WATERSHED PLAN

AND

ENVIRONMENTAL ASSESSMENT

FOR

NORTH HOCKING WATERSHED OHIO

APRIL 1982

WATERSHED PLAN AND ENVIRONMENTAL ASSESSMENT

NORTH HOCKING WATERSHED

Fairfield County, Ohio

Abstract:
This document describes a plan of dikes, one floodwater retarding dam, and floodwarning system to solve urban flooding problems. Alternatives considered during planning include no action, land use changes, nonstructural measures, and various combinations of dikes and floodwater retarding dams. Economic benefits exceed costs of the proposed plan. Sponsors will pay 11 percent of the $1.4 million installation costs. Environmental impacts include reduced flooding and improvements in visual quality of the watershed and wildlife habitat. This document is intended to fulfill the requirements of the National Environmental Policy Act and to be considered for authorization of Public Law 566 funding.

Prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 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 USC 4321 et seq).

Prepared by:
Hunters Run Conservancy District
City of Lancaster
Fairfield County Commissioners
Fairfield Soil and Water Conservation District
U.S. Department of Agriculture, Soil Conservation Service
U.S. Department of Agriculture, Forest Service

For additional information contact: Robert R. Shaw, State Conservationist, Soil Conservation Service, 200 North High Street, Room 522, Federal Building, Columbus, Ohio, 43215. Phone: 614-469-6962.

WATERSHED AGREEMENT

between the

Hunters Run Conservancy District

City of Lancaster

Fairfield County Commissioners

Fairfield Soil and Water Conservation District
(Referred to herein as sponsors)

State of Ohio

and the

Soil Conservation Service
United States Department of Agriculture
(Referred to herein as SCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by sponsors for assistance in preparing a plan for works of improvement for the North Hocking Watershed, State of Ohio, 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 North Hocking Watershed, State of Ohio, hereinafter referred to as the watershed plan-Environmental Assessment, 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-Environmental Assessment, and including the following:

1. The sponsors will acquire, with other than PL-566 funds, such landrights as will be needed in connection with the works of improvement. (Estimated Cost $102,880.)

2. The sponsors assure that uniform and equitable treatment will be given to persons displaced from their homes, businesses, or farms as required by the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 as implemented by 7 CFR Part 21. The costs of relocation payments will be shared by the sponsors and SCS as follows:

	Sponsors (percent)	SCS (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	15	85	31,000

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.

4. The sponsors will obtain all necessary Federal, state, and local permits as may be required for installation of the works of improvement.

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

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Construction Costs (dollars)
Flood Warning System	20	80	49,350
Hunters Run, Hocking River, Tarhe Run Dikes; Storage Pond and Pumps; Diversion/Dam	0	100	743,451
Floodwater Retarding Dam	0	100	170,845

6. The percentages of the engineering costs to be borne by the sponsors and SCS are as follows:

Works of Improvement	Sponsors (percent)	SCS (percent)	Estimated Engineering Costs (dollars)
Flood Warning System	0	0	0 1/
Hunters Run, Hocking River, Tarhe Run Dikes; Storage Pond and Pumps; Diversion/Dam	0	100	59,470
Floodwater Retarding Dam	0	100	13,600

7. The sponsors and SCS will each bear the costs of project administration that each incurs, estimated to be $38,679 and $191,287 respectively.

8. The sponsors will obtain agreements from owners of not less than 50 percent of the land above the floodwater-retarding structure. These agreements state that the owners will carry out conservation farm plans on their land and ensure that 50 percent of the land is adequately protected before construction of any dam.

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

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

11. The sponsors will be responsible for the operation, maintenance, and 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.

12. 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 works of improvement.

13. 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.

1/ Engineering costs for this item will be borne by National Weather Service.

14. 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.

15. This plan may be amended or revised only by mutual agreement of the parties hereto, except that SCS may deauthorize 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 sponsor 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 sponsors having specific responsibilities for the measure involved.

16. 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.

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

Hunters Run Conservancy District By _____

c/o Don Bainter

203 E. Fair Ave. Title _____

Lancaster, Ohio 43130

Date _____

The signing of this plan was authorized by a resolution of the governing body of the _____

adopted at a meeting held on _____

_____ _____

Address Zip Code

Date _____

_____

City of Lancaster By _____

City Building Title _____

Lancaster, Ohio 43130 Date _____
Address Zip Code

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

_____ _____
Address Zip Code

Date _____

_____

Fairfield County Commissioners By _____

Fairfield County Courthouse Title _____

Lancaster, Ohio 43130 Date _____
Address Zip Code

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

_____ _____
Address Zip Code

Date _____

_____

Fairfield Soil and Water Conservation District
1109 E. Main Street

Lancaster, Ohio 43130
Address Zip Code

By _____

Title _____

Date _____

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

_____ _____
Address Zip Code

Date _____

_____

Soil Conservation Service

United States Department of Agriculture

Approved by:

_____
Robert R. Shaw
State Conservationist

_____
Date

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WATERSHED PLAN AND ENVIRONMENTAL ASSESSMENT

North Hocking Watershed Project

Fairfield County

Ohio

Prepared under the Authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969, Public Law 91-190, as amended (42 USC 4321 et seq).

SUMMARY

I. Description of the Watershed and Planned Action.

The plan proposes a project for wildlife habitat improvement and flood prevention in the city of Lancaster, in Fairfield County, Ohio. The principal objectives to be accomplished by the project are the reduction of flood damages to 575 residential, commercial, and industrial properties, an improvement in visual quality of the existing environment, and an increase in the amount and diversity of wildlife habitat. The proposed plan calls for one mile of levees, one dry floodwater retarding dam, a flood warning system, and the planting of field border strips in upland areas of the watershed.

The total project cost is estimated to be $1,457,218, of which $1,249,983 will be borne by PL-566 funds and $207,235 to be borne by other funds. The average annual cost of the project measures is estimated to be $113,711 1/, and the average annual benefits are estimated to be $333,389 1/ providing a benefit cost ratio of 2.9 to 1.0. The Hunters Run Conservancy District, City of Lancaster, Fairfield County Commissioners, and the Fairfield County Soil and Water Conservation District are sponsors of the project and are responsible for installing, operating, and maintaining the works of improvement.

II. Candidate Plans and Impacts. Five candidate plans were considered during project formulation. Candidate Plan 1 is the plan which optimizes national economic development. Candidate Plan 2 is the plan which emphasizes environmental quality. Candidate Plan 3 is the primarily non-structural plan. Candidate Plan 4 is the recommended plan, and Candidate Plan 5 is no project.

1/ Includes interest and benefits accrued during project installation period.

III. Summary of Review-Agencies which information copies were supplied.

Department of the Army
Department of Commerce
Department of Health and Human Services
Department of the Interior
Department of Transportation
U.S. Environmental Protection Agency
Ohio Department of Natural Resources
Water Resources Council
Office of Equal Opportunity, USDA
Federal Power Commission
Governor of Ohio
Ohio State Clearinghouse
Ohio Environmental Protection Agency
Fairfield County Regional Planning Commission
Advisory Council on Historic Preservation
National Wildlife Federation

PROJECT SUMMARY

Name: North Hocking Watershed
Size: 107.3 square miles
State: Ohio
County: Fairfield

Sponsors: Hunters Run Conservancy District, City of Lancaster, Fairfield County Commissioners, and Fairfield Soil and Water Conservation District.

TOTAL PROJECT LAND USE:

	Acres w/o Project	Acres w/Project
Cropland	27,787	27,618
Pastureland	11,032	11,032
Woodland	16,609	16,609
Urban	10,044	10,044
Other Land 1/	3,198	3,367
Total	68,670	68,670

Land Ownership: Private - 97% State/Local - 3% Federal - 0%

Number Farms: 660 2/ Average Size: 179 acres

Prime Farmland: 9000 acres

Wetlands: Type 1-1604 acres, Type 2-3220 acres, Type 5-303 acres

Flood Plains: Cropland-4367 acres, Pasture-325 acres, Woodland-285 acres, and Other-708 acres.

Endangered Species: None

Cultural Resources: None

Purpose: Flood prevention and wildlife habitat improvement.

Principal Project Measures: Dikes, floodwater retarding dam, flood warning system, and field border planting.

Project Costs:	PL-566 Funds $	%	Other Funds $	%	Total Dollars $
Nonstructural Measures	39,480	76.1	12,370	23.9	51,850
Structural Measures:					
Flood Prevention	1,013,716	90.6	105,030	9.4	1,118,746
Wildlife Habitat Improvement			51,156	100.	51,156
Project Administration	191,287	83.2	38,679	16.8	229,966
Technical Assistance	5,500	100.			5,500
Interest-Installation Period	2,092	91.1	205	8.9	2,297

1/ Includes farmsteads, roads, water areas, and wildlife land.
2/ All or partially in the watershed.

Annual Benefits:	$	%
To Nonagricultural Improvements	333,389	100
Total	333,389	100

Total Ac. Benefited: 192; By Struc. Meas.-154; By Nonstruc. Meas.-38

Benefit-Cost Ratio: 2.9:1.0

No. of Farming Units Benefited by Conservation Land Treatment: 165[1/]

No. of Farming Units Benefited by Nonstructural Measures: 0

No. of Farming Units Benefited Directly by Structural Measures: 0

No. of Urban Properties Benefited Directly by Nonstruc. Meas.: 162

No. of Urban Properties Benefited Directly by Structural Meas: 413

Responsible for Operation and Maintenance of Project Measures:
Hunters Run Conservancy District, City of Lancaster, Fairfield County Commissioners, and Fairfield Soil and Water Conservation District.

Estimated Annual Cost of Operation and Maintenance: $4551

Projected Change in Land Use:

Cropland to Pastureland	0
Cropland to Woodland	0
Woodland to Cropland	0
Woodland to Pastureland	0
Woodland to Urban	0
Cropland to Urban	0
Pastureland to Urban	0
Pastureland to Cropland	0
Cropland to Wildlife land	169 acres

Natural Resources Lost or Changed:

Wooded Flood Plains[2/]	2 acres
Wetlands	0
Cultural Resources	0
Wildlife Habitat	0
Fisheries	0
Prime Farmland	0

Other Impacts:

No other significant impacts

1/ Wildlife habitat improvement 169 acres).
2/ Mature hardwood trees replaced with other tree species.

PLAN AND ENVIRONMENTAL ASSESSMENT 1/
NORTH HOCKING WATERSHED
Fairfield County, Ohio

INTRODUCTION

The watershed plan and environmental assessment have been combined into a single document. The document describes plan formulation, expected economic and environmental impacts, and provides the basis for authorizing federal assistance for implementation.

The sponsoring local organizations which developed the plan are: Hunters Run Conservancy District, City of Lancaster, Fairfield County Commissioners, and the Fairfield Soil and Water Conservation District.

The U.S. Department of Agriculture's Soil Conservation Service and Forest Service provided assistance to the sponsors in the development of the plan. Other federal, state, and local agencies provided input into the planning process.

The plan was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566, as amended (16 USC 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 USC 4321 et seq). Responsibility for compliance with the National Environmental Policy rests with the Soil Conservation Service.

1/ All information and data, except as otherwise noted, were collected during watershed planning investigation by the SCS and FS, USDA.

PROJECT SETTING

The North Hocking Watershed, Fairfield County, is located in the central portion of Ohio, approximately 25 miles southeast of the city of Columbus.

Total area encompassed by the watershed is approximately 107 square miles. The topography ranges from gently rolling to hilly. The highest elevation in the watershed is 1238 feet above mean sea level in Section 17 of Hocking Township. The lowest elevation is 755 feet above mean sea level in Section 10 of Berne Township.

The Hocking River originates in Fairfield County, northwest of Lancaster. It flows in a southeasterly direction through Lancaster, and then flows southward. Hunters Run flows east and joins the Hocking River in the western part of Lancaster. Another tributary, Tarhe Run, flows northeast through the southwest section of the city to the Hocking River at a point about 4000 feet downstream from Hunters Run. Fetters Run and Ewing Run flow south through the center of Lancaster combining to form Baldwin Run. Baldwin Run continues to flow south through Lancaster, emptying into the Hocking River about 2000 feet downstream of Tarhe Run.

The soils occurring on the uplands are primarily light colored Alexandria, Cardington, and Bennington silt loams. They are nearly level to sloping moderately productive soils with slow infiltration and rapid runoff rates. Genesee, Sloan, Fox, and Westland soils occur on the low lying floodplain and terrace portion of the watershed adjacent to the Hocking River and its major tributaries.

The climate of the watershed is temperate with relatively cool to cold winters and mild to warm summers. Mean temperatures range from 29.5 degrees F. in January to 73.6 degrees F. in July. Average annual precipitation is 36.9 inches.

Land use of the watershed is 41 percent cropland, 16 percent pasture, 24 percent woodland, and 19 percent in urban land or other uses. The city of Lancaster, which is located within the watershed, occupies about 15 percent of the area.

According to preliminary 1980 census information, the population of Lancaster is 34,911, a six percent increase since 1970. Fairfield County has a population of 93,549, which is more than a 27 percent increase since 1970. Both Lancaster and Fairfield County grew at rates greater than that of Ohio, whose population increased less than 2 percent from 1970 to 1980.

In 1970, 53 percent of the population of Lancaster was female, compared to 50.8 percent for Fairfield County. The percentage of minorities is less than one percent for both Lancaster and Fairfield County. Urban population accounts for 44.9 percent of the total for Fairfield County. In 1969, Lancaster had 3206

people with incomes below the poverty level compared to 7788 in Fairfield County.

In 1970, 44 percent of the labor force of Lancaster was employed in manufacturing and almost 19 percent in wholesale or retail trade occupations. Comparable data for Fairfield County shows 40 percent of the labor force employed in manufacturing, and almost 17 percent in wholesale or retail trade. Per capita income in 1974 was $4070 for the city of Lancaster and $3931 for Fairfield County, compared to $4561 for the state of Ohio. Recent data published by the Ohio Bureau of Employment Services shows the unemployment rate has been lower in Fairfield County than in either Ohio or the United States as a whole.

The Upper Hocking Watershed Project, carried out as a pilot project in the late 1950's, was intended to provide protection from the 25 year flood event. Floodwater retarding dams installed during this project and earthen levees constructed by the city of Lancaster have contributed to a false sense of security for area residents. There has been considerable development of the flood plains for both residential and commercial uses since completion of these structural measures. A flood plain zoning ordinance was recently enacted by the city of Lancaster to prevent future encroachment. Due to flood plain encroachment, the level of protection provided by the existing levees along the Hocking River has been reduced to about the 10 year flood event.

PROBLEM AND OPPORTUNITY IDENTIFICATION

The major problem in the watershed is reduced income or increased cost from floodwater damages along the Hocking River and its tributaries within the city of Lancaster. An estimated 535 residential units and 40 commerical properties are subject to flooding. Floodwater damages begin at about the 2-year frequency flood. Flood depths during the 100-year flood could be as deep as 11 ft. in some houses in the Maher Park area, thus posing a threat to loss of life.

On June 14, 1981, heavy rains fell in the watershed. The heaviest rainfall was concentrated in the Baldwin Run drainage area. Baldwin Run overflowed its banks causing flood damage to properties in the area. Hunters Run also went out of bank and several homes were flooded. Although the Hocking River itself was contained by existing levees, many residences received damages from surface runoff behind the dikes.

Average annual flood damages are summarized as follows:

Reach	Residential Property Number	Damage	Commerical Property Number	Damage	Total Damage
10	102	15,867	16	26,347	42,214
11	22	4,082	1	3,470	7,552
20	5	2,687	16	126,572	129,259
21	319	131,761	5	30,501	162,262
40	87	103,205	2	7,852	111,057
Total	535	257,602	40	194,742	452,344

Note: Urban evaluation reaches are shown on the reach map, page 8-2. No damage occurs in reaches 12, 13, and 14.

Due to the amount and extent of damages, and interest expressed by the sponsors, urban flooding is considered significant to plan formulation.

The scarcity of wildlife food and cover in cropland areas has been identified as a problem. During the last 20 years the number of farmers has decreased which has resulted in more acres being farmed by each farmer. Also many of these additional acres are share cropped or cash rented. This trend has resulted in fields being combined, fence rows being eliminated, and much of the acreage being fall plowed. This has reduced the number of field borders and wildlife food and cover.

In addition to a lack of wildlife food and cover there is also a lack of diversity of habitat in the cropland areas. There are few remaining wetlands in the watershed. The wetlands provide food, shelter, and habitat conducive to reproductive activities for a variety of terrestrial and aquatic species. There are wetland areas along the old Ohio Canal right-of-way and the present Chessie System Railroad in Greenfield Township, Fairfield County.

Now there are dikes along portions of the Hocking River, Hunters Run, Tarhe Run, and Baldwin Run. Along these areas are a mix of residential, commercial, and industrial establishments. This town has grown in a random pattern along the urban waterways which leaves an undesirable view for many of the residents located adjacent to the industrial and commercial businesses. There are parks adjacent to Baldwin Run and the Hocking River which are activity centers for the residents living near them. An improvement of the visual quality along the corridors leading to the recreation areas is desirable.

INVENTORY AND FORECASTING

SCOPING OF CONCERNS

An integral part of the planning process is an inventory and analysis of the concerns in the watershed. This is called scoping. The results of scoping are shown in Table A. The issues significant in the decision making process are identified here.

Other issues considered, but not significant to plan formulation are described in this section.

EROSION: Watershed erosion rates are typically at or below the allowable soil loss as defined by Agricultural Handbook No. 537, "Predicting Rainfall Erosion Losses". The mean soil loss as determined by 239 sample plots was approximately 3 tons per acre per year. Excessive soil losses as high as 20 to 30 tons per acre per year occur on isolated poorly managed areas of Alexandria silty clay loam, Muskingum Rocky Sandy Loam, and Loudenville Silt Loam. These soils occur on the steepest watershed slopes. Urbanizing areas on steeper slopes also promote excessive erosion before and during construction. See Appendix H.

The erosion problem is being addressed through the land treatment program carried out by the Fairfield Soil and Water Conservation District. The impact of erosion is therefore not considered significant to plan formulation, and is not discussed further.

SEDIMENTATION: The sediment yield from the watershed is in the range 200 to 350 tons per square mile per year. As defined by "Geological Survey Water Supply Paper 2045", sediment yield is modified downward due to the trapping effect of numerous man-made reservoirs and ponds throughout the watershed area. The watershed delivery system is well developed. Early farming practices used prior to the World War II decade promoted rill and gully development in the uplands and channel erosion of all major tributaries. Modern conservation practices have healed most of the severely eroding areas, but much of the delivery system remains. Practices such as floodwater retarding dams, farm ponds, and grassed waterways have had a significant impact in slowing the rate of delivery thereby reducing sediment transport.

Therefore, the problem is small enough to be handled through the going program, and sedimentation is not discussed elsewhere in the Plan-EIS.

LAND TREATMENT: There are 27,787 acres of cropland in the project. Practices being applied to adequately protect the cropland include conservation cropping systems, conservation tillage, contour strip cropping, crop residue management, contour farming, grassed waterways, grade stabilization structures, and subsurface drainage.

TABLE A

Significant Concerns

Listing	Significance	Remarks
Water Quality	Low	Project will have no effect on W/Q. See Appendix "E".
Fisheries	Low	Project action will have no effect on fisheries. See Appendix "D".
Wildlife	Medium	Lack of cover and habitat diversity in cropland areas. See Appendix "D".
Visual Quality	Medium	Need some improvement of visual quality in urban dike areas.
Wetlands	Low	Project action will have no effect on wetlands.
Prime Farmland	None	No prime farmland will be affected by project action.
Archaeological and Historical resources	None	No resources have been identified in the Project Action areas.
Endangered Species	None	Project action will have no effect on endangered species. See Appendix "D".
Woodland	Low	
Agricultural Flooding	Low	
Urban Flooding	High	
Sediment and Erosion	Low	Going program.
Cultural Resources	Low	Project will have no effect on cultural resources.
Social Concerns	Medium	Established social patterns may be disrupted during the construction period.

There are 11,032 acres of pasture and 16,609 acres of woodland. Practices being applied include pasture planting, pasture management, spring development, tree planting, and pond construction.

There are 10,044 acres in urban areas. Conservation practices for this area include critical area planting, wildlife upland habitat management, pond construction, and fish pond management.

As stated briefly in the Erosion and Sedimentation sections, the problem is small enough to be handled by the going program. Therefore, accelerated land treatment measures are not included in this project.

WOODLANDS: Most of the forest land occurs in the southern part of the watershed on moderately steep slopes. The remainder of the forested acreage is scattered over the watershed as small farm woodlots found on gently rolling topography. The average forest ownership is 27 acres. The watershed is located within the Central Hardwood Region.

Forest products recently harvested from this watershed are minimal. Many forest owners are absentees and do not participate in available forest management assistance. A significant amount of the forested portion of the watershed north of Lancaster is being developed into housing sites. It is estimated that 75 acres of forest land is being converted annually to housing sites.

There are very few areas with erosion and sedimentation problems within the watershed that are due to forest activities. The current Cooperative Forestry Management Program, as administered by the Project Foresters of the Ohio Department of Natural Resources, Division of Forestry, is capable of handling current and anticipated future needs of forest land treatment. The going forest land treatment program of the Ohio Department of Natural Resources, Division of Forestry, in cooperation with USDA, Forest Service could treat an estimated 360 acres annually and make three forest land management plans as follows:

ESTIMATED ANNUAL ACCOMPLISHMENTS

Management Plans (3 plans, 27 acres each)	81 acres
Reforestation - Tree Planting	30 acres
Timber Stand Improvement	130 acres
Protection from Grazing	75 acres
Harvest Cutting	125 acres

Therefore, forest land treatment needs are not considered significant and are not addressed further in this document.

AGRICULTURAL FLOODING: There are approximately 4300 acres of cropland in the floodplains of the watershed. About 2700 acres of cropland in the floodplain are located downstream from the city of Lancaster to the Hocking County line.

The greatest damage is when flooding occurs during the growing season. Flooding during the growing season reduces both the quality and quantity of harvested crops. Flooding and the threat of flooding also causes a loss of net income due to delayed planting.

During the scoping process, it was determined that there would be no economically feasible way to alleviate agricultural flooding. Therefore, agricultural flooding was not considered further, and is not addressed in the recommended plan or any of the candidate plans.

WATER QUALITY: Water quality and discharge characteristics were measured at 8 locations in the Hocking River Basin in and around Lancaster, Ohio. Data was collected over a six month period from April through September, 1980 by the USGS. Water quality at the upstream stations can be considered to be good. Dissolved oxygen levels, temperature and pH were well within acceptable standards. Nitrogen and phosphorus levels were somewhat elevated due to the runoff from the agricultural watersheds but usually do not produce nuisance algal blooms.

