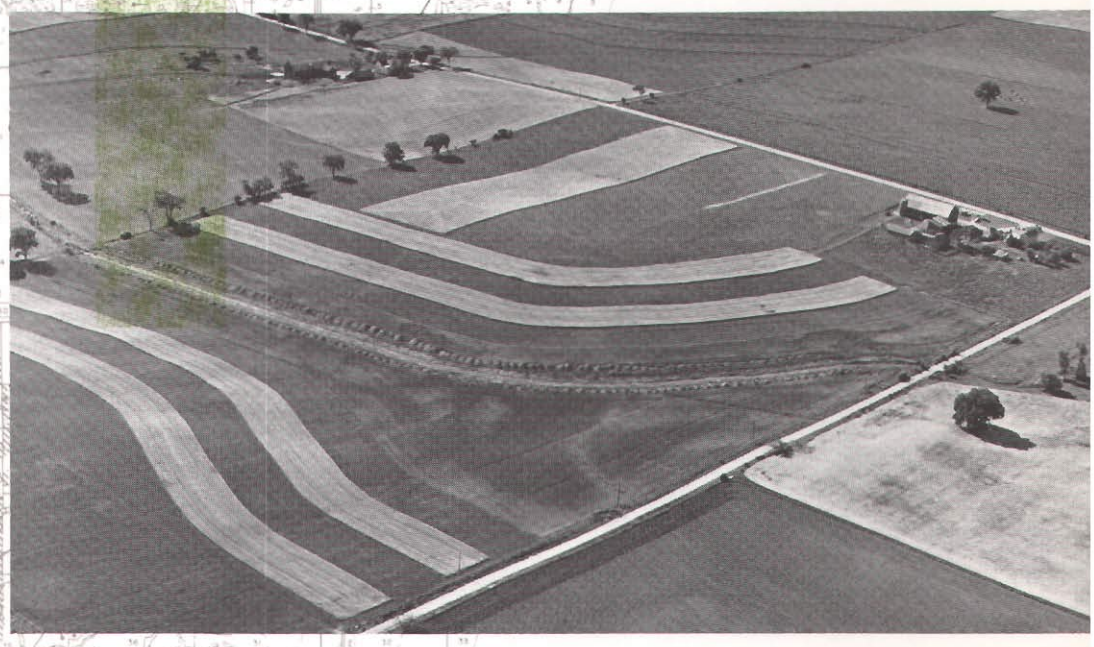
COMMUNITY ASSISTANCE
PLANNING REPORT NO. 171

OZAUKEE COUNTY AGRICULTURAL SOIL EROSION CONTROL PLAN



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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 171

OZAUKEE COUNTY AGRICULTURAL SOIL EROSION CONTROL PLAN

Prepared by the

Southeastern Wisconsin Regional Planning Commission
P. O. Box 1607
Old Courthouse
916 N. East Avenue
Waukesha, Wisconsin 53187-1607

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SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

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February 22, 1989

Chairman and Members
Land Conservation Committee
Ozaukee County Board
Ozaukee County Courthouse
121 W. Main Street
Port Washington, Wisconsin 53074

Dear Committee Members:

Recognizing the need to abate cropland soil erosion, and to comply with the erosion control planning requirements of Section 92.10 of the Wisconsin Statutes, the Ozaukee County Board in 1985 determined to prepare a cropland soil erosion control plan. The County Board requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of the plan. This report presents the requested plan.

The soil erosion control plan as documented in this report identifies the agricultural soil erosion control problems existing in the County; recommends an agricultural soil erosion control objective and related standards; identifies the types and amounts of soil erosion control practices needed to reduce agricultural soil erosion to tolerable levels within the County; and recommends a long-range implementation strategy to guide the concerned agencies and units of government in their efforts to assist farmers in the application of the needed erosion control practices.

Adoption and implementation of the plan presented in this report should result in the material abatement of excessive cropland soil erosion, reducing soil erosion to tolerable levels by the year 2000. This should contribute to the preservation and protection of the invaluable soil resource of the County for use by future generations, and minimize the environmental problems associated with cropland soil erosion.

The Regional Planning Commission is pleased to have been able to be of assistance to the County in the preparation of this plan. The Commission, of course, stands ready to assist the County on request with plan implementation.

Sincerely,

Kurt W. Bauer
Executive Director

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Chapter I

INTRODUCTION

The dust bowl experience of the 1930's generated a national interest in the wise use of the soil. Governmental agencies were created and cost-sharing programs developed to help farmers better manage the soil resource. Since that time, many agriculture landowners have practiced more responsible management aimed at the wise use and conservation of the invaluable soil resources of the nation. Others, however, have not. In addition, in Wisconsin, there has been a shift away from dairy farming and traditional crop rotation patterns generally compatible with long-term resource protection in favor of continuous row cropping that can lead to severe soil erosion and associated problems unless special precautions are taken.

Soil erosion takes place when water or wind carries soil away from inadequately protected land surfaces. When it occurs at a rapid rate, erosion can cause serious problems. The loss of topsoil from agricultural land, for example, means that the land loses part of its productive capacity. Eventually, no amount of fertilizer can, as a practical matter, replace this loss, and the ability of the land to produce crops may be jeopardized. Thus, the land and the people who occupy and work it may both become poorer. Downstream sites—the places to which the eroded soil is carried—experience a different but also very costly set of problems. These may include the clogging of culverts and drainageways, and diminished water quality, and in some cases interference with commercial as well as recreational navigation. Soil erosion contributes to the water quality problems of lakes and streams, as the resulting sediment is volumetrically the greatest water pollutant, destroying fish and wildlife habitat and rendering recreational areas undesirable.

Because of the increasing concern over soil erosion, the Wisconsin Legislature in 1982 revised Chapter 92 of the Wisconsin Statutes, the state soil and water conservation law, to require the preparation of county soil erosion control plans focusing on the control of cropland soil erosion. A total of 55 counties located in generally the southern two-thirds of the State, including Ozaukee County, are required to prepare such a plan. Chapter 92 requires that an erosion control plan: 1) specify maximum acceptable rates of erosion; 2) identify the parcels where soil erosion standards are not being met; 3) identify the land use changes or management practices which would bring each area of land into compliance with standards adopted by the county land conservation committee; 4) specify procedures to be used to assist landowners and land users in controlling soil erosion; and 5) establish priorities for controlling soil erosion.

THE OZAUKEE COUNTY SOIL EROSION CONTROL PLAN

Recognizing the need for increased efforts to control soil erosion in Ozaukee County, and in an effort to comply with the planning requirements of Chapter 92 of the Wisconsin Statutes, the Ozaukee County Board in 1985 determined to prepare a county soil erosion control plan, and requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of such a plan. The County received a planning grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection in partial support of the required work. The planning program was cooperatively undertaken by the Regional Planning Commission and the Ozaukee County Land Conservation Department, and was carried out under the guidance of the Ozaukee County Land Conservation Committee. The Land Conservation Department and the Commission staff were assisted in the preparation of the plan by a Technical Advisory Committee consisting of county farmers and representatives of the Wisconsin Department of Natural Resources, the University of Wisconsin-Extension, and the U. S. Department of Agriculture. A full committee membership list is set forth on the inside front cover of this report.

The soil erosion control planning program was undertaken simultaneously with, and fully coordinated with, a detailed nonpoint source water pollution abatement planning program for the Milwaukee River watershed, referred to as the Milwaukee River Priority Watersheds Program. Among the nonpoint sources of pollution addressed in the priority watersheds program is

cropland soil erosion. Inventory data for cropland within the Milwaukee River watershed collected under that program were incorporated directly into the county soil erosion control planning program.

SCHEME OF PRESENTATION

The Ozaukee County soil erosion control plan is presented in eight chapters. Following this introductory chapter, Chapter II, "Description of the County," describes those aspects of the natural resource base and man-made environment of Ozaukee County that are particularly relevant in any consideration of soil erosion problems and efforts to address those problems. Chapter III, "Soil Erosion Inventory," describes the methodology and findings of a countywide inventory of cropland and related analysis of cropland soil erosion rates. Chapter IV, "Cropland Soil Erosion Control Objective, Principle, and Standards," presents the cropland soil erosion control objective, supporting principle, and related standards, establishing maximum acceptable erosion rates on cropland in the County. Chapter V, "Soil Erosion Control Practice Needs," identifies the types and amounts of soil erosion control practices that would effectively address soil erosion problems in the County. Chapter VI, "Agencies and Programs Concerned with the Control of Cropland Soil Erosion," identifies the agencies and units of government that are concerned with the control of soil erosion, and describes the various government-sponsored programs that have been established to address soil erosion problems. Chapter VII, "Implementation Strategy," sets forth an overall framework to guide the erosion control activities of the concerned agencies and units of government from 1989 through the year 1999. Chapter VIII, "Summary," presents a summary of the major findings and recommendations of the planning program.

Chapter II

DESCRIPTION OF THE COUNTY

The preparation of a workable soil erosion control plan for Ozaukee County requires an understanding of the natural resource base and of the pattern of human activities which has been superimposed on that resource base. Accordingly, this chapter describes those features of the natural resource base and of the man-made environment that are the most important in any consideration of soil erosion problems in the County. The first portion of the chapter describes important elements of the natural resource base, including the topography, geology, soils, and surface water resources of the County. The second portion of the chapter describes trends in population, land use, and cropping patterns in Ozaukee County.

NATURAL RESOURCE BASE

Physiographic and Topographic Features

Glaciation has largely determined the physiography and topography of southeastern Wisconsin, including Ozaukee County. The physiographic features or surficial land forms of southeastern Wisconsin are shown on Map 1, and the regional topography or variation in elevation is depicted in a generalized manner on Map 2. Major glacial land forms in Ozaukee County include end moraines and ground moraine. End moraines were formed by deposition at the margin of a glacier. Typically they consist of a ridge with a rolling surface, often having enclosed depressions, or "kettles." End moraines in Ozaukee County are generally parallel to the Lake Michigan shore, marking the stages of advance and retreat of glaciers from the Lake Michigan basin. Ground moraine, consisting of heterogeneous material deposited beneath the ice, typically occurs as a gently undulating plane of moderate relief, with no definite alignment to the undulation.

Topographic features—particularly slope length and slope steepness—have a direct bearing on soil erosion potential. Slope length and steepness affect the velocity and, accordingly, the erosive potential of runoff. In general, soil loss per unit area increases with the length and steepness of the slope.

Geology

The bedrock formations underlying the unconsolidated surficial deposits in the County include, from oldest to youngest, Precambrian crystalline rock, Cambrian sandstone, Ordovician sedimentary rock, Silurian dolomite, and Devonian dolomite. The bedrock geology of the County is shown in Figure 1 by means of a map of the surface of the bedrock supplemented with representative vertical sections.

The bedrock of the County is, for the most part, covered by unconsolidated glacial deposits. As shown on Map 3, the thickness of such deposits ranges from zero in certain areas where bedrock crops out, to more than 200 feet. Bedrock outcrops occur primarily in the central and southwestern portions of the County. Agricultural activities in areas with soils shallow to bedrock can lead to contamination of groundwater principally with nitrate and pesticides. The potential for groundwater contamination at a given location, however, depends upon the site characteristics, including the subsurface conditions, the characteristics of individual pollutants, and the agronomic practices.

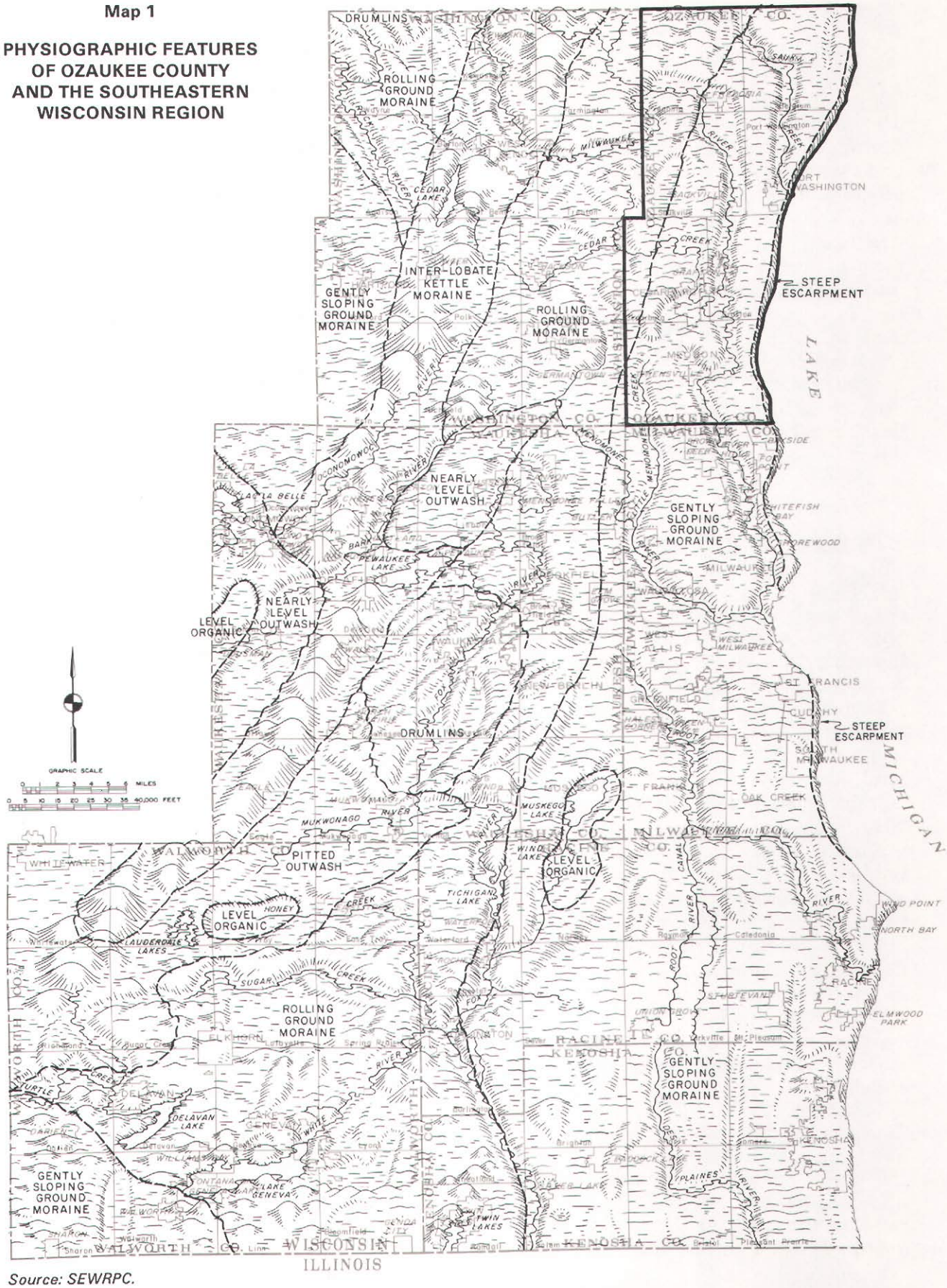
Soils

The soils in Ozaukee County range from very poorly drained organic soils to excessively drained mineral soils. Five soil associations are found in the County, as identified by the U. S. Department of Agriculture, Soil Conservation Service. A soil association is defined as a landscape having a distinctive proportional pattern of soils. An association is typically comprised of one or more major soil types and at least one minor soil type, and is named after the major soil types. A description of the five soil associations in Ozaukee County, along with their distribution within the County, is presented on Map 4.

Soils vary in their potential erosiveness owing primarily to differences in physical characteristics, including soil texture, soil structure, organic matter, and permeability. In order to provide insight into the potential for cropland soil erosion in Ozaukee County, the soils of the County have been categorized as having slight, moderate, and severe erosion potential, and

Map 1

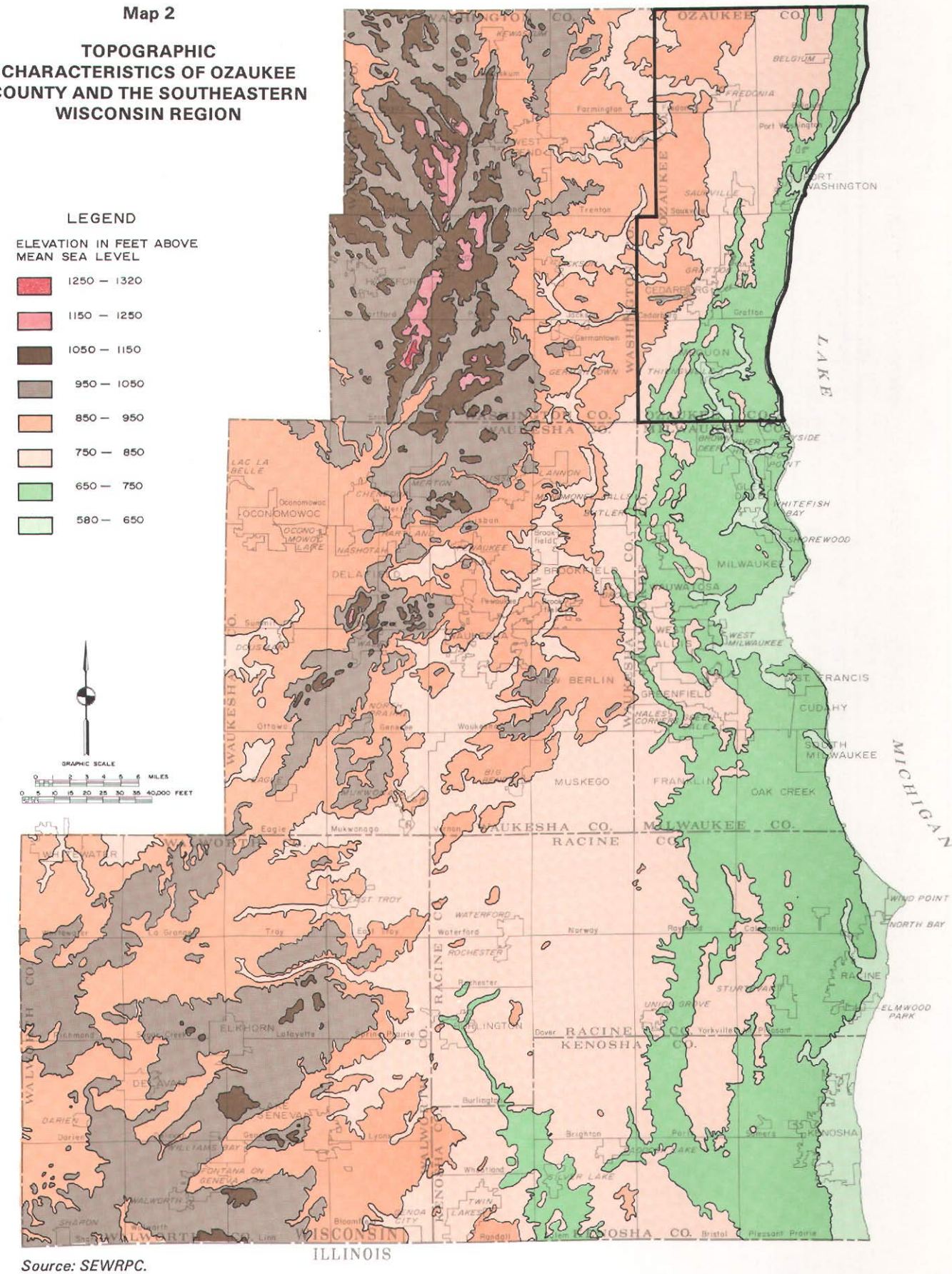
PHYSIOGRAPHIC FEATURES OF OZAUKEE COUNTY AND THE SOUTHEASTERN WISCONSIN REGION



Source: SEWRPC.

Map 2

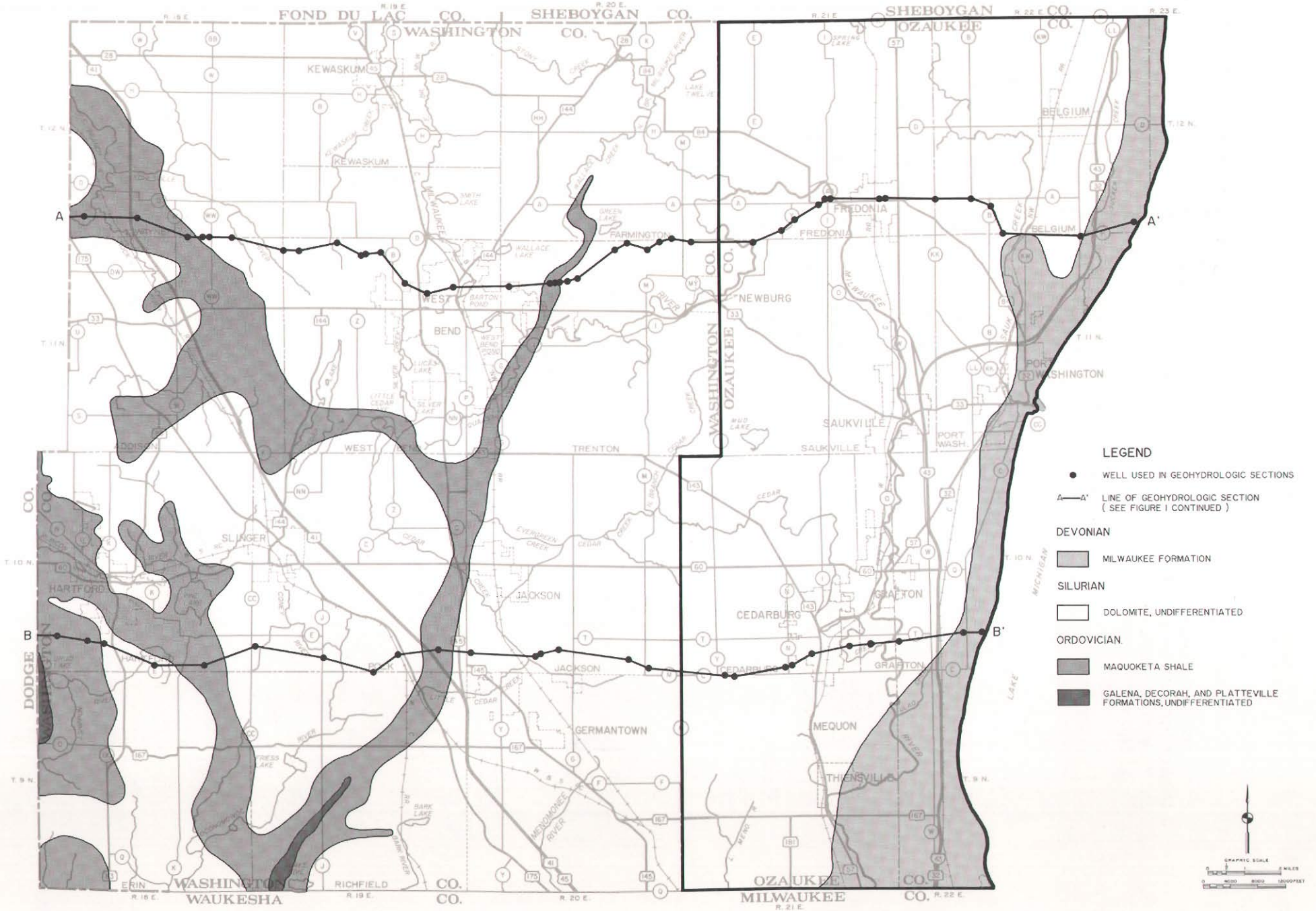
TOPOGRAPHIC CHARACTERISTICS OF OZAUKEE COUNTY AND THE SOUTHEASTERN WISCONSIN REGION



Source: SEWRPC.

Figure 1

MAP AND CROSS-SECTION OF BEDROCK GEOLOGY IN OZAUKEE AND WASHINGTON COUNTIES



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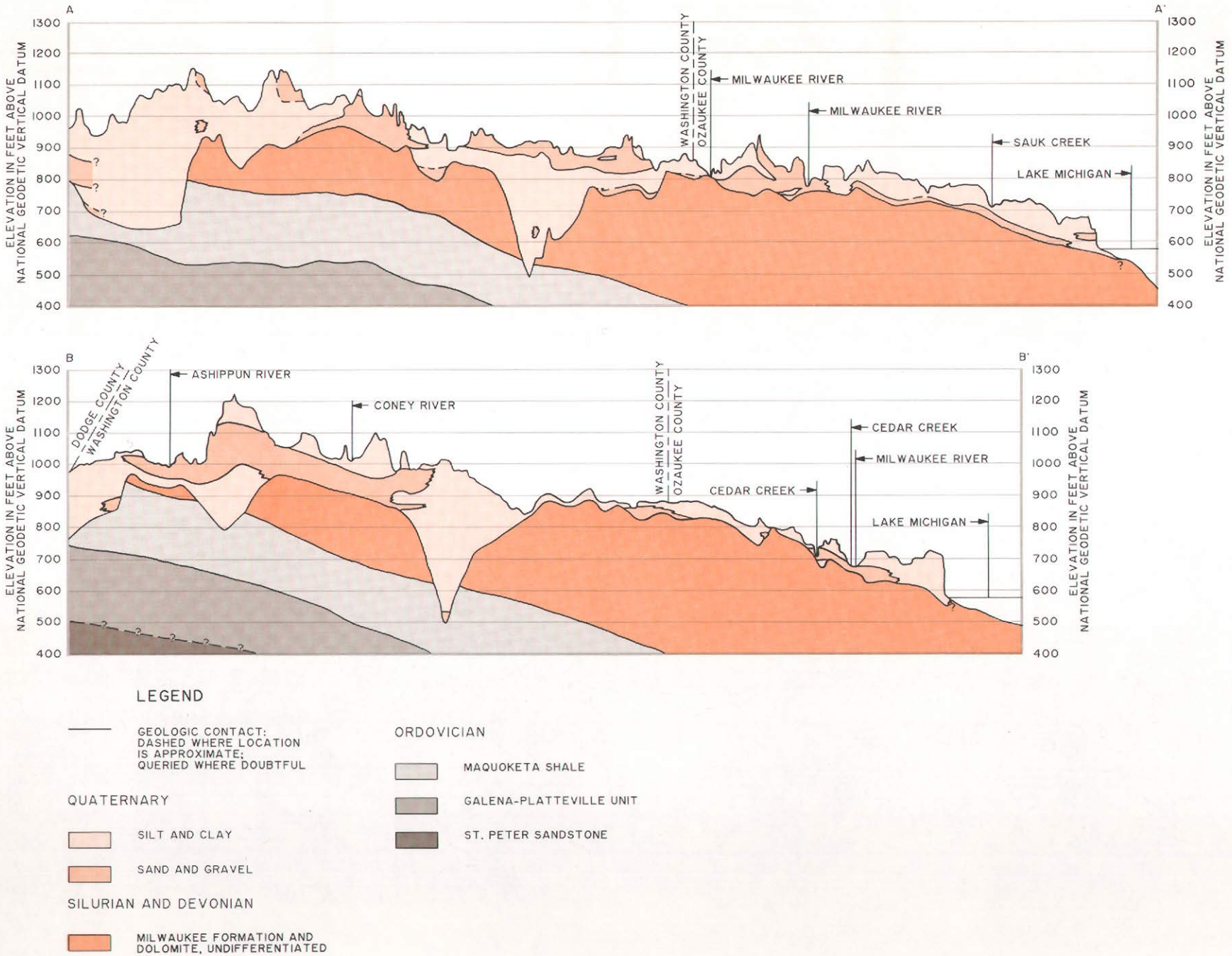
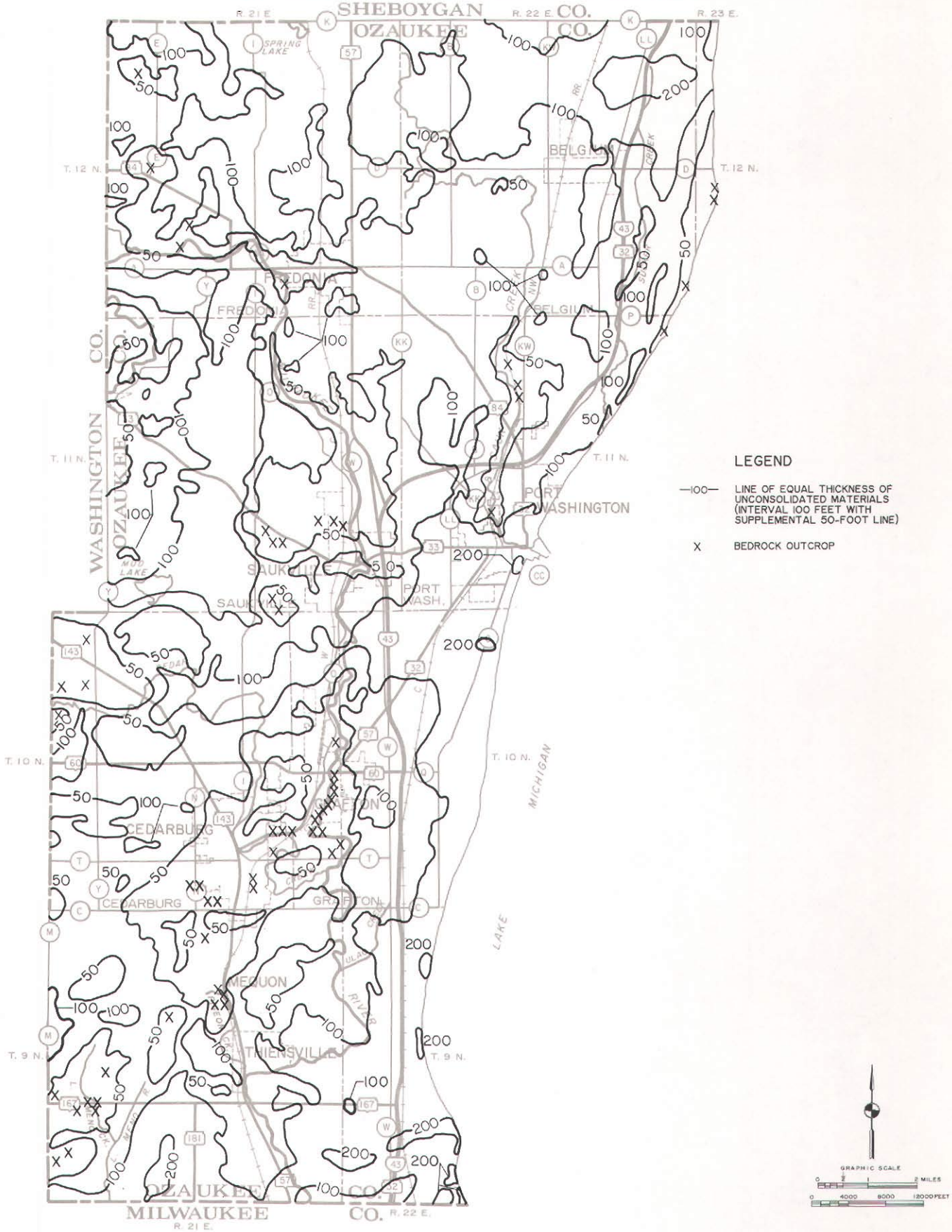


Source: U. S. Department of the Interior, Geological Survey; and University of Wisconsin-Extension Geological and Natural History Survey.

