Grade (%)	Depth of flow (ft)	Side Slopes	"n" Value Aged	"n" Value As Built	Velocities ft./sec. Aged	Velocities ft./sec. As Built	Excavation Cu.-Yds.	Type of Work 1/	Before Project: Type of Channel	Before Project: Flow Condition
M-12	234+00	0.70	36	36	96.0	.00030	8	.062	3.1	1.5:1	.045	.025	.92	1.93		II	M	E
	150+00	2.18	94	95	93.5	.00030	8	.050	4.8	1.5:1	.040	.025	1.30	2.31		II	M	E
	0+00	4.34	164	165	92.0	.00010	10	.016	7.2	1.5:1	.035	.0225	1.10	1.84	45,700	II	M	E

In addition to the above, there are approximately 40 miles of estimated channels, not surveyed, which need to be improved. Of this total, it is estimated that there are 29 miles of "M" channels, 6 miles of "N" channels, and 5 miles of "O" channels. These channels are shown on the Project Map, Figure 8.

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Coding System for

Inventory of Channel Work

Type of Work

I - establishment of new channel including necessary stabilization measures

II - Enlargement or realignment of existing channel or stream

III - cleaning out natural or manmade channel (includes bar removal and major clearing and snagging operation)

IV - clearing and removal of loose debris within channel section

V - stabilization, by continuous treatment or localized problem areas, as primary purpose (present capacity adequate)

VI - present capacity adequate, no work proposed

Type of Channel Before Project

M - manmade ditch or previously modified channel

N - an unmodified, well-defined natural channel or stream

O - no or practically no defined channel

Flow Condition Before Project

Pr - perennial: flow at all times except during extreme drought

I - intermittent: continuous flow during some seasons of the year but little or no flow during other seasons

E - ephemeral: flow only during periods of surface runoff, otherwise dry

S - ponded water: no noticeable flow, caused by lack of outlet or high ground water table

TABLE 4 - ANNUAL COST

Bayou Bonne Idee Watershed, Louisiana

(Dollars)[1/]

Evaluation Unit	Amortization of Installation Cost[2/]	Operation and Maintenance Cost	Total
I	23,100	9,700	32,800
II	63,000	19,800	82,800
III	9,200	3,000	12,200
IV	32,800	11,200	44,000
V	103,600	44,800	148,400
Project Administration	37,300	-	37,300
GRAND TOTAL	269,000	88,500[3/]	357,500

1/ Price base 1973.
2/ 50 years @ 5.5-percent interest.
3/ Includes $29,800 for operation, maintenance and replacement for the recreational development.

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Bayou Bonne Idee Watershed, Louisiana

(Dollars)[1/]

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
Floodwater			
Crop and Pasture	434,600	95,500	339,100
Nonagricultural			
Road and Bridge	27,700	6,400	21,300
Subtotal	462,300	101,900	360,400
Sediment			
Channel Deposition			
(off site)	25,000	11,000	14,000
Subtotal	25,000	11,000	14,000
Indirect	4,900	1,100	3,800
TOTAL	492,200	114,000	378,200

1/ Adjusted normalized prices.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Bayou Bonne Idee Watershed, Louisiana

(Dollars)

Evaluation Unit	Average Annual Benefits[1/]						Average Annual Cost[2/]	Benefit Cost Ratio
	Damage Reduction	More Intensive Land Use	Drainage	Recreation	Secondary	Total		
I	56,700	11,800	53,700	-	24,200	146,400	32,800	4.5:1
II	174,500	36,900	166,300	-	72,900	450,600	82,800	5.4:1
III	10,900	2,000	8,800	-	6,000	27,700	12,200	2.3:1
IV	47,700	10,000	44,700	-	20,600	123,000	44,000	2.8:1
V	88,400	13,300	60,100	107,400	38,300	307,500	148,400	2.1:1
Project Administration	-	-	-	-	-	-	37,300	
GRAND TOTAL	378,200	74,000	333,600	107,400	162,000	1,055,200	357,500	3.0:1

1/ Adjusted normalized prices.

2/ From Table 4

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INVESTIGATIONS AND ANALYSES

Hydraulic and Hydrologic Investigations

Design flows for channel improvement were computed using the emperical Cypress Creek Formula, $Q=CM^{5/6}$, where "Q" is the required capacity in cubic feet per second, "C" is a coefficient related to the level of protection desired, and "M" is the drainage area in square miles. Long-term observations by drainage engineers have verified the general relationship between drainage area and required discharge. For many years the value of "C" has been estimated by observing channels which perform satisfactorily. Recent research has more specifically identified the relationship between drainage area and required discharge. This relationship was used to determine the correct "C" value for three levels of protection (1.5-year, 3-year, 5-year). Designs were made on all channels for each of these three levels of protection. After all costs were developed, the 3-year level of protection was chosen.

The "C" value previously referred to for various levels of protection is associated with cropland; however, other land uses are deserving of consideration. Areas which are primarily forest land require a measure of flood prevention and drainage; however, areas of this type are much more tolerant of excess water and consequently require a much lower level of protection than cropland. In keeping with this requirement, waterways were designed to convey much lower volumes of runoff from forest land areas than cropland areas. In cropland, the excess water will be removed in approximately 1 day. The channels were designed to accept runoff from forest land at the rate it runs off naturally. Normally, this will be accomplished in approximately 5 days. This accommodation of natural runoff will safely protect the forest land areas from significant damages while at the same time, it will discourage converting the forest land to cropland, as this natural runoff rate is not sufficient for cropland.

Structural measures were designed to prevent significant damages from a storm with a recurrance interval of about 3 years or a storm which could be expected to occur 30 to 35 times in a century. The peak flow associated with a storm of this magnitude will not be confined to the waterways, rather, overbank flow can be expected. The duration will be controlled such that significant overbank flow will cease approximately 24 hours after cessation of the storm. Out-of-bank flow of this duration will not produce significant crop damages.