Low bacterial counts were evident and reflected both human and livestock sources that reside in the watershed. The aquatic diversity indices also reflected the good water quality in the upstream areas.

The urban sections through Lancaster downstream from Broad Street indicated a polluted condition. This was reflected by the high bacterial counts, low diversity index, lowered dissolved oxygen and enriched nutrient loadings of nitrogen and phosphorus.

FISHERIES: Recent surveys, performed by the ODNR Division of Wildlife indicate that there is no sport fishery in the study area due to intermittant flows in the upstream areas and poor water quality in the downstream reaches. They also indicated that due to the poor water quality there would be no improvement in the foreseeable future. The proposed project will have no significant effect on the fisheries in the watershed. See Appendix "D" for further information about the fisheries.

ENDANGERED SPECIES: The Indiana Bat is suspected to traverse the area during the summer months. The Division of Wildlife, Small Game and Endangered Species, ODNR was consulted to review the project area for any possible roosting trees. No roosting trees were found in the construction areas. See Appendix "D" for further information.

ARCHAEOLOGICAL AND HISTORICAL: The Ohio State Historical Society did an investigation to evaluate any archaeological or historical resources that would be affected by the planned project. None were found in the areas where work is planned.

Table A indicates the areas considered during the planning

process and their relative significance to the planned project. The following items have been determined to have little or no significance to the project and will not be discussed any further.

Water Quality
Fisheries
Agricultural Flooding
Prime Farmland
Woodland
Endangered Species
Sediment and Erosion
Wetlands
Archaeological and Historical Resources

FORECASTED CHANGES: Baseline data published by the U.S. Bureau of the Census indicate that growth and development of the watershed and surrounding areas are expected to continue to follow historical trends in the absence of a watershed plan. The 1972 OBERS Series E data published by the Water Resource Council for BEA area 64 also indicate continued growth. Baseline data and projections are summarized in Table B, page 5-6. Although the projections indicate an increase in damageable value, both in terms of the number and value of residential property and in the number of businesses, these increases were not considered in the evaluation of floodwater damages. Thus, all damages are based on the present value of existing properties.

Wildlife habitat will decrease in quantity and quality due to more intensive agricultural practices. Increased field size will eliminate fence rows and odd areas, resulting in less food and cover for wildlife.

The present low visual quality in urban areas is expected to remain the same in the future.

TABLE B - POPULATION AND ECONOMIC DATA, CURRENT AND PROJECTED

	1980		1990		2000		2020	
	Lancaster	Fairfield County	Lancaster	Fairfield County	Lancaster	Fairfield County	Lancaster	Fairfield County
Population	34,911	93,549	39,700	106,300	43,400	116,000	49,500	132,600
Per Capita Income 1/	4,025	3,768	5,200	4,900	7,100	6,700	11,800	11,000
Employment	16,884	35,277	19,400	40,600	22,100	46,100	25,100	52,300
Manufacturing (in millions) 1/	143.3	168.6	199.9	235.1	276.2	325.0	480.8	565.6
Agriculture (in millions) 1/	-	16.6	-	17.6	-	19.5	-	24.3

1/ In constant (1967) dollars

FORMULATION OF ALTERNATIVES

General: This section explains how the alternatives were formulated and which items were considered in making the final selection for the measures to be included in the recommended plan.

Formulation Process: Project formulation was begun by listing those measures which would help solve one or more of the identified problems. A preliminary analysis was then made of the impact of each measure under consideration on each of the problems. All alternatives were evaluated against the criteria of completeness, effectiveness, efficiency, and acceptability. Table C, "Impact of Potential Measures on Project Problems" summarizes the results of this effort.

All the measures studied have either a positive or no impact on the identified problems except in two instances. The two negative impacts were for a floodwater retarding dam and bridge removal and modification on Baldwin Run. These measures were considered to have negative impacts because costs exceeded benefits.

Measures evaluated on Baldwin Run included one floodwater retarding dam, dikes (on each side separately, and on both sides) widening of one bridge, and flood proofing of various commercial properties. Of these, the dike on the "left side only" and flood proofing were found to have net benefits. Since flood proofing provided a greater level of protection at a lower cost than the dike, flood proofing was incorporated into the N.E.D. plan for Baldwin Run.

Measures evaluated on the Hocking River hydrologic unit included dikes with a floodwater retarding dam, dikes with a culvert to ease flow restrictions on Tarhe Run, various sizes of pump storage systems, flood proofing, one bridge removal, and a flood warning system. The dike on Hunters Run and bridge modification were considered separately. Due to hydrologic conditions, Maher Park dike and Tarhe Run dike had to be evaluated as one unit. The reason for this is that both overflow into a common floodplain. Due to engineering considerations, Maher Park and Tarhe Run dikes had to be combined with either a floodwater retarding dam or culvert replacement under U.S. Route 33 over Tarhe Run. Without either the dam or culvert replacement, the Tarhe dike would have to be raised by 11.0 feet which is impractical.

Hunters Run dike virtually eliminated damages to the affected area and was included in the N.E.D. Plan. Maher Park dike and Tarhe Run dike in combination with Tarhe Run dam provided the same level of protection at a much lower cost than the dikes with culvert replacement. Therefore, dikes with dam were included in the N.E.D. Plan. Flood proofing of selected commercial properties in reaches 10, 11, and 20 was found to be cost effective, and was also included. Additionally, a flood warning system was economically feasible and was incorporated into the plan. It was found during the evaluation process that signifi-

TABLE C - IMPACT OF POTENTIAL MEASURES ON PROJECT PROBLEMS

Problems and Opportunities	Floodwater Retarding Structures	Flood Prevention Dikes	Accelerated Land Treatment	Floodplain Land Use and Ownership Adjustments	Flood Warning System	Bridge Removal and Modification	Flood Proofing
Urban Flooding							
Baldwin Run	-	+	N	N	+	-	+
Hocking River	+	+	N	N	+	+	+
Hunters Run	N	+	N	+	+	+	N
Poor Visual Quality	N	+	+	+	N	+	N
Lack of Wildlife Habitat in Cropland Areas	N	N	+	N	N	N	N
Preservation of Wetlands	N	N	N	+	N	N	N

+ Favorable - Unfavorable N No Impact

cant damages remain to residential properties as a result of interior surface flooding behind the dikes. To reduce these damages a pump storage system and diversion dam was designed to provide a 25 year level of protection. This was found to have benefits in excess of costs, and was included in the N.E.D. Plan. Increasing the capacity of the pump storage system to a 100 year level of protection reduced remaining damages. However, the cost of the increased capacity was greater than benefits so this increment was not included in the N.E.D. Plan.

The results of the incremental analysis are summarized in Table D, "Incremental Analysis".

Candidate plans were developed from the scoping process and incremental analysis.

EVALUATION OF CANDIDATE PLANS

NED PLAN

Candidate Plan 1: The National Economic Development Plan consists of Hunters Run, Maher Park, and Tarhe Run Dikes; a bridge removal on Tarhe Run; a bridge modification on Hocking River; Tarhe Dam; pump storage system and diversion dam with reinforced concrete pipe outlet; and two non-structural measures: flood proofing of selected properties, and a flood warning system.

The dikes will be either earth fill or a combination of earthfill and concrete. The dam will be a "dry" dam located upstream from Mill Road southeast of Lancaster. It will impound water for a short time during severe storms and then it will drain and be dry. The abandoned railroad bridge on the Hocking River near the junction of Hunters Run will be raised in place to improve the hydraulic efficiency of the channel and another bridge will be removed on Tarhe Run. The pump and temporary storage system is designed to reduce the flood damages in the residential area near Maher Park. The diversion dam is designed to divert water from the west side of Broad Street to Tarhe Run. This will be located near Tarhe Street and will outlet at Utica Park.

Flood proofing measures were designed for 7 buildings in reaches 10, 11, and 20. The flood warning system will be installed so that advance warnings can be given to flood plain residents and businesses in the watershed.

Economic Effects

Flood damage reduction benefits are estimated to be $369,052, annually. Estimated average annual costs are $115,397, with a benefit-cost ratio of 3.2:1.0.

Impacts of the NED Plan would be:

1. The watershed economy would experience a minor uplift through construction spending. Implementation of the NED Plan would create 10.3 jobs for two years.

TABLE D
INCREMENTAL ANALYSIS
Average Annual Dollars 1/ 3/

ITEM	Total Costs 2/4/	Total Benefits	Incremental Costs 2/4/	Incremental Benefits	Net Benefits
Increment #1: Hunters Run Dike	17,784	110,035	17,784	110,035	92,251
Increment #2: Increment #1 + Tarhe Dam	37,797	130,171	20,013	20,136	123
Increment #3: Increment #2 + Maher Park and Tarhe Run Dikes	64,021	195,767	26,224	65,596	39,372
Increment #4: Increment #3 + Flood Proofing	72,490	233,438	8,469	37,671	29,202
Increment #5: Increment #4 + Flood Warning System	78,352	320,493	5,862	87,055	81,193
Increment #6: Increment #5 + 54" RC Diversion Dam Storage Pond & Pumps (25-yr. level of protection)	115,397	369,052	37,045	48,559	11,514
Increment #7: Increment #6 + Larger capacity Storage Pond & Pumps (100-yr. level of Protection)	152,529	371,755	37,132	2,703	-34,429

1/ Price Base: 1981

2/ Amortized at 7 5/8 percent interest for 100 years.

3/ Includes interest costs incurred on installation and O,M, & R costs and benefits accrued during project installation period.

4/ Includes installation costs and O,M, & R.

2. Energy use would increase during construction and decrease during the 100 year life of the project.

3. A reduction of urban flooding in affected areas by 80 percent would be realized.

4. Construction will remove 2 acres of woodland habitat near the dam site. The hardwoods removed will be mitigated with other trees.

5. It is estimated that 8.7 acres of grass, trees, and shrubs in the construction areas would be planted.

6. Two residential properties would need to be relocated due to project constructon on Hunters Run.

7. Visual quality would be improved by planting trees and shrubs. A total of 8.7 acres of grass, trees, and shrubs would be planted in dike construction areas.

8. A disruption of the established social patterns may result for the people living along the dike during the construction period.

ENVIRONMENTAL QUALITY PLAN

Candidate Plan 2: The E.Q. Plan includes the following measures:

1. Planting trees and shrubs on existing levees to improve visual quality. These plantings would provide screening of commercial buildings from residential areas.

2. Planting field border strips of trees and shrubs to provide wildlife winter cover. It is estimated that 25% of the cropfields could be planted which would amount to an additional 169 acres of wildlife habitat. Technical assistance would be provided by SCS with plant materials being provided through the Ohio Department of Natural Resources, Division of Wildlife.

3. Purchase of wetland areas along U.S. Route 33 to preserve wetland habitat. An estimated 71 acres have been identified in this area.

Estimated average annual costs of the Environmental Quality Plan are $17,153.

Impacts to the natural environment would be:

1. An improvement in the visual quality of the natural resources and an improvement of the social well being of the people along the dike corridor.

2. An increase in the quantity and an improvement in the quality of wildlife habitat.

3. The preservation of wetland habitat.

NONSTRUCTURAL PLAN

Candidate Plan 3: The nonstructural measures of flood proofing and flood warning systems were selected for reaches 10, 11, and 20 as the best means of providing flood damage reduction.

Flood plain evacuation was considered for reaches 21 and 40, but was not found to be economically feasible.

Nonstructural measures alone leave significant remaining flood damages to other reaches in the study area. To achieve the goal of urban flood damage reduction, additional structural measures were required. Therefore, the primarily nonstructural plan is the same as the NED plan.

Economic Effects

Average annual benefits are estimated to be $369,052 with costs of $115,397. The benefit-cost ratio is 3.2:1.0.

Impacts of the Nonstructural Plan would be:

1. The watershed economy would experience a minor uplift through construction spending. There would be a creation of 10.3 jobs for a period of two years.

2. Energy use would increase during construction and then decrease during the 100-year life of the project.

3. A reduction of urban flooding in affected areas by 80 percent.

4. Construction would remove 2 acres of woodland habitat. The hardwoods removed would be mitigated with other trees.

5. It is estimated that 8.7 acres of grass, trees, and shrubs in the construction areas would be planted.

6. Two residential properties would need to be relocated due to project construction on Hunters Run.

7. Visual quality would be improved by planting trees and shrubs. A total of 8.7 acres of grass, trees, and shrubs would be planted on dike construction areas.

RECOMMENDED PLAN

CANDIDATE PLAN #4: Measures included in the Recommended Plan are Hunters Run, Maher Park, and Tarhe Run Dikes; a bridge removal on Tarhe Run; a bridge modification on Hocking River; Tarhe Dam; pump storage system and diversion dam with reinforced concrete pipe outlet; flood warning system; and planting of field border strips to provide winter wildlife food and cover.

Economic Effects

Average annual costs to the Environmental Quality objective are $13,177. The EQ costs will be borne by local funds. Average annual costs to the NED objective are $113,711. Average annual benefits are $333,389, and the benefit-cost ratio is 2.9:1.0.

Impacts from implementation of this plan are expected to be:

1. The watershed economy would experience a minor uplift through construction spending. Implementation of the Recommended Plan will create 9.9 jobs for two years.

2. Energy use in the watershed would increase during construction and decrease during the project life.

3. A reduction of urban flooding in affected areas by 72 percent.

4. Construction will remove 2 acres of woodland habitat near the dam site. The hardwood species removed will be mitigated with other trees.

5. It is estimated that 8.7 acres of grass, trees, and shrubs will be planted in the construction areas.

6. Change 169 acres of cropland to trees and shrubs to improve wildlife habitat.

7. Two residential properties would need to be relocated due to project construction on Hunters Run.

8. Visual quality would be improved by planting trees and shrubs. A total of 8.7 acres of grass, trees, and shrubs will be planted on dike construction areas.

9. A disruption of established social patterns may result for the people living along the dike during the construction period.

NO PROJECT

Candidate Plan #5: The alternative of "no project" would leave the water and related land resource problems unsolved. Flooding of urban areas would still occur. Approximately 575 residences and commercial properties would still be affected by floodwaters from the 500 year flood event.

A trend toward more intensive agricultural practices will result in a decrease of the quantity and quality of the wildlife habitat in the watershed. No significant change in wetlands is anticipated. The low visual quality present in urban areas is expected to be relatively unchanged in the future.

Land uses in the flood plains are expected to continue unchanged without project implementation. Residential or commercial use

of flood plains is not expected to increase due to flood plain zoning. Estimated average annual net benefits foregone are $214,383 if the Recommended Plan is not implemented.

COMPARISON OF CANDIDATE PLANS

A comparison of the various economic and environmental impacts of the candidate plans are summarized in Table E, "Comparison of Candidate Plans".

Project Interaction:

There are no existing or proposed Federal or non-Federal projects having significant economic, environmental, or physical interaction with any of the candidate plans.

It is assumed that a storm sewer line proposed by the City of Lancaster will be in place, or built concurrently with the Recommended Plan. The City of Lancaster has completed the design and has proceeded with a preliminary assessment for the storm sewer project.

Risk and Uncertainty:

"Without" and "with" project damages and benefits are based on the present value of existing properties. No projections of future property values were made in the evaluation of floodwater damages.

The risk of Tarhe dam failing from overtopping is infinitesimal. The risk of a failure due to a seepage or piping failure is only slightly more probable. See Appendix G for a map showing the inundation area should the dam fail.

The dikes have been designed to contain the 500 year flood so the risk of them being overtopped is less than 0.2% for any given year. The uncertainty of the pump system failing to operate has been reduced by including stand-by generators that will automatically kick-in should an electrical outage occur.

RATIONALE FOR SELECTION OF RECOMMENDED PLAN

The recommended plan was a result of input from the public, sponsors, and various agencies.

The recommended plan consists of components from the NED, E.Q. and Nonstructural plans to solve the problems identified in the watershed. Items selected from the NED plan include:

a. Diking along Hunters Run, Hocking River, and Tarhe Run.
b. Tarhe Dam.
c. Diversion dam with reinforced concrete pipe outlet near Utica Park.
d. Storage basin and pumps.
e. One bridge modification on Hocking River and one bridge removal on Tarhe Run.

TABLE E

COMPARISON OF CANDIDATE PLANS

	Objectives	Candidate Plan 1 NED	Candidate Plan 2 E.Q.	Candidate Plan 3 Nonstructural	Candidate Plan 4 Recommended	Candidate Plan 5 No Project
Total Project Cost 1/	NA	1,445,862	224,810 4/	1,445,862	1,430,669 5/	0
Local Share of Installation Cost 1/	NA	176,993	219,310 4/	176,993	158,772 5/	0
Annual O,M,&R Cost 1/	NA	5,076	0	5,076	4,551 5/	0
Annual Cost 1/ 2/	NA	115,397	17,153	115,397	113,711 5/	0
Annual Benefit 3/	NA	369,052	0	369,052	333,389 5/	0
Net Benefits	NA	253,655	-17,153	253,655	219,678	0
Number of Properties Reduced to No Flooding at 100 yr. level	464	308	0	308	296	0
Acres of Aquatic and waterfowl Habitat Protected	71	0	71	0	0	0
Acres of Forest and Brush Land Removed	NA	No effect	No effect	No effect	No effect	No effect
Acres of Trees, Shrubs and Grass Planted to Provide Nesting Cover	NA	0	169	0	169	0
Percent Urban Flood Damage Reduction	100	80	0	80	72	0

1/ Includes interest costs incurred during project installation period.
2/ Amortized at 7 5/8 percent interest for 100 years (includes construction, engineering, landrights, project administration, O,M,&R, and interest costs incurred during project installation period.
3/ Includes benefits accrued during installation period.
4/ Includes $116,043 for loss of net income due to conversion of cropland to wildlife land.
5/ Excludes costs of wildlife habitat improvement.

One item each was selected from the E.Q. and nonstructural plans. These are respectively:

a. Field border plantings.
b. Flood warning system (This measure is also part of the NED plan.

The pumps and storage basin were altered from the NED plan to make the measure acceptable to the sponsors and to reduce the depth of water that would be stored in Maher Park. This change was a result of public participation by the sponsors, residents, and SCS to resolve questions concerning safety and aesthetic appearance.

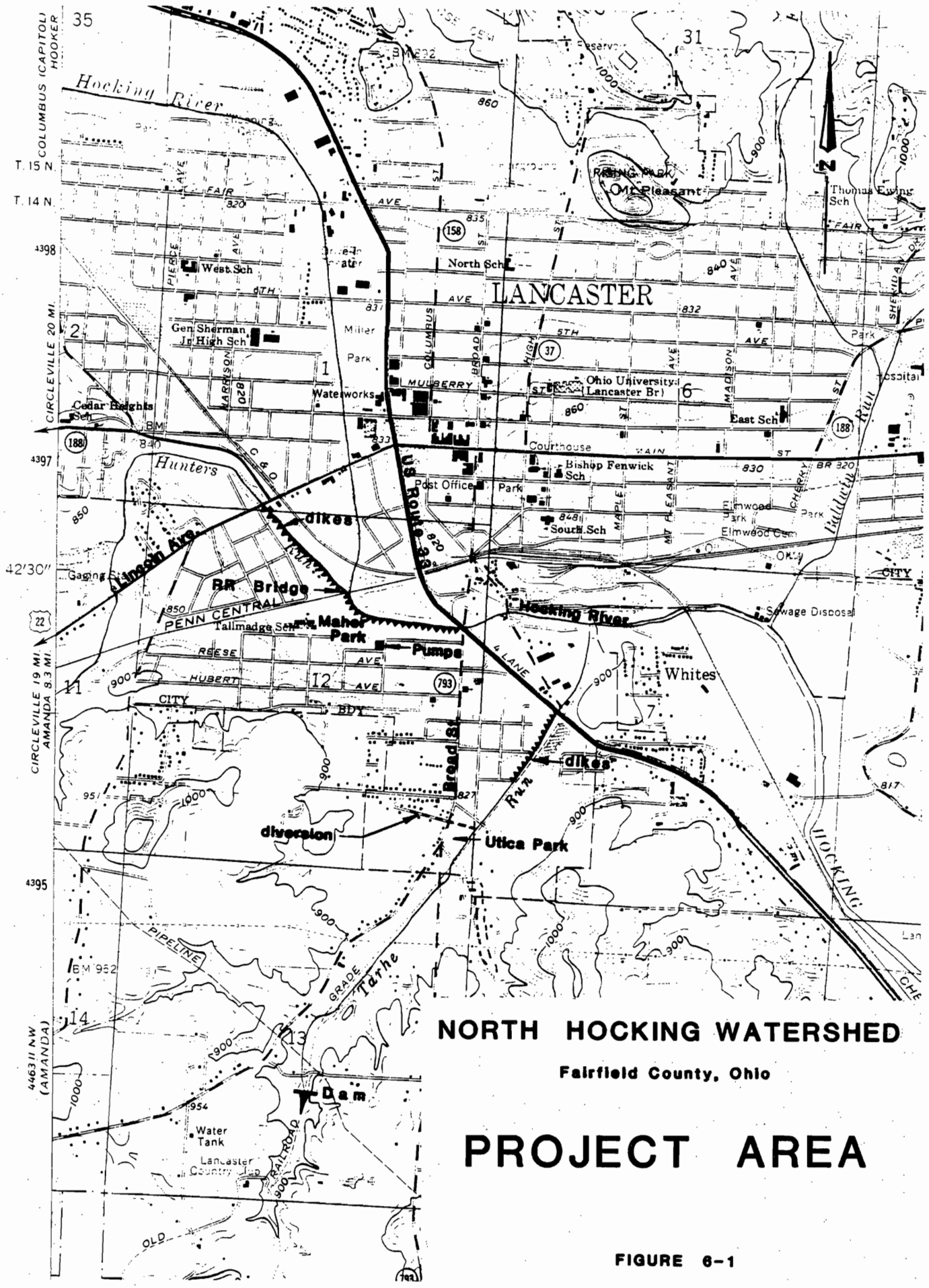
The recommended plan will also include plantings and landscaping measures along the dikes to provide a pleasing appearance. These will be included as mitigative features of the dike construction.

The flood warning system was included because it was cost effective and provided a method to reduce damages for all the flood plain residents and businesses.

The wetland preservation was not chosen as a component because it was concluded that these areas would likely remain intact without any formal purchase. Furthermore, there was no strong support from the local sponsors to initiate a formal commitment on these areas.

The flood proofing measures were not included because there was little support from local businesses and officials in pursuing this item.

The Sponsors approved the Recommended Plan as described above.