Map 3

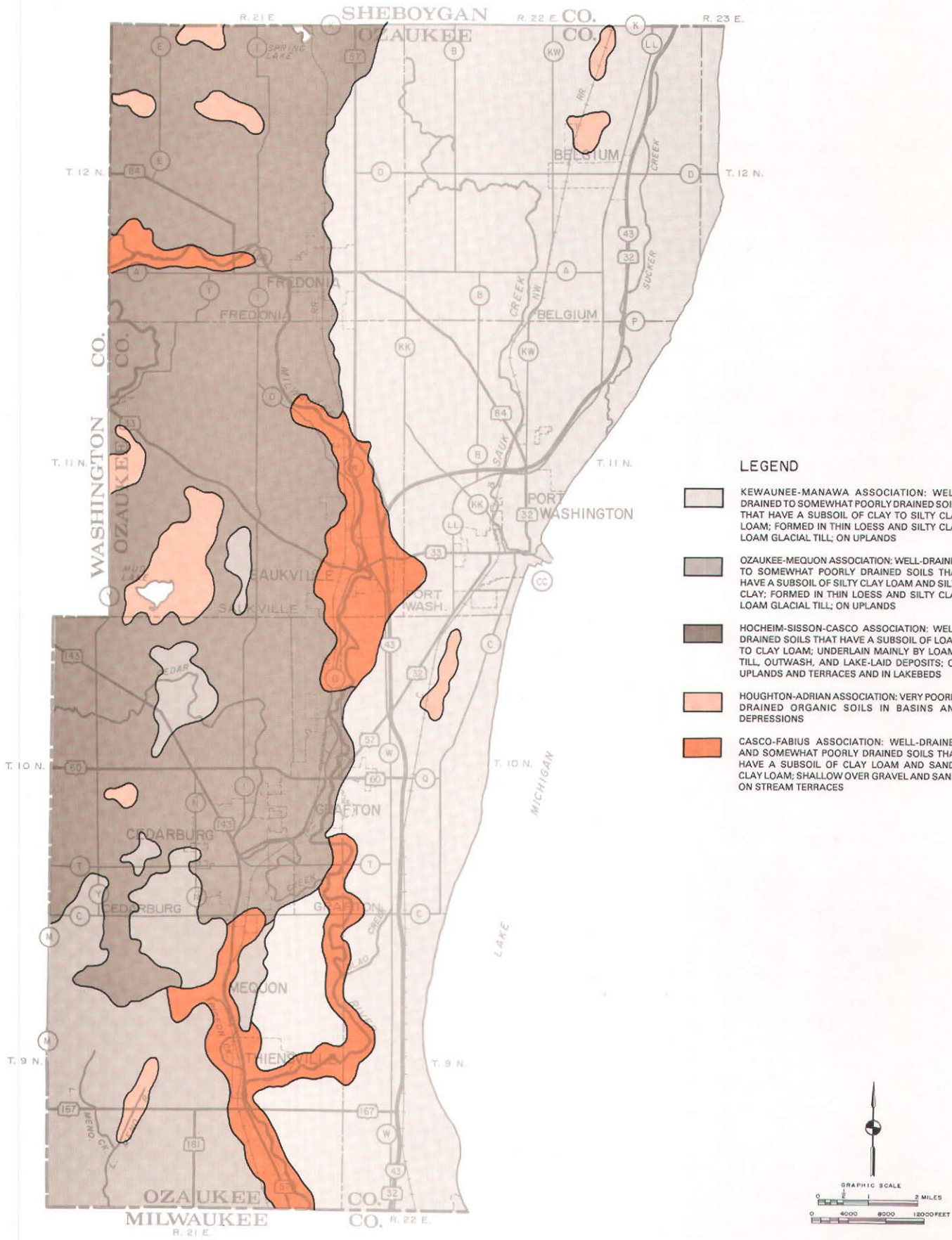
THICKNESS OF UNCONSOLIDATED MATERIALS AND THE LOCATION OF BEDROCK OUTCROPS IN OZAUKEE COUNTY



Source: U. S. Department of the Interior, Geological Survey; and University of Wisconsin-Extension, Geological and Natural History Survey.

Map 4

GENERAL SOIL ASSOCIATIONS IN OZAUKEE COUNTY



Source: U. S. Department of Agriculture, Soil Conservation Service.

mapped accordingly. The rating for each soil is based upon its capability class and subclass as assigned under the U. S. Soil Conservation Service agricultural land capability system.[1] The rating indicates the potential for both water and wind erosion. It is emphasized that the rating is based solely on soil characteristics that affect a soil's response to management and treatment. Farming practices, which have a direct bearing on the rate of erosion, are not taken into account. The erosion potential for soils covering agricultural lands in Ozaukee County is shown on Map 5.[2]

Surface Water Resources

Lakes and streams constitute an extremely valuable part of the natural resource base of Ozaukee County. They constitute a focal point of water-related recreational activities; provide an attractive setting for properly planned residential development; and have immeasurable environmental value. The lakes and streams in Ozaukee County are shown on Map 6. The surface area of named lakes and ponds in Ozaukee County is presented in Table 1.

Soil erosion can create serious surface water problems. The resulting sediment is volumetrically the major pollutant entering surface waters. Sediment tends to damage fish and wildlife habitat, diminish the desirability of recreational areas, decrease the capacity of farm ponds and reservoirs, and increase the need for dredging of waterways. Agricultural chemicals carried by eroded soil particles may be toxic to aquatic life and harmful to man. Nutrients carried on eroded soil particles accelerate the eutrophication, or aging, of lakes.

For water quality planning purposes, the Wisconsin Department of Natural Resources has divided the Southeastern Wisconsin Region into 27 watersheds, seven of which are located wholly or partially within Ozaukee County. These include the Cedar Creek, Milwaukee River East-West Branches, Menomonee River, Milwaukee River South, Milwaukee River North Branch, Onion River, and Sauk Creek-Sucker Creek watersheds. In addition, as shown on Map 6, portions of the County are drained either directly, or by minor tributaries, to Lake Michigan. The entire area of Ozaukee County is located east of the subcontinental divide and is part of the Great Lakes-St. Lawrence River drainage area.

Primary Environmental Corridors

Primary environmental corridors are linear areas in the landscape that encompass the most important elements of the natural resource base, including lakes, rivers, and streams and their associated floodlands and shorelands; wetlands; woodlands; prairies; wildlife habitat areas; and rugged terrain and high-relief topography. Such corridors have been identified throughout southeastern Wisconsin, including Ozaukee County, by the Regional Planning Commission by overlaying all of the appropriate land use and natural resource data to determine the location of significant concentrations of such resources. The preservation of these corridors is important to the maintenance of a high level of environmental quality in the Region, to the protection of its natural beauty, and to the provision of opportunities for certain scientific, educational, and recreational activities. The exclusion of urban development from these corridors will also prevent the creation of serious and costly developmental problems such as wet and flooded basements, foundation failures, and excessive clearwater infiltration and inflow into sanitary sewerage systems.

Map 7 shows the pattern of primary environmental corridors in Ozaukee County in 1985. These corridors encompass about 19,900 acres in Ozaukee County, or about 13 percent of the area of the County. Of this total, 1,600 acres, or

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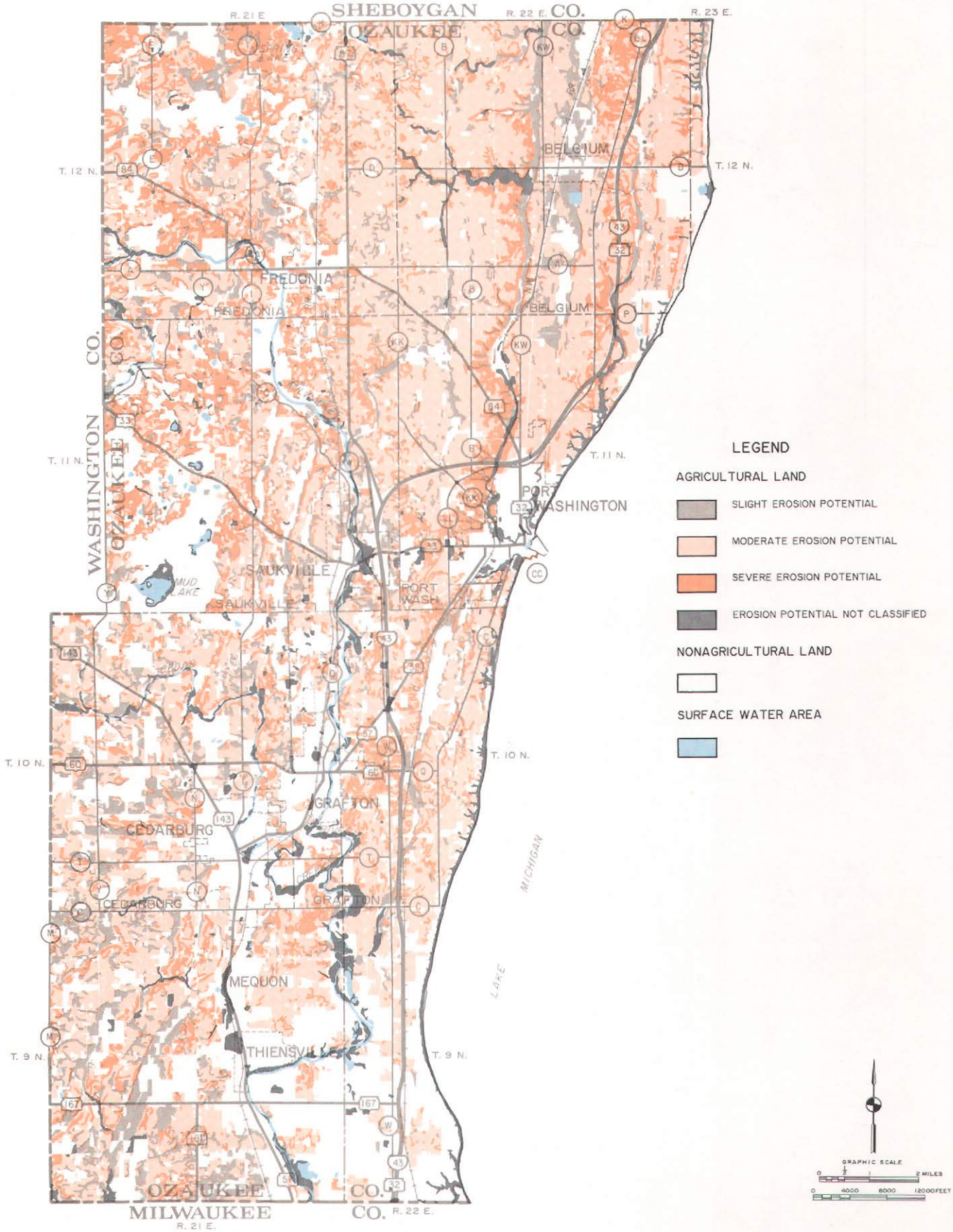
[1] *Following procedures set forth in Soil Erosion Control Planning Manual, prepared by the Wisconsin Department of Agriculture, Trade and Consumer Protection, soils in capability classes/subclasses I, IIw, IIIw, IVw, V, VIw, and VIIw have been classified as having slight soil erosion potential; soils in capability subclasses IIe, IIs, IIIs, IVs, VIs, and VIIs have been classified as having moderate soil erosion potential; and soils in capability subclasses IIIe, IVe, VIe, and VIIe have been classified as having severe erosion potential. The agricultural land capability system itself is described in U. S. Soil Conservation Service Handbook 210, entitled Land Capability Classification, September 1961.*

[2] *The agricultural lands shown on Map 5 include cropland, including some which may be temporarily idle; pastureland; and orchards and nurseries.*

Map 5

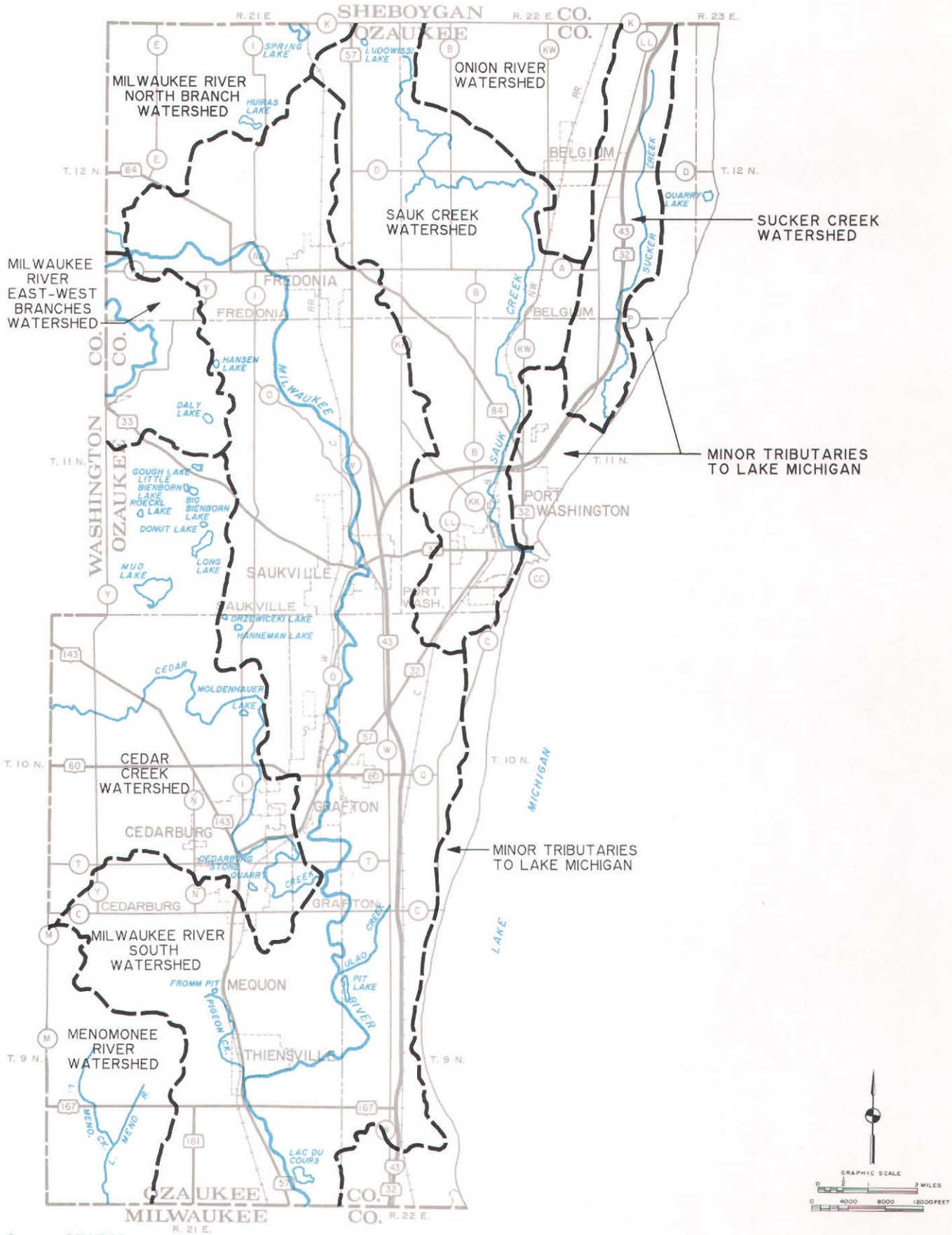
SOIL EROSION POTENTIAL FOR AGRICULTURAL LANDS IN OZAUKEE COUNTY



Source: U. S. Department of Agriculture, Soil Conservation Service; and SEWRPC.

Map 6

SURFACE WATER RESOURCES IN OZAUKEE COUNTY



Source: SEWRPC.

Table 1

NAMED LAKES IN OZAUKEE COUNTY

Named Lakes	U. S. Public Land Survey Section, Town, and Range	Surface Area (acres)
Major Lakes[a]		
Mud Lake	31, 32-11-21	245
Spring Lake	2, 3-12-21	66
Other Lakes		
Big Bienborn Lake	20-11-21	12
Cedarburg Stone Quarry	35-10-21	6
Daly Lake	9, 16-11-21	13
Donut Lake	29-11-21	4
Drzewiceki Lake	3-10-21	2
Fromm Pit	10-9-21	4
Gough Lake	17, 20-11-21	5
Hanneman Lake	3-10-21	6
Hansen Lake	4-11-21	6
Huiras Lake	9, 15, 16-12-21	26
Lac du Cours	36-9-21	49
Little Bienborn Lake	20-11-21	5
Long Lake	28, 29-11-21	34
Ludowissi Lake	1-12-21	11
Moldenhauer Lake	11-10-21	3
Pit Lake	7-9-22	35
Quarry Lake	19-12-23	23
Roeckl Lake	19-11-21	3

[a]*Major lakes as defined by the Regional Planning Commission are bodies of water having 50 acres or more of surface water area.*

Source: Wisconsin Department of Natural Resources, Ozaukee County Land Conservation Department, and SEWRPC.

8 percent, consist of surface water; 11,500 acres, or 58 percent, consist of wetlands; 3,900 acres, or 19 percent, consist of upland woodlands; 2,100 acres, or 11 percent, consist of other open lands; and just over 800 acres, or 4 percent, consist of isolated urban enclaves within the corridor configuration.

MAN-MADE ENVIRONMENT

Population Trends

The population of Ozaukee County stood at about 23,400 persons in 1950, having increased from about 16,400 persons in 1900 (see Table 2). During each of the three decades after 1950, the county population increased substantially—by about 15,100 persons, or 65 percent, during the 1950's; about 16,000 persons, or 42 percent, during the 1960's; and about 12,500 persons, or 23 percent, during the 1970's—so that by 1980, the county population had reached about 67,000 persons. Relative to the three preceding decades, growth in the county population has been comparatively modest since 1980. The 1988 population estimate of 69,400 persons represents an increase of about 2,400 persons, or 3.6 percent, over 1980.

Population projections have been prepared by the Regional Planning Commission for Ozaukee County and the Southeastern Wisconsin Region through the year 2010, and are presented in SEWRPC Technical Report No. 11 (2nd Edition), The Population of Southeastern Wisconsin. Because of the uncertainty entailed in any projection of future population levels in times of great social and economic change, such as are being experienced at the present time, the Commission has postulated three alternative future scenarios as a basis for population projection—two intended to identify extremes and one intended to identify an intermediate, or most probable, future. Critical social and economic factors that could be expected to have an impact upon mortality, birth, and migration rates within the United States, the State, and the Southeastern Wisconsin Region were examined, and a reasonably extreme range of values was established for each component of population change. The "most reasonably optimistic" scenario of population change was provided by combining all factors that were internally consistent to create favorable conditions for population growth in the Region, and the "most reasonably pessimistic" scenario was provided by similarly combining all factors that would create unfavorable conditions for population growth in the Region.

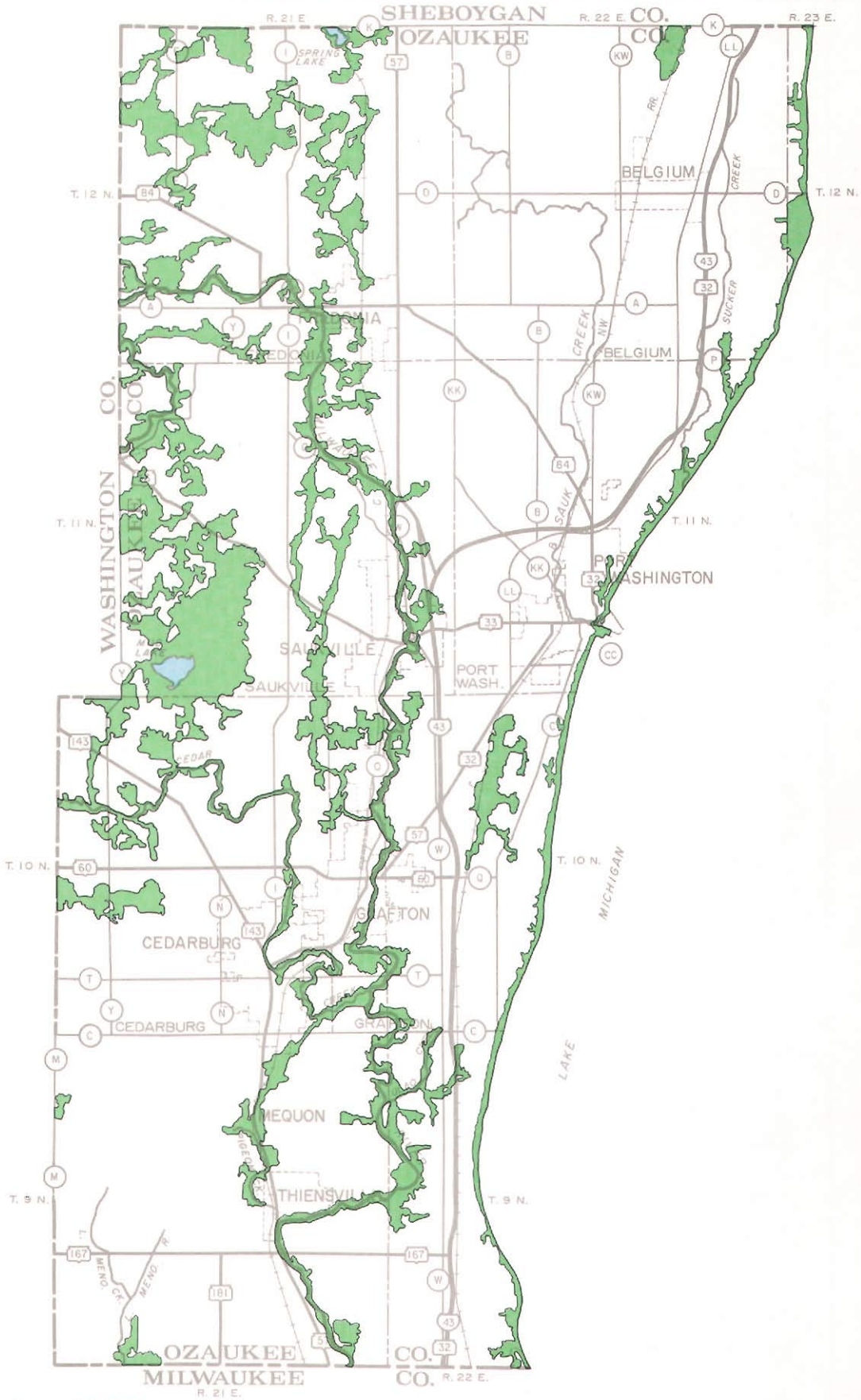
As indicated in Figure 2, under the optimistic scenario for population change, the population of Ozaukee County would be expected to increase by about 72,000 person, or 107 percent—from about 67,000 persons in 1980 to about 139,000 persons in the year 2010. Under the intermediate scenario, the county population would be expected to increase by about 14,900 persons, or 22 percent, to a level of about 81,900 persons in the year 2010. Under the pessimistic scenario, the county population would be expected to experience a decrease of about 9,300 persons, or 14 percent, resulting in a population level of about 57,700 persons in the year 2010. As further indicated in Figure 2, population levels in Ozaukee County from 1980 through 1988 have most closely approximated the trend envisioned under the intermediate growth scenario.

Land Use

Although Ozaukee County is considered to be a relatively urbanized county, just over four-fifths of the area of the County was still devoted to rural uses in 1985, while just under one-fifth was devoted to urban uses. The areas of major categories of land use are presented for the County overall and for U. S. Public Land Survey

Map 7

PRIMARY ENVIRONMENTAL CORRIDORS IN OZAUKEE COUNTY



Source: SEWRPC.

Table 2

POPULATION TRENDS IN OZAUKEE COUNTY: CENSUS YEARS 1850-1980, AND ESTIMATED 1988

Year	Total Population		
	Number	Change from Preceding Census	
		Absolute	Percent
1850	--	--	--
1860	15,682	--	--
1870	15,564	-118	-0.8
1880	15,461	-103	-0.7
1890	14,943	-518	-3.4
1900	16,363	1,420	9.5
1910	17,123	760	4.6
1920	16,335	-788	-4.6
1930	17,394	1,059	6.5
1940	18,985	1,591	9.1
1950	23,361	4,376	23.0
1960	38,441	15,080	64.6
1970	54,461	16,020	41.7
1980	66,981	12,520	23.0
1988	69,391	2,410	3.6

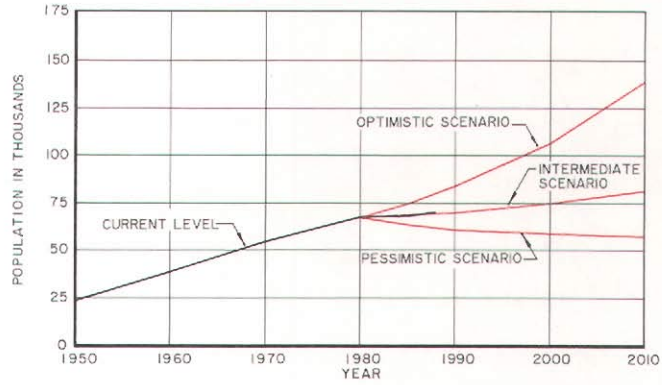
NOTE: Ozaukee County was created from portions of Washington County in 1853. The area that became Ozaukee County had an 1850 population of 8,281.

Source: U. S. Bureau of the Census, Wisconsin Department of Administration, and SEWRPC.

townships in Tables 3 and 4, respectively. As indicated in Table 3, in 1985 urban lands—consisting of lands devoted to residential, commercial, industrial, governmental and institutional, recreational, and transportation, communication, and utility uses—encompassed about 27,300 acres in Ozaukee County, or about 18 percent of the total area of the County. Lands in residential use comprised the largest share of the urban land area—about 13,700 acres—representing about 50 percent of the urban land area and about 9 percent of the total area of the County. As shown on Map 8, urban land development within Ozaukee County has occurred both within expanding urban centers and within isolated enclaves in outlying areas of the County.

Figure 2

CURRENT AND ALTERNATIVE FUTURE POPULATION LEVELS FOR OZAUKEE COUNTY: 1950-2010



Source: U. S. Bureau of the Census, Wisconsin Department of Administration, and SEWRPC.

As further indicated in Table 3, in 1985 rural land uses accounted for about 123,200 acres, or 82 percent of the area of the County. Agricultural lands encompassed just over 92,600 acres, about 75 percent of all rural land in the County, and 62 percent of the total area of the County. The agricultural acreage included about 81,300 acres of cropland, 10,600 acres of pasture and unused agricultural land, and just over 700 acres of orchards and nurseries. Other major rural land use categories in Ozaukee County include wetlands—which in 1985 encompassed about 15,900 acres, or about 11 percent of the total area of the County—and woodlands—which encompassed about 6,600 acres, or about 4 percent of the total area of the County.

The change in land use in Ozaukee County between 1963—the base year for the Regional Planning Commission's initial land use inventory—and 1985 is also indicated in Table 3. During this time, the urban land area of Ozaukee County increased by about 10,700 acres, or 65 percent. Most of this increase consisted of lands developed for residential and transportation use. As indicated in Table 3, much of the new development occurred in areas formerly in agricultural use.

Cropping Patterns

The trend in acreage levels for major crops in Ozaukee County is shown in Figure 3. The most noteworthy changes in cropping patterns shown in that figure are declines in the acreages of oats and hay. The acreage in oats decreased by about

Table 3

LAND USE IN OZAUKEE COUNTY: 1963 AND 1985

Land Use Category	1963		1985		Change: 1963-1985	
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent
Urban						
Residential	7,564	5.0	13,694	9.1	6,130	81.0
Commercial	264	0.2	470	0.3	206	78.0
Industrial	273	0.2	577	0.4	304	111.4
Transportation, Communication, and Utilities	5,971	4.0	8,637	5.7	2,666	44.6
Governmental and Institutional	690	0.5	1,024	0.7	334	48.4
Recreational	905	0.6	1,809	1.2	904	99.9
Unused Urban	912	0.6	1,081	0.7	169	18.5
Subtotal	16,579	11.1	27,292	18.1	10,713	64.6
Rural						
Agricultural						
Cropland	88,631	58.9	81,324	54.1	-7,307	-8.2
Orchards and Nurseries	735	0.5	731	0.5	-4	-0.5
Pasture and Other	14,787	9.8	10,595	7.0	-4,192	-28.3
Subtotal	104,153	69.2	92,650	61.6	-11,503	-11.0
Wetlands	16,356	10.9	15,898	10.6	-458	-2.8
Woodlands	6,805	4.5	6,600	4.4	-205	-3.0
Extractive and Landfill Sites	471	0.3	608	0.4	137	29.1
Unused Rural and Other Open Lands	4,453	2.9	5,416	3.6	963	21.6
Surface Water	1,723	1.1	1,992	1.3	269	15.6
Subtotal	133,961	88.9	123,164	81.9	-10,797	-8.1
Total[a]	150,540	100.0	150,456	100.0	-84	-0.1

[a]*The change in the total area of the County is the net effect of Lake Michigan shoreline erosion and accretion and of any Lake Michigan filling activities.*

Source: SEWRPC.