The reduction in average annual damaging overbank flow to be affected by project channels varies with evaluation units. Proportional runoff volumes were plotted as ordinates against probability. Proportional runoff volumes corresponding to present and with project probability of damaging overbank flooding were set as lower limits of areas under the proportional runoff curves. The areas represent

average annual damaging overbank flow volume and were assumed to be proportional to average annual water induced damages. This curve was plotted for each evaluation unit and level of protection studied. The percent reduction varied between units due to a variation in present conditions level of protection.

Approximately 35 cross sections along with bridge and culvert sections were surveyed on Bayou Bonne Idee. These sections along with pertinent data were processed through an IBM 1130 computer to develop water surface profiles. These profiles were developed for present conditions and with project conditions.

With project condition includes two additional water control structures and removal of vegetation to an extent that will result in retardance. The locations of these water control structures are described in the WORKS OF IMPROVEMENT TO BE INSTALLED. A full range of discharges was used in order that a stage frequency analysis could be made for any reach of the Bayou.

Stage storage curves were developed on Bayou Bonne Idee for each reach controlled by the four water control structures. The permanent water was routed through various combinations of drawdown rates to determine the size conduit required to achieve the desired result. The size conduits chosen will draw down the reach at a rate of 4 inches per day.

Design flows for the grade stabilization structures were computed as described under Engineering Investigations.

Engineering Investigations

The following study was made to determine the structural measures which would be installed:

1. Using U.S. Geological Survey quadrangle maps as a base, a planning map was prepared showing the watershed boundary, proposed channels, drainage patterns, systems of roads, and other pertinent data.

2. Floodwater retarding structures were considered but found inapplicable since the topography does not lend itself to that type measure.

3. The Sponsors agreed upon the locations of channels they wished considered for improvement.

4. Complete designs were made on these channels which would provide 1.5-year, 3-year, and 5-year levels of protection. Complete designs and cost estimates were developed for each of the three levels of protection.

5. The cost of diverting channel M-7 through channel L-7C into channel M-4 which was diverted through channel M-2 was developed.

6. Boeuf River hydrographs were developed and evaluated as to the effects on drainage of the watershed. Levees and floodgates along the Boeuf River were designed and costs developed.

7. With assistance from the Sponsors, the watershed was divided into several areas of priority. The first priority is that area in greatest need of immediate attention. This is the area drained by channels numbered M-2, M-3, M-4, M-5, and M-6 together with all laterals draining into these mains. Sufficient surveys and designs to allow an invitation for bids and preparation of land rights maps were made for this area.

The following abbreviated survey procedure was used on the remaining areas:

Field surveys were made on a representative sample of the remaining channels. Designs and cost estimates for the planned measures of these surveyed channels were developed. Design flow for channel improvement was computed from general formulae as described under Hydraulic and Hydrologic Investigations. Costs of the unsurveyed channels were estimated based upon the surveyed channels and other watersheds with similar characteristics.

The five grade stabilization structures are planned to prevent future channel erosion. These structures are to be placed in the channel to control a drop in water surface elevation or channel bottom elevation. The island method of construction will be used so that excessive flows will be diverted around the structures and will not overtop the embankments. These structures are designed to convey 150 percent of the drainage flow and are considered to be integral parts of the channels, and as such they have a design life of 50 years. These structures will assure that the channels will function properly and will reduce the amount of sediment which enters Boeuf River.

The existing drainage system was extended and improved about 25 years ago. Only a small number of main channels have been dug in recent years. In areas where project channels will outlet through these old channels, the outlets were investigated to determine their stability. Channels are designed so that excavation will be terminated prior to entering potentially erodible outlet sections. Outlet sections that are covered with natural vegetation and show no evidence of active erosion are considered safe and stable outlets for project channels where no additional drainage area is added to the channel.

Estimated unit costs of structural measures were based on the going rate of similar work in the general area with adjustment for special conditions which exist. Land rights maps for all channels in the area of highest priority were prepared. Some locations and realignments of channels in the remaining priority areas will need to be made during the operations stage of the project.

The Sponsors furnished ownership information. The locations of the proposed channels were checked against the ownership map to eliminate channels benefiting only one ownership or resulting, primarily, in bringing new land into agricultural production.

After the land treatment measures and those structural measures needed for flood prevention and drainage had been determined, a table was developed which gave the cost of each measure. The summation of the total costs for all needed measures represents the estimated installation costs of the project (table 1). A second table was developed to show the annual costs of installation and operation and maintenance of the structural measures (table 4). Pertinent physical data for individual structural measures are summarized in tables 3 and 3A.

Land Treatment

The Conservation Needs Inventory, published by the U.S. Department of Agriculture under the leadership of the Soil Conservation Service, provided information on capability units by land use for Morehouse Parish. Agricultural workers in the parish supplied information on soils, capability units, and land use. With this information and the technical guides, the land treatment needs for the watershed were developed.

Conservation measures applied to date were determined from farm operators and from a study of field office records. This information was used in preparing table 1A.

Conservation measures to be applied during the installation period were determined after careful consideration of the following factors:

1. Basic needs of the watershed.

2. Personnel available for planning in the field office.

3. Experience gained from the installation of other projects.

4. Interviews with farm operators regarding their resources, desires, and willingness to install needed land treatment measures.

Sedimentation Investigations

Sheet erosion was calculated by use of the Musgrave Equation. The Musgrave Equation states that:

$$E = FR\left(\frac{S}{10}\right)^{1.35}\left(\frac{L}{72.6}\right)^{.35}\left(\frac{P_{30}}{1.375}\right)^{1.75}$$

Where: E = Sheet erosion, tons per acre per year
F = Soil factor, basic erosion rate in tons per acre per year for each soil series or unit

R = Cover factor
S = Slope in feet per 100 feet
L = Length of slope in feet
P_{30} = Maximum 30-minute, 2-year frequency rainfall in inches

For discussion on the background of this formula, see page 38 of "Applied Sedimentation," edited by P. D. Trask.

