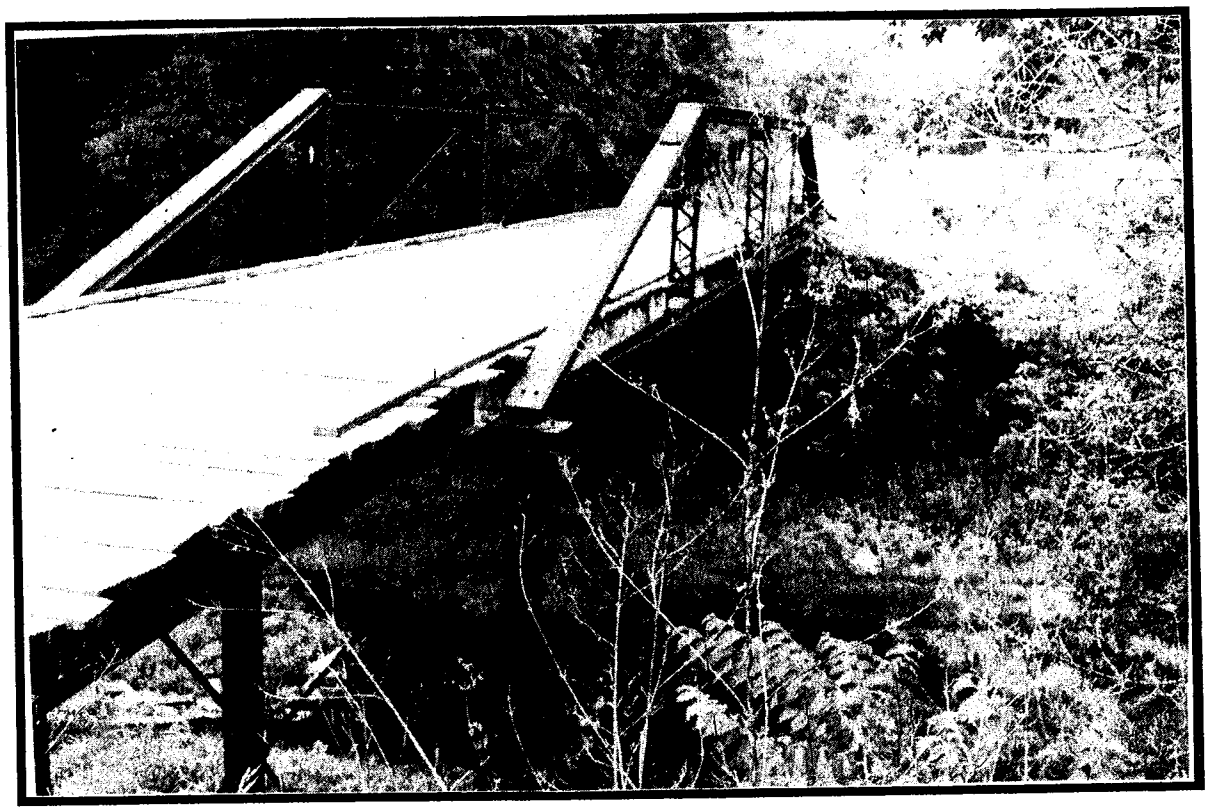
East Fork of the Grand River

Watershed Plan and Environmental Impact Statement



Ringgold and Union Counties, Iowa

Harrison and Worth Counties, Missouri

DRAFT

United States Department of Agriculture

Soil Conservation Service

East Fork of the Grand River

Watershed Plan

Environmental Impact Statement

Cover Photo: Bridge over East Fork of the Grand River, about 3 miles northwest of Denver, Missouri. Stream Bank Erosion required extension of the bridge decking and an additional abutment.

WATERSHED PLAN
ENVIRONMENTAL IMPACT STATEMENT
EAST FORK OF THE GRAND RIVER WATERSHED
Ringgold and Union Counties, Iowa
and
Harrison and Worth Counties, Missouri

ABSTRACT:

This document will set forth a plan to reduce flood damages; improve the management of cropland, forest land, and grassland; improve fish and wildlife habitat; provide water supply; and provide recreational opportunities. The recommended plan consists of 220 small, single-purpose floodwater retarding dams with grade stabilization benefits; one multiple-purpose dam providing flood prevention, agricultural water management, and recreational benefits; one multiple-purpose dam providing flood prevention and recreational benefits; one large, single-purpose floodwater retarding dam; 344 grade stabilization structures to reduce gully erosion; and an accelerated land treatment program. The accelerated land treatment program will provide additional protection on 8,900 acres of cropland, 1,200 acres of grassland, and 453 acres of forest land. The accelerated land treatment program includes funds for both technical and financial assistance. Total project costs are $19,844,400; of which $15,877,300 will be paid from Public Law 83-566 funds and $3,967,100 from other funds. Major project impacts include: a reduction in flood damages, soil erosion, and sedimentation; maintenance of the long term productivity of soils; improved quality and productivity of the forest resource; a source for agricultural and rural water; and improved quality of wildlife habitat for the species evaluated.

This document is pursuant to authorization under Public Law 83-566 funding, and to fulfill requirements of the National Environmental Policy Act. It has been prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1001-1008), and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.).

PREPARED BY THE:

City of Mount Ayr, Iowa
Harrison County Commission
Iowa Department of Natural Resources
Ringgold County Conservation Board
Ringgold County Board of Supervisors
Union County Board of Supervisors
Worth County Commission
U.S. Department of Agriculture, Forest Service

East Fork of the Grand River Watershed Subdistrict
Harrison County Soil and Water Conservation District
Ringgold County Soil and Water Conservation District
Ringgold County Development Corporation
Southern Iowa Rural Water Association (SIRWA)
Union County Soil and Water Conservation District
Worth County Soil and Water Conservation District
U.S. Department of Agriculture, Soil Conservation Service

FOR ADDITIONAL INFORMATION CONTACT:

**Russell C. Mills, State Conservationist, Soil Conservation Service,
Parkade Center, Suite 250, 601 Business Loop 70 West, Columbia, Missouri 65203,
Phone: (314) 876-0901.**

**LeRoy Brown Jr., State Conservationist, Soil Conservation Service,
210 Walnut Street, 693 Federal Building, Des Moines, Iowa 50309,
Phone: (515) 284-4261.**

WATERSHED AGREEMENT

BETWEEN THE

City of Mount Ayr, Iowa
East Fork of the Grand River Watershed Subdistrict, Missouri
Harrison County Commission
Harrison County Soil and Water Conservation District
Iowa Department of Natural Resources
Ringgold County Board of Supervisors
Ringgold County Conservation Board
Ringgold County Development Corporation
Ringgold County Soil and Water Conservation District
Southern Iowa Rural Water Association (SIRWA)
Union County Board of Supervisors
Union County Soil and Water Conservation District
Worth County Commission
Worth County Soil and Water Conservation District

(Referred to herein as Sponsors)

AND THE

Soil Conservation Service

[Final draft will replace Soil Conservation Service with Natural Resources Conservation Service]

United States Department of Agriculture

(Referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsors for assistance in preparing a plan for works of improvement for the East Fork of the Grand River Watershed, State of Iowa and State of Missouri, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); 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 SCS; and

Whereas, there has been developed through the cooperative efforts of the Sponsors and SCS a plan for works of improvement for the East Fork of the Grand River Watershed, the State of Iowa and the State of Missouri, hereinafter referred to as the Watershed Plan-Environmental Impact Statement, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through SCS, and the Sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

REAL PROPERTY:

1. The Sponsors will acquire such real property as will be needed in connection with the works of improvement. The percentages of real property acquisition costs to be borne by the Sponsors and SCS are as follows:

	Sponsors								P.L.-566	
Works of Improvement	City of Mt. Ayr	Union Co. Board of Supervisors	Ringgold Co. Board of Supervisors	Ringgold Co. Development Corporation	Ringgold Co. Conservation Board	SIRWA(2)	Worth County Commission	East Fork Grand River Watershed Subdistrict	SCS	Estimated Real Property Costs
	(Percent)									(Dollars)
Multiple-purpose Dam GB-3 and Recreational Facilities										
Payment to Landowners for 1,640 acres	22.9	--	15.3	7.6	15.3	15.3	--	--	23.6	1,240,500(1)
Other Associated Costs	30.0	--	20.0	10.0	20.0	20.0	--	--	--	37,000
Multiple-purpose Dam F-3 and Recreational Facilities										
Payment to Landowners for 290 acres	--	--	--	--	--	--	79.0	--	21.0	100,100
Other Associated Costs	--	--	--	--	--	--	100.0	--	--	10,000
Single-purpose Dam F-4										
Payment to Landowners for 72 acres	--	--	--	--	--	--	--	100.0	--	24,900
220 Small Single-purpose Dams	--	10.5	71.3	--	--	--	--	18.2	--	102,500

(1) *$1,240,500 includes $500,000 for petroleum pipeline modification at dam and reservoir GB-3.*
(2) *SIRWA - Southern Iowa Rural Water Association*

The Sponsors agree that all land acquired or improved with Public Law 83-566 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.

RELOCATION PAYMENTS AND ASSURANCES:

2. The Sponsors hereby agree that they will comply with all of the policies and procedures of the Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4601 et. seq. as implemented by 7 C.F.R. Part 21) when acquiring real property interests for this federally assisted project. If the Sponsors are legally unable to comply with the real property acquisition requirements of the Act, they agree that, before any Federal financial assistance is furnished, they will provide a statement to that effect, supported by an opinion of the chief legal officer of the state containing full discussion of the facts and law involved. This statement may be accepted as constituting compliance. In any event, the Sponsors agree that they will reimburse owners for necessary expenses as specified in 7 C.F.R. 21.1006(c) and 21.1007.

The cost of relocation payments in connection with the displacements under the Uniform Act will be shared by the Sponsors and SCS as follows:

	Sponsors			P.L.-566	
Works of Improvement	City of Mt. Ayr	Ringgold Co. Conservation Board	SIRWA[1]	SCS	Estimated Relocation Payment Costs
	----------(Percent)----------				(Dollars)
Multiple-purpose Dam GB-3 Relocation Payments	10.0	5.0	5.0	80.0	60,000

[1] *SIRWA - Southern Iowa Rural Water Association*

WATER RIGHTS:

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

PERMITS:

4. The Sponsors will obtain all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

CONSTRUCTION COSTS:

5. The percentages of construction costs to be paid by the Sponsors and by SCS are as follows:

	Sponsors	P.L.-566	
Works of Improvement	Other	SCS	Estimated Construction Costs [1]
	---------- (Percent) ----------		(Dollars)
Multiple-purpose Dam GB-3	38.2	61.8	**951,600**
Recreational Facilities	50.0	50.0	**789,000**
Water Intake Structure	50.0	50.0	**250,000**
Raw Water Line	50.0	50.0	**210,000**
Multiple-purpose Dam F-3	39.5	60.5	**847,400**
Recreational Facilities	50.0	50.0	**101,800**
Single-purpose Dam F-4	--	100.0	**235,900**
220 Small FWR Dams	0.3	99.7[2]	**8,394,300**

[1] *Includes historic preservation costs.*
[2] *$27,800 (0.33 percent) local costs for installation of dry hydrants.*

ENGINEERING SERVICES COSTS:

6. The percentages of the engineering services for structural measures to be borne by the Sponsors and SCS are as follows:

	Sponsors	P.L.-566	
Works of Improvement	**Other**	**SCS**	**Estimated Engineering Service Cost**
	---------- (Percent) ----------		(Dollars)
Multiple-purpose Dam GB-3	--	100.0	**180,000**
Recreational Facilities	50.0	50.0	**157,800**
Water Intake Structure	50.0	50.0	**50,000**
Raw Water Line	50.0	50.0	**42,000**
Multiple-purpose Dam F-3	--	100.0	**127,900**
Recreational Facilities	50.0	50.0	**20,400**
Single-purpose Dam F-4	--	100.0	**48,600**
220 Small FWR Dams	--	100.0	**1,622,900**
Construction Inspection [1]	--	100.0	**213,000**

[1] *The Sponsors and SCS will bear the cost of construction inspection that each incurs, estimated to be $0 and $213,000 respectively.*

PROJECT ADMINISTRATION:

7. The Sponsors and SCS will each bear the costs of project administration that each incurs, estimated to be $160,800 and $718,000, respectively.

LAND TREATMENT - FINANCIAL ASSISTANCE:

8. Cost-sharing rate for the establishment of enduring land treatment practices is 65 percent of the average cost of installing the enduring practices. The estimated total financial assistance cost for enduring practices is $3,074,300.

Practice	Landowner/Operator	SCS	Estimated Total Costs
	---------- (Percent) ----------		(Dollars)
Grade Stabilization Structures	35	65	**1,933,500**
Required & Interdependent Land Treatment	35	65	**1,140,800**
Public Law 83-566 cost-share rates cannot exceed the existing rate for ongoing national programs.			

LAND TREATMENT - TECHNICAL ASSISTANCE:

9. The SCS will assist the Sponsors in providing technical assistance to landowners or operators to plan and install land treatment practices shown in the plan. Percentages of technical assistance costs to be borne by the Sponsors and SCS are as follows:

Works of Improvement	Sponsors	SCS	Estimated Technical Assistance Costs
	---------- (Percent) ----------		(Dollars)
Land Treatment Practices	0	100	286,700

OTHER ITEMS:

10. The Sponsors will obtain agreements from owners of not less than 75 percent of the land above each multiple-purpose and floodwater retarding dam. These agreements state that the owners will carry out conservation farm or ranch plans on their land. The Sponsors will ensure that 75 percent of the land upstream of any floodwater retarding dam site is adequately protected before construction of the dam.

11. The Sponsors will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the watershed plan.

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

13. The Sponsors agree to participate in and comply with applicable Federal flood plain management and flood insurance programs before construction starts.

14. The Sponsors will be responsible for the operation, maintenance, and any needed replacement of the works of improvement by actually performing the work or arranging for such work, in accordance with agreements to be entered into before issuing invitations to bid for construction work.

15. The costs shown in this plan are preliminary estimates. Final costs to be borne by the parties hereto, will be the actual costs incurred in the installation of the works of improvement.

16. This agreement is not a fund-obligating document. Financial and other assistance to be furnished by SCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

17. A separate agreement will be entered into between SCS and Sponsors before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

18. This plan may be amended or revised only by mutual agreement of the parties hereto, except that SCS may deauthorize or terminate funding at any time it determines that the Sponsor has failed to comply with the conditions of this agreement. In this case, SCS shall promptly notify the Sponsor in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the Sponsors or recoveries by SCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between SCS and the Sponsor(s) having specific responsibilities for the measure involved.

19. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, 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.

20. The program conducted will be in compliance with the nondiscrimination provisions as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and in accordance with regulations of the Secretary of Agriculture (7 C.F.R. 15, Subparts A & B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or disability be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

21. **Certification Regarding Drug-Free Workplace Requirements (7 C.F.R. 3017, Subpart F).**

By signing this watershed agreement, the Sponsors are providing the certification set out below. If it is later determined that the Sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the SCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled substance means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction means a finding of (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statues;

Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees' payroll; or employees of subrecipients or subcontractors in covered workplaces).

Certification:

A. The Sponsors certify that they will or will continue to provide a drug-free workplace by:

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(2) Establishing an ongoing drug-free awareness program to inform employees about -

(a) The danger of drug abuse in the workplace;
(b) The grantee's policy of maintaining a drug-free workplace;
(c) Any available drug counseling, rehabilitation, and employee assistance programs; and
(d) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will --

(a) Abide by the terms of the statement; and
(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(5) Notifying the SCS in writing, within ten calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4)(b), with respect to any employee who is so convicted -

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6).

B. The Sponsors may provide a list of the site(s) for the performance of work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

22. **Certification Regarding Lobbying (7 CFR 3018)(applicable if this agreement exceeds $100,000).**

(1) The Sponsors certify to the best of their knowledge and belief, that:

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the Sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form -LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The Sponsors shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

(2) This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

23. **Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions (7 CFR 3017).**

(1) The Sponsors certify to the best of their knowledge and belief, that they and their principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency.

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the primary Sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

City of Mount Ayr, Iowa By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the City of Mount Ayr, Iowa, adopted at a meeting held on _____.

_____ _____
City Clerk Address Zip Code

Date: _____

East Fork of the Grand River Watershed Subdistrict By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the East Fork of the Grand River Watershed Subdistrict adopted at a meeting held on _____.

_____ _____
District Clerk Address Zip Code

Date: _____

Harrison County Commission

By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Harrison County Commission adopted at a meeting held on _____.

_____ _____
Clerk Address Zip Code

Date: _____

Harrison County Soil and Water Conservation District

By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Harrison County Soil and Water Conservation District adopted at a meeting held on _____.

_____ _____
District Clerk Address Zip Code

Date: _____

Iowa Department of Natural Resources By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Iowa Department of Natural Resources adopted at a meeting held on _____.

_____ _____
Secretary Address Zip Code

Date: _____

Ringgold County Board of Supervisors By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Ringgold County Board of Supervisors adopted at a meeting held on _____.

_____ _____
Secretary Address Zip Code

Date: _____

Ringgold County Conservation Board By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Ringgold County Conservation Board adopted at a meeting held on _____.

_____ _____
Clerk Address Zip Code

Date: _____

Ringgold County Development Corporation By: _____

Title: _____

_____ Date: _____
Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Ringgold County Development Corporation adopted at a meeting held on _____.

_____ _____
Director Address Zip Code

Date: _____

Ringgold County Soil and Water Conservation District

By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Ringgold County Soil and Water Conservation District adopted at a meeting held on _____.

_____ _____

District Clerk Address Zip Code

Date: _____

Southern Iowa Rural Water Association (SIRWA)

By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Southern Iowa Rural Water Association adopted at a meeting held on _____.

_____ _____

Director Address Zip Code

Date: _____

Union County Board of Supervisors By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Union County Board of Supervisors adopted at a meeting held on _____.

_____ _____

Clerk Address Zip Code

Date: _____

Union County Soil and Water Conservation District By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Union County Soil and Water Conservation District adopted at a meeting held on _____.

_____ _____

Director Address Zip Code

Date: _____

Worth County Commission By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Worth County Commission adopted at a meeting held on _____.

_____ _____

Clerk Address Zip Code

Date: _____

Worth County Soil and Water Conservation District By: _____

Title: _____

_____ Date: _____

Address Zip Code

The signing of this plan was authorized by a resolution of the governing body of the Worth County Soil and Water Conservation District adopted at a meeting held on _____.

_____ _____

Director Address Zip Code

Date: _____

Soil Conservation Service
United States Department of Agriculture
Missouri

Approved by:

RUSSELL C. MILLS, State Conservationist

Date

TABLE OF CONTENTS

TABLES

FIGURES

SUMMARY OF WATERSHED

PLAN - ENVIRONMENTAL IMPACT STATEMENT

PROJECT NAME

East Fork of the Grand River Watershed
(Refer to Appendix E, Project Map)

COUNTIES/STATES

Ringgold County, Iowa
Union County, Iowa
Harrison County, Missouri
Worth County, Missouri

SPONSORS

City of Mount Ayr, Iowa;
East Fork of the Grand River Watershed Subdistrict, Missouri;
Harrison County Commission, Missouri;
Harrison County Soil and Water Conservation District, Missouri;
Iowa Department of Natural Resources;
Ringgold County Board of Supervisors, Iowa;
Ringgold County Conservation Board, Iowa;
Ringgold County Development Corporation, Iowa;
Ringgold County Soil and Water Conservation District, Iowa;
Southern Iowa Rural Water Association (SIRWA), Iowa;
Union County Board of Supervisors, Iowa;
Union County Soil and Water Conservation District, Iowa;
Worth County Commission, Missouri;
Worth County Soil and Water Conservation District, Missouri

DESCRIPTION OF RECOMMENDED PLAN

The recommended plan consists of 220 small, single-purpose floodwater retarding dams; one large single-purpose floodwater retarding dam; two multiple-purpose dams; 344 grade stabilization structures; and an accelerated land treatment program. The multiple-purpose dams provide flood prevention; fish, wildlife, and recreational development; and a rural water supply. The land treatment program consists of measures that will adequately protect 8,900 acres of cropland, 1,200 acres of grassland, and 453 acres of forest land from erosion.

RESOURCE INFORMATION

Watershed Size - 168,400 acres

Iowa - 102,000 acres
Missouri - 66,400 acres

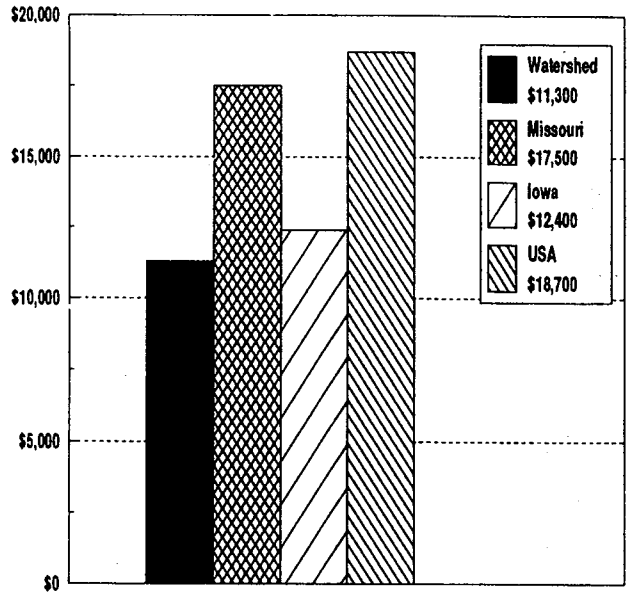
Land Cover	Upland	Bottom Land[1]	Total
	Acres		
Cropland	53,900	11,000	64,900
Grassland	73,200	3,300	76,500
Forest Land	18,800	5,700	24,500
Other Land	2,100	400	2,500
TOTAL	**148,000**	**20,400**	**168,400**

[1] Bottom land consists of 20,400 acres in the 100-year flood plain. An additional 7,600 acres of bottom land are affected downstream of the watershed project boundary in Gentry County, Missouri.

Highly Erodible Cropland (HEL)	49,800 acres (Does not include Conservation Reserve Program acres.)
Conservation Reserve Program (CRP)	27,600 acres (Through 11th sign-up period, July 1991.)
Total HEL	77,400 acres
Land Ownership	Private: 98.9 percent State/Local: 1.1 percent
Number of Farms	538
Average Farm Size	300 acres
Prime and Statewide Important Farmland	57,700 acres
District Cooperators	421 men, 88 women
Minority Farmers	0
Limited Resource Farmers	14
Absentee Landowners	102
Population of Project Area	2,200

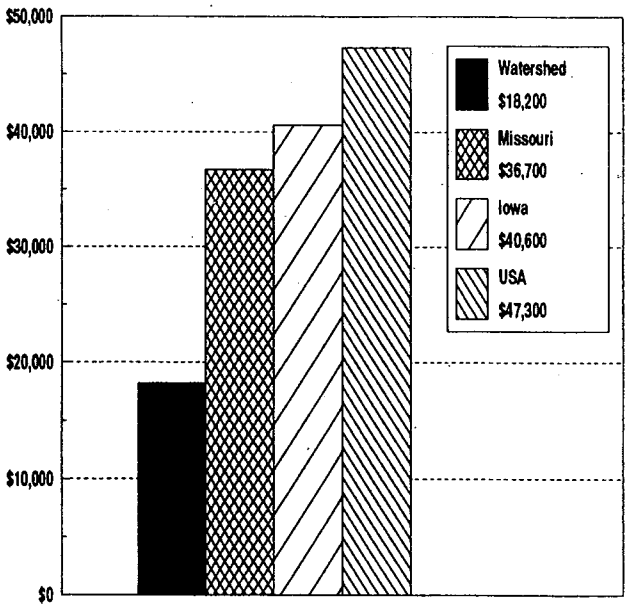
PROJECT BENEFICIARY PROFILE

Per Capita Income (1990)



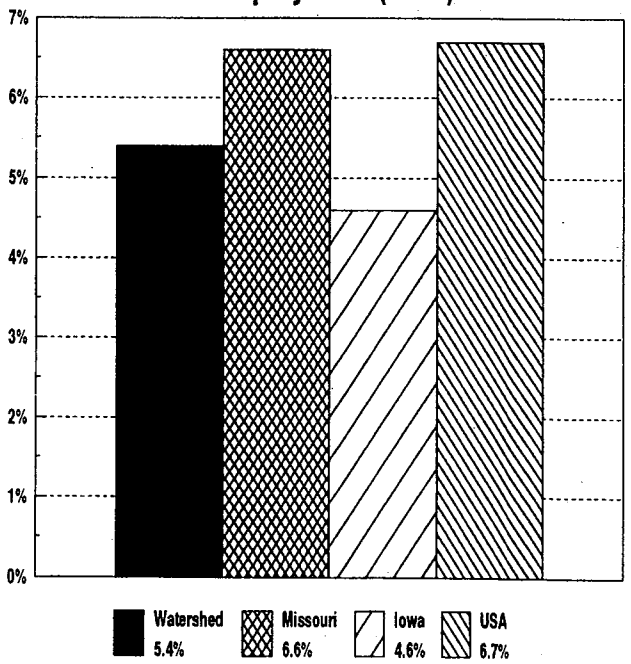
Watershed = 60 percent of USA values

Median Home Value (1990)

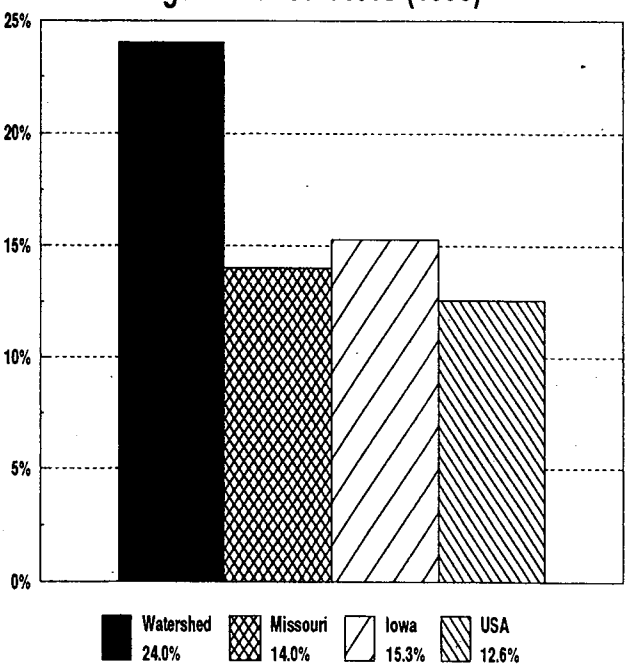


Watershed = 50% of Missouri and 45% of Iowa values

Unemployment (1991)



Age - Over 65 Years (1990)



WETLANDS

There are 5,140 acres of wetlands and 17,770 acres of prior converted wetlands in the watershed project area.

ENDANGERED SPECIES

The bald eagle and Indiana bat may occur in the watershed. This project has no effect on preferred habitat.

CULTURAL RESOURCES

No significant archaeological or historic resources are known to exist in areas which may be affected by installation of the project.

PROBLEM IDENTIFICATION

Decreased farm income and increased maintenance due to flooding on 28,000 acres.

Flood damages to roads and bridges average $263,900 annually.

Reduced farm income due to scour erosion on 2,316 acres of flood plain in the watershed and 528 acres downstream.

Decreased productivity due to sediment deposition on 9,218 acres of flood plain in the watershed and 3,270 acres downstream.

Reduced soil productivity and farm income due to erosion on 34,800 acres of inadequately treated upland cropland.

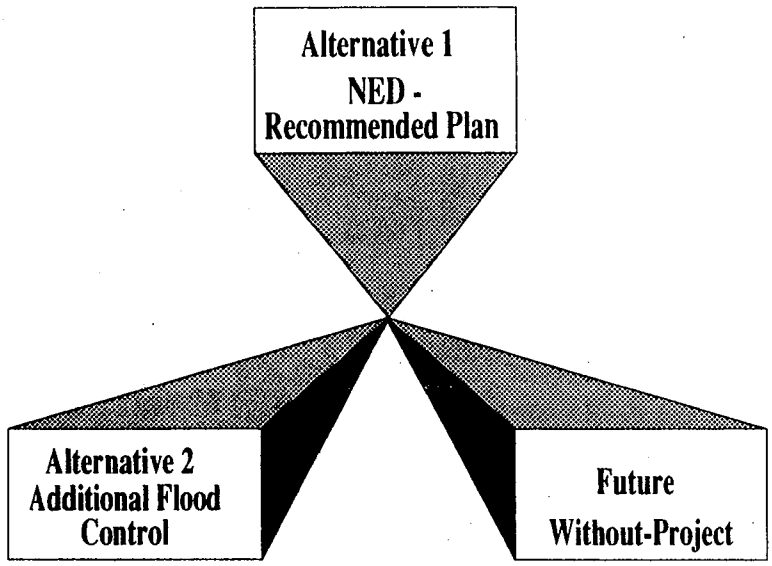
Economic losses from permanent gully erosion on 18,040 acres of upland.

Reduced landowner income and wood production due to excessive erosion on 2,200 acres of forest land.

Limited wildlife and stream habitat quality due to the lack of proper land management.

Limited availability of agricultural and public water sources for livestock and human consumption and use, fish and wildlife development, and water-based recreational development.

ALTERNATIVE PLANS CONSIDERED



Alternative 1
[National Economic Development (NED) - Recommended Plan]

- 220 Small, single-purpose floodwater retarding dams;
- 1 Large, single-purpose floodwater retarding dam;
- 1 Multiple-purpose dam for flood prevention, and fish, wildlife, and recreational development;
- 1 Multiple-purpose dam for flood prevention, rural water supply, and fish, wildlife, and recreational development;
- 344 Grade stabilization structures to control gully erosion;
- Land treatment program: terraces, underground outlets, grassed waterways, diversions, critical area planting, prescribed grazing systems, livestock exclusion, tree planting, integrated pest and nutrient management, field borders, pasture and hayland management, and filter strips.

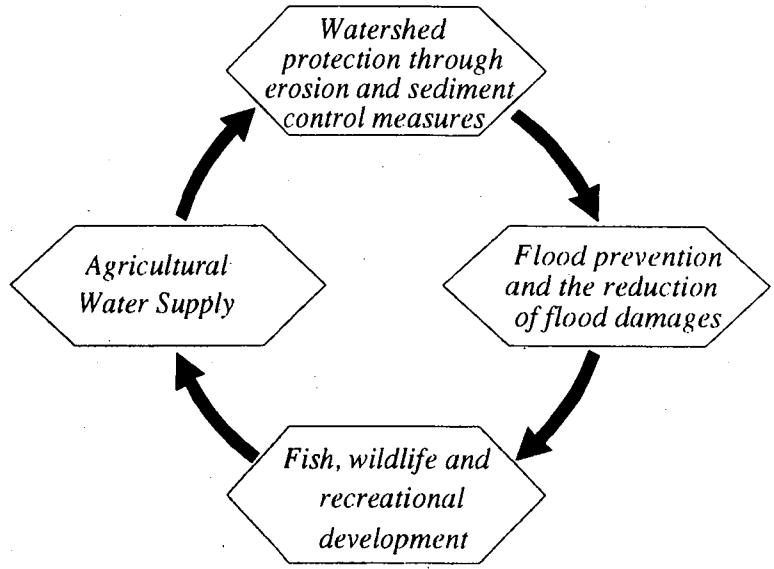
Alternative 2
[Additional Flood Control]

- 240 Small, single-purpose floodwater retarding dams;
- 1 Large, single-purpose floodwater retarding dam;
- 1 Multiple-purpose dam for flood prevention and fish, wildlife, and recreational development;
- 1 Multiple-purpose dam for flood prevention, rural water supply, and fish, wildlife, and recreational development;
- 344 grade stabilization structures to control gully erosion;
- Land treatment program: terraces, underground outlets, grassed waterways, diversions, critical area planting, prescribed grazing systems, livestock exclusion, tree planting, integrated pest and nutrient management, field borders, pasture and hayland management, and filter strips.

Alternative 3
[Future Without-Project]

No Action

PROJECT PURPOSES



PRINCIPAL PROJECT MEASURES

Structural Measures

Two hundred and twenty small, single-purpose floodwater retarding dams with grade stabilization benefits. Drainage areas will range from 100 to 350 acres. Permanent pools will range from 4 to 11 acres and flood pools will range from 6 to 16 acres.

One multiple-purpose dam for flood prevention, rural water supply, and recreational, fish, and wildlife development. The permanent pool will be about 350 acres.

One multiple-purpose dam for flood prevention and recreational, fish, and wildlife development. The permanent pool will be about 100 acres.

One large, single-purpose dam for flood prevention with a permanent pool of about 20 acres.

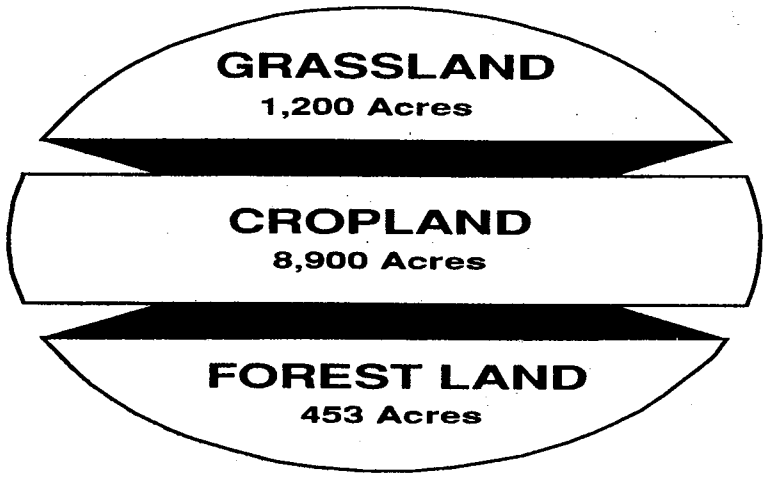
Agricultural Water Management

- 1,750 acre-feet of water available at dam GB-3
- 89 dry hydrants installed for fire protection
- Potential for livestock watering systems at each of the 221 single-purpose floodwater retarding dams and 344 grade stabilization structures.

Land Treatment Measures

Three hundred and forty-four grade stabilization structures to control gully erosion. The primary function of these dams is erosion control. They may store permanent water or may be designed as "dry" dams, holding only temporary water.

-- PROJECT LAND TREATMENT --



- 250 Long Term Contracts
- Terraces: 570,000 feet
- Underground Outlets: 190,000 feet
- Grassed Waterways: 55 acres
- Critical Area Planting: 89 acres
- Tree Planting: 53 acres
- Diversions: 33,500 feet
- Prescribed Grazing Systems: 30 systems (1,100 acres)
- Livestock Exclusion: 400 acres (woodlands)
- 1,985 acres of integrated pest and nutrient management
- 46,325 feet of field border
- 895 acres of pasture and hayland management
- 20 acres of filter strips
- 40 acres livestock exclusion (riparian areas).

INSTALLATION COSTS OVER 12 YEARS

TABLE A

Installation Cost Summary

PROJECT COSTS	P.L.-566		OTHER		TOTAL
	(Dollars)	%	(Dollars)	%	(Dollars)
LAND TREATMENT					
Land Treatment Measures	741,500	65	399,300	35	1,140,800
Grade Stabilization Structures	1,256,800	65	676,700	35	1,933,500
Technical Assistance	286,700	100	0	0	286,700
STRUCTURAL MEASURES					
Flood Prevention	11,379,400	96	505,400	4	11,884,800
Ag. Water Management	549,800	38	898,600	62	1,448,400
Fish, Wildlife, & Recreation	1,663,100	53	1,487,100	47	3,150,200
TOTAL	**15,877,300**	**80**	**3,967,100**	**20**	**19,844,400**

PROJECT BENEFITS

TABLE B

Average Annual Benefits

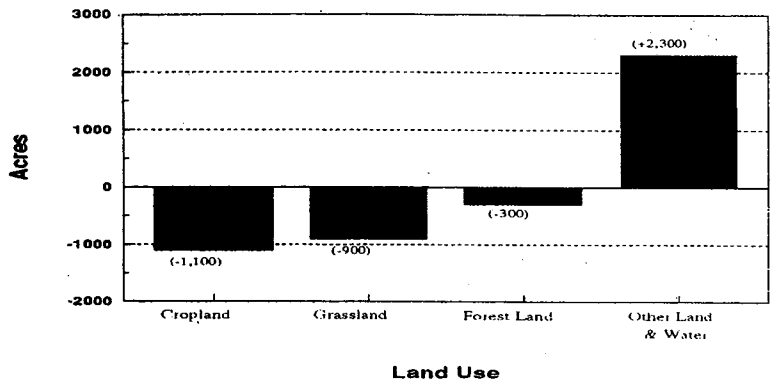
BENEFITS	AVERAGE ANNUAL DOLLARS	PERCENT
Flood Damage Reduction	751,400	32
Road and Bridge Protection	218,100	9
Gully Control	189,600	8
Sediment Reduction	234,400	10
Swamping Damage Reduction	57,700	2
Scour Erosion Control	46,800	2
Rural Water Management	109,800	5
Rural Fire Protection	32,200	1
Recreational Development	447,700	19
Land Treatment	284,600	12
Total Project Benefits	**2,371,800**	**100**

OTHER PROJECT BENEFITS

1. Protect long-term soil productivity and upland land values through a reduction in upland erosion.
2. Provide a source of rural, public water near Mt. Ayr, Iowa.
3. Increase public recreational opportunities at the multiple-purpose dam sites.
4. Increase private recreational opportunities at the single-purpose dam sites.
5. Increase wetlands.
6. Improve water quality through erosion control and reduction of sedimentation and associated nutrient and pesticide contamination.
7. Improve aquatic and terrestrial wildlife habitat and increase aquatic habitat.

LAND USE CHANGES

Construction of 223 floodwater retarding dams and 344 grade stabilization structures will increase water area and reduce other agricultural land areas.



ENVIRONMENTAL VALUES (Changed or Lost)

Wetlands: The project will create approximately 400 acres of wetlands.

Cultural Resources: The project is not expected to adversely affect archaeological and historic resources.

Wildlife Habitat: In Iowa, there will be no net change in habitat units of woody cover due to installation of 788 acres of mitigation areas. There will be 277 habitat units of cropland cover lost to pools and dams. An estimated 142 habitat units of grassland cover will be gained on dams and spillways. In Missouri, there will be no net change in habitat units of woody or cropland cover due to installation of 357 acres of mitigation areas. An estimated 38 habitat units of grassland cover will be gained on dams and spillways.

Prime Farmland: Approximately 5,900 acres of farmland (non-wetland) will be improved, through a reduction in the 2-year frequency flooding, to the status of prime farmland.

Community Effects: Flooding, and its damages, will be reduced on 20,400 acres in the watershed project area and 7,600 acres downstream, adjacent to the project area. Re-routing and disruption of daily traffic, school buses, mail delivery services, farm vehicles, and the transportation of farm products will be lessened. Road and bridge damages will be lower. The availability (through the installation of dry hydrants) of nearby water for fire fighting will help protect the property and lives of rural residents.

Water Quality:	An accelerated land treatment program above rural water supply dam GB-3 to improve water quality.

MITIGATION FEATURES

Features of the plan which will reduce detrimental impacts on wildlife include limited clearing for dam construction, draw-down pipes installed to regulate pool sizes, restricted work limits at each site, and unless impractical, dams constructed where wildlife habitat quality is poor.

Other features planned to mitigate detrimental impacts on wildlife include replacing an estimated 365 habitat units of woody habitat on about 1,145 acres of wildlife mitigation areas, establishing grass-legume mixtures or native warm-season grasses on areas adjacent to the dams and emergency spillways, and protecting these areas from grazing. Mitigation areas will be left to vegetate naturally or planted with vegetation that is different than existing cover in adjacent areas, to improve wildlife habitat. This variety will maximize both edge effects and biodiversity.