NORTH HOCKING WATERSHED

Fairfield County, Ohio

PROJECT AREA

FIGURE 6-1

RECOMMENDED PLAN

Purpose:

The North Hocking Watershed Plan consists of land treatment measures for wildlife habitat improvement, flood prevention dikes, a floodwater retarding dam, pump system, one bridge modification, one bridge removal, and diversion dam for flood damage reduction and environmental quality improvement. In addition, there is a flood warning system to reduce flood damages.

Plan Elements:

Field border plantings are included as an accelerated land treatment measure to improve the poor wildlife food and cover on the cropland. This measure will help solve the problem identified in the Environmental Quality Account. There are an estimated 28,000 acres of cropland in the watershed and 30% of this is fall plowed. It is estimated that through an educational program and technical assistance field borders could be planted on 25% of the cropfields.

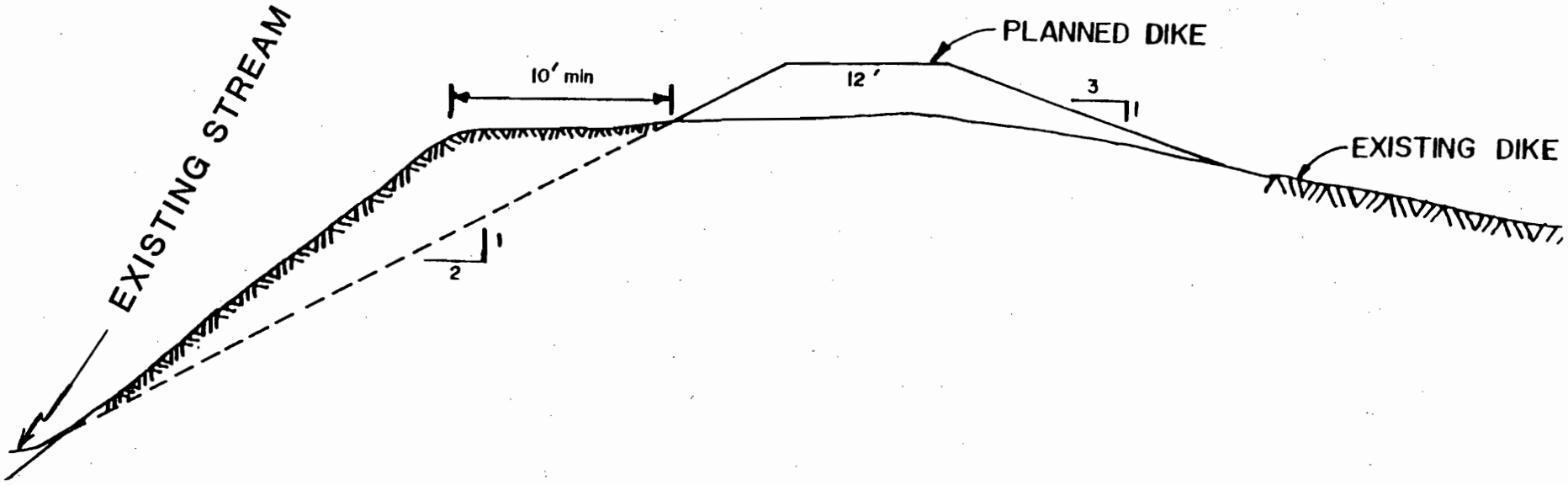
Flood prevention dikes are planned along 0.97 miles of the channel corridor in Lancaster. These dikes will be constructed at the following locations:

1. Hocking River (0.36 mile)
   Right Side, from Broad Street to Abandoned Railroad.
2. Hunters Run (0.31 mile)
   Right Side, from Abandoned Railroad to Lincoln Ave.
3. Tarhe Run (0.30 mile)
   Left Side, from U.S. 33 to Alley Street.

The dikes are designed to provide protection from the 100-year storm event with an additional 2 feet of freeboard added for safety. Dike design is based on geologic and soils data gathered by drilling, soil sampling, and subsequent laboratory and soil mechanics analyses. The dikes will consist of either earth fill or a concrete wall and are designed to be stable under all conditions. See Figures 7-1, 7-2 for a typical cross-section. In addition, a landscape architect will help in designing a plan in cooperation with the local residents that will be both functional and aesthetically pleasing. See Figures 7-3 and 7-3a for an artist's conception of the dikes and Table 3 for design data for the dikes. Anyone desiring information concerning a specific property can contact the SCS office, 1109 E. Main St. Lancaster, O.(Phone 653-5320)

A pump and temporary storage system is planned for the Maher Park and adjacent residential area behind the Hocking dike. This is needed to reduce the flood damages caused by runoff from the rain falling on the immediate watershed which becomes concentrated in the Hubert, Reese, and Lewis Street area.

The pumps will be designed to transfer the water from the low



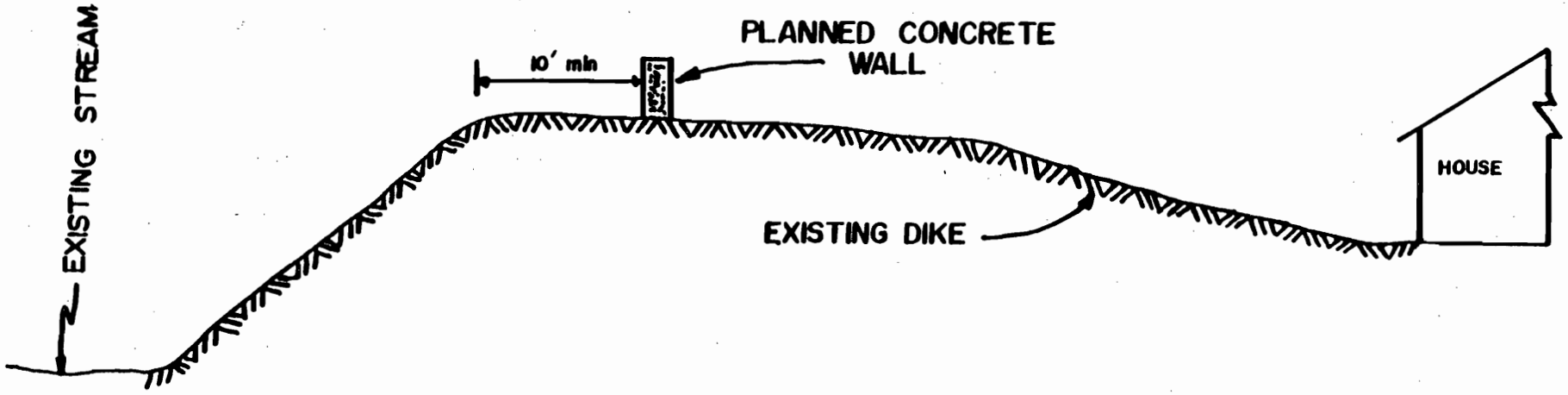
STATION 180+50

HOCKING RIVER

TYPICAL CROSS SECTION

EARTHEN DIKE

FIGURE 7-1



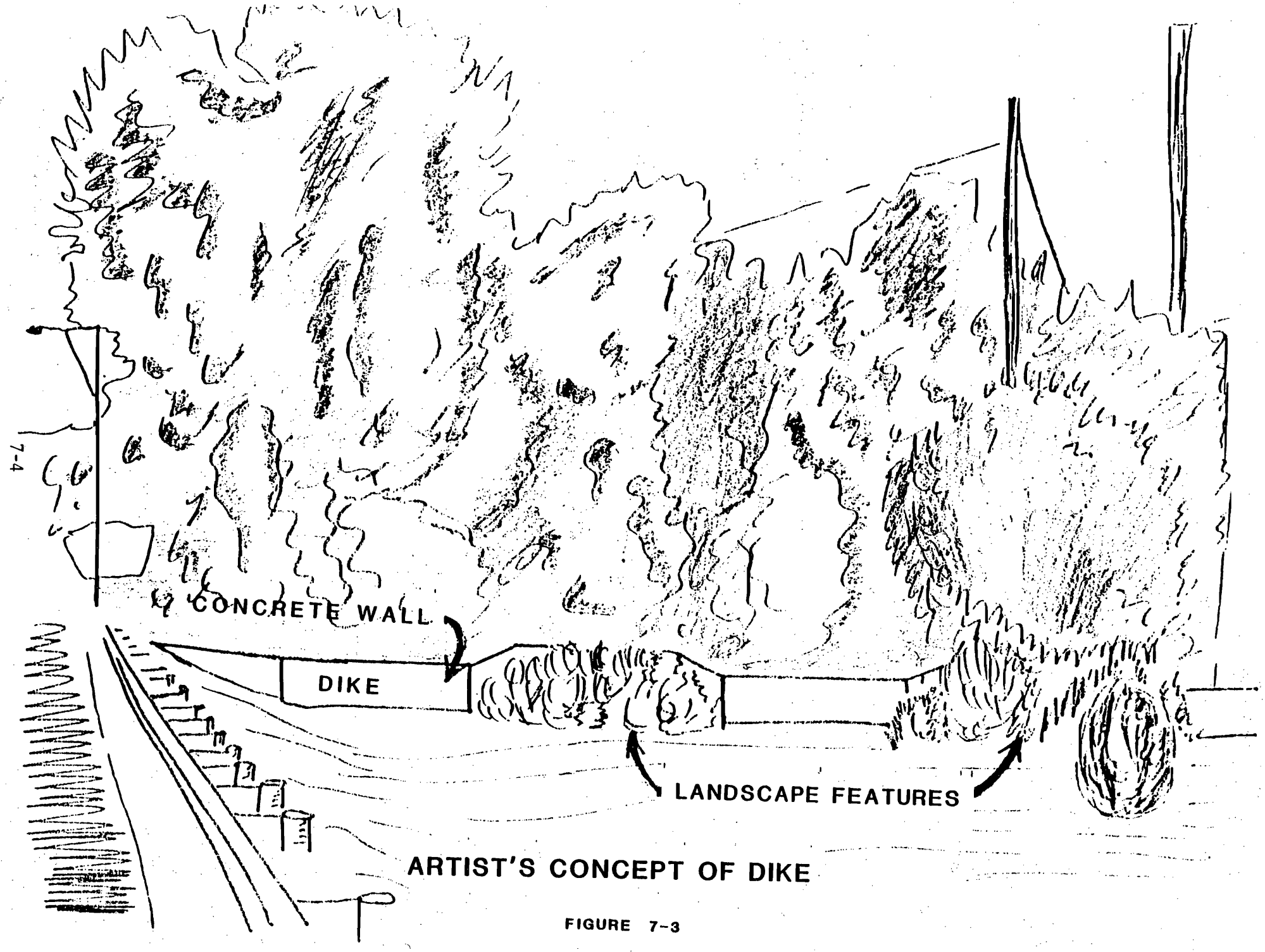
STATION 195+75

HOCKING RIVER

TYPICAL CROSS SECTION

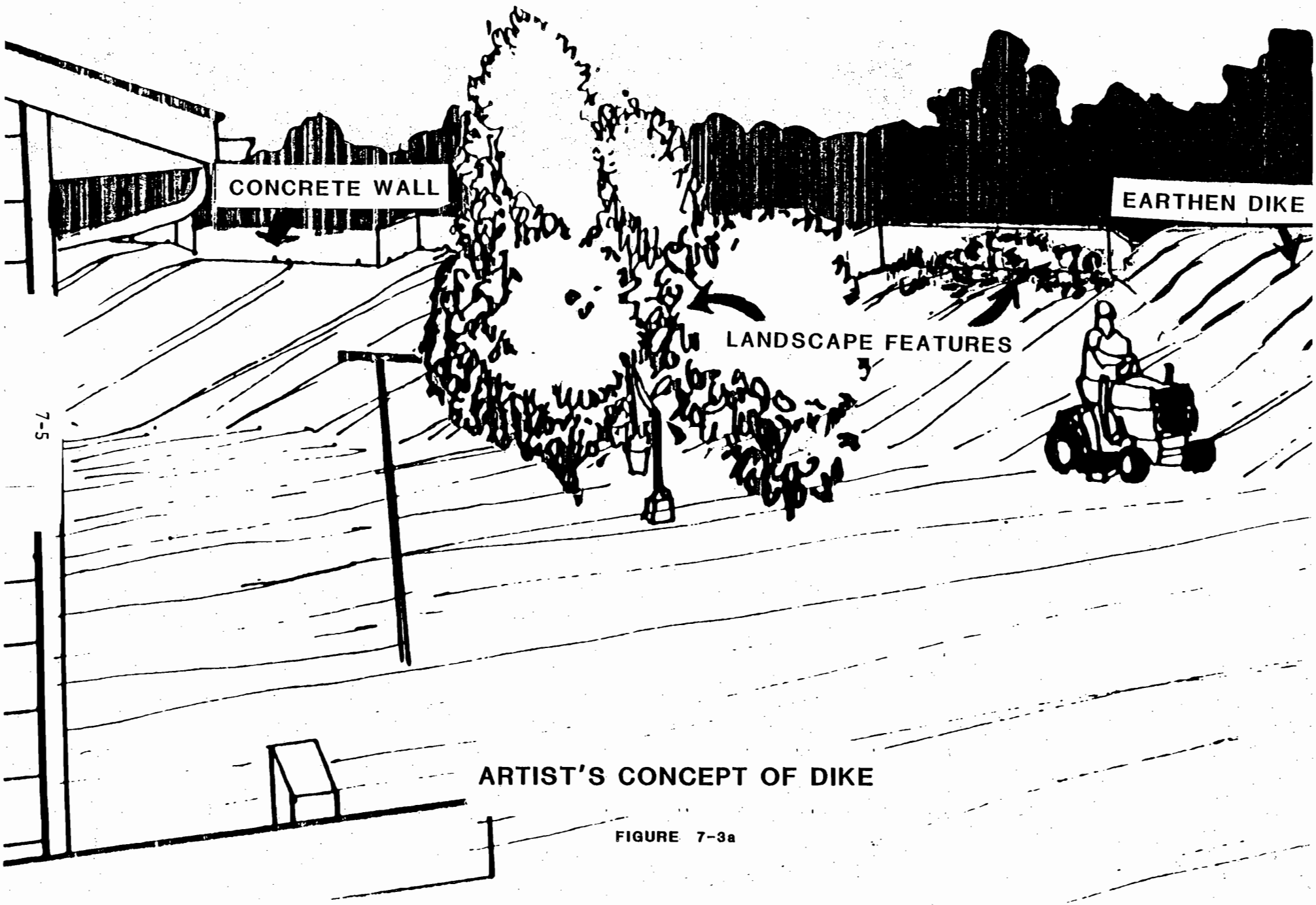
CONCRETE WALL

FIGURE 7-2



ARTIST'S CONCEPT OF DIKE

FIGURE 7-3



ARTIST'S CONCEPT OF DIKE

FIGURE 7-3a

lying area between the streets directly to the Hocking River. Runoff exceeding the capacity of the existing storm sewers from the area south and west of Maher Park will flow by gravity into Maher Park for temporary storage.

The drainage and storage characteristics of Maher Park will be improved by building a low dike around the perimeter, regrading the area and installing surface inlets. Maher Avenue will be regraded and a dropbox will be installed at the junction of Maher and Reese Avenue to permit overland runoff to flow into Maher Park. See Figure 7-4 for a typical section of a multi-use storage basin.

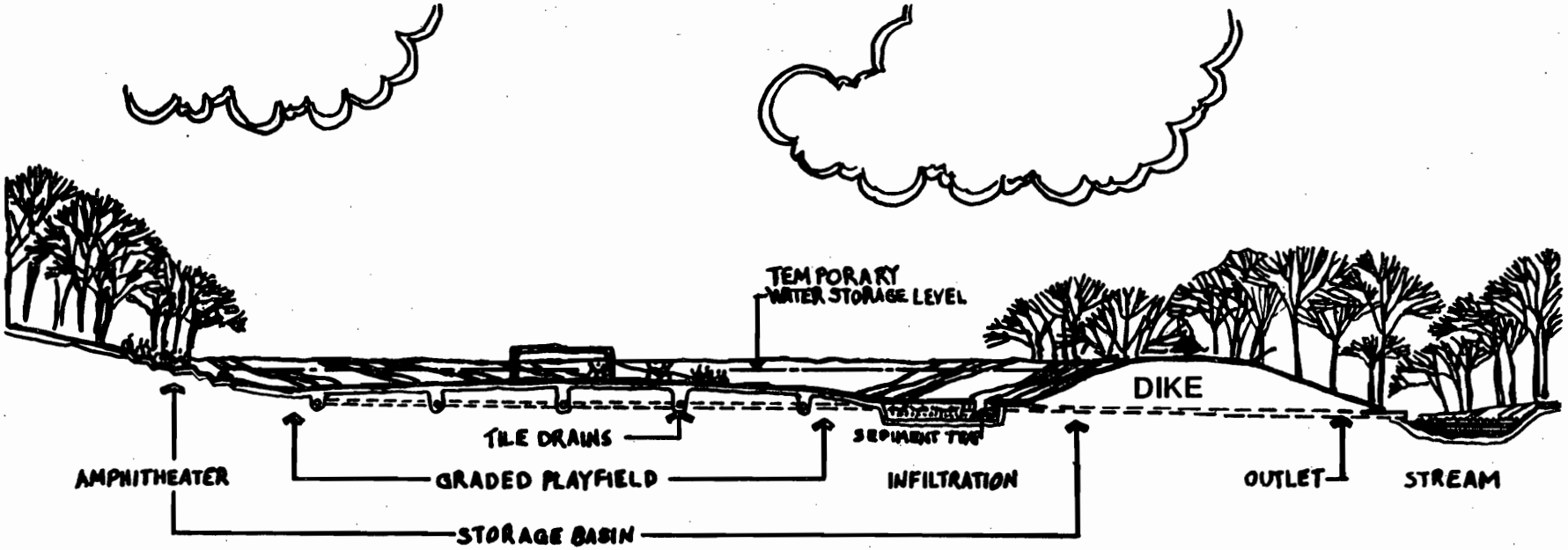
A flood diversion dam with an outlet conduit is planned for the drainage area upstream from Tarhe Street. This structure will consist of an inlet to divert flows into a 54-inch diameter pipe which will carry the flows underground and outlet them into Tarhe Run at Utica Park. This diversion structure is designed to reduce the amount of water draining into the existing 48 inch conduit so that the existing structure will no longer overflow causing flooding in the Lewis-Reese-Hubert Street area. This installation will carry flows from the 100 year event without overflowing.

A flood retarding dam is planned for Tarhe Run upstream from Mill Road and downstream from the Lancaster Country Club. The reservoir will have storage volume reserved for sediment, floodwater, and safety. The volume reserved for sediment will be equivalent to the expected accumulation in 100 years. The dam will impound no water except during periods of excessive rainfall, therefore, it will be a "dry" structure. The volume reserved for floodwater will provide control for the expected runoff from a combination of severe runoff producing conditions, including saturated soil moisture levels and prolonged storms. The design runoff for determining floodwater storage capacity was 7.1 inches. The emergency spillway is designed to safely discharge the flow volumes produced by the design storm. Additional height is added to the dam as freeboard to safeguard the embankment during unusual storm events.

Structural design is based on geologic data gathered by geologic mapping, drilling, sampling, and on subsequent laboratory analyses of soil samples.

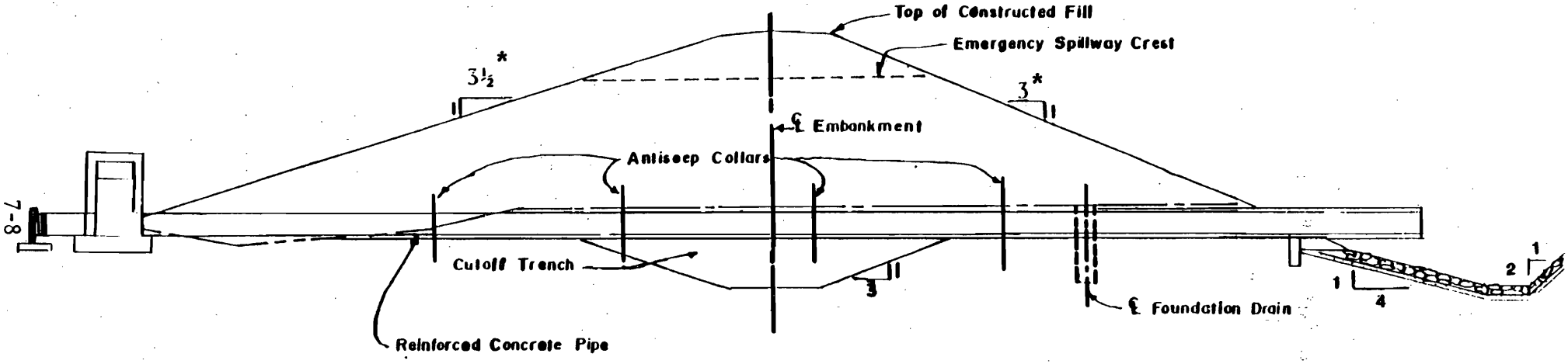
The dam will be constructed of compacted earthfill excavated from the emergency spillway. The principal spillway will be a precast reinforced concrete conduit with an energy-dissipating structure at the outlet. See Table 3 for design data on the dam and Figure 7-5 for a typical cross-section of the dam.

Grass will be established on the dam and emergency spillway. Odd areas on the backslope of the emergency spillway and around the dam will be planted to wildlife habitat equal in value to that lost from building the dam. Disturbed areas will be seeded to permanent vegetation as soon as practical after other con-



TYPICAL SECTION MULTI-USE STORAGE BASIN

FIGURE 7-4



TYPICAL CROSS SECTION OF FLOODWATER RETARDING DAM

FIGURE 7-6

* Side slopes shown are approximate. They may be steeper pending results of the slope stability analysis.

struction activities are completed. Any areas subject to construction delays greater than three weeks will be seeded with a quick germinating small grain or grass to provide erosion protection. When weather conditions become unfavorable for successful seedings, construction will be stopped or exposed areas will be mulched. Construction activities will be scheduled to keep exposed areas to a minimum and the contractor will be required to use erosion control techniques such as diversions or debris basins.

Dams designed by SCS are classified according to the potential hazard to life and property should the dam fail.

Class A - Dams located in rural or agricultural areas where failure may damage farm buildings, agricultural land, or township and county roads.

Class B - Dams located in predominantly rural or agricultural areas where failure may damage isolated homes, main highways or minor railroads or cause interruption of use or service of relatively important public utilities.

Class C - Dams located where failure may cause loss of life, serious damage to homes, industrial and commercial buildings, important public utilities, main highways, or railroads.