For purposes of computing sedimentation, the watershed was divided into two systems; the Bayou Bonne Idee drainage area and the remainder of the watershed. This distinction allowed a more definite approach to the solution of the equation as it grouped the soils and slopes.

Present cover factors were based on observation and records as to amounts and types of land treatment measures that had been applied. Future without project cover factors were estimated based on the rate of land treatment measures that had been applied in the past. Project cover factors were based on an accelerated rate of application of land treatment measures due to accelerated technical assistance.

The sediment yield to a specific point was calculated based on a sediment delivery ratio. This ratio is based primarily on drainage area and its accuracy has been established through sedimentation surveys. Trap efficiency of the water control structures in Bayou Bonne Idee has been estimated based on previous sedimentation surveys conducted by the Agricultural Research Service and the Soil Conservation Service.

Suspended sediment was estimated. The estimates were based on the average annual sediment rate and the average annual runoff. The amount of channel bank erosion which will occur due to construction has been estimated based on the type of material being disturbed, the size of the channel, the method of construction, and the vegetative practices which are being instituted as part of the construction plan. A sequence of construction has been selected so that the reduction in sediment due to land treatment and structural measures will exceed the amount of erosion instigated by construction.

Geologic Investigations

Channel stability investigations were conducted by borings and by analyzing the material at selected points of typical channels. Determination of a stable channel was based on the "allowable velocity" approach as developed by several authors among which were S. F. Fortier, F. C. Scobey, and E. W. Lane. The Russian publication "Standards for Permissible Non-Eroding Velocities"; Bureau of the Methodology of the Hydro-Energo Plan; Gidrotekhniches Koye Stroitel'stro. Obedinennoe Nanchno-Teknicheskoe 12 dated 'stro., Moscow, USSR, May 1936, outlines a similar method.

Borings were made in the vicinity of all proposed water control structures, and their designs were made based on the materials encountered.

INVESTIGATIONS

Forestry Investigations

A field survey showed ground cover, forest, and hydrologic conditions and treatment needs. This survey, supporting data, and information from other agencies and forestry officials determined the amount of remedial measures needed. These needs were adjusted to meet the anticipated participation by landowners in the watershed.

Fish and Wildlife Investigations

A reconnaissance of this watershed was made by biologists of the U.S. Fish and Wildlife Service, the Louisiana Wild Life and Fisheries Commission, and the Soil Conservation Service using maps and other pertinent data provided by the Soil Conservation Service.

Prior to visiting the area, a map study was made and any natural areas that were in the proximity of proposed works were noted. All of the watershed was later covered and the areas previously noted were studied and checked.

Subsequent to the reconnaissance of the watershed, the U.S. Fish and Wildlife Service prepared a report showing their findings and recommendations. This report was reviewed and concurred in by the Louisiana Wild Life and Fisheries Commission. Recommendations contained in their report for maintaining or improving fish and wildlife habitat are contained in this plan.

Preproject habitat conditions and populations of game and fish species were determined from a review of available literature, data provided by the Louisiana Wild Life and Fisheries Commission, and field investigations. Three 1-acre rotenone samples were taken in Bayou Bonne Idee above Water Control Structure No. 2 during July 1973. Fish populations will be monitored over a period of years in this project and other projects in the State to establish better population data. Postproject populations were estimated after a determination was made of the habitat lost or gained due to project action.

An inventory of wetland types, lakes, and ponds was conducted. Wetland types were classified according to data contained in USDI Circular No. 39. Project effects were also determined for wetland types, lakes, and ponds.

Two joint surveys by the Sponsors, Louisiana Wild Life and Fisheries Commission, and Soil Conservation Service, were made following completion of the plan to insure the plan's compliance with necessary safeguards for fish and wildlife resources.

In consultation with the Louisiana Wild Life and Fisheries Commission and the U.S. Fish and Wildlife Service, several alternatives were given

to reestablishing vegetation on spoil areas. In considering these alternatives, the commission pointed out that:

1. Little work had been done on hardwood planting in bottom land areas.

2. Seedlings have a poor survival rate unless the site was well prepared.

3. Cultivation is almost a necessity in these areas where numerous vines and other vegetation would soon overtop and suppress the planted seedlings.

4. Root sprouts from the original vegetation would soon crowd out and outgrow the planted seedlings in a matter of 2 years.

The U.S. Fish and Wildlife Service pointed out that:

1. Various species of oaks tolerate flooding such as water oak, nuttal oak, cow oak, and overcup oak. Species which do not tolerate flooding would be cherrybark oak, shumard oak, and sawtooth oak.

2. Site preparation is necessary in bottom land situations.

3. Seeding a cover crop such as ryegrass and allowing natural succession plus planting some saplings of selected hardwood species to give mast production a shorter time lag is an alternative where little care is feasible.

4. Encourage planting a variety of mast producing species and not allowing cottonwood or willow to completely take over an area.

After studying this data, the Sponsors and the Soil Conservation Service personnel agreed that establishing ground cover and allowing natural regeneration is more practical than planting hardwoods. This same opinion is expressed in a letter from the Louisiana Wild Life and Fisheries Commission dated December 28, 1972.

Economic Investigations

Basic data were obtained from local farmers, agricultural workers, State and parish officials, experiment station, and other agricultural published and unpublished data, the 1970 U.S. Census of Population, and the 1969 Census of Agriculture. Parish statistics used were considered representative of the watershed.

Present land use in the watershed was developed after several reconnaissance trips and close studies of recent aerial photographs, maps, and records and after interviewing agricultural personnel. Using this data, the present land use was then divided into five evaluation

units. This land use was further subdivided into loam soils and clay soils. From the present land use, the future without project and future with project land uses were developed.