9,800 acres, or 58 percent—from 17,000 acres in 1965 to 7,200 acres in 1986. The acreage in hay decreased by about 7,150 acres, or 28 percent—from 25,300 acres in 1965 to 18,150 acres in 1986. As further shown in Figure 3, the 1986 corn acreage of 21,500 acres was 3,300 acres, or 18 percent, greater than the 1965 level of 18,200 acres. The 1986 wheat acreage of 3,800 acres was 1,900 acres greater than, or double, the 1965 acreage.

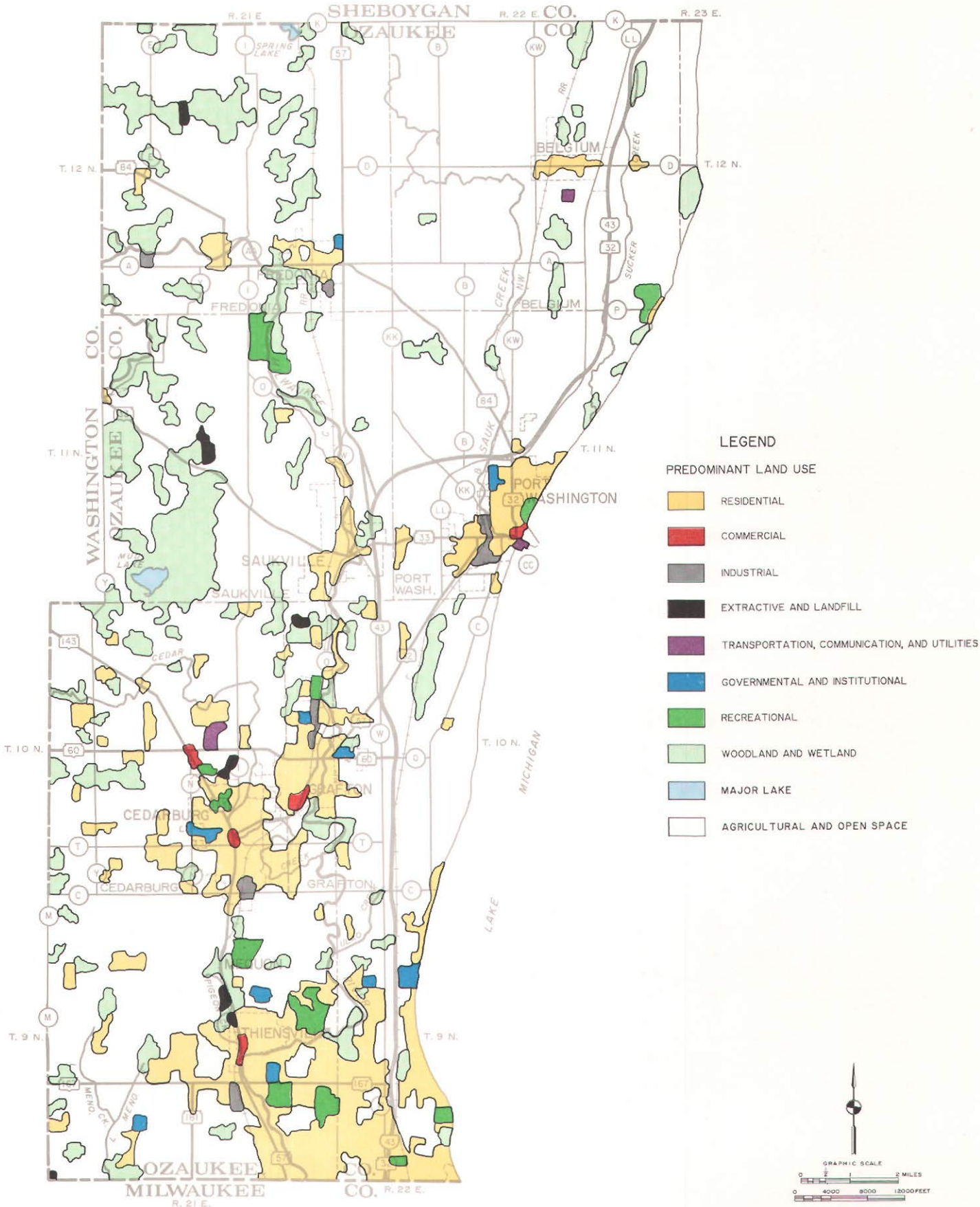
Vegetable crops also constitute an important part of the agricultural base of Ozaukee County. In 1986, lands devoted to growing peas, sweet corn, and snap beans for processing totaled 5,000 acres. Certain additional lands are used for raising other vegetables, including vegetables for fresh market sale.

Soybeans are not presently a major crop in Ozaukee County. The soybean acreage in the County has increased over the past two decades but remains quite low. Thus, about 2,200 acres of soybeans were harvested in 1986, up from about 300 acres in 1965.

Dairy farming, characterized by traditional crop rotations typically including several years of hay, remains an important part of the agricul-

Map 8

EXISTING LAND USE IN OZAUKEE COUNTY: 1985



Source: SEWRPC.

Table 4

LAND USE IN OZAUKEE COUNTY BY U. S. PUBLIC LAND SURVEY TOWNSHIP: 1963 AND 1985

Land Use Category	U. S. Public Land Survey Township																			
	9 North, 21 East (Mequon)				9 North, 22 East (Mequon)				10 North, 21 East (Cedarburg-Grafton)				10 North, 22 East (Grafton)				11 North, 21 East (Saukville)			
	1963 (acres)	1985 (acres)	Change: 1963-1985 Acres	Change: 1963-1985 Percent	1963 (acres)	1985 (acres)	Change: 1963-1985 Acres	Change: 1963-1985 Percent	1963 (acres)	1985 (acres)	Change: 1963-1985 Acres	Change: 1963-1985 Percent	1963 (acres)	1985 (acres)	Change: 1963-1985 Acres	Change: 1963-1985 Percent	1963 (acres)	1985 (acres)	Change: 1963-1985 Acres	Change: 1963-1985 Percent
Urban																				
Residential	2,369	3,458	1,089	46.0	1,419	2,379	960	67.7	1,457	3,747	2,290	157.2	395	798	403	102.0	440	877	437	99.3
Commercial	79	130	51	64.6	25	59	34	136.0	49	116	67	136.7	25	42	17	68.0	17	23	6	35.3
Industrial	29	127	98	337.9	1	15	14	1,400.0	90	163	73	81.1	9	32	23	255.6	22	49	27	122.7
Transportation, Communication, and Utilities	1,056	1,346	290	27.5	516	877	361	70.0	1,100	1,631	531	48.3	454	794	340	74.9	648	1,041	393	60.6
Governmental and Institutional	206	285	79	38.3	166	191	25	15.1	132	250	118	89.4	27	50	23	85.2	22	26	4	18.2
Recreational	315	788	473	150.2	56	157	101	180.4	146	229	83	56.8	0	6	6	0.0	165	325	160	97.0
Unused Urban	268	336	68	25.4	235	212	-23	-9.8	210	242	32	15.2	1	2	1	100.0	43	59	16	37.2
Subtotal	4,322	6,470	2,148	49.7	2,418	3,890	1,472	60.9	3,184	6,378	3,194	100.3	911	1,724	813	89.2	1,357	2,400	1,043	76.9
Rural																				
Agricultural																				
Cropland	11,669	10,275	-1,394	-11.9	1,411	1,290	-121	-8.6	11,338	9,395	-1,943	-17.1	6,713	5,993	-720	-10.7	12,209	11,194	-1,015	-8.3
Orchards and Nurseries	320	367	47	14.7	40	28	-12	-30.0	236	174	-62	-26.3	15	7	-8	-53.3	17	49	32	188.2
Pasture and Other	2,948	2,361	-587	-19.9	2,054	736	-1,318	-64.2	3,276	1,916	-1,360	-41.5	1,598	1,355	-243	-15.2	2,223	1,835	-388	-17.5
Subtotal	14,937	13,003	-1,934	-12.9	3,505	2,054	-1,451	-41.4	14,850	11,485	-3,365	-22.7	8,326	7,355	-971	-11.7	14,449	13,078	-1,371	-9.5
Wetlands	1,452	1,337	-115	-7.9	434	454	20	4.6	2,754	2,634	-120	-4.4	990	976	-14	-1.4	5,197	5,107	-90	-1.7
Woodlands	981	953	-28	-2.9	513	435	-78	-15.2	1,227	1,031	-196	-16.0	612	577	-35	-5.7	1,349	1,404	55	4.1
Extractive and Landfill Sites	137	86	-51	-37.2	0	0	0	0.0	144	165	21	14.6	2	29	27	1,350.0	61	208	147	241.0
Unused Rural and Other Open Lands	995	895	-100	-10.1	741	755	14	1.9	606	972	366	60.4	395	570	175	44.3	385	563	178	46.2
Surface Water	310	390	80	25.8	155	178	23	14.8	357	457	100	28.0	92	97	5	5.4	511	549	38	7.4
Subtotal	18,812	16,664	-2,148	-11.4	5,348	3,876	-1,472	-27.5	19,938	16,744	-3,194	-16.0	10,417	9,604	-813	-7.8	21,952	20,909	-1,043	-4.8
Total	23,134	23,134	0	0.0	7,766	7,766	0	0.0	23,122	23,122	0	0.0	11,328	11,328	0	0.0	23,309	23,309	0	0.0

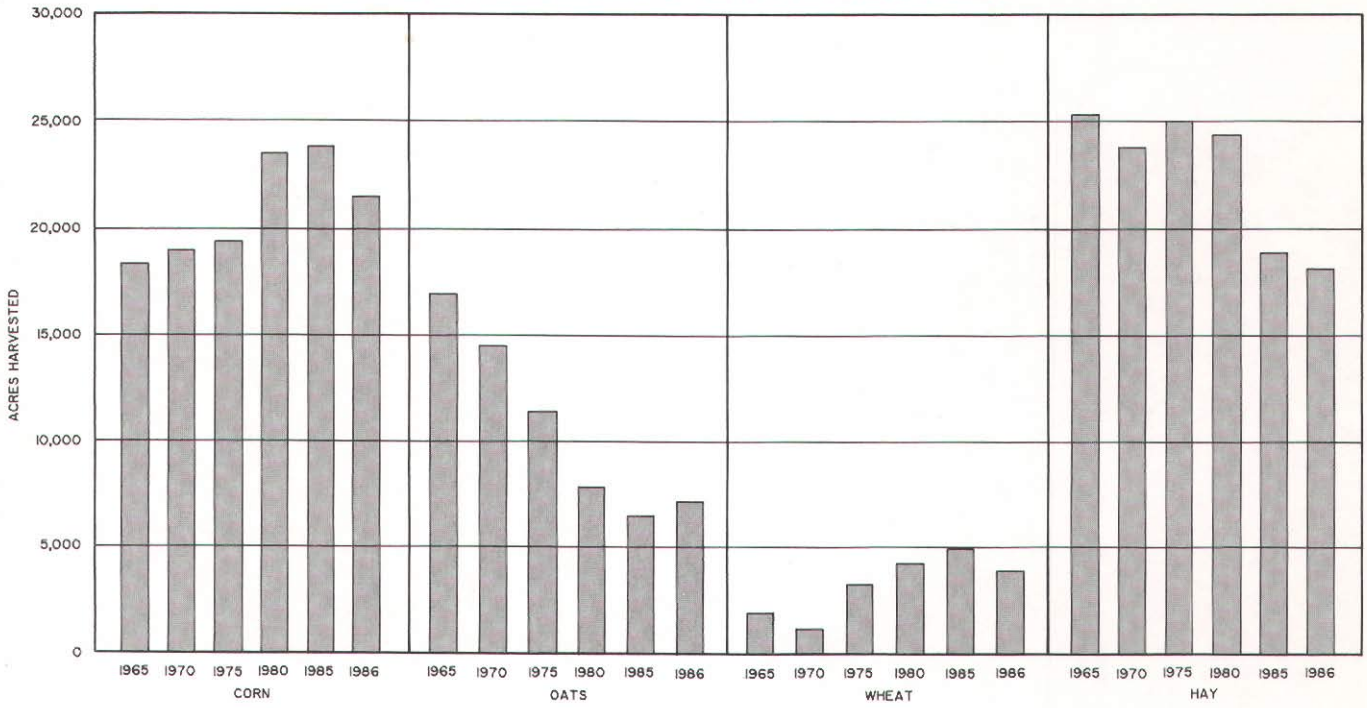
Table 4 (continued)

Land Use Category	U. S. Public Land Survey Township																Ozaukee County Total			
	11 North, 22 East (Port Washington)				12 North, 21 East (Fredonia)				12 North, 22 East (Belgium)				12 North, 23 East (Belgium)							
			Change: 1963-1985				Change: 1963-1985				Change: 1963-1985				Change: 1963-1985				Change: 1963-1985	
	1963 (acres)	1985 (acres)	Acres	Percent	1963 (acres)	1985 (acres)	Acres	Percent	1963 (acres)	1985 (acres)	Acres	Percent	1963 (acres)	1985 (acres)	Acres	Percent	1963 (acres)	1985 (acres)	Acres	Percent
Urban																				
Residential	762	1,171	409	53.7	320	766	446	139.4	305	385	80	26.2	97	113	16	16.5	7,564	13,694	6,130	81.0
Commercial	40	55	15	37.5	18	30	12	66.7	11	15	4	36.4	0	0	0	0.0	264	470	206	78.0
Industrial	77	91	14	18.2	28	72	44	157.1	17	28	11	64.7	0	0	0	0.0	273	577	304	111.4
Transportation, Communication, and Utilities	809	1,182	373	46.1	666	739	73	11.0	677	977	300	44.3	45	50	5	11.1	5,971	8,637	2,666	44.6
Governmental and Institutional	71	119	48	67.6	42	77	35	83.3	24	26	2	8.3	0	0	0	0.0	690	1,024	334	48.4
Recreational	94	99	5	5.3	19	76	57	300.0	110	114	4	3.6	0	15	15	0.0	905	1,809	904	99.9
Unused Urban	105	166	61	58.1	36	53	17	47.2	14	11	-3	-21.4	0	0	0	0.0	912	1,081	169	18.5
Subtotal	1,958	2,883	925	47.2	1,129	1,813	684	60.6	1,158	1,556	398	34.4	142	178	36	25.4	16,579	27,292	10,713	64.6
Rural																				
Agricultural																				
Cropland	10,041	9,213	-828	-8.2	15,532	14,985	-547	-3.5	19,317	18,592	-725	-3.8	401	387	-14	-3.5	88,631	81,324	-7,307	-8.2
Orchards and Nurseries	35	11	-24	-68.6	3	2	-1	-33.3	69	93	24	34.8	0	0	0	0.0	735	731	-4	-0.5
Pasture and Other	540	484	-56	-10.4	1,260	1,070	-190	-15.1	750	719	-31	-4.1	138	119	-19	-13.8	14,787	10,595	-4,192	-28.3
Subtotal	10,616	9,708	-908	-8.6	16,795	16,057	-738	-4.4	20,136	19,404	-732	-3.6	539	506	-33	-6.1	104,153	92,650	-11,503	-11.0
Wetlands	764	690	-74	-9.7	3,212	3,229	17	0.5	1,357	1,310	-47	-3.5	196	161	-35	-17.9	16,356	15,898	-458	-2.8
Woodlands	439	433	-6	-1.4	1,324	1,362	38	2.9	290	287	-3	-1.0	70	118	48	68.6	6,805	6,600	-205	-3.0
Extractive and Landfill Sites	74	40	-34	-45.9	47	79	32	68.1	6	1	-5	-83.3	0	0	0	0.0	471	608	137	29.1
Unused Rural and Other Open Lands	526	628	102	19.4	496	440	-56	-11.3	150	521	371	247.3	159	72	-87	-54.7	4,453	5,416	963	21.6
Surface Water	29	24	-5	-17.2	246	269	23	9.3	4	7	3	75.0	19	21	2	10.5	1,723	1,992	269	15.6
Subtotal	12,448	11,523	-925	-7.4	22,120	21,436	-684	-3.1	21,943	21,530	-413	-1.9	983	878	-105	-10.7	133,961	123,164	-10,797	-8.1
Total	14,406	14,406	0	0.0	23,249	23,249	0	0.0	23,101	23,086	-15	-0.1	1,125	1,056	-69	-6.1	150,540	150,456	-84	-0.1

Source: SEWRPC.

Figure 3

ACREAGES FOR MAJOR CROPS IN OZAUKEE COUNTY



Source: Wisconsin Agricultural Reporting Service and SEWRPC.

tural base of Ozaukee County, although dairying activity has declined somewhat over the past two decades. In 1986 there were 11,100 dairy cows in Ozaukee County, about 3,000 cows, or 21 percent, less than in 1965. The number of dairy herds in the County decreased dramatically during this time—from 477 herds in 1965 to 171 herds in 1986, a decrease of 306 herds, or 64 percent.

The foregoing indicates that Ozaukee County overall has experienced a moderate increase in erosion-prone row crops—including corn and, to a lesser extent, soybeans—and a substantial decrease in crops less susceptible to erosion, including oats and hay, during the past two decades. Portions of the County, particularly the southern and south-central areas, have experienced a significant decrease in traditional crop rotations associated with dairy farming and an increase in the production of row crops.

CONCLUDING REMARKS

This chapter has described those features of the natural resource base and the man-made environment of Ozaukee County that are important in any consideration of soil erosion problems in the County. Natural resource base features considered in this chapter include the topography, physiography, geology, soils, and surface water resources. Aspects of the man-made environment considered include population, land use, and cropping patterns.

Of particular importance in this chapter are data regarding trends in farming activity in Ozaukee County. Ozaukee County overall has experienced a moderate increase in erosion-prone row crops—including corn and, to lesser extent, soybeans—and a substantial decrease in crops less subject to erosion, including oats and hay, during the past two decades. Portions of the County, particularly the southern and south-central areas, have experienced a significant decrease in traditional crop rotations associated with dairy farming and an increase in the production of row crops. A countywide inventory and analysis of cropland and related farming practices is required in order to determine the extent to which such practices are resulting in excessive soil erosion and to identify the areas in which excessive erosion may be occurring. The methodology and findings of such an inventory, conducted in conjunction with the soil erosion control planning program, are described in the next chapter of this report.

Chapter III

SOIL EROSION INVENTORY

The rate of soil erosion on cropland for any given set of climatic conditions will vary with such factors as the cropping system, management practices, soil characteristics, and topographic features of the individual farm fields. Under the Ozaukee County soil erosion control planning program, an inventory and analysis of existing cropland was undertaken in order to determine the extent and severity of cropland soil erosion problems within the County. This chapter describes the methodology and findings of that inventory and analysis work. In addition, this chapter presents a general description of soil erosion for certain other land uses.

SOIL EROSION PROCESSES

The primary agents of soil erosion are wind and water. It is estimated that for cultivated cropland in Wisconsin, water erosion is about three times that caused by wind, although in the Central Sands area of the State, wind erosion is estimated to be more than twice that caused by water. Water erosion is considered to be the primary cropland soil erosion problem in Ozaukee County.

Water erosion on cropland can be characterized as raindrop or splash erosion, sheet erosion, rill erosion, and gully erosion. Raindrop or splash erosion, the initial phase of water erosion, is the result of the impact of raindrops falling on soil particles, dislodging and splashing them about so that they can be readily transported by surface runoff. Sheet erosion is characterized by the removal of a relatively uniform, thin layer of soil from the land surface, the result of runoff in the form of shallow sheets of water flowing over the ground. Such shallow surface flow typically does not move more than a few feet before collecting in surface depressions. Rill erosion occurs when sheet runoff begins to concentrate in surface depressions and, gaining in velocity, cuts small but well-defined channels termed "rills." Rills are at most a few inches deep and are easily obliterated by ordinary tillage. Gully erosion is an advanced form of rill erosion. Gullies may result when concentrated runoff widens and deepens rills, or when flows from several rills combine and form a larger channel. In contrast to rills, gullies are not obliterated by normal tillage.

Under certain conditions, soils may also be removed and transported by the wind. Extensive areas of unprotected sandy soils and drained and cultivated organic soils are susceptible to wind erosion in the absence of effective windbreaks. In Ozaukee County, areas covered by soils considered to be highly susceptible to wind erosion encompass about 11,200 acres, or 7 percent of the total area of the County. Much of this consists of areas of organic soils in the Houghton-Adrian soil association (see Map 4 in Chapter II). About 1,900 acres, or 17 percent of this total, are in agricultural use.

The inventory and analysis work conducted as part of the Ozaukee County soil erosion control planning program focused on water erosion—specifically, sheet and rill erosion. Sheet and rill erosion is a widespread problem causing massive amounts of soil to be moved about on, and in many cases completely off, inadequately protected cropland. Though often not perceived as a problem by the farm operator, sheet and rill erosion can seriously impair soil productivity in the long term and can cause serious and costly offsite damages and environmental problems. Any gully and wind erosion problems which may occur in Ozaukee County should be addressed along with sheet and rill erosion as the county soil erosion control plan is implemented and detailed farm conservation plans are prepared.

CROPLAND SHEET AND RILL EROSION

Universal Soil Loss Equation

Estimates of the amount of sheet and rill erosion may be developed through application of a mathematical model known as the universal soil loss equation. The universal soil loss equation is used to estimate the average soil loss from sheet and rill erosion. The equation may be written as:

$$A = R \cdot K \cdot LS \cdot C \cdot P$$

where:

A = soil loss, expressed in tons per acre per year;

R = rainfall erosion index, expressed in hundreds of foot-tons per acre, times the maximum 30-minute rainfall intensity, in inches per hour, for all significant storms on an average annual basis;

K = soil erodibility factor, or the average soil loss, expressed in tons per acre per unit of R, from a particular soil in cultivated continuous fallow condition—that is, tilled continuously so as to be maintained free of vegetation and surface crusting—with a standard plot length of 72.6 feet and slope of 9 percent;

LS = slope length and steepness factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss expected from a plot 72.6 feet in length, with a slope of 9 percent;

C = vegetative cover factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss from a site in cultivated continuous fallow; and

P = erosion control practice factor, a dimensionless ratio of soil loss expected on the subject field to the soil loss from a site with no erosion control practices.

A detailed description of the universal soil loss equation can be found in Agricultural Handbook Number 537, issued by the U. S. Department of Agriculture.[1] It should be recognized that the soil "loss" estimated by the equation refers to soil dislodged and moved from place to place. The equation does not indicate the distance moved, nor does it indicate whether the movement is to a waterway, a neighboring farm field, or a different location on the same field.

In order to provide perspective on the severity of the soil erosion problem, soil loss as estimated by the universal soil loss equation is often compared to the soil loss tolerance, or "T-value." The term "T-value" refers to the maximum annual average rate of soil loss that can be sustained without impairing the productivity of the soil. T-values have been determined for each soil type by the U. S. Soil Conservation Service. For soils in Ozaukee County, T-values range between two and five tons per acre per year, with about 80 percent of all cropland in the County covered by soils having a T-value of three tons per acre per year. While comparisons to T-values are relied upon to provide insight into the severity of soil erosion problems and are widely used in conservation planning, a number of questions have developed regarding the concept of soil loss tolerances. Soil loss tolerances are considered further in the next chapter of this report.

Inventory Procedures

As indicated in Chapter I, the county soil erosion control planning program was undertaken simultaneously with a nonpoint source pollution abatement planning program for the Milwaukee River watershed, referred to as the Milwaukee River Priority Watersheds Program. Inventory data for cropland within the Milwaukee River watershed collected under the priority watersheds program were incorporated directly into the county soil erosion control planning program. For the remaining areas of the County, cropland inventory data were collected as part of the county soil erosion control planning program, thereby providing detailed cropland inventory throughout the County, facilitating a countywide analysis of cropland soil erosion.

As part of the inventory efforts, each cropland field in Ozaukee County was identified on Regional Planning Commission 1985 one inch equals 400 feet scale, ratioed and rectified vertical aerial photographs. Data were then developed for each farm field to facilitate the estimation of soil erosion through application of the universal soil loss equation. A total of 7,283 cropland fields were identified—having a combined area of about 74,162 acres, or an average of 10.2 acres per field. The data required for application of the universal soil loss equation were developed as described below.

Rainfall Erosion Index (R): The rainfall erosion index is an indicator of the erosive force of rainfall for an area during a normal year. The rainfall index established by the U. S. Soil Conservation Service for Ozaukee County is 120, and that value was used in the determination of soil loss rates presented later in this chapter.

[1] *U. S. Department of Agriculture, Agricultural Handbook Number 537, Predicting Rainfall Erosion Losses, A Guide to Conservation Planning, 1978.*

Soil Erodibility Factor (K): The soil erodibility factor is an indicator of the susceptibility of soil to erosion, being a reflection of soil texture, structure, organic matter, and permeability. Soil erodibility factors have been determined by the U. S. Soil Conservation Service for each soil type. Under the cropland soil erosion inventory, the soil erodibility factor for each farm field was determined from U. S. Soil Conservation Service soil survey data. Where a farm field was covered by soils having different erodibility factors, the erodibility factor of the predominant soil was assigned.

Slope Length-Steepness Factor (LS): The steepness and length of slope have a direct bearing on the rate of soil loss. In general, soil loss per unit area increases as the slope gets longer and steeper. The LS-factor is a reflection of both the length and steepness of slope.

The following procedures were followed in developing LS-factors for farm fields under the cropland soil erosion inventory:

1. The steepness of slope was determined for each farm field from the detailed operational soil survey completed in 1965 by the Regional Planning Commission in cooperation with Ozaukee County and the U. S. Soil Conservation Service. Where a farm field was covered by soil mapping units having different slopes, a weighted average slope was assigned to the field based upon the proportionate area covered by each of the various soil types.
2. The slope length of each farm field was determined through field inspection.
3. An LS-factor was assigned to each field according to its percent slope and slope length, following procedures set forth in the U. S. Soil Conservation Service Technical Guide.

Vegetative Cover Factor (C): The effects of cropping and management practices on soil erosion are taken into account in the universal soil loss equation through the vegetative cover factor, or "C-factor." The C-factor for a particular cropland field is a reflection of its particular crop sequence and management practices. The C-factor is equal to 1.0 for cultivated continuous fallow ground—that is, tilled ground continuously maintained free of vegetation and surface crusting. At the other extreme, the C-factor for land in continuous hay is 0.004.

Under the cropland inventory, field-specific information regarding crop rotations, tillage practices, and timing of field operations was obtained directly from farm operators through personal interviews. Based upon that information, a C-factor was assigned to each field in accordance with the U. S. Soil Conservation Service technical guide.

The cropland inventory provided a basis for the quantification of the extent to which conservation tillage practices are applied in the County. In this regard, the inventory indicated that conservation tillage systems are utilized on a relatively limited basis, being applied on 209 fields encompassing 2,241 acres, representing about 3 percent of all cropland in Ozaukee County.

Erosion Control Practice Factor (P): The effects of conservation practices such as contour cropping, contour strip-cropping, and terracing are taken into account in the universal soil loss equation through the erosion control practice factor, or "P-factor."[2] Cropland fields on which such practices are applied were identified through field inspection. A P-factor value of less than 1.0 was subsequently assigned for each farm field for which such practices were identified, in accordance with the methodology set forth in the U. S. Soil Conservation Service technical guide. In addition, the P-factor was adjusted slightly—that is, reduced slightly below 1.0—for those fields which were farmed substantially on the contour, but which did not fully comply with Soil Conservation Service standards for contour plowing. The balance of cropland fields in the County were assigned a P-factor of 1.0.

It should be noted that contour plowing, contour strip-cropping, and terracing are also practiced on a relatively limited basis in Ozaukee County. In this regard, the inventory indicated that contour plowing was practiced on 153 farm fields encompassing 1,067 acres, or about 1.4 percent of all cropland in the County; and that contour strip-cropping was practiced on 34 fields encompassing 431 acres, or about 0.6 percent of all

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[2] *The effects of terracing are also reflected in the universal soil loss equation in the LS-factor.*

Table 5

CROPLAND SOIL EROSION RATES IN OZAUKEE COUNTY: 1987

Soil Loss Rate (tons per acre per year)	Cropland		
	Number of Fields	Acres	
		Number	Percent of Total
Less than 3.0	5,086	49,209	66.3
3.0 - 3.9	783	9,147	12.3
4.0 - 4.9	416	5,012	6.8
5.0 - 5.9	338	3,691	5.0
6.0 - 6.9	227	2,362	3.2
7.0 - 7.9	123	1,399	1.9
8.0 - 8.9	92	1,147	1.5
9.0 - 9.9	69	797	1.1
10.0 - 14.9	91	905	1.2
15.0 or More	58	493	0.7
Total	7,283	74,162	100.0
Average Soil Loss Rate	2.9 Tons/Acre/Year		

Source: Ozaukee County Land Conservation Department and SEWRPC.

cropland. Five terraced farm fields, encompassing a total of 50 acres, were identified in the inventory.

In addition to the management practices described above, a total of 257 fields encompassing 2,098 acres of cropland, representing 3 percent of all cropland, were identified in the inventory as being farmed substantially on the contour, although not in full compliance with U. S. Soil Conservation Service standards for contour plowing.

Cropland Soil Erosion Rates

The rate of sheet and rill erosion was calculated for cropland fields in Ozaukee County through application of the universal soil loss equation, using the data developed under the cropland inventory described above. The resulting soil loss rates expressed in tons per acre per year are presented for the County overall, for U. S. Public Land Survey townships, and for U. S. Public Land Survey sections in Tables 5 and 6, and on Map 9. Soil loss rates for watersheds in Ozaukee County are presented in Table 7.