Grazing will not be allowed in mitigation areas. Haying after July 1 is acceptable with SCS approval and is contingent on wildlife habitat impacts. Prescribed burning that is consistent with habitat enhancement may also be performed. Livestock watering pipes will extend beyond mitigation areas.

Wetland loss will be mitigated with the development of 90 acres of wetlands through prescribed borrowing in the upper ends of the pools, below the dams, and along the edges of the pools. These wetland areas will be protected from grazing. See Appendix C - Wetland Section - for specific wetland construction criteria. All mitigation areas accepted in Iowa will be obtained under a recorded 50-year term easement that restricts certain uses of the mitigated area. All mitigation practices in Iowa will be installed using the average cost method.

MAJOR CONCLUSION

This project will have major beneficial effects on the watershed problems of soil erosion, sedimentation, flooding, deficiencies of water supply, recreation, and fire protection. The 220 small dams and one large single-purpose dam will provide flood prevention and grade stabilization, improve fish and wildlife habitat, and rural water supply for fire protection. The multiple-purpose dams will provide flood prevention, recreation, grade stabilization benefits, improved fish and wildlife habitat, and a source of public water. The land treatment program will reduce upland erosion and subsequent sedimentation, as well as improve water quality in drainage area GB-3.

AREAS OF CONTROVERSY

The planning process included public meetings, coordination with cooperating agencies and groups, and printed public information to raise issues, resolve conflicts, and recommend the most desirable plan features. No significant unresolved controversy remains.

ISSUES TO BE RESOLVED

None.

INTRODUCTION

The Watershed Plan and Environmental Impact Statement for the East Fork of the Grand River Watershed project are combined into this single document. The purposes of the project are to provide watershed protection in sustaining and improving the productive capacity of the land resources, reduce the magnitude of flood damages, provide an adequate and dependable water supply for rural residents, provide upland erosion control and grade stabilization for active gully systems, improve fish and wildlife habitat, and increase recreational opportunities. This document makes public the expected impacts of the project and provides the basis for authorizing federal assistance for local implementation.

Local residents requested assistance from the United States Department of Agriculture (USDA) - Soil Conservation Service (SCS) to address the problems of flooding, excessive erosion, water supply needs, and recreation and wildlife habitat deficiencies. Concerns and impacts were discussed and prioritized at numerous public meetings. The sponsors were assisted in the development of this plan by SCS and the USDA Forest Service (FS). Technical input for preparation of this document was also provided by the United States Department of the Interior (USDI) - Fish and Wildlife Service, Division of Ecological Services; the Iowa Department of Natural Resources; and the Missouri Department of Conservation (MDC).

This plan was prepared under authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 U.S.C. 1001-1008), and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 U.S.C. 4321 et seq.). Responsibility for compliance with the National Environmental Policy Act rests with the Soil Conservation Service (SCS).

All information and data, except as otherwise noted, were collected during watershed planning investigations by the Soil Conservation Service and Forest Service.

PROJECT SETTING

SIZE

168,400 acres

Iowa - 102,000 acres
Missouri - 66,400 acres

LOCATION

The watershed project area begins near Arispe, Iowa, and continues in a southerly direction to the Worth and Gentry county line near Denver, Missouri. The project area lies in Union and Ringgold Counties, Iowa, and in Worth and Harrison Counties, Missouri.

SOILS/TOPOGRAPHY

The watershed lies within Major Land Resource Area 109 - Iowa and Missouri Heavy Till Plain. The area is characterized by a dissected till plain with an occasional thin mantle of loess. Topography is primarily rolling to hilly with some broad ridgetops that are nearly level to undulating. Smaller tributary streams exhibit narrow valley floors while mainstem channels have broad flood plains.

Detailed soil surveys have been published for each of the four counties in the watershed. Refer to Appendix D, General Soils Map, for information and locations of major soil associations in the watershed.

STREAM SYSTEM - MAIN TRIBUTARIES

Iowa: Lotts Creek, Gooseberry Creek, Bealls Creek, Hackberry Creek, Squaw Creek

Missouri: Lotts Creek, Big Rock Creek

CLIMATE

The watershed has a continental climate. The area is subject to frequent large-scale changes in day-to-day temperatures. This is caused by the influx of cold air from the north; warm, moist air from the south; and warm, dry air from the southwest.

The average annual precipitation is slightly more than 34 inches per year. About 24 inches, 70 percent, usually falls between April and September. June is usually the wettest month, both in the total amount of precipitation and the number of days on which a measurable amount of precipitation is received. Thunderstorms occur on about 50 days each year. Average snowfall is about 20 inches per year. The growing season is approximately 170 days.

SOCIAL AND ECONOMIC

Number of Farms:	538
Average Farm Size:	300 acres
District Cooperators:	421 men, 88 women
Minority Farmers:	0
Limited Resource Farmers:	14
Absentee Landowners:	102
Producers:	
Full-farm owners:	55 percent
Part-farm owners:	30 percent
Tenants:	15 percent

City, State	Population (U.S. Bureau of Census, 1990)
Allendale, Missouri	58
Denver, Missouri	53
Mount Ayr, Iowa	1,796 (partially in watershed)
Kellerton, Iowa	367 (partially in watershed)
Beaconsfield, Iowa	27 (partially in watershed)
Ellston, Iowa	44 (partially in watershed)
Tingley, Iowa	179 (partially in watershed)
Arispe, Iowa	92 (partially in watershed)
Population of Watershed Project Area:	**2,200**

U.S. Highway 169, Iowa State Highway 2, Missouri State Highway 46, and other secondary state, county, and local roads provide service to the project area.

The weighted average value of agricultural land and improvements for Harrison, Worth, Ringgold, and Union Counties is $470 per acre (U.S. Bureau of the Census, 1987).

Approximately 2,200 people live in the watershed. Twenty-four percent of the watershed's population is over the age of 65, which is 10 percent above the Missouri average and 8.7 percent above Iowa's.

The watershed per capita income was $11,300 in 1990 - $7,400 below the national level. Twenty-two percent of the watershed population is below the poverty level, compared to 12.2 percent for Missouri and 10.1 percent for Iowa.

In 1991, unemployment was 5.4 percent in the watershed, 6.6 percent in Missouri, and 4.6 percent in Iowa. The watershed's median value of homes was $18,200 in 1980, 50 percent of Missouri's median value ($36,700) and 45 percent of Iowa's ($40,600).

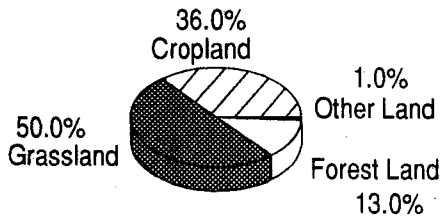
LAND COVER AND USE

Most upland crop fields are farmed with rotations that include row-crops, small grain, and hay. Fields with less than five percent slope are often continuous row-crop or row-crop and small grain rotations. Steeper fields typically include more years of hay in order to reduce erosion. Common conservation measures include no-till, conservation tillage, contour farming, terraces, waterways, and crop rotations that include forages. Grade stabilization structures are commonly used to control gully erosion, provide outlets for waterways, provide livestock water, and improve or maintain field accessibility.

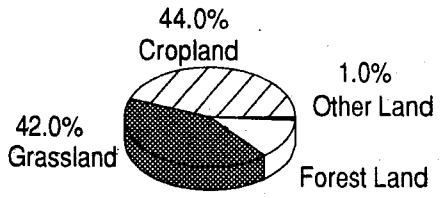
Grassland cover is primarily smooth bromegrass, tall fescue, orchard grass, Kentucky bluegrass, and timothy. In recent years there has been a significant increase in the use of switch grass, big bluestem, indian grass, and other native, warm-season grasses for hay, pasture and the 10-year Conservation Reserve Program.

Upland forests occur primarily on steep slopes adjacent to the flood plains of the larger streams, and consist of approximately even-aged pole timber or small saw timber stands of shagbark hickory, swamp white oak, shingle oak, white oak, black oak, hackberry, elm, and other species.

Upland Land Cover



Present

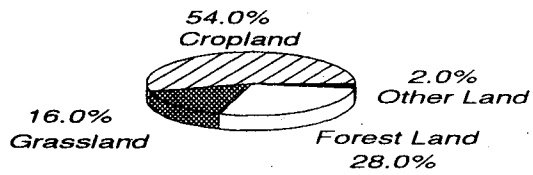


Future Without-Project

The 100-year flood plain (bottom land) for the watershed totals about 20,400 acres. Additionally, about 7,600 acres of flood plain immediately downstream of the project area (off-site) are directly affected by watershed land use and treatment. Flood plain land cover is 54% cropland, 16% grassland, 28% forest land, and 2% other land. Flood plain cropland includes 53 percent corn, 43 percent soybeans, 2 percent hay, and 2 percent wheat.

Most bottom land forests in the watershed occur on the flood plains of the larger tributary streams that drain into East Fork of the Grand River. These stands are mostly even-aged saw timber stands of silver maple, cottonwood, boxelder, hackberry, black walnut, honeylocust, osage-orange, black willow, green ash, elm, and other typically associated species.

Flood Plain Land Cover

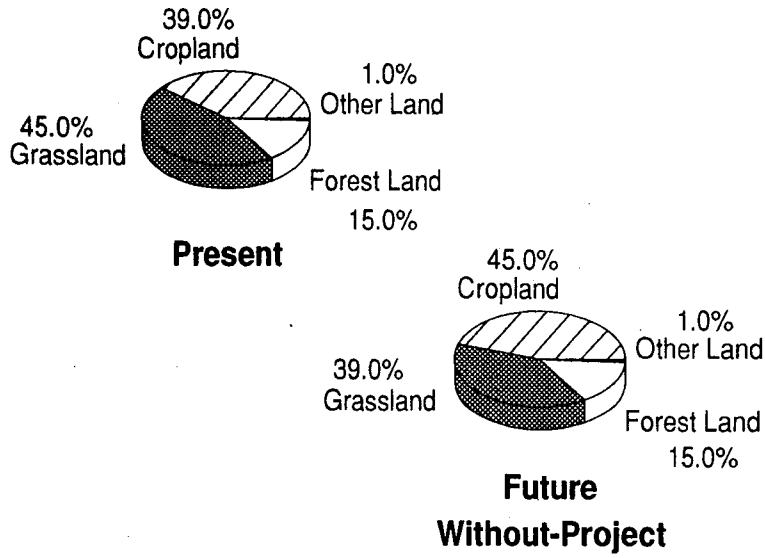


Present

The present flood plain land cover is not anticipated to change under future without project conditions.

Total watershed land cover for present and future without project conditions are illustrated below.

Watershed Land Cover

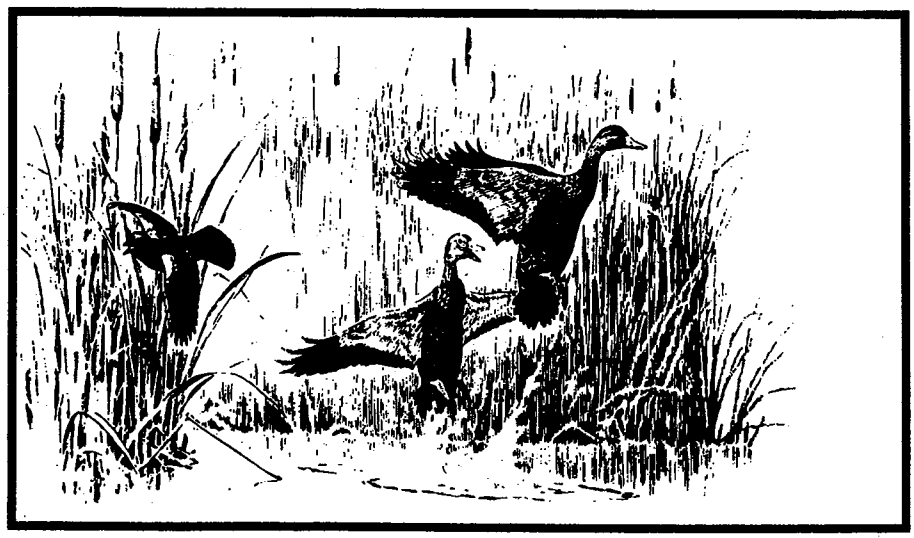


WETLANDS

There are 5,140 acres of wetlands in the watershed. Consisting of:

- 30 acres emergent wetlands
- 890 acres pastured wetlands
- 2,680 acres wooded wetlands
- 160 acres farmed wetlands
- 220 acres riverine lower perennial unconsolidated bottom wetlands
- 1,160 acres riverine intermittent unconsolidated bottom wetlands

An additional 17,770 acres of former wetlands are now prior converted cropland.



STREAM RESOURCES

Streams in Missouri are classified by the Missouri Department of Natural Resources according to their flow conditions. The watershed project area includes approximately 14 miles of the East Fork of the Grand River and its tributaries classified as class "P" (permanent flow) and 19.5 miles as class "C" (intermittent with permanent pools) (MDNR, 1987). In Iowa, approximately 100 miles of the East Fork of the Grand River and its tributaries have been classified as class "C" (Gastineau, 1992).

Studies of fish distribution in Missouri have shown 3.5 to 5 percent of the fish species found in this area early in the century have either been eliminated or greatly reduced in number. Sedimentation and turbidity are generally associated with this decline in species (MDNR, 1979). Similar patterns exist in Iowa (Roosa, 1977). The present average stream index value for the watershed is 0.41 as evaluated with the Stream Habitat Assessment Device (SHAD)(MDC, 1987). An index of 1.0 is the highest quality.

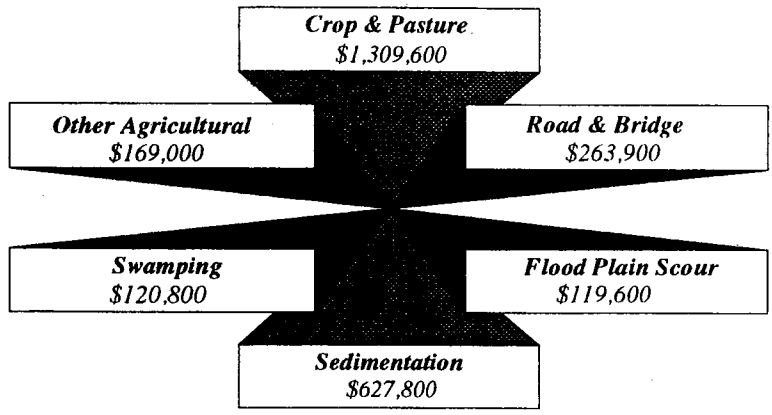
WATERSHED PROBLEMS AND OPPORTUNITIES

Major problems in the watershed include reduced farm income and increased government service costs caused by floodwater, sedimentation in the flood plain, flood plain scour, and swamping. There is also a very serious concern about sheet and rill erosion, ephemeral gullies, and permanent gullies in the upland areas of the watershed. Upland problems include the effects of sheet and rill erosion on long-term productivity; the detrimental effects of gully erosion on field access, land values, and productivity; and the reduction of crop yields and field access due to upland sedimentation. Lack of a dependable rural water supply for the agricultural community and local recreation is also a problem in the watershed. The total average annual flood damage is $2,610,700 (refer to Figure 1).

FLOODING

FIGURE 1

Average Annual Flood Damages



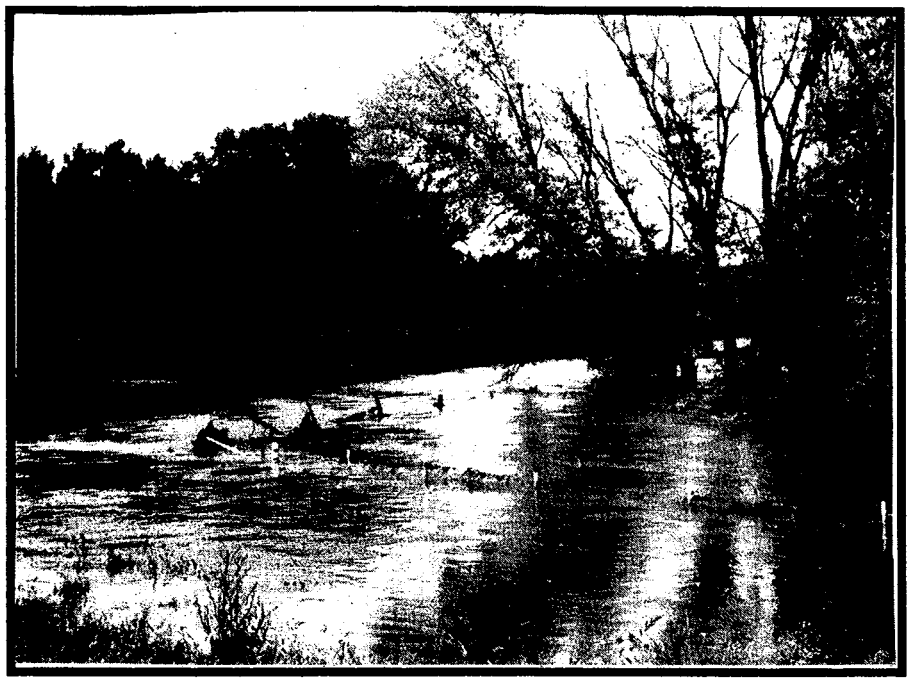
Major floods occur at least every other year and cover about 65 percent of the flood plain. Some flood damages occur every year, primarily during the period from March through June. Spring floods delay planting and cause producers to grow soybeans instead of corn. Late summer and fall flooding is also a problem. Floodwaters coat mature crops with soil which reduces both grain values and yields, and causes more wear on harvesting equipment. Flood currents cause crop lodging and voiding, which further reduces yields. Flood delayed harvests cause yield losses through lodging, reduced field access due to wetness and debris, increased probability for insect and disease damage, soybean pod shattering, and weather-damaged grain.

Other agricultural damages in the flood plain include damages to fences and deposition of debris. A survey shows there are approximately 200 miles of fence in the flood plain. Damages include the costs of removing logs and other debris. Several farmers that were interviewed reported damages to combines and other harvesting equipment from debris deposited by floods.

Non-agricultural property subject to damage includes roads and bridges. Damages to roads require rebuilding of road beds and removal of sediment and debris. Bridge damages, such as erosion around abutments and piers, and debris in railings, often require replacement of wooden decks and wing walls, as well as removal of logjams and debris. Flooded roads cause traffic delays and the rerouting of traffic, including school buses, mail delivery services, farm vehicles, and the transportation of

farm products. Costs associated with delays and rerouting were evaluated. The threat of loss of life is eminent when flooded roads hinder the deployment of emergency vehicles.

Flooding endangers the lives and the financial and psychological well-being of the people who live and travel through the watershed.



Damage to fences and other agricultural property costs $169,000 annually.

Flooding in early autumn destroys mature crops.

Total average annual flood damage is almost $1.8 million each year. (Refer to Figure 1)

SOIL EROSION

Nearly 2.2 million tons of soil erode annually, causing a major resource problem within the East Fork of the Grand River Watershed. Soil losses result from sheet and rill erosion, ephemeral and permanent gullies, streambank erosion, and flood plain scour. The following contribute to the existing erosion problems: intensive crop rotations, poor tillage practices, conversion of grassland and forest land to cropland, straightened and channelized stream reaches, and uncontrolled livestock grazing on pastures, wooded areas, and along streams. Erosion reduces the long-term productivity of the land for future generations.

Sheet and Rill Erosion

Annually, sheet and rill erosion is reducing the soil productivity on an estimated 41,900 upland acres. These inadequately protected acres have an average soil loss in excess of 24 tons per acre per year. Total sheet and rill soil loss on all upland acres is approximately 1.3 million tons per year.

Sheet and rill erosion on cropland is causing reduced yields and increased production costs due to the depletion of topsoil, organic matter, moisture holding capacity, nutrients, herbicides, and insecticides. Nearly 35,000 acres of cropland have erosion rates exceeding tolerable levels ("T").

Sheet and rill erosion rates on grassland average nearly 3 tons per acre annually with rates in excess of 7 tons occurring on overgrazed, poorly managed, and/or steeply sloping pastures. Nearly 5,000 acres of grassland are eroding at rates above tolerable levels.

Ephemeral Gully Erosion

Ephemeral gully erosion occurs on cultivated fields and causes significant soil loss and crop damage. Ephemeral gullies are smoothed during tillage operations but recur in approximately the same location and pattern during the next season or following the next rain. Plant populations are reduced because of seed and plant washout, loss of nutrients and chemicals, exposure of subsoil areas, and the formation of sediment fans at the toe of slopes. In addition to the actual voiding caused by gullying, the surrounding area is depleted and depreciated as its soil is moved in to fill the eroded areas. The ephemeral gully network is continuing to expand and "finger" into upland crop fields as a result of the active gully processes present in the watershed. Left untreated, ephemeral gullies usually evolve into permanent gullies. Ephemeral gully erosion in the watershed is estimated at 418,000 tons per year.

Permanent Gully Erosion

TABLE C

Permanent Gully Erosion
Present Average Annual Damages

	Acres	Dollars
Voiding (bridges)	--	25,600
Voiding (agricultural)	3,100	13,000
Depreciation (agricultural)	8,300	401,400
TOTAL	**11,400**	**440,00**

Past straightening and channelization of portions of the East Fork of the Grand River stream system and increased runoff from poor conservation practices have degraded (deepened) stream channels, created advancing overfalls, and triggered the movement of active gullies into the upper

reaches of many drainage areas. Areas voided by permanent gully erosion suffer significant economic losses while adjacent areas undergo depreciation of the land resource. Presently, an estimated 3,100 upland acres are voided and 8,300 acres are depreciated as a result of permanent gully erosion. Total erosion is approximately 327,000 tons yearly.

The opportunity exists to prevent gullies from advancing by constructing grade stabilization structures.

Gully erosion may be started by cattle paths, wheel ruts, or concentrated-flow of runoff water.

Streambank Erosion

Problems associated with streambank erosion are present throughout the stream system. Roads, bridges, and fences are damaged, land adjacent to stream channels is voided and depreciated, logjams are created by riparian trees that have been undercut and dislodged by erosion, and fisheries habitat is degraded. These problems are the result of excessive runoff, channel straightening, absence of woody or vegetated corridors between crop fields and the stream channel, and uncontrolled livestock grazing along streambanks. An estimated 28,000 tons of sediment are produced annually by streambank erosion.

Flood Plain Scour Erosion

Erosion of the flood plain by scour channels has affected over 2,300 acres in the watershed and over 500 acres off-site. Scouring removes soil material and agricultural chemicals, and damages standing crops and pasture. It also cuts sharp channels in fields, reduces field accessibility and creates low spots where standing water is trapped. Flood plain scour displaces nearly 110,000 tons of soil each year.

SEDIMENTATION

An estimated 31 percent (669,200 tons) of the total sediment produced annually in the East Fork of the Grand River drainage area moves through the stream system and leaves the watershed project area at the Worth and Gentry county line (Table I). The remaining 1,519,100 tons of sediment are deposited on fields in upland areas; in wetlands, lakes,

and stream channels; and on flood plains. These deposits decrease the capacity of streams and tributary channels, damage crops and grass, fill ponds and wetlands, diminish aquatic habitat, and degrade water quality.

Sediment deposits cover fertile soil, destroy plants, and reduce both current and long-term crop yields.

Upland Deposition

Only a portion of the soil material eroded annually from upland areas moves into the stream system. Nearly 744,000 tons remain behind and are deposited as over-bank deposits along gullies, in some gully bottoms, and as fan deposits where sediment-laden runoff moves across areas of reduced slope. Crops are destroyed or damaged by sediment accumulations on or around them. The quality and palatability of forages are diminished. Cattle are less inclined to graze on forages with sediment deposits. Farm machinery is subjected to additional wear-and-tear as abrasive, gritty sediment moves through bearings, blades, and other moving parts.

The upland area of the watershed contains an estimated 1,715 farm ponds and grade stabilization structures which trap approximately 180,000 tons of sediment yearly. As these structures fill with sediment, their water storage capacities, stabilization benefits, recreational, and aesthetic values are diminished.

Stream Channel Deposition

Approximately 1.2 million tons of sediment enter the East Fork of the Grand River stream system annually. About 49,000 tons remain in the system and are deposited on channel bottoms. Consequently, channel capacities are being reduced; the potential for flood plain scour, swamping damages, and flooding is increasing; and the habitat for aquatic species is decreasing.

Flood Plain Deposition

An estimated 547,000 tons of sediment are deposited annually on 9,200 acres of flood plain within the watershed. Some areas of the flood plain, especially those adjacent to or near the channel, have received in excess of four feet of sediment over the past 100 years. Much of this "modern"

sediment consists of gully-derived sands and subsoil material which have buried the old, fertile flood plain soil surface. As a result, the soil resource has been damaged and productivity reduced.

Sediment Yields

Sediment yield refers to that portion of the total erosion that is actually delivered to a specified location, such as the watershed outlet or the stream system. Gully and streambank erosion, due to their close proximity to concentrated flow channels, can contribute as much as 80 to 100 percent of their erosion product to the streams. On the other hand, most sediment produced by sheet and rill erosion is moved by sheet flow with less than 50 percent of the total sediment reaching the stream system. The remaining sediment is left behind as deposition on fields.

WATER SUPPLY

The region of southern Iowa and northern Missouri is affected by a limited quantity of water for all uses. The East Fork of the Grand River Watershed lies within this region. Water for domestic use in the watershed is obtained from well systems, streams, or surface reservoir storage. There is concern for an adequate water supply most of the time, and this concern becomes more serious during periods of drought. It is during these drought periods that water levels in wells drop or the wells go dry, stream flow is drastically reduced or dries up, and reservoirs are depleted. Ponds and lakes for livestock water also dry up or become seriously depleted. The region was dangerously close to being "out-of water" during the 1987 through 1989 drought. Public water supply districts for rural areas experience difficulty in maintaining adequate and dependable water supply sources on a month-by-month basis (Hensley, 1993).

RECREATION

The watershed project area lacks public fishing lakes. There are several public lakes within the region but outside of the watershed project area. Slip Bluff Park lies within 20 miles of Mount Ayr, Iowa. Little River Recreation Area, Nine Eagles State Park, Lake of Three Fires, and Green Valley State Park are within 30 miles of Mount Ayr. Seat Memorial Wildlife Area, three miles east of Denver, Missouri, lies partly within the watershed and is owned and managed by the Missouri Department of Conservation. This public use area provides hunting, fishing, and nonconsumptive outdoor recreational activities.

The Iowa Statewide Comprehensive Outdoor Recreation Plan (IASCORP) indicates that there is a recreational need in the region of the watershed. This determination is based on comparable needs of other regions in Iowa (Iowa Department of Natural Resources, 1990).

Several small lakes are located within 20 miles of Allendale, Missouri. These lakes are located at the following areas: Worth County Lake, Seat Memorial Wildlife Area, File's Grove Park, and Poe Hollow Park.

A study of small P.L.-566 lakes showed 97 percent of anglers traveled less than 50 miles and 38 percent traveled less than 10 miles to fish (Goebel, 1985). This study also showed that 81 percent of the impoundments were open to public fishing if the landowner was first asked for permission. Currently the fishing demand has created a 12,900 annual user-day deficiency. This demand for fishing in small private ponds is considered to be a separate demand from the public reservoir style of fishing.

The Missouri Department of Conservation and Iowa Department of Natural Resources provides bass, bluegill, and channel catfish to landowners for stocking. These were the three most sought after fish species identified in Goebel's study.

WETLANDS

This project will provide an opportunity to create wetlands above the pools and below the dams. There is potential to create wetland areas above the pools by constructing wider, more shallow areas versus narrow deeper ones. The potential also exists to create a shallow water area below the dams. These are excellent opportunities to add to the wetland resource.

SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

Formal scoping of the project began at public meetings held in Mount Ayr, Iowa, on February 22, 1989, and in Allendale, Missouri, on February 23, 1989. The concerns listed in Table D were identified by the public, as well as federal, state, and local agency representatives. The environmental evaluation conducted while planning this project focused primarily on those resource concerns ranked highly significant to decision making. Other listed resource concerns were evaluated to enable impact analyses for proposed alternative project actions. These evaluations are described further in the following section, "Formulation and Comparison of Alternatives," and Appendix C. The primary concerns of the local people and project sponsors are:

- Δ **Erosion control** - particular concern was expressed with respect to sheet and rill erosion, ephemeral gullies, permanent gullies, and streambank erosion;
- Δ **Water supply** - concerns about water quantity and quality were expressed; significant interest was voiced about the need for rural, domestic, and livestock water;
- Δ **Flood control** - flood damages to crops, roads, and bridges, as well as flood plain damages resulting from sedimentation, scouring, and swamping, were identified as major problems;
- Δ **Water-based recreation** - a need for recreational facilities that would help enhance the area's economic development was expressed.

Erosion control, water supply, and flood control were mentioned almost equally as major concerns at the public meetings. Participants expressed concerns about how current agricultural practices are degrading the soil resource. Sheet, rill, and gully erosion were mentioned as major problems within the watershed. Streambank and flood plain scour erosion were also cited as problems.

Sedimentation and resultant loss of capacity in existing water supply reservoirs and the undependable nature of shallow wells during periods of drought were stated as major points of concern. A critical need for additional supplies of both domestic and livestock water was expressed by many participants. Many residents also expressed a desire for water-based recreational facilities.

Local landowners and operators cited numerous flood-related problems, especially along the main stems of the East Fork of the Grand River and Lotts Creek. Some participants noted that channels in some areas are gradually filling with sediment. One landowner stated that Lotts Creek had flooded seven times in 1986. Problems mentioned include: flood damages to growing crops and to roads and bridges, deposition of sand and debris, and scour of flood plain fields.

Short term and long term water supply needs were discussed in Iowa and Missouri. Residents from Missouri decided to purchase water from a private water supply company in Worth County.

TABLE D

Evaluation of Concerns

Concerns	Degree of Significance to Decision Making[1]			Remarks
	High	Medium	Low	
Flood Damage	X			excessive frequency, crop damages, planting & harvesting delays, road & bridge damages
Soil Erosion	X			yield reductions, increased production costs
Water Supply	X			need for additional water during drought
Small Dams	X			preferred - less impact of land conversion and better water distribution
Sediment Damage	X			affecting production and field access
Gully Erosion	X			real estate depreciation, field access, aesthetics, safety factors
Recreation	X			local need for both water and land based
Road & Bridge Damage		X		maintenance is high
Streambank Erosion		X		threatens crops and bridges, reduces real estate values
Wildlife Habitat			X	drought affected
Stream Corridor			X	little management concern (lack of vegetative protection)
Wetlands			X	drought affected
Cropland Conversion (Flood Risk)			X	some occurring
Threatened and Endangered Species			X	no known resources
Prime Farmland			X	little concern, minimal loss
Loss of Forest			X	management needed, economics, wildlife habitat
Archaeological and Historic Losses			X	no known resources
Animal Waste			X	little concern (few confinement operations)
Mineral Resources			X	little concern (not an economic factor)

[1] **High**: reflects concerns expressed by over 50% of the comments at scoping meetings,
Medium: over 25% but under 50%, and
Low: under 25%.

These concerns are public perceptions which may not be supported by field data gathered and analyzed as part of this project.

FORMULATION AND COMPARISON OF ALTERNATIVES

In developing alternative plans, an effort was made to select elements that would solve the identified problems in the most efficient manner. Federal, state, and local agencies, in cooperation with nongovernmental interests, participated in the formulation process. Non-structural and a wide variety of structural alternatives were discussed with the project sponsors and landowners in the watershed. Alternatives that failed to solve problems associated with agricultural flooding, land depreciation, permanent gully erosion, and projected water supply needs were determined unacceptable by these local residents and therefore are not included in this document. Plans that could be implemented by them were considered.

FORMULATION PROCESS

Four problems or opportunities were determined to be significant. These problems were identified through resource inventories, public meetings, and interviews.

1. **Flooding** - Crops, pastures, fences, roads and bridges, and other agricultural properties are damaged by flooding. Sediment deposition, as well as scouring and swamping damages contribute to crop losses, lower soil productivity, and increased road and bridge maintenance. Flooded roads hinder traffic and the deployment of ambulances, fire protection, law enforcement, and other emergency vehicles.

2. **Land Damages** - Sheet, rill, and gully erosion contribute to lower soil productivity, increase off-site sedimentation, and reduce field accessibility. On-site and off-site productivity is lowered on cropland, grassland, and forest land due to long term land damages.

3. **Water Supply** - The community of Mount Ayr and the Southern Iowa Rural Water Association are in need of additional water supply for domestic use and fire protection.

4. **Recreation** - There is a large demand and need for public fishing lakes in the watershed.

To determine how flood plain problems could best be solved and how other problems and opportunities could be addressed, several systems of structural measures were analyzed. The environmental effects of these measures were also evaluated. Only those measures which provided benefits greater than their costs were considered in formulating the National Economic Development (NED) plan.

It became apparent that the community of Mount Ayr, Iowa, and the Southern Iowa Rural Water Association needed a water supply source and would be financially able to meet their share for the cost of developing a water supply source through the P.L.-566 program.

A rural water district in Worth County, Missouri also needed a water supply source and site F-3 was considered. During formulation, a private water supply company moved into the area and began meeting their needs. The sponsors then chose not to include water supply at site F-3 and consideration for this was no longer pursued during formulation.

The sponsors, SCS, and other USDA agencies jointly determined the expected acceptance of measures for flood control, land treatment, and recreation. Public meetings were held to discuss measures, cost-sharing, and the rate of participation for plan installation.

The alternatives with small dams, large multiple-purpose dams, and land treatment as an interdependent part of project installation were expected to have higher participation rates than other alternatives. Alternatives with small dams provide watershed residents with a more desirable distribution of project benefits such as flood control, erosion control, recreation, and water for livestock and fire protection. Several potential sites were evaluated for their capacity to satisfy needs for local recreational opportunities. Sites GB-3 and F-3 were selected as multiple-purpose sites that provide recreational opportunities.

The following alternatives describe the basis for selecting combinations of several measures for further analysis:

Initial structural alternatives dealt with combinations of large floodwater retarding dams (drainage areas of 1,200 to 3,500 acres). From these evaluations two large multiple-purpose dams (GB-3 and F-3) and one single-purpose dam (F-4) were selected by the sponsors. The multiple-purpose dams were sized to maximize benefits within physical, economic, and social constraints.

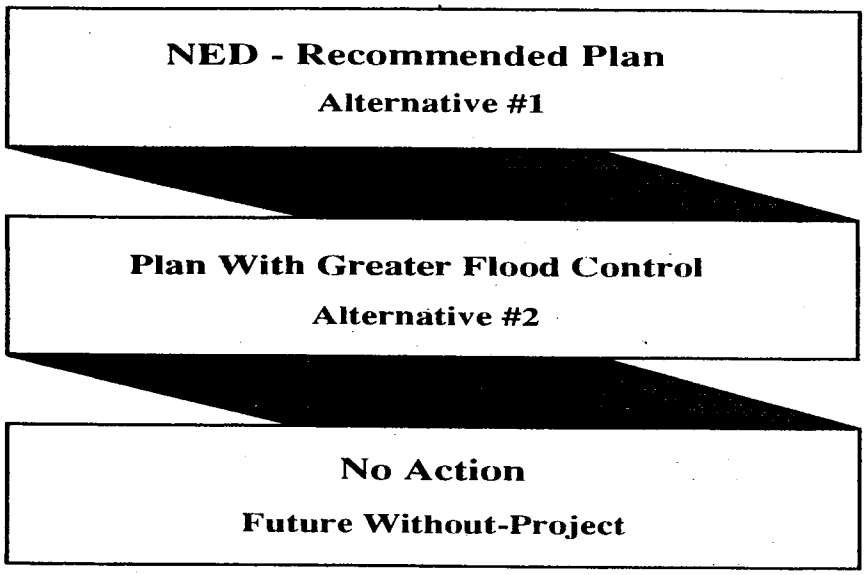
Several alternatives were evaluated consisting of various combinations of small dams (drainage areas of 100 to 350 acres). Small dams were grouped using physical features such as topography, soil conditions, drainage area, and estimated economic and environmental effects. The NED objective was reached by adding small dams in increments until annual net benefits were maximized. (Refer to Investigation and Analyses, Appendix C).

Selection of land treatment alternatives for cropland, grassland, and forest land with excessive erosion was accomplished by incrementally evaluating the cost and return of mechanical and management practices by slope and soil mapping unit. Land treatment benefits were calculated as the difference between net income with and without conservation, less the cost of the conservation measures.

District conservationists identified 425 gully erosion sites that could be treated by grade stabilization structures. Sites were stratified into four drainage area groups, ranging from less than 15 to 70 acres. Each group was then incrementally evaluated to meet the NED objective. There are 344 sites in the 15- to 70-acre drainage area range that meet the NED objective.

The first two alternative plans include installation of erosion control measures that are necessary to adequately treat 75 percent of the drainage area above flood control dams. The extent of land treatment was determined by subtracting treated acres, existing and projected, from the acres of erosion control required by the alternative plans.

DESCRIPTION OF ALTERNATIVE PLANS



Alternative 1 (NED/Recommended Plan)

Structural Components

Alternative 1 has been identified through incremental analysis as the National Economic Development (NED) plan.

Two hundred and twenty small single-purpose floodwater retarding dams (4- to 11-acre permanent pools, 100- to 350-acre drainage areas) and one large single-purpose floodwater retarding dam, F-4 (22-acre permanent pool, 1,090-acre drainage area) for a total of 221 single-purpose floodwater retarding dams.

One multiple-purpose dam, F-3, for flood prevention and fish, wildlife, and recreational development (100-acre permanent pool, 1,180-acre drainage area).

One multiple-purpose dam, GB-3, for flood prevention, rural water supply, and fish, wildlife, and recreational development (350-acre permanent pool, 6,030-acre drainage area).

One water supply intake structure.

One raw water transmission line.

Structures for recreational facilities at dams GB-3 and F-3.

Eighty-nine dry hydrants installed for fire protection.

Refer to Project Map, Appendix E, for approximate dam locations.

Land Treatment Components

Gully Control
- 344 grade stabilization structures.

Cropland (upland)
- 55 acres, grassed waterways
- 570,000 feet of terraces
- 190,000 feet of underground outlets
- Conversion of 89 acres of cropland to grassland through critical area planting
- 1,985 acres of integrated pest and nutrient management
- 46,325 feet of field border.

Grassland (upland)
- 1,200 acres of grassland improvement (Includes 1,100 acres of prescribed grazing. Prescribed grazing includes cross-fencing, water supplies, forage management, and rotational grazing.).
- 33,500 feet of diversions on grassland to protect cropland
- 895 acres of pasture and hayland management including planned grazing systems
- 20 acres of filter strips
- 40 acres of livestock exclusion to protect filter strips and riparian areas.

Forest land
- 400 acres livestock exclusion (fencing).
- 53 acres of tree planting.

Costs

Estimated Installation Costs:

	P.L.-566	Other	Total
		(Dollars)	
Structural Measures	13,592,300	2,891,100	16,483,400
Land Treatment	2,285,000	1,076,000	3,361,000
TOTAL	**15,877,300**	**3,967,100**	**19,844,400**

Average Annual Costs:

	Installation	OM&R	Total
		(Dollars)	
Structural Measures	1,322,700	133,100	1,455,800
Land Treatment	269,800	67,300	337,100
TOTAL	**1,592,500**	**200,400**	**1,792,900**

Benefits

Average Annual Benefits: $2,358,000

Benefit/Cost ratio: 1.32:1.0

Alternative 2
(Additional Flood Control)

Structural Components

Two hundred and forty single-purpose floodwater retarding dams (4- to 11-acre permanent pools, 100- to 350-acre drainage areas).

One large single-purpose floodwater retarding dam, F-4 (22-acre permanent pool, 1,090-acre drainage area).

One multiple-purpose dam, F-3, for flood prevention and fish, wildlife, and recreational development (100-acre permanent pool, 1,180-acre drainage area).