The land use is not expected to change significantly from the present to the future without project. Since relatively little forest land remains, the residents recognize the value of the remaining small on-farm plots. The clearing of these plots is not likely. Most of the larger forest tracts are owned by absentee landowners which are not interested in selling or clearing the land. The Morehouse Parish School Board owns the remaining larger blocks, and they plan to leave them in forest.

Project channels were designed so that clearing of forest land would not be induced. The only forest clearing induced by the project will be in the channel rights-of-way.

The watershed population is all rural and projections indicate that it will probably decrease. The likelihood of industry or any other type development occurring which would increase the OTHER land use category is not likely. Changes shown are because of increases in channel size due to project.

Cropland and grassland acreages are not likely to change drastically in the future with or without the project. Land which is now in pasture could be cropped without the project or vice versa. Owner preference and prices will influence these more than the project effects.

Evaluation Unit I consists of the land draining into Channels M-2 to M-6 and their laterals. Evaluation Unit II consists of land draining into Channel M-7 and its laterals. Evaluation Unit III consists of the land draining into Channels M-8, M-9, and M-10. Evaluation Unit IV consists of land draining into Channel M-11 and its laterals and Channels M-12 and M-13. Evaluation Unit V consists of Channel M-1 and its laterals. Evaluation Units I, III, and IV contain more than one channel system. The type problems, the soils, and the crops grown did not differ enough to warrant development of evaluation units at the single channel level.

Average present crop and pasture yields were based on information obtained from interviews and secondary data. These yields were developed by soil groups for both reaches. From the interviews with agricultural personnel, future without project yields were developed taking into account technological advances and better management practices. Using the same procedure, future maximum yields were developed assuming that flooding and water management problems were minimized. The difference between these two yield levels was multiplied by the damage reduction factor calculated by alternative and evaluation unit from information obtained from the hydrologist. This damage reduction factor was lowered for the lag in the application of land treatment measures. The product of the modified damage reduction factor and the difference in future without project and future maximum yields essentially is the effect of the project on yields. This product was added to the future without project yields to obtain future with project yields.

Production budgets were developed for the various crop and pasture operations for conditions expected in the future. These budgets were based on those of similar watersheds. However, they were revised using data such as fertilizer rates, types of operations, and trips per acre, which were obtained from farmers and research publications. Reductions in production costs brought about by the project for the main crops was calculated from a study of the production budgets. Installation of the project will induce farmers to increase inputs such as more liming, higher fertilization rates, and better weed control. These increases in cost were offset by the increased quality of products, reduction in applications of preplant herbicides, reduction in the number of replantings and land preparation operations, and increased timeliness and reduced cost of operations. Operation and maintenance cost of equipment will also be lowered. Studies of crop and pasture production budgets indicate that more intensive use benefits will be about 10 percent of the net crop and pasture benefits. Since flood prevention and drainage are inseparable, the more intensive use benefits were divided equally between these two purposes.

No project effects were evaluated on the forest land within the watershed. The internal drainage and the removal rate will be such that the effects on forest will be minor.

Using the estimated yields, adjusted normalized prices for crops and pasture, and the cost of production, tables necessary to evaluate production losses due to flooding, insufficient drainage, and other damages were developed for the five evaluation units. These tables reflect the difference in yields, gross returns, production costs, and net returns received under the PRESENT and the FUTURE WITH and WITHOUT project conditions. A study was conducted to assure that the measures in each evaluation unit provided sufficient benefits to justify their inclusion. Similar type data was developed to evaluate the several different alternatives indicated under the Project Formulation section.

Information from the hydrologist indicated that under present conditions, capacity of channels in the system is adequate to remove the runoff from an event varying in average occurrence frequencies of about twice a year to about once a year depending on the evaluation unit. With the project installed, the drainage system will be adequate to have the runoff back within banks 24 hours after the cessation of a storm that has an average recurrence interval of 3 years. Percentages in reduction of overbank flow were used to reflect the damage reduction attributable to road and bridges.

The analysis of secondary benefits was for those local benefits stemming from or induced by project installation. Secondary benefits were estimated and are expressed in this work plan; however, they were not needed for project justification. Since there is no research data available to estimate agriculture multiplier effects in Louisiana, secondary benefits on a regional basis were not calculated.

The following data have been developed:

1. Estimated yields and production costs for crops and pasture grown under various conditions.

2. Land use and production under future conditions both with and without the project.

3. Associated cost induced by the project.

4. Flood damage reduction to crop and pasture due to the project.

5. Increased returns due to increased quality of products.

6. Reduction in crop production cost due to project.

7. Road and bridge damage reduction due to the project.

8. Secondary benefits stemming from or induced by the project.

The Bayou Bonne Idee Watershed Committee, after consulting with realtors, landowners, and the Morehouse Parish Police Jury, furnished the estimated land easement values and the cost of obtaining these easements. These values were used in determining land rights costs.

The improvement of Bayou Bonne Idee will reduce flooding of agricultural land along its banks. A total of six evaluation reaches were used for making the economic studies. Floodwater damages and benefits were computed using the frequency method of analysis as described in Chapter III of the Economics Guide for Watershed Protection and Flood Prevention. Damages were computed for floods up to and including the 100-year frequency event.

Separable flood prevention benefits were also calculated on Channel L-1D. These separable flood prevention benefits are due to the improvement of Bayou Bonne Idee. Benefits on this area were calculated from damage information obtained from farmers and from the percentage reduction in overbank flow obtained from the hydrologist.