The Tarhe dam has been classified as "C". This dam has been designed to safely pass a storm of 26.7 inches in six hours, which is the probable maximum precipitation for this area. This floodwater would be temporarily held behind the dam and released at a rate that ensures dam safety.

While the dam in this project is not expected to fail, there is always a risk of failure any time a dam is constructed. However, by using more restrictive design criteria and the best investigative design and construction techniques available, this risk is kept to a minimum. Local land use planning organizations should be aware of the hazard and plan the land use accordingly. No residential or industrial development should be permitted downstream from a dam where there is any chance for loss of life should the dam breach. A map showing the areas that would be affected by a breach of the Tarhe Dam is shown in Appendix G.

The procedure "Simplified Dam Breach Routing" was used to predict the effects of a sudden failure of Tarhe Dam. The failure was assumed to occur when the elevation of the water was at the emergency spillway crest. The flood wave would proceed downstream at a depth of approximately 12 feet until it reached Utica Park. In its path are 5 dwellings, one township road, and one county road that would be inundated with 4 to 12 feet of water.

After the water reaches Utica Park the peak dissipates rapidly as the valley widens into the Maher Park-Broad Street area. The

depths in this area range from 4 to 12 feet deep and are very close to the elevations predicted for the 500 year "without project" event. Downstream from U.S. Route 33 the flows would stay in bank and would cause no significant damage.

A large number of homes would be damaged in the Maher Park-Broad Street area and a threat to loss of life would exist.

Other items included in the recommended plan are one bridge modification and one bridge removal. These are needed to improve the hydraulic characteristics of the channels. The abandoned railroad bridge crossing the Hocking River near the confluence of Hunters Run will be raised in place to eliminate any headloss for the 100-year event. By leaving the bridge intact it can still be used as an access route to Cenci Park. The cost for this is included in the design for the Hunters Run Dike. The other bridge is located on Tarhe Run near the upstream end of Utica Park. The deck has collapsed and the abutments are undermined and unstable. This bridge will be removed. The cost for this work has been included in the cost for Tarhe Run Dike.

A flood warning system is planned as a method to reduce flood damages in the urban floodplain area. The system will be designed in cooperation with a National Weather Service Program.

A system of continuous recording rain gauges and stream gauges will be installed and will send rainfall and stream stage information to a central location to be analyzed. A stream flood model (computer program) will be designed by NWS personnel to predict flood stages far enough in advance to allow businesses to move their inventory to safe locations and to allow residents to prepare for flooding.

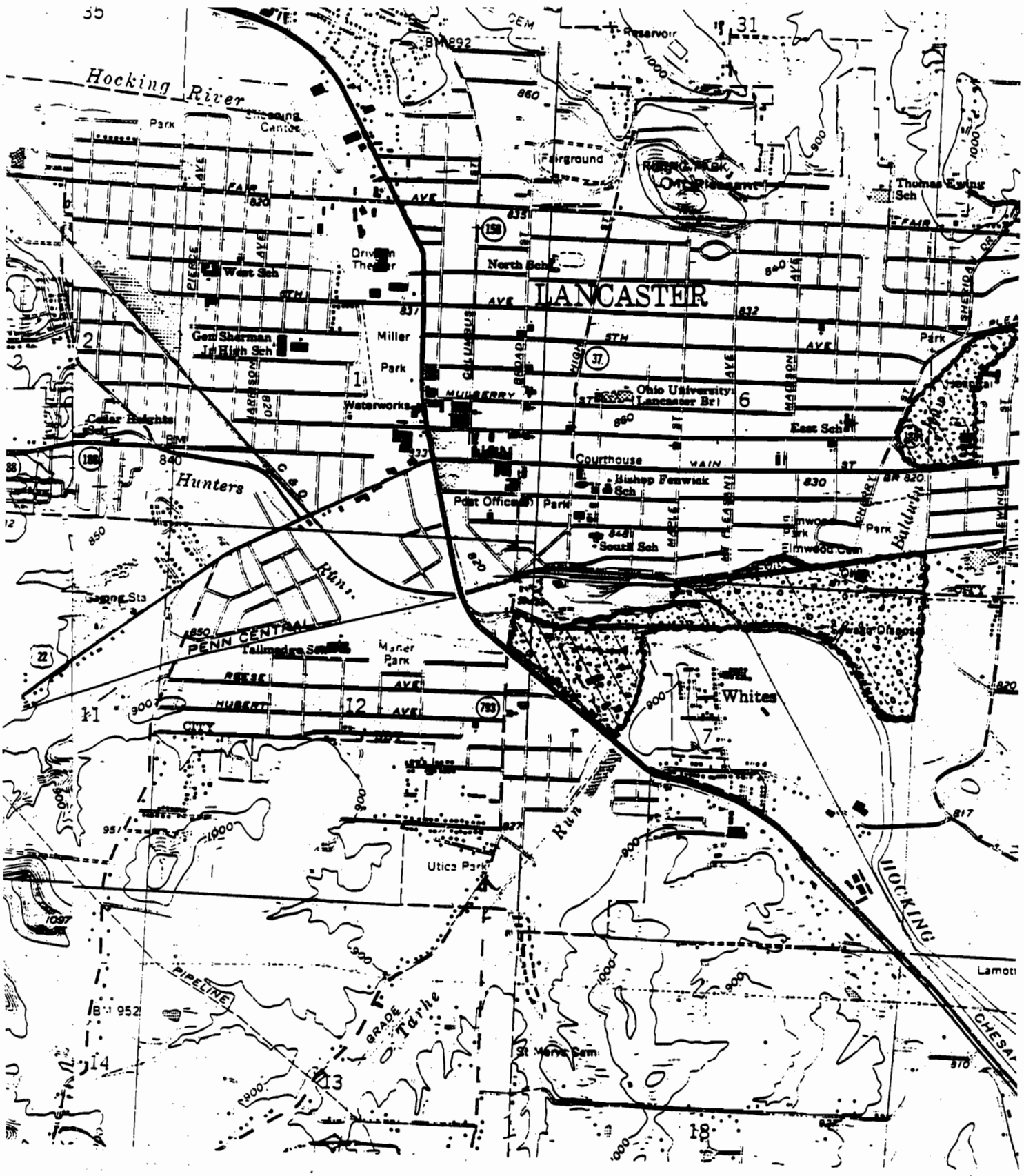
High hazard areas were identified based on the 100-year "with project" elevations for the locations shown on the map in Figure 7-6. A high hazard is defined as any area where there is a high risk to loss of life. The following criteria was used:

1. Building used to house overnight occupancy i.e. homes, motels, hospitals, etc.
2. Two or more feet of water on the first floor.
3. A velocity of four feet per second or greater and water on the first floor.

Three high hazard residential properties were identified in the Columbus Street area and two more were identified in the Lawrence Street area. Since project measures will have no effect on the flood elevations at these locations no measures are recommended for these properties at this time.

Mitigation Features

The dikes, pump and storage pond areas will be fertilized, reseeded, and mulched to reduce the impact of construction activities. Trees and shrubs will be selectively planted to add



HIGH HAZARD AREAS STUDIED

FIGURE 7-6

wildlife food and cover as well as to add a pleasing landscape to the construction areas. The concrete wall portion of the dike will be designed to complement the surrounding landscape.

Two acres of woody habitat equal in value to that displaced by the Tarhe Dam will be planted. The final locations will be selected by the Engineer and Biologist at final design but areas to be considered are:

1. The backslope of the emergency spillway above design highwater.
2. Area between the dam and emergency spillway on the left abutment.
3. Other odd areas as desired by the owner.

No mitigation will be required for the pool area since no water will be impounded permanently.

Permits Required

Section 404 of PL-92-500 (Clean Water Act) may require a permit from the Army Corps of Engineers for construction of Tarhe Dam. Final determination will be made after the project has been approved for operations.

No other federal permits will be required since no dredging or filling of the stream will be done during the dike construction.

Necessary state and local permits required for construction and to move equipment will be the responsibility of the contractor.

See also Table F - Compliance of Recommended Plan with WRC - Designated Environmental Statutes.

Costs

Land Treatment Costs: Detailed installation costs of the accelerated land treatment measure, field border plantings for wildlife habitat improvement, are shown in Table 1. The total cost is $56,656 of which $5,500 represents the cost of technical assistance.

Costs for installing the land treatment measure are based on current costs of supervision, labor, equipment, and materials needed. Technical assistance costs are based on projected expenditures and estimated work to be accomplished.

Structural and Nonstructural Measure Costs

Construction costs are for labor, equipment, and materials based on the engineer's estimate plus an allowance for contingencies. Structural measure installation costs are shown on Table 1. Table 2 shows the estimated cost distribution and Table 2A the cost allocations by purpose for "Federal" and "other" shares. The estimates were made by applying appropriate unit costs to

TABLE F - COMPLIANCE OF THE RECOMMENDED PLAN WITH
WRC - DESIGNATED ENVIRONMENTAL STATUTES

Federal Policies:	Compliance 1/
Archeological and Historic Preservation Act, 16 U.S.C. 469 et seq.	Full Compliance
Clean Air Act, as amended, 42 U.S.C. 1857h-7, et seq.	Not Applicable
Clean Water Act (Federal Water Pollution Control Act) 33 U.S.C. 1251 et seq.	Full Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et seq.	Not Applicable
Endangered Species Act, 16 U.S.C. 1531 et seq.	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et seq.	Not Applicable
Federal Water Project Recreation Act, 16 U.S.C. 460-1(12), et seq.	Not Applicable
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et seq.	Full Compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/-460/-11, et seq.	Full Compliance
Marine Protection, Research and Santuary Act, 33 U.S.C. 1401, et seq.	Not Applicable
National Environmental Policy Act, 42 U.S.C. 4321, et seq.	Full Compliance
National Historic Preservation Act, 16 U.S.C. 470a, et seq.	Full Compliance
River and Harbors Act, 33 U.S.C. 403, et seq.	Not Applicable
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et seq.	Full Compliance
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et seq.	Not Applicable

1/ a. Full Compliance. Having met all requirements of the Statute for the current stage of planning (either preauthorization or postauthorization.)
b. Partial Compliance. Not having met some of the requirements that normally are met in the current stage of planning.
c. Non-Compliance. Violation of a requirement of the statute.
d. Not applicable. No requirements for the statute required compliance for the current stage of planning.

detailed quantity estimates. Unit costs, based on recent contract bid schedules and actual construction costs of similar projects in Ohio, were adjusted to the 1981 price level. Cost allowances for contingencies, ranging from 12 to 15 percent, were included to offset unknown conditions. Total cost of construction is estimated to be $963,646.

Engineering costs are for design surveys, site investigation studies (borings, laboratory tests and analysis), designs, preparation and interpretation of drawings and specifications, and similar services. Total engineering cost of all measures is estimated to be $73,070.

Project administration costs associated with installation of structural measures are those of contract administration, government representation for contracts, administering relocation payments, layout and inspection to assure construction in accordance with drawings and specifications, and overhead. Overhead includes costs of direct and indirect services of the SCS and the sponsors in installing measures under PL-566. The sponsors and the SCS will each bear the costs they incur. Total cost of project administration is estimated to be $229,966.

Landrights costs are for acquiring land, easements, rights-of-way and altering utilities. Acquisition costs include survey, appraisal, legal and other administrative costs. Land costs include fee simple, easement and right-of-way cost of land, mineral rights and improvements. Utility costs are included for altering existing power, telephone, gas and sewer lines, and other facilities as required for the installation of the planned measures. Total landrights costs are estimated to be $102,880.

Relocation payments reimburse displaced persons for expenses such as moving personal property, increased finance charges, and other costs of acquiring comparable replacement housing that is decent, safe, and sanitary. There are 2 relocations involved with this plan. These are located on Hunters Run and are necessary to install the flood prevention dike. The costs for relocation will be shared in the ratio of the PL-566 funds to "other" funds for the project. The PL-566 share will be 85 percent and the local share will be 15 percent. There are no minority or economically disadvantaged persons who would have difficulty coping with a relocation. Adequate replacement housing is available within a short distance of their current homes.

The sponsors will provide relocation assistance advisory services to any displaced persons in order to minimize hardships in completing the relocation. The sponsor's personnel will provide the services. Advisory services include:

1. Determining needs.
2. Obtaining and furnishing current pertinent information concerning available replacement housing, costs, etc.
3. Informing affected persons of benefits to which they are entitled.

Operation and maintenance costs were based on actual costs for similar projects in Ohio. These range in age from 45 years to the present. In addition, a projected maintenance schedule was prepared for each item and the costs associated with it are shown as O&M costs.

Replacement costs were considered but there were no major items that would need replacing and therefore no replacement costs were included.

Installation and Financing

This plan will be carried out as a joint venture of private, local, and federal agencies. The plan will be installed over a two year period.

Table G shows the expected schedule of installation and costs for structural and nonstructural measures.

TABLE G
Installation Schedule 1/

Installation Year	Project Measures	PL-566 Costs	Other Costs
1	Tarhe Dam, Diversion Dam, Flood Warning System	$386,939	$38,013
2	Hunters Run, Maner Park, and Tarhe Run Dikes; and Storage Ponds and Pumps	884,958	120,759
	Total	$1,271,897	$158,772

Structural and Nonstructural Measures:

The Sponsoring Local Organization will administer contracts unless the Sponsors, at a later date, request the Soil Conservation Service to administer contracts.

The SCS will provide engineering and administrative services for structural and mitigation measures, construction, and installation. Engineering services include design surveys, geologic investigations, and designs. Project administration includes preparation of construction contracts, government representation for contracts, construction surveys and inspection and similar services for installation of structural measures.

The sponsors will acquire all landrights for installation, operation, and maintenance of structural measures. Landrights shall be acquired by easement, purchase, or subordination of the affected items. This will include such items as land, buildings, utilities, roads, bridges and mineral rights. In addition, construction permits which may be required under PL-92-500, Section 404, will be obtained by the sponsors. Provisions for obtaining

1/ Includes interest accrued at 7 5/8 percent during project installation.

funds shall be through the benefit and damage appraisal procedures. The sponsors shall use all authorities provided through the state statutes, including the right of eminent domain, to secure the necessary landrights. The sponsors shall be financially responsible for the local share of the construction, operation and maintenance costs associated with the works of improvement.

Prior to entering into agreements that obligate funds of SCS, the sponsors will develop a code of conduct governing the performance of its officers, employees, or agents in contracting with or expending PL-566 funds; and a financial management system for control, accountability, and disclosure of PL-566 funds received and for control and accountability for property and other assets purchased with PL-566 funds.

It is the responsibility of the sponsors to provide relocation assistance advisory services. These shall be done in accordance with the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970", (Public Law 91-646, 84 Stat., 1894). These services are:

1. Determine the need, if any, of displaced persons for relocation assistance.
2. Provide current and continuing information on the availability, prices and rentals of comparable decent, safe, and sanitary sale and rental housing, and of comparable commercial properties and locations for displaced businesses and farm operations.
3. Assure that, within a reasonable period of time prior to displacement, replacement dwellings will be available.
4. Assist a displaced person, displaced from his business or farm operation, in obtaining and becoming established in a suitable replacement location.
5. Supply information concerning housing programs, disaster loan programs, and other federal or state programs offering assistance to displaced persons.
6. Provide other advisory services to displaced persons in order to minimize hardships to such persons in adjusting to relocations.
7. Advise displaced persons that they should notify the displacing agency before they move.
8. Prior to initiation of acquisition, provide persons from whom it is planned to acquire land, a brochure or pamphlet outlining the benefits to which they may be entitled.

The administrative functions to be provided as needed include:

1. Provide each displaced person, business, or farming operation with written notice at least 90 days before they are to vacate.
2. Assistance in filing applications.
3. Reviewing applications for assistance.
4. Making relocation payments.

If cultural resource values are discovered unexpectedly during construction, SCS procedures to implement compliance with appropriate regulations and executive orders for the protection of these resources will be followed. Identified sites of cultural value will not be affected by the works of improvement 1/.

The sponsors will be encouraged to investigate funding through grants and loans. Possible agencies include Farmers Home Administration, Housing and Urban Development, and State of Ohio through the Ohio Department of Natural Resources.

Operation, Maintenance, and Replacement

Landowners and operators will operate and maintain conservation land treatment measures on their lands. Technical assistance will be available for operation and maintenance from the Fairfield Soil and Water Conservation District, the SCS, the Ohio Department of Natural Resources, and Division of Forestry in cooperation with the U.S.D.A., Forest Service. The project sponsors will encourage landowners and operators to operate and maintain the measures to protect and improve the watershed's resources.

The sponsors will operate and maintain structural project measures upon acceptance of construction work from the contractors. Funds for the work will be obtained through an equitable local assessment. The sponsors will use their staff, equipment, and materials or other means satisfactory to the SCS to do the work.

Public and private bridges, other road facilities, and public utilities which have been modified to accommodate the project will be maintained by their respective owners with expenditures from their normal maintenance funds.

The SCS and sponsors will complete an operation and maintenance agreement for each structural measure before signing a land-right, relocation, or project construction agreement. The agreements will provide for inspections, reports, and procedures for performing the maintenance items. They will include specific provisions for retention and disposal of real and personal property acquired or improved with PL-566 funds. The agreements will be in accordance with the Ohio Watersheds Operation and Maintenance Handbook published by the SCS and will document the responsibilities of the sponsors and the SCS. An operation and maintenance plan will be prepared for each structural measure.

Structural measures will be maintained in good condition for proper functioning during the project life. The dikes and dam have a design life equal to the 100-year economic evaluation period.

To assure an effective maintenance program at minimum cost, inspections of dike areas and the dam will be made annually,

1/ Preliminary Archaeological Survey of the North Hocking Watershed, Ohio Historical Society, 1981.

after unusually severe storms, and whenever other unusual conditions may adversely affect the measures. The SCS and the sponsors will jointly conduct the inspections for the first three years. Thereafter, the sponsors will be responsible for inspections with SCS assistance to continue at the discretion of the State Conservationist. A qualified engineer will assist in the inspection every 5 years. Authorized persons will have free access for inspections at any reasonable time.

The inspection will determine if conditions of the structural measures are favorable for their proper functioning. Written inspection reports will describe needed maintenance work and will include cost estimates for the work.

Typical inspection items for the dike areas include the following: the condition of the concrete structures, walks, grass, shrubs, trees, channel and dike slopes, deposition or rodent damage, and maintenance travelways. Typical inspection items for the pumps and storage basin include the following: condition of the grass, fence, gravity inlets and outlets, the standby generators, and pumps. Typical inspection items for the flood diversion dam include the following: condition of the inlet and outlet, check for sediment deposition in the pipe or any structural deficiencies.

Typical inspection items for the Tarhe dam include the following: drainage system; evidence of slope instability such as slides, slumps, or cracking; condition of vegetation; evidence of rodent or erosion damage; and the condition of riprap, concrete, and metal work, and hazard classification as it relates to downstream developments.

Typical inspection items for the flood warning system include replacing the battery packs at the remote sensing stations, checking their operation, reviewing the data collected, and revising the computer program as needed. NWS personnel will provide the expertise in updating the computer forecasting and the sponsors will maintain the equipment necessary to operate the system.

The sponsors will maintain records of continuing and completed maintenance work and will furnish reports of these activities to the SCS and the Division of Water, Ohio Department of Natural Resources. Periodic reports will continue until all deficiencies described in inspection reports are satisfactorily corrected.

SCS will be responsible for establishing the vegetation in a vigorous condition. Afterwards the sponsors will maintain the vegetation in a vigorous condition by fertilizing, reseeding and other means as necessary. The sponsors will protect the permanent vegetation from encroachment by farming or other activities by prompt, timely enforcement of landrights instruments. Where vegetation is damaged by maintenance work or natural forces, it will be restored to comparable quality and quantity by the project sponsors. Unwanted vegetation will be controlled

by mowing or other means. Mowing will be delayed until after July 1 to minimize disturbances to nesting and young wildlife. During the establishment period, earlier mowing will be used, if needed, to control competition from annual plants.

Wildlife habitat quality will be maintained on areas planted as part of the project measures by replanting or by management of natural plant successions.

Erosion damage will be repaired promptly and rodents controlled where necessary. Debris and sediment accumulations that create flow restrictions in the channel will be removed. Concrete and metal work will be maintained in good functional order by painting, repairing, or replacing as necessary.

For complex or unusually difficult or extensive maintenance work, the SCS may provide technical assistance upon request of the sponsors and within the limits of available resources. Drawings, specifications, layout, advice on techniques, and similar services may be provided. The sponsors will prohibit installation of facilities or appurtenances that would interfere with the operation and maintenance of the structural measures. They will obtain SCS approval of any drawings and specifications for altering or repairing a structural measure. Cost sharing, at the same rate as the original construction contract, may be provided if a repair is determined to be the result of latent conditions, misjudgements, deficiencies, or mistakes by SCS. The estimated total average annual operation, maintenance, and replacement costs shown in Table 4, are $4402.

TABLE 1 - ESTIMATED INSTALLATION COST
North Hocking Watershed, Ohio

Installation Cost Item	Unit	Number	ESTIMATED COST DOLLARS 1/ PL-566 Funds SCS 2/	Other Funds SCS 2/	Total Installation Cost
NONSTRUCTURAL MEASURES					
Flood Warning System	Ea.	1	39,480	14,870	54,350
sub total			39,480	14,870	54,350
STRUCTURAL MEASURES					
Flood Prevention Dikes					
Hunters Run Dike	Miles	.38	215,423	72,574	287,997
Hocking River Dike (Maher Park)	Miles	.36	186,140	14,550	200,690
Tarhe Run Dike	Miles	.23	143,375	20,335	163,710
Storage Pond & Pumps	Ea.	1	340,020	13,300	353,320
Diversion/Dam	L.F.	1000	96,225	7,775	104,000
Floodwater Retarding Dam					
Tarhe Dam	Ea.	1	223,820	12,675	236,495
sub total			1,205,003	141,209	1,346,212
LAND TREATMENT (ACCELERATED)					
Field Border Plantings 3/	Ac.	169		51,156	51,156
Technical Assistance			5,500		5,500
sub total			5,500	51,156	56,656
GRAND TOTAL			1,249,983	207,235	1,457,218

1/ Price Base 1981

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

3/ Environmental Quality component.