One multiple-purpose dam, GB-3, for flood prevention, rural water supply, and fish, wildlife, and recreational development (350-acre permanent pool, 6,030 acres drainage area).

Eighty-nine dry hydrants installed for fire protection.

Land Treatment Components

Gully Control

- 344 grade stabilization structures.

Cropland (upland)

- 60 acres, grassed waterways
- 621,600 feet of terraces
- 207,300 feet of underground outlets
- Conversion of 110 acres of cropland to grassland through critical area planting
- 1,985 acres of integrated pest and nutrient management
- 46,325 feet of field border.

Grassland (upland)

- 1,300 acres of grassland improvement (Includes 1,200 acres of prescribed grazing. Prescribed grazing includes cross-fencing, water supplies, forage management, and rotational grazing.).
- 36,500 feet of diversions on grassland to protect cropland
- 895 acres of pasture and hayland management including planned grazing systems
- 20 acres of filter strips
- 40 acres of livestock exclusion to protect filter strips and riparian areas.

Forest land

- 440 acres livestock exclusion (fencing).
- 58 acres of tree planting.

Costs

Estimated Installation Costs:			
	P.L.-566	Other	Total
	(Dollars)		
Structural Measures	14,551,300	2,925,300	17,476,600
Land Treatment	2,378,100	1,112,100	3,490,200
TOTAL	**16,929,400**	**4,037,400**	**20,966,800**

Average Annual Costs:			
	Installation	OM&R	Total
	(Dollars)		
Structural Measures	1,402,400	141,800	1,544,200
Land Treatment	280,100	69,800	349,900
TOTAL	**1,682,500**	**211,600**	**1,894,100**

Benefits

Average Annual Benefits: $2,423,800
Benefit/Cost ratio: 1.28:1.0

No-Action (Future Without Plan) Refer to forecasted future without-project conditions in the following "Effects of Alternative Plans" section.

Components None

Costs None

EFFECTS OF ALTERNATIVE PLANS

Floodwater Damage

Existing Conditions

TABLE E

Average Annual Flood Damages By Reach
Existing Conditions

Evaluation Reach	Flood Plain	Crop and Pasture	Other Ag.	Road and Bridge	Sediment	Swamping	Scour	Total
	(Acres)	(Dollars)						
Upper East Fork	10,000	512,700	68,200	154,800	176,000	45,500	38,900	**996,100**
Lotts Creek	7,600	363,200	50,400	100,200	142,800	42,300	37,500	**736,400**
Lower East Fork	2,800	87,400	14,800	8,900	91,500	11,800	13,400	**227,800**
Off-site	7,600	346,300	35,600	----	217,500	21,200	29,800	**650,400**
Total	**28,000**	**1,309,600**	**169,000**	**263,900**	**627,800**	**120,800**	**119,600**	**2,610,700**

Major floods occur at least every other year and cover about 65 percent of the flood plain. Some flood damages occur every year, primarily from March through June. Present agricultural damages to crops and pastures in the project area are estimated at $963,300 annually. Damages in the flood plain immediately downstream (off-site) are estimated to be $346,300.

Other agricultural damages in the flood plain include damages to fences and deposition of debris and sediment. A survey shows that there are approximately 200 miles of fence in the flood plain. Damages from deposition include the costs of removing logs, sediment and other debris. Several farmers that were interviewed reported damages to combines and other harvesting equipment caused by debris deposited by floods.

Future Without-Project

The flooded area is expected to remain the same without a watershed project. Flooding depths should remain at present levels and no significant changes are anticipated in floodwater damages or the problems associated with floods.

Alternative 1
(NED-Recommended Plan)

TABLE F

Average Annual Flood Damages By Reach
Future with Alternative 1 (NED-Recommended Plan)

Evaluation Reach	Flood Plain	Crop and Pasture	Other Ag.	Road and Bridge	Sediment	Swamping	Scour	Damages Total
	(Acres)	----------Dollars----------						
Upper East Fork	8,500	214,900	25,400	26,700	93,400	22,700	21,500	**404,600**
Lotts Creek	6,000	147,300	19,200	18,300	78,000	20,300	21,200	**304,300**
Lower East Fork	2,300	41,100	6,100	800	60,500	6,000	8,100	**122,600**
Off-site	6,200	248,000	25,200	----	161,900	14,100	22,000	**471,200**
TOTAL	**23,000**	**651,300**	**75,900**	**45,800**	**393,800**	**63,100**	**72,800**	**1,302,700**

The recommended plan will eliminate flooding on approximately 5,000 acres and reduce flooding on 23,000 acres with the 100-year flood event. The total average annual flood damages will be reduced by 56 percent. Average annual road and bridge damages will be reduced 83 percent. Average annual damages to crops, pastures, and other agricultural property will be reduced 51 percent.

Reduction in average annual flood damages with alternative 1 varies considerably among evaluation reaches.

Alternative 2
(Additional Flood Control)

Alternative 2 will eliminate flooding on approximately 5,100 acres and reduce flooding on 22,900 acres. The total average annual floodwater damages will be reduced 57 percent. Road and bridge damages will be reduced 83 percent. Crop, pasture, and other agricultural damages will be reduced 52 percent.

Reduction in average annual flood damages with alternative 2 varies considerably among evaluation reaches.

TABLE G

Average Annual Flood Damages By Reach
Future With Alternative 2

Evaluation Reach	Flood Plain	Crop and Pasture	Other Ag.	Road and Bridge	Sediment	Swamping	Scour	Damages Total
	(Acres)	----------Dollars----------						
Upper East Fork	8,400	196,600	24,100	26,200	73,900	20,800	18,500	**360,100**
Lotts Creek	5,800	141,400	18,700	17,900	74,400	20,700	21,300	**294,400**
Lower East Fork	2,300	38,100	5,900	700	62,300	5,900	8,100	**121,000**
Off-site	6,200	258,100	25,300	----	179,100	15,700	24,300	**502,500**
TOTAL	**22,700**	**634,200**	**74,000**	**44,800**	**389,700**	**63,100**	**72,200**	**1,278,000**

Soil Erosion

Existing

Nearly 2.2 million tons of soil erode annually, causing a major resource problem in the East Fork of the Grand River Watershed project area. Soil losses result from sheet and rill erosion, ephemeral and permanent gullies, streambank erosion, and flood plain scour.

The federal Agricultural Conservation Program (ACP), administered by the (USDA) - Agricultural Stabilization and Conservation Service (ASCS), and state programs , administered by the local Soil and Water Conservation Districts (SWCDs) land treatment cost-share assistance programs are ongoing cost-share allocations for federal and state programs are completely expended each year. Conservation measures included in these programs include terraces, underground outlets, grassed waterways, diversions, critical area planting, and grade stabilization structures. Additional cost-share assistance is desired by farmers and needed to control gully erosion.

The Worth County, Missouri, SWCD also administered a Special Area Land Treatment (SALT) project for the Little Rock Creek Watershed, which lies in East Fork of the Grand River Watershed. This five-year project began in 1989 and ended in 1993. Erosion has been successfully reduced on 1,777 acres of cropland to the tolerable soil loss level ("T").

Land enrolled in the Conservation Reserve Program (CRP) is included as adequately protected grassland. There are 27,600 acres under CRP contracts, as of the 11th sign-up period, August 1991. District conservationists did not expect significant additional entries into the CRP in subsequent sign-up periods.

Sheet and Rill Erosion

Annually, sheet and rill erosion is reducing the soil productivity on an estimated 41,900 upland acres. These inadequately protected acres have an average soil loss in excess of 24 tons per acre per year.

Sheet and rill erosion on cropland is causing reduced yields and increased production costs due to the depletion of topsoil, organic matter, moisture holding capacity, and applied fertilizer, herbicides, and insecticides.

Sheet and rill erosion rates on grassland average nearly 3 tons per acre annually with rates in excess of 7 tons occurring on overgrazed, poorly managed, and/or steeply sloping pastures. Nearly 5,000 acres of grassland are eroding at rates above tolerable levels ("T"). Upland sheet and rill erosion causes $120,000 damages annually.

Ephemeral Gully Erosion

Ephemeral gully erosion occurs on cultivated fields and causes significant soil loss and crop damage. Ephemeral gullies are smoothed during tillage operations but recur in approximately the same location and pattern during the next season or following the next rain. Plant populations are reduced because of seed and plant washout, loss of nutrients and chemicals, exposure of subsoil areas, and the formation of sediment fans at the toe of slopes. In addition to the actual voiding caused by gullying, the surrounding area is depleted and depreciated as its soil is moved in to fill the eroded areas. The ephemeral gully network is continuing to expand and "finger" into upland crop fields in response to the active gully processes present in the watershed. Left untreated, ephemeral gullies usually evolve into permanent gullies. Upland ephemeral gully erosion causes $238,000 damages annually.

Permanent Gully Erosion

Past straightening and channelization of portions of the East Fork of the Grand River stream system and increased runoff from poor conservation practices have degraded (deepened) stream channels, created advancing overfalls, and triggered the movement of active gullies into the upper reaches of many drainage areas. Areas voided by permanent gully erosion suffer a significant economic loss while adjacent areas undergo depreciation of the land resource.

An estimated 3,100 upland acres are voided and 8,300 acres are depreciated as a result of permanent gully erosion.

Total erosion from permanent gullies is estimated at 327,000 tons yearly. Average annual damages are estimated to be $1,476,100.

Streambank Erosion

Problems associated with streambank erosion are present throughout the stream system. Roads, bridges, and fences are damaged; land adjacent to stream channels is voided and depreciated; logjams are created by riparian trees that have been undercut and dislodged by erosion; and fisheries habitat is degraded. These problems are the result of excessive runoff, channel straightening, absence of woody or vegetated corridors between crop fields and the stream channel, and uncontrolled livestock grazing along streambanks.

An estimated 28,000 tons of sediment are produced annually by streambank erosion.

Flood Plain Scour Erosion

Scouring removes soil material and agricultural chemicals, and damages standing crops and pasture. It also cuts sharp channels in fields, reduces field accessibility and creates low spots where standing water is trapped.

Flood plain scour erosion causes $119,600 of damages annually.

Future Without-Project

There are two changes expected to occur in the watershed in the future. One change is the conversion of a percentage of the Conservation Reserve Program acreage from grassland to cropland. Projections for CRP grassland to be converted to cropland are based on the Monson, MDNR Report 89-4, 1992. CRP acres not converted will remain protected grassland. It is predicted that 11,500 acres of CRP will be converted to cropland, of which 5,400 acres will be adequately treated, 4,900 acres will meet conservation compliance requirements but will not be adequately treated, and 1,200 acres will not be adequately treated.

The second expected change is the reduction of soil erosion on highly erodible cropland due to compliance with the conservation provisions of the 1985 Food Security Act (FSA) and 1990 Food, Agriculture, Conservation and Trade Act (FACTA). About 96 percent of all highly erodible cropland (HEL) is planned and 93 percent of all plans are expected to be applied. An estimated 11,600 acres of upland cropland that are not adequately protected at the present will be adequately protected due to conservation compliance. An additional 27,600 acres of cropland will be in compliance using alternative conservation systems, but will not meet the definition of adequately protected (tolerable soil loss level, "T").

Although the conservation provisions of the FSA will reduce sheet, rill, and ephemeral gully erosion, the watershed's permanent gully system is expected to remain active with erosion rates continuing at present levels. Future voiding will occur as gully headcuts advance and branch out, dissecting and isolating fields into smaller tracts. Many tracts will become less accessible to farm machinery, resulting in depreciation to less intensive land uses or abandonment. Under the future without-project conditions, it is estimated that an additional 1,300 acres will be voided and 10,350 acres depreciated over the next 25 years. Total erosion attributable to permanent gullies will remain at approximately 327,000 tons annually. The average annual damage from gully erosion is estimated at $1,476,100 without the project.

Total annual soil loss resulting from streambank erosion is expected to remain about the same during future without-project conditions. While some stream reaches will experience increased bank erosion, others will undergo healing and reduced erosion.

Flood plain scour erosion will continue to cause $119,600 of annual damages.

Alternative 1
(NED - Recommended Plan)

Land treatment is required on 75 percent of the drainage area above each floodwater retarding dam. The installation of watershed project land treatment measures will reduce erosion to the tolerable level on 10,500 acres (8,900 acres of cropland; 1,200 acres of grassland; and 453 acres of forest land). Erosion from all sources will decrease from 1,425,000 tons annually to about 1,176,600 tons (17 percent reduction). Increased cost-share assistance will be available to all landowners in the watershed (including 14 limited resource farmers) for accelerated land treatment.

Conversion and treatment of CRP acres to cropland is expected to be the same as future conditions without a project.

Sheet and Rill Erosion

Application of the planned land treatment measures will provide adequate erosion protection for an additional 8,900 acres of cropland. This is expected to reduce erosion by approximately 13 percent (nearly 63,000 tons annually). Sheet and rill erosion on grassland and forest land is projected to decrease by nearly 10,000 tons per year.

Total on-site benefits from land treatment on cropland are $277,100. These benefits accrue from:

(1) reductions in sheet and rill erosion;

(2) conservation of moisture, nutrients, chemicals, and fertilizers; and

(3) savings from conservation tillage.

Protection of the watershed's soil resource by the application of proposed conservation measures will benefit present land users, as well as future generations. Runoff volumes and peak discharges will be reduced, helping to maintain soil loss at an acceptable level and ensuring the value of the resource indefinitely.

Ephemeral Gully Erosion

Cropland acres not adequately protected will decrease from 34,700 acres to 25,300 acres. It is forecasted that sediment derived from ephemeral gully erosion will decrease by approximately 67,800 tons annually. Fewer crops will be damaged, farming efficiency will improve, and voiding and depreciation of the soil resource will be reduced.

Permanent Gully Erosion

Installation of grade stabilization structures will stabilize active gully systems on critical eroding areas and reduce voiding and depreciation damages. Erosion is expected to decrease by nearly 74,000 tons annually, a 23 percent decrease when compared to the future without-project conditions. Average annual economic damages caused by permanent gullies will be reduced 12.6 percent. Areas voided and depreciated will be reduced 21.4 percent. These benefits reflect the production value of the soil resources that would be lost or greatly depreciated under the future without-project conditions.

Streambank Erosion

Storm related runoff, within the floodwater controlled areas, will enter the stream system at a regulated rate. Construction of 220 small floodwater retarding dams will reduce the frequency of bankfull flow conditions. Streambank erosion is projected to decrease about 25 percent. Significant bank erosion will continue along some stream reaches due to past channelization, tillage and crop production close to the streambank edge (lack of buffer strips), and uncontrolled grazing of livestock.

Flood Plain Scour Erosion

The recommended plan will reduce flood plain scour erosion damages from $119,600 annually to $72,800 (39 percent reduction).

Alternative 2
(Additional Flood Control)

The effects of Alternative 2 compared to Alternative 1 (NED/recommended plan):

- Reduce soil erosion to an adequate level on an additional:
  800 cropland acres;
  100 acres of grassland;
  40 acres of forest land;

- Reduce flood plain scour erosion by 38 percent;
- Increase other land (water) by 100 acres; and
- Decrease cropland, grassland, and forest land proportionately.

Conversion and treatment of CRP acres to cropland is expected to be the same as future without-project conditions. The addition of 20 small floodwater retarding dams will not significantly effect land cover or treatment.

Average annual economic damages caused by permanent gullies will be reduced 12.8 percent, 0.2 percent more than the recommended plan. Areas voided and depreciated will be reduced 22.5 percent.

Construction of 240 small floodwater retarding dams will reduce the frequency of bankfull flow conditions, and will provide about 25 percent reduction in streambank erosion.

TABLE H

Economic Loss From Permanent Gully Erosion [1]

	ALTERNATIVE 1 (NED-Recommended Plan)		ALTERNATIVE 2 (Additional Flood Control)		Future Without-Project	
	Acres	*Dollars*	*Acres*	*Dollars*	*Acres*	*Dollars*
Voiding (bridges)	--	22,200	--	22,200	--	27,500
Voiding (Ag.)	3,640	69,800	3,580	69,400	4,840	93,900
Depreciation (Ag.)	18,200	1,194,500	18,065	1,191,400	20,900	1,354,700
TOTAL	**21,840**	**1,286,500**	**21,645**	**1,283,000**	**25,740**	**1,476,100**
Benefits	**3,900**	**189,600**	**4,095**	**193,100**	--	--

[1] Future projections are for the life of the recommended project and include existing damages incurred. (Reference Table C in Problems and Opportunities section.)

Sedimentation

Existing

An estimated 31 percent (669,200 tons) of the total sediment produced annually in the East Fork of the Grand River drainage area moves through the stream system and leaves the watershed at the Worth and Gentry county line (Table I). The remaining 1,519,100 tons of sediment are deposited on fields in upland areas, in wetlands, lakes, stream channels, and on flood plains. These deposits decrease the capacity of streams and tributary channels, damage crops and grass, fill ponds and wetlands, diminish aquatic habitat, and degrade water quality.

Upland Deposition

Only a portion of the soil material eroded annually from upland areas moves into the stream system. It is estimated that nearly 744,000 tons of sediment remain behind and are deposited at various locations. Sediment deposition occurs as overbank deposits along gullies, in aggrading gully reaches, and as fan deposits where sediment-laden runoff moves across areas of lower gradient. Crops are killed or damaged by sediment accumulations on or around them. The quality and palatability of grass used for grazing are diminished. Cattle are less inclined to graze on grass with sediment deposited on it. Farm machinery is subjected to additional wear-and-tear as abrasive, gritty sediment moves through bearings and other moving parts.

The upland area of the watershed contains an estimated 1,715 farm ponds and grade stabilization structures which trap approximately 180,000 tons of sediment yearly. As these structures fill with sediment, their water storage capacities, stabilization benefits, and recreational and aesthetic values are diminished.

Average annual damages due to upland sediment deposition are estimated to be $255,400.

Stream Channel Deposition

Approximately 1.2 million tons of sediment enter the East Fork of the Grand River stream system annually. About 49,000 tons remain in the system and are deposited on channel bottoms. Consequently, channel capacities are being reduced; the potential for flood plain scour, swamping damages, and flooding is increasing; and the habitat for aquatic species is decreasing.

TABLE I

Soil Loss, Sediment Deposition, Sediment Yield Existing Conditions

Sediment Sources	Upland Acres [1]	Gross Soil Loss	Deposited		Sediment Entering Stream System [3]	Deposited		Sediment Leaving Watershed
			Small Lakes [2]	Upland		Stream Channels	Flood Plain	
CROPLAND		Tons Per Year [4]						
Sheet & Rill (A)	19,100	77,300						
(N)	34,800	974,200	98,000	381,400	572,100	8,200	123,100	440,800
GRASSLAND								
Sheet & Rill (A)	68,300	150,600						
(N)	4,900	37,200	18,100	101,800	67,900	1,200	34,500	32,200
FOREST LAND								
Sheet & Rill (A)	16,600	43,300						
(N)	2,200	15,800	5,700	42,700	10,700	200	3,900	6,600
OTHER	2,100	8,400	600	4,700	3,100	100	1,000	2,000
PERMANENT GULLY		327,000	18,500	61,700	246,800	12,200	172,300	62,300
EPHEMERAL GULLY		417,600	39,000	151,400	227,200	7,300	147,700	72,200
STREAMBANK		28,000			28,000	14,600	4,900	8,500
SCOUR		108,900			54,500	4,900	59,400	44,600
TOTALS	**148,000**	**2,188,300**	**179,900**	**743,700**	**1,210,300**	**48,700**	**546,800**	**669,200**

[1] *(A)-Land adequately protected from erosion; (N)-Land not adequately protected from erosion.*
[2] *Drainage area less than 1 square mile - includes farm and grade stabilization ponds.*
[3] *Represents gross soil loss minus sediment deposited in upland areas and in ponds.*
[4] *All figures rounded to nearest 100 tons.*

Flood Plain Deposition

Nearly 657,000 tons of sediment are deposited annually on 12,450 acres of flood plain in the watershed project area and off-site. Total sedimentation damages are $627,800.

Some areas of the flood plain, especially those adjacent to or near the channel, have received in excess of four feet of sediment over the past 100 years. Much of this "modern" sediment consists of gully-derived sands and subsoil material which have buried the old, fertile flood plain soil surface. As a result, the soil resource has been damaged and productivity reduced.

Sediment Yields

Sediment yield refers to that portion of the total erosion that is actually delivered to a specified point, such as the watershed outlet or the stream system. Gully and streambank erosion, due to their close proximity to concentrated flow channels, can contribute as much as 80 to 100 percent of their erosion product to the streams. On the other hand, most sediment produced by sheet and rill erosion is moved by sheet flow with less than 50 percent of the total sediment reaching the stream system. The remaining sediment is left behind as deposition on roads and farm fields.

Future Without-Project

Due to implementation of the Food Security Act, sediment resulting from sheet, rill and ephemeral gully erosion will be reduced. Total sediment input from other sources is expected to remain about the same. It is estimated that sediment delivered to the stream system will decrease by about 412,000 tons annually while sediment yield to the watershed outlet will decline by 224,000 tons (Table J).

TABLE J

Soil Loss, Sediment Deposition, Sediment Yield
Future Without Project

Sediment Sources	Upland Acres [1]	Gross Soil Loss	Deposited		Sediment Entering Stream System [3]	Deposited		Sediment Leaving Watershed
			Small Lakes [2]	Upland		Stream Channels	Flood Plain	
CROPLAND		Tons Per Year [4]						
Sheet & Rill (A)	30,700	117,900						
(N)	34,700	358,400	44,600	172,700	259,000	5,400	81,200	172,400
GRASSLAND								
Sheet & Rill (A)	56,900	130,000						
(N)	4,800	36,500	15,900	90,400	60,200	800	22,700	36,700
FOREST LAND								
Sheet & Rill (A)	16,600	43,300						
(N)	2,200	15,800	5,700	42,700	10,700	200	2,600	10,700
OTHER	2,100	8,400	600	4,700	3,100	100	600	3,100
PERMANENT GULLY		327,000	18,500	61,700	246,800	8,000	113,700	125,100
EPHEMERAL GULLY		250,800	23,500	90,900	136,400	4,800	97,500	34,100
STREAMBANK		28,000			28,000	9,600	3,200	15,200
SCOUR		108,900			54,500	3,200	57,700	48,000
TOTALS	**148,000**	**1,425,000**	**108,800**	**463,100**	**798,700**	**32,100**	**379,200**	**445,300**

[1] *(A)-Land adequately protected from erosion; (N)-Land not adequately protected from erosion.*
[2] *Drainage area less than 1 square mile - includes farm and grade stabilization ponds.*
[3] *Represents gross soil loss minus sediment deposited in upland areas and in ponds.*
[4] *All figures rounded to nearest 100 tons.*

Upland Deposition

Sediment available for deposition in upland areas is projected to decline by 38 percent or about 280,000 tons per year. Sediment yield to farm ponds and grade stabilization structures will be reduced by about 71,000 tons annually (approximately 40 percent).

Stream Channel Deposition

Sediment yield to the stream system will decrease by approximately 34 percent. As a result, sediment deposited on channel bottoms will be reduced by about 16,500 tons annually.

Flood Plain Deposition

Nearly 380,000 tons of sediment will be deposited annually on the watershed's flood plain. This represents a 31 percent decrease from present conditions. Infertile and sub-fertile sediments will continue to accumulate on the flood plain, but at reduced rates. Damages to the soil resource and productivity will continue.

Alternative 1
(NED - Recommended Plan)

The effects of conservation compliance are projected to continue. Installation of proposed floodwater retarding dams and associated land treatment will act to further reduce sediment supplies from nearly all

source areas. Annually, sediment entering the stream system is projected to decrease by nearly 300,000 tons, while sediment leaving the watershed outlet will be reduced by an estimated 167,000 tons.

TABLE K

Soil Loss, Sediment Deposition, Sediment Yield
Future With Alternative 1 (NED-Recommended Plan) Conditions

Sediment Sources	Upland Acres [1]	Gross Soil Loss	Deposited		Sediment Entering Stream System [3]	Deposited		Sediment Leaving Watershed
			Lakes [2]	Upland		Stream Channels	Flood Plain	
CROPLAND		Tons Per Year [4]						
Sheet & Rill (A)	39,200	151,600						
(N)	25,300	261,900	107,900	122,200	183,400	3,400	50,900	129,100
GRASSLAND								
Sheet & Rill (A)	57,500	132,800						
(N)	3,500	26,600	41,500	70,700	47,200	500	14,200	32,500
FOREST LAND								
Sheet & Rill (A)	16,900	44,800						
(N)	1,600	11,500	15,100	33,000	8,200	100	1,600	8,200
OTHER	4,000	8,400	3,100	3,200	2,100	0	400	2,100
PERMANENT GULLY		253,300	97,700	31,100	124,500	5,000	71,200	48,300
EPHEMERAL GULLY		183,000	61,600	48,600	72,800	3,000	61,000	8,800
STREAMBANK		21,000			21,000	6,000	2,000	13,000
SCOUR		81,700			40,900	2,000	42,900	36,800
TOTALS	**148,000**	**1,176,600**	**326,900**	**308,800**	**500,100**	**20,000**	**244,200**	**278,800**

[1] *(A)-Land adequately protected from erosion; (N)-Land not adequately protected from erosion.*
[2] *Includes farm ponds, grade stabilization structures, and single- and multiple-purpose P.L.-566 structures.*
[3] *Represents gross soil loss minus sediment deposited in upland areas and in ponds.*
[4] *All figures rounded to nearest 100 tons.*

Upland Deposition

Sediment produced in upland areas is projected to decrease 17 percent when compared to without-project conditions. Consequently, the amount of sediment available for deposition in upland areas will decrease by approximately 154,000 tons per year. It is estimated that the proposed floodwater retarding dams, multiple-purpose dams, grade stabilization structures, and existing farm ponds will trap about 327,000 tons of sediment annually.

Stream Channel Deposition

Sediment entering the stream system will be reduced from approximately 800,000 to around 500,000 tons annually - a decrease of 37 percent. Sediment actually deposited on channel bottoms is projected to decrease from 32,100 to 20,000 tons per year. This decrease will help maintain channel capacity, reduce flooding and its associated sediment, decrease scour and swamping damages, and lessen detrimental effects on aquatic habitat.

Flood Plain Deposition

It is estimated that future with-project measures will result in a 36 percent reduction (135,000 tons annually) in the amount of sediment deposited on the watershed's flood plain. Aggradation of the flood plain by infertile and subfertile sediments will diminish, allowing for recovery from past sediment damages and a gradual improvement in soil productivity.

Projected soil loss, sediment deposition, and sediment yield for the recommended plan are displayed in Table K. Average annual flood plain sedimentation damages are estimated to be $393,800.

Alternative 2 (Additional Flood Control)

The addition of 20 small floodwater retarding dams would reduce sediment damages slightly more than Alternative 1 (NED-recommended plan).

Upland Deposition

Upland deposition would be reduced by approximately 168,000 tons per year, 19 percent.

Stream Channel Deposition

Stream channel deposition would be reduced to 19,000 tons per year. Sediment entering the stream system would be reduced to about 473,000 tons annually.

Flood Plain Deposition

Flood plain sediment damages would be reduced to $389,700 annually ($4,100 more than the recommended plan).

Water Supply

Existing

The region of southern Iowa and northern Missouri is affected by a limited quantity of water for all uses. The East Fork of the Grand River Watershed lies within this region. Water for domestic use in the watershed is obtained from well systems, streams, or surface reservoir storage. There is concern for an adequate water supply most of the time, but especially during periods of drought. It is during these drought periods that concerns become worries, as water levels in wells drop, wells go dry, stream flow is drastically reduced and often dries up, and reservoirs are depleted. Ponds and lakes for livestock water also dry up or become seriously depleted. The region was dangerously close to being "out-of water" during the 1987 through 1989 drought. Public water supply districts for rural areas experience difficulty in maintaining adequate and dependable water supply sources.

Records show that in 1988 the Loch Ayr reservoir, sole source of public water for the City of Mount Ayr, Iowa, had 133 million gallons of useable water and consumptive use totaled 130.5 million gallons. While the average for the entire year shows a 2.5 million gallon surplus, this does not reflect actual monthly supply during the drought months of May through September. Water consumption was high during 1988 because of the drought and the fact the lake had a seemingly adequate and endless supply of water. Drought conditions continued into 1989, depleting the lake. Conditions continued to deteriorate to the point where Mount Ayr instituted a water conservation plan and eventual water rationing. During this period, water consumption was drastically curtailed, resulting in considerably less water being used during the period 1989 to 1990. The lack of surplus water has a negative effect on economic development in the watershed.

Total water storage capacity of the reservoir was 286 million gallons in 1938 when the dam was built. Sedimentation reduced total water storage capacity to 185 million gallons by 1985. This reflects a 35 percent reduction in storage. Water quality in the reservoir has not been a problem.

Groundwater quality in the region is rated as poor and very poor due to total dissolved solids (TDS). TDS range from 500 to 10,000 parts-per-million (MDNR, 1988). Lack of good quality groundwater necessitates the use of surface water sources.

Years 1981 through 1992 were marked with periods of drought. During severe periods of drought the city of Mt. Ayr rationed water. Projected normal consumptive use is expected to be limited by water supplies and will restrict economic development.

People living in the country that are not on city water rely on shallow wells or surface water for domestic and livestock use. The quantity and quality varies widely. Site GB-3 will provide an additional supply of water for Mt. Ayr and for SIRWA (Southern Iowa Rural Water), which supplies rural water to a 12 county area.

Future Without-Project

The need for additional water supply and improved water quality will continue.

Alternative 1
(NED - Recommended Plan)

Multiple-purpose dam, GB-3, near Mount Ayr, Iowa, will provide 1,750 acre-feet (over 570 million gallons) of total water storage.

Several measures are planned to protect water storage capacity and enhance water quality. The sponsors intend to purchase about 1,640 acres surrounding the multiple-purpose site near Mt. Ayr. A buffer strip of permanent vegetation will be established around the lake and agricultural use will be reduced in the drainage area. Design criteria for dam GB-3 also includes construction of a rock dike to trap sediment immediately above the upper end of the permanent pool. Special emphasis will be placed on potential sources of nutrients and pesticides in the watershed of dam GB-3. The watershed has been targeted for additional land treatment and technical assistance to enhance water quality.

Installation of dry hydrants in the floodwater retarding dams will provide needed water for rural fire protection. Conservation of treated water and the energy used for treatment will occur with dry hydrants installed.

Alternative 2
(Additional Flood Control)

The addition of 20 small floodwater retarding dams to Alternative 1 (NED - recommended plan) will provide additional water sources for livestock and recreation but will not provide a significant increase in water supply.

Road and Bridge Damage

Existing

Flood damages to roads require replacement of road surfaces and sub-surfaces and removal of sediment and debris. Bridge damages, such as erosion around abutments and piers, and debris in railings, often require replacement of wooden decks and wing walls, as well as removal

of logjams and debris. Flooded roads cause traffic delays and the rerouting of traffic such as school buses, mail delivery services, farm vehicles, and the transportation of farm products.

Rerouting traffic during floods is detrimental to ambulance, fire protection, and law enforcement services. Costs associated with delays and rerouting were evaluated. Flooding endangers the lives and the financial and psychological well-being of the people who live and travel through the watershed. The threat of loss of life is eminent when flooded roads hinder the deployment of emergency vehicles.

Average annual road and bridge damages are about $263,900.

Future Without-Project

No significant change is expected without floodwater reduction.

Alternative 1
(NED - Recommended Plan)

Road and bridge maintenance and replacement expenses caused by floodwater will be reduced to $45,800 (83 percent reduction).

Traffic delays and traffic rerouting due to flooding will be greatly reduced. This will reduce the threat of loss of life and will improve ambulance, fire protection, and law enforcement services.

Alternative 2
(Additional Flood Control)

Road and bridge maintenance and replacement expenses will be reduced to $44,800 (83 percent reduction).

RECREATION

Existing

Iowa: Several small public lakes are located within 20 miles of the multiple-purpose lake site near Mount Ayr, Iowa. These lakes -- Slip Bluff Park, File's Grove Park, Kokesh Recreation Area, and Poe Hollow Park -- contain a total of 19 acres of open water. The number of annual user-days supplied by these lakes is 3,300. The reservoir type fishing demand within 20 miles of the multiple-purpose lake site is 70,500 annual user-days. Therefore, there is a need to provide 67,200 annual user-days of fishing opportunities.

Missouri: Several small public lakes are located within 20 miles of the multiple-purpose lake site near Allendale, Missouri. These lakes, which are located in Worth County Lake, Seat Memorial Wildlife Area, File's Grove Park, and Poe Hollow Park, contain a total of 32 acres of open water. The number of annual user-days supplied by these lakes is 5,500. The reservoir type fishing demand within 20 miles of the multiple-purpose lake site is 52,200 annual user-days. Therefore, there is a need to provide 46,700 annual user-days of fishing opportunities.

Iowa and Missouri: There are approximately 1,200 small ponds within 20 miles of the watershed. These small ponds have a total open water area of 1,560 acres. They supply approximately 39,100 annual user-days. The small pond type fishing demand within 20 miles of the watershed is 52,000 annual user-days. Therefore, there is a need to provide approximately 13,000 annual user-days of fishing opportunities.

Future Without-Project

No significant change in the number of lakes or amount of public or private recreational areas is expected without the project.

Alternative 1 (NED - Recommended Plan)

The 350-acre multiple-purpose lake near Mount Ayr, Iowa, will provide approximately 60,600 annual public recreational visits consisting of fishing, camping, bird watching, picnicking, hiking, nature study, and hunting. These visits are estimated to generate $304,000 annually for the local community.

The 100-acre multiple-purpose lake near Allendale, Missouri, will provide approximately 17,300 annual public recreational visits consisting of fishing, bird watching, picnicking, hiking, and nature study. These visits are estimated to generate $88,400 annually for the local community.

The 221 single-purpose, floodwater retarding dams will provide opportunities for fishing and other water-based recreation. The results of a recreational needs analysis, which utilized a 40-mile wide circle as the sample area, indicate that the current population represents a demand for 86 ponds. Studies have shown that pond usage averages 25 trips per acre per year for fishing (Novinger, 1977), thus the project provides a potential for 13,000 annual opportunities for fishing by local residents. These visits are estimated to generate $55,300 annually for the local communities.

Alternative 2 (Additional Flood Control)

There is no demand for small pond recreational fishing beyond the 86 additional ponds discussed in Alternative 1. Therefore, the addition of 20 small floodwater retarding dams will not provide additional project benefits.

Water Quality

Existing

Missouri and Iowa have designated the East Fork of the Grand River and its tributaries for the following uses:

* irrigation
* aquatic life protection
* boating and canoeing
* livestock and wildlife watering
* whole body contact recreation
* drinking water supply

Designated uses require existing water conditions to remain in the current range of acceptable values in order to support healthy livestock and wildlife and to sustain warm-water aquatic life, including critical stages of reproduction and early life. Maintenance of naturally reproducing populations of recreational fish species is also included in these uses (MDNR, 1987 and Gastineau, 1992). In general, the present water quality in these streams supports all designated uses. The present average stream index value for the watershed is 0.41 ("needs improvement") as evaluated with the Stream Habitat Assessment Device (SHAD). (Refer to the glossary for further information about SHAD).

Future Without-Project

Implementation of the Conservation Compliance Provision of the Food Security Act of 1985 and Food, Agriculture, Conservation, and Trade Act of 1990 is expected to have a positive impact on water quality through the reduction of soil loss, sedimentation, and associated contaminants. The anticipated effects on water quality include:

* less sedimentation in aquatic habitats
* decreased concentrations of phosphorus and some pesticides in

receiving waters
* decreased organic loading
* increased water transparency
* less stress to fish at all life stages

Alternative 1
(NED - Recommended Plan)

Installation of the recommended plan is expected to improve the water quality in the East Fork of the Grand River. However, improvements may not be discernable because the extent of land treatment and the amount of drainage areas controlled by the 220 small dams are relatively small in comparison to the overall size of the watershed. It has been shown that small reservoirs similar to those in the recommended plan reduce sediment, nutrient, and pesticide delivery via the trapping action of the dams (Rausch and Schreiber, 1981).

The dams should also have a beneficial impact on water quality parameters affecting aquatic life. Brenner (1981) conducted a study of six flood control reservoirs on three warm water streams in Pennsylvania. He found no significant differences in water chemistry - dissolved oxygen (DO), temperature, total hardness, total dissolved solids (TDS), coliform bacteria, ferric iron, silica, ammonia, pH, and alkalinity - above or below the reservoirs he studied. Additionally, fish and invertebrate populations showed more diversity and biomass in the streams below the dams than above them. Brenner (1981), like Rausch and Schreiber (1981), found reservoirs to be efficient sediment traps with the sediment serving as a nutrient source for aquatic macrophytes.

The Environmental Protection Agency found that soil conservation practices which reduce sediment losses also reduce associated chemicals, such as organic nitrogen and phosphorus, inorganic particulate phosphorus, and chlorinated hydrocarbons (EPA, 1979). Since nitrogen and phosphorus are major factors in stream eutrophication in northern Missouri and southern Iowa, reducing these nutrients by installation of the project should improve water quality in the streams below the dams.

Establishment of vegetated buffers or filter strips around or along water bodies will further reduce sedimentation and will improve water quality. Critical area planting and grassed waterway measures can be implemented to establish vegetative filters to reduce sedimentation, and subsequent nutrient loading and pesticide contamination. Vegetative filter strips can effectively reduce sediment delivery by 96 percent (Gough, 1988).

Water sources provided by the floodwater retarding dams can be used for livestock water supply. Water supply pipes installed in the dams can be used to develop and improve rotational grazing systems. This measure can reduce or eliminate livestock use of streams or ponds for water sources. This will reduce nutrient loading, agitation of bottom sediments, and streambank degradation caused by livestock.

The floodwater retarding dams occur on reaches with intermittent flow. Prolonged flows up to 10 days may be realized below these dams as the flood pools empty. According to Beard and Moore (1976), monthly streamflows tend to increase below such dams. Brenner (1981) reported the mean number of invertebrate taxa increased 1.7 times and the total biomass increased approximately twofold in streams below similar impoundments compared to populations above the pools.

Implementation of the recommended plan will reduce sediment delivery to the stream system by 37 percent. A reduction of sediment to a stream ecosystem will increase numbers and diversity of aquatic organisms, such as invertebrates (EPA, 1979).

Because multiple-purpose dam GB-3 will provide a source of rural water supply, whole-body contact recreational opportunities, and fish and wildlife habitat; special emphasis will be placed on potential sources of nutrients and pesticides in the watershed and targeting land treatment and technical assistance components toward those potential sources.

Land use above multiple-purpose dam F-3 is 80 percent woodland, 15 percent grassland (CRP), and 5 percent cropland. There is no anticipated or forseeable water quality problems in this multiple-purpose reservoir.

Alternative 2 (Additional Flood Control)

The addition of 20 small single-purpose floodwater retarding dams and related land treatment will not improve water quality significantly better than Alternative 1, the NED-recommended plan.

Wetlands

Existing

Total wetland acreage has decreased as land was cleared and converted to other uses. Accelerated flooding, erosion, and sediment deposition have degraded the quality and size of the wetland resources. The majority of the wetlands occur in low lying areas adjacent to streams. Accelerated sedimentation in wetland areas has changed vegetation, structure, and composition, as well as lowered wetland values. These lowered values result in reduced water retention in wetlands, poorer water quality and aquatic habitat, and increased flood plain scour and flood stages.

There are 5,140 acres of wetlands in the watershed project area. These consist of:

Palustrine Emergent	1,080 acres
emergent wetlands	*30 acres*
pastured wetlands	*890 acres*
farmed wetlands	*160 acres*
Palustrine Forested	2,680 acres
wooded wetlands	*2,680 acres*
Riverine Lower Perennial Unconsolidated Bottom	220 acres
Riverine Intermittent Unconsolidated Bottom	1,160 acres

An additional 17,770 acres of former wetlands are now prior converted cropland.