Recreation benefits were based on the expected number of visitor days of recreation use which will be made available by the clearing of Bayou Bonne Idee, construction of two water control structures and the addition of drawdown facilities on two existing water control structures, a recreation facility, and access points including three boat launching ramps. Activities which will be provided or enhanced include fishing, boating, camping, picnicking, and hunting. The estimate of use was based on data obtained from the Outdoor Recreation Resource Review Commission Report and the State of Louisiana Comprehensive Outdoor Recreation Plan (SCORP). Another source of data was a report titled Creel Census on Bussey Brake Reservoir for the First Three Years which was published by the Louisiana Wild Life and Fisheries Commission. A value of $1.50 per visitor day was used in determining the benefits for the recreation facility. Other recreation provided by the water

control structures and clearing of the bayou were assigned values from $0.50 to $1 with the exception of duck hunting which was assigned a value of $3 per visitor day.

The benefits claimed for project justification are net annual benefits. All production costs and associated costs have been deducted. Lag in accrual was considered in evaluating the benefits. Indirect damages were estimated to be 20 percent of the direct road and bridge floodwater damages. The costs of structural works of improvement were reduced to average annual cost to compare with project benefits. This comparison shows a 3 to 1 benefit-cost ratio. Structural measures were amortized for a 50-year period at 5.5-percent interest. This period is comparable to that of similar projects. Operation and maintenance costs were converted to annual estimates.

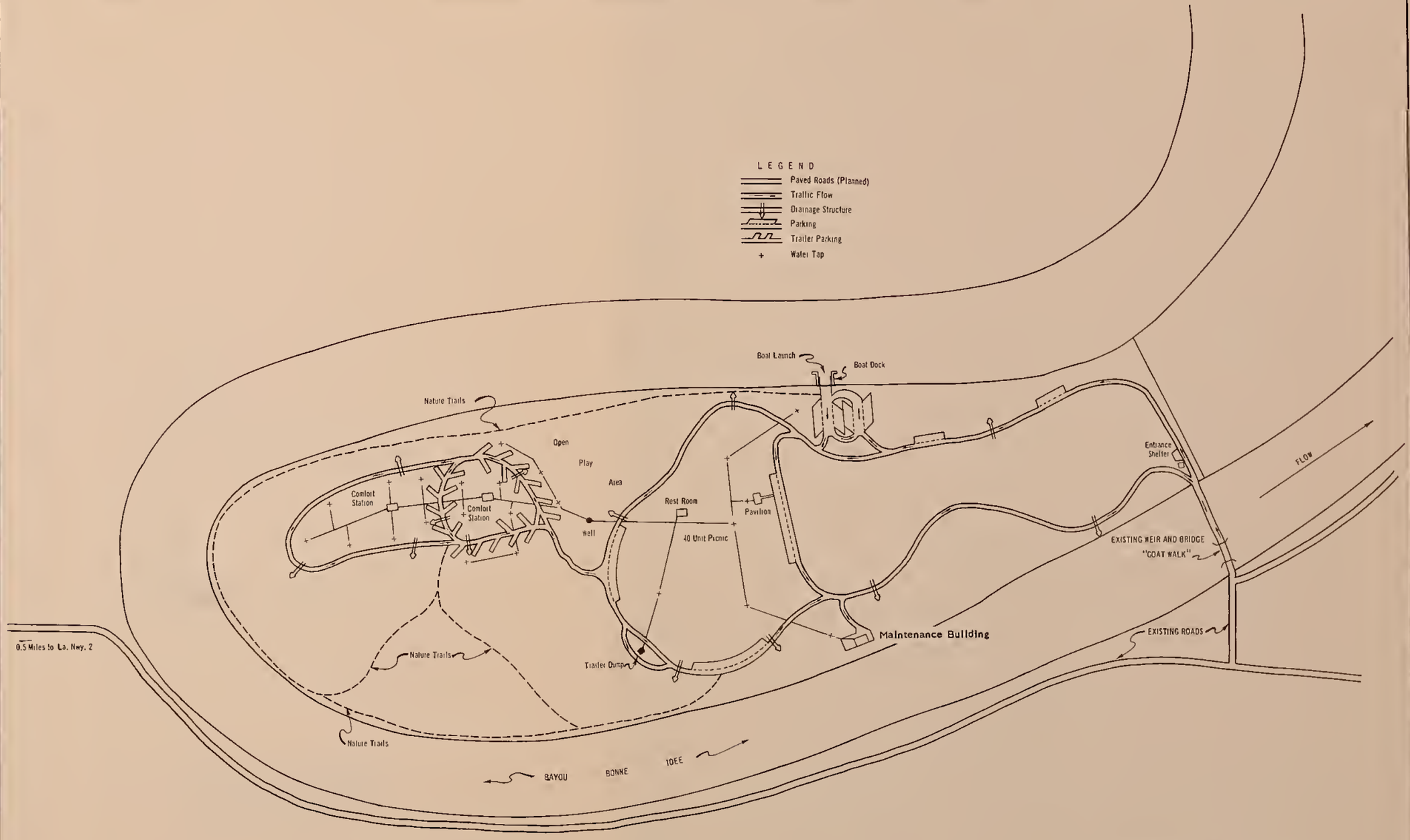


Figure 3

RECREATION FACILITIES

BAYOU BONNE IDEE WATERSHED

Morehouse Parish, Louisiana

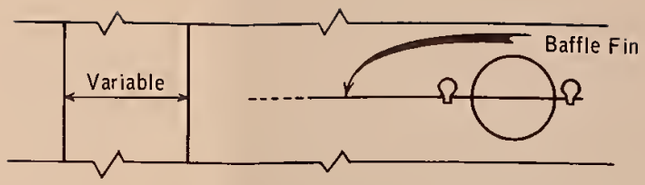
U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