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TABLE 2 - ESTIMATED COST DISTRIBUTION
STRUCTURAL AND NONSTRUCTURAL MEASURES
North Hocking Watershed, Ohio

ITEM	Installation Costs PL-566 Funds					Installation Cost - Other Funds					
	Construc-tion	Engi-neering	Reloca-tion Payments	Project Admin.	PL-566 TOTAL	Construc-tion	Land Rights	Reloca-tion Payments	Project Admin.	Total Other	TOTAL Installa-tion Cost
STRUCTURAL MEASURES											
Hunters Run Dike	146,586	11,730	26,350	30,757	215,954		61,000	4,650	6,924	72,574	287,997
Hocking River Dike (Maher Park)	145,090	11,600	- -	29,450	186,140		9,180	- -	5,370	14,550	200,690
Tarhe Run Dike	111,750	8,940	- -	22,685	143,375		16,200	- -	4,135	20,335	163,710
Storage Basin and Pumps	265,025	21,200		53,795	340,020		3,500	- -	9,800	13,300	353,320
Diversion Dam	75,000	6,000	- -	15,225	96,225		5,000	- -	2,775	7,775	104,000
Tarhe Run Dam	170,845	13,600	- -	39,375	223,820		5,500	- -	7,175	12,675	236,495
Subtotal	914,296	73,070	26,350	191,287	1,205,003		100,380	4,650	36,179	141,209	1,346,212
NONSTRUCTURAL MEASURES											
Flood Warning System	39,480	- -	- -	- -	39,480	9,870	2,500	- -	2,500	14,870	54,350
sub total	39,480	- -	- -	- -	39,480	9,870	2,500	- -	2,500	14,870	54,350
GRAND TOTAL	953,776	73,070	26,350	191,287	1,244,483	9,870	102,880	4,650	38,679	156,079	1,400,562

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TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY
STRUCTURAL AND NONSTRUCTURAL MEASURES
North Hocking Watershed, Ohio
(Dollars) 1/

ITEM	Cost Allocation Purpose		Cost Sharing			
	Flood Prevention	Total	PL-566 Flood Prev.	Total	Other Flood Prev.	Total
Structural Measures						
Flood Prevention Dikes						
Construction	743,451	743,451	743,451	743,451	- -	- -
Engineering	59,470	59,470	59,470	59,470	- -	- -
Relocation	31,000	31,000	26,350	26,350	4,650	4,650
Land Rights	94,880	94,880	- -	- -	94,880	94,880
Project Administration	180,916	180,916	151,912	151,912	29,004	29,004
Floodwater Retarding Dam						
Construction	170,845	170,845	170,845	170,845	- -	- -
Engineering	13,600	13,600	13,600	13,600	- -	- -
Land Rights	5,500	5,500	- -	- -	5,500	5,500
Project Administration	46,550	46,550	39,375	39,375	7,175	7,175
sub total	1,346,212	1,346,212	1,205,003	1,205,003	141,209	141,209
NONSTRUCTURAL MEASURES						
Flood Warning System						
Construction	49,350	49,350	39,480	39,480	9,870	9,870
Land Rights	2,500	2,500	- -	- -	2,500	2,500
Project Administration	2,500	2,500	- -	- -	2,500	2,500
sub total	54,350	54,350	39,480	39,480	14,870	14,870
GRAND TOTAL	1,400,562	1,400,562	1,244,483	1,244,483	156,079	156,079

1/ Price Base 1981

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TABLE 3 - STRUCTURAL DATA

DAM WITH PLANNED STORAGE CAPACITY

ITEM	Unit	Tarhe
Class of Structure		C
Seismic Zone		2
Total Drainage Area	Sq. Mi.	0.94
Runoff Curve No. (1-day) (AMC II)		78
Time of Concentration (T_c)	Hrs.	0.88
Elevation Top of Dam	Ft.	893.0
Elevation Crest Emergency Spillway	Ft.	885.6
Elevation Crest Low Stage Inlet	Ft.	876.7
Emergency Spillway Type		Vegetated
Emergency Spillway Bottom Width	Ft.	160
Emergency Spillway Exit Slope	%	4
Maximum Height of Dam	Ft.	27.0
Volume of Fill	Cu.Yd.	15,500
Total Capacity 1/		
Sediment Aerated	Ac. Ft.	3.0
Floodwater Retarding	Ac. Ft.	24.1
Surface Area Sediment Pool 2/	Acres	1.0
Floodwater Retarding Pool 1/	Acres	4.8
Principal Spillway Design		
Rainfall 1 day	In.	5.5
Rainfall 10 day	In.	9.0
Runoff 1 day	In.	3.2
Runoff 10 day	In.	6.3
Capacity of Low Stage (Max.)	cfs	300
Diameter of Conduit	In.	54
Frequency Operation-Emergency Spillway	% chance	≤ 1
Emergency Spillway Hydrograph		
Rainfall Volume	In.	9.8
Runoff Volume	In.	7.1
Storm Duration	Hrs.	6
Velocity of Flow (V_e)	Ft./Sec.	7.0
Max. Reservoir Water Surface Elevation	Ft.	889.2
Freeboard Hydrograph		
Rainfall Volume	In.	26.7
Runoff Volume	In.	23.6
Storm Duration	Hrs.	6
Max. Reservoir Water Surface Elevation	Ft.	893.0
Discharge per foot of width (Q_e/b)	Ac. Ft.	6.1
Bulk Length	Ft.	250
Capacity Equivalents		
Sediment Volume	In.	0.06
Floodwater Retarding Volume	In.	0.54

1/ Crest of Emergency Spillway

2/ Dam will impound no permanent pool. Dry Dam.

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TABLE 3B - STRUCTURAL DATA DIKE WORK

Name	Station	D.A.	100-YR. Freq. Design Discharge	Water Surface Elevation	Top Levee 2/ Elevation	Side	Type	Dike Side Slope		Top Width	Existing Channel Type	Present Flow Condition	Earth Fill or Concrete Volume
								Stream Side	Land Side				
		sq.mi.	cfs	m.s.l.	m.s.l.					ft.			c.y.
Hocking River	200+00	47.7	7870	819.5	821.5	Right	Concrete Wall	Existing	- -	- -	M (1950)	PR	155
	187+50	46.7	7870	819.5	821.5	Right	Earth Fill	Existing Proj. at 2:1 from toe.	2:1 or flatter	12	M	PR	4040
	180+80	46.7	7870	819.5	821.5	Right							
Hunters Run	180+80	46.7 1/	7870	819.5	821.5	Right	Earth Fill	Existing; proj. @ 2:1 from toe	2:1 or flatter	12	M (1900)	PR	7493
	171+00	11.2	2340	819.5	821.5	Right	Concrete Wall	- -	- -	-	M	PR	95
	164+25	11.2	2340	819.8	821.8	Right	Earth Fill	Existing; proj. @ 2:1 from toe	2:1 or flatter	12	M	PR	613
	160+55	11.2	2340	821.1	823.1	Right							
Tarhe Run	203+80	5.2	1820	820.4	822.4	Left	Concrete Wall	- -	- -	- -	M (1900)	PR	76
	199+00	5.2	2090	821.3	823.3	Left	Earth Fill	- -	2:1 or flatter	12	M	PR	460
	197+50	5.2	2090	821.5	823.5	Left	Concrete Wall	- -	- -	-	M	PR	10
	196+50	5.2	2090	823.1	825.1	Left	Earth Fill	- -	2:1 or flatter	12	M	PR	1360
	194+50	5.2	2090	825.1	827.1	Left	Concrete Wall	- -	- -	-	M	PR	33
	191+50	5.2	2090	826.7	828.7	Left							

PR = Perennial - flows at all times except during extreme drought M = Manmade ditch or previously modified channel
1/ = At confluence of Hunters Run and Hocking River, includes D.A. of both watersheds.
2/ = Add 0.3' to height of dike for settlement of Earth Fill reaches.

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TABLE 4 - ANNUAL COSTS

North Hocking Watershed, Ohio

(Dollars) 1/

Evaluation Unit	Amortization Of Installation Cost 2/	Operation Maintenance, & Replacement Cost	Total
North Hocking River	89,317 (13,177) 4/	4402	95,775 3/ (13,177) 4/
Grand Total	106,863 5/	4402	113,711 3/ 5/ 6/

1/ Price Base: 1981

2/ Amortized at 7 5/8 percent interest rate for 100 years.

3/ Includes $1907 for interest costs incurred on project measure installation costs, and $149 for interest costs incurred on O, M, & R costs during installation period (7 5/8 percent).

4/ Cost allocated to the EQ objective.

5/ Includes $17,546 for Project Administration.

6/ Includes $390 for interest costs incurred on Project Administration during installation period (7 5/8 percent).

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TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE

REDUCTION BENEFITS

North Hocking Watershed, Ohio

(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit 2/
	Without Project	With Project	
Floodwater			
Nonagricultural			
Urban	452,344	126,696	333,389 3/
Total	452,344	126,696	333,389

1/ Price Base: 1981

2/ No benefit to land treatment.

3/ Includes benefits of $7741 accrued during project installation period.

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TABLE 6 - COMPARISON OF BENEFITS AND COSTS

North Hocking Watershed, Ohio

(Dollars)

Evaluation Unit	Average Annual Benefits 1/		Average Annual Cost 3/	Benefit Cost Ratio
	Damage Reduction 2/	Total		
North Hocking River	333,389	333,389	113,711	2.9:1.0
Grand Total	333,389	333,389	113,711	2.9:1.0

1/ Price Base: 1981

2/ From Table 5.

3/ From Table 4.

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IMPACTS OF RECOMMENDED PLAN

A range of environmental, economic, and social values were considered during the environmental assessment process. Areas of potential impact were evaluated and an analysis made of the significance of the impact to decision making.

A description of the project impacts is presented below. Appropriate data has been included to show project effects.

The planned structural and nonstructural measures will reduce the depth, extent, and frequency of flooding. Damage reduction benefits occur in reaches 20, 21, and 40. For the locations of reaches see Figure 8-1. The properties flooded with and without project are shown below.

PROPERTIES FLOODED

	Frequency			
	500-Year	100-Year	25-Year	3-Year
Without Project				
Residential	535	426	133	68
Commercial	40	38	22	7
With Project				
Residential	198	133	24	10
Commercial	37	35	22	5

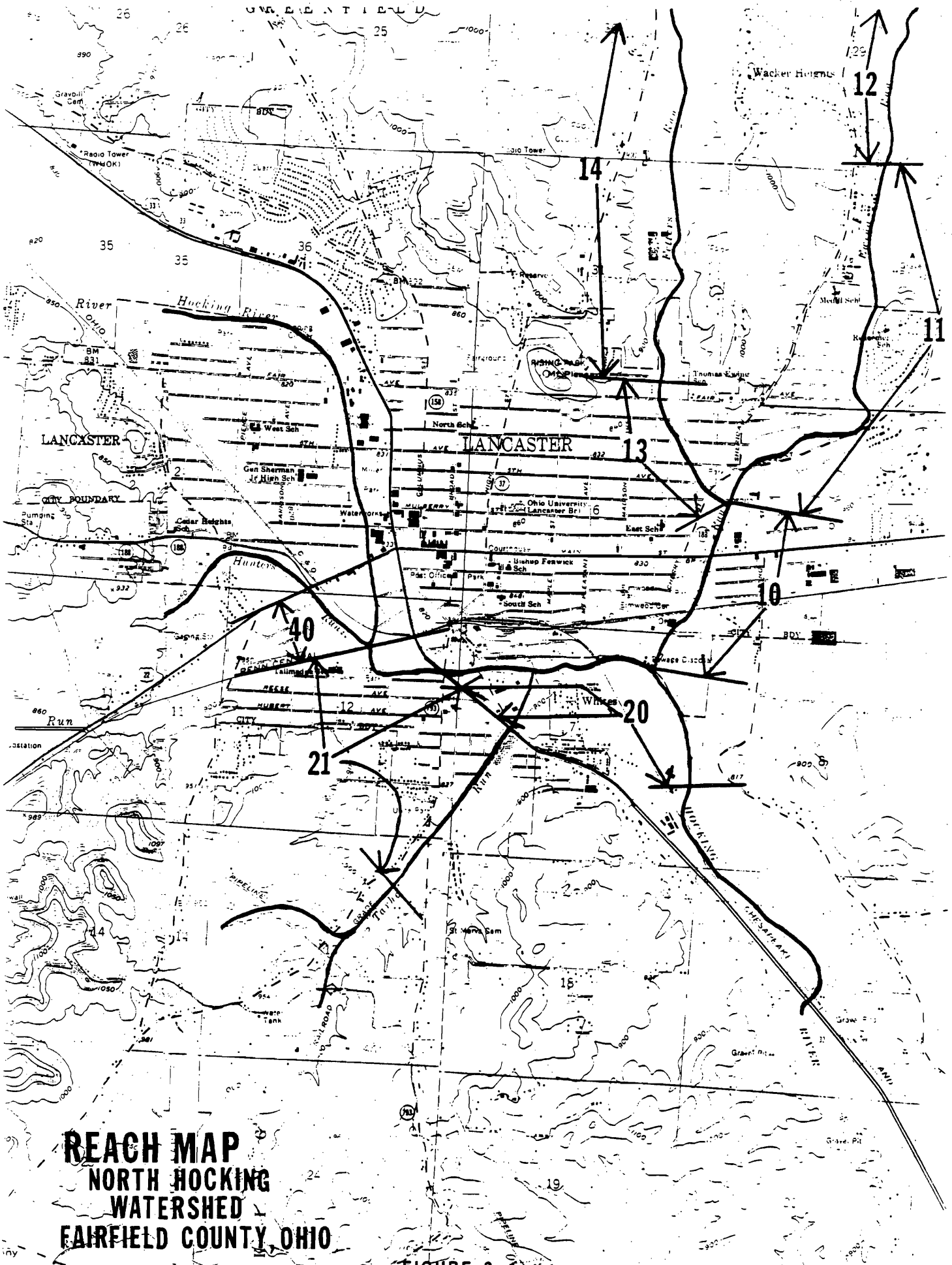
The flood warning system is expected to provide flood damage reduction benefits of $82,749 to 16 commercial properties. In addition, there are 146 residences and businesses, in reaches 10, 11, and 20 that receive damages from the 100 year and larger floods. Some damage reduction benefits would occur, although they were not economically evaluated.

The flood warning system would allow time for the removal of some damageable items, thereby reducing flood damages to these properties. The flood warning system will give adequate advance warning to area residents to remove the threat of loss of life.

Implementation of project measures will result in average annual benefits of $333,389. This is a flood damage reduction of over 72 percent to residential, commercial, and industrial properties.

Currently, 575 urban properties would experience damages from the 500-year flood event. With the project measures in place, this will be reduced to 235 properties.

Two residential properties need to be relocated due to the construction of project measures. Those residents who are relocated will be moved to safe, sanitary housing which meet applicable Federal standards, and is comparable to their present homes.



REACH MAP
NORTH HOCKING
WATERSHED
FAIRFIELD COUNTY, OHIO

FIGURE 8-1

Adequate, safe, sanitary and decent housing is available in the area so that relocating will not cause any undue hardships such as job changes or increased cost of living.

The local economy will experience a minor uplift due to increased employment and spending associated with construction of this plan. It is estimated that $42,700 will be spent for materials locally at Lancaster. An additional $196,500 will be spent within the Columbus metropolitan area for materials. Project construction will create 9.9 jobs for two years.

The recommended plan is expected to significantly reduce damages, trauma, health hazards, and the nuisance associated with flooding for area residents. No watershed occupant is expected to be negatively impacted by planned project measures. No minority or economically disadvantaged group will be adversely affected by this plan.

Construction of the diversion/dam at Utica Park will require temporary closing of a portion of St. Rt. 793. The resulting detour will cause an estimated one mile increase in travel distances. The bridge modification and bridge removal are on abandoned railroads, and will not cause a disruption of transportation systems. Truck and construction equipment traffic will temporarily increase in areas of construction. No other impacts on transporation systems are expected.

The planned project measures will have no detrimental effects on water quality. The work on the dikes will not alter the existing stream channel during construction. The temporary storage pond in Maher Park will allow some of the sediment to drop out before being released to the stream which will be a positive impact. Bacterial contamination contained in the runoff stored in Maher Park could pose a health problem. However, the Ohio EPA has indicated that these bacteria die rapidly when exposed to air and they felt by the time the field was dry enough for play, any danger of bacterial contamination would be gone.

The water impounded at the damsite will occur too infrequently to cause any measureable impact on water quality. Erosion control techniques such as mulching, diversions, temporary seeding, and sediment traps will be used during the construction of the dam to reduce the amount of sediment reaching the stream. Construction will extend over a 3-4 month period with no more than 1-2 acre being disturbed at any given time. The total area disturbed is less than 4 acres.

Fish and wildlife resources are negligible in the dike area due to the poor water quality and the fact that 95 percent of the area is urbanized. Most of the area is either in lawns or gardens and little change is anticipated in the future.

Dike construction will temporarily eliminate an estimated 2 acres of trees and shrubs and 7 acres of grassland in residential lawns and gardens. A permanent loss of 0.1 acre of grass-

land will occur as a result of the concrete dikes. Plantings will be made along the dike beneficial to wildlife and also to enhance the visual quality of the landscape. The mitigation team decided that no significant impacts would result from the proposed dike or pump and storage basin construction.

The Tarhe dam site is presently in pasture and woodland. The stream is spring fed but supports no sport fishery. No significant short or long term adverse affects to the aquatic and benthic habitat are anticipated. See Appendix D.

The dam construction will remove 2 acres of mixed hardwoods and will disturb one acre of grassland. The woody habitat will be replaced in value by wildlife shrub and tree plantings in odd areas around the dam site. No loss of the grassland will occur since the dam will be planted to grass. The opening of the forest canopy by construction will benefit wildlife by increasing understory growth and providing additional food, nesting, and escape cover.

Studies by the Ohio Historical Society concluded that the project will have no impact on archaeologic or historic values within the watershed.

See also Table H - Effects of the Recommended Plan on Resources of Principal National Recognition.

RELATIONSHIP TO LAND AND WATER RESOURCE PLANS, POLICIES, AND CONTROLS

The state of Ohio has no approved comprehensive land use plan. The Fairfield County Regional Planning Commission has an approved land use plan. This plan indicates that floodplains are potential open space areas. The city of Lancaster has a floodplain zoning ordinance in effect in accordance with Federal Emergency Management Agency regulations.

The North Hocking Watershed Work Plan - EIS is not in conflict with any land or water resource plan in the area.

TABLE H - Effects of the Recommended Plan on Resources of Principal National Recognition

Types of Resources	Principal Sources of National Recognition	Measurement of effects
Air quality	Clean Air Act, as amended (42 U.S.C. 1857h-7 et seq.)	Not present in planning area.
Areas 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 threathened species critical habitat.	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et.seq.)	Not present in planning area.
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.)	169 acres of field border strips gained.
Floodplains	Executive Order 11988, Floodplain Management	116 acres lost 1/ 134 acres lost 2/
Historic and cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec. 470 et seq.)	Not present in planning area.
Prime and unique farmland	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act	No effect.
Water quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)	No effect.
Wetlands	Executive Order 11990, Protection of Wetlands Clean Water Act of 1977. (42 U.S.C. 1857h-7, et seq.).	No effect.
Wild and scenic rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 et seq.).	Not present in planning area.

1/ Reduction of urban 500-year floodplain area.

2/ Reduction of urban 100-year floodplain area.

CONSULTATION AND PUBLIC PARTICIPATION

Public participation in the planning process began in June, 1964, when an application for planning assistance was made under provisions of Public Law 566, 83rd Congress. Sponsors of the application were the Hunters Run Conservancy District, City of Lancaster Fairfield County Commissioners, and the Fairfield Soil and Water Conservation District. The application was reviewed in the field on March 18, 1965. A public hearing attended by 37 people was held later that day in Lancaster. Conclusions from this hearing were that flooding problems were most severe in Lancaster and local interest in the project was high. The application was subsequently approved in March, 1965 by the Ohio Department of Natural Resources and the Ohio Water Commission.

Between 1966 and 1973, the sponsors held numerous meetings to discuss matters pertaining to problems encountered in getting planning started. On June 18, 1968 a meeting was held with the sponsors and interested citizens. There were 19 people in attendance. As a result of this meeting, the City of Lancaster and the Fairfield County Commissioners voted in December, 1969 to provide $2,250 each in funds for a preliminary investigation.

A public hearing held at Lancaster by the Ohio Department of Natural Resources on March 21, 1974 was attended by 57 people. At this meeting, it was noted that in addition to the $2,250 pledged by the City of Lancaster and the Fairfield County Commissioners for preliminary investigation, they would provide $14,000 each for completing the detailed planning. Conclusions reached at this meeting were that flooding was still a problem in the watershed and becoming worse, the PL-566 program was best suited to address the problems, and that local interest was still high. As a result, the ODNR recommended to the State Conservationist, Soil Conservation Service, that the North Hocking Watershed be given planning priority.

Authorization for planning assistance was granted by the Administrator of the Soil Conservation Service on September 26, 1978. Since planning authorization was received, numerous agencies and individuals have provided assistance in the planning process.

The Ohio Historical Society has conducted an archaeological reconnaissance through a cooperative agreement with SCS. The project will not affect any cultural resources.

A mitigation team composed of representatives of the Soil Conservation Service, U.S. Fish and Wildlife Service, and the Ohio Department of Natural Resources was formed in 1979. The purpose of the team and its technical advisors is to resolve any conflicts involving environmental issues.

The U.S. Fish and Wildlife Service was consulted on the Indiana Bat, the only endangered species found in the project area. A study was conducted by ODNR, Division of Wildlife, to determine if any critical habitat for the Indiana Bat is present in the construction area. For more information see Appendix D.

A water quality study was conducted in the North Hocking Watershed with the assistance of the U.S. Geologic Survey (See Appendix E).

Representatives from the Fairfield County Commissioners, Township Trustees, County Engineer, Fairfield Regional Planning Commission, Hunters Run Conservancy District, Lancaster City Council, Fairfield Soil and Water Conservation District, and the North Hocking Watershed Steering Committee have met periodically during the planning process to discuss items of interest pertaining to the Watershed.

Throughout the planning process the sponsors have kept the public informed through articles in the local newspaper, radio announcements, and letters to interested parties.

On March 14, 1979, a public hearing was held at Ohio University - Lancaster Branch with approximately 40 people in attendance. At the meeting land and water resource problems were discussed along with possible plan elements. Planning procedures and schedules, and the responsibilities of the public and sponsors were also presented. The people at the meeting expressed a favorable reaction to the information given them by SCS personnel and sponsors.

A public meeting held on July 1, 1981, at Lancaster, was attended by 74 local residents. Five alternatives were presented to reduce flooding and improve the overall environmental quality. One plan seemed to best fit the needs of the local people. There was some opposition to the design of one feature of the plan. This measure was redesigned according to the wishes of the public, and the sponsors approved the recommended plan.