Future Without-Project

Low depressional wetland areas receive substantial sediment deposition. The quality of these wetlands will be reduced due to continued sediment deposition in the future without-project conditions. The 1985 Food Security Act, Swampbuster Provision, and section 404 of the 1987 Clean Water Act Reauthorization reduce the probability of converting wetlands to other land uses.

Alternative 1
(NED - Recommended Plan)

Implementation of the recommended project will reduce the sediment deposited on wetlands by about 36 percent, improving their quality and increasing their longevity. This will maintain both the variety of habitat types and a varied landscape pattern. The extent of this improvement has not been quantified.

Flood reduction from project actions will not adversely affect wetlands as defined by SCS. Studies in the Midwest show the duration of floods during the growing season will not exceed 10 percent of the total growing season. The only wetland areas within the flood plain that may experience seasonal flooding are old stream channels, sloughs, and other depressional areas. These areas currently flood two or three times-a-year. With the project installed, they will continue to flood about twice a year. This flooding regime in combination with hydric soils and hydrophytic vegetation should maintain the wetland values.

A total of about 90 acres of wetlands will be flooded by project structural practices. These acres consist of 45 acres of pasture and 45 acres of woods. They both have saturated water regimes.

The 350-acre multiple-purpose reservoir located near Mount Ayr, Iowa, and the 100-acre multiple-purpose site located near Allendale, Missouri, will create approximately 90 acres of shallow water habitat.

The creation of about 1,500 acres of water in the 221 single-purpose dams, 22 acres in the large single-purpose dam, and the 344 grade stabilization structures will create new wetlands in the littoral zones of the ponds. Since cattle will have free access to some of the pools, not all dams and pools will develop associated wetlands. Approximately 300 acres of these wetlands will eventually become dispersed randomly throughout the watershed.

The U.S. Fish and Wildlife Service was consulted and the resulting mitigation is described in the Recommended Plan section.

Alternative 2
(Additional Flood Control)

The addition of 20 small floodwater retarding dams to Alternative 1 will not significantly alter the quantity or quality of wetlands. Alternative 2 will provide an additional 25 acres of wetlands.

Threatened and Endangered Species

The Section 7 Consultation Process of the Endangered Species Act was followed. The U.S. Fish and Wildlife Service provided information stating the Indiana bat and the bald eagle may occur in the watershed. The scope and nature of the project indicate that diurnal perches, roost sites, food sources, or other preferred habitat for the species will not be affected. This precludes the need for preparation of a biological assessment.

Relationship to Other Plans, Policies, and Controls

The East Fork of the Grand River Watershed is within the Northern Missouri River Tributaries Basin. A river basin plan for this area, "The Land and Water Resources of the Northern Missouri River Tributaries Basin -- Iowa and Missouri," was completed in 1982. This watershed project conforms to the same principles and is consistent with the conclusions and recommendations of that plan.

The 1979 Missouri Water Quality Management Plan has identified four regional areas with potential water quality benefits from erosion control.

The East Fork of the Grand River is within Area 2 and designated as a second priority. This watershed project will aid Missouri in reaching the goal of reducing stream sediment loads by 50 percent over a 30-year period.

Ringgold and Union County Soil & Water Conservation Districts have established soil loss limits to implement Iowa's erosion control law. The recommended plan measures conform to the established limits. Both counties are in the Area XIV Southern Iowa Council of Governments. This group functions as a regional planning agency. The recommended plan measures are compatible with the direction of the council.

The conservation provisions of the 1985 Food Security Act (FSA) and the 1990 Food, Agriculture, Conservation, and Trade Act (FACTA) were considered during the development of this plan. Impacts from these farm bills which involve land use changes and land treatment measures were incorporated into this watershed plan and environmental impact statement.

Irreversible or Irretrievable Commitments

Irreversible and irretrievable commitments of resources consist of labor, material, and energy needed for installing and maintaining project measures.

Permanent alteration of land use and cover will occur on 400 acres. This consists of 180 acres of cropland, 160 acres of grassland, and 60 acres of forest land.

Archaeological and Historical Resources

Cultural resource surveys have been completed for the three larger dam site areas along with a sampling of 30 percent of the smaller floodwater retarding dam sites. These surveys found no significant properties affected by the project. No properties currently listed on the National Register of Historic Places are in the watershed project area.

The sample survey indicated that some areas have a higher probability for significant cultural resources. Additional small dam sites in these areas will be surveyed prior to construction. Significant cultural resources identified during implementation will be avoided or otherwise preserved in place to the fullest practical extent. If significant cultural resources cannot be avoided or preserved, pertinent information will be recovered prior to construction.

COMPARISON OF ALTERNATIVE PLANS

Table L summarizes each alternative considered. Major items used in the decision process are included.

TABLE L

Comparison of Alternative Plans

EFFECTS	ALTERNATIVE 1 (1)	ALTERNATIVE 2	WITHOUT PROJECT
MEASURES			
Structural	221 single-purpose floodwater retarding dams; one (GB-3) multiple-purpose floodwater retarding, fish, wildlife, and recreational development; agricultural water management dam; and one (F-3) multiple-purpose floodwater retarding, fish, wildlife, and recreational development dam.	241 single-purpose floodwater retarding dams; one (GB-3) multiple-purpose floodwater retarding, fish, wildlife, and recreational development; agricultural water management dam; and one (F-3) multiple-purpose floodwater retarding, fish, wildlife, and recreational development dam.	0
Land Treatment			
Grade Stabilization Structures	344 structures	344 structures	0
Cropland	8,900 acres	9,700 acres	0
Grassland	1,200 acres	1,300 acres	0
Forest Land	400 acres	440 acres	0
PROJECT INVESTMENT			
Structural Measures	$16,483,400	$17,476,600	0
Land Treatment (2)	$3,361,000	$3,490,200	0
National Economic Development (NED) Account			
Avg. Annual Adverse Effects	$1,792,900	$1,894,100	0
Avg. Annual Beneficial Effects	$2,358,000	$2,423,800	0
Net Beneficial Effect	$565,100	$529,700	0
Environmental Quality (EQ) Account			
Land Use			
Cropland	Reduce erosion on 8,900 acres to tolerable levels ("T").	Reduce erosion on 9,700 acres to tolerable levels ("T").	No erosion reduction
Grassland	1,200 acres reduced soil erosion and improved productivity	1,300 acres reduced soil erosion and improved productivity.	Continued decline in resource and forage management.
Forest Land	Improved management on 453 acres of forest land.	Improved management on 440 acres of forest land.	Continued decline in forest resources.
Land Damages			
Sedimentation	Reduce flood plain sediment damage 37 percent annually.	Reduce flood plain sediment damage 38 percent annually.	Continued sediment damage (379,200 tons annually).
Scour	Reduce flood plain scour damage 39 percent annually.	Reduce flood plain scour damage 40 percent annually.	Continued scour damage (109,000 tons displaced annually).
Swamping	Reduce flood plain swamping damage by 48 percent.	Reduce flood plain swamping damage by 48 percent.	Continued swamping damage.
Wetland	Gain 401 acres of wetland habitat.	Gain 426 acres of wetland habitat.	No Change
Gullies	Average Annual Damages - $1,286,500 (12.6 percent reduction).	Average Annual Damages - $1,283,000 (12.8 percent reduction).	Average Annual Damages voided and depreciated - $1,476,100.

TABLE L (Continued)

Comparison of Alternative Plans

EFFECTS	ALTERNATIVE 1 [1]	ALTERNATIVE 2	WITHOUT PROJECT
Other Social Effects (OSE) Account			
Flood Damages	Reduce flood damages 56 percent on 28,000 acres.	Reduce flood damages 57 percent on 28,000 acres.	No reduction in flood damages.
Long-Term Productivity	Reduce erosion, sedimentation, scouring, and swamping damages 39 percent.	Reduce erosion, sedimentation, scouring, and swamping damages 40 percent.	Continued reduction in soil productivity.
Recreation	Recreation increased 90,900 user days.	Recreation increased 90,900 user days.	No change, water-based recreation deficit of 126,900 user days.
Community Infrastructure	Reduce road and bridge damages 83 percent.	Reduce road and bridge damages 83 percent.	Continued rerouting and disruption of daily traffic, school buses, mail delivery service, farm vehicles, and the transportation of farm products during flooding.
Life, Health, and Safety			
Rural Fire Protection	Add 89 dry hydrants, provide readily accessible water. Protect the property and lives of rural residents, and lower insurance premiums. With lower insurance rates and improved fire fighting capability, the area would be more attractive to developers and homeowners.	Add 89 dry hydrants, provide readily accessible water. Protect the property and lives of rural residents, and lower insurance premiums. With lower insurance rates and improved fire fighting capability, the area would be more attractive to developers and homeowners.	No Change
Agricultural Water Management	Add 1,750 acre-feet water supply.	Add 1,750 acre-feet water supply.	No Change, deficit supply.
Water Quality	Reduce sediment, nutrient, and pesticide delivery through trapping actions of dams and accelerated land treatment. Sediment reduced 37 percent.	Reduce sediment, nutrient, and pesticide delivery through trapping actions of dams and accelerated land treatment. Sediment reduced 38 percent.	
Technical Assistance	Increase funding available to all landowners in the watershed, including 14 limited resource farmers, for accelerated land treatment and gully control.	Increase funding available to all landowners in the watershed, including 14 limited resource farmers, for accelerated land treatment and gully control.	No Change
Social Acceptability	Small dams acceptable to landowners. Dry hydrants favorable to rural landowners.	Small dams acceptable to landowners. Dry hydrants favorable to rural landowners.	No Protection
Regional Economic Development (RED) Account			
Avg. Annual Beneficial Effects.	$2,358,000	$2,423,800	0
Avg. Annual Adverse Effects			
Installation Cost	$1,592,500	$1,682,500	0
Avg. Annual OM&R	$200,400	$211,600	0

[1] NED/Recommended Plan

[2] Refer to pages 31 and 32 for list of land treatment components.

RISK AND UNCERTAINTY

Compliance with the conservation provisions of the 1985 FSA and 1990 FACTA and participation in the P.L.-566 land treatment program is voluntary. This creates a degree of uncertainty associated with accomplishing the necessary land treatment. However, this uncertainty is reduced by the Iowa and Missouri SCS policy requiring adequate protection on at least 75 percent of the drainage area above floodwater retarding and multiple-purpose dams.

It is anticipated that some alternative conservation measures will be substituted which generate less economic benefits than the measures identified in the recommended plan. In these cases, costs will be limited to costs of the measures in the recommended plan and the difference in loss of net benefits will be decreased.

A core group of dams exhibiting the maximum net benefits, in addition to dams GB-3, F-4, and F-3, were used as a starting point for incremental analysis. Small groups of dams were added to this core until the last increment failed to generate benefits in excess of costs. Thus, all dams identified as part of the NED-Recommended Plan generated benefits in excess of costs. The NED-Recommended Plan is not sensitive to moderate variations in the number or location of dams that are ultimately built because of the approach taken in establishing the plan. The elimination of any dam or even 10 percent of the total number of dams, will not adversely affect justification of the project.

RATIONALE FOR PLAN SELECTION

Alternative 1 (NED Plan) is the recommended and selected watershed plan. The combination of multiple-purpose dam GB-3 (flood prevention/agricultural water management/fish, wildlife, and recreational development); multiple-purpose dam F-3 (flood prevention/fish, wildlife, and recreational development); one large single-purpose floodwater retarding dam, F-4; 220 small, single-purpose floodwater retarding dams; and the land treatment measures in Alternative 1 (NED-Recommended plan) maximize net economic returns. The plan will significantly reduce flooding; accelerate land treatment for erosion control; provide agricultural rural water supply; improve and increase fish and wildlife habitat; increase recreational opportunities; and improve grassland and forest land management. The NED plan was selected by the watershed sponsors as the plan that would best accomplish their goals.

CONSULTATION AND PUBLIC PARTICIPATION

Application for assistance was submitted by the steering committee in 1969. The request was a result of local concern and interest in addressing flood protection, soil erosion control, water supply, and fish, wildlife, and recreational development. On May 11, 1970, the East Fork of the Grand River Watershed Subdistrict was formed in Worth and Harrison Counties, Missouri.

The sponsors of the East Fork of the Grand River Watershed have held public meetings to receive input, discuss project alternatives, and update progress. The following list summarizes the meetings held:

February 8 & 9, 1993	Public meetings held at Allendale, Missouri and Mt. Ayr, Iowa to present the sponsors' decision and an overview of the watershed draft plan review process.
January 5, 1993	Alternatives were presented to the sponsors and the NED plan was selected. The NED plan consists of 220 small dams, one 350-acre multiple-purpose dam, one 100-acre multiple-purpose dam, and one 22-acre single-purpose dam. Over 50 people attended.
August 6, 1992	Meeting of the Steering Committee with SCS to discuss multiple-purpose and large dam benefits, costs, and locations.
June 30, 1992	A meeting was held in Bethany, Missouri, of the Missouri and Iowa SCS, MDC, IDNR, and the US Forest Service. This meeting was held to discuss the impact to quail habitat and the effects of floodwater retarding dams on brushy draws associated with cropland.
April 22, 1992	Twenty-seven people attended. It was decided to include a large multiple-purpose dam with flood prevention; fish, wildlife, and recreational development; and rural water management/water supply as purposes. There was also some interest in large single-purpose dams.
April 16, 1992	A Steering Committee was elected for the East Fork of the Grand River Watershed. Steve Fetty, Mayor of the City of Mt. Ayr, Iowa, was elected chair-person of the committee.
March 19, 1992	The SCS planning staff requested that the sponsors decide whether a large multiple-purpose lake should be included in the final plan.
October 10, 1990	A meeting was held with SCS and SWCD personnel and watershed trustees to discuss crop yields in the East Fork of the Grand River Watershed.
February 22 & 23, 1989	Scoping meetings were held in Mt. Ayr, Iowa and Allendale, Missouri to compile a listing of the sponsors' stated needs in the watershed. Seventy-four people and 43 people attended respectively.

THREATENED AND ENDANGERED SPECIES COORDINATION

The Section 7 consultation process in the Endangered Species Act was followed. The U.S. Fish and Wildlife Service provided information stating the bald eagle and Indiana bat may occur in the watershed. The scope and nature of the project indicates that diurnal perches, roost sites, food sources, or other preferred habitat for the species will not be affected. This precludes the need for preparation of a biological assessment.

ARCHEOLOGICAL AND HISTORIC RESOURCES COORDINATION

An archeological and historic overview has been prepared. Copies of the report were furnished to the State Historic Preservation Officers (SHPO) in Iowa and Missouri. Missouri SHPO has agreed with the recommendations for additional surveys prior to construction. As of this publication date, comments have not been received from Iowa's SHPO. Comments will be incorporated into the final EIS.

SUMMARY OF SIGNIFICANT WRITTEN COMMENTS

To be inserted in the Final plan-EIS. This could add several pages to this document. RE: NWSM part 504.39 page 504-38.

RECOMMENDED PLAN

PURPOSE

1. Flood prevention and the reduction of flood damages.
2. Watershed protection through erosion and sediment control measures.
3. Fish, wildlife, and recreational development.
4. Agricultural water management (rural water supply).

SUMMARY

The National Economic Development (NED) plan is the recommended plan. Plan elements include accelerated land treatment, 344 grade stabilization structures, 220 small single-purpose floodwater retarding dams, one large single-purpose floodwater retarding dam in Missouri, one multiple-purpose dam for flood prevention, agricultural water management, fish, wildlife, and recreational development in Iowa, and one multiple-purpose dam for flood prevention and fish and wildlife development in Missouri. The project installation period is 12 years. Operation, maintenance, and replacement are planned for all measures. The evaluated project life is 75 years.

The benefit/cost ratio is 1.32.

MEASURES TO BE INSTALLED

Accelerated Land Treatment Practices

Technical and financial assistance are based on implementing the NED land treatment practices in drainage areas above the floodwater retarding dams. This accelerated program will supplement current ongoing programs. The existing Agricultural Stabilization and Conservation Service (ASCS), State of Iowa and State of Missouri cost-sharing programs are expected to continue unaffected by the actions of this plan. Technical assistance for the ongoing programs will be provided by the agency which has technical responsibility to implement each cost-share program.

Project funds will be made available to provide approximately five staff years of additional technical assistance for conservation planning and application. Participation in the program is voluntary and the land user makes the final decision on land use and conservation systems to be installed. Alternative practices which provide equal or greater benefits are permitted, but the cost-share amount is limited to the amount that would have been paid for the practices in the selected plan. There are limitations on technical and financial assistance. Assistance will be provided only when it contributes to identified project objectives and does not result in significant adverse impacts. Cost-sharing is available for enduring practices only.

Conservation systems necessary to adequately protect 8,900 acres of severely eroding cropland above floodwater retarding dams include conservation tillage, contour farming, grass waterways, terraces and critical area plantings. Conservation systems necessary to adequately protect 1,200 acres of grassland from poor to excellent condition will be accomplished through various grassland practices such as rotational grazing, fencing, and watering systems. Soil erosion will be reduced and

wildlife habitat improved on 400 acres of forest land through livestock exclusion from woody draws and other woodland tracts, and/or timber stand improvement. There will also be 53 acres of tree planting adjacent to draws to increase woody wildlife habitat.

Conservation treatment necessary to adequately treat gully erosion includes 344 grade stabilization structures. The only requirement is that the drainage area must be 16 acres or greater. See Appendix C - Economic Investigation and Analyses - for details of this requirement. Of the 344 grade stabilization structures, 188 will be located in Ringgold County, Iowa; 85 in Worth County, Missouri; 44 in Harrison County, Missouri; and 27 in Union County, Iowa. Each District Conservationist will determine sites, priority, and needs for their county when planning and installing these structures.

Because multiple-purpose dam GB-3 will provide a source of rural water supply, whole body contact recreational opportunities, and fish and wildlife habitat; additional land treatment and technical assistance components have been targeted toward potential sources of water quality impairment located in the drainage area of this structure. These additional components include 1985 acres of integrated pest and nutrient management, 46,325 feet of field border, 895 acres of pasture and hayland management including planned grazing systems, 20 acres of filter strip, and 40 acres of livestock exclusion to protect filter strips and riparian areas.

Accelerated Land Treatment

	Union County	Ringgold County	Worth & Harrison Counties	Total
	---------- Iowa ----------		---------- Missouri ----------	
Cropland:				
Grassed Waterways	5 acres	40 acres	10 acres	55 acres
Terraces	50,160 feet	408,120 feet	111,720 feet	570,000 feet
Underground Outlets	16,720 feet	136,040 feet	37,240 feet	190,000 feet
Critical Area Planting	8 acres	64 acres	17 acres	89 acres
*Integrated Nutrient & Pest Management		1,985 acres		
*Field Border		46,325 feet		
Grassland:				
Prescribed Grazing (forage establishments, fencing, & water systems)	97 acres	788 acres	215 acres	1,100 acres
Diversions	2,950 feet	23,985 feet	6,565 feet	33,500 feet
*Pasture & Hayland Management		895 acres		
*Filter Strips		20 acres		
*Livestock Exclusion		40 acres		
Cropland/Grassland:				
Tree Planting	5 acres	48 acres	---	53 acres
Forest land:				
Livestock Exclusion	40 acres	360 acres	---	400 acres
Gully Erosion:	27 structures	188 structures	85 structures - Worth Co. 44 structures - Harrison Co.	344 grade stabilization structures

* Land treatment measures to be applied above dam GB-3.

Structural Measures

Structural measures include 2 multiple-purpose dams, 1 large, and 220 small single-purpose floodwater retarding dams. The 220 single-purpose dams have a design life of 75 years, while the 2 multiple-purpose dams and one large single-purpose dam have a design life of 100 years. Eighty-nine of the small floodwater retarding dams will include dry hydrants.

Dry hydrants will provide needed water for rural fire protection.

Using untreated water from the sediment pools of small floodwater detention dams for fire protection conserves treated water and energy.

Pre-Design Conference

A pre-design conference will be held prior to or at initiation of field surveys for each dam or group of dams to discuss installation of structural measures and environmental enhancement opportunities at the structure site. The conference will be scheduled by the project engineer and watershed manager; attended by the district conservationist, area biologist, and affected landowners. Some of the items to be discussed are design details of the dam and reservoir, such as limits of areas to be cleared and grubbed; pool size, depth, and surface area; fencing details; and environmental opportunities. These opportunities include fish and wildlife enhancements, wetland development, livestock watering pipes, and dry hydrants. Islands for waterfowl nesting and resting will be considered. Easement areas adjacent to the dam and pool can be used for wildlife mitigation. Mitigation criteria are described under the heading Mitigation Features.

Environmental Criteria

Permanent vegetation will be established on embankments, spillways, and surrounding areas immediately following completion of the final grading and finishing operations. Only sod-forming grass will be seeded on the embankments and spillways. Seeding mixtures containing bunch-type grasses or legumes are not acceptable because of inadequate soil cover and deep root structure. However, areas surrounding the dam and spillway will be seeded or planted with a mixture of plant materials to provide habitat for wildlife.

Planting recommendations have been developed by SCS, Iowa DNR and MDC. The plan for establishing wildlife habitat at the dam sites in each state will be developed jointly between local representatives of SCS, Iowa DNR or MDC, and the sponsors. Planting costs have been included as part of the structural measure costs.

The construction period, for both dam GB-3 and dam F-3, is expected to extend beyond one construction season to at least part of a second season. If construction extends beyond one construction season, temporary seeding of the disturbed areas will be done as soon as possible when winter shut-down seems eminent.

The general policy of the plan is to limit clearing of the reservoir sites to areas required for the dam, spillway, and that portion of the sediment pool needed for the borrow area.

Trees and other woody vegetation will be cleared and grubbed from the dam and pool area to a minimum of 400 feet upstream from the dam. Additional area will be cleared as needed for borrow material. In most cases, timber and woody growth will be left standing in the upper ends of the pools, in the coves and side tributaries. The purpose of this policy is to encourage fish and wildlife habitat development. On an individual case by case basis landowners are permitted to clear additional areas of the sediment pool at their expense.

The borrow area for dam GB-3 will be cleared and grubbed up to elevation 1090.0 feet, National Geodetic Vertical Datum (NGVD), and for dam F-3 to elevation 1003.0 feet, NGVD. In both cases, these elevations are 10-feet below the principal spillway crest elevation. Clearing and/or grubbing will be limited to the dam and emergency spillway area, reservoir access area, and borrow areas. Timber in the coves, side tributaries, and upper reaches of the reservoir shall be left standing to encourage fish and wildlife habitat development.

Brush piles to provide habitat for fish and other aquatic life will be constructed using the cleared materials. Placement of brushpiles around the perimeter of the pools will also be permitted and encouraged. Size and location of the brushpiles will depend on availability of material and site suitability as determined by SCS and MDC or Iowa DNR biologists. In all cases, the SCS and state agency biologists will be involved when developing the clearing details for each site or group of sites.

Islands for waterfowl nesting and resting can be created at sites that are physically suitable and are acceptable to the landowner. These islands can often be created at little or no cost by directing borrow activity, placement of waste spoil, borrowing to cut a point off from the mainland, and other similar means.

All applicable state and federal standards for minimizing water, air, and noise pollution will be followed during the construction of all dams. Water and air pollution that might be caused by construction activity will be minimized by utilizing the following methods as needed:

1. Leaving existing vegetation on work areas as long as possible.
2. Establishing temporary vegetative cover on areas where work is not ongoing.
3. Constructing dikes to divert runoff water.
4. Using silt filtering fabric.
5. Constructing sediment detention basins.

In the event of a significant cultural resource discovery, SCS will follow established agency procedures to insure important resources are not destroyed.

Single-Purpose Floodwater Retarding Dams

This group includes two size categories, 220 small floodwater retarding dams with height times storage values less than 3,000 and 1 large floodwater retarding dam F-4, with a height times storage value greater than 3,000.

The 220 small dams (Figure 2) are designed using pond specification 378 and floodwater retarding dam specification 402. Forty-five study sites (12 percent of 381 total potential sites) were randomly selected to inventory and prepare designs as small floodwater retarding dams. A display of statistics, extrapolated from 16 of the sampled dam sites is shown in Table M. Data for the 16 individual small dams are displayed in Table 3.

TABLE M

Small Dam Statistics

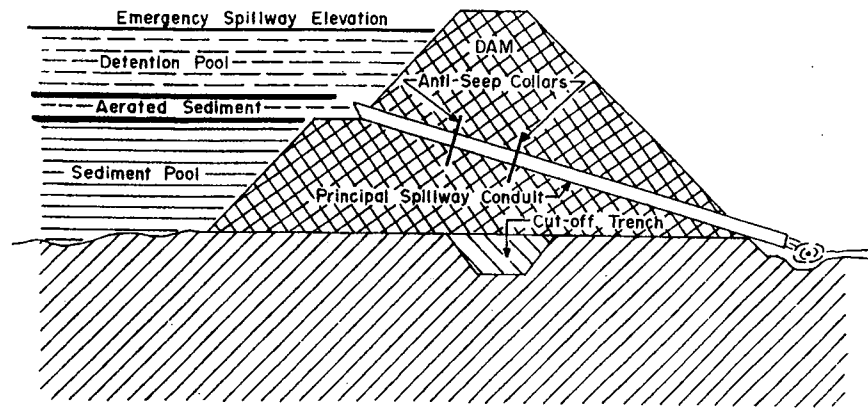
Drainage Area Range	Pipe Size/ Release Range [1]		Average Sediment Pools Surface Storage		Average Flood Pools Surface Storage	
(ac)	(in)	(csm)	(ac)	(ac-ft)	(ac)	(ac-ft)
100-175	6	7-13	3.9	22	6.8	30
176-300	8	8-14	6.1	40	11.5	55
301-350	10	13-15	8.5	54	15.5	73
Averages for Sample Dams:	Earth fill = 15,000 cubic yards Embankment height = 22.5 feet Drainage Area = 188 acres Stage between Sediment Pool and Flood Pool = 7.4 feet					

[1] csm = cubic feet per second per square mile

Approximately 90 percent of the small dam sites are located in the upland, glacial till area. The depth of flood plain alluvium varies from 0 to 15 feet. Deeper recent alluviums tend to be associated with those sites located immediately above a major flood plain, while the more shallow recent alluvium occurs on sites located in the smaller upland tributaries.

Approximately 10 percent of the sites exhibit rippable shales, sandstones, and limestones in the foundation or abutments. These rock units appear to be sound, providing for positive cutoff of seepage water.

FIGURE 2
Cross-Sectional View of a Small Floodwater Retarding Dam



Sufficient borrow material can be found within the sediment pool area for approximately 90 percent of the dams. Borrow material may need to be obtained above the sediment pool elevation for the remaining 10 percent. Field examination of several dam sites, as well as general knowledge of soils and geology of the watershed, indicates that borrow material will consist of glacial till and alluvium.

Storage for approximately two watershed-inches of sediment is reserved in each reservoir, with 90 percent being submerged and 10 percent being stored above the sediment pool.

The 220 small floodwater retarding dams will have smooth steel pipe principal spillways. There may be some exceptions to the pipe size-drainage area relationships shown in Table M. A larger pipe may be used in some instances to reduce the pool drawdown time to meet SCS standards, or to allow the dam design to stay within certain SCS criteria. The number of pipe size changes will be kept to a minimum. Exceptions must be approved by the SCS State Conservation Engineer on a site-by-site basis. In all instances, the pipe sizes will remain small enough to retain the floodwater retarding effect of the dam.

Stockwater pipes may be installed in the dams at the landowners request. They would be installed at the landowners expense, except in situations involving mitigation areas. See the section titled Mitigation Features.

The small dams will be designed to store runoff from a 10-year frequency, 24-hour duration storm (approximately 5.0 inches of rainfall) before any emergency spillway flow occurs. This amounts to storing 3.0 watershed-inches of runoff. Vegetated earth emergency spillways will be designed to safely pass the 50-year frequency, 24-hour duration storm (approximately 6.4 inches of rainfall). A one-foot freeboard will be provided above the water surface generated by the emergency spillway design storm for the top of the dam elevation.

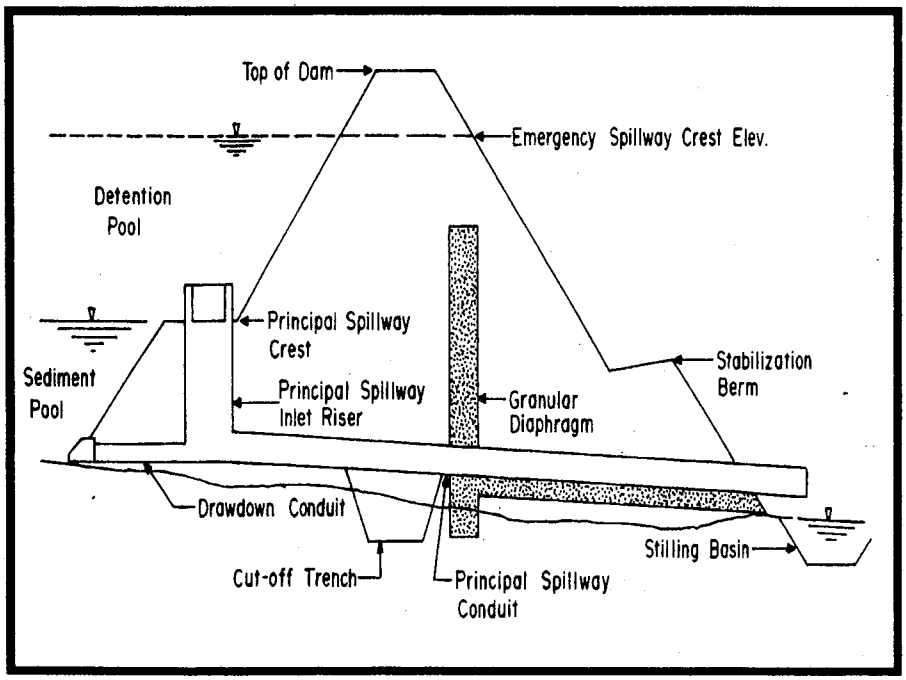
The emergency spillway capacity will be further checked by flood routing the 25-year frequency, 24-hour duration storm (approximately 5.8 inches of rainfall) through the emergency spillway. This design storm flood

routing will assume the water surface of the pool is at the emergency spillway crest elevation when inflow begins. The emergency spillway will be widened to safely pass this design storm.

Dam F-4 (Figure 3) will be designed using Technical Release 60 criteria because the height times storage value exceeds 3,000. Dam F-4 is planned as a compacted earth-fill embankment with a vegetative emergency spillway. The principal spillway will be a reinforced concrete pipe with a reinforced concrete riser.

Dam F-4 will be designed to temporarily store the runoff from a 25-year frequency, 24-hour duration storm (approximately 5.8 inches of rainfall), before the emergency spillway begins to flow. The emergency spillway will be designed to safely convey the runoff from a 100-year frequency, 6-hour duration storm (approximately 5.5 inches) without damaging the spillway. The emergency spillway has a four percent or less chance of flowing in any one year.

FIGURE 3
Cross-Sectional View of a Large Floodwater Retarding Dam



All single-purpose dams have been classified class "a", according to the potential hazard classification system stated in Subchapter C, Part 520, of the National Engineering Manual. This classification means that in case of dam failure, damage would be limited to uninhabited farm buildings and agricultural land. Any damage to roads in the watershed would not result in isolation of any community. Class "a" dams are designed to control the runoff from less than the probable maximum precipitation. Therefore, a possibility exists where the dams could overtop and create the potential for breach failure. All dams are located on tributaries to the main channel. There are no dams in series. Any breach would create inundation conditions on the tributary, but would be rapidly dissipated when the flood flows reach the main channel and valley. Consequently, any additional development downstream of these dams could create a

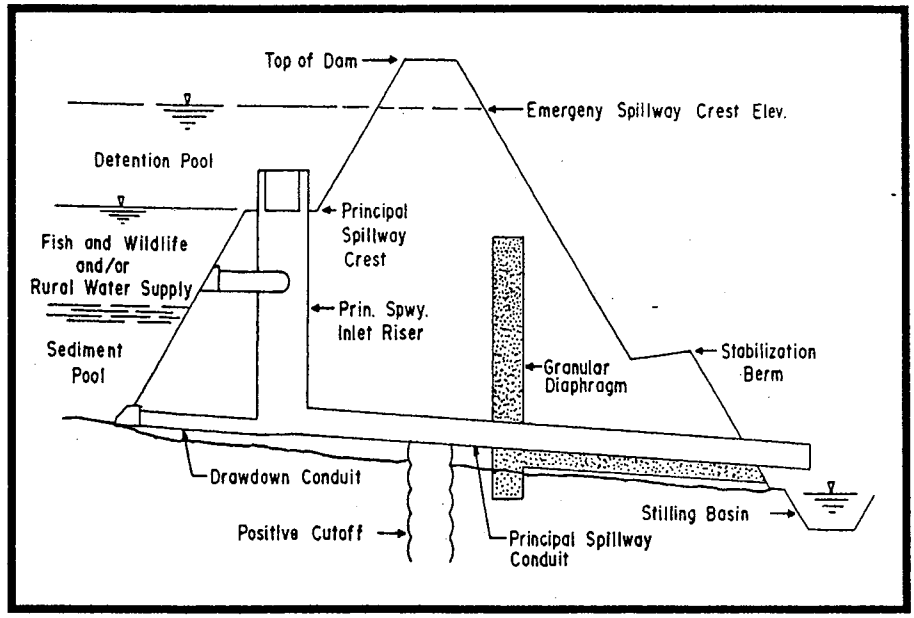
more hazardous condition than currently exists. As a general guide, the areas of potential hazard from dam failures could be defined as the benefited area shown in yellow on the project map (Appendix E). Even though paved roads and highways exist in the area, there is a very limited potential for development to occur on the tributary flood plains. Prior to any development within the limits of this potential hazard area, specific site evaluation studies would be made to reduce the possibility of creating an unsafe condition.

Watershed sponsors will secure landrights needed for installation and maintenance of all dams. Term easements for the life of the project will be obtained for the single-purpose floodwater retarding dams, spillways, and pools. The easements will provide access to the site and cover an area equal to that at the elevation of the top of each dam. The areas affected are approximately 1,250 acres for permanent pools, 1,050 acres for temporary pools, and 360 acres for dams and spillways. There are no anticipated alterations, modifications, changes to existing improvements, or relocations associated with installation of the small dams.

Multiple-Purpose Dams

There are two multiple-purpose dams included in the plan, dam F-3 in Missouri and dam GB-3 in Iowa (Figure 4).

FIGURE 4
Cross-Sectional View of a Multiple-Purpose Dam



The embankment of both dams will be compacted earthfill with borrow material taken from the permanent pool and emergency spillway areas. The medium and highly plastic clays will be placed in the center of the embankment. Alluvial clays and silts will be placed on either side of the embankment core. A positive foundation cutoff through the alluvium in the flood plain will be accomplished with a slurry trench keyed into the glacial till. An excavated core-trench will extend up the abutments to approximately the emergency spillway crest elevation. A granular diaphragm and filter will control seepage around the principal spillway.

The abutments of both dams consist of a thin mantle of loess overlaying glacial till. The alluvial deposits in the valley floor overlay glacial till and range in depth from 0 to 40 feet.

Design of both dams, GB-3 and F-3 is based on class "b" hydrologic criteria. The principal spillway will consist of a single-stage, reinforced concrete riser and reinforced concrete pipe that outlets into a riprap-lined stilling basin. Multiple-purpose reservoir design includes two drawdown pipes, one located at the bottom of the riser and a second drawdown pipe for water level control to aid in fisheries management. The inlet elevation of the second drawdown pipe will be approximately 5.5 feet below the principal spillway crest.

The principal spillway for both dams will be designed to control the 50-year frequency storm (approximately 6.4 inches of rainfall) before the emergency spillway begins to flow. The emergency spillway has a two percent or less chance of flowing in any one year. Sediment storage of 2.0 watershed-inches is provided for in reservoir and dam GB-3. Eighty-five percent of the sediment yield is expected to remain submerged in the reservoir and fifteen percent deposited as aerated. Sediment storage for 1.5 watershed-inches in F-3 is reserved in the permanent sediment pool, with 90 percent of the sediment being submerged and 10 percent aerated. Additional data is provided in Table 3.

The vegetated emergency spillways are designed to carry runoff flows from storms exceeding the 50-year frequency with minimal damage to the spillway channel. Emergency spillway flows from both dams will outlet into a drainageway that joins the main channel approximately 200 feet downstream of the dam.

A sediment debris basin will be created at the upper-end of the reservoir by constructing a dike across the lake. The dike will be located where it will create a basin with a surface area of five to six acres. The top of the dike will be four feet above the principal spillway crest, at elevation 1104.8, except for the crest elevation of the spillway notch through the dike. The crest elevation of the spillway notch will be at elevation 1100.8, NGVD, same elevation as the principal spillway crest. The spillway notch should be approximately 125% of the distance between the channel banks where the pool is contained within the banks. This basin is to perform as a settling basin for any sediment carried into the lake. The basin is included primarily for improvement in water quality.

Dam GB-3, located approximately three miles east and one mile north of Mount Ayr, Iowa, is designed to serve the purposes of flood prevention, nonagricultural water management (fish and wildlife development), and agricultural water management (rural water supply). Dam GB-3 will create a pool with a surface area of 350 acres at the principal spillway crest. The sponsors for this dam and reservoir are the Ringgold County Soil and Water Conservation District, City of Mount Ayr, and the Southern Iowa Rural Water Association (SIRWA).

Because dam and reservoir GB-3 will provide a source for rural water supply, whole body contact recreational opportunities, and fish and wildlife habitat; additional land treatment and technical assistance components have been targeted toward potential sources of water quality impairment located in the drainage area of this structure.

Hazard classification for dam GB-3 is determined to be class "b" hazard, and is designed for less than the probable maximum runoff. This classification was based upon the potential hazard defined by an analysis that assumes the dam fails when full. Although the dam is not expected to fail, if it should occur, Iowa State Highway 2 would be subject to overflow of 0.2 feet at a velocity of 2 feet-per-second. Damage would be expected to be light and would be limited to highway shoulders, a low-use graveled road, a county bridge, and agricultural land.

Limits of the flood wave from such a failure or breaching are delineated on the breach inundation maps in Appendix B. Delineation of the flood boundaries was terminated where the water surface elevation of the breach flow is less than the elevation of a 100-year flood with the dam built. To avoid the possibility of creating unsafe conditions, future developments within the breach inundation zone will be of the same type of developments already in existence.

Basic recreational facilities are planned for dam GB-3. Included will be facilities for overnight camping. Table 2B displays all the basic facilities included and costs associated with the recreational development at dam GB-3. The facilities will be designed for use by disabled persons. Appropriate state and federal guidelines for safety, health, and sanitation will be followed. A recreational sketch map which shows the location of the planned development for each site is included in Appendix B.

Watershed sponsors will secure landrights in fee-simple title for installation, operation, maintenance, and development of dam and reservoir GB-3. Minimum landrights acquisition will be required to the elevation of the top of dam. Additional areas will be acquired as determined by the sponsors. Total area to be acquired for dam GB-3, reservoir, and recreational area is approximately 1,640 acres. The real property acquisition area for dam GB-3 amounts to approximately 350 acres for the permanent pool, 215 acres for the temporary pool, dam, and spillway, and 1,075 acres available for buffer and wildlife development land.

Dam F-3, located approximately two miles east and one mile north of Allendale, Missouri, is designed to serve the purposes of flood prevention and nonagricultural water management (fish and wildlife development). The Worth County Commission is the sponsoring local organization for dam F-3.

Dam F-3 will create a pool with a surface area of 100 acres at the principal spillway crest. The abutments consist of a thin mantle loess overlaying glacial till. The alluvial deposits in the valley floor overlay glacial till and range in depth from 0 to 30 feet at site F-3.