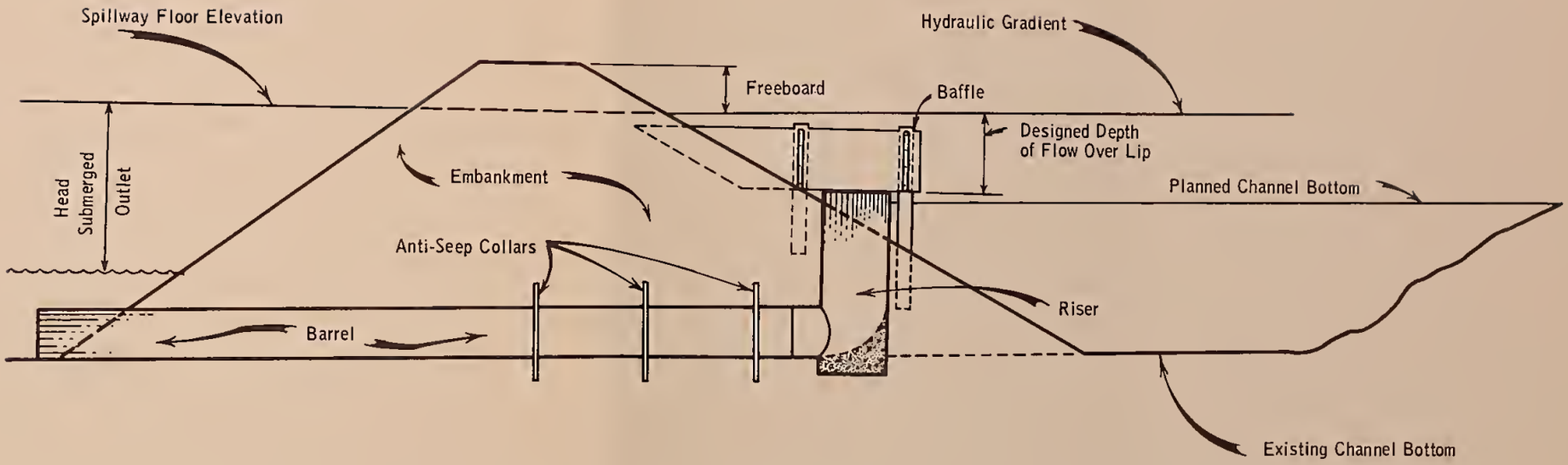
ALEXANDRIA LOUISIANA

3—73 4-R-31140

USDA-SCS-FORT WORTH, TEX. 1974



PLAN VIEW OF BAFFLE AND RISER

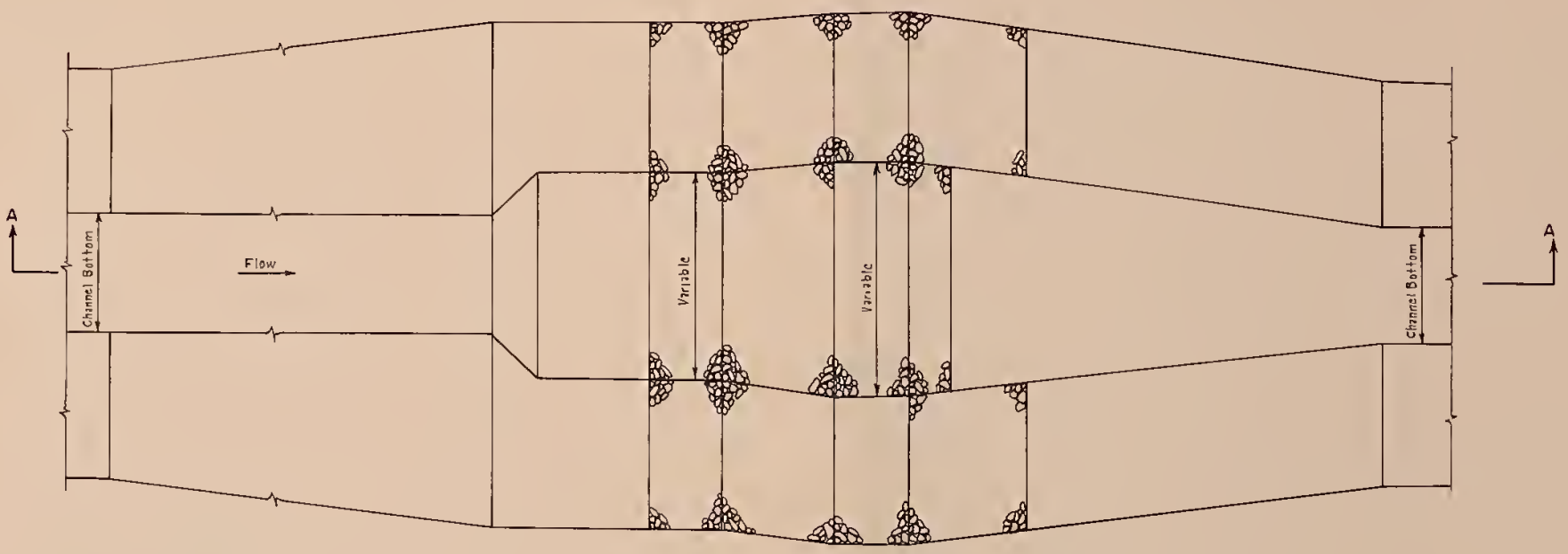


SECTION VIEW

Figure 4
GRADE STABILIZATION STRUCTURE
BAYOU BONNE IDEE WATERSHED
MOREHOUSE PARISH, LOUISIANA

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Alexandria, Louisiana
USDA-SCS-FORT WORTH, TEX 1974

3-73 4-32859



SECTION A—A

FIGURE 5

TYPICAL PLAN

WATER CONTROL STRUCTURE TYPE 2

BAYOU BONNE IDEE WATERSHED

MOREHOUSE PARISH, LOUISIANA

U S DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ALEXANDRIA LOUISIANA

3-73 4-E-32,858

USDA-SCS-FORT WORTH TEX 1974

SCS-ENG-314 (Rev. 7-71)