On March 5, 1982, a Notice of a Finding of No Significant Impact was published in the Federal Register.

AGENCIES WHICH INFORMATION COPIES WERE SUPPLIED:

Department of the Army

Department of Health and Human Services

U.S. Environmental Protection Agency

Federal Power Commission

Ohio Environmental Protection Agency

Advisory Council on Historic Preservation

Department of Commerce

Department of the Interior

Department of Transportation

Ohio Department of Natural Resources

Water Resources Council

Office of Equal Opportunity USDA

Governor of Ohio

Ohio State Clearinghouse

Fairfield County Regional Planning Commission

National Wildlife Federation

LIST OF PREPARERS

Organization and Name	Present Title	Education: Degree	Education: Continuing Education	Experience
Soil Conservation Service				
Marshall D. Edens	WR Planning Staff Ldr.	BS-Agriculture MS-Economics		Agri. Economist - 18 years Staff Leader - 7 years
Wayne E. Achor, P.E.	Supervisory Hydraulic Engineer	BS-Civil Engr.	Stream Mechanics Hydrologic Modeling	Construction Engr.- 2 years Area Engineer - 3 years Hydrologist - 5 years
Robert L. Burris, P.E.	Planning Engineer	BS-Agricultural Engineer	Water Quality and Pollutant Service Monitoring	Construction Engr.- 8 years Planning Engr. - 3 years
James E. Christensen	Supervisory Economist	BS-General Agri.		Soil Conservationist - 5 years Agri. Economist - 17 years
J.Craig Whitcomb	Agricultural Economist	BS-Economics		Agri. Economist - 3 years
Robert Sennett	Biologist	BS-Wildlife Conservation and Mgmt.	Warm Water Fisheries Aquaculture	Soil Consv. - 2 years District Consv. - 3 years Biologist - 2 years
Sally L. Griffith	Biologist	BS-Natural Resources	Warm Water Fisheries	Soil Consv. - 2 years Biologist - 2 months
James N. Wade	Geologist	BA-Geology MA-Geology and Resource Development		Geologist - 15 years
Loring E. Beerbower	District Consv. Coordinator	BS-Agri. Engr.		Soil Consv. - 3 years District Consv. - 27 years
Ohio Department of Natural Resources				
Kenneth R. Fritz	Fish Management Supervisor	BA-1976	Fish Management	Biologist - 1 year Research Asst., Fish Management - 3 years

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2. County and City Data Book, 1972, U.S. Dept. of Commerce; Social, Economics, and Statistical Division, Bureau of Census.

3. Survey of Current Business, February, 1981, Volume 61, No.2 U.S. Dept. of Commerce, Bureau of Economic Analysis.

4. "Federal Census of the Population, April 1, 1980," Office of Research, Dept. of Economic and Community Development.

5. "Ohio Labor Market Information, March, 1981," Bureau of Employment Services.

6. SCS Technical Release 20, "Computer Program for Project Formulation - Hydrology".

7. SCS Technical Release 48, "Computer Program for Project Formulation - Structure Site Analysis".

8. SCS Technical Release 60, "Earth Dams and Reservoirs".

9. SCS Technical Release 61, "WSP2 Computer Program - Water Surface Profile Calculation".

APPENDIX A

DISPLAY OF PRINCIPLES AND STANDARDS ACCOUNTS FOR RECOMMENDED PLAN

RECOMMENDED PLAN

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

North Hocking Watershed, Ohio

Components	Measure of Effects (Average Annual) 1/ 2/	Components	Measure of Effects (Average Annual) 1/ 2/
Beneficial Effects:		Adverse Effects:	
A. The value to users of increased output of goods and services.		A. The value of resources required for the plan.	
1. Flood Prevention	$325,648	1. Dikes, dam, pumping system, and flood warning system.	
2. Interest 3/	7,741		
Total Beneficial Effects	$333,389	Project Installation	$106,863
Net Beneficial Effects	$219,678	O,M, & R	$ 4,402
		Interest 3/	$ 2,446
		Total Adverse Effects	$113,711

1/ 100 years at 7 5/8 percent interest.

2/ Price Base: 1981

3/ Interest for benefits, installation, and O,M, & R costs accrued during installation period.

RECOMMENDED PLAN

REGIONAL ECONOMIC DEVELOPMENT ACCOUNT

North Hocking Watershed, Ohio

Components	Measure of Effects: State of Ohio	Measure of Effects: Rest of Nation
Income:	(Average Annual) 1/ 2/	
Beneficial Effects:		
A. The value of increased output of goods and services to users residing in the region.		
1. Flood Prevention	$325,648	0
2. Interest 3/	7,741	0
Total Beneficial Effects	$333,389	0

Components	Measure of Effects: State of Ohio	Measure of Effects: Rest of Nation
Income:	(Average Annual) 1/ 2/	
Adverse Effects:		
A. The value of resources contributed from within the region to achieve the outputs.		
1. Levees, dam, flood warning system, pump storage system.		
Project Installation	$11,909	$94,954
O,M, & R	4,402	0
Interest 3/	354	2,092
Total Adverse Effects	16,665	97,046
Net Beneficial Effects	$316,724	-$97,046

1/ 100 years at 7 5/8 percent interest.

2/ Price Base 1981

3/ Interest for benefits, installation, and O,M, & R costs accrued during installation period.

RECOMMENDED PLAN

REGIONAL ECONOMIC DEVELOPMENT ACCOUNT

North Hocking Watershed, Ohio

Components	Measure of Effects: State of Ohio	Measure of Effects: Rest of Nation	Components	Measure of Effects: State of Ohio	Measure of Effects: Rest of Nation
Employment Beneficial Effects:			Employment Adverse Effects:	0	0
A. Increase in the number and types of jobs.					
1. Employment for Project Construction	19.8 semi-skilled jobs for one year.				
2. Employment for Project O,M, & R.	.2 permanent semi-skilled jobs.				
Total Beneficial Effects:	19.8 semi-skilled jobs for one year and .2 permanent semi-skilled jobs.				
Net Beneficial Effects:	19.8 semi-skilled jobs for one year and .2 permanent semi-skilled jobs.				

RECOMMENDED PLAN

ENVIRONMENTAL QUALITY ACCOUNT

North Hocking Watershed, Ohio

COMPONENTS	MEASURE OF EFFECTS
Beneficial and Adverse Effects:	
A. Areas of natural beauty.	1. Levees will be planted to trees and shrubs improving visual quality.
	2. Temporary loss of visual quality during construction.
B. Quality considerations of water, land, and air resources.	
	1. Construction will temporarily remove 2 acres of woodland habitat.
	2. Construction will alter 8.7 acres of flood plain land in the city of Lancaster. Establish 8.7 acres of grass, trees, and shrubs on areas of dike construction.
	3. Establish 169 acres of upland wildlife habitat consisting of grass, trees, and shrubs on field border plantings.
	4. Temporarily increase dust, noise, and exhaust gasses during project construction.
C. Biological resources and selected ecosystems.	
	1. Temporarily increase erosion, sedimentation, and turbidity during construction, which will affect the aquatic habitat downstream of the construction limits.
D. Irreversible or irretrievable commitments.	
	1. Loss of expended energy, manpower, and material needed for construction.

RECOMMENDED PLAN
OTHER SOCIAL EFFECTS
North Hocking Watershed, Ohio

COMPONENTS	MEASURE OF EFFECTS
Beneficial and Adverse Effects:	
A. Real Income Distribution	1. Create .2 low to medium income permanent jobs, and 19.8 low to medium income jobs for one year.
	2. Create regional income benefit distribution of $333,389 by income class as follows:

Income class (Dollars, 1969)	Percentage of Adjusted Gross Income in Class	Percentage Benefits In Class
Less than $5,000	18	18
$5,000 - $15,000	68.6	68.6
More than $15,000	13.4	13.4

3. Local costs to be borne by region total $16,665 with distribution by income class as follows:

Income Class (Dollars, 1969	Percentage of Adjusted Gross Income in Class	Percentage Contributions in Class
Less than $5,000	18	18
$5,000 - $15,000	68.6	68.6
More than $15,000	13.4	13.4

B. Life, Health, and Safety	1. Provide 72 percent flood damage reduction.
	2. Provide flood damage reduction for 535 residences and 40 businesses from the 500 year event, and 426 residences and 38 businesses from the 100 year flood event.
	3. Remove the threat to loss of life.

APPENDIX B

URBAN FLOOD PLAIN MAP

This map shows the floodplain that is affected by this project. The 100 year and 500 year "with" and "without" project areas are shown.

The urban floodplain that will not be affected by this project is shown in three documents.

1. Lancaster Flood Insurance Study
2. Upper Hocking River Flood Analysis Report, 1979
3. Hocking River Flood Analysis Report, 1977

These are available in limited supply at the following address:

Soil Conservation Service
200 N. High Street, Room 522
Columbus, Ohio 43215


HOCKING RIVER
HUNTERS RUN
500 YEAR
WITH PROJECT
BROAD ST.
MAIN ST.
BALDWIN RUN
100 YR. WITH
PROJECT
500 YEAR
WITH PROJECT
HOCKING RIVER
LINCOLN AVE.
100 YR. W/OUT
PROJECT
500 YEAR
WITH OUT PROJECT
TARHE RUN
U.S. ROUTE 33
S.R. 793
N
scale
0 500 1000 2000
feet
UNITED STATES DEPARTMENT OF ARGICULTURE
SOIL CONSERVATION SERVICE
NORTH HOCKING WATERSHED
URBAN FLOODPLAIN MAP
LANCASTER, OHIO JUNE 1981

APPENDIX C

CHANNEL PROFILES

PHOTOBASE PREPARED FROM 1971 AERIAL PHOTOGRAPHY
THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT

APPROXIMATE SCALE 0 100 200 300 400 500 FEET
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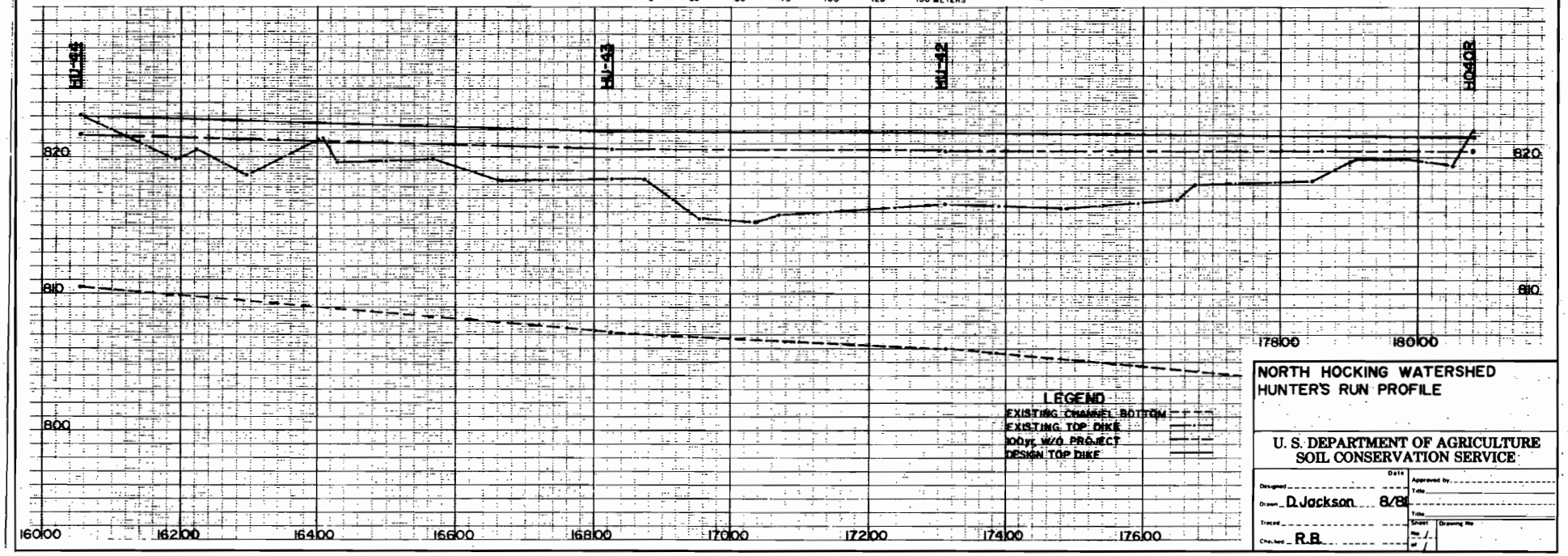

NORTH HOCKING WATERSHED
HUNTER'S RUN PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawn D. Jackson	8/81	Title
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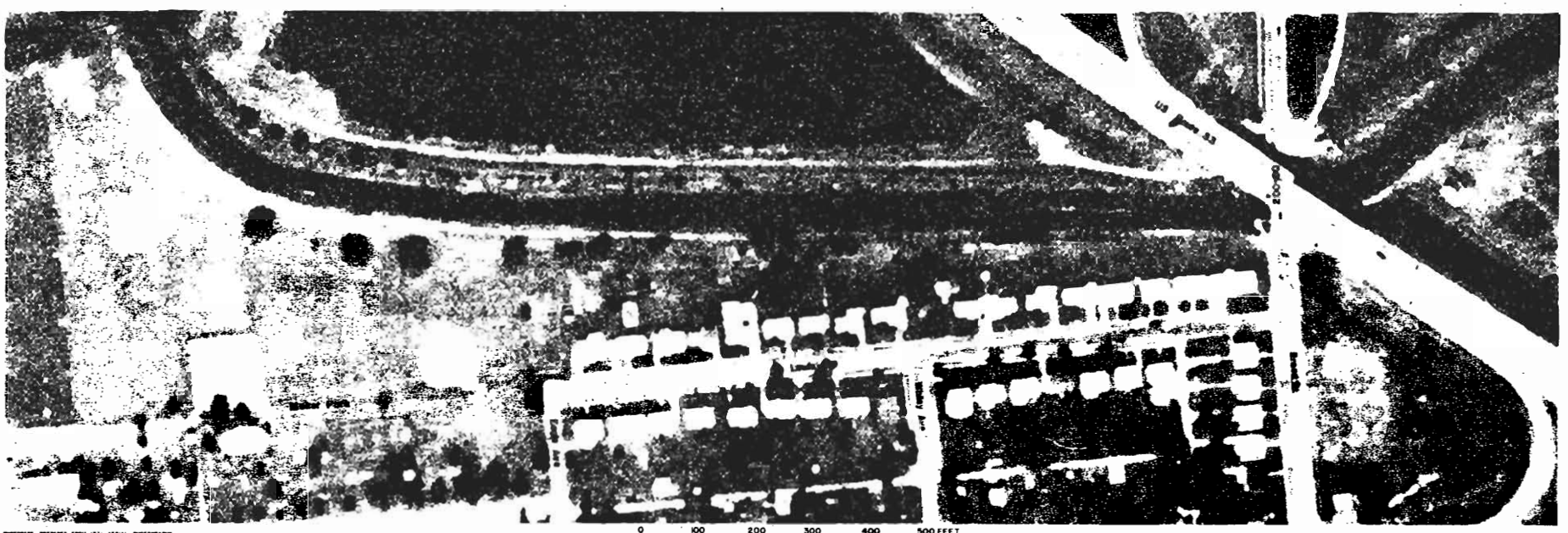

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THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION
DUE TO UNEVEN AERIAL PHOTOGRAPHIC DISPLACEMENT

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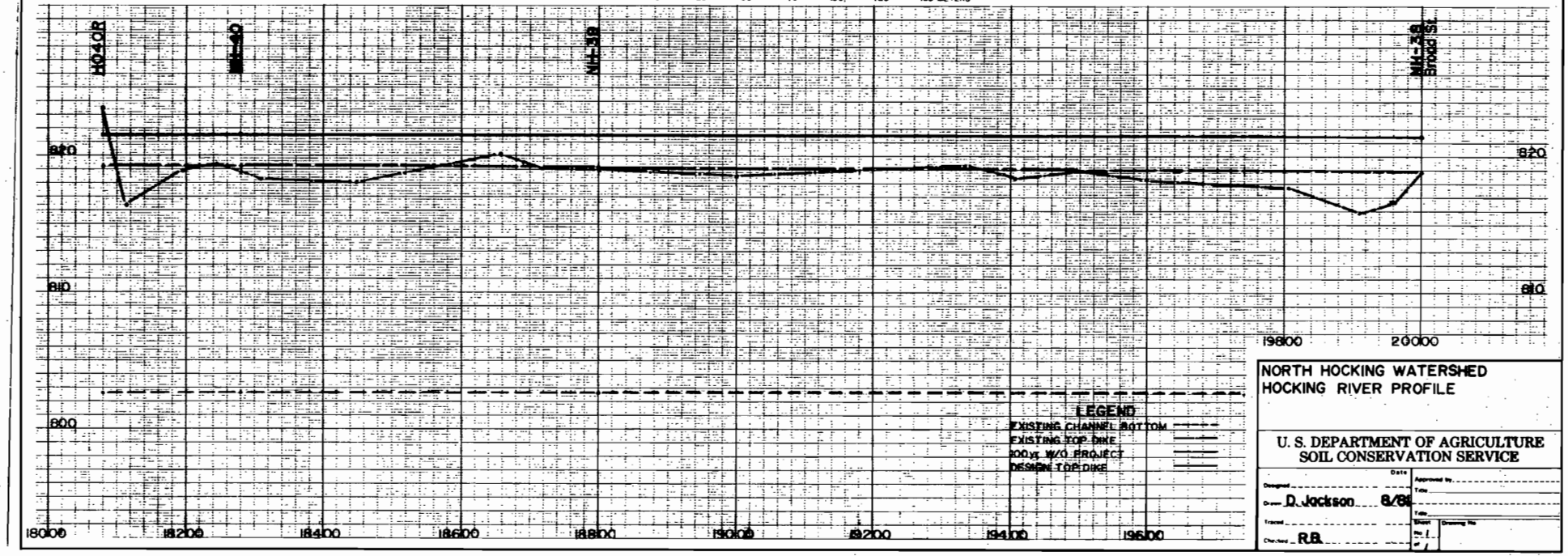

NORTH HOCKING WATERSHED
HOCKING RIVER PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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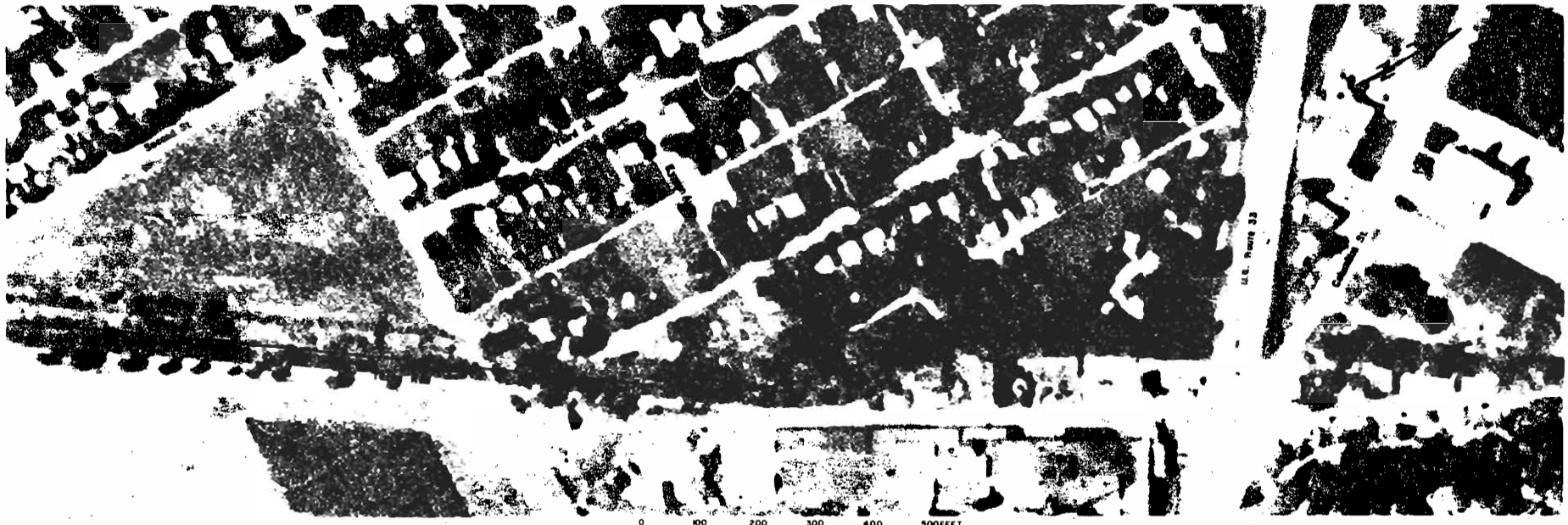

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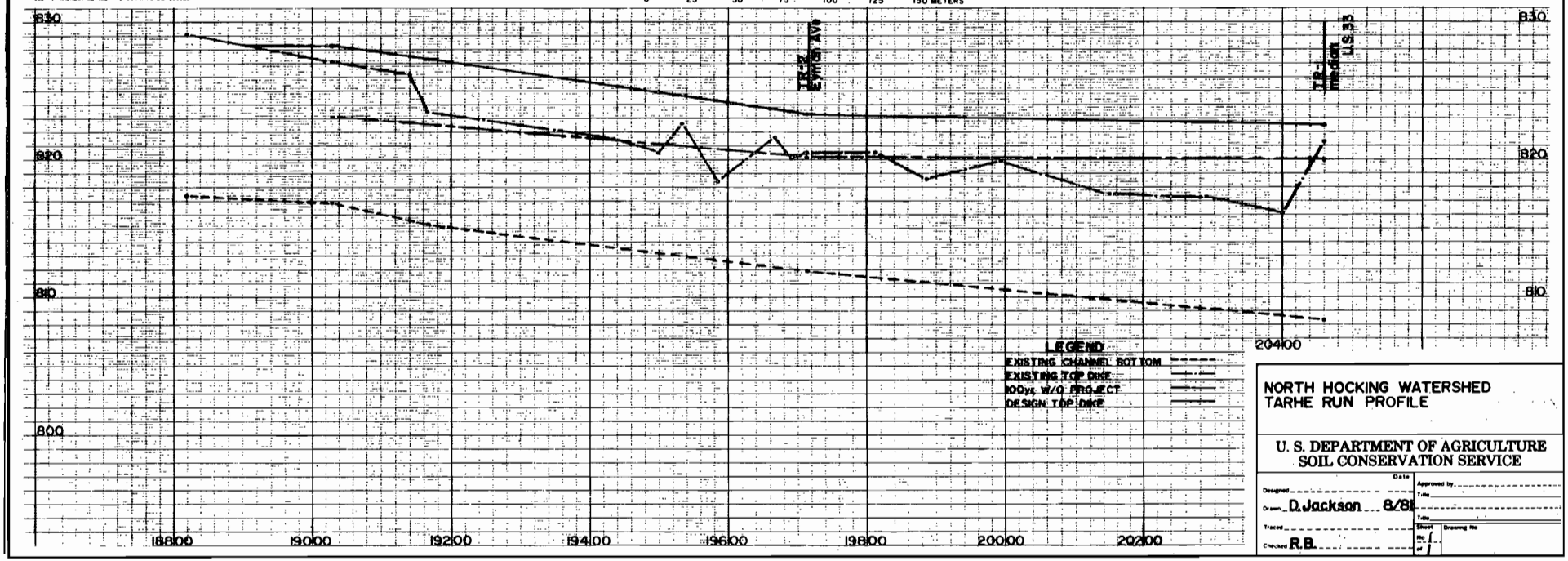
THE PHOTOGRAPHIC IMAGE MAY VARY FROM TRUE GROUND LOCATION DUE TO INHERENT AERIAL PHOTOGRAPHIC DISPLACEMENT

APPROXIMATE SCALE 0 100 200 300 400 500 FEET
0 25 50 75 100 125 150 METERS



NORTH HOCKING WATERSHED
TARHE RUN PROFILE

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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Drawing No.