The principal spillway will be designed to control the 50-year frequency storm (approximately 6.4 inches of rainfall) before the emergency spillway begins to flow. The emergency spillway has a two percent or less chance of flowing in any one year. Sediment storage of 1.5 watershed-inches is reserved in the permanent sediment pool, with 90 percent of the sediment being submerged and 10 percent aerated. Additional data is provided in Table 3.

Hazard classification for dam F-3 is determined to be class "a" hazard, and is designed for less than the probable maximum runoff. This classification was based upon the potential hazard defined by an analysis that assumes the dam fails when full. Although the dam is not expected to fail, if it should occur, damage will be restricted to a low-use graveled road, a county bridge, and agricultural land.

Delineation of the flood boundaries was terminated where the water surface elevation of the breach flow is less than the elevation of a 100-year flood with the dam built. To avoid the possibility of creating unsafe conditions, future developments within the breach inundation zone will be of the same type of developments already in existence. Limits of the flood wave from such a failure or breaching are delineated on the breach inundation maps in Appendix B.

Basic recreational facilities are planned for dam F-3. Day-use facilities will be provided. Table 2B displays all the basic facilities included and costs associated with the recreational development at dam F-3. Handicapped-accessible facilities will be provided. Appropriate state and federal guidelines for safety, health, and sanitation will be followed. A recreational sketch map which shows the location of the planned development is included in Appendix B.

Watershed sponsors will secure landrights in fee-simple title for installation, operation, maintenance, and development of dam and reservoir F-3. Minimum landrights acquisition will be required to the elevation of the top of dam. Additional areas will be acquired as determined by the sponsors. Total area to be acquired for dam F-3, reservoir, and recreational area is approximately 290 acres. The real property acquisition area for dam F-3 amounts to approximately 100 acres for the permanent pool, 27 acres for the temporary pool, dam, and spillway, and 163 acres available for buffer and wildlife development land.

Mitigation Features

Features of the plan which will reduce detrimental impacts on wildlife include limited clearing for dam construction, installation of draw-down pipes to regulate permanent pool sizes, and restricted work limits at each site. Unless impractical, dams will be constructed where wildlife habitat quality is poor.

Other features planned to mitigate impacts on wildlife include replacing woody habitat on wildlife mitigation areas as stated in Table N.

The buffer and wildlife development areas around GB-3 and F-3 can be used to meet mitigation requirements of the project. The additional acres required can be obtained from areas around the single-purpose floodwater retarding dams and grade stabilization structure sites. Acquisition of these mitigation areas will be prioritized (Appendix C - Biology Section).

Mitigation features include but are not limited to fencing materials, livestock watering pipes through the dams, and any wildlife plantings that may be approved on a site by site basis by the SCS and other sponsors.

TABLE N

Mitigation Requirements

	Structure	Acres	Habitat Units
Missouri	Dam F-3	89	28
	41 Floodwater Retarding Dams	237	73
	129 Grade Stabilization Structures	31	21
Iowa	Dam GB-3	159	45
	180 Floodwater Retarding Dams	577	161
	215 Grade Stabilization Structures	52	37
Total		**1145**	**365**

All mitigation measures will be installed using the average cost method. All mitigation areas will be fenced, if necessary, to exclude livestock access. Fence will be installed according to SCS Fencing Specification 382 and the mitigation guidelines listed above. Mitigation features on areas not associated with a structure site and all mitigation areas adjoining single-purpose flood control structures will be installed at 100 percent of the approved average cost. Cost-share assistance for mitigation will be available at a 65 percent rate, not to exceed established maximum levels.

Mitigation areas will be left to vegetate naturally or planted to vegetation which is different from existing cover in adjacent areas if wildlife habitat will improve. This variety will maximize edge and biodiversity.

Grazing and haying will not be allowed in mitigation areas. Prescribed burning that is consistent with habitat enhancement may be performed on mitigation areas, dams, emergency spillways, and adjacent grassland areas. An approved, prescribed burn plan should be followed. Livestock watering pipes shall extend beyond mitigation areas.

All mitigation areas accepted in Iowa will be obtained under a recorded 50-year term easement that restricts certain uses of the mitigated area. All mitigation practices in Iowa will be installed using the average cost method.

Wetland loss will be mitigated with the development of 90 acres of wetlands through prescribed and selective borrowing in the upper ends of the pools, below the dams, and along the edges of the pools. These wetland areas will be protected from grazing. See Appendix C - Wetland Section - for specific wetland construction criteria.

Grass-legume mixtures or native warm-season grasses will be established in fenced areas adjacent to the dam and emergency spillway. These fenced areas will be protected from grazing.

Sponsors in each county will prepare and maintain a list of potential mitigation sites. Accumulated mitigation shall not lag construction by more than three years. Sponsors are responsible for assuring that adequate mitigation acres are identified and set aside. Availability of construction dollars will be dependent upon a balanced acquisition of mitigation areas as the project proceeds.

Permits and Compliance

Federal Clean Water Act, Section 404 permits will be obtained prior to construction in order to comply with the Act. No other known federal permits or licenses will be required. For the Iowa portion, construction permits, water storage permits, and water supply permits from the Iowa Department of Natural Resources, Environmental Protection Division (EPD), will be obtained where required.

Procedures specified by the Fish and Wildlife Coordination Act were used to insure important fish and wildlife resources would not be lost.

This document was prepared to comply with the National Environmental Policy Act and the Principles and Guidelines for Water and Related Land Resources Implementation Studies.

Project measure installation will be in compliance with applicable federal, state, and local laws and regulations concerning environmental pollution control and abatement.

COSTS

Total project cost is $19,844,400, of which $15,877,300 will be borne by P.L.-566 funds and $3,967,100 by other funds. The watershed agreement shows actual cost-sharing rates between P.L.-566 and other funds. All project costs reflect the 1993 price base.

All installation costs for structural measures are allocated to purposes. Installation costs of the single-purpose floodwater retarding dams are allocated to flood prevention. Installation costs for dams GB-3 and F-3 are allocated to purposes for which the dam is designed. For dam GB-3, these purposes are flood prevention, rural water supply, and fish, wildlife, and recreational development. For dam F-3, these purposes are flood prevention and fish, wildlife, and recreational development. The installation costs for the multiple-purpose dams are allocated according to the Separable Cost-Remaining Benefits (SCRB) method.

Land treatment costs include funds for technical assistance which are necessary to install the planned measures. Landowners and operators will pay the local share of the cost of land treatment measures. Of the $3,361,000 land treatment costs, $2,285,000 are P.L.-566 costs and $1,076,000 are local costs. Included in these costs is $286,700 of P.L.-566 technical assistance.

Construction costs for all proposed measures are based on current costs for similar work. A twelve percent contingency allowance was included for all dams. Total construction costs are $11,780,000, of which $10,378,600 will be borne by P.L.-566 and $1,401,400 by other funds.

Engineering services include the cost of engineers, geologists, archaeologists, and technicians for design and layout of structural measures. Engineering costs also include investigations, preparation of plans and specifications for the structural measures, and inspection during construction. Total engineering services are $2,249,600, of which $2,114,500 are P.L.-566 costs and $135,100 are paid by other funds.

Project administration costs include contract administration, relocation assistance advisory services, and other items. Total project administration costs are $878,800, of which $718,000 will be borne by P.L.-566 and $160,800 by other funds.

Landrights costs for structural measures include the value of land covered by the dams, sediment pools, and flowage easements; plus costs for such items as appraisals, legal fees, and access roads. All landrights costs for the single-purpose floodwater retarding dams will be covered by local funds. Landrights costs for these measures are $127,400. Total landrights costs for dam and reservoir GB-3 are $1,277,500, of which $293,700 will be borne by P.L.-566 funds and $983,800 will be borne by other funds. Total landrights for dam and reservoir F-3 are $110,100 of which $39,500 will be borne by P.L.-566 funds and $70,600 will be borne by other funds.

Relocation payments are estimated to be $60,000, of which $48,000 will be borne by PL-566 funds and $12,000 will be borne by other funds. The cost-share rates are shown in the watershed agreement. These payments are associated with dam GB-3.

Prior to disturbance by planned actions, reservoirs recommended for further survey will be assessed by SCS to determine the location and significance of historic properties. Properties expected to be disturbed by project actions which are listed on or determined eligible for listing on the National Register of Historic Places (NRHP) will be avoided by changing project plans. In some cases, the effect will be mitigated through a proposal agreed to by SCS, the State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP). Funds have been included for surveys and mitigation.

Table 2 shows the estimated cost distribution between P.L.-566 and other funds for structural measures in the plan.

INSTALLATION AND FINANCING

Framework for Carrying Out Plan

Installation of land treatment and structural measures in this project have been planned and coordinated to be accomplished over a twelve-year period. Funds have been scheduled to provide for both construction and technical assistance during the twelve-year period. Implementation of the plan in each state will be conducted in accordance with policies, criteria, and procedures developed and applicable to the particular state, either Iowa or Missouri.

Planned Sequence of Installation

Land treatment will be established during the 12-year installation period. SCS and/or the SWCD will contact landowners in order to identify those willing to participate in this voluntary program. Cost-sharing will be based on eligible land treatment practices in each conservation district through existing federal and state cost-sharing programs.

Conservation Plans

The conservation plan with an installation schedule is the basis of the long term contract and other cost-share programs. Landowners/operators can select the land use and conservation practice they want installed from alternatives available in their plan. All alternatives for treatment of problems will reduce soil loss to tolerable levels for sustained long term productivity ("T" value). Length of long term contracts with the landowner or operator will be at least 3 years and not more than 10 years.

Long-Term Contracts

All P.L.-566 cost-shared land treatment will be installed at least two years before contracts expire. Long term contracts can extend beyond the project installation period for maintenance only. Operation, maintenance, and replacement procedures will be included in conservation plans. Landowners/operators will be responsible for operating and maintaining

land treatment measures for the life of the long term contract. The responsibility for maintenance will continue throughout the expected life of the practice.

Construction Units

The project area is divided into seven construction units to facilitate efficient installation of the small dams. A map of these units is shown in Figure 5. Construction will not begin in any unit until landrights for 80 percent of the dam sites in that unit are obtained. The construction schedule for dams GB-3 and F-3 is not affected by the requirements associated with the construction units. Contracts for construction of any dam will not be executed until 75 percent of the drainage area above that site is adequately protected (tolerable level, "T") from erosion. Construction of dam GB-3 shall not begin until additional land treatment and technical assistance for water quality enhancement has been implemented.

Recreational Facilities Dam GB-3

The restroom facilities and parking lot at dam GB-3, access site 1, modern and tent campsites, and waste treatment lagoon will be installed by the Ringgold County Conservation Board. They will also install the trash receptacles, picnic tables, and provide 50 percent of the display and entrance signs. Iowa Department of Natural Resources will install the other items listed on Table 2B. Installation of items located within the pool area will be coordinated with construction of dam GB-3.

A schedule of estimated federal and non-federal obligations during the 12-year installation period is tabulated in Table O.

TABLE O
Schedule of Obligations

YEAR		Measure	P.L.-566	Other	Total
1st	Land Treatment	Financial Assist.	39,970	21,520	61,490
		Technical Assist.	22,940	0	22,940
	Structural	Financial Assist.	0	0	0
		Technical Assist.	110,660	0	110,660
		Landrights	0	20,970	20,970
	Subtotal		**173,570**	**42,490**	**216,060**
2nd	Land Treatment	Financial Assist.	119,900	64,560	184,460
		Technical Assist.	31,540	0	31,540
	Structural	Financial Assist.	570,450	1,890	572,340
		Technical Assist.	261,140	4,430	265,570
		Landrights	293,700	1,029,670	1,323,370
	Subtotal		**1,276,730**	**1,100,550**	**2,377,280**
3rd	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	31,540	0	31,540
	Structural	Financial Assist.	1,188,900	15,780	1,204,680
		Technical Assist.	300,960	8,850	309,810
		Landrights	0	23,300	23,300
	Subtotal		**1,681,260**	**134,010**	**1,815,270**
4th	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	31,540	0	31,540
	Structural	Financial Assist.	1,140,900	3,780	1,144,680
		Technical Assist.	633,460	112,750	746,210
		Landrights	0	23,250	23,250
	Subtotal		**1,965,760**	**225,860**	**2,191,620**
5th	Land Treatment	Financial Assist.	219,810	118,360	338,170
		Technical Assist.	43,010	0	43,010
	Structural	Financial Assist.	2,248,800	886,480	3,135,280
		Technical Assist.	393,060	91,050	484,110
		Landrights	39,500	84,610	124,110
	Subtotal		**2,944,180**	**1,180,500**	**4,124,680**
6th	Land Treatment	Financial Assist.	299,750	161,400	461,150
		Technical Assist.	43,010	0	43,010
	Structural	Financial Assist.	1,291,650	108,150	1,399,800
		Technical Assist.	404,700	19,280	423,980
		Landrights	0	0	0
	Subtotal		**2,039,110**	**288,830**	**2,327,940**
7th	Land Treatment	Financial Assist.	199,830	107,600	307,430
		Technical Assist.	22,940	0	22,940
	Structural	Financial Assist.	950,750	3,150	953,900
		Technical Assist.	250,800	7,380	258,180
		Landrights	0	0	0
	Subtotal		**1,424,320**	**118,130**	**1,542,450**

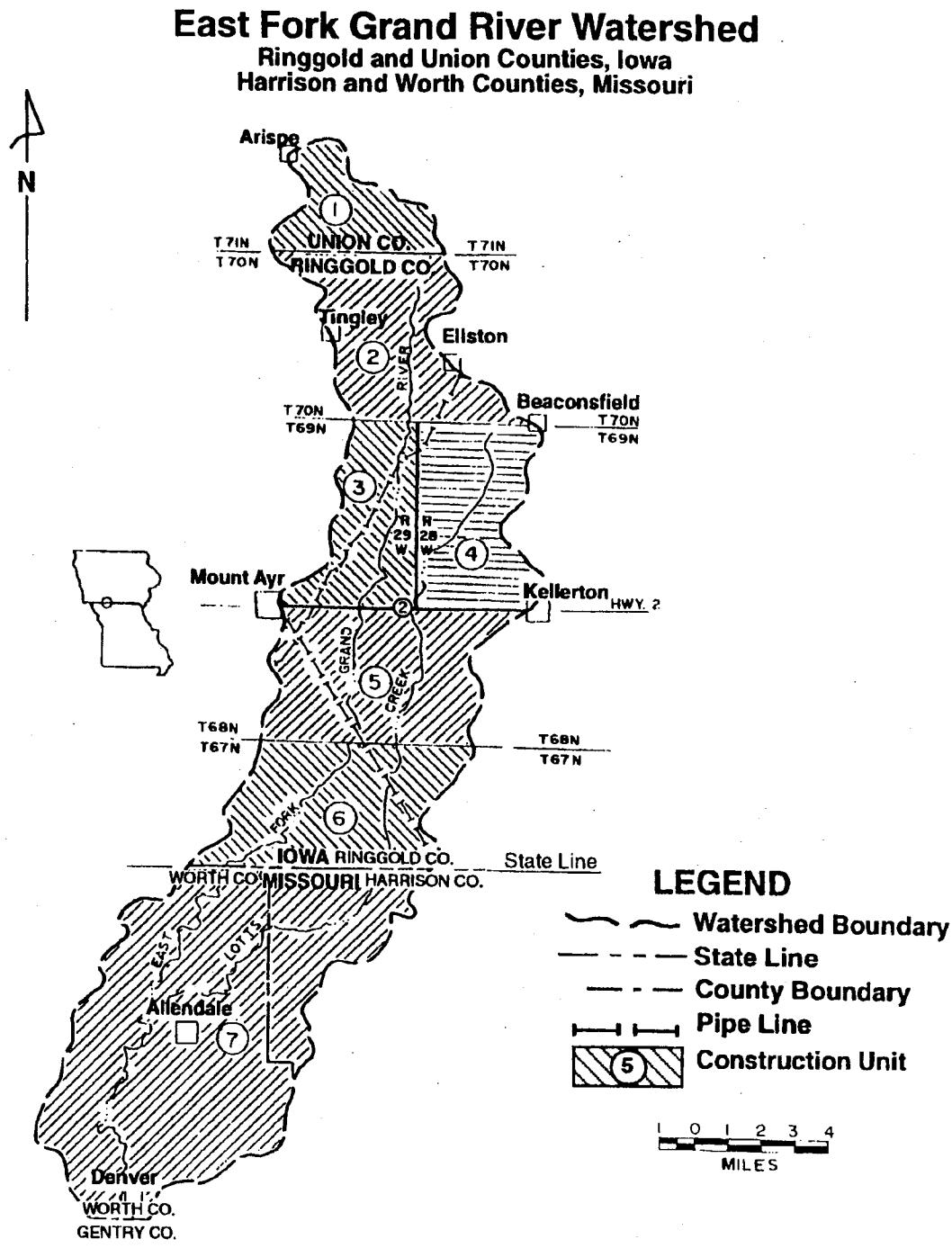
(Continued)

TABLE O
Schedule of Obligations (Continued)

YEAR		Measure	P.L.-566	Other	Total
8th	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	17,200	0	17,200
	Structural	Financial Assist.	1,323,900	368,420	1,692,320
		Technical Assist.	244,240	31,200	275,440
		Landrights	0	0	0
	Subtotal		**1,745,200**	**485,700**	**2,230,900**
9th	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	17,200	0	17,200
	Structural	Financial Assist.	570,450	1,890	572,340
		Technical Assist.	150,480	4,430	154,910
		Landrights	0	0	0
	Subtotal		**897,990**	**92,400**	**990,390**
10th	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	8,600	0	8,600
	Structural	Financial Assist.	570,450	1,890	572,340
		Technical Assist.	39,830	4,430	44,260
		Landrights	0	0	0
	Subtotal		**778,740**	**92,400**	**871,140**
11th	Land Treatment	Financial Assist.	159,860	86,080	245,940
		Technical Assist.	8,600	0	8,600
	Structural	Financial Assist.	380,300	1,260	381,560
		Technical Assist.	26,550	2,950	29,500
		Landrights	0	0	0
	Subtotal		**575,310**	**90,290**	**665,600**
12th	Land Treatment	Financial Assist.	159,880	86,080	245,960
		Technical Assist.	8,580	0	8,580
	Structural	Financial Assist.	142,050	8,710	150,760
		Technical Assist.	64,620	21,150	85,770
		Landrights	0	0	0
	Subtotal		**375,130**	**115,940**	**491,070**
TOTAL	Land Treatment	Financial Assist.	1,998,300	1,076,000	3,074,300
		Technical Assist.	286,700	0	286,700
	Structural	Financial Assist.	10,378,600	1,401,400	11,780,000
		Technical Assist.	2,880,500	307,900	3,188,400
		Landrights	333,200	1,181,800	1,515,000
GRAND TOTAL			**15,877,300**	**3,967,100**	**19,884,400**

April 1994

FIGURE 5
Construction Unit Map



Responsibilities

The Soil and Water Conservation Districts of Ringgold and Union Counties, Iowa, and Harrison and Worth Counties, Missouri, will have the primary responsibility to set priorities for accelerated planning and application of land treatment measures. Land treatment will be established during the project installation period by willing landowners in cooperation with their district.

Technical assistance will be provided by SCS to plan and apply land treatment measures. Landowners will be responsible for making all necessary arrangements to assure land treatment work is started and completed according to the installation schedule located in the conservation plan. Cost-share payments to landowners will be made after the eligible conservation practice has been completed and certified by SCS. However, landowners/operators must file a claim for payment.

Local sponsors will be responsible for project administration duties related to obtaining permits to install the works of improvement, provide relocation assistance advisory services, perform administrative functions connected with relocation payments, and conduct contract administration. SCS will be responsible for its project administration duties, but will assist the local sponsors with their contract administration responsibilities.

Contracting

The Soil Conservation Service will be responsible for administering long-term contracts for land treatment. SCS will coordinate the installation of land treatment measures with the appropriate Soil and Water Conservation District.

Contracting procedures may differ between Iowa and Missouri. The sponsors will be responsible for coordinating with SCS during the installation of structural measures. Project measures will be installed by contracts awarded and administered by the appropriate Sponsor in each state, unless they request SCS to administer the contracts.

The East Fork of the Grand River Watershed Subdistrict in Missouri and the Soil and Water Conservation Districts of Ringgold and Union Counties in Iowa will administer the contracts for installation of the single-purpose floodwater retarding dams. The City of Mount Ayr will administer the contracts for construction of dam GB-3, the water intake structure, and raw water transmission line. Iowa Department of Natural Resources and the Ringgold County Conservation Board will be responsible for installing the recreational facilities at site GB-3. The Worth County Commission will be responsible for installing dam F-3 and associated recreational facilities.

Real property and relocations

Watershed sponsors will obtain landrights needed for installation and maintenance of all dams. Landrights will be obtained for approximately 1,250 acres for permanent pools, 1,050 acres for temporary pools, and 360 acres for dams and spillways. These are the areas needed for the 220 small and 1 large single-purpose floodwater retarding dams. There are no anticipated alterations, modifications, changes to existing improvements, or relocations associated with installation of the small dams.

The City of Mount Ayr, Ringgold County Conservation Board, and Ringgold County Board of Supervisors will acquire land for the dam, spillways, reservoir, and wildlife area for structure GB-3. The amount of land area determined to be acquired for reservoir and fish and wildlife development is approximately 1,640 acres. The dam, spillway, and

reservoir will be located entirely within the 1,640 acres. Acquisition of land for dam and reservoir GB-3 will require the closing of two county roads, relocation of four residences and farm operations, and modification of a petroleum pipeline. Land acquisition for dam GB-3 will also require negotiations with the petroleum pipeline company to obtain permission to permanently store water over the pipeline and on the easement presently held by the pipeline company. The length of pipeline involved is approximately 2,600 feet. The modification required will be determined by the pipeline company. Modifications will assure protection against environmental damage due to rupture.

Landrights for dam F-3 will consist of acquiring fee-simple title to 550 acres. The Worth County Commission will be responsible for acquiring the landrights. Relocation is not involved at this site.

Sponsors will acquire all landrights in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat 1894, 42 U.S.C. 4601 et seq.), and the implementing regulations issued by the U.S. Department of Agriculture (7 CFR 21).

Cultural Resources

Funds for the recovery of information from archaeological and historic sites listed on, or eligible for listing on, the National Register of Historic Properties are available.

Significant cultural resources identified during implementation will be avoided or otherwise preserved in place to the fullest practical extent. If significant cultural resources cannot be avoided or preserved, pertinent information will be obtained prior to construction.

In the event of a significant cultural resource discovery during construction, appropriate notice will be made by SCS to the State Historic Preservation Officer (SHPO) and the National Park Service. Consultation and coordination has been and will continue to be used to insure the provisions of Section 106 of P.L. 89-665 have been met and to include provisions of P.L. 89-523, as amended by P.L. 93-291.

SCS will take action as prescribed in SCS GM 420, part 401, to protect and/or recover any significant cultural resources discovered during construction.

Financing

Federal assistance will be provided under authority of the Watershed Protection and Flood Prevention Act (P.L.-566, 83rd Congress, 68 Stat. 666), as amended. The balance of funds will be furnished by the local sponsors and landowners.

All construction and engineering services costs allocated to flood prevention will be paid with P.L.-566 funds. Construction costs and engineering services costs allocated to fish and wildlife and rural water supply are shared jointly by P.L.-566 funds and other funds. The source of other funds for dam GB-3 is the City of Mount Ayr, Southern Iowa Rural Water Association, Ringgold County Conservation Board, and Ringgold County Board of Supervisors through general taxing authorities, general revenue bonds, and general obligation bonds.

Project administration costs will be paid by SCS and local sponsors as they are incurred.

Construction and engineering services costs for the design and installation of the recreational and fish and wildlife facilities are specific costs. They are allocated to this purpose and shared jointly by the City of Mount Ayr, Ringgold County Conservation Board, and Iowa Department of Natural Resources.

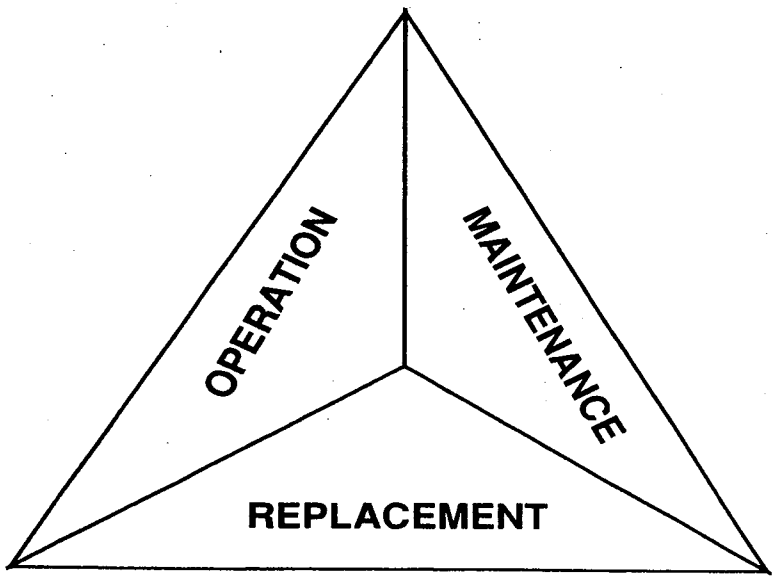
Landrights costs will be paid by the local sponsors, except for dams GB-3 and F-3. Landrights costs for dam GB-3 and F-3 will be shared between P.L.-566 and local sponsors. Funds to finance the local share will be derived from bonds and general revenue.

Conditions for Providing Assistance

Federal assistance is subject to the appropriation of funds and the sponsors' securement of landrights/permits necessary for the installation of project measures.

Before construction can begin on an individual dam, 75 percent of its drainage area must be adequately protected. Any exception to this must be approved by the State Conservationist. Adequate protection is achieved by applied land treatment practices or applied long term contracts to ensure that soil erosion rates will not exceed the tolerable level ("T") providing for such treatment.

SPONSORS' RESPONSIBILITIES AND COSTS



OPERATION, MAINTENANCE, & REPLACEMENT

Operation

Operation is the administration, management, and performance of any services needed to insure proper functioning of a measure throughout its evaluated life. This includes such items as periodic inspections, reports, and other needed labor.

Maintenance

The maintenance of project measures is divided into annual and periodic. Annual maintenance is the regular service required on a measure to prevent deterioration and insure consistent functioning. It includes controlling the growth of undesirable vegetation; managing grass cover through mowing; controlling grazing; cleaning trash racks; inspecting the measure; and repairing any damages that may impair the function or character of the measure.

Periodic maintenance is required on a recurring basis. It includes revegetation, fence repair, and the more complex and costly work required to repair concrete, steel, or earthen parts of structural measures. It also includes repairing significant erosion damage and storm damages. Damages to completed measures caused by normal deterioration, drought, flooding caused by rainfall in excess of design, or vandalism is considered maintenance regardless of when it occurs.

Replacement

Replacement is required when a component has a shorter life span than the evaluation period. Thus, it must be replaced to insure continued effectiveness of the measure throughout the 75-year life of the project. The smooth steel principal spillway pipe is considered to be a replacement item. Replacement could also be required when a major storm damages a component.

Sponsors' Responsibility/Costs

The sponsors accept responsibility for Operation, Maintenance, and Replacement (OM&R) on structural measures in two stages. The first stage begins upon completion of construction and approval by the sponsors and SCS. The second stage begins following the establishment of vegetation which occurs normally within two years after construction is completed. Landowners accept responsibility for OM&R on land treatment practices when work on the installation of a practice commences. The sponsors'/landusers' liability extends throughout the life of the measure or practice, until the measure or practice is modified to remove potential risk of loss of life and property, or as may be required by federal, state, and local laws.

The annual cost of OM&R for the 180 small single-purpose floodwater retarding dams in Iowa is $77,200, which includes $10,800 for replacement of the steel pipe in each dam at the midpoint of the project life. Seventy-two of the small single-purpose floodwater retarding dams include dry hydrants, for which the average annual OM&R cost is $3,600. OM&R of these 180 dams in Iowa will be performed and financed by the respective County Board of Supervisors. The OM&R costs for the 23 dams in Union County, Iowa are $9,860 which includes $1,380 for pipe replacement. The OM&R costs for the 157 dams in Ringgold County, Iowa are $67,340 which includes $9,420 for pipe replacement.

The annual cost of OM&R for the 40 small single-purpose floodwater retarding dams in Missouri is $17,150, which includes $2,400 for replacement of the steel pipe in each dam at the midpoint of the project life. Seventeen of the small dams include dry hydrants for which the average annual OM&R cost is $850. The annual cost of OM&R for the single-purpose floodwater retarding dam F-4 is $900. OM&R of these 41 dams will be performed by the East Fork of the Grand River Watershed Subdistrict and financed by funds generated from taxes collected in the subdistrict through their existing taxing authority. These annual expenses are calculated by determining the average for the 75-year project life. In order to insure available finances the subdistrict will establish a "sinking fund" for major maintenance costs and pipe replacement.

The annual OM&R costs for dam GB-3 and recreational facilities is estimated to be $3,800 and $21,100, respectively. The City of Mount Ayr and SIRWA will be responsible for the operation and maintenance of the dam, appurtenances, and water intake facilities. They will be responsible for all replacement items relative to the dam and intake structure when the need arises. Iowa DNR will be responsible for OM&R of all recreational facilities at site GB-3, except the parking lot, campsites (modern and primitive), restroom-shower facility, waste treatment lagoon, and some of the signs, all located at Access Site 1. The Ringgold County Conservation Board will be responsible for OM&R of these facilities. The recreational facilities involved at site GB-3 are listed in Table 2B.

The annual OM&R costs for dam F-3 and recreational facilities is estimated to be $3,400 and $4,000, respectively. The Worth County Commission will be responsible for the operation and maintenance of the dam, appurtenances, and recreational facilities. They will also be responsible for all replacement items relative to the dam and recreational facilities. Recreational facilities involved at Site F-3 are listed in Table 2B.

Operation, Maintenance, and Replacement costs also include annual visits to each site for the purpose of mowing and fertilizing as necessary to maintain a good vegetative cover. Plantings will be maintained in a manner to preserve their wildlife values. Mowing, prescribed burning, and restricted grazing are a few of the management options the sponsors can select. Dams and spillways will be limed and seeded as needed for proper vegetative growth. Occasionally, unscheduled maintenance will be necessary in order to remove trash and repair damages from major storms.

OPERATION, MAINTENANCE, and REPLACEMENT AGREEMENT

A specific OM&R agreement will be completed for each structural measure prior to signing a landrights, relocation, or project agreement. Agreements will provide for inspections, reports, and procedures necessary for the performance of maintenance items. The agreements will include specific provisions for retention, use, and disposal of property acquired with P.L.-566 assistance. An OM&R agreement will also be prepared for each land treatment measure.

Operation, Maintenance, and Replacement requirements will be determined by the complexity of each site. These requirements will be covered in the OM&R plan attached to and made part of the OM&R agreement.

OPERATION, MAINTENANCE, and REPLACEMENT INSPECTIONS

Inspections are necessary to ensure that installed measures are safe and functioning properly. Inspections check the adequacy of OM&R activities, identify needed OM&R work, identify unsafe conditions, specify means of relieving unsafe work, set action dates for performing corrective actions, and review hazard classification of dams.

The sponsors/landusers are responsible for making these inspections. Inspections will be made annually for the life of a practice or as specified in the OM&R agreement. SCS may, depending on the availability of resources, assist the sponsors/landusers with their inspections. These inspections will be conducted in accordance with SCS's "National Operation and Maintenance Manual" and Missouri Supplement.

Each dam is to be inspected annually on a regularly scheduled basis; during or immediately following the initial filling of a reservoir; and during or immediately following major storms, earthquakes, or other occurrences which could adversely affect the structural measure.

TABLE 1

Estimated Installation Costs (dollars) [1]

Installation Cost Item	Unit	Amount	P.L.-566 Funds *Nonfederal Land* SCS	Other Funds *Nonfederal Land*	TOTAL
LAND TREATMENT					
Grade Stabilization Structures	no.	344	1,256,800	676,700	**1,933,500**
Required and Interdependent					
Cropland	ac.	8,900	644,300	346,900	**991,200**
Grassland	ac.	1,200	73,100	39,400	**112,500**
Forest Land	ac.	453	24,100	13,000	**37,100**
Subtotal			**1,998,300**	**1,076,000**	**3,074,300**
Technical Assistance			286,700	0	**286,700**
Total Land Treatment			**2,285,000**	**1,076,000**	**3,361,000**
STRUCTURAL MEASURES					
Multiple-Purpose Dam GB-3			1,933,900	2,177,300	**4,111,200**
Multiple-Purpose Dam F-3			784,500	492,000	**1,276,500**
Single-Purpose Dam F-4			300,300	26,600	**326,900**
Small FWR Dams	no.	220	10,573,600	195,200	**10,768,800**
Total Structural Measures			**13,592,300**	**2,891,100**	**16,483,400**
TOTAL PROJECT			**15,877,300**	**3,967,100**	**19,844,400**

[1] Price Base September 1993

April 1994

TABLE 2
Estimated Cost Distribution
Structural Measures
East Fork Grand River Watershed
(dollars) (1)

	Installation Costs - P.L.-566 Funds						Installation Costs - Other Funds						Total Installation Cost
	Const.	Engr. Services	Real Property Rights	Reloc. Paymnts	Project Admin.	Total	Const.	Engr. Services	Real Property Rights	Reloc. Paymnts	Project Admin.	Total	
Multiple-Purpose Dam													
Dam GB-3	588,400 (2)	180,000	293,700	48,000	64,800	1,174,900	363,200	0	983,800 (5)	12,000	7,200	1,366,200	2,541,100
Recreational Facilities	394,500	78,900	0	0	2,400	475,800	394,500	78,900	0	0	44,900	518,300	994,100
Water Intake Structure	125,000	25,000	0	0	3,900	153,900	125,000	25,000	0	0	9,100	159,100	313,000
Raw Water Line	105,000	21,000	0	0	3,300	129,300	105,000	21,000	0	0	7,700	133,700	263,000
Subtotal	**1,212,900**	**304,900**	**293,700**	**48,000**	**74,400**	**1,933,900**	**987,700**	**124,900**	**983,800**	**12,000**	**68,900**	**2,177,300**	**4,111,200**
Multiple-Purpose Dam													
Dam F-3	512,400 (3)	127,900	39,500	0	41,100	720,900	335,000	0	70,600 (6)	0	22,700	428,300	1,149,200
Recreational Facilities	50,900	10,200	0	0	2,500	63,600	50,900	10,200	0	0	2,600	63,700	127,300
Subtotal	**563,300**	**138,100**	**39,500**	**0**	**43,600**	**784,500**	**385,900**	**10,200**	**70,600**	**0**	**25,300**	**492,000**	**1,276,500**
Single-purpose Dams													
Dam F-4	235,900	48,600	0	0	15,800	300,300	0	0	24,900 (7)	0	1,700	26,600	326,900
220 Small FR Dams	8,366,500	1,622,900	0	0	584,200	10,573,600	27,800	0	102,500	0	64,900	195,200	10,768,800
Subtotal	**8,602,400** (4)	**1,671,500**	**0**	**0**	**600,000**	**10,873,900**	**27,800**	**0**	**127,400**	**0**	**66,600**	**221,800**	**11,095,700**
TOTAL	**10,378,600**	**2,114,500**	**333,200**	**48,000**	**718,000**	**13,592,300**	**1,401,400**	**135,100**	**1,181,800**	**12,000**	**160,800**	**2,891,100**	**16,483,400**

(1) Price Base September 1993

April 1994

(2) Includes $12,300 for mitigation and cultural resources.

(3) Includes $11,000 for mitigation and cultural resources.

(4) Includes $227,100 for mitigation and cultural resources.

(5) Includes $37,000 for surveys, legal fees, and other costs; and $500,000 for reinforcing pipeline in reservoir.

(6) Includes $4,400 for surveys, legal fees, and other costs.

(7) Includes $1,100 for surveys, legal fees, and other costs.