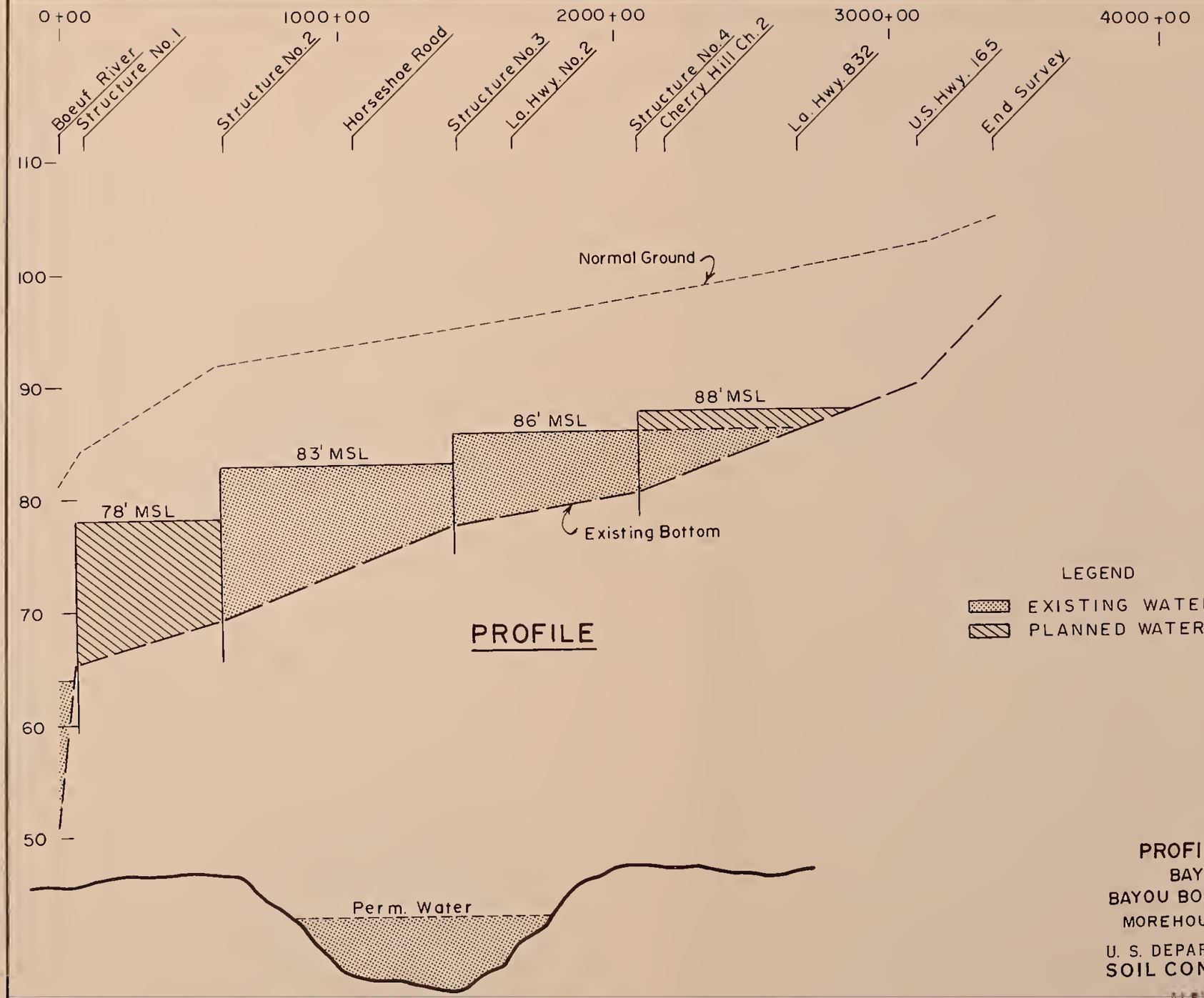


FIGURE 6
PROFILE AND SECTION
BAYOU BONNE IDEE
BAYOU BONNE IDEE WATERSHED
MOREHOUSE PARISH, LOUISIANA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALEXANDRIA, LOUISIANA