APPENDIX D

EVALUATION OF

WATERSHED WILDLIFE HABITAT

APPENDIX D
EVALUATION OF WATERSHED WILDLIFE HABITAT

The drainage area of the watershed is approximately 68,670 acres consisting of 41 percent cropland (27,787 acres), 16 percent pastureland (11,032 acres), 24 percent forest land (16,609 acres), 14 percent urban (10,044 acres), and 5 percent other land uses (3,198 acres).

Field investigations have been conducted by representatives of the ODNR, Division of Fish and Wildlife, Natural Area and Preserves; U.S.D.I., Fish and Wildlife Service; and U.S.D.A., Soil Conservation Service for purposes of identifying existing habitat, inventorying and evaluating existing conditions and formulating mitigation plans.

Clearing the land for agriculture has been a continual process since the first settlers arrived. Agriculture remains the predominant land use within the watershed, however, urbanization is now the fastest growing land use.

The topography of the North Hocking Watershed changes from a flat to rolling extensive agricultural area in the north to forested hills in the south.

The highest quality wildlife habitat is in the southern part of the watershed. Crop fields are small and surrounded by strips of grass, weeds, and shrubs adjacent to forested tracts.

These areas provide nesting, food, and escape cover for squirrels, white-tailed deer, raccoons, quail, rabbits, songbirds, and other related upland species of wildlife.

Forested areas become quite extensive near the Fairfield-Hocking County line. Some harvesting of timber has been continued throughout the years, but in many areas few forest land management programs have been applied. This produced forests consisting of low quality, second growth timber.

Forest lands that are pastured or previously have been pastured are void of low woody vegetation and sapling growth. The remaining vegetation is represented by poor quality trees.

Some of the dominant species of trees are, but not limited to, Black Walnut, Hickory, Beech, Black Cherry, White Ash, Box Elder, Sugar Maple, Black Willow, Red Oak, White Oak, Black Oak, American Elm, and Honey Locust.

The watershed is not located in a major waterfowl flyway. National records indicate that a medium to low number of waterfowl utilize the flyway over central Ohio. Usage of the stream and ponds within the watershed by mallards, black ducks, and teal is largely restricted to resting stop-overs during migration. Nesting wood ducks are not common in this area due to range limitations.

Most of the watershed's furbearers inhabit the streamside vegetation, forest land, and nearby areas. In the watershed, records reveal that populations of opossum and skunk are maintaining a high density. Beaver, muskrat, and raccoon populations are medium density. Mink populations are low.

Additional species that can be found in the North Hocking Watershed are:

AMPHIBIANS 1/

Mudpuppy	Necturus maculosus
Hellbender	Cryptobranchus alleganiensis
Red Spotted Newt	Diemictulus u. viridescens
Longtailed Salamander	Eurycea l. longicauda
Northern Two-Lines Salamander	Eurycea b.bislineata
Small-mouthed Salamander	Ambystoma texanum
Marbled Salamander	Ambystoma maculatum
Western Chorus Frog	Pseudacria t. triseriat
Blanchard's Cricket Frog	Acres crepitans blanchordi
Pickerel Frog	Rana palustris
Northern Dusky Salamander	Desmognathus f. fuscus
Slimy Salamander	Plethodon g.glutinosus
Northern Red Salamander	Pseudotriton r. ruber
American Toad	Bufo americanus
Mountain Chorus Frog	Pseudncris brachyphona
Bullfrog	Rana catesbeiann
Northern Leopard Frog	Rana pipiens

REPTILES 2/

Northern Fence Lizard	Sceloporus undulatus hyacinthinus
Broad Headed Skink	Eumeces laticeps
Snapping Turtle	Chelydra serpentina
Eastern Box Turtle	Terrapene c. carolina
Midland Printed Turtle	Chrysemys picta marginata
Eastern Spiny Softshell	Trionyx s. spinifer
Map Turtle	Graptemys grographica
Kirtland's Watersnake	Natrix kirtlandi
Northern Ringneck Snake	Diadophis punctatus edwardsi
Eastern Hognose Snake	Heteroden platyrhinos
Northern Watersnake	Natrix s. sipedon
Northern Red Bellied Snake	Storerina o, occupitomacalata
Northern Brown Snake	Storeria d. dekayi
Eastern Garter Snake	Thamnophis s., sirtalis
Black Rat Snake	Elaphe o.obsoleta

1/ Ohio Department of Natural Resources, Divison of Wildlife, Non-Game Species Amphibians and Reptiles, Inservice Document 71, September, 1969.

2/ Ibid.

SMALL RODENTS 1/

Eastern Chipmunk	Tamias striatus obioensis
Deer Mouse	Peromyscus leucopus hoveboracensis
Eastern Harvest Mouse	Reithrodontomys humulis merriami
Meadow Vole	Microtus pennsylvanicus
Short Tailed Shrew	Blarina brevicauda kirtlandi
Smoky Shrew	Sorex femeus fumeus
Cottontail Rabbit	Sylvilagus floridanus
Raccoon	Procyan lotor
Eastern Fox Squirrel	Sciurus niger
Eastern Gray Squirrel	Scalurus carolinensis
Eastern Mole	Scalopus aguaticus machrinus
Muskrat	Ondatra zibethica
Opossum	Didelphis marsupialis
Striped Skunk	Mephitis mephitis
Whitetailed Deer	Odocoileus virginianus
Woodchuck	Marmota monax

FLYING MAMMALS 2/

Pygmy Bat	Pepistrellus subflavus
Big Brown Bat	Eptesicus fuscus fuscus
Red Bat	Lasiurus borealis borealis

SONGBIRDS 3/

There have been 280 taxons of birds recorded in the Central Ohio region. They vary from common to rare and accidental. The species break down is:

35 permanent	153 migrants
101 nonwintering summer breeding	10 summer visitors

FISHERY RESOURCES

The fishery resources have been studied in the Hocking River since the early 1930's. Recent surveys have been performed by the ODNR, Division of Wildlife.

Hocking River water quality within the watershed is generally poor. The section through Lancaster, Ohio, is the most polluted. The dissolved oxygen is low, B.O.D., C.O.D., and fecal coliform levels are high 4/.

1/ Ohio Department of Natural Resources, Division of Wildlife, Non-Game Species Mammals, Inservice Document 65, Sept.,1969.
2/ Ibid.
3/ Dennis M. Anderson and Charles C. King (ed.), Environmental Analysis of Central Ohio - An Initial Approximation, (Columbus, Ohio, November, 1976), Map Folio, page 11-B.
4/ U.S.G.S. (see Appendix E).

ODNR reports poor quality sport fisheries in the northern portion of the Hocking River. The fisheries do improve as the river flows south.

The following fish species are representative of the North Hocking:

FISH 1/

Ohio Brook Lamprey	Lampetra aepyptera
Golden Redhorse	Moxostoma erythrurum
Hog Sucker	Hypentelium nigricans
Common White Sucker	Catostomus commersoni commersoni
Bluntnose Minnow	Pimephales notatus
Silverjaw Minnow	Ericymba buccata
Black Bullhead	Ictalurus melas
Northern Smallmouth Blackbass	Micropterus dolomieui dolomieui
Northern Spotted Blackbass	Micropterus punctuintus punctuintus
Northern Largemouth Blackbass	Micrapterus salmoides salmoides
Greenside Darter	Etheostoma blennioides
Rainbow Darter	Etheostoma caeruleum
Barred Fantail Darter	Etheostoma flabellare flabellare

ENDANGERED, THREATENED OR PROPOSED SPECIES

The U.S. Fish and Wildlife Service listed five endangered, threatened, or proposed species in the watershed. They are the Indiana Bat, American Peregrine Falcon, Arctic Peregrine Falcon, Kirtland's Warbler, and American Glade - flower. Since then, all have been removed from the federal list with the exception of the Indiana Bat.

The Indiana Bat (Myotis sodalis) is suspected of traversing the area during the summer months. Contact was made with the ODNR, Division of Wildlife, Small Game and Endangered Species representative concerning the possible location of roosting trees in the proposed construction area. No roosting trees were located. The U.S. Fish and Wildlife Service determined no further consultation on the Indiana bat was necessary.

ODNR, Division of Natural Areas and Preserves, has no records of state listed endangered, threatened, or proposed species in the project area.

1/ Dennis M. Anderson and Charles C. King (ed.), Environmental Analysis of Central Ohio - An Initial Approximation, (Columbus, Ohio, November, 1976), Map Folio, page 11-B.

MITIGATION PLAN

The North Hocking Watershed Interagency Mitigation Team was formed and held its first meeting on October 21, 1980. The team members consist of representatives from Soil Conservation Service, Fish and Wildlife Service, Ohio Department of Natural Resources (Division of Fish, Wildlife, and Water) and technical advisors from the Corps of Engineers, S.C.S., Environmental Protection Agency, and local units of government and interested groups or organizations.

The team members reviewed the proposed area for diking, pumps, and storage pond construction.

The area affected is approximately 95 percent residentially developed. The areas disturbed by dike construction will be replanted to grass, trees, and shrubs. The pumps would be located on residential street corners involving very little vegetation disturbance. The storage pond in Maher Park is presently mowed grass and after construction will be replanted to grass and available for park use.

It was the consensus of the team members present that replanting the disturbed areas would be adequate mitigation. The team decided no significant impacts would result from the proposed dike, pumps, and storage pond construction.

The proposed Tarhe Run floodwater control structure design has not been finalized. Present estimates involve an area of approximately three acres. There will be no permanent pool. Storage of water will result only from storms of a 10-year frequency or greater. When water storage does occur it will only be for a brief period. A 100-year frequency storm has a maximum storage time of five hours.

The proposed mitigation plan consists of seeding all disturbed areas and replanting woody vegetation in an adjacent area. Mitigation team members will evaluate the Tarhe Run site after completion of design and will assist in developing a mitigation plan. Cooperation with mitigation team members and technical advisors will be an ongoing process.

FISH AND WILDLIFE VALUES

A review of Evaluation of Watershed Wildlife Habitat, will aid the reader in understanding the following impacts.

The watershed project has structural measures consisting of diking, pumps, and a storage pond within the city of Lancaster and a flood water retarding structure on Tarhe Run outside the city limits.

The construction within the residential area of Lancaster, Ohio consist of raising approximately 7600 feet of existing dike and installing pumps with a storage pond. Dike construction will temporarily eliminate an estimated 2 acres of trees and shrubs

and 7 acres of grassland primarily in residential lawns. A permanent loss of grass vegetation, approximately one-tenth acre, will occur as a result of constructing concrete dikes in areas where buildings restrict construction of earthen dikes.

Trees are generally in the sapling and pole stage. Woody vegetation is primarily located on the inside channel slope and will not be disturbed. Dike construction will be limited to the area on top of the bank and adjacent to the channel. Small isolated areas of streambank erosion will be repaired and vegetated. Borrow material for earthen dikes will be obtained from open areas behind the dike or an SCS approved offsite source.

The pumps will be installed adjacent to city streets. The pumps will disturb approximately one-half acre of residential lawns.

The storage pond will be in Maher Park. It will consist of a low dike around the park and surface grading to improve the storage capacity. The area presently consists of mowed grass and is utilized for park recreation purposes. Water from the pumps will be stored in the park for short periods of time, usually three hours or less. The disturbed area will be replanted to grass and designed to incorporate recreational uses and blend into the landscape. It is anticipated construction will be completed in one year.

The dike, pumps, and storage pond construction will not have a significant impact on wildlife. The aquatic and benthic environments will not be effected by construction.

The dike, pumps, and storage pond construction areas will be mitigated by fertilizing, seeding, and mulching. Trees and shrubs will be planted where feasible.

Dike construction is expected to temporarily displace populations of songbirds, rabbits, and rodents. They will return to the area quickly after revegetation.

The Tarhe Run floodwater control structure has a drainage area of approximately 600 acres consisting of 150 acres of cropland, 60 acres of permanent grassland, 156 acres of forest land, 234 acres of other land uses. Urbanization is increasing in the immediate area of the structure and this trend is expected to continue.

The structure will be located in a woodland and pasture area adjacent to a golf course south of Mill Road. The construction area will be limited to that required for the dam and spillway. Sufficient material to build the dam will be obtained from spillway excavation. It is anticipated construction will be completed in one year.

The structure will not impound permanent water. The flood pool will briefly store runoff from storms greater than a 10-year frequency. Maximum storage time is approximately five hours once in one hundred years. The base flow and runoff produced by

less than a 10-year frequency storm will flow unimpeded through the pipe.

Runoff contains a minimal amount of sediment and no build-up will occur in the pool. The pool area and area below the dam will not be disturbed by construction.

The construction will permanently eliminate an estimated two acres of mixed hardwoods and a one-fourth acre seasonal home site. Also, approximately one acre of grassland will be temporarily disturbed. Following construction the area will be fertilized, limed, seeded, and mulched.

The loss of mature hardwoods will permanently displace the population of squirrels. Remaining species of upland wildlife inhabiting the area will quickly return. The opening of the forest canopy by construction is expected to benefit wildlife by increasing understory growth and providing additional food, nesting, and escape cover.

Existing terrestrial nesting habitat within the pool will be flooded, on the average, once every ten years. The effect will be minimal due to the short duration of water storage. The pool will fill to a maximum area of approximately 4.2 acres, during a 100-year event. No long term adverse effects are anticipated. Loss of woody vegetation will be mitigated by planting trees and shrubs.

The stream is continually supplied by springs. It is approximately four feet wide and six inches deep with a gravel bottom. The water quality improves upstream from Mill Road 1/. The stream flow will not be interrupted during construction.

A temporary increase in sediment is expected during construction, however, techniques will be utilized to minimize this problem. No long term effects from sediment is anticipated.

A check of ODNR records reveals fishery data is not available on Tarhe Run. The placing of a pipe will temporarily alter approximately 200 feet of existing stream bottom which will displace aquatic and benthic populations. The pipe will be approximately four feet in diameter. It is anticipated the stream bottom material will redistribute throughout the bottom of the pipe. It is expected the aquatic and benthic habitat will recolonize quickly after construction.

No significant short or long-term adverse effects to the aquatic and benthic habitat are anticipated.

1/ U.S.G.S. Open file data on water quality in North Hocking Watershed.

APPENDIX E

WATER QUALITY

A WATER QUALITY ASSESSMENT FOR THE NORTH HOCKING WATERSHED

Purpose

A water resource project to reduce flooding is being planned for the North Hocking Watershed in Fairfield County, Ohio. The study will concentrate on the urban area along the floodplain in Lancaster. Measures that may be used to reduce flooding include diking of certain areas in the city, flood control dams in the headwaters of tributaries and nonstructural measures such as a flood warning system and flood-proofing.

A water quality study was planned in order to characterize the existing quality and to predict the impacts of the planned measures on the future water quality.

Approach

Eight locations were chosen as sample sites in the watershed. See Map pg. 2. Samples were taken 4 times over a six-month period from April through September, 1980. This consisted of samples for 3 base flow measurements and one storm event.

The station locations were chosen to provide a picture of the water quality at the headwaters and to show any changes as it proceeded through the urban area and finally its condition downstream from the sewage treatment plant.

The land use in the watershed is primarily agricultural with the following major uses:

41% Cropland
16% Pasture
24% Woodland
19% Other and Urban

The headwaters are represented by stations #3, #5, #6, #7, and #8. The influence of the urban area is represented by stations #4 and #2. The condition downstream from the sewage treatment plant is indicated by station #1.

A cooperative agreement was entered into with the USGS to perform the sampling and lab analysis. The following items were measured or determined by lab or field analysis:

Item	Units
Flow	cfs
Specific Conductance	micromhos
pH	units
Temperature	centigrade
Turbidity	NTU
Dissolved oxygen	mg/l
COD	mg/l
BOD_5	mg/l
Coliform, fecal 0.7 UM-MF	cols/100ml
Streptocci fecal KFAGAR	cols/100ml
Calcium total recoverable	Mg/las Ca
Magnesium total recoverable	mg/l as Mg
Sodium total recoverable	mg/l as Na
Potassium total recoverable	mg/l as K
Bicarbonate	mg/l as NCO_3
Carbonate	mg/l as CO_3
Alkalinity	mg/l as Ca_3CO
Carbon dioxide, dissolved	mg/l as CO_2
Sulfate, dissolved	mg/l as SO_4
Chloride, dissolved	mg/l as CI
Solids, residue @ 180°C, total	mg/l
Solids, residue @ 105°C, total	mg/l
Nitrogen, (NO_2 + NO_3) total	mg/l as N
Nitrogen, Ammonia total	mg/l as NH_4
Nitrogen, Ammonia + Organic total	mg/l as N
Nitrogen, total	mg/l as N
Nitrogen, total	mg/l as NO_3
Phosphorus total	mg/l as P
Phosphorus, Orthophosphate total	mg/l as P

Heavy Metals in Bottom Sediment:

Arsenic	Cobalt	Molybdenum
Barium	Copper	Nickel
Beryllium	Lead	Selenium
Cadmium	Manganese	Zinc
Chromium	Mercury	

Pesticides in Bottom Material:

PCB	Endrin	Methyl trithion
Aldrin	Ethion	Parathion
Chlordane	Heptachlor	Toxaphene
DDD	Heptochor epoxide	Trithion
DDE	Lindane	2,4-D
DDT	Malathion	2, 4,-5t
Diazinon	Methoxychlor	Silvex
Dieldrin	Methylparathion	

Benthic invertebrates

WATER QUALITY DATA

Dissolved oxygen

Dissolved oxygen is necessary for the survival of aquatic species and plants. State Standards require a minimum level of 5.0 mg/l for warm water habitat for 16 hrs. of any 24 hour period or an instantaneous minimum of 4.0 mg/l. All stations had D.O. values in excess of allowable standards except stations #1 and #2. The low levels are attributed to the effect of the sewage treatment plant effluent during the summer months.

Temperature

Stream temperature varied throughout the sampling period and from station to station, but generally it increased as the water proceeded downstream. At no time did the temperature exceed the standards set by the state for any of the locations sampled.

pH

The pH is a measure of the hydrogen ion activity in a water sample. It is an important factor in the chemical and biological systems of natural waters. Changes in pH can affect the concentrations of toxic compounds such as ammonia NH_3 or hydrogen cyanide HCN. It also affects the amount of CO_2 released when an acid is discharged in a slug. The pH was near neutral (7.0) or slightly above (8.3) and is well within the acceptable range of 6.5 to 9.0 at all stations. This was true for both base flow and storm flow events.

Nutrients

Two of the common nutrients required for aquatic plant growth and reproduction are nitrogen and phosphorus. They are generally considered to be the major nutrients which can limit or control biological productivity in aquatic systems.

Forms of phosphorus and nitrogen which can be utilized by aquatic plants are the soluble orthophosphate and inorganic nitrogen (NO_2 + NO_3) fractions. (Rast and Lee 1978). Critical concentratrations of inorganic phosphorus and inorganic nitrogen required for aquatic growth are 0.01 mg/l and 0.3 mg/l respectively. (Sawyer 1974). Above these levels nuisance algal blooms can occur.

The inorganic nitrogen concentrations at all stations exceeded the minimum levels shown to cause algal growths. The base flows for the headwater stations #3, #5, #6, and #8 showed concentrations from 0.9 mg/l to 2.7 mg/l. Concentrations increased during the June storm events in the headwater streams. Values ranged from 3.0 at station #8 to 10 mg/l at station #6. This probably was caused by the leaching of fertilizers from the agricultural watershed during periods of runoff.

Concentrations of inorganic nitrogen at stations #1 and #2 showed elevated levels ranging from a low of 0.41 mg/l to 4.2 mg/l. These values reflect the nutrient loading from the sewage treatment plant effluent.

Concentrations of orthophosphates ranged from 0.00 at station #6, to 0.15 mg/l at station #5 for the base flow at the headwater stations. Values from the June storm event showed concentrations of 0.03 mg/l at station #8 to 0.21 mg/l at station #7. The increased level of phosphates during the storm event reflects the soil erosion coming from the agricultural watershed. Concentration at stations #1 and #2 showed elevated levels of phosphates ranging from a low of 0.12 mg/l to a high of 1.9 mg/l. These reflect the nutrient loading from the sewage treatment plant effluent.

Major Constituents

The major cations in most inland surface waters are calcium (Ca), magnesium (Mg), sodium (Na), and potassium (K). The major anions are bicarbonate (HCO_3), carbonate (CO_3), sulfate (SO_4), and chloride (Cl). The concentration of these constituents in surface waters is related to the composition of rock material in the drainage basin (Wetzel, 1975).

The streamflow at sites #3, #5, #6, #7, and #8 were characterized by very hard calcium bicarbonate water during low flows. (28-82) mg/calcium, (150-342) mg/l bicarbonate, (20-56) mg/l sulfate. See criteria used to classify water from Tobin and Younger, (1972). See Table below:

MAJOR CONSTITUENTS COMPARED

	#3 mg/l	#5 mg/l	#6 mg/l	#7 mg/l	#8 mg/l
Calcium	28-59	42-77	44-81	51-82	42-67
Bicarbonate	150-204	240-312	230-316	300-342	240-308
Sulfate	20-21	24-53	48-56	40-45	39-41
Magnesium	11-17	18-29	19-30	20-31	18-26

Pesticides

Samples from the bottom material were taken in June and September to be analyzed for pesticides. The following items did not show up in any of the samples:

Aldrin	Methoxychlor	Trithion
Ethion	Methylparathion	2-4,D
Heptachlor	Methyltrithion	2-4, 5-T
Lindane	Parathion	Silvex
Malathion	Toxaphene	

The only pesticide that showed up consistently at all stations was chlordane. It was in the range of 1-7 ug/kg at all stations except #1 where it was very high 24-140 ug/kg. This can be explained since station #1 is downstream of the tributaries and the sewage treatment plant effluent. Also, chlordane persists for a long period of time in the soil. Other pesticides identified at more than one station were DDT, Diazinon Dieldrin, and Heptochlorepoxide.