As indicated in Table 5, the average rate of sheet and rill erosion on cropland in Ozaukee County in 1987 was 2.9 tons per acre per year. The soil loss rate was less than 3.0 tons per acre per year on about 49,200 acres of cropland, representing about 66 percent of all cropland. At the other extreme, the soil loss rate was 10 tons per acre per year or more on about 1,400 acres, representing about 2 percent of all cropland. As shown on Map 9, there was considerable variation in the rate of cropland soil erosion within the County, with the eastern and south-central areas generally having the highest erosion rates. On a watershed basis, the highest average soil loss rate—3.2 tons per acre per year—occurred on cropland in the Milwaukee River South watershed.

Actual soil loss rates within the County relative to "tolerable" soil loss rates, or "T-value," are presented in Tables 8, 9, and 10, and on Map 10. As indicated in Table 8, for about 53,000 acres of cropland, or just over 71 percent of all cropland in Ozaukee County, the soil loss rate was less than or equal to T-value. Conversely, for about 21,100 acres, representing almost 29 percent of all cropland, soil erosion was occurring in excess of T-value—including about 14,400 acres, or almost 20 percent of all cropland, eroding at rates between 1.1 and 2.0 times T-value; about 4,300 acres, or about 6 percent, eroding at rates between 2.1 and 3.0 times T-value; and the balance—about 2,400 acres, or about 3 percent—eroding at rates of more than 3.0 times T-value. As shown on Map 10, the highest erosion rates relative to established soil loss tolerances also occur within the eastern and south-central areas of the County. Among the watersheds in the County, the highest average soil loss rate relative to T-value was also identified for the Milwaukee River South (see Table 10).

NONCROPLAND SOIL EROSION

As already noted, under the county soil erosion control planning program, primary data collection activity focused on cropland soil erosion. A general description of soil erosion attendant to other selected land uses is presented below.

Erosion on Pastureland and Grazed Woodland

Pastureland and grazed woodlands are susceptible to excessive erosion under certain circumstances, particularly when overgrazing occurs on steep slopes. Soil erosion inventory data were collected for pastureland and grazed woodlands throughout the Milwaukee River watershed in Ozaukee County under the Milwaukee River Priority Watersheds Program. For the remainder of the County, under the county soil erosion

Table 6

CROPLAND SOIL EROSION RATES IN OZAUKEE COUNTY BY TOWNSHIP: 1987

U. S. Public Land Survey Township	Cropland Eroding at Less than 3.0 Tons/Acre/Year		Cropland Eroding at 3.0-4.9 Tons/Acre/Year		Cropland Eroding at 5.0-6.9 Tons/Acre/Year		Cropland Eroding at 7.0-8.9 Tons/Acre/Year		Cropland Eroding at 9.0 Tons/Acre/Year or More		Total Cropland		Average Soil Loss Rate: Tons/Acre/Year
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
9 North, 21 East (Mequon)	5,254	51.8	1,885	18.6	1,367	13.5	768	7.6	867	8.5	10,141	100.0	4.0
9 North, 22 East (Mequon)	228	19.8	257	22.3	538	46.7	58	5.0	72	6.2	1,153	100.0	4.8
10 North, 21 East (Cedarburg-Grafton)	6,364	74.2	1,074	12.5	627	7.3	314	3.7	193	2.3	8,572	100.0	2.5
10 North, 22 East (Grafton)	2,684	51.3	1,335	25.5	815	15.6	234	4.5	160	3.1	5,228	100.0	3.5
11 North, 21 East (Saukville)	7,300	74.4	1,547	15.8	628	6.4	167	1.7	166	1.7	9,808	100.0	2.4
11 North, 22 East (Port Washington)	5,641	65.7	1,702	19.8	605	7.1	317	3.7	317	3.7	8,582	100.0	3.1
12 North, 21 East (Fredonia)	11,003	77.7	2,262	16.0	554	3.9	218	1.5	127	0.9	14,164	100.0	2.2
12 North, 22 East (Belgium)	10,579	65.0	4,035	24.8	919	5.6	470	2.9	275	1.7	16,278	100.0	2.8
12 North, 23 East (Belgium)	156	66.1	62	26.3	0	0.0	0	0.0	18	7.6	236	100.0	2.9
County Total	49,209	66.3	14,159	19.1	6,053	8.2	2,546	3.4	2,195	3.0	74,162	100.0	2.9

Source: Ozaukee County Land Conservation Department and SEWRPC.

Table 7

CROPLAND SOIL EROSION RATES IN OZAUKEE COUNTY BY WATERSHED: 1987

Watershed	Cropland Eroding at Less than 3.0 Tons/Acre/Year		Cropland Eroding at 3.0-4.9 Tons/Acre/Year		Cropland Eroding at 5.0-6.9 Tons/Acre/Year		Cropland Eroding at 7.0-8.9 Tons/Acre/Year		Cropland Eroding at 9.0 Tons/Acre/ Year or More		Total Cropland		Average Soil Loss Rate: Tons/Acre/Year
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Menomonee River	3,052	65.1	921	19.7	288	6.2	212	4.5	213	4.5	4,686	100.0	2.8
Milwaukee River Cedar Creek	5,676	72.2	937	11.9	726	9.3	262	3.3	262	3.3	7,863	100.0	2.8
Milwaukee River East-West Branches	2,062	85.2	227	9.4	75	3.1	27	1.1	30	1.2	2,421	100.0	2.0
Milwaukee River South	16,266	60.7	5,224	19.5	3,163	11.8	1,179	4.4	981	3.6	26,813	100.0	3.2
Milwaukee River North Branch	3,391	80.9	589	14.1	114	2.7	44	1.0	53	1.3	4,191	100.0	2.0
Subtotal	27,395	66.3	6,977	16.9	4,078	9.9	1,512	3.7	1,326	3.2	41,288	100.0	2.9
Balance of County (Onion River, Sauk Creek, Sucker Creek, Minor Tributaries to Lake Michigan)	18,762	66.6	6,261	22.2	1,687	6.0	822	2.9	656	2.3	28,188	100.0	2.8
County Total	49,209	66.3	14,159	19.1	6,053	8.2	2,546	3.4	2,195	3.0	74,162	100.0	2.9

Source: Ozaukee County Land Conservation Department and SEWRPC.

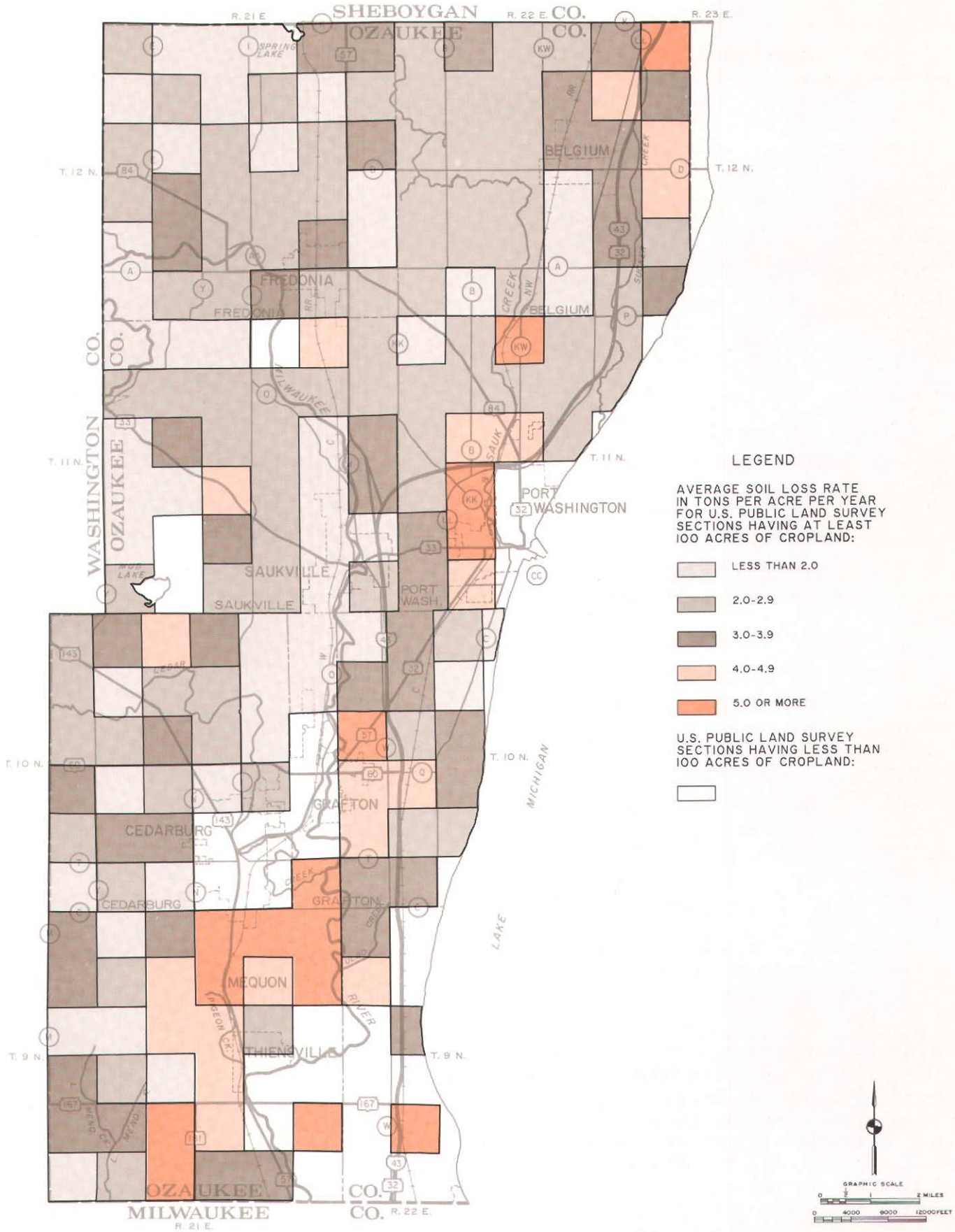
control planning program, soil erosion inventory data were collected for those pasture fields and grazed woodlands which, based upon field inspection, appeared to be eroding at excessive rates. Application of the universal soil loss equation indicated that only 89 acres of pastureland and grazed woodlands in the County were eroding at rates exceeding T-value. It is envisioned that the detailed farm planning activities required to address the cropland soil erosion problems identified in this report will also address any apparent erosion problems on pastureland and grazed woodlands.

Stream Bank Erosion

Erosion of stream banks in rural areas may be promoted by livestock disturbance, cropping activity immediately adjacent to a stream, and

Map 9

CROPLAND SOIL EROSION RATES IN OZAUKEE COUNTY: 1987



Source: Ozaukee County Land Conservation Department and SEWRPC.

Table 8

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN OZAUKEE COUNTY: 1987

Soil Loss Rate in Multiples of T-Value	Cropland		
	Number of Fields	Acres	
		Number	Percent of Total
1.0 or Less	5,405	53,018	71.5
1.1 - 1.5	783	9,079	12.2
1.6 - 2.0	465	5,371	7.3
2.1 - 3.0	386	4,303	5.8
3.1 - 4.0	131	1,342	1.8
4.1 - 5.0	47	467	0.6
5.1 or More	66	582	0.8
Total	7,283	74,162	100.0

Source: Ozaukee County Land Conservation Department and SEWRPC.

certain recreational activities. Increased stormwater runoff from urbanizing areas may also contribute to increased stream bank erosion in downstream rural areas. Although an analysis of stream bank erosion was not conducted as part of the soil erosion control planning program, it is envisioned that the detailed farm planning activities required to address cropland soil erosion problems will also address any apparent stream bank erosion problems in rural areas.

Construction Site Erosion

The development and redevelopment of land for residential, commercial, industrial, institutional, transportation, and other intensive urban uses may result in significant soil erosion. Such erosion can contribute to problems on the construction site itself, such as rilled and gullied slopes and washed-out roads, and to offsite problems, including water quality degradation and the clogging of culverts, roadside ditches, channels, and bays. Upon completion, increased runoff from impervious pavements, building roofs, and compacted soil at the developed site may cause erosion on adjacent lands and may increase the potential for flooding.

Soil erosion rates attendant to construction activities are extremely variable. The amount of erosion depends upon the time period and areal extent of the construction operation; the topography of the site; the soil characteristics; the construction methods utilized; and the preventive measures taken to control soil erosion. Erosion rates on land under construction may be very high, ranging up to 200 tons per acre per year.

As indicated in Chapter II, Ozaukee County has experienced a substantial increase in lands devoted to intensive urban uses. Such lands increased by about 10,700 acres, or 65 percent, between 1963 and 1985, with residential lands accounting for about 6,100 acres, or about 57 percent, of the total increase. A total of 5,224 residential lots were platted during this time period, an average of 237 lots per year. From 1985 through 1987, a total of 450 residential lots were platted, an average of 150 lots per year. Within Ozaukee County, urban land development—and the attendant potential for construction site erosion—has occurred both within expanding urban centers and within isolated enclaves in outlying areas of the County (see Map 8 in Chapter II).

Soil erosion from construction sites can be minimized through appropriate soil erosion control practices. In 1987, the Wisconsin Department of Natural Resources, in conjunction with the League of Wisconsin Municipalities, published a model ordinance which local units of government may adopt to control construction site erosion.[3] The model ordinance requires erosion control practices which reduce the amount of sediment and other pollutants leaving construction sites during the development process. The ordinance sets forth requirements with regard to seeding, sodding, mulching, and other means of stabilizing disturbed ground; use of sedimentation basins and filter fences to minimize the amount of sediment leaving the site; diversion of runoff from upland areas away from the construction site; and other erosion control practices. In Ozaukee County, only the Village of Thiensville had adopted a construction site erosion control ordinance based upon the model ordinance as of the end of 1988.

Shoreline Erosion and Bluff Recession

Shoreline erosion and bluff recession constitute a serious threat to land and improvements along portions of the Lake Michigan shoreline in

[3] *"Model Ordinance," The Municipality, Volume 82, No. 1, January 1987.*

Table 9

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN OZAUKEE COUNTY BY TOWNSHIP: 1987

U. S. Public Land Survey Township	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at More than 1.0 Times T-Value								Total Cropland		Average Soil Loss Rate in Multiples of T-Value
			Cropland Eroding at 1.1-1.5 Times T-Value		Cropland Eroding at 1.6-2.0 Times T-Value		Cropland Eroding at More than 2.0 Times T-Value		Subtotal				
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
9 North, 21 East (Mequon)	5,693	56.1	1,253	12.4	1,173	11.6	2,022	19.9	4,448	43.9	10,141	100.0	1.2
9 North, 22 East (Mequon)	285	24.7	204	17.7	454	39.4	210	18.2	868	75.3	1,153	100.0	1.6
10 North, 21 East (Cedarburg-Grafton)	6,741	78.7	637	7.4	506	5.9	688	8.0	1,831	21.3	8,572	100.0	0.7
10 North, 22 East (Grafton)	2,880	55.1	936	17.9	758	14.5	654	12.5	2,348	44.9	5,228	100.0	1.1
11 North, 21 East (Saukville)	7,553	77.0	1,105	11.3	569	5.8	581	5.9	2,255	23.0	9,808	100.0	0.7
11 North, 22 East (Port Washington)	6,256	72.9	1,045	12.2	393	4.6	888	10.3	2,326	27.1	8,582	100.0	0.9
12 North, 21 East (Fredonia)	11,801	83.3	1,384	9.8	476	3.4	503	3.5	2,363	16.7	14,164	100.0	0.7
12 North, 22 East (Belgium)	11,644	71.5	2,462	15.1	1,031	6.4	1,141	7.0	4,634	28.5	16,278	100.0	0.8
12 North, 23 East (Belgium)	165	69.9	53	22.5	11	4.6	7	3.0	71	30.1	236	100.0	0.8
County Total	53,018	71.5	9,079	12.2	5,371	7.3	6,694	9.0	21,144	28.5	74,162	100.0	0.9

Source: Ozaukee County Land Conservation Department and SEWRPC.

Table 10

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN OZAUKEE COUNTY BY WATERSHED: 1987

Watershed	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at More than 1.0 Times T-Value								Total Cropland		Average Soil Loss Rate in Multiples of T-Value
			Cropland Eroding at 1.1-1.5 Times T-Value		Cropland Eroding at 1.6-2.0 Times T-Value		Cropland Eroding at More than 2.0 Times T-Value		Subtotal				
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
Menomonee River	3,258	69.5	609	13.0	303	6.5	516	11.0	1,428	30.5	4,686	100.0	0.8
Milwaukee River Cedar Creek	5,929	75.4	636	8.1	532	6.8	766	9.7	1,934	24.6	7,863	100.0	0.8
Milwaukee River East-West Branches	2,072	85.6	196	8.1	64	2.6	89	3.7	349	14.4	2,421	100.0	0.6
Milwaukee River South	17,285	64.5	3,602	13.4	2,839	10.6	3,087	11.5	9,528	35.5	26,813	100.0	1.0
Milwaukee River North Branch	3,605	86.0	331	7.9	156	3.7	99	2.4	586	14.0	4,191	100.0	0.6
Subtotal	28,891	70.0	4,765	11.5	3,591	8.7	4,041	9.8	12,397	30.0	41,288	100.0	0.9
Balance of County (Onion River, Sauk Creek, Sucker Creek, Minor Tributaries to Lake Michigan)	20,869	74.0	3,705	13.2	1,477	5.2	2,137	7.6	7,319	26.0	28,188	100.0	0.8
Total	53,018	71.5	9,079	12.2	5,371	7.3	6,694	9.0	21,144	28.5	74,162	100.0	0.9

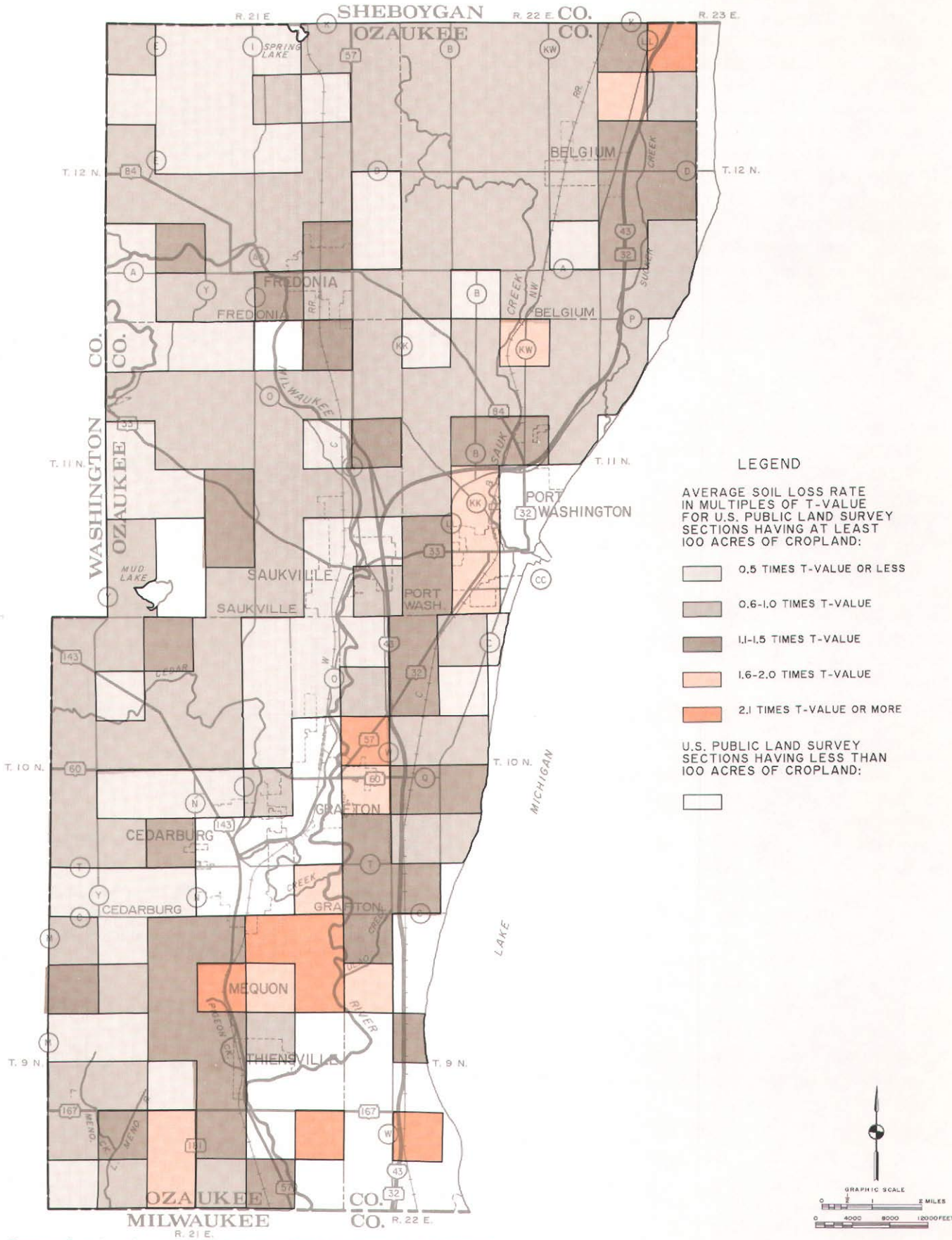
Source: Ozaukee County Land Conservation Department and SEWRPC.

Ozaukee County. Bluff recession rates of up to 12 feet per year were documented in the shore erosion study completed in 1977 under the Wisconsin coastal management program. A shoreline reach approximately six and one-half miles long, extending from Virmond Park to the northern section line of Section 28 of U. S. Public Land Survey Town 10 North, Range 22 East, was designated as the second most critical reach along the Lake Michigan coast in Wisconsin in terms of recession rates and potential shore damage.

Shoreline erosion problems may be mitigated or prevented through structural shore protection measures and through regulatory approaches. Structural measures—including the installation of revetment, seawalls, groins, and breakwaters

Map 10

CROPLAND SOIL EROSION RELATIVE TO T-VALUE IN OZAUKEE COUNTY: 1987



Source: Ozaukee County Land Conservation Department and SEWRPC.

and measures to stabilize coastal bluffs—are particularly important where erosion threatens existing public and private development. Conversely, land use regulations can be used to protect proposed development from shoreline erosion and bluff recession by establishing setback provisions which restrict the location of buildings and other land uses that are vulnerable to damage or destruction from erosion. Lake Michigan structural setback requirements have been established in the Ozaukee County shoreland regulations—which are in effect in the unincorporated areas of the County—and in the City of Mequon zoning ordinance.

CONCLUDING REMARKS

This chapter has described the methodology and findings of an inventory and analysis of cropland soil erosion in Ozaukee County. That work indicated that the average rate of sheet and rill erosion on cropland in Ozaukee County was 2.9 tons per acre per year in 1987. The soil loss rate was less than three tons per acre per year on about 49,200 acres of cropland, or about 66 percent of all cropland in the County. At the other extreme, the soil loss rate was 10 tons per acre per year or more on about 1,400 acres, representing about 2 percent of all cropland. About 21,100 acres, or almost 29 percent of all cropland in the County, was identified as having a soil loss rate in excess of soil loss tolerances, or "T-values," established by the U. S. Soil Conservation Service. Specifically, about 14,400 acres, or almost 20 percent of all cropland, was eroding at rates between 1.1 and 2.0 times T-value; about 4,300 acres, or about 6 percent, was eroding at rates between 2.1 and 3.0 times T-value; and the balance—about 2,400 acres, or about 3 percent—was eroding at rates greater than 3.0 times T-value. There was considerable variation in the rate of cropland soil erosion within the County, with the eastern and south-central areas generally having the highest erosion rates. Subsequent chapters of this report establish a cropland soil erosion control objective and related standards and set forth a plan for the abatement of the identified cropland soil erosion problems.

Pastureland and grazed woodlands are susceptible to excessive erosion under certain circumstances, particularly when overgrazing occurs on steep slopes. Erosion on pastureland and grazed woodlands is not, however, a widespread problem in Ozaukee County. A total of only 89 acres of pastureland and grazed woodlands in the County have been identified as eroding at rates exceeding T-value. It is envisioned that the detailed farm planning activities required to address the cropland soil erosion problems identified in this report will also address any erosion problems on pastureland and grazed woodlands. It is further envisioned that stream bank erosion problems in rural areas will also be identified and addressed as part of the detailed farm planning activities.

This chapter has also pointed out the potential for serious construction site erosion problems as Ozaukee County continues to urbanize. Erosion rates on land under construction may be very high—up to 200 tons per acre per year. Construction site erosion can, however, be minimized through appropriate erosion control practices. The adoption and enforcement by local units of government of construction site erosion control ordinances—such as the model ordinance recently prepared by the Wisconsin Department of Natural Resources in conjunction with the League of Wisconsin Municipalities—can significantly reduce construction site erosion problems. In Ozaukee County, only the Village of Thiensville had adopted a construction site erosion control ordinance based upon the model ordinance as of the end of 1988.

Shoreline erosion and bluff recession constitute a serious threat to land and improvements along portions of the Lake Michigan shoreline in Ozaukee County. Under the shore erosion study completed in 1977 under the Wisconsin coastal management program, a shoreline reach approximately six and one-half miles long extending north from Virmond Park was designated as the second most critical reach along the Lake Michigan coast in Wisconsin in terms of recession rates and potential shore damage. Shoreline erosion problems may be mitigated or prevented through structural shore protection measures—such as the installation of revetment, seawalls, groins, and breakwaters and measures to stabilize coastal bluffs—and through regulatory approaches, including the establishment of setback provisions which restrict the location of buildings and other land uses that are vulnerable to damage or destruction from erosion. Such structural setbacks have been adopted by Ozaukee County as part of its shoreland regulations and by the City of Mequon as part of its zoning ordinance.

Chapter IV

CROPLAND SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

Planning is a rational process for formulating and meeting objectives. The formulation of objectives, therefore, is an essential task which must be undertaken before plans can be properly prepared. This chapter presents a cropland soil erosion control objective for Ozaukee County, together with a supporting principle and related standards, all as recommended for adoption by the Technical Advisory Committee as part of the county soil erosion control plan.[1]

BACKGROUND

Central to the formulation of cropland soil erosion objectives and standards is a consideration of what constitutes excessive erosion. Traditionally in conservation planning, excessive erosion has been defined as erosion in excess of the specific soil loss tolerance for a given soil. A soil loss tolerance, or "T-value," has been established by the U. S. Soil Conservation Service for each soil type. Soil loss tolerance is defined by the Soil Conservation Service as the maximum level of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely. Considered in the establishment of soil loss tolerances, or T-values, are soil depth, including depth to a restrictive layer, permeability, and other factors. For soils in Ozaukee County, T-values range from two to five tons per acre per year.

Chapter Ag 160 of the Wisconsin Administration Code, which governs the preparation of county soil erosion control plans, requires that every county soil erosion control plan establish maximum acceptable rates of cropland soil erosion and that these rates be expressed in terms of T-value, or multiples or fractions of T-value. Chapter Ag 160 further requires that these rates meet certain minimum statewide goals, including an ultimate goal that erosion on all cropland be reduced to no more than T-value by the year 2000. Several interim goals are also prescribed.

Attainment of T-value on all cropland would represent a substantial reduction in cropland soil erosion in Ozaukee County, and would contribute significantly to the long-term maintenance of soil productivity. It should be recognized in this respect that while T-values enjoy a widespread use as a basis for soil conservation planning, they are not universally accepted as goals for cropland soil erosion control. There is growing concern that T-values have been set too high to adequately protect the long-term productivity of the soil. If the actual topsoil formation rate is less than the assigned T-value, topsoil may be gradually depleted even though erosion would appear to be at tolerable levels. It should also be recognized, in this respect, that the established T-values do not take into account offsite impacts attendant to cropland soil erosion. Controlling erosion at T-value does not ensure the prevention of erosion-related water quality problems or other offsite damages, such as the clogging of culverts and ditches. Nevertheless, a reduction in cropland soil erosion to T-value throughout Ozaukee County would contribute significantly to the abatement of such offsite problems.

Some conservationists argue for more aggressive control of cropland erosion, calling for the prevention of all "accelerated" erosion. Acceler-

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[1] *For the purposes of this report, the following definitions of these terms will be employed: 1) objective—a goal or end toward the attainment of which plans and policies are directed; 2) principle—a fundamental, primary, or generally accepted tenet used to assert the validity of objectives and to prepare standards and plans; 3) standard—a criterion used as a basis of comparison to determine the adequacy of alternative and recommended plan proposals to attain objectives; 4) plan—a design which seeks to achieve the agreed-upon objectives; 5) policy—a rule or course of action used to ensure plan implementation; and 6) program—a coordinated series of policies and actions to carry out a plan. Although this chapter discusses only the first three of these terms, an understanding of the interrelationship of the basic concepts which the foregoing terms represent is essential to the discussion of objectives, principles, and standards.*

ated erosion refers to erosion induced by man, as opposed to "normal" erosion caused by geological processes under natural environmental conditions. This position was espoused by the Ad Hoc Committee on Land Resources, created by the Wisconsin Chapter of the Soil and Water Conservation Society, in a report entitled "Soil Conservation Policies for the 1980's."[2] That report notes that soil productivity in terms of crop yield is declining about 2 percent annually, and that increased use of fertilizer and cultural technology have been relied on to offset this decline. The report cautions that there is no assurance that technological advances can indefinitely counter the losses in natural soil productivity. While there are practical impediments to achieving zero accelerated erosion on a widespread basis, there may come a time when soil erosion control beyond currently established soil loss tolerance levels will be required.

RECOMMENDED SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

After careful deliberation, the Technical Advisory Committee recommended the adoption of the cropland soil erosion control objective, supporting principle, and related standards set forth in Table 11. It should be noted that the standards set forth in Table 11 incorporate the minimum standards for erosion control prescribed in Chapter Ag 160 of the Wisconsin Administrative Code—including, importantly, the reduction of soil erosion on all cropland to no more than T-value by the year 2000.