Rev. 3-74 4-E-32,860

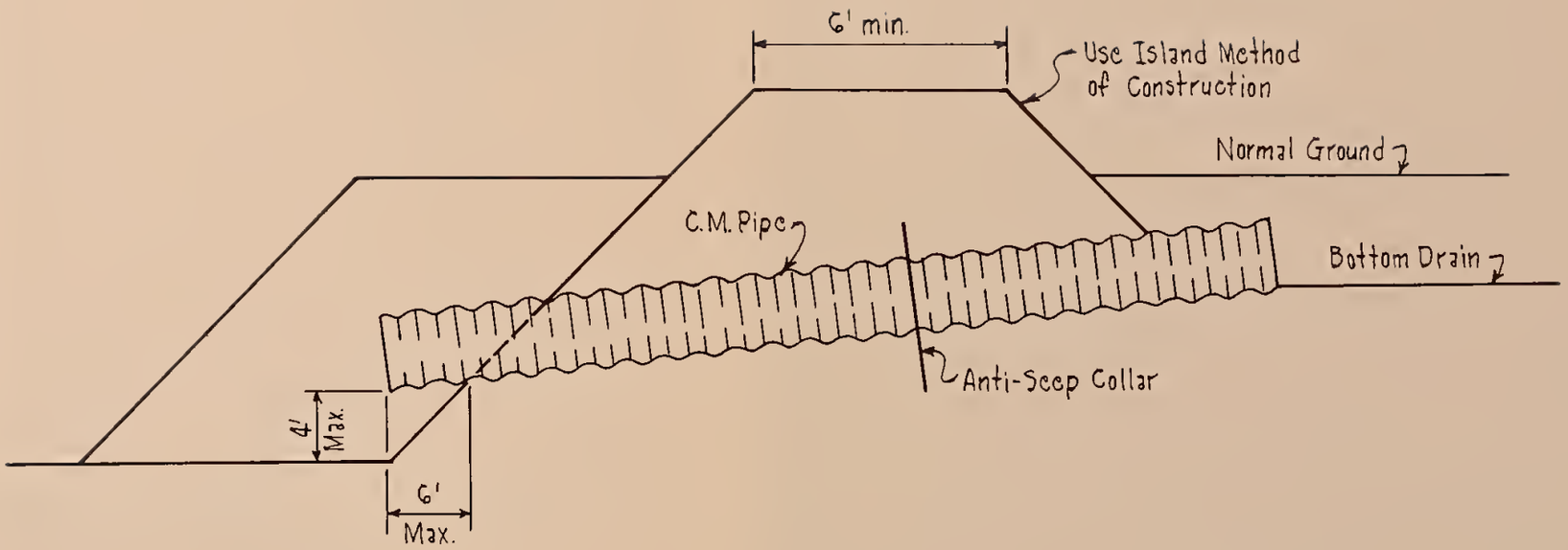


FIGURE 7

TYPICAL PIPE DROP STRUCTURE

WATER CONTROL STRUCTURE TYPE 3

BAYOU BONNE IDEE WATERSHED

MOREHOUSE PARISH, LOUISIANA

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

ALEXANDRIA, LOUISIANA

4-73 4-R-32,981

USDA SCS FORT WORTH, TEX 1974

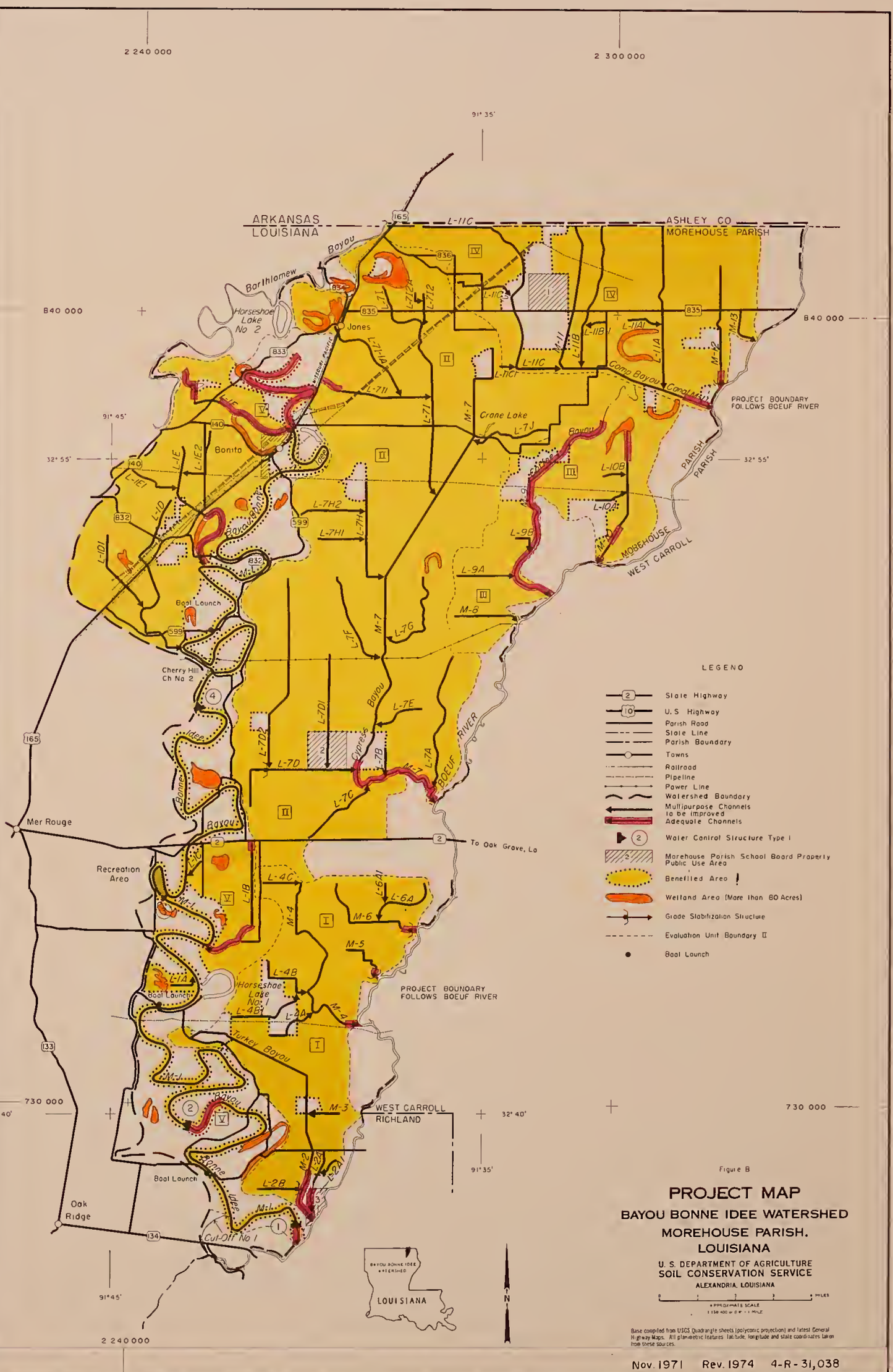


Figure B

PROJECT MAP

BAYOU BONNE IDEE WATERSHED
MOREHOUSE PARISH,
LOUISIANA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALEXANDRIA, LOUISIANA

Base compiled from USGS Quadrangle sheets (polyconic projection) and latest General Highway Maps. All planimetric features, latitude, longitude and state coordinates taken from these sources.

Nov. 1971 Rev. 1974 4-R-31,038

USDA-SCS-FORT WORTH, TEX. (1974)