TABLE 2A
Cost Allocation and Cost-Sharing Summary
Structural Measures
East Fork Grand River Watershed
(dollars) [1]

	Cost-Allocation Purpose				Cost-Sharing P.L.-566				Cost-Sharing Other			
	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total
Multiple-purpose Dam No. GB-3												
Construction	225,300	329,200	397,100	951,600	225,300	164,600	198,500	588,400	0	164,600	198,600	363,200
Engineering Services	42,600	62,300	75,100	180,000	42,600	62,300	75,100	180,000	0	0	0	0
Real Prop. Rights												
Land Acquisition	147,600	250,900	339,500	738,000	0	0	169,700	169,700	147,600	250,900	169,800	568,300
Pipeline Modification	100,000	170,000	230,000	500,000	0	0	115,000	115,000	100,000	170,000	115,000	385,000
Flowage Easement	600	900	1,000	2,500	0	0	500	500	600	900	500	2,000
Other Costs Assoc. w/LR	7,400	12,600	17,000	37,000	0	0	8,500	8,500	7,400	12,600	8,500	28,500
Relocation	12,000	21,600	26,400	60,000	9,600	17,300	21,100	48,000	2,400	4,300	5,300	12,000
Project Administration	17,000	24,900	30,100	72,000	15,300	22,400	27,100	64,800	1,700	2,500	3,000	7,200
Subtotal	**552,500**	**872,400**	**1,116,200**	**2,541,100**	**292,800**	**266,600**	**615,500**	**1,174,900**	**259,700**	**605,800**	**500,700**	**1,366,200**
Recreational Facilities												
Construction - Basic Fac.	0	0	789,000	789,000	0	0	394,500	394,500	0	0	394,500	394,500
Engineering Services	0	0	157,800	157,800	0	0	78,900	78,900	0	0	78,900	78,900
Project Administration	0	0	47,300	47,300	0	0	2,400	2,400	0	0	44,900	44,900
Subtotal	**0**	**0**	**994,100**	**994,100**	**0**	**0**	**475,800**	**475,800**	**0**	**0**	**518,300**	**518,300**
Water Intake Str.												
Construction	0	250,000	0	250,000	0	125,000	0	125,000	0	125,000	0	125,000
Engineering Services	0	50,000	0	50,000	0	25,000	0	25,000	0	25,000	0	25,000
Project Admin.	0	13,000	0	13,000	0	3,900	0	3,900	0	9,100	0	9,100
Subtotal	**0**	**313,000**	**0**	**313,000**	**0**	**153,900**	**0**	**153,900**	**0**	**159,100**	**0**	**159,100**
Raw Water Line												
Construction	0	210,000	0	210,000	0	105,000	0	105,000	0	105,000	0	105,000
Engineering Services	0	42,000	0	42,000	0	21,000	0	21,000	0	21,000	0	21,000
Project Admin.	0	11,000	0	11,000	0	3,300	0	3,300	0	7,700	0	7,700
Subtotal	**0**	**263,000**	**0**	**263,000**	**0**	**129,300**	**0**	**129,300**	**0**	**133,700**	**0**	**133,700**
Multiple-purpose Dam No. F-3												
Construction	177,400	0	670,000	847,400	177,400	0	335,000	512,400	0	0	335,000	335,000
Engineering Services	26,800	0	101,100	127,900	26,800	0	101,100	127,900	0	0	0	0
Real Prop. Rights												
Land Acquisition	21,000	0	79,100	100,100	0	0	39,500	39,500	21,000	0	39,600	60,600
Other Costs Assoc. w/RPR	2,000	0	8,000	10,000	0	0	0	0	2,000	0	8,000	10,000
Project Administration	9,400	0	54,400	63,800	8,500	0	32,600	41,100	900	0	21,800	22,700
Subtotal	**236,600**	**0**	**912,600**	**1,149,200**	**212,700**	**0**	**508,200**	**720,900**	**23,900**	**0**	**404,400**	**428,300**

[1] Price Base September 1993

April 1994
(Continued)

TABLE 2A (Continued)
Cost Allocation and Cost-Sharing Summary
Structural Measures
East Fork Grand River Watershed
(dollars) [1]

	Cost-Allocation Purpose				Cost-Sharing P.L.-566				Cost-Sharing Other			
	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total	Flood Prevention	Agric. Water Mgmnt.	Fish & Wildlife	Total
Multiple-purpose Dam No. F-3 (Cont.)												
Recreational Facilities												
Construction	0	0	101,800	101,800	0	0	50,900	50,900	0	0	50,900	50,900
Engineering Services	0	0	20,400	20,400	0	0	10,200	10,200	0	0	10,200	10,200
Project Administration	0	0	5,100	5,100	0	0	2,500	2,500	0	0	2,600	2,600
Subtotal	**0**	**0**	**127,300**	**127,300**	**0**	**0**	**63,600**	**63,600**	**0**	**0**	**63,700**	**63,700**
Single-purpose Floodwater Retarding Dams												
Dam F-4												
Construction	235,900	0	0	235,900	235,900	0	0	235,900	0	0	0	0
Engineering Services	48,600	0	0	48,600	48,600	0	0	48,600	0	0	0	0
Real Prop. Rights	24,900	0	0	24,900	0	0	0	0	24,900	0	0	24,900
Project Administration	17,500	0	0	17,500	15,800	0	0	15,800	1,700	0	0	1,700
Subtotal	**326,900**	**0**	**0**	**326,900**	**300,300**	**0**	**0**	**300,300**	**26,600**	**0**	**0**	**26,600**
220 Small Dams												
Construction	8,394,300	0	0	8,394,300	8,366,500	0	0	8,366,500	27,800	0	0	27,800
Engineering Services	1,622,900	0	0	1,622,900	1,622,900	0	0	1,622,900	0	0	0	0
Real Prop. Rights	102,500	0	0	102,500	0	0	0	0	102,500	0	0	102,500
Project Administration	649,100	0	0	649,100	584,200	0	0	584,200	64,900	0	0	64,900
Subtotal	**10,768,800**	**0**	**0**	**10,768,800**	**10,573,600**	**0**	**0**	**10,573,600**	**195,200**	**0**	**0**	**195,200**
TOTAL	**11,884,800**	**1,448,400**	**3,150,200**	**16,483,400**	**11,379,400**	**549,800**	**1,663,100**	**13,592,300**	**505,400**	**898,600**	**1,487,100**	**2,891,100**

[1] Price Base September 1993

April 1994

TABLE 2B
Recreational Facilities
Estimated Construction Costs

Item	Unit	Number [2]	Unit Cost	Total Construction Cost
DAM GB-3, IOWA			(dollars) [1]	(dollars) [1]
Facilities to be installed by Iowa Department of Natural Resources				
Access Site 1				
Entrance road, graveled	mile	1.0	$25,000	$25,000
Parking lot, graveled 50-car w/trailer	each	1.0	Lump Sum	$20,000
Fishing pier, disabled accessible	each	1.0	Lump Sum	$50,000
Parking lot, graveled 40-car w/trailer	each	1.0	Lump Sum	$18,000
Two lane conc. boat ramp	each	1.0	Lump Sum	$20,000
Five car disabled user paved parking lot	each	1.0	Lump Sum	$10,000
Waste Treatment Lagoon	each	1.0	Lump Sum	$25,000
Access Site 2				
Entrance road, graveled	mile	0.3	$25,000	$7,500
Parking lot, graveled, 25 car	each	1.0	Lump Sum	$16,000
Two lane conc. boat ramp	each	1.0	Lump Sum	$20,000
Access Site 3				
Entrance road, graveled	mile	0.3	$25,000	$7,500
Parking lot, graveled, 25 car	each	1.0	Lump Sum	$16,000
Iowa Sites 1, 2, 3 (GB-3)				
Fishing jetties	each	7.0	$10,000	$70,000
Signs, entrance & display		---	Lump Sum	$5,000
In-lake Facilities				
Sediment barrier	each	1.0	Lump Sum	$60,000
Riprap, shoreline	feet	2,500	$12	$30,000
Underwater Fish Structures				
Earthen mounds	each	4.0	$5,000	$20,000
Rock covered mounds	each	2.0	$10,000	$20,000
Rockpiles on roadways	tons	1,500	$10	$15,000
Waterfowl Nesting Islands	each	8.0	$1,500	$12,000
Contingency, 12%				**$54,200**
Subtotal, Iowa DNR & PL-566				**$521,200**
Facilities to be installed by Ringgold County Conservation Board				
Access Site 1				
Campsites				
Modern with Electricity	each	30.0	$1,200	$36,000
Primitive - Tent Sites	each	10.0	$400	$4,000
Restroom Facilities w/flush toilets, showers, concession. Room, disabled accessible	each	1.0	Lump Sum	$165,000
Sealed vault privy, disabled accessible	each	1.0	Lump Sum	$10,000
Iowa Sites 1, 2, 3 (GB-3)				
Trash receptacles	each	25.0	$100	$2,500
Picnic tables	each	25.0	$800	$20,000
Contingency, 12%				**$30,300**
Subtotal, Ringgold County Conservation Board & PL-566				**$267,800**
Total Construction, GB-3				**$789,000**

[1] Price Base September 1993
[2] Estimated quantity subject to variations at time of detailed design.

April 1994
(continued)

TABLE 2B (Continued)

Recreational Facilities
Estimated Construction Costs

Item	Unit	Number [2]	Unit Cost	Total Construction Cost
DAM F-3, MISSOURI			(dollars) [1]	(dollars) [1]
Access Site 1				
Entrance road, graveled	mile	0.4	$25,000	$10,000
15-car w/ trailer graveled parking lot	each	1.0	$8,000	$8,000
25-car graveled parking lot	each	1.0	lump sum	$16,000
Two lane conc. boat ramp	each	1.0	$15,000	$15,000
5-car parking lot, paved, disabled accessible	each	1.0	$10,000	$10,000
Sealed vault privies, disabled accessible	each	2.0	$5,000	$10,000
Fishing pier, paved, disabled accessible	each	1.0	$15,000	$15,000
Signs, Entrance & Display		---	lump sum	$2,000
Grills	each	7.0	$100	$700
Picnic tables	each	7.0	$500	$3,500
Trash receptacles	each	7.0	$100	$700
Subtotal, F-3, Construction				**$90,900**
Contingency, 12%				**$10,900**
Total Construction, F-3				**$101,800**

[1] Price Base September 1993 April 1994

[2] Estimated quantity subject to variations at time of detailed design.

TABLE 3

Structural Data [4]
Dams with Planned Storage Capacity

	Unit	Structure Number				
		A-50	A-60	A-72	B-32	B-43
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	acres	325	225	165	165	310
Total Drainage Area	acres	325	225	165	165	310
Runoff Curve Number (1-day)(AMC II) [1]		78	78	78	78	78
Elevation						
Top of Dam	feet	1168.7	1151.0	1147.3	1082.1	1081.8
Crest Emergency Spillway	feet	1166.7	1149.0	1145.3	1080.1	1079.6
Crest Low Stage Inlet	feet	1161.6	1143.2	1137.6	1072.7	1073.1
Emergency Spillway Type [2]		Veg.	Veg.	Veg.	Veg.	Veg.
Emergency Spillway Bottom Width	feet	30.0	30.0	20.0	20.0	30.0
Emergency Spillway Exit Slope	% slope	8.0	8.0	8.0	8.0	8.0
Maximum Height of Dam	feet	18.7	23.0	21.3	20.1	23.8
Volume of Fill	cu yd	12,200	16,500	15,500	17,600	16,000
Total Capacity	ac-ft	119.7	88.6	80.7	81.0	111.9
Sediment Submerged	ac-ft	48.8	33.8	24.8	24.8	46.5
Sediment Aerated	ac-ft	5.4	3.8	2.8	2.8	5.2
Floodwater Retarding	ac-ft	65.5	51.0	53.1	53.4	60.2
Surface Area						
Sediment Pool	acres	9.7	6.6	4.9	5.2	7.3
Floodwater Retarding	acres	17.9	12.4	10.0	10.0	12.7
Principal Spillway Design						
Rainfall Volume (10-yr/24-hr)	inches	5.0	5.0	5.0	5.0	5.0
Runoff Volume	inches	2.7	2.7	2.7	2.7	2.7
Capacity of Low Stage (max)	cfs	7.4	4.2	2.0	2.0	7.4
Dimensions of Conduit	inches	10.0	8.0	6.0	6.0	10.0
Type of Conduit [3]		SSP	SSP	SSP	SSP	SSP
Frequency Operation-Emergency Spillway	% chance	10.0	10.0	10.0	10.0	10.0
Emergency Spillway Hydrograph						
Rainfall Volume (50-yr/24-hr)	inches	6.4	6.4	6.4	6.4	6.4
Runoff Volume	inches	3.9	3.9	3.9	3.9	3.9
Storm Duration	hours	24.0	24.0	24.0	24.0	24.0
Velocity of Flow (Ve)	ft/sec	3.6	2.7	2.7	2.8	4.2
Maximum Water Surface Elevation	feet	1167.3	1149.2	1145.5	1080.3	1080.4
Capacity Equivalents						
Sediment Volume	inches	2.0	2.0	2.0	2.0	2.0
Floodwater Retarding Volume	inches	2.4	2.7	2.7	2.7	2.3

[1] RCN's are representative areas of the watershed in which the sample structures are located. Final design RCN's for specific sites may differ slightly from the listed value.

[2] Veg. = vegetated, sod-forming grass only.

[3] SSP = smooth steel pipe.

[4] Data for Table 3 were developed during plan formulation. Quantities, elevations, and dimensions are subject to refinement at time of final design and prior to installation.

April 1994

TABLE 3 (Continued)

Structural Data [4]
Dams with Planned Storage Capacity

	Unit	Structure Number D-29	E-41	E-44	E-53	E-54
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	acres	295	295	270	290	180
Total Drainage Area	acres	295	295	270	290	180
Runoff Curve Number (1-day)(AMC II) [1]		78	78	78	78	78
Elevation						
Top of Dam	feet	1185.0	1080.3	1101.9	1084.9	1066.6
Crest Emergency Spillway	feet	1182.9	1078.2	1099.9	1082.9	1064.6
Crest Low Stage Inlet	feet	1177.0	1071.1	1093.6	1075.8	1057.9
Emergency Spillway Type [2]		Veg.	Veg.	Veg.	Veg.	Veg.
Emergency Spillway Bottom Width	feet	30.0	30.0	30.0	30.0	20.0
Emergency Spillway Exit Slope	% slope	8.0	8.0	8.0	8.0	8.0
Maximum Height of Dam	feet	18.0	22.3	19.9	24.9	22.6
Volume of Fill	cu yd	17,300	13,100	17,700	12,100	13,800
Total Capacity	ac-ft	140.7	116.2	106.0	114.3	71.0
Sediment Submerged	ac-ft	44.3	44.3	40.5	43.5	27.0
Sediment Aerated	ac-ft	4.9	4.9	4.5	4.8	3.0
Floodwater Retarding	ac-ft	91.5	67.0	61.0	66.0	41.0
Surface Area						
Sediment Pool	acres	10.6	6.8	7.7	7.2	4.8
Floodwater Retarding	acres	25.8	13.5	13.2	13.2	8.8
Principal Spillway Design						
Rainfall Volume (10-yr/24-hr)	inches	5.0	5.0	5.0	5.0	5.0
Runoff Volume	inches	2.7	2.7	2.7	2.7	2.7
Capacity of Low Stage (max)	cfs	4.2	4.2	4.2	4.2	4.2
Dimensions of Conduit	inches	8.0	8.0	8.0	8.0	8.0
Type of Conduit [3]		SSP	SSP	SSP	SSP	SSP
Frequency Operation-Emergency Spillway	% chance	10.0	10.0	10.0	10.0	10.0
Emergency Spillway Hydrograph						
Rainfall Volume (50-yr/24-hr)	inches	6.4	6.4	6.4	6.4	6.4
Runoff Volume	inches	3.9	3.9	3.9	3.9	3.9
Storm Duration	hours	24.0	24.0	24.0	24.0	24.0
Velocity of Flow (Ve)	ft/sec	2.2	4.2	4.2	3.9	3.0
Maximum Water Surface Elevation	feet	1183.1	1079.0	1100.7	1083.5	1064.9
Capacity Equivalents						
Sediment Volume	inches	2.0	2.0	2.0	2.0	2.0
Floodwater Retarding Volume	inches	2.7	2.7	2.7	2.7	2.7

[1] RCN's are representative areas of the watershed in which the sample structures are located. Final design RCN's for specific sites may differ slightly from the listed value.

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[2] Veg. = vegetated, sod-forming grass only.

[3] SSP = smooth steel pipe.

[4] Data for Table 3 were developed during plan formulation. Quantities, elevations, and dimensions are subject to refinement at time of final design and prior to installation.

TABLE 3 (Continued)

Structural Data [4]
Dams with Planned Storage Capacity

	Unit	Structure Number				
		E-58	G-55	H-26	H-27	H-40
Class of Structure		a	a	a	a	a
Seismic Zone		1	1	1	1	1
Uncontrolled Drainage Area	acres	265	280	160	255	180
Total Drainage Area	acres	265	280	160	255	180
Runoff Curve Number (1-day)(AMC II) [1]		78	78	78	78	78
Elevation						
Top of Dam		1069.2	977.6	1026.1	1016.3	1051.4
Crest Emergency Spillway	feet	1067.2	975.6	1024.1	1014.3	1049.4
Crest Low Stage Inlet	feet	1060.4	968.6	1017.3	1007.3	1043.7
Emergency Spillway Type [2]		Veg.	Veg.	Veg.	Veg.	Veg.
Emergency Spillway Bottom Width	feet	30.0	30.0	20.0	30.0	20.0
Emergency Spillway Exit Slope	% slope	8.0	8.0	8.0	8.0	8.0
Maximum Height of Dam	feet	21.2	26.6	22.1	22.3	18.4
Volume of Fill	cu yd	10,500	17,000	7,200	7,900	16,100
Total Capacity	ac-ft	104.2	110.7	75.5	100.6	71.0
Sediment Submerged	ac-ft	39.8	42.0	24.0	38.3	27.0
Sediment Aerated	ac-ft	4.4	4.7	2.7	4.3	3.0
Floodwater Retarding	ac-ft	60.0	64.0	48.8	58.0	41.0
Surface Area						
Sediment Pool	acres	6.5	5.9	5.3	6.5	5.9
Floodwater Retarding	acres	12.4	16.0	10.7	12.1	9.7
Principal Spillway Design						
Rainfall Volume (10-yr/24-hr)	inches	5.0	5.0	5.0	5.0	5.0
Runoff Volume	inches	2.7	2.7	2.7	2.7	2.7
Capacity of Low Stage (max)	cfs	4.2	4.2	2.0	4.2	4.2
Dimensions of Conduit	inches	8.0	8.0	6.0	8.0	8.0
Type of Conduit [3]		SSP	SSP	SSP	SSP	SSP
Frequency Operation-Emergency Spillway	% chance	10.0	10.0	10.0	10.0	10.0
Emergency Spillway Hydrograph						
Rainfall Volume (50-yr/24-hr)	inches	6.4	6.4	6.4	6.4	6.4
Runoff Volume	inches	3.9	3.9	3.9	3.9	3.9
Storm Duration	hours	24.0	24.0	24.0	24.0	24.0
Velocity of Flow (Ve)	ft/sec	4.3	2.7	2.5	3.0	3.0
Maximum Water Surface Elevation	feet	1068.0	975.9	1024.4	1014.6	1049.6
Capacity Equivalents						
Sediment Volume	inches	2.0	2.0	2.0	2.0	2.0
Floodwater Retarding Volume	inches	2.7	2.7	2.7	2.7	2.7

[1] RCN's are representative area of the watershed in which the sample structures are located. Final design RCN's for specific sites may differ slightly from the listed value.

[2] Veg. = vegetated, sod-forming grass only.

[3] SSP = smooth steel pipe.

[4] Data for Table 3 were developed during plan formulation. Quantities, elevations, and dimensions are subject to refinement at time of final design and prior to installation.

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TABLE 3 (Continued)

Structural Data [4]
Dams with Planned Storage Capacity

	Unit	Structure Number H-44	Total P1-4	204 Add'l	Subtotal
Class of Structure		a			
Seismic Zone		1			
Uncontrolled Drainage Area	acres	180	3,840	48,960	52,800
Total Drainage Area	acres	180	3,840	48,960	52,800
Runoff Curve Number (1-day)(AMC II) [1]		78	---	---	---
Elevation					
Top of Dam	feet	1048.3	---	---	---
Crest Emergency Spillway	feet	1046.3	---	---	---
Crest Low Stage Inlet	feet	1037.9	---	---	---
Emergency Spillway Type [2]		Veg.	---	---	---
Emergency Spillway Bottom Width	feet	20.0	---	---	---
Emergency Spillway Exit Slope	% slope	8.0	---	---	---
Maximum Height of Dam	feet	25.3	---	---	---
Volume of Fill	cu yd	9,400	219,900	2,803,700	3,023,600
Total Capacity	ac-ft	71.0	1563.1	19,930	21,493
Sediment Submerged	ac-ft	27.0	576.4	7,350	7,926
Sediment Aerated	ac-ft	3.0	64.2	820	884
Floodwater Retarding	ac-ft	41.0	922.5	11,760	12,683
Surface Area					
Sediment Pool	acres	3.9	104.8	1,336	1,441
Floodwater Retarding Pool	acres	6.6	205.0	2,614	2,819
Principal Spillway Design					
Rainfall Volume (10-yr/24-hr)	inches	5.0	---	---	---
Runoff Volume	inches	2.7	---	---	---
Capacity of Low Stage (max)	inches	4.2	---	---	---
Dimensions of Conduit	inches	8.0	---	---	---
Type of Conduit [3]		SSP	---	---	---
Frequency Operation-Emergency Spillway	% chance	10.0	---	---	---
Emergency Spillway Hydrograph					
Rainfall Volume (50-yr/24-hr)	inches	6.4	---	---	---
Runoff Volume	inches	3.9	---	---	---
Storm Duration	hours	24.0	---	---	---
Velocity of Flow (Ve)	ft/sec	3.4	---	---	---
Maximum Water Surface Elevation	feet	1046.7	---	---	---
Capacity Equivalents					
Sediment Volume	inches	2.0	---	---	---
Floodwater Retarding Volume	inches	2.7	---	---	---

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[2] Veg. = vegetated, sod-forming grass only.

[3] SSP - smooth steel pipe.

[4] Data for Table 3 were developed during plan formulation. Quantities, elevations, and dimensions are subject to refinement at time of final design and prior to installation.

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TABLE 3 (Continued)

Structural Data [4]
Dams with Planned Storage Capacity

	Unit	Structure Number F-3	F-4	GB-3	Subtotal	Total
Class of Structure		a	a	b	---	---
Seismic Zone		1	1	1	---	---
Uncontrolled Drainage Area	acres	1,180	1,090	6,030	8,300	61,100
Total Drainage Area	acres	1,180	1,090	6,030	8,300	61,100
Runoff Curve Number (1-day)(AMC II) [1]		78	81	81	---	---
Time of Concentration (Tc)	hours	1.2	1.0	1.6	---	---
Elevation						
Top of Dam		1019.8	1009.2	1111.3	---	---
Crest Emergency Spillway	feet	1016.8	1005.2	1106.4	---	---
Crest Low Stage Inlet	feet	1013.3	992.7	1100.8	---	---
Emergency Spillway Type [2]		Veg.	Veg.	Veg.	---	---
Emergency Spillway Bottom Width	feet	100.0	100.0	200.0	---	---
Emergency Spillway Exit Slope	% slope	8.0	8.0	8.0	---	---
Maximum Height of Dam	feet	58.1	35.2	51.3	---	---
Volume of Fill	cu yd	190,300	51,700	248,000	490,000	3,513,600
Total Capacity	ac-ft	2,124	571	6,650	9,345	30,838
Sediment Submerged	ac-ft	165	163	850	1,178	9,104
Sediment Aerated	ac-ft	20	18	150	188	1,072
Floodwater Retarding	ac-ft	354	390	2,075	2,819	15,502
Beneficial Use	ac-ft	1,585	0	3,575	5,160	5,160
Surface Area						
Sediment Pool	acres	(18)	22	(122)	22	1,463
Floodwater Retarding	acres	115	48	456	619	3,438
Beneficial Use		100	0	350	450	450
Principal Spillway Design						
Rainfall Volume (1-day)	inches	6.5	6.4	6.4	---	---
Rainfall Volume (10-day)	inches	11.2	11.2	11.3	---	---
Runoff Volume (10-day)	inches	6.2	6.2	6.8	---	---
Dimensions of Conduit	inches	24.0	24.0	42.0	---	---
Type of Conduit [3]		RCP	RCP	RCP	---	---
Frequency Operation-Emergency Spillway	% chance	2.0	4.0	2.0	---	---
Emergency Spillway Hydrograph						
Rainfall Volume	inches	8.0	8.0	8.0	---	---
Runoff Volume	inches	5.4	5.7	5.7	---	---
Storm Duration	hours	6.0	6.0	6.0	---	---
Velocity of Flow (Ve)	ft/sec	5.1	6.6	6.5	---	---
Maximum Water Surface Elevation	feet	1018.7	1006.5	1107.7	---	---
Freeboard Hydrograph						
Rainfall Volume		14.0	14.1	14.7	---	---
Runoff Volume		11.1	11.6	12.2	---	---
Storm Duration		6.0	6.0	6.0	---	---
Velocity of Flow (Ve)		10.0	13.3	15.4	---	---
Maximum Water Surface Elevation		1019.8	1009.2	1111.3	---	---
Discharge Per Foot of Width (Qe/b)		3.3	6.1	17.5	---	---
Capacity Equivalents						
Sediment Volume	inches	1.9	2.0	2.0	---	---
Floodwater Retarding Volume	inches	3.6	4.3	4.1	---	---
Beneficial Volume		16.1	0.0	7.1	---	---

[1] RCN's are representative area of the watershed in which the sample structures are located. Final design RCN's for specific sites may differ slightly from the listed value.
[2] Veg. = vegetated, sod-forming grass only.
[3] RCP = reinforced concrete pipe
[4] Data for Table 3 were developed during plan formulation. Quantities, elevations, and dimensions are subject to refinement at time of final design and prior to installation.

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TABLE 4

Estimated Average Annual NED Costs (Dollars) [1]

Evaluation Unit	Amortization of Installation Cost	Operation Maintenance and Replacement Cost	Total
STRUCTURAL			
220 Small Single-Purpose Dams with 89 dry hydrants	$864,200	$99,900	$964,100
Dam F-4 Small Single-Purpose	$26,200	$900	$27,100
Subtotal Single-Purpose	**$890,400**	**$100,800**	**$991,200**
Dam F-3 Flood Control, Fish, Wildlife, & Recreation	$102,400	$7,400	$109,800
Dam GB-3 Ag. Water Management, Flood Control, Fish, Wildlife, & Recreation	$329,900	$24,900	$354,800
Subtotal Multiple-Purpose	**$432,300**	**$32,300**	**$464,600**
Subtotal Structural	**$1,322,700**	**$133,100**	**$1,455,800**
LAND TREATMENT			
344 Grade Stabilization Structures	$155,200	$38,700	$193,900
Required and Interdependent 10,553 Acres (Crop, Grassland, Forest Land)	$114,600	$28,600	$143,200
Subtotal Land Treatment	**$269,800**	**$67,300**	**$337,100**
TOTAL	**$1,592,500**	**$200,400**	**$1,792,900**

[1] Price Base 1993, Discounted at 8% interest rate for 75 years

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TABLE 5

Estimated Average Annual Damage Reduction Benefits[1] (Dollars)

Item	Estimated Average Annual Damage		Damage Reduction Benefits	
	Without Project	With Project	Average Annual	% Reduction
Floodwater				
Crop and Pasture	$1,309,600	$651,300	$658,300	50
Other Agriculture	$169,000	$75,900	$93,100	55
Road and Bridge	$263,900	$45,800	$218,100	83
Subtotal	**$1,742,500**	**$773,000**	**$969,500**	**56**
Sediment				
Flood plain deposits	$627,800	$393,800	$234,000	37
Swamping	$120,800	$63,100	$57,700	48
Subtotal	**$748,600**	**$456,900**	**$291,700**	**39**
Erosion				
Gully	$1,476,100	$1,286,500	$189,600	13
Flood Plain Scour	$119,600	$72,800	$46,800	39
Subtotal	**$1,595,700**	**$1,359,300**	**$236,400**	**15**
Grand Total	**$4,086,800**	**$2,589,200**	**$1,497,600**	**37**

[1] 1994 Current Normalized Commodity Prices April 1994

TABLE 6
Comparison of NED Benefits and Costs
East Fork Grand River Watershed
(dollars) [1]

Evaluation Reach	Crop and Pasture	Other Ag.	Road and Bridge	Sediment	Swamping	Scour	On Site Gully	Recreation	Rural Water Management	Rural Fire Protection	Avg. Ann. Benefits Total	Avg. Ann. Costs Total	Net Benefits [2]	Benefit/ Cost
STRUCTURAL														
221 Single-Purpose	561,200,	77,300	155,100	208,800	50,700	45,500	38,100	55,300	0	31,400	1,223,400	991,200	232,200	1.23
GB3 Multiple-Purpose	47,800	6,300	5,200	12,700	3,600	400	200	304,000	103,500	400	484,100	354,800	129,300	1.36
F3 Multiple-Purpose	20,400	2,700	2,300	5,500	1,600	200	200	88,400	0	400	121,700	109,800	11,900	1.11
Subtotal	**629,400**	**86,300**	**162,600**	**227,000**	**55,900**	**46,100**	**38,500**	**447,700**	**103,500**	**32,200**	**1,829,200**	**1,455,800**	**373,400**	**1.26**
LAND TREATMENT														
344 Grade Stabilization Structures	28,800	6,800	55,500	7,000	1,800	700	151,100	0	0	0	251,700	193,900	57,800	1.30
Other Measures:														
10,500 acres	277,100										277,100	143,200	133,900	1.94
Subtotal	**305,900**	**6,800**	**55,500**	**7,000**	**1,800**	**700**	**151,100**	**0**	**0**	**0**	**528,800**	**337,100**	**191,700**	**1.57**
TOTAL	**935,300**	**93,100**	**218,100**	**234,000**	**57,700**	**46,800**	**189,600**	**447,700**	**103,500**	**32,200**	**2,358,000**	**1,792,900**	**565,100**	**1.32**

[1] Price base: 1993, discount rate 8 percent for 75 years, 1994 Current Normalized Commodity Prices. April 1994

[2] Total average annual equivalent benefits are $1,554,700; total average annual equivalent costs are $1,176,800; for an average annual equivalent benefit/cost ratio of 1:32:1.0, at 8 percent for 75 years.

[3] From TABLE 4

GLOSSARY

Adequate Protection: Land having an erosion rate equal to or less than the tolerable soil loss rate ("T").

Alluvium: A general term for all eroded material deposited or in transit by streams, including gravel, sand, silt, clay, and all variations and mixtures of these.

Alternative Conservation System: A conservation system for highly erodible land (HEL) that is documented in the Field Office Technical Guide. The system achieves a substantial reduction in existing soil loss rates, successfully meets the 1985 and 1990 Farm Bill Conservation Compliance requirements, but does not reduce erosion to the tolerable soil loss.

Application: The act of installing conservation practices and/or systems of practices in conformance with conservation planning decisions.

Average Annual Benefits: The difference between the without-project average annual damages and the with-project average annual damages plus fish and wildlife benefits, rural water management, and fire protection.

Average Annual Cost: The initial cost amortized to an annual cost plus the necessary operation, maintenance, and replacement cost.

Average Annual Equivalent (Annualized): Results of a procedure in which costs or benefits are discounted from the year they occur to the beginning of the period of analysis by converting them to present value equivalents. The present values are then amortized over the period of analysis.

Conservation Practice or Measure: A technique or management strategy (for which standards and specifications have been developed), used on land to control soil erosion, conserve water, protect plants, or generally improve soil, water, and plant resources.

Conservation Tillage System: Any tillage sequence that reduces loss of soil or water relative to conventional (bare soil) tillage. A form of seedbed preparation or weed control that retains protective amounts (minimum 30 percent cover) of residue mulch on the surface after planting. No-till farming is one form of conservation tillage.

Contour Farming: Farming sloping land in such a way that plowing, preparing, planting, and/or cultivating are done on the contour.

Conventional Tillage: The combined primary and secondary tillage operations traditionally performed in preparing a seedbed for a given crop grown in a given geographical area. Commonly involves using a moldboard plow as the primary tillage tool, leaving the soil surface bare, without crop or weed residue cover.

Cost-sharing: Monetary assistance from a federal, state, or local agency to a land user for installation of soil and water conservation measures.

Depreciated Areas: Areas that have suffered a loss of value and decreased monetary returns because of soil erosion, or because they have become inaccessible due to active gullies.

Dissolved Oxygen: The amount of gaseous oxygen dissolved in a liquid - usually water. Most aquatic life is dependent on dissolved oxygen. Aquatic plants can benefit a lake by producing dissolved oxygen, however, excessive plant growth can deplete oxygen through decomposition of dead plants.

Eligible Practice: A practice for which cost-sharing or another incentive payment is available to the landowner.

Ephemeral Gully: Concentrated flow erosion occurring on cropland. The soil erosion pattern can be eliminated by tillage operations but returns in approximately the same location following a runoff event.

Erosion (rill): An erosion process in which numerous small channels are formed by runoff water; occurs mainly on recently cultivated soil and is intermediate between sheet and ephemeral gully erosion.

Erosion (sheet): The removal of a fairly uniform layer of soil from the land surface by runoff water. There is no development of conspicuous water channels.

Enduring Practices: Those long-term practices that, when properly installed and maintained, remain on the land without reconstruction or reestablishment during the normal life span of the practice. Enduring practices are self sustaining and may be supplemented by management practices.

Evaluation Units: Areas with similar characteristics which require similar systems of practices to achieve various levels of resource protection.

Extirpated: Refers to a species that once occurred in the area of reference, but is not now known to exist within the same area.

FACTA: The Food, Agriculture, Conservation, and Trade Act of 1990. Referenced to the conservation title of the 1990 Farm Bill.

Flood Plain: Level land adjacent to a channel subject to overflow flooding.

Floodwater Damage: The economic loss caused by floods, including damage by inundation, erosion, scour, or sediment deposition on flood plains. Floodwater damages result from physical damages or losses, emergency costs, and business or financial losses. Evaluation may be based on the cost of replacing, repairing, or rehabilitating.

Floodwater Damage Reduction Measures: Any land treatment, structural, or nonstructural measures that decrease the damage from floodwater.

Frequency: An expression or measure of how often a hydrologic event, such as precipitation or a flood, of a given size or magnitude should, on an average, be equaled or exceeded.
Example:
10 Yr. - A hydrologic event having a 10 percent chance of occurring in any given year.
100 Yr. - A hydrologic event have a 1 percent chance of occurring in any given year.

FSA: The Food and Security Act of 1985. Reference to the conservation title of the 1985 Farm Bill.

Grade Stabilization Structure: A structure which stabilizes the grade of a gully or other watercourse, thereby preventing further head-cutting or lowering of the channel grade.

Grassed Waterway or Outlet: A natural or constructed waterway shaped, graded, and established in suitable erosion-resistant vegetation used to safely dispose of surface water.

Gross (total) Erosion: Erosion within a drainage area resulting from all sources (sheet, rill, ephemeral and permanent gully, streambank, scour, etc.).

Habitat Suitability Index (HSI): A number representing the comparison between present or projected habitat quality and the optimum conditions possible in the area where a specific animal lives.

Highly Erodible Land (HEL): Fields or management units where one-third or more of the area has an erosion index (EI) equal to or greater than eight. Using the USLE values for rainfall (R), soil erodibility (K), slope length and steepness (LS), and tolerable soil loss level (T) the erosion index is determined by the formula: EI = RKLS / T. (Reference to FSA).

Incremental Analysis: A systematic approach to formulating cost-effective resource protection. The technique involves layering and comparing protection levels of elements that address each of the watershed project purposes.

Major Land Resource Area (MLRA): An area of land similar in its relationships to agriculture with emphasis on combination and/or intensities of problems in soil and water conservation; ordinarily larger than a land resource unit and smaller than a land resource region.

Land Treatment Measure: A practice necessary to improve watershed protection.

Landrights: Any interest acquired or permission obtained to use land, buildings, structures, or other improvements; includes the acquisition of land by fee title or certain designated rights to the use of land by perpetual easement; also includes the costs of modifying utilities, roads, and other improvements.

Limited Resource Farmers: Farmers who, when compared to other farmers and farm operations in a given geographic area - such as a state, county, or project area - have distinct disadvantages in obtaining U.S. Department of Agriculture (USDA) program assistance.

Littoral Zone: Extends from the shoreward boundary of the aquatic system to a depth of 2 meters (6.6 feet) below low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than 2 meters.

Long Term Productivity: Maintaining the soil resource base for sustained future use.

Multiple-purpose Dams: Dams designed to serve more than one purpose. They may include storage for floodwater, irrigation, recreation, fish and wildlife development, rural water, etc.

NED Plan (National Economic Development Plan): A plan that reasonably maximizes net national economic development benefits.

Ongoing Program: Existing federal, state, and local programs other than P.L.-566 which provide technical assistance, cost-sharing, or incentives for the installation of land treatment practices.

Other Agricultural Damage: Damage to agricultural fences, machinery, equipment, and agricultural buildings caused by floodwater and debris.

Other Land: Rural land not classified as cropland, pasture, range, or forest land. Includes roads, small communities, bodies of water, etc.

Palustrine: All non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

Permanent Gully Erosion: The erosion process whereby water concentrates in narrow channels and cuts into the soil to depths ranging from 1 to 2 feet to as much as 75 to 100 feet. Cannot be obliterated by ordinary tillage.

Poletimber Stands: Forest stands dominated by trees 5.0 to 10.9 inches in diameter.

Prime Farmland: Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is available for these uses (the land could be cropland, grassland, rangeland, forest land, or other land but not urban built-up land or water). It has the soil quality,

growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed, including water management, according to acceptable farming methods. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content and few or no rocks. They are permeable to water and air.

Riparian Corridor: Strips of land, often narrow, that border creeks, rivers, or other laterally flowing waters.

Riverine: All wetlands and deep water habitats contained within a channel with one exception: wetland dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens.

Rotations: Systems of planned crop sequence on the same land. They are usually designed to reduce problems associated with soil erosion, insects, disease, weeds, and economics.

Saturated Water Regime: The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

Sawtimber Stands: Forest stands dominated by trees equal to or greater than 11.0 inches in diameter.

Scour Damage: Erosion of the flood plain surface by flowing floodwaters. Results in the formation of channels or depressional areas which suffer reduced crop yields or other monetary agricultural losses.

Sediment Yield: That portion of the gross (total) erosion that is actually delivered to a specified location (i.e., watershed outlet, stream channel, etc.). Gross erosion less the sediment that is deposited prior to reaching the point of concern.

Seedling/Sapling Stands: Forest stands dominated by trees less than 5.0 inches in diameter.

SHAD (Stream Habitat Assessment Device): A model used to assign a value to a stream reach. This value is used to categorize stream habitat as good, needs improvement, or degraded.

Single-purpose Floodwater Retarding Dams: Those dams whose sole purpose is to retard floodwater and release it in a controlled flow. These dams include storage only for floodwater and not for other purposes such as irrigation, recreation, fish and wildlife development, rural water, etc.

Site Index: An index of forest site productivity, expressed as the average height of dominant trees at age 50 years.

Structural Measures: Project works of improvement such as dams, levees, diversions, channels, or other constructed devices, installed and maintained for flood prevention, drainage, irrigation, recreation, fish and wildlife, municipal and industrial water supply, water quality management, or other agricultural water management purposes. Structural measures ordinarily require group action for their installation, always require group benefits, are not usually included in individual farm or ranch conservation plans, and are installed, operated, and maintained by a project sponsor.

Swamping Damages: Low, depressional areas formed on the flood plain, which tend to pond water or remain wet for extended periods of time, caused by impairment of natural drainage by sediment deposits. Results in monetary agricultural losses by reducing crop yields or restricting access of farm equipment.

Technical Assistance: Services provided to individuals, groups, and units of government on opportunities, potentials, and problems having to do with soil and water resources. May include program formulation, planning, design, application, and maintenance.

Tolerable Soil Loss: Expressed as the erosion factor "T" in the universal soil loss equation; an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without reducing crop productivity; rate expressed in tons per acre per year; an individual value is assigned to each soil.

Total Dissolved Solids (TDS): The total amount of dissolved material, organic and inorganic, contained in water and wastes. Excessive dissolved solids make water unpalatable for drinking and unsuitable for industrial use.

Underground Outlet: A conduit installed beneath the surface of the ground to collect surface water and convey it to a suitable outlet.

Voided Areas: Those portions of the land which have been eroded by gullies or gully systems. The productive capacity of these "voided areas" is essentially destroyed and restoration or productivity is, for the most part, not economically feasible.

Watershed: The land area above a point on a drainageway with surface drainage to that point. Synonymous with drainage area.

Wetland Types: A classification system, based on Cowardin's classification, developed by the U.S. Fish and Wildlife Service that groups low, wet areas by similar soil, water conditions, and plant types.

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LIST OF PREPARERS

NAME	TITLE	DEGREE	CAREER
Steve F. Baima	Water Resources Staff Leader	MS - Biology - 1971	23 years
Ross B. Braun, CPESC	Water Resources Planning Specialist	BS - Soil Science - 1982	11 years
Rob A. Cheshier, CPG	Geologist	MS - Geology - 1982	11 years
Jerry P. Edwards, P.E.	Hydrologist	BS - Agricultural Engineering - 1959	34 years
John C. Hamilton	Biologist	MS - Biology - 1987	4 years
James L. Hosack	Agricultural Economist	BS - Agricultural Economics - 1972	22 years
Rita M. Mueller	Agricultural Economist	BS - Agricultural Economics - 1986	10 years
Louis L. Studer	Planning Engineer	BS - Agricultural Engineering - 1959	30 years

SCS STAFF PROVIDING SUPPORT

IOWA

Jerry Collins, Soil Conservationist
Paul G. Goldsmith, District Conservationist
Mark D. Lindflott, Biologist
Dennis R. Loreth, Area Conservationist
James M. Reel, Water Resources Planning Staff Leader
Wayde A. Ross, District Conservationist
Roger Schnorr, Planning Engineer
Southern Iowa RC&D (Resource Conservation & Development)

MISSOURI

Clifford J. Baumer, Environmental Engineer
Hubert D. Cook, Civil Engineering Technician
Charles L. Eddy, Area Conservationist
Gary Fak, RC&D Coordinator, Green Hills RC&D
Joleen M. Finders, Resource Conservationist
Ronald A. Harris, Area Conservationist
Robert L. Harryman, District Conservationist
David Johnson, District Conservationist
Francis F. Miller, Hydraulic Engineer
Terri L. Neu, Water Resources Secretary
Don Williams, Geologist

Other federal, state, and local agencies assisting in the development of the project area:

SOIL AND WATER CONSERVATION DISTRICTS

Harrison County, Missouri
Ringgold County, Iowa
Union County, Iowa
Worth County, Missouri

MISSOURI DEPARTMENT OF CONSERVATION

Richard Wehnes - Stream Coordination Supervisor
David Urich - Wildlife Coordination Specialist

U.S. DEPARTMENT OF INTERIOR - FISH AND WILDLIFE SERVICE

MISSOURI - Jim Hazelman, Biologist
IOWA - Joe Slater, Biologist

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE

Robert A. McQuilkin - Forester
Frank Hershey - Watershed Specialist/Forester

IOWA DEPARTMENT OF NATURAL RESOURCES

Randy Goerndt - Forester
Jeff Joens - Wildlife Biologist
Melvin Moe - Wildlife Biologist
Michael McGee - Fisheries Biologist

CRESTON, IOWA VOLUNTEER FIRE DEPARTMENT

Roger Nurenburg - Assistant Fire Chief, Creston, Iowa

REVIEW PROCESS

The draft Watershed Plan and Environmental Impact Statement was reviewed and concurred on by SCS state staff specialists having responsibility for engineering, hydrology, economics, soils, agronomy, range conservation, biology, forestry and geology. This review was followed by a review of the document and supporting data by USDA-Soil Conservation Service, Midwest National Technical Center. A similar review was provided by Forest Service personnel.