The recommended objective and related standards are based upon the following conclusions drawn by the Advisory Committee during its deliberation on this matter:

- That despite their limitations, soil loss tolerances, or T-values, established by the U. S. Soil Conservation Service, currently provide the best available basis for establishing cropland soil erosion control objectives and standards, although continuing research of those tolerances is required.
- That the attainment of the recommended standards would result in a substantial reduction in cropland soil erosion in Ozaukee County, contributing significantly to the maintenance of the long-term productivity of soil resources and to the abatement of erosion-related water quality problems and offsite damages.
- That given the amount of cropland—about 21,100 acres, or almost 29 percent of all cropland in the County—eroding at rates in excess of T-value, and given the trend toward production of erosion-prone crops in certain areas of the County, the reduction of soil loss to tolerable levels throughout the County by the year 2000 represents a major challenge to the County's agricultural sector.
- That, in the long term, the County may wish to explore more aggressive erosion control objectives and standards as warranted by continuing erosion research.

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[2] *Wisconsin Chapter, Soil Conservation Society of America (now Soil and Water Conservation Society), "Soil Conservation Policies for the 1980's," Report of the Ad Hoc Committee on Land Resources, November 1984.*

Table 11

CROPLAND SOIL EROSION CONTROL OBJECTIVE, PRINCIPLE, AND STANDARDS

OBJECTIVE

The maintenance of the long-term productivity of soils through the prevention of excessive cropland soil erosion.

PRINCIPLE

Erosion can diminish soil productivity by degrading the physical, biological, and chemical properties of the topsoil and by decreasing the depth of soil that is suitable for plant rooting. Prevention of excessive cropland soil erosion is necessary to ensure soil productivity for future generations. Prevention of excessive cropland soil erosion would also contribute to the abatement of erosion-related water quality problems and other offsite damages, including the clogging of culverts and drainageways.

STANDARDS

A. Standards for Individual Fields

1. The soil erosion rate on individual cropland fields should not exceed T-value on or after January 1, 2000.
2. The soil erosion rate on individual cropland fields should not exceed three times T-value on or after July 1, 1990.
3. The soil erosion rate on individual cropland fields should not exceed two times T-value on or after July 1, 1995.
4. The soil erosion rate on individual cropland fields on farms owned by any department or agency of state government should not exceed T-value on or after July 1, 1990.

B. Standards for the County

1. The average soil erosion rate for all cropland in the County should not exceed 1.5 times T-value on or after July 1, 1990.
2. The average soil erosion rate for all cropland in the County should not exceed T-value on or after July 1, 1993.

NOTE: "T-value" is the tolerable soil loss rate—the maximum level of soil erosion that will permit a high level of crop productivity to be sustained economically and indefinitely, as determined by the U. S. Soil Conservation Service. "Excessive" cropland erosion refers to erosion in excess of the tolerable rate, or T-value.

Source: SEWRPC.

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Chapter V

SOIL EROSION CONTROL PRACTICE NEEDS

A variety of conservation practices are available to farmers for the control of cropland soil erosion. These practices range from structural approaches, such as the installation of terraces and the construction of grassed waterways, to management approaches, such as conservation tillage and contour plowing. An important objective of the county soil erosion control planning program was the identification of those practices which would be the most effective in addressing the soil erosion problems identified within the County. This chapter describes the major types of erosion control practices which are available, and identifies the types and amounts of such practices believed to have the greatest potential for reducing cropland soil erosion to tolerable levels in Ozaukee County. This chapter also sets forth a rank ordering of areas of the County based upon the severity of the erosion problem and the need for erosion control practices.

DESCRIPTION OF SOIL EROSION CONTROL PRACTICES

The major conservation practices that may be utilized in efforts to control cropland soil erosion include conservation tillage, changes in crop rotations, contouring, contour strip-cropping, terraces, grassed waterways, cover crops, grade stabilization structures, field diversions, and establishment of permanent vegetative cover. A description of those practices is presented in this section.

Conservation Tillage

The term conservation tillage refers to any tillage and planting system that maintains a crop residue uniformly spread on at least 30 percent of the soil surface after planting to reduce soil erosion by water.[1] There are many types of conservation tillage systems. The major types include mulch-till systems, no-till systems, and variations of no-till systems, including ridge-till and strip-till systems.

In mulch-till systems, the entire soil surface is disturbed by tillage before planting. Tillage implements may include chisel plows, disks, and field cultivators, with one primary pass and one or two secondary passes typically made. Chisel plowing is illustrated in Figure 4. Weed control is achieved through a combination of herbicide use and cultivation. To be considered conservation tillage, residue cover should be at least 30 percent after planting. Mulch-till systems are also referred to as minimum- or reduced-till systems.

Under no-till systems, the soil is left essentially undisturbed from harvesting through planting (see Figure 5). Planting is done on a narrow seedbed about one to three inches wide. Weed control is achieved primarily through application of herbicides. Residue cover at planting is usually between 60 and 70 percent of the surface area, but may be as high as 80 to 90 percent.

A ridge-till system is a variation of the no-till system under which about one-third of the soil surface is tilled at planting with sweeps or row cleaners. Planting is done on four- to six-inch-high ridges formed the previous year. Weed control is achieved through a combination of herbicide use and cultivation. Residue cover after planting is between 35 and 65 percent of the soil surface. Strip-till systems are similar to ridge-till systems in that about one-third of the soil surface is tilled at planting. Planting, however, is done on a level surface rather than on ridges.

Typical field operations, percent residues, and major advantages and disadvantages for major types of conservation tillage systems and the conventional moldboard plow system are set forth in Table 12.

Conservation tillage systems result in a significant reduction in soil erosion. For continuous corn, for example, conservation tillage may reduce soil loss by 55 to 85 percent, in compari-

[1] *Where soil erosion by wind is the primary concern, a conservation tillage system is defined as one which maintains at least 1,000 pounds of flat small grain residue equivalent on the surface during the critical erosion period.*

Figure 4

CHISEL TILLAGE

Source: U. S. Department of Agriculture, Soil Conservation Service.

Figure 5

NO-TILL PLANTING

Source: U. S. Department of Agriculture, Soil Conservation Service.

Table 12

COMPARISON OF MOLDBOARD PLOW AND CONSERVATION TILLAGE SYSTEMS: TYPICAL FIELD OPERATIONS, RESIDUE, AND MAJOR ADVANTAGES AND DISADVANTAGES

System	Typical Field Operations	Percent Residue	Major Advantages	Major Disadvantages
Moldboard Plow	Fall or spring plow; two spring diskings; plant; cultivate	0-10	Prepares a fine seedbed Excellent pesticide and fertilizer incorporation opportunities Adaptable for poorly drained soils Full range of management options	Minimal erosion control High field costs and horsepower requirements Timeliness problems Can cause soil damage
Mulch-Till Chisel Plow	Fall or spring primary tillage; spring disk; plant; cultivate	30 or more	Very good erosion control Good pesticide and fertilizer incorporation opportunities Adaptable to many soil types High field efficiency capacity Wide range of management options	Easy to overtill soil High horsepower requirements Not suggested for rocky soils Rapid moisture loss possible in spring
Offset Disk	Fall or spring disk; spring disk; plant; cultivate	30 or more	Very good erosion control Good pesticide and fertilizer incorporation opportunities One-pass tillage possible on coarse soils Wide range of management options	Only tills 4-6 inches deep High horsepower requirements Not suggested for rocky soils Rapid moisture loss possible in spring
Ridge-Plant	Stalk chopping; planting on ridges; cultivate to maintain ridges	35-65	Good erosion control on contour Offers controlled traffic farming opportunities Suitable for more poorly drained soils Lower fuel/labor costs Lower horsepower requirements	Rotation options are limited Not recommended for slopes over 6-8 percent No pesticide or fertilizer incorporation opportunities Special equipment needed Requires special ridge maintenance and operation
No-Till	Spray; plant into undisturbed surface; postemergent spraying necessary	65-90	Maximum erosion control Low fuel/labor costs Low horsepower requirements Well suited for coarse-textured soils Improved soil structure	No pesticide or fertilizer incorporation opportunities Not suited to poorly drained soils More management skills required Increased dependence on chemicals

NOTE: This table pertains primarily to growing of corn.

Source: University of Wisconsin-Extension, "Conservation Tillage for Corn Handbook," 1986.

Table 13

ESTIMATED EFFECTIVENESS OF EROSION CONTROL PRACTICES

Primary Practices	Approximate Soil Loss Reduction[a] (percent)
Conservation Tillage (up and down the slope)	55 - 85
Contouring (moldboard plow)	10 - 50
Contour Strip-cropping (moldboard plow)	75 - 95
Terracing (moldboard plow)	60 - 80
Crop Rotation (moldboard plow, up and down the slope)	Variable[b]
Grassed Waterways	Up to 99 in grassed channel
Permanent Vegetative Cover	Up to 99

[a] *In comparison to soil loss assuming continuous corn and moldboard plowing up and down the slope.*

[b] *Depends upon type and sequence of crops grown.*

Source: U. S. Soil Conservation Service, Waukesha County Land Conservation Department, and SEWRPC.

son to moldboard plowing (see Table 13). The potential for controlling soil erosion depends upon the amount of tillage, the type and amount of crop residue, and the roughness of the soil.

Crop Rotation

Crop rotation is a cropping system in which row crops, small grains, and forage crops are grown in a planned sequence to reduce soil erosion. This sequence may be used on an entire field or as strips on one field. Forage-based rotations reduce soil erosion and direct runoff. Soil loss from a good-quality grass and legume meadow is negligible. When the sod is plowed, residual effects improve infiltration, leaving the soil less erodible. The effects of the sod are greatest during the first year, but are also significant during the second year. Rotating two kinds of row crop or row crop and small grain is not as effective as including forage crops in the rotation, but may aid in control of some diseases and pests, and usually reduces the amount of fertilizers and herbicides required, a particularly important consideration. The impact of crop rotations on soil erosion thus depends on the type and sequence of crops grown. For example, changing from continuous row crops—corn and soybeans—to a rotation of three years of row crop, one year of oats, and three years of hay would reduce average annual soil loss by about 60 percent. Changing from continuous row crops to a rotation of one year of row crop, one year of oats, and four years of hay would reduce average annual soil loss by about 80 percent.

The advantages of this cropping sequence include reduced pesticide, herbicide, and fertilizer use and ease of implementation. The disadvantages of this cropping sequence are that it reduces erosion primarily during periods when the land is under cover by legumes or small grains, with erosion being only slightly reduced during the years when row crops are grown; and that it is applicable only on farms where both row crops and legumes are needed in the farming operation.

Contouring

Contouring is a planting practice in which the crop rows follow the land contours across the slope. The average soil loss reduction from contouring is about 50 percent on moderate slopes, but less on steeper slopes.

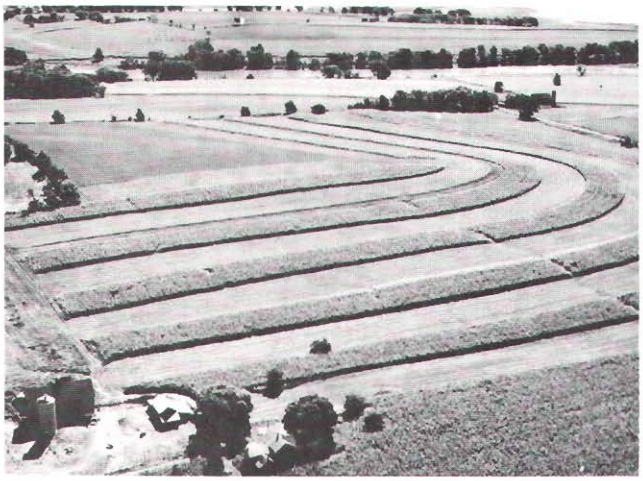
The advantage of contouring is that erosion control is provided for storms with up to moderate levels of rainfall, with the greatest effectiveness provided on slopes of 3 to 8 percent. The disadvantages of contouring are that it is ineffective in severe rainstorms; it needs to be supported by terraces or runoff diversions on long slopes; field contour lines are difficult to follow with large equipment, resulting in time consumption and the creation of point rows; and with poorly drained soils, wetness problems are aggravated.

Contour Strip-cropping

Contour strip-cropping is a method of growing crops in a systematic arrangement of alternating strips or bands of hay or small grain and row crops which follow the land contours across the slope (see Figure 6). High-quality hay strips 80 to 100 feet in width may filter 75 percent or more of the suspended soil from the runoff from the cultivated strips. Strip-crop systems using a four-year rotation—two years of meadow, one of

Figure 6

CONTOUR STRIP-CROPPING



Source: U. S. Department of Agriculture, Soil Conservation Service.

row crop, and one of small grain in which new meadow is established—reduce soil loss to about half of the average for the same rotation contour farmed without the alternating strips, or about 25 percent of the rotation average with the rows up and down a moderate slope. The soil loss reduction from contour strip-cropping ranges from 75 percent to 95 percent in comparison to continuous corn planted up and down the slope.

Contour strip-cropping is the most applicable for farmers who need both row crops and hay in their farming operations.

Cover Crops

Cover crops are crops of close-growing grasses, legumes, or small grain used primarily for seasonal protection and for soil improvement. The crop usually occupies land for a period of one year or less. The purposes of the cover crop are to provide vegetative protection from soil erosion by wind and water during periods when the major crops do not furnish adequate cover; to add organic material to the soil; and to improve infiltration, aeration, and tilth.

Depending on weather conditions in any given year, a cover crop may be a help or a hindrance. If soil wetness in the spring is a problem, the early growth of a wheat cover crop can enable earlier corn planting by removing excess water from the soil. Conversely, if soil moisture supplies are critical, water used for growth of the winter cover crop may reduce the amount of water available to the primary crop later in the growing season and thereby lower crop yields. An example of a cover crop is spring oats planted in the fall after harvesting a row crop. The growing oats freeze, but the tops protect the soil during the winter. The soil loss reduction from cover crops will vary depending upon the crop that preceded the cover crop, the time that the cover crop was planted, and the type of cover crop utilized.

Terracing

A terrace system is a series of earth embankments or ridges and channels constructed across the slope at a prescribed spacing. Terraces reduce the slope length by dividing the overall slope into segments. The soil loss reduction from terracing can range from 60 percent to 80 percent.

The most common types of terraces used in southeastern Wisconsin are the farmable terrace and the vegetated ridge terrace. The type of terrace system selected is determined by the inherent soil and slope conditions and the crop management practices employed on the field. Farmable terraces are used on gently sloping land. The ridges of these terraces have relatively flat front and back slopes and are entirely farmable (see Figure 7).

The vegetated ridge terrace is used on steeper land. The ridges of this type of terrace system have steep front and/or back slopes. The ridges are not farmable and are maintained in erosion-resistant vegetation (see Figure 8). The channels may also remain in permanent vegetation depending on the type of outlet provided.

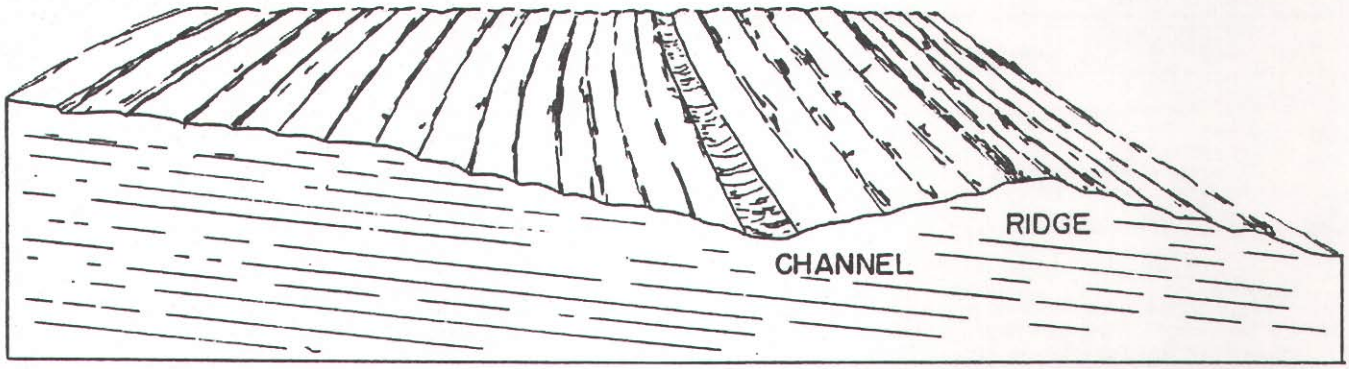
Terraces may use underground outlets or channels to collect and transport runoff water from the field.

Grassed Waterways

Grassed waterways and outlets are natural drainageways or constructed channels shaped to required dimensions and maintained in erosion-resistant perennial vegetation (see Figure 9). Grassed waterways collect and transport runoff water from fields, diversions, terraces, or other structures. A grassed-lined waterway reduces erosion by lowering water flow velocity over the soil surface and binding the surface soil particles with grass roots. The soil loss reduction from grassed waterways ranges up to 99 percent in the grassed channel.

Figure 7

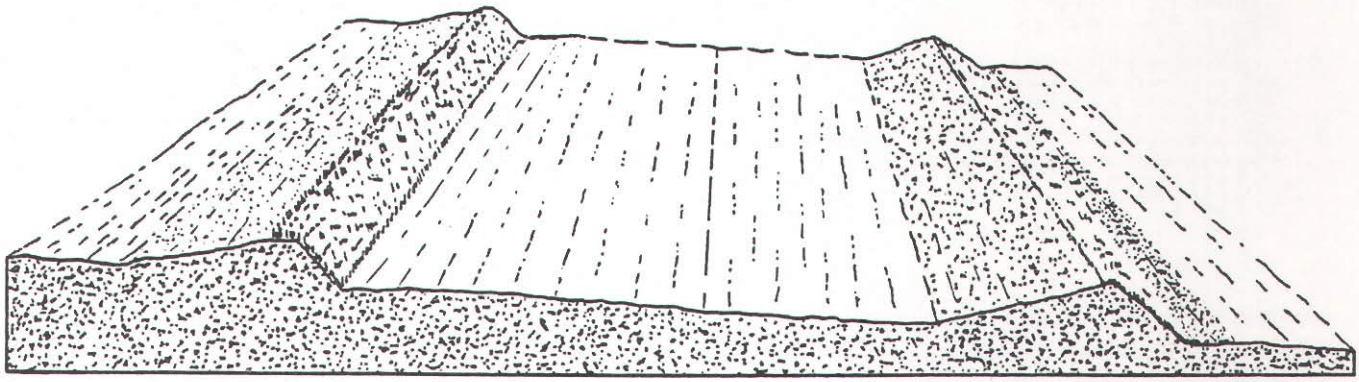
FARMABLE TERRACE



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

Figure 8

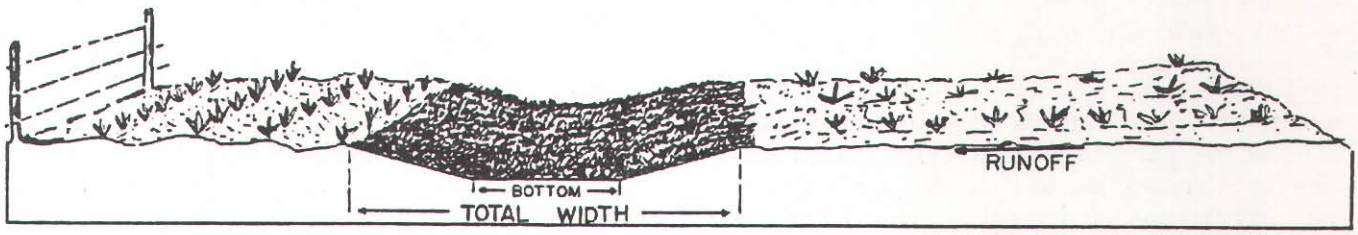
VEGETATED RIDGE TERRACE



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

Figure 9

GRASSED WATERWAY



Source: U. S. Department of Agriculture, Soil Conservation Service; and Waukesha County Land Conservation Department.

Table 14

PRACTICE APPLICATION SEQUENCE USED IN SYSTEMS LEVEL DETERMINATION OF SOIL EROSION CONTROL PRACTICE NEEDS IN OZAUKEE COUNTY

Contourable Fields		Noncontourable Fields	
Practice or Combination of Practices	Application Order	Practice or Combination of Practices	Application Order
Conventional Tillage		Conventional Tillage	
Basic Rotation Change/Contouring	1-2[a]	Basic Rotation Change	1
Basic Rotation Change and Contouring	3		
Contour Strip-cropping	4	Conservation Tillage—30 Percent Residue	
Basic Rotation Change and Contour Strip-cropping	5	Conservation Tillage Alone	2
		Conservation Tillage and Basic Rotation Change	3
Conservation Tillage—30 Percent Residue			
Conservation Tillage Alone	6	Conservation Tillage—50 Percent Residue	
Conservation Tillage Combined with Other Practices:		Conservation Tillage Alone	4
Basic Rotation Change/Contouring	7-8[a]	Conservation Tillage and Basic Rotation Change	5
Basic Rotation Change and Contouring	9	Conservation Tillage and Major Rotation Change	6
Contour Strip-cropping	10		
Basic Rotation Change and Contour Strip-cropping	11	Permanent Vegetative Cover	7
Conservation Tillage—50 Percent Residue			
Conservation Tillage Alone	12		
Conservation Tillage Combined with Other Practices:			
Basic Rotation Change/Contouring	13-14[a]		
Basic Rotation Change and Contouring	15		
Contour Strip-cropping	16		
Basic Rotation Change and Contour Strip-cropping	17		
Permanent Vegetative Cover	18		

NOTES: For purposes of this report, a "basic" rotation change involves 1) adding one year of hay or dropping one year of row crop for fields with hay in the rotation; or 2) adding one year of small grain every fourth year for fields without hay in the rotation. A "major" rotation change involves 1) adding two years of hay or dropping two years of row crop for fields with hay in the rotation; or 2) adding a year of small grain every third year for fields without hay in the rotation.

For fields with no hay in the rotation, contour strip-cropping could involve contour strip-cropping with alternate strips of row crops and small grain, or contour buffer strip-cropping with narrow protective strips alternated with wide cultivated strips. For purposes of this systems level analysis, P-factor values for contour buffer strip-cropping were assumed.

[a]*For contourable fields with hay in the rotation, a basic rotation change would be tried first, followed by contouring. For contourable fields without hay in the rotation, contouring would be tried first, followed by a basic rotation change.*

Source: Ozaukee County Land Conservation Department and SEWRPC.

Although periodic mowing is required, grassed waterways are aesthetically pleasing and offer cover for wildlife, especially when mowing is delayed until mid-summer.

Water and Grade Control Structures

Water and grade control structures include drop spillways, box inlets, chute spillways, pipe drop inlets, debris basins, ponds, and other grade control structures. These structures supplement vegetative practices by reducing the grade in watercourses, reducing the velocity of flowing water, storing water, trapping sediment, reducing peak water flows, and providing surface water inlets to ditches.

Diversions

A diversion is an individually designed graded channel with the supporting ridge on the lower side constructed across the slope. For erosion control purposes, diversions can be used to divert runoff from upslope areas to a stable outlet.

Permanent Vegetative Cover

Permanent vegetative cover refers to the conversion of very erodible cropland to a less intensive use, involving the establishment of a permanent vegetative cover, such as perennial grasses, legumes, forbs, shrubs, or trees. The soil loss reduction from permanent vegetative cover ranges up to 99 percent.

EROSION CONTROL PRACTICE NEEDS

Analysis Procedures

Under the soil erosion control planning program, a "systems level" determination was made of the types of erosion control practices that would effectively address soil erosion problems in Ozaukee County. This systems level planning required the establishment of a general ordering of conservation practices for assignment to excessively eroding farm fields. Based upon consultation with the Ozaukee County

Land Conservation Department and the U. S. Soil Conservation Service staffs, a sequence of management practices was identified for fields which can be farmed on the contour and for fields which cannot (see Table 14). For "contourable" fields, slightly different practice sequences were developed for fields with hay in the rotation and for fields without hay in the rotation. In this regard, for contourable fields with hay in the rotation, a rotation change was given precedence over contouring in the practice sequence. For contourable fields without hay in the rotation, contouring was given precedence over a change in rotation.

Under the systems level analysis of erosion control practice needs, a specific erosion control practice or set of practices was assigned to each farm field which had been identified as experiencing excessive soil erosion—that is, erosion in excess of T-value. From the appropriate sequence in Table 14, fields were assigned the first practice or combination of practices which would have the effect of reducing soil loss to T-value. The effectiveness of the various practices or combination of practices was determined through repeated application of the universal soil loss equation.

With the exception of information regarding the potential for farming on the contour, the data required for this systems level analysis were available on a field-by-field basis, having been collected under the cropland inventories described in Chapter III. In lieu of field-specific information regarding the potential for farming on the contour, a sample of excessively eroding farm fields in each U. S. Public Land Survey township was evaluated in terms of their "contourability," through a review of topographic maps and aerial photographs, as well as field inspection, where necessary. Based upon that sample analysis, the percentage of excessively eroding fields which could be farmed on the contour was estimated for each township. In the process of assigning erosion control practices, a corresponding percentage of excessively eroding farm fields in each township was assumed to be contourable. It should be noted that the sample analysis indicated that very little of the excessively eroding cropland in Ozaukee County—about 2 percent—could be farmed on the contour.

It also should be noted that the systems level of planning described herein was undertaken to provide insight into the types and amounts of conservation practices that could be applied to effectively address soil erosion problems in Ozaukee County. As discussed in more detail later in this report, detailed conservation plans should be prepared for all farms with excessively eroding cropland. It is not intended that the ordering set forth in Table 14 be strictly adhered to in the preparation of such detailed farm plans. Rather, the practices ultimately selected must be cooperatively determined by a qualified conservationist and the farmer, taking into account the characteristics of the farm operation and the farmer's individual resources and objectives.

Identified Erosion Control Practice Needs

The types and amounts of erosion control practices needed to reduce cropland soil erosion to tolerable levels, identified through the systems level analysis described above, are set forth in Table 15. In general, the analysis indicated the following:

- That 5,844 acres, representing about 28 percent of the excessively eroding cropland in the County, would be able to be treated through management practices involving conventional moldboard plowing—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.[2]

- That 9,308 acres, representing about 44 percent of the excessively eroding cropland in the County, would require conservation tillage systems—typically involving fall chisel and spring disking—leaving at least 30 percent of the soil surface covered by crop residue after planting. Of that total, 3,591 acres would be treated through conservation tillage alone, while 5,717 acres would be treated through conservation tillage in conjunction with other practices—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.

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[2]*For purposes of this report, a "basic" rotation change involves 1) adding one year of hay or dropping one year of row crop for fields with hay in the rotation; or 2) adding one year of small grain every fourth year for fields without hay in the rotation. A "major" rotation change involves 1) adding two years of hay or dropping two years of row crop for fields with hay in the rotation; or 2) adding a year of small grain every third year for fields without hay in the rotation.*

Table 15

SOIL EROSION CONTROL PRACTICE NEEDS FOR CROPLAND
HAVING A SOIL LOSS RATE GREATER THAN T-VALUE IN OZAUKEE COUNTY

Conservation Practice	Contourable Fields		Noncontourable Fields		Total	
	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total
Conventional Tillage						
Basic Rotation Change	112	21.9	5,417	26.3	5,529	26.1
Contouring	148	29.0	0	--	148	0.7
Basic Rotation Change and Contouring	112	21.9	0	--	112	0.5
Contour Strip-cropping	12	2.3	0	--	12	0.1
Basic Rotation Change and Contour Strip-cropping	43	8.4	0	--	43	0.2
Subtotal	427	83.5	5,417	26.3	5,844	27.6
Conservation Tillage—30 Percent Residue						
Conservation Tillage Alone	0	--	3,591	17.4	3,591	17.0
Conservation Tillage Combined with Other Practices:						
Basic Rotation Change	0	--	5,637	27.3	5,637	26.7
Contouring	30	5.9	0	--	30	0.1
Basic Rotation Change and Contouring	0	--	0	--	0	--
Contour Strip-cropping	17	3.3	0	--	17	0.1
Basic Rotation Change and Contour Strip-cropping	33	6.5	0	--	33	0.2
Subtotal	80	15.7	9,228	44.7	9,308	44.1
Conservation Tillage--30 Percent Residue						
Conservation Tillage Alone	0	--	0	--	0	--
Conservation Tillage Combined with Other Practices:						
Basic Rotation Change	0	--	1,717	8.3	1,717	8.1
Contouring	0	--	0	--	0	--
Basic Rotation Change and Contouring	0	--	0	--	0	--
Contour Strip-cropping	0	--	0	--	0	--
Basic Rotation Change and Contour Strip-cropping	0	--	0	--	0	--
Major Rotation Change	0	--	1,823	8.8	1,823	8.6
Subtotal	0	--	3,540	17.1	3,540	16.7
Permanent Vegetative Cover	4	0.8	2,448	11.9	2,452	11.6
Total	511	100.0	20,633	100.0	21,144	100.0

Source: Ozaukee County Land Conservation Department and SEWRPC.

- That 3,540 acres, representing about 17 percent of the excessively eroding cropland in the County, would require conservation tillage systems leaving at least 50 percent of the soil surface covered by crop residue after planting.[3] These lands would also require changes in rotation to reduce soil loss to tolerable levels. In this regard, 1,717 acres would require a basic rotation change, while 1,823 acres would require a major rotation change.

- That 2,452 acres, representing just over 11 percent of the excessively eroding cropland in the County, would be retired from production and placed in permanent vegetative cover owing to the steepness of slope or highly erodible nature of the soil. This acreage represents about 3 percent of all cropland in Ozaukee County.

[3] *In some cases, achieving a 50 percent crop residue may require no-till planting. No-till planting is used periodically by a small percentage of farmers in Ozaukee County. More plantings need to be conducted and evaluated to provide information on the suitability of no-till planting in the County.*

In addition to the practices required to reduce soil loss to tolerable levels as described above, other practices—including terraces, grade stabilization structures, grassed waterways, and field diversions—will be needed to address erosion problems in certain situations. The amounts of such practices required in Ozaukee County have been estimated by the County Land Conservation Department. Those estimates indicate a need for a total of 240,000 feet of grassed waterways, 10,000 feet of field diversions, 14,000 feet of terraces, and 152 grade stabilization structures. It should be noted that gradient terraces are favored over tile outlet terraces because of the potential water quality problems associated with tile outlet terraces.