At the present time there are no limits set by U.S. EPA for pesticides in sediment. PCB's were found in high concentrations

at station #1 which probably can be attributed to the sewage plant effluent which in turn reflects the wastes generated by industry in the city.

BIOLOGIC DATA

Benthic Invertebrates

Benthic invertebrates are associated with the substrate of a stream. Because of their limited mobility and relatively long life span, they are often used as indicators of water-quality conditions. The benthic community of an unstressed, clean water system normally consists of a large number of different organisms with few individuals of each type present. Aquatic systems stressed or degraded by contamination are characterized by benthic communities of a few different types with large numbers of each.

The quantitative expression of the distribution of organisms among taxa is called a diversity index. The Shannon-Weaver function was used to calculate mean diversity (d) for this study (Shannon and Weaver, 1949).

Diversity index values of clean water systems are usually between 3 and 4, while those of highly polluted waters are less than 1. Values between 3 and 1 indicate slight to moderate levels of degradation (Wilhm, 1970).

Sample counts and diversity indices are included in the lab data. Samples were collected on multiplate samplers left in the stream for approximately one month:

DIVERSITY INDICES

Station	D.I.	Date
#1	0.0	July, 1980
#3	2.9	July, 1980
#5	3.0	July, 1980
#6	3.4	Sept., 1980
#7	3.3	Sept., 1980
#8	2.7	July, 1980

The samples indicate that the headwater streams have good water quality while station #1 indicates a polluted condition. This agrees closely with the chemical and physical parameters analyzed.

Bacteria

Water samples are analyzed for bacteria as an indication of contamination. Two bacteria commonly tested for are fecal coliforms and fecal streptococci. The ratio of fecal coliform to fecal streptococci is used as an indication of the source of these bacteria. Ratios greater than 4.0 indicate wastes of predominantly human origin whereas ratios less than 1.0 indicate wastes of animals, particularly livestock and poultry (Millipore Corp. 1973).

Fecal coliform and fecal streptococci data for sampling sites #1, #3, #5, #6, #7, and #8 are shown in the sample data. The average fecal coliform to fecal streptococci ratios are:

#1 = 12:1	human
#2 = 10.3:1	human
#3 = 2.7:1	both
#4 = 4.7:1	human
#5 = .79:1	livestock
#6 = 2.7:1	both
#7 = 1.6:1	both
#8 = 2:1	both

The base flow samples indicated moderate levels of bacteria at all stations except the urban stations where levels were high. The levels at station #3, #5, #6, #7, and #8 were all less than 5000 col/100ml fecal coliform except during the runoff event when this ranged from 16,000 to 170,000 col/100ml fecal.

The urban stations indicated a high level of bacteria predominantly from humans and also reflects the poor quality of the sewage treatment plant effluent. The urban stations all exceeded the Ohio EPA standards for secondary contact recreation of 5000 col/100ml.

The stations in the headwaters generally indicated bacteria from livestock which reflects the agricultural watersheds in those locations.

SUMMARY

Water quality and discharge characteristics were measured at 8 locations in the Hocking River Basin in and around Lancaster, Ohio. Data was collected over a six month period from April through September, 1980 by the USGS. Water quality at the upstream stations can be considered to be good. Dissolved oxygen levels, temperature and pH were well within acceptable standards. Nitrogen and phosphorus levels were somewhat elevated due to the runoff from the agricultural watersheds but usually do not produce nuisance algal blooms.

Bacterial contamination was evident and reflected both human and livestock sources that reside in the watershed. The aquatic diversity indices also reflected the good water quality in the upstream areas.

The urban section through Lancaster downstream from Broad Street indicated a polluted condition. This was reflected by the high bacterial counts, low diversity index, lowered dissolved oxygen and enriched nutrient loadings of nitrogen and phosphorus.

Planned Measures

The proposed measures include raising the level of the existing dikes by 3' - 4' along portions of the Hocking River, Tarhe Run, and Hunters Run. (See Map) No work is planned in the channel bottom and only minimal hand clearing of woody vegetation will

occur on the slopes. Surface waters in the Maher Park area will be impounded temporarily and then released to the stream through gravity outlets.

A flood retarding dam is planned on Tarhe Run just upstream from Sample Site #3. No permanent water will be stored behind this dam. Storm runoff from rainfalls less than a 10 year frequency will flow straight through the structure. Temporary storage for the 100 year event is less than 5 hours.

Impacts

The planned project measures will have no detrimental effects on the existing water quality. The work on the dikes will not alter the existing stream channel during construction. The temporary storage pond in Maher Park will allow some of the sediment to drop out before being released to the stream which will be a positive impact. Bacterial contamination contained in the run-off stored in Maher Park could pose a health problem. However, the Ohio EPA has indicated that these bacteria die rapidly when exposed to air and they felt that by the time the field was dry enough for play any danger of bacterial contamination would be gone.

The water impounded at the dam site will be too infrequent to cause any measureable impact on water quality. Erosion control techniques such as mulching, diversions, temporary seeding, and sediment traps will be used during the construction of the dam to reduce the amount of sediment reaching the stream. Construction will extend over a 3-4 month period with no more then 1-2 acre being disturbed at any given time. The total area disturbed is less than 4 acres.

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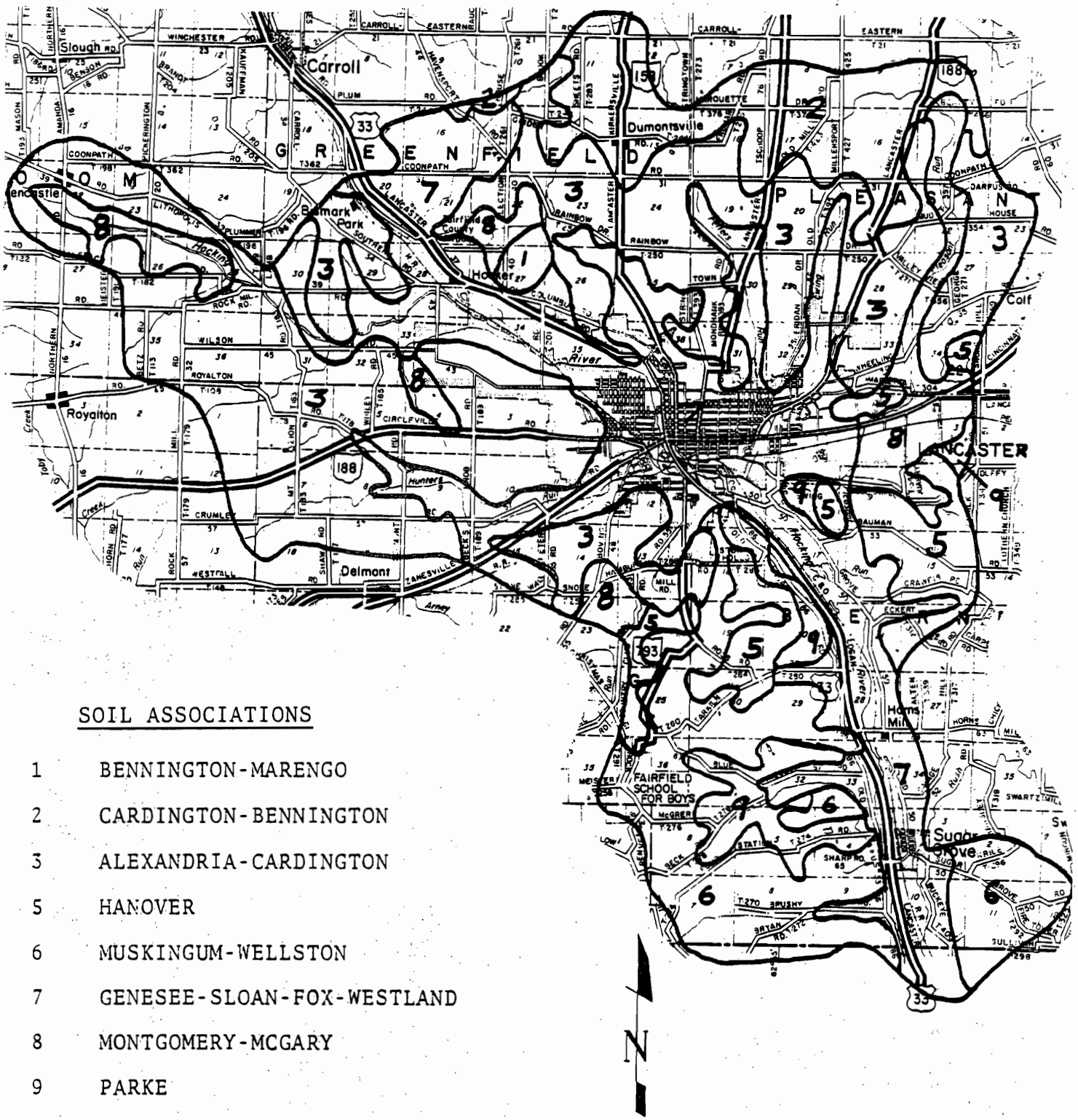
APPENDIX F

SOILS MAP

GENERAL SOIL MAP - NORTH HOCKING WATERSHED



SOIL ASSOCIATIONS

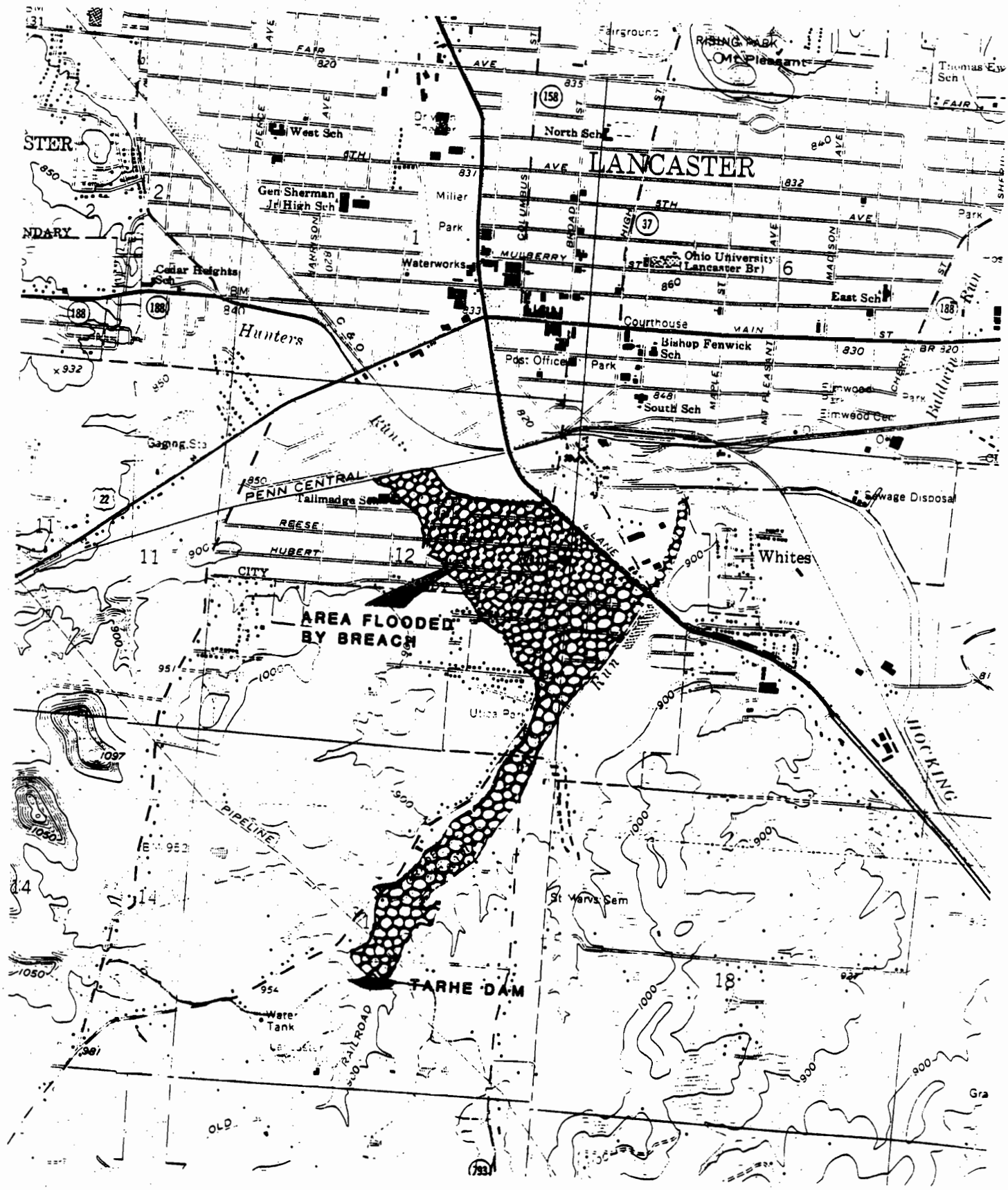
1	BENNINGTON-MARENGO
2	CARDINGTON-BENNINGTON
3	ALEXANDRIA-CARDINGTON
5	HANOVER
6	MUSKINGUM-WELLSTON
7	GENESEE-SLOAN-FOX-WESTLAND
8	MONTGOMERY-MCGARY
9	PARKE

0 1 2 3 4 5 6

SCALE OF MILES

APPENDIX G

BREACH ROUTING



BREACH ROUTING MAP

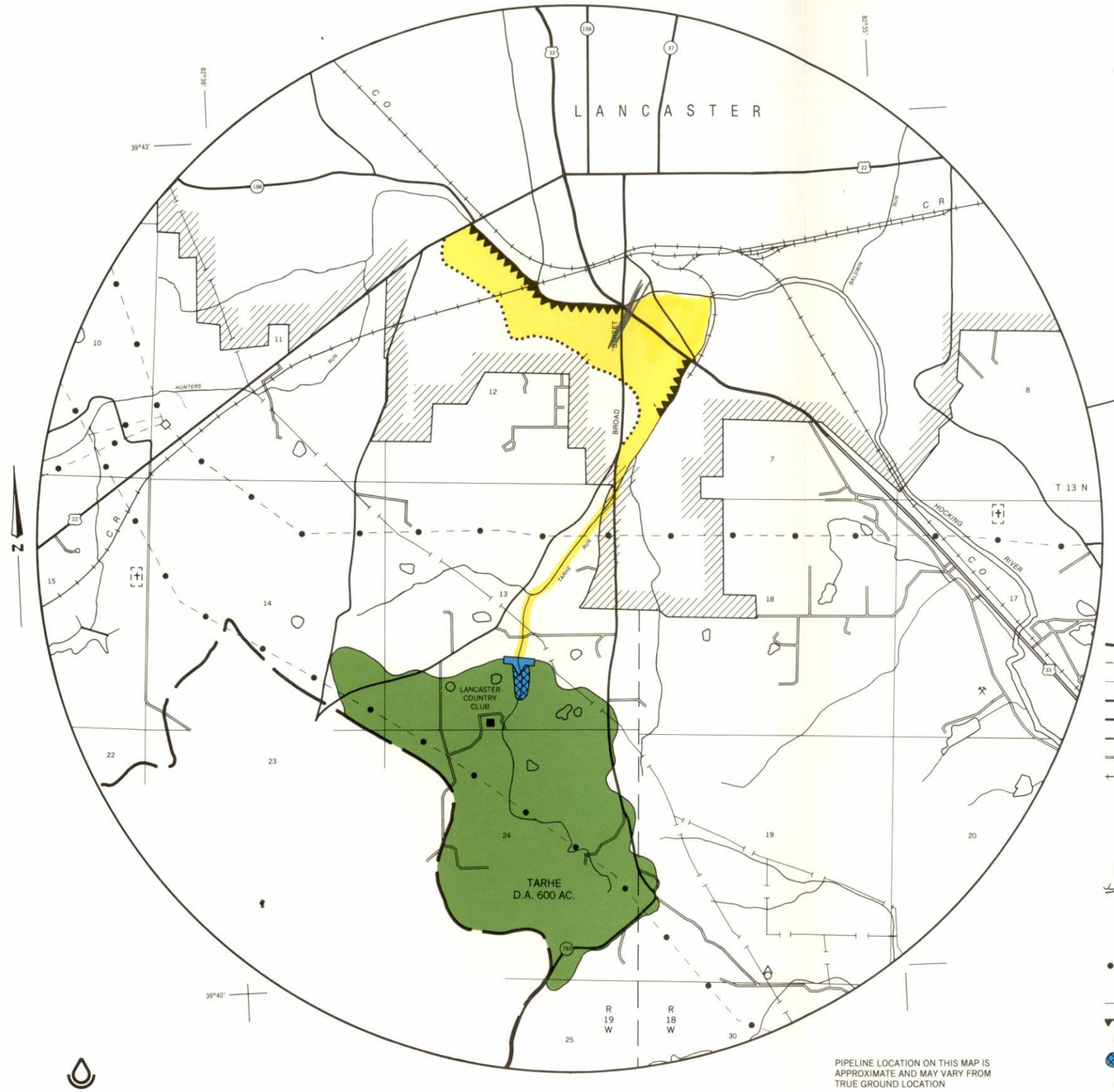
TARHE DAM

APPENDIX H

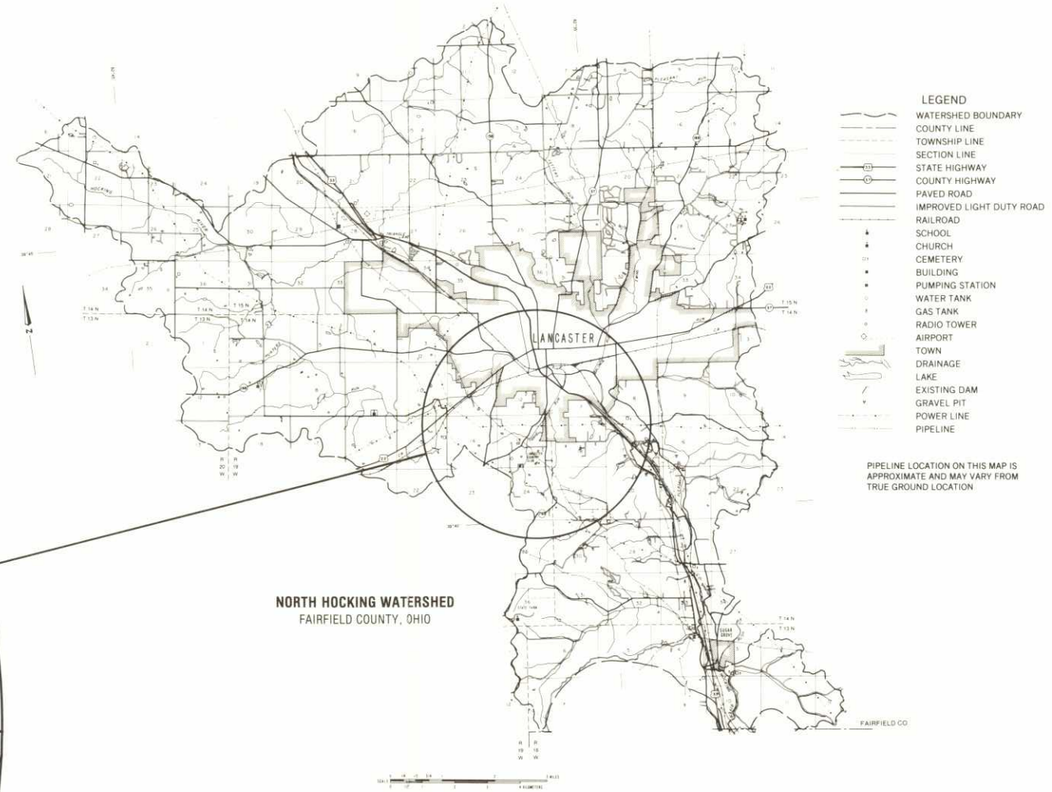
PROJECT MAP

U.S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE



PIPELINE LOCATION ON THIS MAP IS APPROXIMATE AND MAY VARY FROM TRUE GROUND LOCATION



NORTH HOCKING WATERSHED
FAIRFIELD COUNTY, OHIO

LEGEND
- WATERSHED BOUNDARY
- COUNTY LINE
- TOWNSHIP LINE
- SECTION LINE
- STATE HIGHWAY
- COUNTY HIGHWAY
- PAVED ROAD
- IMPROVED LIGHT DUTY ROAD
- RAILROAD
- SCHOOL
- CHURCH
- CEMETERY
- BUILDING
- PUMPING STATION
- WATER TANK
- GAS TANK
- RADIO TOWER
- AIRPORT
- TOWN
- DRAINAGE
- LAKE
- EXISTING DAM
- GRAVEL PIT
- POWER LINE
- PIPELINE

PIPELINE LOCATION ON THIS MAP IS APPROXIMATE AND MAY VARY FROM TRUE GROUND LOCATION

OHIO

LEGEND
- WATERSHED BOUNDARY
- TOWNSHIP LINE
- SECTION LINE
- STATE HIGHWAY
- COUNTY HIGHWAY
- PAVED ROAD
- IMPROVED LIGHT DUTY ROAD
- RAILROAD
- CEMETERY
- BUILDING
- WATER TANK
- GAS TANK
- TOWN
- DRAINAGE
- LAKE
- EXISTING DAM
- GRAVEL PIT
- POWER LINE
- SUBSTATION
- PIPELINE
- FLOOD PREVENTION DIKES
- BENEFITED AREA
- FLOODWATER RETARDING STRUCTURE
- DRAINAGE AREA CONTROLLED BY STRUCTURE
- D.A. 600 AC. DRAINAGE AREA ACREAGE

PROJECT MAP
NORTH HOCKING WATERSHED
FAIRFIELD COUNTY, OHIO

SOURCE:
SCS DRAWING NO. 5,R-38,028, AND INFORMATION FROM SCS FIELD PERSONNEL
POLYCONIC PROJECTION
USDA-SCS LINCOLN, NEBR. 1981

6-9-81
5,S-38,248