INDEX

APPENDIX A -

LETTERS AND ORAL COMMENTS RECEIVED ON DRAFT WATERSHED PLAN-EIS

APPENDIX B -

BREACH INUNDATION MAPS

Δ Dam F-3

Δ Dam F-4

Δ Dam GB-3

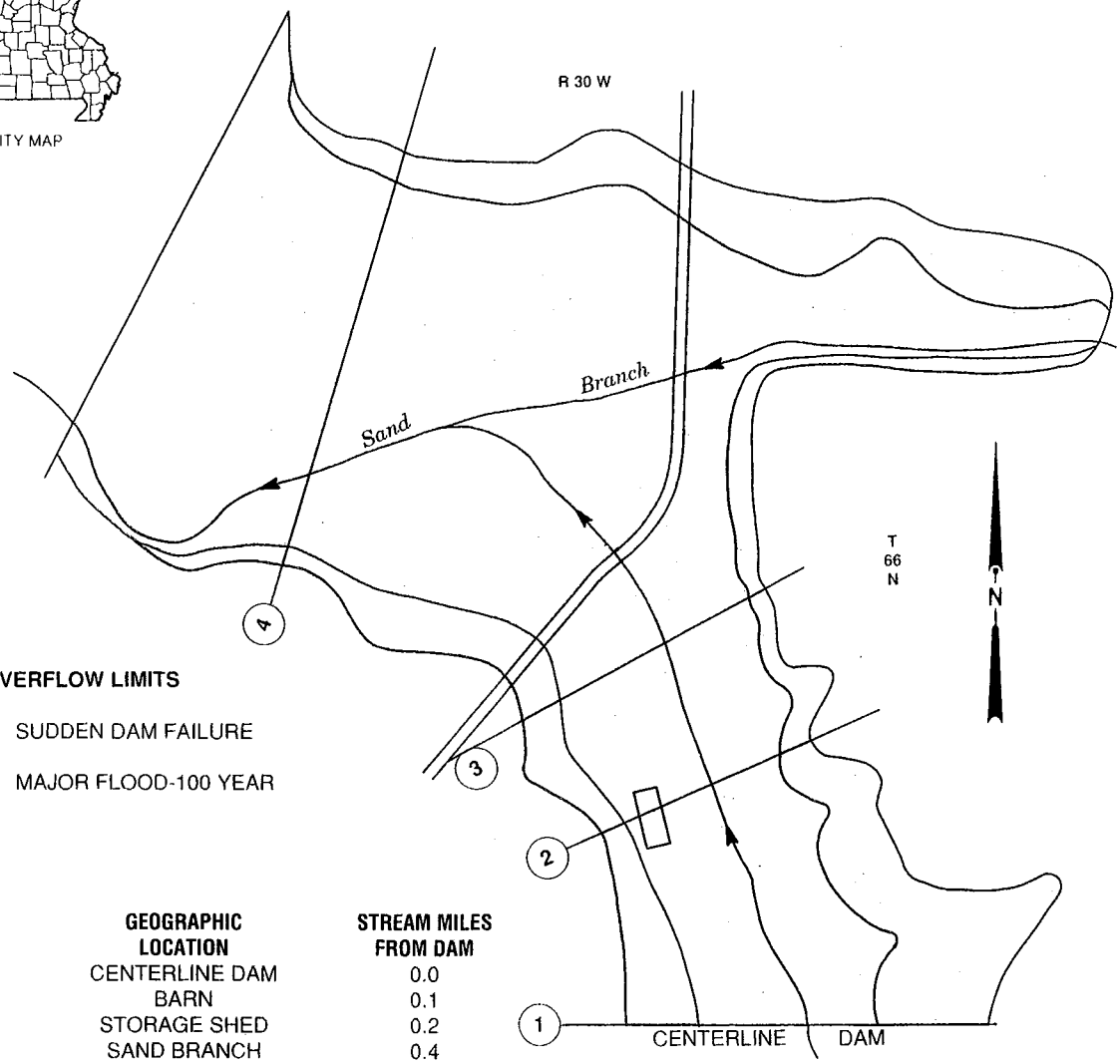
RECREATIONAL DEVELOPMENT MAPS

Fish and Wildlife Development

Δ Dam F-3

Δ Dam GB-3

VICINITY MAP



OVERFLOW LIMITS

SUDDEN DAM FAILURE

MAJOR FLOOD-100 YEAR

SECTION NUMBER	GEOGRAPHIC LOCATION	STREAM MILES FROM DAM
1	CENTERLINE DAM	0.0
2	BARN	0.1
3	STORAGE SHED	0.2
4	SAND BRANCH FLOOD PLAIN	0.4

BREACH INUNDATION MAP:
THE INUNDATION AREAS SHOWN ON THIS MAP REFLECT EXTREMELY RARE EVENTS. PUBLICATION ON THIS MAP IS NOT INTENDED TO REFLECT IN ANY WAY UPON THE INTEGRITY OF THE DAM.

BREACH INUNDATION MAP
SITE F-3
EAST FORK OF GRAND RIVER WATERSHED

WORTH COUNTY, MISSOURI

0 400 800 1600

FEET

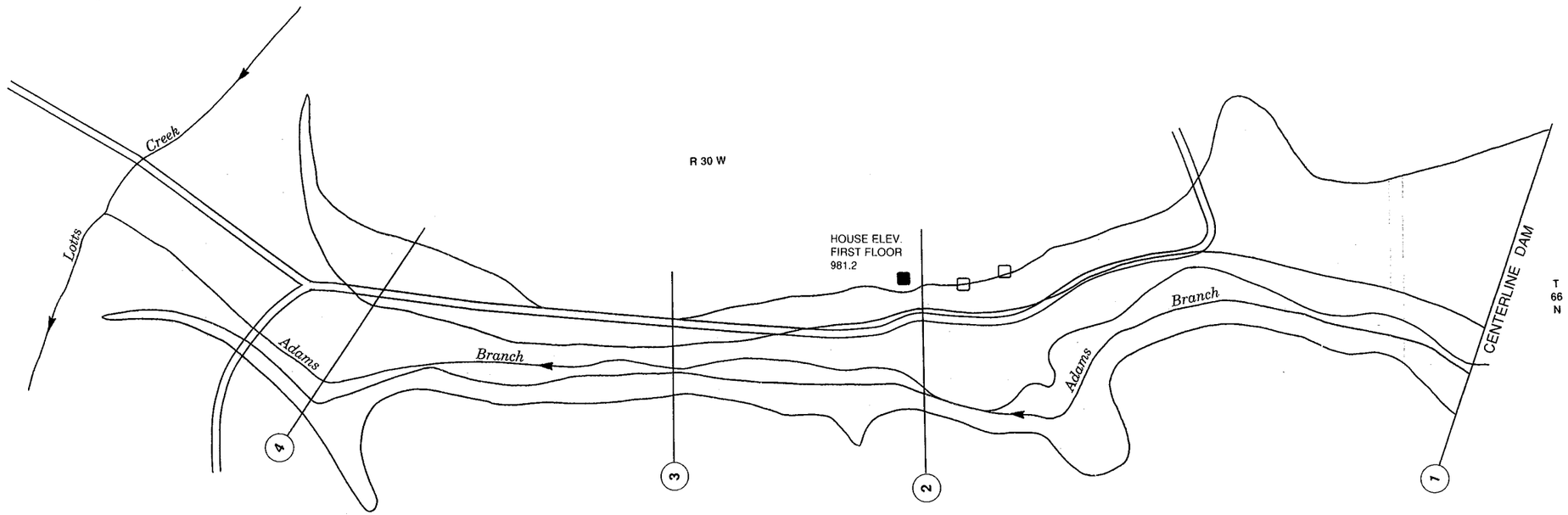
SOURCE:
1:24,000 USGS QUADRANGLES AND INFORMATION FROM SCS FIELD PERSONNEL.
TRANSVERSE MERCATOR PROJECTION.

FEBRUARY 1993 1007652

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX, 1993

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



N

SECTION NUMBER	GEOGRAPHIC LOCATION	STREAM MILES FROM DAM
1	CENTERLINE DAM	0.0
2	HOUSE	0.3
3	-----	0.5
4	COUNTY ROAD	0.7

BREACH INUNDATION MAP:
THE INUNDATION AREAS SHOWN ON THIS MAP REFLECT EXTREMELY RARE EVENTS. PUBLICATION ON THIS MAP IS NOT INTENDED TO REFLECT IN ANY WAY UPON THE INTEGRITY OF THE DAM.

VICINITY MAP

OVERFLOW LIMITS

SUDDEN DAM FAILURE

MAJOR FLOOD-100 YEAR

NOTE:
MAXIMUM ELEVATION OF WATER SURFACE AT SECTION 2 IS 979.0

BREACH INUNDATION MAP
SITE F-4
EAST FORK GRAND RIVER WATERSHED
WORTH COUNTY, MISSOURI

0 400 800 1600
FEET

SOURCE:
1:24,000 USGS QUADRANGLES AND INFORMATION FROM SCS FIELD PERSONNEL.
TRANSVERSE MERCATOR PROJECTION.

FEBRUARY 1993 1007626

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX, 1993

U.S. DEPARTMENT OF AGRICULTURE

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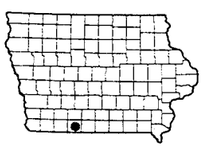


VICINITY MAP

TRIBSTOR 2

BR 1076

R 29 W

CENTERLINE DAM

1

2

3

4

5

6

Gooseberry

Creek

BR 1074

BR 1067

TRIBSTOR 1

Grand

River

Fork

East

T 69 N

T 68 N

OLD RAILROAD GRADE

STATE HIGHWAY 2

BR 1066

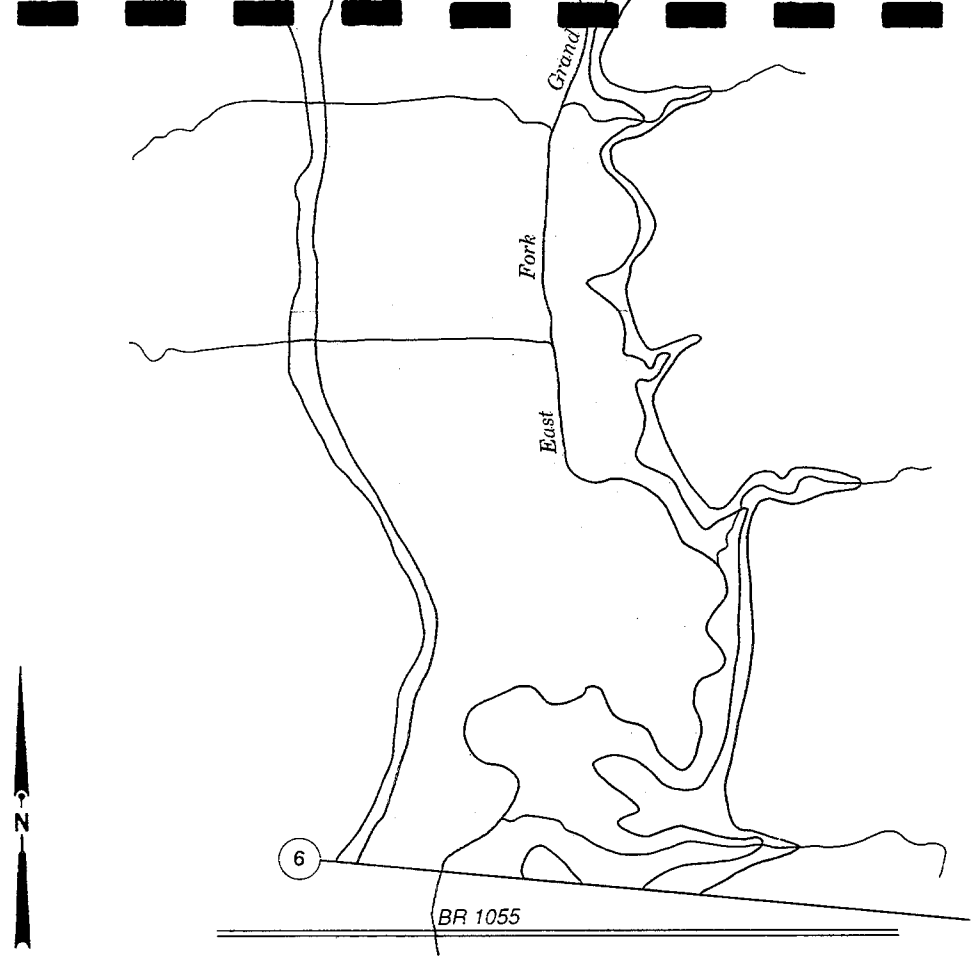
SECTION NUMBER	GEOGRAPHIC LOCATION	STREAM MILES FROM DAM
1	CENTERLINE DAM	0.0
2	-----	0.1
3	COUNTY ROAD	0.3
4	-----	0.7
5	STATE HIGHWAY 2	1.3
6	COUNTY ROAD	2.3

OVERFLOW LIMITS

SUDDEN DAM FAILURE

MAJOR FLOOD-100 YEAR

BREACH INUNDATION MAP



OVERFLOW LIMITS

SUDDEN DAM FAILURE

MAJOR FLOOD-100 YEAR

BREACH INUNDATION MAP:
THE INUNDATION AREAS SHOWN ON THIS MAP REFLECT EXTREMELY RARE EVENTS. PUBLICATION ON THIS MAP IS NOT INTENDED TO REFLECT IN ANY WAY UPON THE INTEGRITY OF THE DAM.

BREACH INUNDATION MAP
SITE GB-3
EAST FORK GRAND RIVER WATERSHED

RINGGOLD COUNTY, IOWA

0 1000 2000 3000

FEET

SOURCE:
1:24,000 USGS QUADRANGLES AND
INFORMATION FROM SCS FIELD PERSONNEL.
LAMBERT CONFORMAL CONIC PROJECTION.

FEBRUARY 1993 1007625

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX, 1993

U.S. DEPARTMENT OF AGRICULTURE

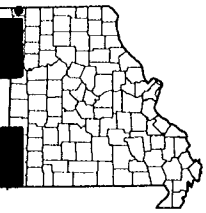
VICINITY MAP

LEGEND

- P PARKING AREA
- PICNIC AREA
- PICNIC SHELTERS
- BOAT RAMP
- TOILET
- PROPOSED TAKE LINE
- 25 CENTER SECTION

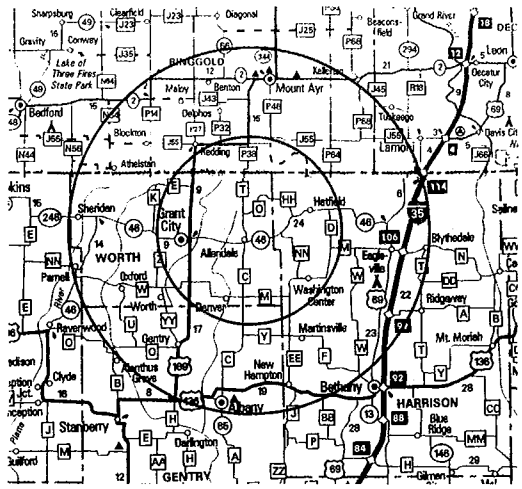
SOURCE:
MAP PREPARED BY SCS FIELD PERSONNEL.

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX 1994



VICINITY MAP

POPULATION CENTERS MAP



LEGEND

P PARKING AREA

PICNIC AREA

PICNIC SHELTERS

BOAT RAMP

TOILET

PROPOSED TAKE LINE

25 CENTER SECTION

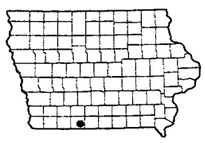
DAM F-3
FISH AND WILDLIFE DEVELOPMENT
EAST FORK GRAND RIVER WATERSHED

WORTH COUNTY
MISSOURI

0 615 1230 1845
FEET

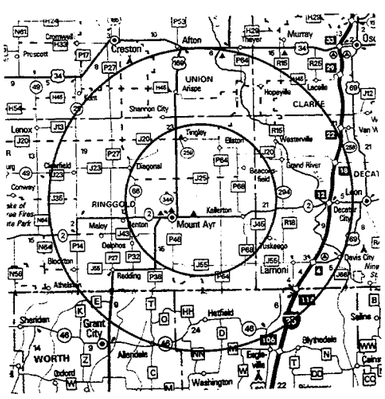
U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



VICINITY MAP

POPULATION CENTERS MAP



LEGEND

- P PARKING LOT
- C CAMPING
- BOAT RAMPS
- PICNIC SHELTERS
- REST ROOMS
- FISHING JETTIES
- PIPELINE
- PROPOSED TAKE LINE
- 34 CENTER SECTION

15

22

27

COUNTY ROAD

COUNTY ROAD

COUNTY ROAD

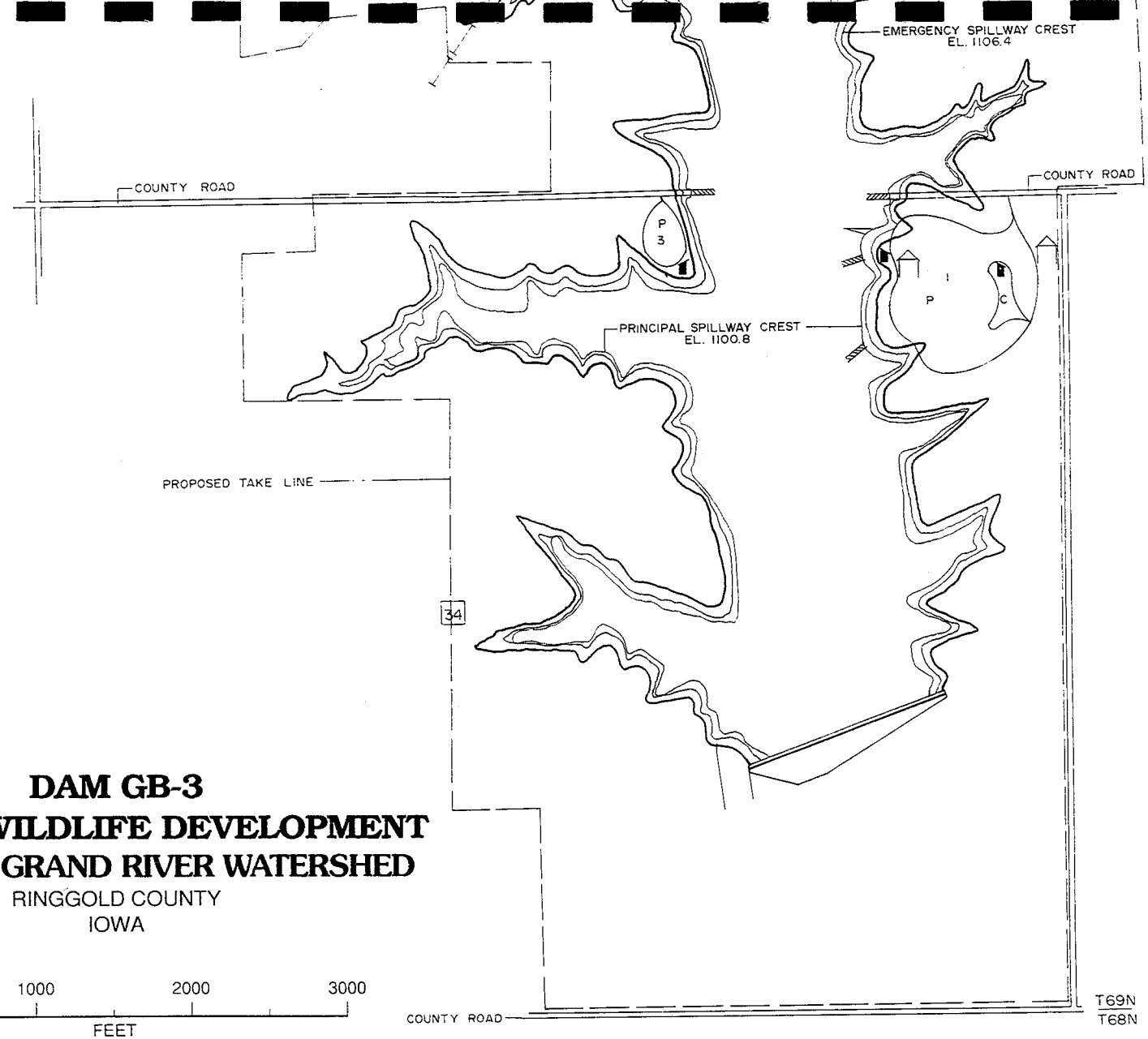
COUNTY ROAD

PROPOSED TAKE LINE

P 2

EMERGENCY SPILLWAY CREST EL. 1106.4

N



DAM GB-3
FISH AND WILDLIFE DEVELOPMENT
EAST FORK GRAND RIVER WATERSHED

RINGGOLD COUNTY
IOWA

0 1000 2000 3000
FEET

SOURCE:
MAP PREPARED BY SCS FIELD PERSONNEL.

FEBRUARY 1993 1007628

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX, 1993

APPENDIX C -

INVESTIGATION AND ANALYSES

INVESTIGATION AND ANALYSES

The purpose of this section is to present information that supports the formulation, evaluation, and conclusions of the watershed plan. Items of a routine nature are not included, however citations are included throughout the Watershed Plan-Environmental Impact Statement text for appropriate manuals, handbooks, research, and other references. Supporting data developed for this study are on file at the Soil Conservation Service state office in Columbia, Missouri. Additional support and associated information is included in "The Land and Water Resources of the Northern Missouri River Tributaries Basin - Iowa and Missouri," published in April, 1982 by the United States Department of Agriculture, Economic Research Service, Forest Service, and Soil Conservation Service in cooperation with the State of Iowa, and the State of Missouri.

HYDRAULICS AND HYDROLOGY

Channel and Valley Cross Sections

Preliminary locations were identified by examining aerial photographs and USGS 7.5 minute quadrangles. Final locations were determined after making field examinations of hydraulic characteristics and considering the needs of the economist and geologist.

Field Surveys were made by SCS survey crews. A total of 113 channel and valley cross sections and 65 bridges were surveyed. These cross sections were used for hydraulic determinations, economic analysis, and land damage studies.

Hydraulics

Water surface profiles were developed using SCS Technical Release 61 (TR-61), WSP-2 step backwater computer program. This program develops elevation-discharge and elevation-area flooded relationships used for hydrologic and economic analysis.

Manning's roughness coefficient 'n' was determined by field examination and the SCS National Engineering Handbook, Section 5, Supplement B, in conjunction with the publication "Guide for Selecting Roughness Coefficient 'n' Values for Channels". Flood plain 'n' values were based on the land use in the flood plain. Factors affecting hydraulic characteristics of bridges were obtained from TR-61 and the publications referenced in it.

Hydrology

The hydrologic condition was determined by using soil maps and soil hydrologic groups. A reconnaissance survey was made to obtain additional data as to the conditions of hydrologic cover.

The future hydrologic condition of the watershed was based on information furnished by district conservationists concerning land use changes expected during the installation period. Runoff curve numbers were computed from the soil cover complex data and used with Figure 10.1 in the SCS National Engineering Handbook, Section 4-Hydrology, in order to determine the depth of runoff from single storm events.

Weather Bureau Technical Paper No. 40 was used to determine the amount and frequency of rainfall for storms of 24-hour durations. These rainfall amounts were for frequencies ranging from 0.30- to 100-years.

Project Formulation-Hydrology (TR-20), version PC 9/83 (0.2) was used to estimate peak discharges for an array of frequencies at each cross-section location. Flood plain width and area flooded were adjusted against the 100-year flood. Regional stream gauge data was used to compare and check TR-20 results. These results compared favorably.

Times of concentration for each dam and intervening drainage area was computed using procedures in Chapter 15 of the SCS National Engineering Handbook, Section 4.

ENGINEERING DESIGN AND COST ESTIMATES

Aerial photographs and USGS topographic maps were studied to select potential floodwater retarding dam sites. Other information and criteria used in selection of sites included drainage area limitations, wildlife habitat, and proximity to public roads.

Three hundred and eighty-one potential dam sites were identified in East Fork of Grand River Watershed project area. Field investigations of 45 (12 percent) randomly selected study sites were made with members of the interdisciplinary team to evaluate the physical conditions, abutment conditions, habitat, cultural resource considerations, and land cover complexes. The interdisciplinary team consisted of a biologist, geologist, water resources planning specialist, planning engineer, and representatives from the Missouri Department of Conservation, Iowa Department of Natural Resources, and the U.S. Fish and Wildlife Service. This group traveled as a team in the field to evaluate each of the randomly selected study sites.

The basis and criteria for planning and design of the structural measures are contained in the following documents, manuals, and guides:

National Watershed Manual
National Engineering Manual
SCS Engineering Field Manual
Principles and Guidelines
Technical Release No. 19
Technical Release No. 20
Technical Release No. 48
Technical Release No. 52
Technical Release No. 60
Technical Release No. 66
National Engineering Handbooks

The small floodwater retarding dams will be designed in accordance with Floodwater Retarding Dams Standard (402) and shall meet or exceed the criteria as called for in Pond Standard (378)

The major problems identified by the sponsors of the East Fork of Grand River Watershed project are water supply shortage, damages due to flooding, erosion and loss of topsoil, and shortage of fish and wildlife developments.

Early planning activities included field investigation and observation trips by the interdisciplinary team to identify and evaluate the natural resources of concern in their present conditions.

Formulation for flood prevention resulted in selection of two multiple-purpose dams, one large (TR-60 criteria) single-purpose floodwater retarding dam and 220 small floodwater retarding dams (378 criteria). An earlier attempt at formulating a plan to reduce flood damages was undertaken in 1972. This attempt resulted in an alternative with large dams (TR-60 criteria), which were economically, physically, and socially unacceptable. An alternative with all large dams was not seriously considered in this most recent formulation.

Formulation of the multiple-purpose dams included flood prevention, rural water supply, and recreation in dam GB-3 for the City of Mount Ayr, the Southern Iowa Rural Water Association (SIRWA), and Ringgold County, Iowa. Flood prevention and recreation purposes are included in dam F-3 for Worth County, Missouri.

Allocation of installation costs for the multiple-purpose dams to the specific purposes was accomplished by using the Separable Cost-Remaining Benefits (SCRB) procedure. A worksheet was developed for this allocation procedure using the Lotus 123 software. The worksheet was expanded to incorporate development and preparation of Table 2A for the plan. A copy of this entire process is included on a 5.25" disk found in the front part of Volume 1.

Planning designs for all dams are based on data taken from USGS topographic maps. There are no aerial photography based stereoplotted topographic maps available for the watershed. The maps were cross-checked with field surveyed cross-sections of which the elevations verified the maps.

Dam GB-3

Planning design for dam GB-3 is prepared with all topographic data taken from USGS topographic maps. A field survey of the centerline profile was taken and checked with the profile prepared from the USGS topographic maps. The profiles compared favorably. Profiles were also taken of the roads crossing the valley. These also checked favorably. The design work is specifically developed from maps created by enlarging the USGS maps to a scale ratio of 1:4800, 1 inch = 400 feet. These maps plus all other data, computations, mylar base maps, etc. will be transferred to Iowa upon completion of the watershed plan. Enlargement of the USGS maps was accomplished photographically by an engineering-photo laboratory in St. Louis, Missouri.

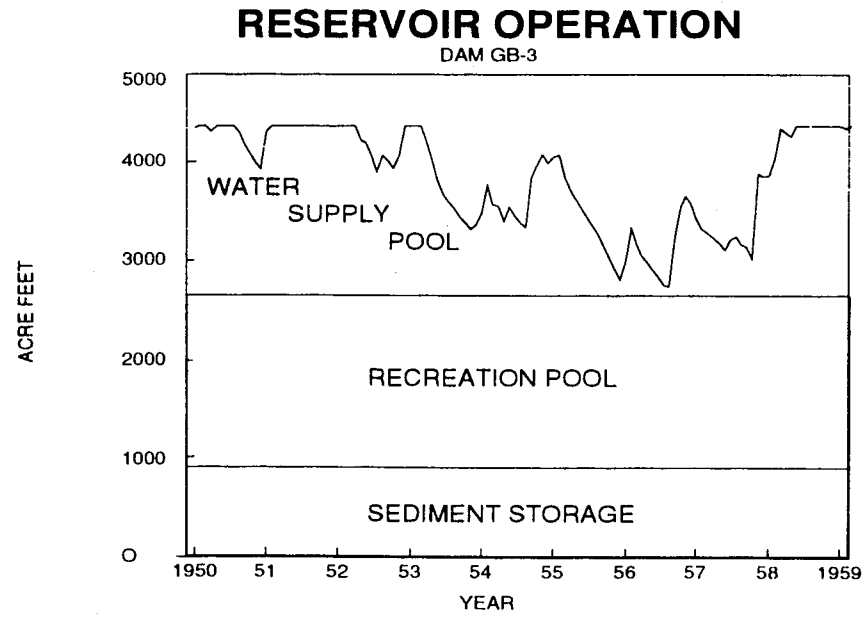
Dam GB-3, as it is planned, will require the closing of two public roads, relocation of three homes (farmsteads), and treatment of approximately 5,000 feet of petroleum pipeline for inundation. Names, addresses, and telephone numbers of persons to contact about the pipeline are included in the correspondence section of the documentation, Volume III. The correspondence includes an estimate of the cost to prepare the pipeline for inundation under the lake. The estimate was prepared by the Williams Pipeline Company.

Geologic data and foundation treatment recommendations for this dam are not complete as no geologic investigation (foundation investigation-core drilling) was conducted at this site. Installation costs do include costs for a slurry trench cut-off. This will control seepage through the foundation.

Total storage in dam GB-3 at the emergency spillway crest is 6,650 acre-feet. This storage is made up of 850 acre-feet for submerged sediment; 150 acre-feet for aerated sediment; 1,750 acre-feet for agricultural water management (rural water supply); 1,825 acre-feet for recreation pool; and 2,075 acre-feet for floodwater detention. Total storage in reservoir at top of dam is 9,170 acre-feet.

The reservoir includes 4,425 acre-feet of storage at the principal spillway crest, of which 1,750 acre-feet is for agricultural water management-rural water supply. This amount was determined by analysis of the present and projected demand. The watershed yield and reservoir operation was analyzed using TR-19, Reservoir Operation Study program. Figure 6 is a graphical presentation of the reservoir operation performance. The reservoir performance was evaluated against the drought period of 1950 through 1959, considered to be the most severe drought period in recent times. According to the study, the reservoir yield ranges from 467,000 gallons per day in March to approximately 700,000 gallons per day in July. This fluctuation in yield is dictated by the variable demand rates for each month used in the input data. A graph showing the operation of the reservoir over a ten-year period from 1950 through 1959 is included in Volume III, under the section of Water Supply. The input information for the reservoir operation study is included on a 5.25" disk in Volume I.

FIGURE 6



Special emphasis was placed on identifying potential sources of nutrients and pesticides in the watershed of structure GB-3. Details of this investigation are found in this Appendix under the Water Quality section.

The water supply need and demand was determined with input from representatives of the City of Mount Ayr and the Southern Iowa Rural Water Association.

The fish, wildlife and recreation development component was determined primarily by representatives from Iowa Department of Natural Resources, Ringgold County Conservation Board, and Soil Conservation Service. The Iowa DNR lake classification was used to evaluate several potential lake sites. The primary elements used to evaluate the lake sites were surface area, watershed area to pool surface area ratio, maximum depth, mean depth, and the mean basin slope. The additional land around the lake designated to be acquired for wildlife habitat was determined by representatives of the Iowa Department of Natural Resources and Ringgold County Conservation Board. The recreational facilities are planned to include boat ramps, access points, and a campground with flush-type toilets. A lagoon type system is planned for waste-water treatment. It should be noted that consideration was given to pumping the waste-water (sewage) to the Mount Ayr treatment facilities. This treatment process continues to be a possibility. Fish and wildlife development includes waterfowl islands, fish-attracting elements, sediment basins around the perimeter of the reservoir plus one at the upper end of the pool, and other measures. The sediment basin at the upper end of the lake is located within the lake or reservoir. The basin will be created by constructing a dike across the upper end of the reservoir with a notch designed in the dike to allow normal flows to pass through the basin. The flowline crest elevation of the notch in the dike will be the same elevation as that of the principal spillway crest and crest flowline of the dike notch. The width of the notch should be approximately 125% of the distance between the channel banks where the lake is contained within the banks. The dike should be situated in the reservoir such that a water area with a minimum surface area of five to six acres is created upstream of the dike. This sediment basin will serve as a sediment trap where the velocity of the incoming water is decreased to allow the sediment to settle. Table 2B in the watershed plan includes a complete list of the planned elements. See the recreational development map in the watershed plan.

The principal spillway is planned to be reinforced concrete pipe with a reinforced concrete riser and a vegetated earth emergency spillway. The emergency spillway is located on the right abutment.

Dam F-3

Dam F-3, located east-northeast of Allendale, Missouri, is planned as a multiple-purpose dam with flood prevention and recreation. The dam and reservoir do not effect any roads or utility lines. A cattle shed does exist about 500 feet downstream of the centerline. A low-use county road is located approximately 3,000 feet downstream of the dam. No other improvements exist below the dam. The dam is designed using class "b" hydrology. The site has a class "a" hazard classification.

The dam is planned as a relative homogeneous compacted earthfill. Foundation drainage and seepage will be controlled with an embankment trench drain and slurry-mix cut-off trench.

The recreation access point and facilities are located on the left side of the lake and approximately 1,500 feet upstream of the dam. The basic facilities will consist of an access road, parking lot, a boat ramp, and toilets. See the recreational development map in the watershed plan.

Hydrologic and Hydraulic design was completed using Technical Release Number 48, Structure Site Analysis Computer Program (DAMS2). Provisions were made for a 100-year sediment volume (1.5 watershed inches) for structures F-3, F-4, and GB-3. Sediment storage volume of two watershed inches was provided for in the small dams. All dams will be designed to include a vegetated emergency spillway.

For wave erosion protection, 10-foot wide berms will be constructed at or near the crest elevation of all dams designed with SCS 378 criteria. Rock riprap will be used on the face of dams F-3 and GB-3 to prevent wave erosion.

Sixteen dams were selected to represent the range of drainage areas (100-340 acres) for the 220 small floodwater retarding dams.

The dam sites were assessed for habitat destruction in the emergency spillway and pool areas. Where possible, the dam location and sediment drawdown facilities will be utilized to minimize the habitat damage.

The earth fill and pool areas will be located so as not to disturb any known archaeological sites.

The geologic boring and surficial investigation indicated that good fill materials are available for each dam. The abutments were found to be sound glacial till with sporadic lenses of sand. The investigation of foundation conditions indicated a positive-cutoff core trench will be needed on all sites.

Preliminary breach inundation studies indicate hazard classification "a" for all involved sites. Prior to final design, a geologic investigation will be made for each structure.

Installation Costs

Actual contract bids from P.L.-566 construction contracts for similar work during the period 1983 to 1989, were used as the basis for construction costs. Bid items included site preparation, excavation, principal spillways, earthfill, fencing, seeding, and mulching.

Construction costs for the small dams were computed using specific drainage area ranges (100-150, 150-200, 200-250, 250-300, and 300-400 acres). Forty-five representative dams were designed using stage-storage-area data developed from USGS topographic maps. These sites represented all the drainage area ranges and different topography in the watershed.

Unit costs for the multiple-purpose dams and large floodwater retarding dam were also determined from recent construction contracts. These unit costs were used to determine the construction cost. Other costs were computed similar to the small dams. Engineering and Project Administration costs are based on percentages of construction costs. They were estimated from records of the time and personnel used to perform the engineering and project administration functions for similar work performed under P.L.-566 construction contracts.

Operation and Maintenance (O&M) costs were estimated by first analyzing the functions and activities necessary to maintain a good vegetative cover for the dams and spillways, keep them free of undesirable woody-growth and debris, and maintain the appurtenances in proper working condition. Consideration was given for repair of anticipated storm damages. Next, an estimate was made of the time, equipment, and materials which is needed to carry out the O&M program. Normally, the O&M cost is determined as 0.4 percent of the construction. The O&M cost for smaller dams is approximately one percent of the construction cost. It is anticipated the O&M costs for the smaller dams will be somewhat greater than for the larger dams. The annual O&M cost in the plan is $380 per dam. Replacement costs were estimated by defining and costing the tasks necessary to drain a structure, remove and replace the pipe, and re-seed the disturbed areas. Since this operation would be a high risk operation for a contractor, the estimated cost was doubled. The average annual cost of replacement for each structure was computed as follows:

Cost		Sinking Fund Factor		Amortization
37 Years Hence $10,000 each	X	37 Years 0.00492	=	$50.00

The $50 represents the annual deposit to a sinking fund over a period of 37 years to cover the replacement expenditures as they come due in the future, approximately 37 years from time of installation.

The total cost of installing 220 small floodwater retarding dams, one larger single-purpose dam, and 2 large multiple-purpose dams is $16,483,400.

GEOLOGY

Erosion and sedimentation data for upland areas was derived using information collected on 28 randomly selected small sample sites (average drainage area 163 acres) and 2 large sites (avg. drainage area 1,133 acres). Land use, soil type, and sheet and rill soil losses were provided by the local district conservationists. Sheet and rill erosion on the sampled areas was expanded to estimate soil losses on the total upland area.

Ephemeral gully erosion, as well as the associated voiding and depreciation, were calculated using the Ephemeral Gully Erosion Model (EGEM). Inputs for the model were derived from inadequately protected cropland fields believed to be representative of the watershed.

The randomly selected sample sites were used to inventory permanent gully erosion. Each sample site was thoroughly inspected and mapped on an aerial photography base with a scale of approximately 1" = 600'. Attention was given to gully width and depth, headcut advancement rates, bank erosion rates, and aggradation/degradation. The estimated cubic feet of annual gully erosion on the sample sites was expanded to give a total for the entire upland area. Associated voiding and depreciation rates for present, future-without, and future-with project conditions were estimated from the collected field data.

Grade stabilization structures are included as an element of the watershed plan to address problems associated with active gully systems. Permanent gully erosion was identified as a significant problem by numerous landowners, as well as the district conservationists. Field examinations were made of several areas with gullies and conservation plans for sites where grade stabilization structures are needed were reviewed as representative samples. The geologist interviewed each district conservationist to determine how many grade stabilization structures were needed within each county. Total structures desired were stratified into four drainage area categories. Costs for structures in each category were determined through consultation with the planning engineer, taking into consideration information provided by the district conservationists. Data from representative sites with varying drainage areas were analyzed to determine voiding and depreciation rates, erosion rates, and sediment yields to the stream system and other off-site areas. Pertinent information was provided to the economist to be used in computing benefit-cost ratios.

The surveyed valley cross-sections used by the hydrologist for the WSP-2, TR-20, and ECON2 programs were utilized to evaluate flood plain damages resulting from modern sediment deposition, scour, and swamping. Data was collected using the range method as described in various SCS publications, including the National Engineering Handbook, Section 3, Chapter 7, and the Guide to Sedimentation Investigations, Technical Guide 12, Chapter 6. Various adaptations to the sampling procedures were incorporated at the discretion of the planning geologist in order to make the results more applicable to conditions existing within watersheds in Missouri and Iowa. For example, location and spacing of soil probe boring were an onsite decision, intended to maximize the validity of data and therefore best describe conditions at each specific cross-section. Damage information was recorded in the field using a pocket size tape recorder. Data was later transcribed to a notebook and eventually onto the Worksheet for Summarization of Range Data (MO-263). Final data were combined with that provided by the economist and input into the Land Damage Analysis (LDAMG) program.