Environmental Considerations with Conservation Tillage Systems: The reliance on conservation tillage as one of the major methods to reduce cropland soil erosion in Ozaukee County requires a related effort to judiciously manage agri-chemical inputs. Relative to other conservation tillage systems, no-till systems may present a greater potential for groundwater contamination by herbicides and fertilizers and accordingly require more careful management. The highest potential for groundwater contamination exists with soil shallow to groundwater or bedrock (i.e., less than three feet) or soils with rapid permeability (sandy textures). Conversely, no-till systems may result in less sediment, fertilizer, and herbicide runoff which would otherwise get into surface water when using other tillage systems.

Conservation tillage systems tend to require a more intensive level of production management. With these systems, weed and insect problems tend to be different and may require closer monitoring than under conventional moldboard plowing. Integrated pest management technologies with crop scouting can be used to reduce pest problems and to minimize agricultural chemical inputs. With crop scouting, pest infestation levels—typically insects and/or weeds—are monitored closely throughout the growing season. Random locations within fields are sampled for the presence and relative abundance of pests, their developmental stages with respect to the crop grown, and their potential for adversely affecting yields. In some locations, spot treatment may be prescribed to keep pest population levels in check. More often, infestations are evaluated against their potential to significantly lower yields. In some cases, no pesticide application is made, as the cost of treatment is found to equal or exceed the cost of projected yield reductions. In other cases, the pests are brought under control to ensure marketability, but application is timed and measured so as to work the most effectively. Through such programs, the calendar or routine application of chemicals is used less. A similar integrated type of approach with soil testing can be used to ensure the judicious application of fertilizers.

Reduced use of chemical fertilizers and pesticides is one aspect of a comprehensive approach to farming referred to as "sustainable agriculture." While the definition of this term is still evolving, it generally includes a reduction in the use of nonrenewable resources, including oil-based products; and a shift to the use of resources already available on the farm, away from purchased inputs. Sustainable agriculture seeks to minimize adverse environmental impacts both on the farm and on surrounding areas, and at the same time to provide a sustained level of production and profit from the farm operation. It should be noted that grants in support of sustainable agriculture demonstration projects are available in Wisconsin under a program administered by the Wisconsin Department of Agriculture, Trade and Consumer Protection.

Costs of Recommended Practices

Of the various soil erosion control practices described above, implementation costs may be readily estimated for grassed waterways, grade stabilization structures, field diversions, terraces, and permanent vegetative cover. The costs of installing these practices are set forth in Table 16. As indicated in that table, the estimated costs include $480,000 for grassed waterways; $228,000 for grade stabilization structures; $35,000 for field diversions; $49,000 for terraces; and $196,200 for the establishment of permanent vegetative cover.

The costs of other conservation practices—including the cost of shifting to conservation tillage, the cost of implementing rotation changes, and the cost of contouring or contour strip-cropping—are far more difficult to specify. With regard to conservation tillage, for example, net return to the farmer may be adversely affected by decreased yields, although in some cases yields could actually increase; by greater

Table 16

COSTS OF SELECTED EROSION CONTROL PRACTICES REQUIRED IN OZAUKEE COUNTY

Erosion Control Practice	Unit Cost	Units Needed	Total Cost
Grassed Waterways	$2.00/foot	240,000 feet	$480,000
Grade Stabilization Structures	1,500/structure	152 structures	228,000
Field Diversions	3.50/foot	10,000 feet	35,000
Terraces	3.50/foot	14,000 feet	49,000
Permanent Vegetative Cover	80/acre	2,452 acres	196,200

Source: Ozaukee County Land Conservation Department and SEWRPC.

use of pesticides; and by an initial capital outlay for the specialized equipment used in some conservation tillage systems. On the other hand, net return may be positively affected by lower fuel consumption and lower operation and maintenance costs, because conservation tillage systems involve fewer tillage operations. Moreover, in the long term, net return may be positively affected owing to the maintenance of natural soil productivity. The impacts on net return of shifting from conventional to conservation tillage may be expected to vary from farm to farm, depending upon the size of operation, the physical characteristics of the farm including soil and topographic characteristics, the types of crops grown, and the type and condition of existing farm machinery.

RANK ORDERING OF AREAS IN TERMS OF EROSION CONTROL PRACTICE NEEDS

As indicated in Chapter III, there is considerable variation in the severity of erosion problems, and accordingly in the need for erosion control practices, within Ozaukee County. In order to provide insight into the relative need for soil erosion control practices within the County, U. S. Public Land Survey sections, each approximating 640 acres in area, have been grouped into four categories based on the average soil loss rate and the amount of excessively eroding cropland. The specific criteria for grouping and ranking U. S. Public Land Survey sections are set forth in Table 17. The relative ranking of each section, based on those criteria, is shown on Map 11. Summary information for each of the four areas is presented in Table 18.

Table 17

CRITERIA FOR THE GROUPING AND RANKING OF U. S. PUBLIC LAND SURVEY SECTIONS ACCORDING TO THEIR RELATIVE NEED FOR EROSION CONTROL PRACTICES

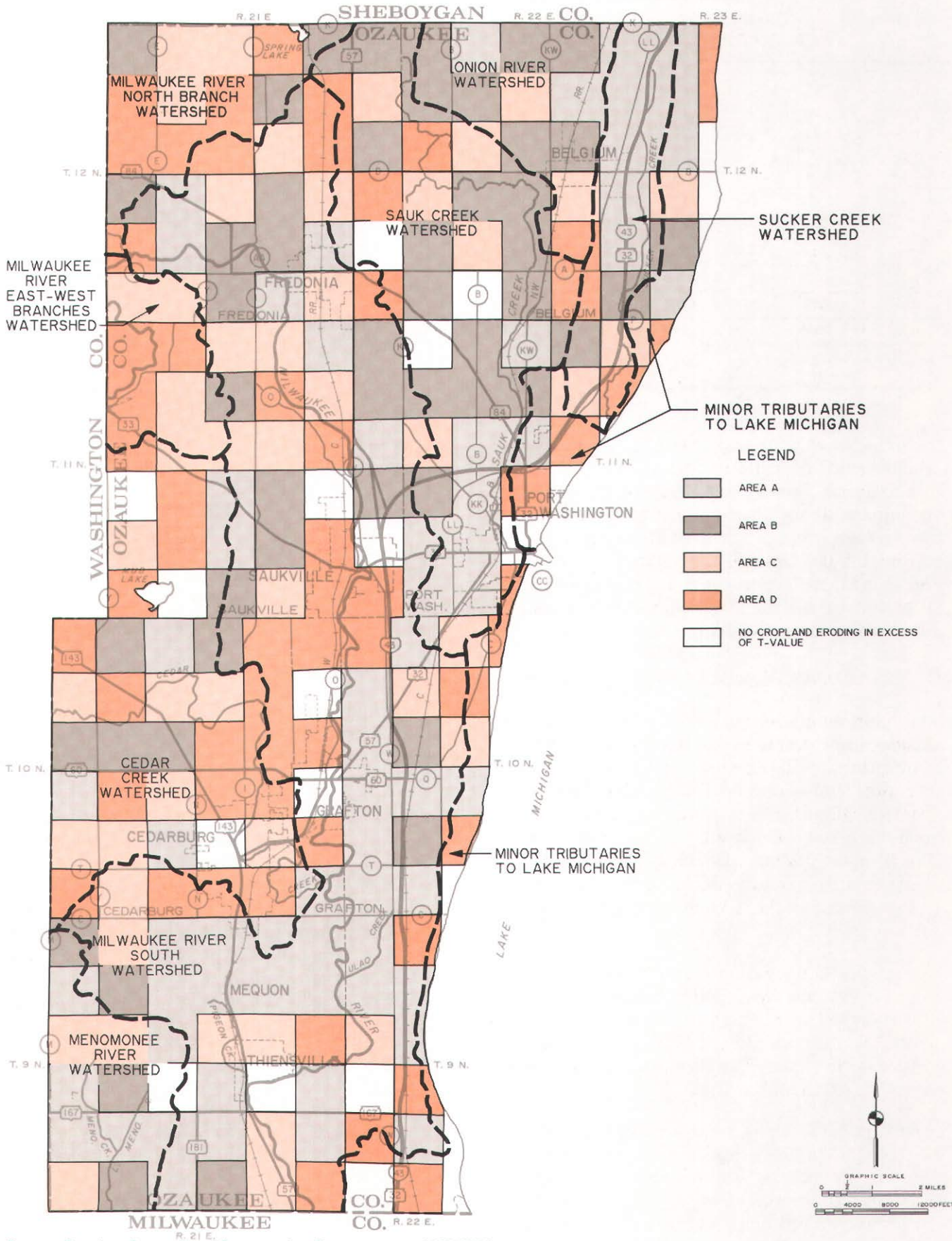
Area	Criteria
A	U. S. Public Land Survey sections having an average soil loss rate of greater than or equal to T-value and at least 75 acres of cropland with a soil loss rate exceeding T-value
B	Other U. S. Public Land Survey sections having at least 75 acres of cropland with a soil loss rate exceeding T-value
C	U. S. Public Land Survey sections having 40-74 acres of cropland with a soil loss rate exceeding T-value
D	U. S. Public Land Survey sections having 1 to 39 acres of cropland with a soil loss rate exceeding T-value

Source: Ozaukee County Land Conservation Department and SEWRPC.

As indicated in Table 18, Area A—the area having the greatest need for cropland soil erosion control practices—includes 64 U. S. Public Land Survey sections, which together encompass about 20,247 acres of cropland. On the average, cropland in Area A was found to be eroding at 1.4 times T-value, and about 11,164 acres, or about 55 percent of all cropland in the 64 sections concerned, was found to be eroding at rates exceeding T-value. Conversely, Area D—

Map 11

AREAS GROUPED ACCORDING TO THEIR RELATIVE NEED FOR SOIL EROSION CONTROL PRACTICES IN OZAUKEE COUNTY



Source: Ozaukee County Land Conservation Department and SEWRPC.

Table 18

CROPLAND SOIL EROSION RELATIVE TO T-VALUE FOR AREAS GROUPED ACCORDING TO THEIR RELATIVE NEED FOR EROSION CONTROL PRACTICES

Area (See Map 11)	Number of U.S. Public Land Survey Sections	Cropland Eroding at 1.0 Times T-Value or Less		Cropland Eroding at More than 1.0 Times T-Value								Total Cropland		Average Soil Loss Rate in Multiples of T-Value
				Cropland Eroding at 1.1-1.5 Times T-Value		Cropland Eroding at 1.6-2.0 Times T-Value		Cropland Eroding at More than 2.0 Times T-Value		Subtotal				
		Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	Acres	Percent of Total	
A	64	9,083	44.9	3,705	18.3	3,048	15.0	4,411	21.8	11,164	55.1	20,247	100.0	1.4
B	50	15,852	72.6	3,217	14.7	1,491	6.8	1,279	5.9	5,987	27.4	21,839	100.0	0.8
C	48	13,541	83.6	1,383	8.5	600	3.7	683	4.2	2,666	16.4	16,207	100.0	0.7
D	59	12,057	90.1	774	5.8	232	1.7	321	2.4	1,327	9.9	13,384	100.0	0.6
Other	12	2,485	100.0	0	0.0	0	0.0	0	0.0	0	0.0	2,485	100.0	0.4
Total	233[a]	53,018	71.5	9,079	12.2	5,371	7.3	6,694	9.0	21,144	28.5	74,162	100.0	0.9

[a]*Excludes sections with no cropland.*

Source: Ozaukee County Land Conservation Department and SEWRPC.

the area having the least need for cropland soil erosion control practices—includes 59 U. S. Public Land Survey sections, which together encompass about 13,384 acres of cropland. On the average, cropland in Area D was found to be eroding at 0.6 times T-value, and about 1,327 acres, or about 10 percent of the cropland in the 59 sections concerned, was found to be eroding at rates exceeding T-value.

CONCLUDING REMARKS

This chapter has described the major types of conservation practices available for the control of cropland soil erosion problems, and has identified those practices believed to have the greatest potential for reducing cropland soil erosion to tolerable levels in Ozaukee County. This chapter has also set forth a rank ordering of areas of the County based upon the severity of the erosion problem and the need for erosion control practices.

Under the soil erosion control planning program, a systems level determination was made of the types and amounts of erosion control practices that would effectively address soil erosion problems in Ozaukee County. The analysis indicated the following:

- That 5,844 acres, representing about 28 percent of the excessively eroding cropland in the County, would be able to be treated through management practices involving conventional moldboard plowing—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.
- That 9,308 acres, representing about 44 percent of the excessively eroding cropland in the County, would require conservation tillage systems leaving at least 30 percent of the soil surface covered by crop residue after planting. Of that total, 3,591 acres would be treated through conservation tillage alone, while 5,717 acres would be treated through conservation tillage in conjunction with other practices—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.
- That 3,540 acres, representing about 17 percent of the excessively eroding cropland in the County, would require conservation tillage systems leaving at least 50 percent of the soil surface covered by crop residue after planting. These lands would also require changes in rotation to reduce soil loss to tolerable levels. In this regard, 1,717 acres would require a basic rotation change, while 1,823 acres would require a major rotation change.
- That 2,452 acres, representing about 11 percent of the excessively eroding cropland in the County, would be retired from production and placed in permanent vegetative cover owing to the steepness of slope or highly erodible nature of the soil. This acreage represents about 3 percent of all cropland in Ozaukee County.

In addition to the practices described above, other erosion control measures—including terraces, grade stabilization structures, grassed waterways, and field diversions—will be needed to address erosion problems in certain situations. In this regard, it is estimated that a need exists for 240,000 feet of grassed waterways, 10,000 feet of field diversions, 14,000 feet of terraces, and 152 grade stabilization structures.

In order to provide insight into the relative need for soil erosion control practices within the County, U. S. Public Land Survey sections have been grouped into four categories based on the average soil loss rate and the amount of excessively eroding cropland. The relative ranking of each section is shown on Map 11. Area A—the area having the greatest need for cropland soil erosion control practices—includes 64 U. S. Public Land Survey sections, which encompass 20,247 acres of cropland. On the average, cropland in that area was found to be eroding at 1.4 times T-value, and about 11,164 acres, or 55 percent of all cropland in the 64 sections concerned, was found to be eroding at rates exceeding T-value. Conversely, Area D—the area having the least need for cropland soil erosion control practices—includes 59 U. S. Public Land Survey sections, which encompass 13,384 acres of cropland. On the average, cropland in Area D was found to be eroding at 0.6 times T-value, and about 1,327 acres, or about 10 percent of the cropland in the 59 sections concerned, was found to be eroding in excess of T-value.

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Chapter VI

AGENCIES AND PROGRAMS CONCERNED WITH THE CONTROL OF CROPLAND SOIL EROSION

Previous chapters of this report have described cropland soil erosion problems in Ozaukee County, and have identified the types and amounts of erosion control practices that would be needed to reduce cropland soil erosion to tolerable levels. While ultimately the responsibility for the control of cropland soil erosion rests with the farm operator, a number of agencies and units of government have, in accordance with law, important responsibilities for conservation of the soil resource. This chapter identifies those units and agencies of government concerned with the control of soil erosion, and describes the various government-sponsored programs that have been established to address soil erosion problems. This chapter also describes existing regulatory authority which may be brought to bear to minimize soil erosion problems.

CONCERNED AGENCIES

Those units and agencies of government which are concerned, directly or indirectly, with the control of cropland soil erosion include, at the county level, the Ozaukee County Board and the Ozaukee County Land Conservation Committee; at the state level, the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the University of Wisconsin-Extension; and at the federal level, the U. S. Department of Agriculture—Agricultural Stabilization and Conservation Service, Soil Conservation Service, and Farmer's Home Administration. The powers and responsibilities of these agencies and units of government pertaining to the control of soil erosion problems are summarized below.

County Level

Ozaukee County Land Conservation Committee: The Ozaukee County Land Conservation Committee has broad authority and responsibility for the conservation and protection of the soil and water resources of Ozaukee County. The Ozaukee County Land Conservation Department staff, under the direction of the Land Conservation Committee, is involved in the administration and coordination of a variety of programs dealing with soil erosion and nonpoint sources of pollution in the County. The County Land Conservation Department, in cooperation with the U. S. Department of Agriculture, Soil Conservation Service, provides technical assistance to landowners and local units of government, including assistance in planning and in the design and installation of soil and water conservation measures. The Land Conservation Department engages in a variety of educational programs regarding proper management of soil and water resources in cooperation with the UW-Extension. The Land Conservation Department is directly involved in the administration of state soil and water conservation programs, including the state priority watershed program and the soil conservation provisions of the Wisconsin Farmland Preservation Program. An important function of the Land Conservation Department is the coordination of state and federal soil and water conservation programs within the County, to avoid duplication of efforts and achieve maximum program benefits.

Ozaukee County Board: The Ozaukee County Board determines the level of county funding of the Land Conservation Committee in carrying out its various responsibilities as described above. The County Board thus has ultimate authority over the types and levels of county-sponsored activities for the conservation and protection of the soil and water resources of Ozaukee County. The Ozaukee County Board also has the authority under Section 92.11 of the Wisconsin Statutes to adopt ordinances for the regulation of land use and land management practices—including, potentially, ordinances controlling excessive soil erosion.

State Level

Wisconsin Department of Agriculture, Trade and Consumer Protection: The Wisconsin Department of Agriculture, Trade and Consumer Protection has a wide range of responsibilities for the conservation and protection of soil and water resources in the State. The Department is responsible for administering the Wisconsin Farmland Preservation Program, the recently created state Soil and Water Resources Management Program, and the soil erosion control

planning program established under Section 92.10 of the Wisconsin Statutes.

Wisconsin Department of Natural Resources: The Wisconsin Department of Natural Resources has broad authority and responsibility in the area of natural resource protection and environmental quality management. The Department of Natural Resources is responsible for administration of the state nonpoint source abatement program, referred to as the priority watershed program. The Department has authority under Section 144.025 of the Wisconsin Statutes to order the abatement of significant nonpoint sources of pollution, such as severe erosion and sedimentation problems.

University of Wisconsin-Extension: The University of Wisconsin-Extension office in Ozaukee County is a local component of a statewide educational network supported by the U. S. Department of Agriculture, the UW-Extension, and Ozaukee County. The UW-Extension office is responsible for coordinating the County's educational program on soil and water conservation. The UW-Extension is available to organize educational programs and demonstration projects intended to increase the awareness among landowners of soil erosion problems, and to assist them in evaluating the options available to remedy those problems.

Federal Level

U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service: The U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service, administers the federal Agricultural Conservation Program, a financial assistance program intended to help rural landowners in carrying out approved conservation practices; and the Conservation Reserve Program, a financial assistance program intended to help farmers convert highly erodible land from cropland to less intensive uses. The Agricultural Stabilization and Conservation Service also assists in administering the conservation compliance provisions of the Food Security Act of 1985.

U. S. Department of Agriculture, Soil Conservation Service: The U. S. Department of Agriculture, Soil Conservation Service, has a number of responsibilities in the area of cropland soil erosion control. The Soil Conservation Service, in conjunction with the Agricultural Stabilization and Conservation Service, is responsible for administering the conservation compliance provisions of the Food Security Act of 1985. The Soil Conservation Service maintains an extensive technical assistance program involving the provision of technical assistance to landowners—including the preparation of farm conservation plans and assistance in designing and applying conservation practices—and the provision of soil and water conservation resource information to units of government. The Soil Conservation Service also conducts detailed soil surveys and provides interpretations as a guide to the use of soil survey data. Within the Southeastern Wisconsin Region, including Ozaukee County, detailed operational soil surveys were completed under a cooperative agreement between the Regional Planning Commission and the Soil Conservation Service negotiated in 1963, thereby providing modern standard soil surveys for the entire Region, together with interpretations for a wide range of rural and urban planning activities.

U. S. Department of Agriculture, Farmers Home Administration: The U. S. Department of Agriculture, Farmers Home Administration, administers a number of loan programs for farm and nonfarm enterprises in rural areas that are unable to obtain credit from other sources. One such program, the Soil and Water Loan Program, represents a potential source of credit for a variety of soil and water conservation improvements, including soil erosion control improvements.

PROGRAMS THAT ADDRESS CROPLAND SOIL EROSION

A number of government-sponsored programs have been established to promote the adoption of farming practices consistent with maintenance of the soil resource. Traditionally, these programs have involved the provision of financial assistance to landowners in support of the application of erosion control practices. More recently, the state and federal governments have established conservation compliance provisions requiring that participants in certain farm programs adhere to sound soil and water conservation practices. A description of those programs and their current status in Ozaukee County follows.

State Level Programs

Soil and Water Resource Management Program: Created as part of the 1987-1989 State Budget

Bill, the State Soil and Water Resources Management Program represents a consolidation and restructuring of several previous programs—namely, the Wisconsin Farmers Fund, the Erosion Control Program, and the Conservation Aids Program—into a single program intended to more effectively address soil and water conservation problems in the State. The consolidation represents a general shift away from direct financial assistance to landowners for implementation of soil and water conservation practices, with greater emphasis placed upon financial support of county technical assistance activities. The program is administered by the Wisconsin Department of Agriculture, Trade and Consumer Protection. During 1989, the first priority for the use of available Soil and Water Resources Management Program funds is the "basic allocation" to counties for the maintenance of county conservationist positions. A second priority is the continuation of financial support for additional county staff working to implement key state soil and water conservation programs—including, in particular, county staff retained to assist farmers in their efforts to comply with the soil conservation requirements of the Wisconsin Farmland Preservation Program. Very limited financial assistance is currently available for new projects under the Soil and Water Resources Management Program.

Wisconsin Farmland Preservation Program: Created in 1977, the Wisconsin Farmland Preservation Program provides property tax relief in the form of state income tax credits to eligible owners of farmland who decide to participate. Farmers in "urban" counties, including all counties in southeastern Wisconsin, are eligible to participate in the program if their land has been placed in a state-certified exclusive agricultural zoning district, and if certain other program eligibility requirements are met. Program changes enacted in 1988 also allow farmers in urban counties to participate on the basis of long-term agreements with the State that limit the use of their land to agricultural use. Farmers in urban counties may apply for such agreements between July 1, 1988, and June 30, 1991. After that period, the requirement of exclusive agricultural zoning for tax credit eligibility in urban counties will be restored.

Six local units of government in Ozaukee County—the Towns Belgium, Cedarburg, Fredonia, Grafton, Port Washington, and Saukville—have adopted exclusive agricultural zoning, enabling owners of farmland in the areas so zoned to apply for Farmland Preservation tax credits. A total of 211 landowners enrolled 30,100 acres of farmland in the Wisconsin Farmland Preservation Program in Ozaukee County for tax year 1987. The average property tax credit was $1,313, representing 36 percent of the average farm property tax of $3,691 for program participants.

As a result of legislation contained in the 1985-1987 state budget bill, all participants in the Farmland Preservation Program are required to adhere to sound soil conservation practices so that cropland soil erosion is kept at or below tolerable levels. The Ozaukee County Land Conservation Department is responsible for determining compliance with the soil conservation requirements in Ozaukee County. In order to assist farmers in reducing soil loss to the established tolerances, a detailed conservation plan has been, or will be, prepared for each farm for which Farmland Preservation Program tax credits are claimed. The detailed plans are prepared in cooperation with the farm operator by the Ozaukee County Land Conservation Department or the Ozaukee County office of the U. S. Soil Conservation Service. Installation of the planned conservation practices may be scheduled over several years, but annual progress is required. By the end of 1988, farm conservation plans had been prepared for about 13,000 acres, or 43 percent of the land currently enrolled in the Farmland Preservation Program. Plans will be prepared for the remainder of the land currently enrolled in the program by the end of 1989.

Additional participation in the Farmland Preservation Program may be expected in Ozaukee County, primarily in the City of Mequon, as a result of the aforementioned program changes enabling landowners to participate on the basis of long-term agreements with the State rather than through exclusive agricultural zoning. Additional participation may also occur as farmers who have conservation plans prepared in conjunction with the conservation compliance provisions of the federal Food Security Act decide to include their lands in the tax credit program.

Priority Watershed Program: The state nonpoint source pollution abatement program, referred to as the priority watershed program and adminis-

tered by the Wisconsin Department of Natural Resources, is designed to maintain and improve the quality of lakes and streams by reducing nonpoint sources of pollution, including cropland soil erosion. Many of the land management practices that the priority watershed program supports for improved water quality are aimed at reducing soil erosion.

A priority watershed program includes an inventory and analysis of nonpoint source pollution problems, the formulation of a detailed plan addressing the identified problems, and implementation activities, including the provision of financial assistance in support of needed conservation practices. With regard to cropland soil erosion, the priority watershed program provides financial assistance in an amount of up to 70 percent of the cost of installing such improvements as grassed waterways and grade stabilization structures, and provides financial assistance on a per-acre basis for the adoption of such practices as contour farming, contour strip-cropping, and conservation tillage. At the local level, much of the responsibility for implementation of a priority watershed plan—including the preparation of detailed farm conservation plans and administration of cost-share agreements—rests with the land conservation committee of the concerned county.

Under the state priority watershed program, a nonpoint source pollution abatement plan was completed in 1981 for the Onion River watershed, a small portion of which lies in Ozaukee County. The portion of the Onion River watershed located in Ozaukee County encompasses 11.4 square miles, or 5 percent of the County. As part of the effort to implement the Onion River priority watershed plan, detailed farm conservation plans have been prepared for 1,100 acres of cropland. The project sign-up phase of the Onion River priority watershed program concluded in 1984. Landowners who have signed a cost-share agreement have five years to complete all projects and practices that are approved by the Department of Natural Resources during the project sign-up phase.

Under the Milwaukee River Priority Watersheds Program, nonpoint source pollution abatement plans will be prepared for five watersheds—the Menomonee River, Cedar Creek, Milwaukee River North Branch, Milwaukee River East-West Branches, and Milwaukee River South—all of which are located in part in Ozaukee County. In combination, these watersheds encompass about 162.5 square miles in Ozaukee County, or 69 percent of the total area of the County. Nonpoint source pollution abatement plans for the Milwaukee River East-West Branches and the Milwaukee River North Branch are expected to be completed early in 1989, followed by the preparation of plans for the Milwaukee River South, Menomonee River, and Cedar Creek watersheds. It is anticipated that implementation of these plans will involve the preparation of detailed farm conservation plans for about 13,000 acres of cropland—excluding land anticipated to be treated in conjunction with the Wisconsin Farmland Preservation Program or the federal Food Security Act conservation compliance provisions.

It should noted that the priority watershed program is primarily concerned with the water quality impacts of soil erosion. Farm fields eroding in excess of T-value but which are not a significant source of sediment would generally not be treated under a priority watershed program. Conversely, farm fields which are eroding at less than T-value but which are a significant source of sediment would generally be treated.

State Soil Erosion Control Planning Program: The Wisconsin Department of Agriculture, Trade and Consumer Protection is responsible for administering the soil erosion control planning program established under Section 92.10 of the Wisconsin Statutes. Under that section of the Statutes, each "priority" county in the State, including Ozaukee County, is required to prepare a countywide soil erosion control plan, focusing on cropland soil erosion. The plan documented in this report is intended to fulfill that planning requirement for Ozaukee County. All such plans must be submitted for review to the Wisconsin Land Conservation Board and the Department of Agriculture, Trade and Consumer Protection. The Department must act to approve or disapprove the plans after reviewing the recommendations of the Land Conservation Board.

Federal Level Programs

Agricultural Conservation Program: Financial assistance is available to farmers throughout Ozaukee County for soil erosion control practices and other conservation practices under the Agricultural Conservation Program administered by the U. S. Department of Agriculture, Agricultural Stabilization and Conservation Service. Under that program, a farmer may

receive assistance in partial support of a variety of erosion control practices, including contour plowing, contour strip-cropping, conservation tillage, terrace systems, diversions, grassed waterways, establishment of long-term vegetative cover, and others. Cost sharing to farm owners and operators ranges from 50 to 75 percent of eligible costs up to a maximum of $3,500 per year. Technical assistance in support of needed practices is provided by the U. S. Soil Conservation Service and the County Land Conservation Department.

For the five years from 1984 through 1988, an average of $18,000 per year was made available in support of soil and water conservation practices in Ozaukee County under the Agricultural Conservation Program, with greater amounts being available in 1987 and 1988. Typically, 95 percent of Agricultural Conservation Program funds available in Ozaukee County is used for soil erosion control purposes.

Conservation Reserve Program: The Conservation Reserve Program, administered by the U. S. Agricultural Stabilization and Conservation Service, provides financial assistance to farmers as incentive to retire highly erodible farm fields from crop production. Under this program, annual payments are made to the landowner over a period of 10 years on a per-acre basis for highly erodible cropland taken out of production. Such payments may also be made for lands adjacent to perennial or intermittent streams, ponds, or wetlands with at least five acres of surface water which are taken out of production. The program also provides financial assistance for up to 50 percent of the normal costs of establishing permanent vegetative cover.

As of the end of 1988, a total of 120 landowners had enrolled 5,500 acres of cropland in the Conservation Reserve Program in Ozaukee County. Funding under the Conservation Reserve Program is not expected to be available beyond 1990.

Conservation Compliance Provisions of the Food Security Act of 1985: The federal Food Security Act of 1985 established "conservation compliance" requirements for farmers participating in a number of U. S. Department of Agriculture farm programs, including price and income support programs, crop insurance programs, Farmers Home Administration loan programs, the Conservation Reserve Program, and others. Under the conservation compliance provisions, producers farming highly erodible fields must develop and be applying a conservation plan for the fields by January 1, 1990, and such plans must be fully implemented by January 1, 1995. A field is considered to be highly erodible under the conservation compliance provisions if at least one-third of the field is covered by soil having an erosion index of eight or greater.[1] The U. S. Department of Agriculture, Soil Conservation Service, is responsible for identifying highly erodible lands in Ozaukee County. The required plans are to be prepared, for the most part, by the U. S. Soil Conservation Service, with some assistance provided by the County Land Conservation Department.

By the end of 1988, the U. S. Soil Conservation Service had completed the process of identifying highly erodible lands for current participants in federal farm programs in Ozaukee County. Farm fields encompassing about 25,000 acres were thereby identified as highly erodible. Additional highly erodible land may be identified in the County as other farmers decide to participate in federal farm programs. Conservation plans were completed for about 5,900 acres of cropland under the provisions of the Food Security Act by the end of 1988.

It should be recognized that the conservation compliance provisions of the Food Security Act pertain only to lands identified as highly erodible. Other lands farmed by participants in federal farm programs are not subject to the Food Security Act conservation compliance requirements, even though they may be eroding above established tolerances. However, as part

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[1] *The erosion index is an indication of the potential erodibility of a soil. The index does not take into account the type of crops grown or management practices used. The index is calculated as follows:*

$$\textit{Erosion Index} = \frac{R \cdot K \cdot LS}{T}$$

where: R is the rainfall factor; K is the soil erodibility factor; LS is the length and steepness of slope factor; and T is the T-value. These factors are described in Chapter III of this report.

of its conservation planning work in conjunction with the Food Security Act, the Ozaukee County office of the U. S. Soil Conservation Service has, to the extent practicable, prepared plans for the entire farm operations concerned.

It should also be noted that under the "alternative conservation systems" provisions of the Food Security Act, a farmer may remain eligible to participate in federal farm programs while using management practices which result in soil erosion above established tolerances on highly erodible land. The intent of the alternative conservation systems provisions is to avoid situations where reduction to T-value would result in economic hardship. Under these provisions, a farmer is generally required to achieve a substantial reduction in soil erosion, but is not required to reduce soil loss to T-value. As a practical matter, in certain situations—for example, for fields which already have hay in the rotation—the alternative conservation systems provisions may allow the farmer to continue to farm without any change in management practices.

Sodbuster Provisions of the Food Security Act of 1985: The Food Security Act of 1985 also included "sodbuster" provisions intended to discourage the conversion of highly erodible land from grassland or woodland to cropland. The sodbuster provisions apply, in particular, to highly erodible land which was not planted to annually tilled crops during the period 1981 through 1985. Under the Food Security Act, farmers desiring to remain eligible for basic U. S. Department of Agriculture programs may convert such land to cropland only by developing and applying a conservation plan in cooperation with the U. S. Department of Agriculture, Soil Conservation Service.

Soil and Water Loan Program: The Soil and Water Loan Program administered by the U. S. Department of Agriculture, Farmers Home Administration, represents a potential source of credit to farmers in financing the installation of grassed waterways, terraces, and other soil erosion control improvements. Applicants must be unable to obtain credit from other sources under reasonable terms and conditions. Loans may be repaid over a period of up to 40 years.

Farmers Home Administration Conservation Easements: The U. S. Farmers Home Administration in 1988 began a program through which farmers experiencing serious difficulty in repaying Farmers Home Administration loans may be able to obtain a reduction in their debt by placing conservation easements on portions of their farm consisting of highly erodible land, wetlands, or wildlife habitat. The debt would generally be reduced by the value of the land included in the easement. The amount of land left after the "set aside" must be sufficient to continue the farm operation.

REGULATORY AUTHORITY FOR THE CONTROL OF SOIL EROSION

Government activities intended to achieve a reduction in cropland soil erosion have traditionally relied upon voluntary cooperation by the farmer, supported by financial and technical assistance programs and educational programs, and—more recently—by conservation compliance provisions as an eligibility requirement for participation in farm programs. Wisconsin law does, however, provide certain regulatory authority for the control of cropland soil erosion and other forms of soil erosion, as indicated below.

Section 92.11, Wisconsin Statutes

Counties as well as cities and villages in Wisconsin have been granted the authority under Section 92.11 of the Wisconsin Statutes to adopt ordinances prohibiting land uses and land management practices which cause excessive soil erosion, sedimentation, nonpoint source water pollution, or stormwater runoff. Upon adoption of such an ordinance by the governing body, the ordinance provisions become effective only upon approval by a majority of voters in a referendum in the affected area. At the end of 1988, regulations governing cropland soil erosion adopted under Section 92.11 were known to be in effect in only one municipality in Wisconsin, the Town of Sterling in Vernon County—the Town of Sterling having approved regulations set forth in the Vernon County Erosion and Sediment Control Ordinance.

Section 144.025, Wisconsin Statutes

In April 1988, the Wisconsin Legislature enacted 1987 Wisconsin Act 297, expanding Section 144.025 of the Wisconsin Statutes, thereby authorizing the Wisconsin Department of Natural Resources to order the abatement of significant nonpoint sources of pollution, such as severe erosion and sedimentation problems, in urban and rural areas. In exercising this author-

Table 19

SELECTED FEATURES OF MAJOR EROSION CONTROL PROGRAMS

Program	Agency Primarily Responsible for Program Administration and Technical Assistance Within the County	Cropland Considered	General Program Standards
Wisconsin Farmland Preservation Program—Soil Conservation Requirements	LCD assisted by SCS	All cropland enrolled in Wisconsin Farmland Preservation Program	Maintenance of soil erosion at or below T-value
Wisconsin Priority Watersheds Program	LCD, DNR	Cropland identified as a sediment problem (such lands may be eroding at rates greater than, equal to, or less than T-value)	Reduction of sediment delivery to target levels established as part of priority watershed plan
Federal Food Security Act Conservation Compliance Provisions	SCS assisted by ASCS and LCD	Highly erodible farm "fields"—that is, fields for which potential erosion is more than eight times T-value	Maintenance of soil erosion at or below T-value; however, "alternative conservation systems" provisions allow soil erosion above T-value
Federal Agricultural Conservation Program	ASCS assisted by SCS	All cropland	--
County Erosion Control Planning Program	LCD	All cropland	Maintenance of soil erosion at or below T-value

NOTE: Agency abbreviations are as follows:

LCD - Ozaukee County Land Conservation Department
SCS - U. S. Soil Conservation Service
ASCS - U. S. Agricultural Stabilization and Conservation Service
DNR - Wisconsin Department of Natural Resources

Source: SEWRPC.

ity, the Department of Natural Resources must send written notice of its intent to issue the pollution abatement order to the individual concerned, as well as to the Wisconsin Department of Agriculture, Trade and Consumer Protection and to the appropriate county land conservation committee.

If the nonpoint source pollution problem is agricultural in nature, the Department of Agriculture, Trade and Consumer Protection must advise the individual concerned of appropriate management options to address the problem and of the financial assistance and technical assistance resources available. Within one year, the Department of Agriculture, Trade and Consumer Protection must provide the Department of Natural Resources with a description of any pollution abatement measures taken and a recommendation as to whether an order to abate the pollution should be issued. Should an abatement order be issued and not complied with, the Department of Natural Resources may implement the order and collect the costs from the noncomplying landowner. State grants for up to 70 percent of the cost of the required conservation practices are available to assist the landowner in resolving the identified problems.

Sections 59.974, 61.354, and 62.234, Wisconsin Statutes

Under Section 59.974 of the Wisconsin Statutes, counties in Wisconsin are granted authority to adopt ordinances for the control of construction site erosion within their unincorporated areas. Such an ordinance does not require approval and is not subject to disapproval by town governments. Villages and cities in Wisconsin are granted similar authority to adopt construction site erosion control ordinances under Sections 61.354 and 62.234, respectively, of the Wisconsin Statutes. As indicated in Chapter III, the Wisconsin Department of Natural Resources, in conjunction with the League of Wisconsin Municipalities, in 1987 published a model ordinance which may be refined as necessary and

adopted by counties, villages, and cities under Sections 59.974, 61.354, or 62.234 for the control of construction site erosion.

CONCLUDING REMARKS

This chapter has identified those agencies and units of government concerned with the control of cropland soil erosion, and has described existing government-sponsored programs intended to improve farm management practices. The various state and federal financial and technical assistance programs and the conservation compliance provisions of state and federal farm programs should result in increased use of erosion control practices within the County. It should be noted, however, that while all of these programs are intended directly or indirectly to reduce erosion, there are significant differences in the cropland treated and in erosion control standards (see Table 19). Thus, the soil conservation requirements of the Wisconsin Farmland Preservation Program pertain to lands enrolled in that program throughout the County, the objective being the maintenance of soil erosion at or below T-value on the entire farm unit concerned. The conservation compliance provisions of the federal Food Security Act pertain to "highly erodible" farm fields farmed by participants in federal farm programs, the general objective being the maintenance of soil erosion at or below T-value, but with soil erosion in excess of T-value allowed under the "alternative conservation systems" provisions of that program. The state priority watershed program pertains to cropland identified as a sediment problem—some of which may be eroding at rates in excess of T-value and some of which may not—the objective being a reduction of sediment rates to standards established in the priority watershed plan. The county soil erosion control planning program, conducted under Section 92.10 of the Wisconsin Statutes and documented in this report, is concerned with all cropland eroding in excess of T-value throughout the County. Owing to these differences, administration of the various erosion control programs must be carefully coordinated to avoid duplication of effort and ensure the maximum program benefits.

Chapter VII

IMPLEMENTATION STRATEGY

As previously indicated, the long-range objective of the county soil erosion control planning program is the reduction of soil erosion on all cropland to tolerable levels, or "T-value," by the year 2000. A total of about 21,100 acres of cropland, representing almost 29 percent of all cropland in the County, have been identified as eroding in excess of T-value. The types and amount of erosion control practices needed to reduce erosion on these lands to tolerable levels were indicated in Chapter V. The agencies and units of government concerned with the control of cropland soil erosion were identified in Chapter VI, along with government-sponsored programs which have been established to address erosion problems. A long-range strategy is needed to guide the concerned agencies and units of government in their efforts to assist farmers in the application of needed erosion control practices. Such a strategy, developed under the guidance of the Ozaukee County Soil Erosion Control Planning Program Technical Advisory Committee, is presented in this chapter.

OVERRIDING CONSIDERATIONS

The implementation strategy presented in this chapter is intended to provide an overall framework to guide the erosion control activities of the concerned agencies and units of government from 1989 through the year 1999. The development of that strategy was based upon the following assumptions:

1. That the Ozaukee County Land Conservation Committee, working through its staff in the County Land Conservation Department, will be the lead agency in carrying out the implementation strategy, with technical support provided by the Ozaukee County office of the U. S. Soil Conservation Service, and with informational and educational assistance provided by the Ozaukee County offices of the U. S. Soil Conservation Service and University of Wisconsin-Extension.

2. That over much of the 11-year implementation period, the erosion control activities of the Land Conservation Department and the U. S. Soil Conservation Service will be determined, to a large extent, by staff commitments under major existing government-sponsored programs—including the conservation compliance provisions of the federal Food Security Act, the soil conservation requirements of the Wisconsin Farmland Preservation Program, and the state priority watershed program; and that implementation of the Milwaukee River Priority Watersheds Program, in particular, will be a major determinant of how staff resources are allocated over time within the County.

3. That where use is not predetermined by existing program commitments, available public financial and technical assistance resources will be targeted to areas of the County having the most serious soil erosion problems.

In the development of the implementation strategy, careful consideration was given to the provisions of existing government programs which have been established to address soil erosion problems. As noted in Chapter VI, those programs differ in terms of such factors as the cropland treated, the erosion control standards, and the implementation time frames. The implementation strategy presented in this chapter was designed to help coordinate the available programs, taking into account inherent differences, in an effort to achieve the primary objective of the county soil erosion control plan—the maintenance of soil erosion at or below T-value on all cropland in the County by the year 2000.

It must be recognized that government-sponsored conservation programs are subject to change, that new programs may be created, and that existing programs may be phased out. Given the long-range nature of the implementation strategy set forth herein and the dynamic nature of the programs involved, it may be expected that the strategy will have to be revised from time to time to reflect program changes.

IMPLEMENTATION STRATEGY

Proposed Activities

In developing the erosion control strategy, the overall 11-year implementation period from 1989 through 1999 was divided into four time periods—the first three periods being three years in length and the fourth, two years. The strategy indicates the areas proposed to be addressed and the types of activities proposed to be undertaken during each period. The major types of erosion control activities considered in the implementation strategy include farm conservation planning—that is, the preparation of detailed farm conservation plans for individual landowners; and practice implementation—that is, the provision of technical assistance to farmers in the application of needed erosion control practices. Supporting activities—including information and education activities to increase the awareness of soil erosion problems and the available means for addressing those problems, and administrative activities, including coordination of soil and water conservation programs and administration of financial assistance agreements—were also considered.

The strategy proposes that cropland soil erosion problems be addressed, for the most part, on a watershed-by-watershed basis. However, the strategy recognizes the need for the provision of technical assistance to farmers scattered throughout the County in conjunction with the soil conservation requirements of the Wisconsin Farmland Preservation Program and the conservation compliance provisions of the federal Food Security Act.

A summary of the areas to be addressed and the activities to be undertaken during each implementation period is presented in Table 20. During the first two implementation periods, the implementation strategy generally coincides with the program commitments of the state priority watershed program, the Wisconsin Farmland Preservation Program, and the federal Food Security Act.[1] As indicated in Table 20, activities during the first implementation period, from 1989 through 1991, would include conservation planning and practice implementation within the Milwaukee River East-West Branches watershed, the Milwaukee River North Branch watershed, and the Milwaukee River South watershed; and conservation planning and practice implementation for participants in the Farmland Preservation Program and farmers subject to the conservation compliance provisions of the federal Food Security Act.

Activities during the second implementation period, from 1992 through 1994, would include practice implementation within the Milwaukee River East-West Branches watershed and the Milwaukee River North Branch watershed; conservation planning and practice implementation within the Cedar Creek watershed, the Menomonee River watershed, and the Milwaukee River South watershed; and practice implementation for participants in the Farmland Preservation Program and farmers subject to the conservation compliance provisions of the Food Security Act.

Activities during the third implementation period, from 1995 through 1997, would include practice implementation within the Milwaukee River South watershed and the Menomonee River watershed; and conservation planning and practice implementation within the Cedar Creek, Sauk Creek, and Sucker Creek watersheds. The Sauk Creek and Sucker Creek watersheds are the first watersheds outside the Milwaukee River Priority Watersheds Program area that are targeted for erosion control. They were selected because of the relatively high need for erosion control practices (see Map 11 in Chapter V).

Activities during the fourth implementation period, consisting of the years 1998 and 1999, would include conservation planning and practice implementation within the Sauk Creek, Sucker Creek, and Onion River watersheds.

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[1] *These program commitments are described in Chapter VI of this report. With regard to the Milwaukee River Priority Watersheds Program, it should be noted that nonpoint source pollution abatement plans for the Milwaukee River East-West Branches watershed and the Milwaukee River North Branch watershed were nearing completion at the time of the preparation of this report. In developing the cropland soil erosion control strategy, it was assumed that implementation of these plans would begin first, followed by the implementation of nonpoint source pollution abatement plans for the Milwaukee River South watershed, the Menomonee River watershed, and the Cedar Creek watershed, respectively.*

Table 20

CROPLAND SOIL EROSION CONTROL IMPLEMENTATION STRATEGY: 1989-1999

Implementation Period	Watersheds Targeted for Erosion Control/ Compliance Provisions to be Addressed	Proposed Activities			
		Conservation Planning	Practice Implementation	Information and Education	Administration
Period I— 1989-1991	Milwaukee River East-West Branches Watershed	X	X	X	X
	Milwaukee River North Branch Watershed	X	X	X	X
	Milwaukee River South Watershed	X	X	X	X
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements	X	X	X	X
Period II— 1992-1994	Milwaukee River East-West Branches Watershed	--	X	X	X
	Milwaukee River North Branch Watershed	--	X	X	X
	Milwaukee River South Watershed	X	X	X	X
	Menomonee River Watershed	X	X	X	X
	Cedar Creek Watershed	X	X	X	X
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements	--	X	X	X
Period III— 1995-1997	Milwaukee River South Watershed	--	X	X	X
	Menomonee River Watershed	--	X	X	X
	Cedar Creek Watershed	X	X	X	X
	Sauk Creek Watershed	X	X	X	X
	Sucker Creek Watershed	X	X	X	X
Period IV— 1998-1999	Sauk Creek Watershed	X	X	X	X
	Sucker Creek Watershed	X	X	X	X
	Onion River Watershed	X	X	X	X

NOTE: The strategy outlined in this table is intended to indicate the emphasis of erosion control activities during each implementation period. It may be expected that, as implementation proceeds, some of the activities will begin somewhat earlier, or end somewhat later, than scheduled.

Source: Ozaukee County Land Conservation Department and SEWRPC.

As further indicated in Table 20, information and education activities and administrative activities would be carried out during each implementation period. A strong information and education program—designed to increase the awareness among farmers of soil erosion problems, of the types of practices that may be utilized to address those problems, and of the public financial and technical assistance resources that are available to help in implementing those practices—would be an integral part of the erosion control implementation strategy. The information and education activities, like most activities undertaken as part of the erosion control implementation strategy, would be closely coordinated with related activities to be carried out under the Milwaukee River Priority Watersheds Program.

Staff Requirements

The government agency staffing levels needed to carry out this erosion control implementation strategy from 1989 through 1999 are presented in Table 21. As indicated in that table, the erosion control implementation strategy would involve the commitment of about 4,900 staff-hours for conservation planning; about 20,500 staff-hours for practice implementation work; just over 2,500 staff-hours for information and education activities; and about 5,100 staff-hours

Table 21

CROPLAND SOIL EROSION CONTROL IMPLEMENTATION STRATEGY: STAFF REQUIREMENTS

Implementation Period	Watersheds Targeted for Erosion Control/ Compliance Provisions to be Addressed	Staff Required (hours)					Available Staff (hours)[e]	Staff Shortfall (hours)
		Conservation Planning[a]	Practice Implementation[b]	Information and Education Activities[c]	Administration[d]	Total		
Period I— 1989-1991	Milwaukee River East-West Branches Watershed	160	300	50	90	600	360	240
	Milwaukee River North Branch Watershed	280	530	80	160	1,050	630	420
	Milwaukee River South Watershed	890	2,580	350	690	4,510	2,710	1,800
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements[f]	1,330	3,500	480	970	6,280	3,760	2,520
	Subtotal	2,660	6,910	960	1,910	12,440	7,460	4,980
Period II— 1992-1994	Milwaukee River East-West Branches Watershed	0	230	20	50	300	180	120
	Milwaukee River North Branch Watershed	0	450	50	90	590	350	240
	Milwaukee River South Watershed	890	3,130	400	800	5,220	3,130	2,090
	Menomonee River Watershed	160	280	40	90	570	340	230
	Cedar Creek Watershed	130	700	80	170	1,080	650	430
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements	0	2,490	250	500	3,240	1,940	1,300
	Subtotal	1,180	7,280	840	1,700	11,000	6,590	4,410
Period III— 1995-1997	Milwaukee River South Watershed	0	1,250	130	250	1,630	970	660
	Menomonee River Watershed	0	430	40	90	560	340	220
	Cedar Creek Watershed	130	740	90	170	1,130	340	790
	Sauk Creek Watershed	290	1,180	150	290	1,910	320	1,590
	Sucker Creek Watershed	100	390	50	100	640	110	530
	Subtotal	520	3,990	460	900	5,870	2,080	3,790
Period IV— 1998-1999	Sauk Creek Watershed	290	1,300	160	320	2,070	350	1,720
	Sucker Creek Watershed	100	390	50	100	640	110	530
	Onion River Watershed	150	610	80	150	990	170	820
	Subtotal	540	2,300	290	570	3,700	630	3,070
Total		4,900	20,480	2,550	5,080	33,010	16,760	16,250

[a]Based upon estimated acreage requiring farm conservation plans and a planning rate of 0.1 hour per acre.

[b]Based upon estimated erosion control practice needs and the following practice implementation technical assistance rates: contour plowing, including obstruction removal—0.2 hour per acre; contour strip-cropping, including obstruction removal—0.4 hour per acre; conservation tillage—0.3 hour per acre; permanent cover—0.1 hour per acre; terraces—0.04 hour per foot; grassed waterways—0.02 hour per foot; diversions—0.04 hour per foot; and grade stabilization structures—70 hours per structure.

[c]Time required for information and education activities was estimated as 10 percent of the time required for conservation planning and practice implementation.

[d]Time required for administration was estimated as 20 percent of the time required for conservation planning and practice implementation.

[e]Available staff time includes the portion of the time which "funded" staff—including the Ozaukee County Conservationist, the U. S. Soil Conservation Service District Conservationist, the conservation planner retained by Ozaukee County in conjunction with the Farmland Preservation Program, the Ozaukee County University of Wisconsin-Extension Agricultural Agent, and the conservationist retained by Ozaukee County in conjunction with the state priority watershed program—would be able to devote to cropland soil erosion control activities.

[f]Data pertain to program participants outside the Milwaukee River East-West Branches, Milwaukee River North Branch, and the Milwaukee River South watersheds.

Source: Ozaukee County Land Conservation Department and SEWRPC.

for administrative work. The erosion control implementation strategy would thus involve a commitment of about 33,000 staff-hours, or just over 16 staff-years, over the 11-year implementation period.

Also presented in Table 21 is the amount of staff time which may be expected to be available for the work envisioned under the erosion control implementation strategy. Included are staff positions currently funded or anticipated to be funded under committed county, state, and federal programs. Specifically included are the amounts of time which would be able to be devoted to cropland soil erosion control activities by the Ozaukee County Conservationist, the U. S. Soil Conservation Service District Conservationist, the Ozaukee County University

of Wisconsin-Extension Agricultural Agent, the conservation planner retained by Ozaukee County in conjunction with the Farmland Preservation Program, and the conservationist retained by Ozaukee County in conjunction with the state priority watershed program. As indicated in Table 21, committed staff may be expected to devote about 16,800 staff-hours, or just over eight staff-years, to cropland soil erosion control activities over the 11-year implementation period—or about 51 percent of the staff time required. The additional staff required for carrying out the erosion control implementation strategy, beyond presently committed staff, totals about 16,200 staff-hours, or about eight staff-years. The cost of the additional staff required, at 1989 salary and fringe benefit levels, would approximate $268,100.

Financial Assistance Requirements

It is anticipated that an effective cropland soil control program would have to be supported by financial assistance to farm operators—either "cost-share" assistance to help offset the cost of such erosion control practices as terraces, grade stabilization structures, grassed waterways, and diversions; or incentive payments to promote the adoption of contouring, contour strip-cropping, and conservation tillage. This section presents an estimate of the amount of financial assistance required in support of those practices needed to reduce cropland soil erosion to tolerable levels, assuming that all farmers with excessively eroding cropland are eligible for, and amenable to, such assistance.

As indicated in Table 22, the amount of financial assistance required in support of needed cropland soil erosion practices would total about $1,082,500. Conversely, the amount of financial assistance which may be expected to be available in support of those practices under current financial assistance programs would total $699,900, including about $259,900 under the state priority watershed program and $440,000 under the federal Agricultural Conservation Program. The additional amount of financial assistance funds required—beyond the amounts which may be expected to be provided through current assistance programs, would, thus, approximate $382,600, or about 35 percent of the total amount needed. It is emphasized that this analysis assumes participation by all farmers with excessively eroding cropland. The shortfall in financial assistance would be less to the extent that farmers decide not to participate in financial assistance programs.

PROGRAM MONITORING AND EVALUATION

Inventory work conducted under the county soil erosion control planning program and priority watershed programs, described in Chapter III, have resulted in the creation of a detailed computerized data base of soil erosion data for farm fields throughout Ozaukee County. If maintained up-do-date, that data base may be expected to serve as an important planning tool, helping in the coordination of cropland soil erosion control efforts in the County. The soil erosion data base should provide a good means of monitoring progress in reducing cropland soil erosion over time, and a good basis for evaluating the effectiveness of the overall cropland erosion control implementation strategy. In this regard, the County Land Conservation Committee should periodically evaluate the activities being carried out under that implementation strategy, considering, among other factors, the impacts on soil loss rates in the County, in order to identify any areas in which soil erosion control efforts might be improved.

REGULATORY MEASURES FOR EROSION CONTROL

Cropland Soil Erosion

As indicated in Chapter VI, while government activities intended to bring about a reduction in cropland soil erosion have traditionally relied upon the voluntary cooperation of farmers, counties as well as cities and villages in Wisconsin have been granted authority under Section 92.11 of the Wisconsin Statutes to adopt ordinances prohibiting land management practices that cause excessive soil erosion. As also indicated in Chapter VI, use of this authority in Wisconsin has been very limited.

After deliberating on the possible exercise of the regulatory authority granted under Section 92.11, the Ozaukee County Soil Erosion Control Planning Program Technical Advisory Committee determined that efforts to address cropland soil erosion in Ozaukee County should continue to emphasize a basically voluntary approach, supported by available technical and financial

Table 22

CROPLAND SOIL EROSION CONTROL IMPLEMENTATION STRATEGY: FINANCIAL ASSISTANCE REQUIREMENTS

Implementation Period	Watersheds Targeted for Erosion Control/ Compliance Provisions to be Addressed	Financial Assistance Required[a]	Available Financial Assistance			Financial Assistance Shortfall
			Priority Watershed Program	Agricultural Conservation Program	Total	
Period I— 1989-1991	Milwaukee River East-West Branches Watershed	$ 9,860	$ 4,930	$ 4,930	$ 9,860	$ 0
	Milwaukee River North Branch Watershed	18,060	9,030	9,030	18,060	0
	Milwaukee River South Watershed	116,360	58,180	41,800	99,980	16,380
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements	225,530	0	64,240	64,240	161,290
	Subtotal	$ 369,810	$ 72,140	$120,000	$192,140	$177,670
Period II— 1992-1994	Milwaukee River East-West Branches Watershed	$ 8,500	$ 4,250	$ 3,600	$ 7,850	$ 650
	Milwaukee River North Branch Watershed	16,950	8,480	7,200	15,680	1,270
	Milwaukee River South Watershed	159,830	79,920	51,600	131,520	28,310
	Menomonee River Watershed	16,690	8,340	4,800	13,140	3,550
	Cedar Creek Watershed	38,100	19,050	12,000	31,050	7,050
	Wisconsin Farmland Preservation Program-Soil Conservation Requirements; and Federal Food Security Act-Conservation Compliance Requirements	134,320	0	40,800	40,800	93,520
	Subtotal	$ 374,390	$120,040	$120,000	$240,040	$134,350
Period III— 1995-1997	Milwaukee River South Watershed	$ 74,160	$ 37,080	$ 37,080	$ 74,160	$ 0
	Menomonee River Watershed	23,090	11,550	11,540	23,090	0
	Cedar Creek Watershed	38,100	19,050	19,050	38,100	0
	Sauk Creek Watershed	61,930	0	39,250	39,250	22,680
	Sucker Creek Watershed	20,600	0	13,080	13,080	7,520
	Subtotal	$ 217,880	$ 67,680	$120,000	$187,680	$ 30,200
Period IV— 1998-1999	Sauk Creek Watershed	$ 69,160	$ 0	$ 44,800	$ 44,800	$ 24,360
	Sucker Creek Watershed	20,600	0	13,600	13,600	7,000
	Onion River Watershed	30,690	0	21,600	21,600	9,090
	Subtotal	$ 120,450	$ 0	$ 80,000	$ 80,000	$ 40,450
County Total		$1,082,530	$259,860	$440,000	$699,860	$382,670

[a]Financial assistance requirements were based upon estimated erosion control practice needs and 1988 assistance rates available under the state priority watershed program. It was assumed that financial assistance would be provided in support of all erosion control practices required in the County. The following financial assistance rates were utilized:

Contour Plowing—$6.00 per acre
Contour Strip-cropping—$12 per acre
Conservation Tillage—$30 per acre
Grassed Waterways—$1.40 per foot (70 percent of the average cost of $2.00 per foot)
Terraces and Diversions—$2.45 per foot (70 percent of the average cost of $3.50 per foot)
Grade Stabilization Structures—$1,050 per structure (70 percent of the average cost of $1,500 per structure)
Permanent Cover—$56 per acre (70 percent of the average cost of $80 per acre)

With regard to the assistance rate for conservation tillage, it was assumed that half of the fields requiring conservation tillage have hay in the rotation, qualifying for assistance at a rate of $15 per acre for one year, and that the other fields are continuous row croplands, qualifying for assistance at a rate of $15 per year for three years.

Source: Ozaukee County Land Conservation Department and SEWRPC.

assistance and information and education programs and by the conservation compliance provisions of state and federal farm programs. The Committee determined that only if the proposed voluntary approach fails should consideration be given to the enactment of mandatory requirements.

As further indicated in Chapter VI, the Wisconsin Legislature in 1988 expanded Section 144.025 of the Wisconsin Statutes authorizing the Wisconsin Department of Natural Resources to order the abatement of significant nonpoint sources of pollution, including severe erosion and sedimentation problems. The direct state action authorized under Section 144.025 may be expected to be taken primarily for very severe erosion problems, including cropland erosion problems, which seriously impair water quality.

Construction Site Erosion

While the focus of the soil erosion control planning program has been on the control of cropland soil erosion, this report has also pointed out the potential for serious construction site erosion problems in Ozaukee County as the County continues to urbanize. As indicated in Chapter VI, under Section 59.974 of the Wisconsin Statutes, counties in Wisconsin are granted authority to adopt ordinances for the control of construction site erosion within their unincorporated areas. Villages and cities are granted similar authority within their incorporated areas under Sections 61.354 and 62.234, respectively, of the Wisconsin Statutes. As also previously indicated, the Wisconsin Department of Natural Resources, in conjunction with the League of Wisconsin Municipalities, has published a model ordinance which may be refined as necessary and adopted by counties, villages, and cities under Sections 59.974, 61.354, and 62.234 for the control of construction site erosion. In Ozaukee County only the Village of Thiensville has adopted a construction site erosion control ordinance based upon the model ordinance.

After deliberating on this matter, the Ozaukee County Soil Erosion Control Planning Program Technical Advisory Committee recommended that Ozaukee County adopt construction site erosion regulations applicable to the unincorporated areas of Ozaukee County, and that each of the cities and villages in Ozaukee County similarly adopt construction site erosion regulations applicable to their incorporated areas. Each of the units of government concerned should review the existing framework of local land use regulations and determine how that framework should be modified to incorporate the desired construction site erosion regulations.