Channel conditions and streambank erosion were inventoried at the surveyed valley cross sections, as well as at randomly selected half-mile reaches. Total channel lengths for East Fork of the Grand and its tributaries, measured up to the last surveyed cross section, were provided by the hydrologist. Average lateral erosion rates and average eroding portion of bank were used with lengths to calculate total annual cubic feet of eroded material. Volume weight of eroded bank material was set at 85 lbs/cu. ft. based on an average of flood plain soil types within the watershed.

Delivery ratios, sediment yields, and trap efficiencies used to calculate sediment budgets and sediment storage requirements for the proposed P.L.-566 dams were based on guidelines set forth in the National Engineering Handbook, Section 3, Chapters 6 and 8.

BIOLOGY

Field investigations of upland wildlife habitat impacted by this project were conducted in 1986 and 1987 by a triagency team composed of biologists from the U.S. Fish and Wildlife Service (FWS), Missouri Department of Conservation (MDC) or Iowa Department of Natural Resources (IDNR) and SCS. Team members agreed to use five representative species (deer, turkey, quail, rabbit, and squirrel) and five habitat types (bottom land hardwoods, upland hardwoods, old field,

grassland, and cropland) for the evaluation. Wildlife Habitat Appraisal Guide (WHAG) software was used to model the range of species niche requirements and habitat conditions impacted by the project.

Each habitat type to be effected were measured by overlaying an acetate sheet with proportionate figures of floodwater retarding dams on aerial photographs. Acres of each habitat type were then determined by a dot count grid. Calculations were made for 45 small floodwater retarding dam sites and the three large dam sites. The 45 sample site acreages were extrapolated for the 220 dam sites.

A visit to the SCS Field Office in Mt. Ayr, Iowa was made to determine the impact to habitat caused by construction of the grade stabilization structures. The team examined aerial photographs of potential sites and visited sites in the field. Interviews were also conducted with all of the district conservationists to determine the habitat types that would be impacted. Most sites are located in grassland, cropland, or CRP fields. These structures will be constructed in gullies that have minimal vegetative cover and wildlife benefit.

Based on a field investigation utilizing WHAG, the triagency biologists from both Missouri and Iowa decided that woody cover was the most valuable wildlife habitat type. The teams agreed that the bobwhite quail habitat suitability index (HSI) model would be used as the indicator of impacts on woody draws. Since the project has potential to adversely impact both distribution and density of wildlife species utilizing woody habitat, it was decided that all unavoidable losses of woody habitat due to project action would require replacement. The team agreed that losses of grassland could be offset by fencing the dams and limiting grazing, since undisturbed grass on the dams would provide better quality habitat than the overgrazed pasture that will be flooded.

Cropland was not limiting in Iowa based on the aerial photograph sampling procedure. Therefore, the Iowa team agreed that any loss of cropland in Iowa would not be significant, and would be adequately replaced by establishing woody mitigation areas adjacent to cropland. In Missouri, based on the HSI values for cropland, the Missouri team concluded that cropland provides valuable habitat and would require mitigation.

The biologists recommended the following priority order for acquiring mitigation areas:

1. Bottomland 'stringers' - wooded drainage ways or gullies connecting uplands with streams and crossing or abutting cropland.

2. Riparian timber - corridors along major tributaries and East Fork of the Grand.

3. Ox-bows - wooded wetland areas in bottomland fields.

4. Upland draws - wooded gullies, strips or odd areas in pasture that are less than 1/4 mile to cropland.

5. Structure areas - fenced periphery of project pools. Areas adjacent to sites F-3, F-4, and GB-3 will not require fencing, unless grazing will occur at these sites. Count all areas that are above the sediment pool elevation. Again, highest priority if less than 1/4 mile to cropland.

6. Any area between 1/4 - 1/2 mile to cropland.

7. Any other areas.

This priority order reflects the IDNR concern over potential loss of bobwhite quail habitat and the fact that most large timber areas will not be impacted by project activity. Priority within each category will be given to areas between 5 and 20 acres in size in order to increase both edge and spatial diversity of mitigation areas. Mitigation areas will be left to vegetate naturally or vegetation will be planted that is different from existing adjacent cover in order to improve wildlife habitat.

The Indiana bat (Myotis soldalis) maternity colonies are known to occur in the watershed. However, the watershed is within the bats' summer range only. Removal of trees during construction could impact nursery trees. To prevent damage to maternity colonies, a "no-cut" period from May 1 to August 31 will be established. This will be waived only with the approval of SCS, MDC, or IDNR biologists on an individual basis. With the "no cut" period and the biologists examining each site before construction, no habitat critical to the bats survival will be impacted by the project.

WATER QUALITY

Stream habitats and resources were evaluated by the original team of biologists using the Stream Habitat Assessment Device (SHAD) model (MDC, 1987). Stream reaches were divided into 1/2 mile increments and numbered. A random number program generated 10 percent of the stream reaches for evaluation. Values for individual reaches were tabulated and all reaches were averaged to arrive at the final value.

Projected water quality conditions involve sedimentation, associated nutrients (esp. phosphorus), and pesticides. Effects are supported in the geology section of this appendix. Comparisons with water quality related research literature that addresses similar conditions and alterations were also used to evaluate water quality concerns.

Multiple-purpose dam GB-3 will provide a source of rural water supply, whole body contact recreational opportunities, and fish and wildlife habitat. In addition to land treatment measures for soil conservation, special consideration was given to potential sources of nutrients and pesticides in the GB-3 drainage area.

Up to 1,250 acres of CRP land in the watershed above multiple-purpose dam GB-3 could return to crop production as contracts expire, significantly increasing the potential for runoff of nutrients and pesticides. Further, state and federal legislation could significantly affect the types of chemicals and rates at which they are applied to cropland. Due to the potential changes in land use, particularly CRP conversion, sources of water quality impairment were based upon current farming and land use information rather than water quality sampling and analysis.

Field office staff in Ringgold County provided detailed information on present and projected land use, and also collected pesticide use information from local suppliers. This information includes demographics, land cover, livestock data, typical rotations, CRP acreage, and herbicide and insecticide use. Potential sources of nutrients and pesticides in the watershed were identified and land treatment and technical assistance components were targeted toward those sources.

Land treatment and technical assistance components were selected to protect the soil resource on at least 75 percent of the land in the drainage area above multiple-purpose dam GB-3. Additional land treatment and technical assistance components were selected to target potential sources of water quality impairment on all concentrated livestock feeding areas and on at least 50 percent of the cropland, pasture, and hayland in the drainage area of multiple-purpose dam GB-3.

WETLANDS

Present wetland acres were determined by examination of aerial photography, USGS 7.5 min. quads, and soil maps. The wetland acres were tallied into appropriate categories for both Food Security Act (1985) and Cowardin (1979) as defined below:

FSA	Cowardin
Emergent wetland	Palustrine emergent
Pastured wetland	Palustrine emergent
Wooded wetland	Palustrine forested
Farmed wetland	Palustrine emergent

The current FSA wetland inventory acres were measured with a planimeter.

The impact of reduced flooding to wetlands was evaluated by using data generated by the ECON2 program. This data was used to determine changes in the frequency of flooding. Twice a year flooding is expected to provide enough water to maintain wetland values. Currently, these wetland areas flood one to three times a year. With the project installed, these areas will continue to flood on the average of one to two times a year. This frequency of inundation, combined with location on the landscape, will maintain them as functional wetland areas. FSA disincentives for conversion to other uses are expected to maintain these areas as wetlands.

New wetland acres created by the pools were determined by computing a representative land slope for an average sized pool and determining how much of the surface area has water 2 meters or less in depth (Cowardin definition of shallow water). This area was determined to be 40 percent (50 percent for grade stabilization structures) of the surface area.

A Missouri study of P.L.-566 watershed projects (Goebel 1985) shows that aquatic macrophytes invade these shallow water areas. Plant genera to be represented in the littoral zones of these ponds include: Lemna, Wolffia, Potamogeton, Chara, Ceratophyllum, Myriophyllum, Typha, Scirpus, Sagittaria, Jussiaea, Numphae, and Dianthera (Goebel, 1985). In addition to these macrophytes, a number of microscopic algae, diatoms, and zooplankton should inhabit the littoral zone, providing a base for the aquatic food web. Inspection of completed watershed project dams

revealed that about half of the pools are grazed by livestock. Grazing prevents macrophyte development. Therefore, to determine the number of acres of newly created wetlands, the total surface area of water is multiplied by 40 percent (50 percent for grade stabilization structures) and then multiplied by 50 percent. The combination of shallow water and macrophytes is an adequate criteria to call these shallow pool areas wetlands. On the multiple-purpose sites, the same formula was used. It was assumed that human disturbance rather than grazing will prevent 50 percent of the shallow areas from developing functional wetland values.

The triagency team determined that the wetland pasture and forested wetlands which will be adversely impacted by the project will be mitigated. These mitigated acres of wetlands are in addition to those wetlands created along the pond and lake edges which were calculated using the methodology stated above because they do not provide the same function and values as those wetlands impacted by the project. The following criteria will be used to construct the mitigated wetlands:

- slopes along the pond and lake edges will be 8:1 or flatter,
- livestock grazing will be excluded,
- a minimum of one acre in size.

In addition, slopes along two-thirds of the pond shoreline near the dams should be constructed with 3:1 side slopes to maximize fishery and wetland habitat.

Priority will be given to wetlands mitigated near flooded forested areas associated with sites F-3, F-4, and GB-3. Grazing will also be excluded from these wetland mitigation areas.

PROJECT FORMULATION

The future without-project conditions were forecasted using present conditions as a base. An interdisciplinary team approach was used to reflect a cross-section of viewpoints.

The major objectives outlined in the Pre-Authorization Report for the watershed are reduced flooding, agricultural water development, fish, wildlife, and recreational development, and stabilization of gullies. The most desirable solution to the watershed problems was the installation of 220 small and one large floodwater retarding dams, one multiple-purpose floodwater - agricultural management - fish and wildlife development dam, and one multiple-purpose floodwater - fish and wild life development dam and 344 grade stabilization structures. The drainage areas range from 100 to 350 on the 220 small single floodwater dams, 6,160 acres on site GB-3, 1,085 acres on site F-4, 1,180 on site F-3, and 16 to 70 acres on the 344 proposed grade stabilization structures.

The national economic development (NED) plan was developed for each purpose. Increments were added until maximum net benefits were reached as described in Principle and Guidelines. In this way the number of single-purpose dams were determined, the sizing of the fish and wildlife pool and agricultural water management pool was achieved, and the number of grade stabilization structures and land treatment was determined.

FOREST RESOURCES

Information on the forest resources was obtained from recent forest surveys in Missouri (Ostrom, 1991) and Iowa (Brand and Walkowiak, 1991), and data from field plots. Data on forest soils was taken from the Worth, Harrison, Ringgold, and Union County soil surveys (Brown, 1968; Minor, 1979; Boeckman, 1992; and Nixon and Boeckman, 1978). Recommended conifers are from Erdmann (1966) and USDA Soil Conservation Service (1992), and flood tolerances are from Teskey and Hinckley (1977).

LAND COVER and SOIL CONSERVATION

Land cover was determined by digitizing data for each category from an infra-red enhanced SPOT satellite photograph. The classification scheme included level I categories of urban and built-up land, agricultural land, forest land, water, and barren land. Agricultural land was further defined by level II categories of cropland and grassland.

Field office personnel in the watershed project area completed worksheets that provided detailed information for present and projected land use and conditions. The worksheets include soil erosion rates, HEL acres, cropping information, FSA effects, prime farmland, and additional federal, state, and local programs. In addition, field office staff and SWCD board members were interviewed to determine present and projected land uses.

Soil surveys were used to determine soil mapping units, prime farmland, and crop yields. The dot matrix method and county highway maps were used to determine the watershed acreage in each county. The Universal Soil Loss Equation was used to determine erosion rates. Field observations, aerial photographs, and farmer interviews were used to determine land use and cropping systems in the flood plain.

Projected land cover and soil conservation application were calculated by proportionately reducing or increasing acreages according to land cover category, slope range, and anticipated changes. Reports from SCS district conservationists and visits with farmers and SWCD board members were used to determine application of conservation plans in the future.

An incremental analysis of individual conservation practices or alternatives was used to plan and evaluate land treatment.

PUBLIC PARTICIPATION

Since 1969, public meetings were held to discuss local problems and concerns in the East Fork of the Grand River Watershed area. The public voted to develop the East Fork of the Grand River Watershed Subdistrict in Missouri under Missouri statutes. The Board of Supervisors in Ringgold and Union Counties, Iowa will administer the project according to Iowa statutes.

The sponsors conducted public meetings to gather public input and keep the public informed of the status of the project.

In conjunction with a public scoping meeting, a scoping notice was mailed to all watershed property owners, agricultural producers, and government officials for additional comments and concerns. Their responses were submitted to the sponsors and are included in this plan.

A fact sheet was developed to summarize the many components of this plan and was mailed to all property owners and producers who requested additional information. The purpose of the fact sheet was to keep the public informed of the components of the project.

CULTURAL RESOURCES

The East Fork of the Grand River Watershed was the subject of two separate Historic Property Surveys during the development of the plan. A contract was awarded to Bear Creek Archeology, Inc., to survey the three larger dam sites in the watershed. A contract awarded to American Resources Group resulted in a stratified survey of 30 percent of the smaller flood water retarding dam sites proposed for the project. A predictive model, presented as a result of this contract, will be used to identify other dam sites where there is potential for the dam sites to affect historic properties.

The cultural resources investigation of proposed site GB-3 resulted in the identification of five previously unreported prehistoric and historic archeological sites (13RN131-13RN135). Included in the inventory of investigated archeological sites are two prehistoric resource procurement sites, one combination resource procurement and temporary bivouac site, one farmstead outbuilding, and one former road alignment. The location of a previously reported mound group site, 13RM70, was also inspected as part of this investigation. Efforts to relocate the mound group were unsuccessful.

All of the identified sites are described in detail in "An Historic Properties Survey of Selected Lands within the East Fork Grand River Watershed, Liberty Township, Ringgold County, Iowa" report. Of the five investigated archeological sites, none were considered to meet eligibility requirements for potential nomination to the National Register of Historic Places (NRHP).(Sellars, June 1993)

The cultural resources investigation of sites F-3 and F-4 resulted in the identification of two previously unreported historic and prehistoric archeological sites (23WO15; 23WO16). Included in the inventory of investigated archeological sites is one prehistoric resource procurement site (23WO16) and one historic artifact scatter (23WO15). Because of their locations within the project corridors, it is expected that both sites will be destroyed by construction activities. All artifacts recovered from the sites were found within a disturbed context (the plowzone). Systematic shovel testing of the site areas found no sub-plowzone cultural deposits or features. Neither of these sites meet the requirement for listing on the National Register of Historic Places (NRHP).(Thompson and Sellars, June 1993)

SOCIAL RESOURCES

Sources for the social assessment include documented research data and interviews with local residents and city/county officials. Some watershed figures are weighted averages of the county data. Criteria listed in the SCS General Manual, Title 180-GM, Part 406, were used to determine limited resource farmer eligibility.

ECONOMICS

The economic methodology used to evaluate the damages, benefits and costs are from the SCS document, "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies". This document, signed by the President in

1983, provides consistent formulation and evaluation procedure guidelines for water and related land resource implementation studies planned by federal agencies.

Crop and Pasture

Crop and pasture damages were evaluated using the SCS ECON2 computer program. Storm frequencies evaluated include the 100-, 50-, 25-, 10-, 5-, 2-, 1-, 0.5-, 0.333, 0.25- year events. Distribution of floods throughout the year came from the study of stream gage and National Weather Service records.

The depth/damage factors by month were developed. Replanting cost and alternate crops were considered in developing the factors.

Economic reaches for flood plain analysis were selected to aggregate the area of comparable cropping pattern and productivity. Distribution of crops by reach was determined from field observation and noted on aerial photos. The cropping system and land use data were also tabulated by reach for input into the SCS ECON2 program and flood damage analysis.

The value used for agricultural commodities was 1992 current normalized prices. The price for pasture was $10 per animal unit month. Yields by crop for flood-free conditions under present conditions were determined. These same yields were used for the future with- and without-project conditions.

Recreation

The unit day value method, as described in Principles and Guidelines, Section VII, Appendix 3, was used to evaluate recreation benefits. The general recreation activity category was used to determine the value of recreation visits.

An inventory was made by the staff biologist to determine the supply and demand for recreational user days within a 20 mile radius of site GB-3, F-3, F-4, and the small, single-purpose floodwater retarding dams.

A team made up of federal and state representatives determined points for general recreation required by the methodology described. Recreation user-day point values were determined as shown on page 84 of the Principles and Guidelines publication. The values were updated to current by the consumers price index.

The fish, wildlife, and recreational development pools for sites GB-3 and F-3 were sized to maximize net benefits for the national economic development plan. Sites GB-3 and F-3 had physical site limitations that resulted in limiting the pool size of each to less than would have been achieved at the size that would have maximized net benefits.

Gully

The annual extent of depreciated and voided land was determined by a geologic investigation. In addition, various degrees of depreciation on lands immediately associated with nonrecoverable (voided) areas were evaluated. The net-income method was used to evaluate on-site damages by developing crop budgets for each crop and weighting the values to arrive at a net-income per composite acre. Benefits were determined to be the difference in net-income between the future with- and without-project conditions.

Off-site damages were determined by using SCS ECON2 computer program to model reduced crop and pasture flooding and SCS LDAMG computer program to model the reduction of sediment, scour, and swamping damage reduction. Ten percent of the potential grade stabilization dam sites were evaluated to determine gully control effects on roads and bridges.

Other Agricultural Land

SCS ECON2 computer program was used to evaluate other agricultural damages. An inventory was made to determine the type of other agricultural property located in the flood plain. The inventory revealed that fences received the majority of the property damage. The other major damage category was debris removal. Damages expected for flood stages came from landowner experience in past flood events. Fencing costs were obtained from the Field Office Technical Guide. Costs for debris removal are from the crop budget system. Additional information was obtained from field observations. Length of fence affected by floodwater per acre by depth increment was determined and multiplied by the cost per foot.

Debris removal damages were computed by depth increment per acre. Fences below the floodwater retarding dams were evaluated to derive benefits.

Land Damage

SCS's land damage analysis program was used to determine damages from sedimentation, swamping, and scour. The interest rate was 8 1/2 percent. Fixed and variable production costs came from the crop budget for each crop.

The geologist analyzed the flood plain for reach damage rates, acres damaged for each damage category, and number of years for recovery from sedimentation, swamping, and scour. Evaluation of land damage was projected for 75 years by the geologist to develop an annual rate.

Road and Bridge

SCS ECON2 program was used to evaluate road and bridge damages. Information for roads and bridges was obtained by field observation, use of information from other watersheds and from interviews with county engineers. Reductions in costs for maintenance, repair, and replacements were considered a benefit. Damages were analyzed using a stage-damage procedure. A stage-damage curve was developed as input for each bridge evaluated. County highway engineers provided the data for the curve. Their estimates were used to estimate dollar damages by stage and frequency.

Rural Water Supply

The benefits from water supply were measured by the resource cost of a single-purpose dam alternative most likely to be implemented in the absence of the proposed multiple-purpose dam. This method, described in "Principles and Guidelines," was used because current data does not reflect the marginal cost the users are willing to pay. The present rural water supply, future needs, population trends, and rural development were considered.

Rural Fire Protection

Benefits from installing dry hydrants at 89 identified floodwater retarding dam sites were derived from an estimated reduction in fire insurance premiums. Sites were chosen based upon certain criteria. Good all-weather road surfaces and stable bridges are necessary to enable heavy

tanker equipment to travel to and get close to the access of water. The number of households to benefit from dry hydrants were identified. The number of households and population trends were considered in the evaluation.

Sources of information for the dry hydrant analysis included local residents; Resource, Conservation, and Development (RC&D) Coordinators; insurance companies; Insurance Services Office; Assistant State Conservation Engineer; and published materials.

Land Treatment

A land treatment economic evaluation was conducted on cropland. A NED alternative was evaluated. Prices used were current normalized for crops and $10 per animal unit month for pasture.

The Missouri Land Treatment Evaluation Computer Program was used to evaluate 14 alternative conservation systems on cropland. Project benefits and costs were calculated as the difference between with-project land treatment and without-project land treatment benefits and costs. Crop budgets were produced with and without conservation treatment by soil, slope group, and crop on four common and reasonable conservation crop rotations.

Current normalized prices were used. The yields and crop budgets were agreed on by a committee made up of farmers and USDA representatives (Extension Service, FmHA, ASCS) in the area. The cost of conservation practices and technical assistance needs were provided by the district conservationists.

Other

Installation costs of structural measures were amortized at 8 1/2 percent interest for the life of the project Operation and maintenance costs were computed for each dam.

The economic base data used in the evaluation of benefits were current normalized prices, local production costs, and federal discount rate.

The methodology and procedures used in measuring the problems and computing benefits are outlined in the "Economics Guide" and "Economic and Environmental Principles and Guidelines for Water and Related Land Resourses Implementation Studies."

Damage reduction benefits were determined by computing the difference in damages for the future without-project condition and the damages expected with each alternative in place.

The basis for the assumptions concerning future without-and future with-project conditions are covered in the plan under "Effects of Alternative Plans."

INCREMENTAL ANALYSIS

National Economic Development Plan

All procedures used are described in the SCS Principles and Guidelines.

Floodwater Purpose

The NED floodwater damage reduction plan was identified by adding 20 dams at a time to the ECON2 and LDAMG computer programs until maximum net benefits were reached and exceeded.

Incremental Analysis of Small Dams

Number of Dams	Incremental Benefits	Total Benefits	Incremental Costs	Total Cost	Net Benefits
			Dollars		
201	--	1,126,600	--	902,400	224,200
221	96,800	1,223,400	88,800	991,200	232,200
241	26,200	1,249,600	88,400	1,079,600	170,000

Agricultural Water Management

Benefits were computed by using the cost of the most likely alternative as described in Principles and Guidelines, 2.2.2.

Fish, Wildlife, and Recreational Development

Three sizes of recreation pools (350, 400, and 450 acres) were analyzed at site GB-3. The 350-acre pool supplied all of the recreation user-days for the area demand.

The recreation pool size for site F-3 was determined by maximizing environmental assets such as shoreline, depths, etc. Biologists from the Missouri triagency team concurred on a formula that maximizes environmental resources. The results were used to size the pool. This became an environmental constraint. Dam F-3 could have been built larger to maximize net recreation benefits but not for the fish and wildlife purpose.

Grade Stabilization of Gullies

On-site gully damages were calculated for each slope group (2-5%, 5-9%, 9-14%, and 14+%) and primary soil type as per the SCS Econ Handbook, part 1, pages 621-659.

Off-site damages were evaluated by the ECON2 and LDAMG computer programs.

Road and bridge damage reduction benefits were calculated using information gathered from each county engineer and by conducting a sample of the potential sites (about 10 percent).

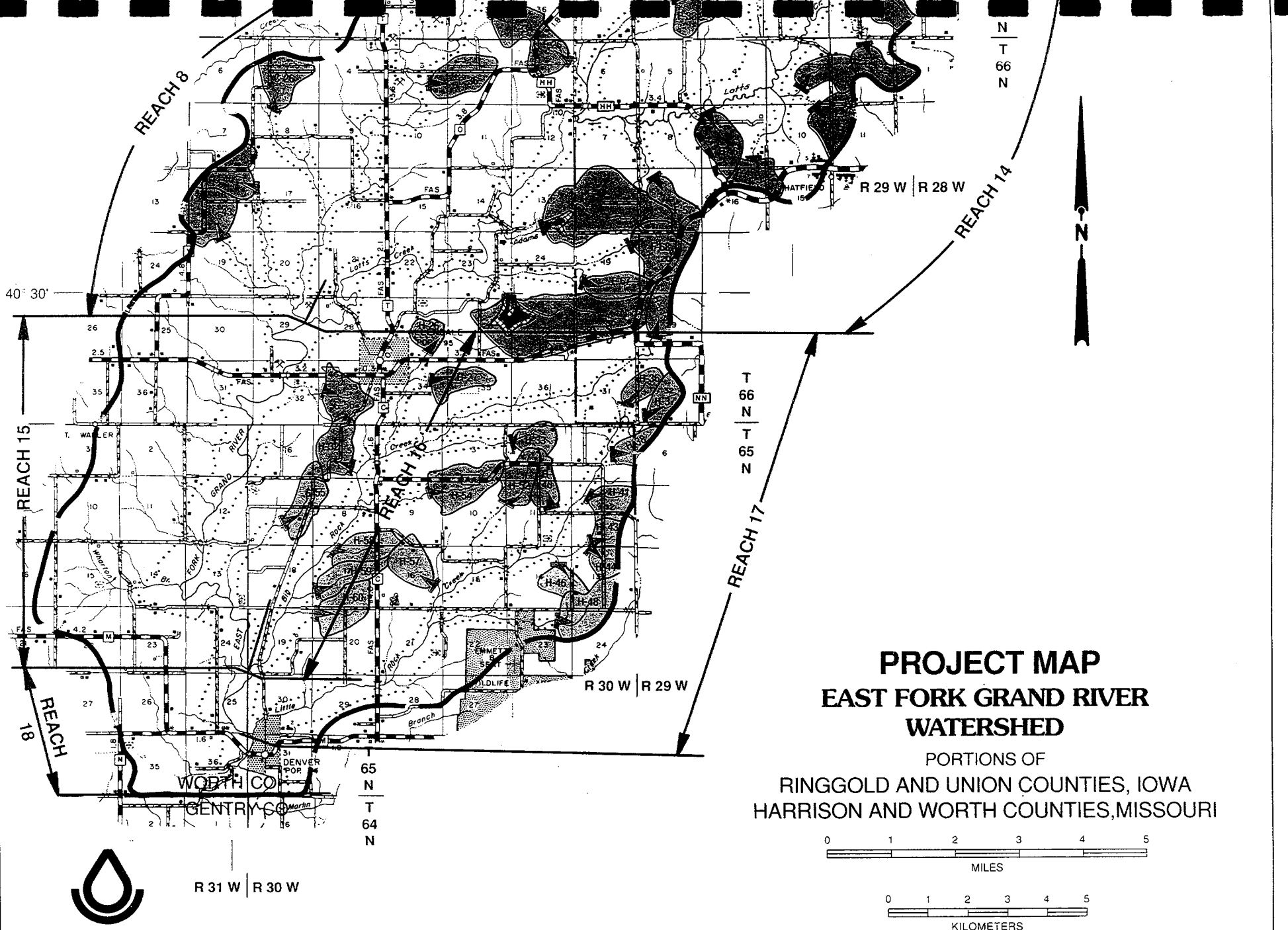
There were 425 gullies identified in the watershed. They were stratified into 4 drainage area groups for economic evaluation. There were 82 gullies in the 0- to 15-acre area, 159 in the 16- to 30-acre drainage area, 127 in the 30- to 45-acre drainage area and 57 in the 46- to 70-acre drainage area. Each group was evaluated for grade stabilization structures. The benefits were calculated and allocated back per acre by drainage area. The 0- to 15-acre drainage area group did not meet the test for net economic benefits and are not part of the NED plan.

EFFECTS OF THE RECOMMENDED PLAN ON RESOURCES OF NATIONAL RECOGNITION

Types of Resources	Authorities	Measurement of Effects
Air quality	Clean Air Act, as amended (42 U.S.C. 7401 et. seq.)	No effect.
Area of particular concern within the coastal zone	Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 et. seq.)	Not present in planning area.
Endangered and threatened species critical habitat	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et. seq.)	No effect.
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et. seq.)	Overall increase in quality of wildlife and fish habitat.
Flood plain	Executive Order 11988, Flood Plain Management.	100-year frequency flood plain is reduced by 5,000 acres.
Historic and cultural properties	National Historic Preservation Act of 1986, as amended (16 U.S.C. Sec. 470 et. seq.)	No adverse effect. Information recovery or site protection guards important information.
Prime and unique farmland	CEQ Memorandum of August 1, 1980: Analyses of impacts on Prime or Unique Agriculture Lands in implementing the National Environmental Policy Act.	Protect 5,900 acres from flooding more frequently than once every two years, changing classification to prime farmland.
Water quality	Clean Water Act of 1977 (33 U.S.C. 1251, et. seq.)	Nonpoint goal of Missouri Water Quality Management Plan.
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977 (42 U.S.C. 1857th-7, et. seq.)	Reduces sediment deposited on wetlands by about 36 percent; changes 90 acres to dams, spillways, and water; gain 400 acres of wetland habitat.
Wild and scenic rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 et. seq.)	Not present in planning area.

APPENDIX D -

GENERAL SOILS MAP



PROJECT MAP
EAST FORK GRAND RIVER WATERSHED

PORTIONS OF
RINGGOLD AND UNION COUNTIES, IOWA
HARRISON AND WORTH COUNTIES, MISSOURI

0 1 2 3 4 5
MILES

0 1 2 3 4 5
KILOMETERS

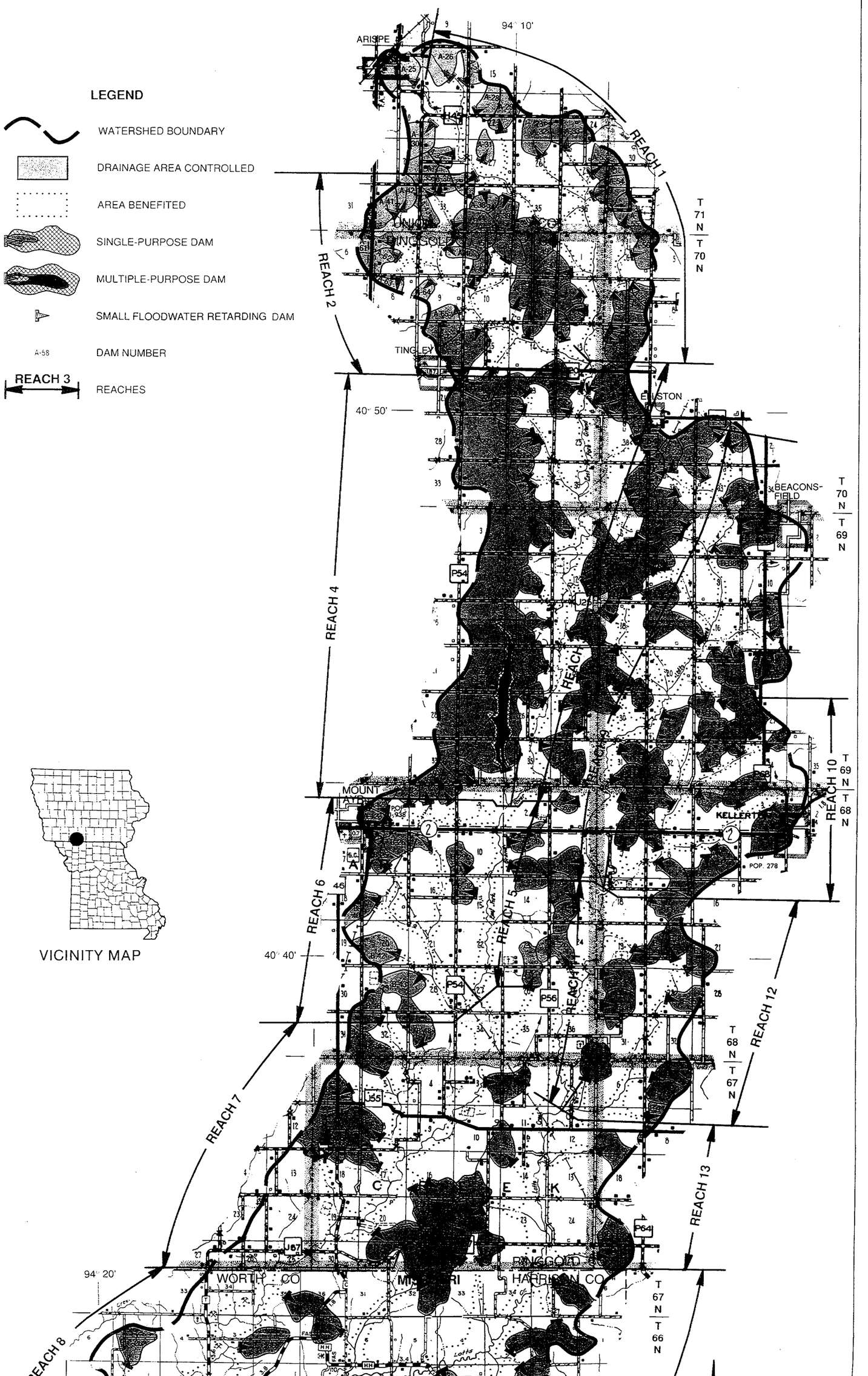
SOURCE:
COMPILED FROM COUNTY GENERAL HIGHWAY
MAPS AND INFORMATION FROM SCS FIELD PERSONNEL.
POLYCONIC PROJECTION

JANUARY 1993 1007623

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER FORT WORTH, TX 1993

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



APPENDIX E -

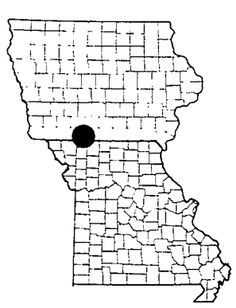
PROJECT MAP

U.S. DEPARTMENT OF AGRICULTURE

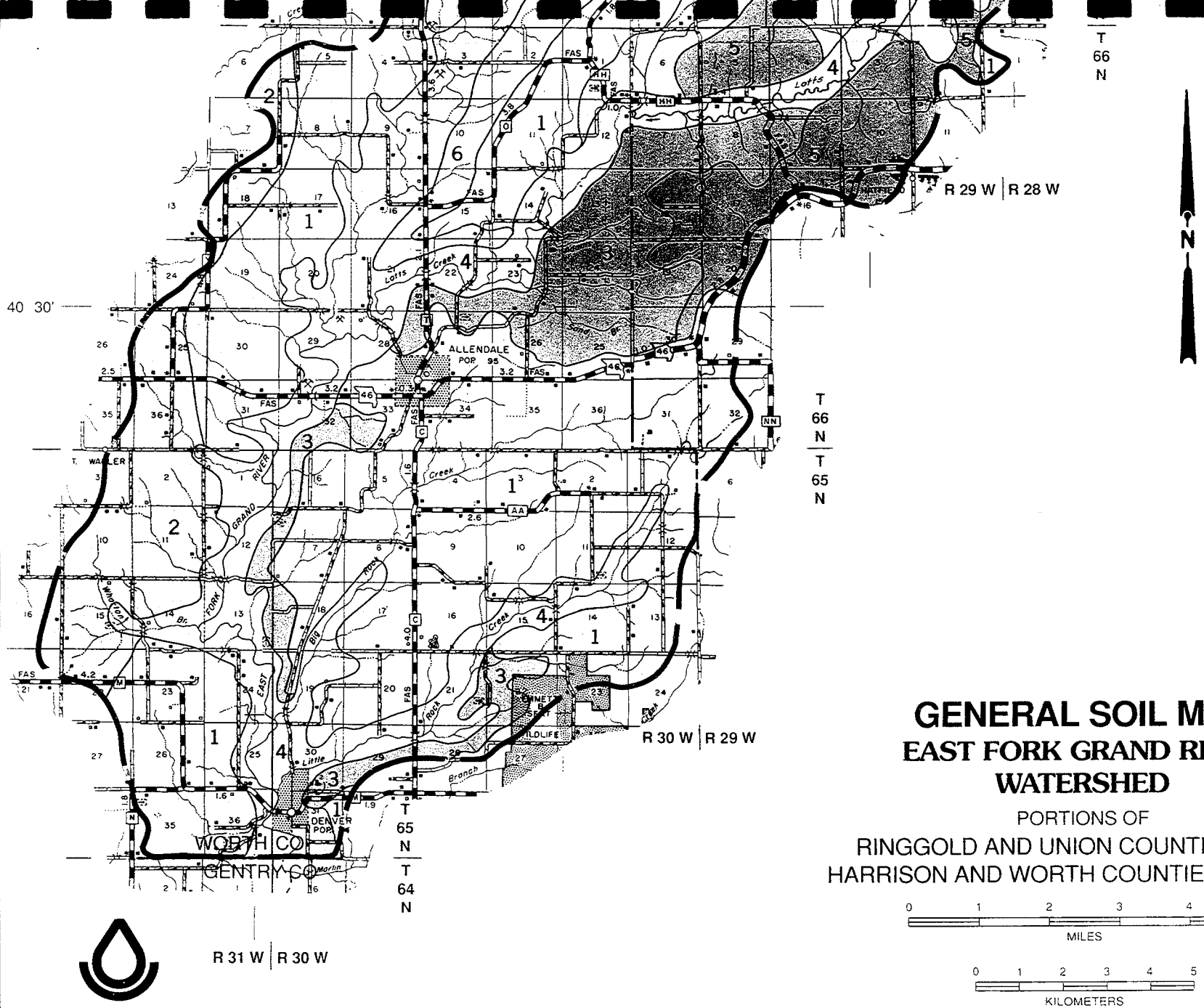
SOIL CONSERVATION SERVICE

LEGEND

1	Shelby-Lagonda-Grundy Association: Moderately sloping to moderately steep, moderately well drained or somewhat poorly drained soils that have developed in glacial till on side slopes and somewhat poorly drained soils that have developed in loess on ridgetops.
2	Shelby-Lagonda-Sharpsburg Association: Sloping to moderately steep, moderately well drained or somewhat poorly drained soils that have developed in glacial till on side slopes and in loess on ridgetops.
3	Gara-Keswick-Pershing Association: Moderately sloping to steep, moderately well drained soils that have developed in glacial till on side slopes and ridges and somewhat poorly drained soils that have developed in loess on bench terraces and ridgetops.
4	Wabash-Nodaway-Kennebec Association: Nearly level, poorly drained soils that have developed in clayey alluvium and moderately well drained or well drained soils that have developed in silty alluvium; on flood plains.
5	Shelby-Adair-Zook Association: Deep, nearly level to moderately steep, moderately well drained to poorly drained soils formed in glacial till and alluvium; on upland side slopes and flood plains.
6	Gara-Pershing-Armstrong Association: Deep, gently sloping to moderately steep, moderately well drained or somewhat poorly drained soils that formed in loess and glacial till; on uplands.
7	Lindley-Keswick Association: Moderately sloping to very steep, well drained to somewhat poorly drained loamy soils formed in glacial till; on uplands.
8	Arispe-Shelby-Lamoni Association: Gently sloping to moderately steep, well drained to somewhat poorly drained; silty and loamy soils formed in loess and glacial till; on uplands.
9	Grundy-Haig Association: Nearly level and gently sloping, somewhat poorly drained or poorly drained, silty soils formed in loess; on uplands
10	Nodaway-Humeston-Wabash Association: Nearly level and gently sloping, moderately well drained to very poorly drained; loamy to clayey soils formed in alluvium; on stream bottom lands.



VICINITY MAP



GENERAL SOIL MAP

EAST FORK GRAND RIVER WATERSHED

PORTIONS OF

RINGGOLD AND UNION COUNTIES, IOWA

HARRISON AND WORTH COUNTIES, MISSOURI

0 1 2 3 4 5

MILES

0 1 2 3 4 5

KILOMETERS

SOURCE:
COMPILED FROM COUNTY GENERAL HIGHWAY
MAPS AND INFORMATION FROM SCS FIELD PERSONNEL.
POLYCONIC PROJECTION

JANUARY 1993 1007624

USDA, SCS, NATIONAL CARTOGRAPHY & GIS CENTER, FORT WORTH, TX, 1993