SUMMARY OF AGENCY RESPONSIBILITIES

As indicated in Chapter VI, a number of agencies and units of government are concerned with the control of cropland soil erosion, including—at the county level—the Ozaukee County Board, and the Ozaukee County Land Conservation Committee and its staff in the County Land Conservation Department; at the state level—the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the University of Wisconsin-Extension; and at the federal level—the U. S. Department of Agriculture, Soil Conservation Service, Agricultural Stabilization and Conservation Service, and Farmers Home Administration. While the Ozaukee County Land Conservation Committee and its staff in the County Land Conservation Department, along with the Ozaukee County offices of the U. S. Soil Conservation Service and the University of Wisconsin-Extension, will be the most directly involved in carrying out the implementation strategy proposed in this chapter, the cooperation and involvement of all of the aforementioned agencies is important. The implementation responsibilities of all of the concerned agencies and units of government are summarized in Table 23.

Table 23

AGENCY RESPONSIBILITIES UNDER THE CROPLAND SOIL EROSION CONTROL IMPLEMENTATION STRATEGY

Implementation Activity	Ozaukee County Board of Supervisors	Ozaukee County Land Conservation Committee/Land Conservation Department	Wisconsin Department of Agriculture, Trade and Consumer Protection	Wisconsin Department of Natural Resources	University of Wisconsin-Extension	U. S. Soil Conservation Service	U. S. Agricultural Stabilization and Conservation Service	U. S. Farmers Home Administration
Plan Adoption/Endorsement	X	X	X	X	X	X	X	X
Provision of Technical Assistance to Farmers: Farm Conservation Planning and Practice Implementation		X				X		
Information and Education Activities		X		X	X	X		
Administration of Conservation Requirements of Wisconsin Farmland Preservation Program and Federal Food Security Act		X				X	X	
Allocation of State and Federal Financial Assistance Resources to Ozaukee County			X	X			X	X
Administration of Financial Assistance Programs to Landowners		X					X	X
Coordination of the County Soil Erosion Control Implementation Strategy		X						

Source: Ozaukee County Land Conservation Department and SEWRPC.

Chapter VIII

SUMMARY

Soil erosion takes place when water or wind carries soil away from inadequately protected land surfaces. Erosion causes serious problems. The loss of topsoil from agricultural land means that the land loses part of its productive capacity. Eventually, no amount of fertilizer can, as a practical matter, replace this loss, and the ability of the land to produce crops may be jeopardized. Thus, the land and the people who occupy and work it both become poorer. Downstream sites—the places to which the eroded soil is carried—experience a different but also very costly set of problems. Soil erosion contributes to the water quality problems of lakes and streams. Eroded soil constitutes a form of pollution and is directly injurious to various forms of aquatic life. It destroys fish and wildlife habitat and renders recreational areas undesirable by siltation and by the pollutants carried by the eroded soil.

The dust bowl experience of the 1930's generated a national interest in the wise use of the soil. More recently, concern about soil erosion has increased in southeastern Wisconsin due in part to a shift from dairy farming to cash grain and vegetable farming. This increased continuous row cropping has led to accelerated soil erosion and associated problems. In Ozaukee County there has been a moderate increase in erosion-prone row crops over the past two decades and a substantial decrease in crops that are less susceptible to erosion, including oats and hay.

Because of the increasing concern over soil erosion, the Wisconsin Legislature in 1982 revised Chapter 92 of the Wisconsin Statutes, the state soil and water conservation law, to require the preparation of county soil erosion control plans focusing on the control of cropland soil erosion. A total of 55 counties located generally in the southern two-thirds of the State, including Ozaukee County, are required to prepare such a plan.

Recognizing the need for soil erosion control, and in an effort to comply with the requirements of Chapter 92 of the Wisconsin Statutes, the Ozaukee County Board in 1985 determined to prepare a county soil erosion control plan. The Board requested the assistance of the Southeastern Wisconsin Regional Planning Commission in the preparation of such a plan. The County received a planning grant from the Wisconsin Department of Agriculture, Trade and Consumer Protection in partial support of the required work. The plan presented herein was prepared by the Regional Planning Commission in cooperation with the Ozaukee County Land Conservation Committee and its staff in the County Land Conservation Department. The Land Conservation Department and the Commission staff were assisted in the preparation of the plan by a technical advisory committee consisting of county farmers, the Wisconsin Department of Natural Resources, the University of Wisconsin-Extension, and the U. S. Department of Agriculture, Soil Conservation Service and Agricultural Stabilization and Conservation Service.

The soil erosion control plan presented herein is intended to serve as a guide for use in controlling cropland soil erosion in Ozaukee County. The plan identifies cropland soil erosion control problems in the County; recommends a cropland soil erosion control objective and related erosion control standards; identifies the types and amounts of soil erosion control practices that may be used to reduce soil erosion to tolerable levels; and recommends a long-range implementation strategy to guide the concerned agencies and units of government in their efforts to assist farmers in the application of the erosion control practices. The major findings and recommendations of the plan are summarized below.

SOIL EROSION CONTROL OBJECTIVE

The primary objective of the cropland soil erosion control plan, as recommended by the Technical Advisory Committee, is the maintenance of the long-term productivity of soils within the County through the prevention of "excessive" cropland soil erosion. "Excessive" erosion is defined as erosion in excess of soil tolerances—or T-value—as determined by the U. S. Department of Agriculture, Soil Conservation Service. The related standards recommended by the Technical Advisory Committee incorporate the minimum standards for erosion control prescribed in Chapter Ag 160 of the

Wisconsin Administrative Code—including, importantly, the reduction of soil erosion on all cropland to no more than T-value by the year 2000 (see Table 11 in Chapter IV of this report).

Soil loss tolerance, or T-value, refers to the maximum level of soil erosion that will permit a high level of crop production to be sustained economically and indefinitely. For soils in Ozaukee County, T-values range between two and five tons per acre per year, with about 80 percent of the cropland in the County covered by soils with a T-value of three tons per acre per year. It should be noted that while the concept of the T-value enjoys widespread use as a basis for soil conservation planning, T-values are not universally accepted as goals for cropland soil erosion control. There is some concern that T-values have been set too high to adequately protect the long-term productivity of the soil. It should also be recognized, in this respect, that the established T-values do not take into account offsite impacts attendant to cropland soil erosion. Nevertheless, in developing the soil erosion control plan, the Technical Advisory Committee determined that, despite limitations, soil loss tolerances, or T-values, established by the U. S. Soil Conservation Service currently provide the best available basis for establishing cropland soil erosion objectives and standards—although continuing research of those tolerances is required.

SOIL EROSION INVENTORY AND ANALYSIS

The rate of soil erosion on cropland for any given set of climatic conditions varies considerably, depending upon the cropping system, management practices, soil characteristics, and topographic features of the individual farm fields. Under the Ozaukee County soil erosion control planning program, an inventory and analysis of existing cropland was undertaken in order to determine the extent and severity of cropland soil erosion problems within the County, focusing, in particular, on "sheet" and "rill" erosion. Sheet erosion is characterized by the removal of a relatively uniform, thin layer of soil from the land surface, the result of runoff in the form of shallow sheets of water flowing over the ground. Such shallow surface flow typically does not move more than a few feet before collecting in surface depressions. Rill erosion occurs when sheet runoff begins to concentrate in surface depressions and, gaining in velocity, cuts small but well-defined channels termed "rills." Sheet and rill erosion is a widespread problem causing massive amounts of soil to be moved about on, and, in many cases, completely off inadequately protected cropland. Though often not perceived as a problem by the farm operator, sheet and rill erosion can seriously impair soil productivity in the long term, and can cause serious and costly offsite damages and environmental problems.

Estimates of the amount of sheet and rill erosion on individual farm fields in Ozaukee County were developed through application of the universal soil loss equation. This equation, the attendant data requirements, and the manner in which the required data were developed for cropland in Ozaukee County are described in Chapter III of this report.

The inventories conducted under the planning program indicated that the average rate of sheet and rill erosion in Ozaukee County in 1987 was 2.9 tons per acre per year. The soil loss rate was less than 3.0 tons per acre per year on about 49,200 acres of cropland, representing about 66 percent of all cropland in the County in 1987. At the other extreme, the soil loss rate was 10 tons per acre per year or more on about 1,400 acres, representing about 2 percent of all cropland.

In order to provide perspective on the severity of the soil erosion problem, soil loss rates, as estimated by the universal soil loss equation, are frequently expressed in multiples or fractions of T-value. About 21,100 acres of cropland, representing almost 29 percent of all cropland in Ozaukee County, was found to be eroding at rates exceeding T-value in 1987—including about 14,400 acres, or almost 20 percent of all cropland, eroding at rates between 1.1 and 2.0 times T-value; about 4,300 acres, or about 6 percent, eroding at rates between 2.1 and 3.0 times T-value; and about 2,400 acres, or about 3 percent, eroding at rates of more than 3.0 times T-value. The remaining cropland—totaling about 53,000 acres, or just over 71 percent of all cropland in the County—was eroding at rates at or below T-value.

EROSION CONTROL PRACTICE NEEDS

A variety of conservation practices are available to farmers for the control of cropland soil

erosion. These practices range from structural approaches, such as the installation of terraces and the construction of grassed waterways, to management approaches, such as conservation tillage and contour plowing. Under the county soil erosion control planning program, a systems level determination was made of the types of practices that would effectively address soil erosion problems within the County. The analysis indicated the following:

- That 5,844 acres, representing about 28 percent of the excessively eroding cropland in the County, would be able to be treated through management practices involving conventional moldboard plowing—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.

- That 9,308 acres, representing about 44 percent of the excessively eroding cropland in the County, would require conservation tillage systems—typically involving fall chisel and spring disking—leaving at least 30 percent of the soil surface covered by crop residue after planting. Of that total, 3,591 acres would be treated through conservation tillage alone, while 5,717 acres would be treated through conservation tillage in conjunction with other practices—including a basic rotation change, contouring, contour strip-cropping, or a combination of these.

- That 3,540 acres, representing about 17 percent of the excessively eroding cropland in the County, would require conservation tillage systems leaving at least 50 percent of the soil surface covered by crop residue after planting. These lands would also require changes in rotation to reduce soil loss to tolerable levels. In this regard, 1,717 acres would require a basic rotation change, while 1,823 acres would require a major rotation change.

- That 2,452 acres, representing just over 11 percent of the excessively eroding cropland in the County, would be retired from production and placed in permanent vegetative cover owing to the steepness of slope or highly erodible nature of the soil. This acreage represents about 3 percent of all cropland in Ozaukee County.

In addition to the practices required to reduce soil loss to tolerable levels as described above, other practices—including terraces, grade stabilization structures, grassed waterways, and field diversions—will be needed to address erosion problems in certain situations. The amounts of such practices required in Ozaukee County, as estimated by the County Land Conservation Department, include a total of 240,000 feet of grassed waterways, 10,000 feet of field diversions, 14,000 feet of terraces, and 152 grade stabilization structures.

It should be noted that conservation tillage systems—which are recommended on a widespread basis for use in controlling soil erosion under the plan—tend to require an intensive level of production management. Careful monitoring of all agricultural inputs is extremely important to minimize the detrimental effects of these inputs on the quality of the environment. Integrated pest management technologies are recommended for conservation tillage to prevent excessive application of pesticides. A similar integrated type of approach with soil testing can be used to ensure the judicious application of fertilizers.

Cost of Recommended Practices

Of the various soil erosion control practices described above, implementation costs may be readily estimated for grassed waterways, grade stabilization structures, field diversions, terraces, and establishment of permanent vegetative cover. The estimated costs of such practices needed in Ozaukee County are as follows: grassed waterways—$480,000; grade stabilization structures—$228,000; field diversions—$35,000; terraces—$49,000; and establishment of permanent vegetative cover—$196,200.

The cost of other conservation practices—including the cost of shifting to conservation tillage, the cost of implementing rotation changes, and the cost of contouring or contour strip-cropping—are far more difficult to specify. With regard to conservation tillage, for example, net return to the farmer may be adversely affected by decreased yields, although in some cases yields could actually increase; by greater use of pesticides; and by an initial capital outlay for the specialized equipment used in some conservation tillage systems. On the other hand, net return may be positively affected by lower fuel consumption and lower operation and maintenance costs, because conservation tillage sys-

tems involve fewer tillage operations. Moreover, in the long term, net return may be positively affected owing to the maintenance of natural soil productivity. The impacts on net return of shifting from conventional to conservation tillage may be expected to vary from farm to farm, depending upon the size of operation; the physical characteristics of the farm including soil and topographic characteristics; the types of crops grown; and the type and condition of existing farm machinery.

IMPLEMENTATION STRATEGY

While ultimately the responsibility for the control of cropland soil erosion rests with the farm operator, a number of agencies and units of government have important responsibilities for the conservation of soil resources. Those units and agencies of government concerned directly or indirectly with the control of cropland soil erosion include—at the county level—the Ozaukee County Board and the Ozaukee County Land Conservation Committee; at the state level—the Wisconsin Department of Agriculture, Trade and Consumer Protection, the Wisconsin Department of Natural Resources, and the University of Wisconsin-Extension; and at the federal level—the U. S. Department of Agriculture, Soil Conservation Service, Agricultural Stabilization and Conservation Service, and Farmers Home Administration. One of the most important tasks undertaken as part of the soil erosion control planning program was the development of a long-range implementation strategy to guide the concerned agencies and units of government in their efforts to assist farmers in the application of needed erosion control practices. The strategy was designed to bring about a reduction of soil erosion to established tolerances on all cropland in the County by the year 2000.

Proposed Activities

In developing the erosion control strategy, the overall 11-year implementation period from 1989 through 1999 was divided into four time periods—the first three periods being three years in length and the fourth, two years. The strategy indicates the areas proposed to be addressed and the types of activities proposed to be undertaken during each period. The strategy proposes that cropland soil erosion problems be addressed, for the most part, on a watershed-by-watershed basis, and that efforts to address cropland soil erosion problems be closely coordinated with the Milwaukee River Priority Watersheds Program implementation activities. However, the strategy also recognizes the need for the provision of technical assistance to farmers scattered throughout the County in conjunction with the soil conservation requirements of the Wisconsin Farmland Preservation Program and the conservation compliance provisions of the federal Food Security Act.

During the first two implementation periods, the implementation strategy generally coincides with the program commitments of the state priority watershed program, the Wisconsin Preservation Program, and the federal Food Security Act. Activities during the first implementation period, from 1989 through 1991, would include conservation planning and practice implementation within the Milwaukee River East-West Branches watershed, the Milwaukee River North Branch watershed, and the Milwaukee River South watershed; and conservation planning and practice implementation for participants in the Farmland Preservation Program and farmers subject to the conservation compliance provisions of the federal Food Security Act.

Activities during the second implementation period, from 1992 through 1994, would include practice implementation within the Milwaukee River East-West Branches watershed and the Milwaukee River North Branch watershed; conservation planning and practice implementation within the Cedar Creek watershed, the Menomonee River watershed, and the Milwaukee River South watershed; and practice implementation for participants in the Farmland Preservation Program and farmers subject to the conservation compliance provisions of the Food Security Act.

Activities during the third implementation period, from 1995 through 1997, would include practice implementation within the Milwaukee River South watershed and the Menomonee River watershed; and conservation planning and practice implementation within the Cedar Creek, Sauk Creek, and Sucker Creek watersheds. The Sauk Creek and Sucker Creek watersheds are the first watersheds outside the Milwaukee River Priority Watersheds Program area that are targeted for erosion control. They were selected because of the relatively high need for erosion control practices.

Activities during the fourth implementation period, consisting of the years 1998 and 1999, would include conservation planning and practice implementation within the Sauk Creek, Sucker Creek, and Onion River watersheds.

Information and education activities and administrative activities would be carried out during each implementation period. A strong information and education program—designed to increase the awareness among farmers of soil erosion problems, of the types of practices that may be utilized to address those problems, and of the public financial and technical assistance resources that are available to help in implementing those practices—would be an integral part of the erosion control implementation strategy.

Staff Requirements

The government agency staffing level requirements needed to carry out the erosion control implementation strategy from 1989 through 1999 include about 4,900 staff-hours for conservation planning; abut 20,500 staff-hours for practice implementation work; just over 2,500 staff-hours for information and education activities; and about 5,100 staff-hours for administrative work. The erosion control implementation strategy would thus involve a commitment of about 33,000 staff-hours, or just over 16 staff-years, over the 11-year implementation period.

The amount of staff time which may be expected to be available for the work envisioned under the erosion control implementation strategy—including staff positions currently funded or anticipated to be funded under committed county, state, and federal programs—totals about 16,800 staff-hours, or just over eight staff-years, over the 11-year implementation period—or about 51 percent of the staff time required. The additional staff required for carrying out the erosion control implementation strategy, beyond presently committed staff, totals about 16,200 staff-hours, or about eight staff-years. The cost of the additional staff required, at 1989 salary and fringe benefit levels, would approximate $268,100.

Financial Assistance Requirements

It is anticipated that an effective cropland soil control program would have to be supported by financial assistance to farm operators—either "cost-share" assistance to help offset the cost of such erosion control practices as terraces, grade stabilization structures, grassed waterways, and diversions; or incentive payments to promote the adoption of contouring, contour strip-cropping, and conservation tillage. The amount of financial assistance required in support of needed cropland soil erosion practices would total about $1,082,500. Conversely, the amount of financial assistance which may be expected to be available in support of those practices under current financial assistance programs would total $699,900, including about $259,900 under the state priority watershed program and $440,000 under the federal Agricultural Conservation Program. The additional amount of financial assistance funds required—beyond the amounts which may be expected to be provided through current assistance programs—would thus approximate $382,600, or about 35 percent of the total amount needed. This analysis assumes participation by all farmers with excessively eroding cropland. The shortfall in financial assistance would be less to the extent that farmers decide not to participate in financial assistance programs.

CONSTRUCTION SITE EROSION CONTROL

While the focus of the soil erosion control planning program has been on the control of cropland soil erosion, this report has also pointed out the potential for serious construction site erosion problems in Ozaukee County as the County continues to urbanize. Construction site erosion can contribute to problems on the construction site itself—including rilled and gullied slopes and washed out roads—and to offsite problems—including water quality degradation and clogging of culverts and roadside ditches and other watercourses. Construction site erosion can be effectively controlled through adoption and enforcement by local units of government of appropriate construction site erosion control regulations.

The plan recommends that Ozaukee County adopt construction site erosion control regulations applicable to the unincorporated area of Ozaukee County, and that each of the cities and villages in Ozaukee County similarly adopt construction site erosion control regulations applicable to their incorporated areas. Each of the units of government concerned should review the existing framework of local land use regulations and determine how that framework should be revised in order to incorporate the desired

construction site erosion control regulations and how those regulations should be administered.

PUBLIC REACTION TO THE PLAN

A public hearing was held on January 5, 1989, at the Ozaukee County Courthouse for the purpose of receiving comments on the soil erosion control plan as summarized above. A copy of the public notice for, and minutes of, the hearing is set forth in Appendix C.

No objections to the plan recommendations pertaining to the control of cropland soil erosion were raised at the hearing. There was, however, considerable discussion regarding plan recommendations pertaining to the adoption of regulations for the control of construction site erosion. As indicated above, the plan recommends that Ozaukee County adopt construction site erosion control regulations applicable to the unincorporated area of the County, and that each of the cities and villages in Ozaukee County similarly adopt construction site erosion control regulations applicable to their incorporated areas. Comments regarding this recommendation were mixed. Several individuals indicated that construction site erosion regulations are needed in cities and villages, where most land development in Ozaukee County is occurring, but questioned whether the County should impose such regulations in rural town areas at this time. Concern was expressed about the possibility of the County proceeding to adopt construction site erosion regulations, while cities and villages in the County may delay in adopting such regulations or adopt regulations that are less rigorous than those of the County. Concern was also expressed that land use and land management practices in rural areas have been subject to greater regulation in the interest of protecting the environment than in urban areas. Conversely, several individuals expressed support for both county and city-village adoption of construction site erosion control regulations. In their comments, these individuals noted that the awareness of construction site erosion problems is increasing, and that the movement to adopt construction site erosion control ordinances may be expected to gain in momentum as a result of programs like the Milwaukee River Priority Watersheds Program.

APPENDICES

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Appendix A

PUBLIC INFORMATIONAL ACTIVITIES UNDER THE OZAUKEE COUNTY SOIL EROSION CONTROL PLANNING PROGRAM

A countywide meeting was held on March 31, 1986, at the Ozaukee County Courthouse to provide information to the public concerning the county soil erosion control planning program and related programs, including the Milwaukee River Priority Watersheds Program and the soil conservation provisions of the Wisconsin Farmland Preservation Program. A copy of the newspaper announcement of the meeting is included in this appendix. Forty-eight farmers and interested parties attended the informational meeting.

As indicated in Chapter VII of this report, under the soil erosion control implementation strategy, soil erosion problems in Ozaukee County would be addressed largely on a watershed-by-watershed basis. As one of the first steps in addressing soil erosion problems in a watershed, one or more public meetings would be held to explain the nature and extent of soil erosion problems and to describe the types of technical and financial assistance resources available to farmers in addressing those problems. Written notices would be sent to farmers in the watershed concerned, describing average soil loss rates and the types of practices which may be applied to reduce soil erosion.

Appendix A-1

NEWSPAPER ANNOUNCEMENT OF THE OZAUKEE COUNTY SOIL EROSION CONTROL PUBLIC INFORMATIONAL MEETING

Milwaukee River, erosion control conservation topics

Milwaukee River watershed program, county soil erosion control planning and farmland preservation program will be the topics for the informational meeting of the Ozaukee County land conservation committee, Monday, Mar. 31.

The 8 p.m. meeting will be held in the Ozaukee County courthouse auditorium.

Gary Kurer, Ozaukee County conservationist, will discuss the soil conservation cross compliance requirements for the farmland preservation program.

The nonpoint source pollution abatement program for the Milwaukee River priority watershed will be discussed by Gary Nelson, who is program coordinator for the Wisconsin department of natural resources.

William Stauber, principal land use planner for southeastern Wisconsin regional planning commission, will discuss the county soil erosion control planning program.

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Appendix B

USDA AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE MEMORANDUM REGARDING USE OF COUNTY SOIL EROSION CONTROL PLANS

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL STABILIZATION AND CONSERVATION SERVICE
WISCONSIN STATE ASCS OFFICE
4601 HAMMERSLEY ROAD
MADISON, WISCONSIN 53711

Date: 7-9-87
WI CONS. MEMO-154

To: All County ASCS Offices

From: Donald I. Wachter, Specialist
Conservation and Environmental Protection Programs

Subject: Use of County Soil Erosion Control Plans.

USDA is dead serious about halting excessive soil erosion. Farmers who continue to cause serious soil erosion while farming will soon lose many USDA program benefits.

The CRP attacks the erosion problem by removing highly erodible cropland from production and returning it to protective cover.

The ACP assists in solving erosion problems by sharing in the cost of installing needed conservation practices.

A perennial dilemma is identifying serious erosion problems so we can effectively target our program to solving them.

Erosion Control Plans are being compiled by 55 county Land Conservation Departments. Data supporting these Plans show the location of most critically eroding sites. These Plans will be useful to you in targeting your conservation programs.

Plans will not be developed for the following counties:

Ashland	Bayfield	Burnett	Douglas
Florence	Forest	Iron	Langlade
Marinette	Menominee	Oneida	Price
Rusk	Sawyer	Taylor	Vilas
Washburn			

Plans have been completed and approved for the following counties:

Adams	Buffalo	Calumet	Dunn
Green	Lafayette	Lincoln	Marquette
Oconto	Pepin	Pierce	Portage
Rock	Shawano	Trempealeau	Vernon

Plans are in various stages of development in many other counties. Even though a county's plan may not yet be approved, background data will be useful to you.

Contact your county Land Conservation Department to become acquainted with the Erosion Control Plan and its supporting data. It is expected that County ASCS Offices will use the Plan to further its conservation programs objective, where such Plan is available.

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Appendix C

NOTICES AND MINUTES OF PUBLIC HEARING ON OZAUKEE COUNTY SOIL EROSION CONTROL PLAN

(Dec. 29, 1988)
NOTICE OF PUBLIC HEARING
OZAUKEE COUNTY LAND CONSERVATION COMMITTEE

THURSDAY, JANUARY 5, 1989 1:30 P.M.
ROOM 162, COURTHOUSE, PORT WASHINGTON, WISCONSIN

AGENDA

Introduction
Ozaukee County Agricultural Erosion Control Plan
Open Discussion and Comments
Farmland Preservation Program Policy Revision
Open Discussion and Comments
Adjournment

William F. Schanen III, being duly sworn, says that he is the vice president of Port Publications, Inc., publishers of the Ozaukee Press, a public newspaper of general circulation, printed and published in the city of Port Washington and county of Ozaukee, Wisconsin; that a notice, of which the printed one hereto attached is a true copy, was published in the Ozaukee Press once each week for 1 weeks successively; that the first publication thereof was on the 29TH day of DECEMBER A.D. 19 88, and that the last publication thereof was on the 29TH day of DECEMBER A.D. 1988.

William F. Schanen III

Subscribed and sworn to before me this 17th day of Jan A.D. 19 89.

Margaret L. Grape

Notary Public, Ozaukee County, Wisconsin.

My commission expires 11-30-92

NOTICE OF PUBLIC HEARING
OZAUKEE COUNTY LAND CONSERVATION COMMITTEE

THURSDAY, JANUARY 5, 1989
1:30 P.M.
ROOM 162, COURTHOUSE, PORT WASHINGTON, WI

AGENDA

Introduction
Ozaukee County Agricultural Erosion Control Plan
Open Discussion and Comments
Farmland Preservation Program Policy Revision
Open Discussion and Comments
Adjournment.

12-29-1tc

Phil Paige, being duly sworn that he is the publisher of the **News Graphic Pilot**, a newspaper published in the City of Cedarburg, in said County, and that a notice, of which the annexed is a true copy, taken from such paper, has been published in said paper, once in each week for 1 weeks successively; that the first publication thereof was on the 29 day of Dec. A.D. 19 88, and that the last publication thereof was on the ..... day of ..... A.D. 19 .....

Subscribed and sworn to before me this 29 day of Dec. A.D. 19 88

Phil Paige

Robert Schaefer

8.2759

LAND CONSERVATION PUBLIC HEARING MINUTES
JANUARY 5, 1989

Mr. Kurer called the public hearing regarding the County Soil Erosion Control Plan and Farmland Preservation Program Policy Revision to order at 1:30 p.m. He then introduced Mr. Stauber, SEWRPC. The following people were in attendance:

William Stauber, Southeastern Wisc. Regional Planning Commis
Andy Holschbach, Ozaukee County Land Conservation Department
Martin Lehman, Ozaukee County Land Conservation Department
Roland Kison, Ozaukee County LCC
Brian Behrens, Town of Grafton
Lawrence Albinger, Agricultural Stabilization Committee
Robert Fechter Sr., Town of Saukville
LaVern Gosewehr, Town of Saukville
James Speiden, Ozaukee County LCC
Ella Opitz, Ozaukee County LCC
Iris Cance, Ozaukee County LCC
Daniel Lynch, Soil Conservation Service
Rose Hass Leider, Ozaukee County LCC
Gary Kurer, Ozaukee County Land Conservation Department
Kenneth Roell, Town of Cedarburg

Mr. Stauber reviewed the abstract of the Ozaukee County Soil Erosion Control Plan which provided a good summary of the plan contents.

Mr. Fechter raised a concern regarding that construction site erosion control ordinances and other land regulations have always been adopted in unincorporated areas first before cities and villages. He indicated that farmers in rural areas have difficulty in understanding why cities and villages, incorporated areas, do not have the same controls and regulations regarding land use as the unincorporated areas. He noted that soil conservation requirements of the Farmland Preservation Program have put constraints on his own land management and farming business.

Mr. Stauber noted that the county has the statutory authority to set-up and adopt construction site erosion control ordinances and that the Technical advisory committee has only recommended that the county and municipalities prepare an adopt erosion control ordinances. He added that its left up to each unit of government concerned to review the existing framework of local land use regulations and determine how that framework should be modified if desirable. Mr. Stauber made reference to Chapter VII, page 8 and 9, and Chapter VI page 13.

Mr. Roell asked how county land conservation staff will be able to administer and enforce a county ordinance. Mr. Lynch made reference to the City of Mequon's soil erosion control planning agreement. He indicated that before construction can begin the developer must submit an erosion control plan of the construction area to the city personnel which in turn forwards it to the county for review.

Ms. Opitz expressed concern with regulations and the coordination between DNR and county ordinances. Mr. Kurer indicated that Milwaukee River watershed plans will be recommending such ordinances because of the large urban concentrations and that such ordinances will be the main issue in the near future. Mr. Kison commented that the soil erosion control plan deals with agricultural concerns and that urban issues are only secondary.

After considerable discussion on erosion control ordinances, Mr. Stauber indicated that a paragraph will be added on page 11 of Chapter VIII as a public reaction section to incorporate the concerns raised from this hearing.

Mr. Kurer asked if there were any more questions or comments regarding the soil erosion control plan. He then introduced Mr.Martin Lehman.

Mr. Lehman reported on the recent changes in the land conservation committee's policy for the Farmland Preservation Program. He indicated that landowners within the City of Mequon are now eligible to sign agreements and that the planning deadline was extended to the end of 1989. Mr. Lehman also indicated that gully erosion control would also be mandatory now in order to come in line with FSA regulations and rules.

Mr. Behrens asked whether a new landowner who recently purchased land from someone who signed up in 1984 would have to comply with the committee standards. Mr. Lehman noted that as long as the new owner has a conservation plan he would still be eligible for farmland preservation tax credits. Mr. Kurer commented that all participants in the farmland preservation program will have to comply with the new revisions in the LCC policy. Mr. Lehman agreed that there is no grandfather clause to exempt previously signed-up participants to comply with new standards.

Mr. Kurer asked if there were any more questions or comments. He then adjourned the meeting at 3:00 p.m.