Programmatic Environmental Assessment

Michigan Conservation Reserve Enhancement Program (CREP)

Farm Service Agency
United States Department of Agriculture

February 2006

THIS PAGE LEFT INTENTIONALLY BLANK

Cover Sheet

Mandated Action:

The United States Department of Agriculture, Commodity Credit Corporation (USDA/CCC) and the State of Michigan have agreed to implement the Michigan Conservation Reserve Enhancement Program (CREP), a component of the national Conservation Reserve Program.

USDA is provided the statutory authority by the provisions of the Food Security Act of 1985, as amended (16 U.S.C. 3830 et seq.), and the regulations at 7 CFR 1410. In accordance with the 1985 Act, USDA/CCC is authorized to enroll lands through December 31, 2007.

The Farm Service Agency (FSA) of USDA proposes to enter into a CREP agreement with the State of Michigan covering the counties of Allegan, Arenac, Bay, Clare, Genesee, Gladwin, Gratiot, Hillsdale, Huron, Iosco, Isabella, Jackson, Lapeer, Lenawee, Livingston, Mecosta, Midland, Monroe, Montcalm, Oakland, Ogemaw, Osecola, Ottawa, Roscommon, Saginaw, Sanilac, Shiawassee, Tuscola, and Washetenaw.

CREP is a voluntary land conservation program for State agricultural landowners.

Type of Document: Programmatic Environmental Assessment (PEA)

Lead Agency: United States Department of Agriculture, Farm Service Agency

Sponsoring Agencies: Michigan Department of Agriculture

Cooperating Agencies: United States Department of Agriculture, Natural Resource Conservation Service (NRCS)

For Further Information:

Dale A. Allen, Conservation Chief,
Michigan State FSA Office
3001 Coolidge Road, Suite 100
East Lansing, MI 48823
(517) 324-5105

Comments:

This PEA was prepared in accordance with the United States Department of Agriculture FSA National Environmental Policy Act Implementation Procedures found in 7 CFR part 1b and 7 CFR 799, as well as the National Environmental Policy Act of 1969, Public Law 91-190, 42 U.S.C. 4321-4347, 1 January 1970, as amended. Once this document is finalized a Notice of Availability will be printed in the Federal Register. Following the Notice of Availability FSA will provide a public comment period prior to any FSA decision.

Any written comments regarding this assessment shall be submitted to:

Dale A. Allen, Conservation Chief
Michigan State FSA Office
3001 Coolidge Road, Suite 100
East Lansing, MI 48823
(517) 324-5105
Dale.Allen@mi.usda.gov.

THIS PAGE LEFT INTENTIONALLY BLANK

Executive Summary

Purpose of and Need for the Programmatic Environmental Assessment

The purpose of this Programmatic Environmental Assessment (PEA) is to provide to the public an analysis of the environmental, social, and economic effects of implementing the Michigan Conservation Reserve Enhancement Program (CREP). This PEA specifically addresses the consequences of implementing two alternatives: a no action alternative and a proposed action alternative.

The Farm Service Agency (FSA) has prepared this PEA in accordance with its National Environmental Policy Act regulations found in 7 CFR 799, as well as the National Environmental Policy Act of 1969, Public Law 91-190, 42 U.S.C. 4321-4347, 1 January 1970, as amended.

Purpose and Need for the Proposed Action

High levels of nutrients, sediments, pathogens, and pesticides are common problems in Michigan's waters. Current agricultural practices in Michigan contribute to poor water conditions within the project area, particularly in the Lower Peninsula where agricultural use accounts for much of the area's land. Agricultural runoff contains high amounts of nutrients, silt, pesticides, and pathogens. Agricultural runoff from fertilized crops transports high levels of nitrogen and phosphorus to surface waterbodies, where elevated nutrient levels promote algal growth, negatively impact aquatic wildlife, impair recreational uses, and contaminate drinking water supply.

These problems are of particular concern because Michigan lies almost entirely within the Great Lakes Basin. The Great Lakes contain 20 percent of the world's fresh waters supply and are vital to the agricultural, industrial, and recreational markets of the U.S. and Canada.

The purpose of the CREP program is to reduce sediment, phosphorus, and nitrogen loading to three watersheds that drain into one of the Great Lakes (Lake Macatawa, River Raisin, and Saginaw Bay); and to improve water quality, enhance fish and wildlife habitat, and enhance nesting for upland birds, mammals, and waterfowl.

Description of Alternatives

The alternatives that will be discussed in the PEA include two possible actions: Alternative A (No Action)—Continue Current Agricultural Practices and Alternative B (Proposed Action)—Implement the Michigan CREP. No other alternatives are being developed at this time.

Alternative A (No Action)—Continue Current Agricultural Practices

Under Alternative A current agricultural practices would continue and modes of agricultural production would remain as they have for decades. Land development, irrigation water use rates, and agricultural chemical application rates would most likely remain at current levels.

Alternative B (Proposed Action)— Implement the Michigan CREP

Alternative B is the preferred alternative and targets 80,000 acres for the installation and maintenance of selected conservation practices (CPs). Land placed under CREP contracts would be remove from crop

production and irrigation for 10-15 years. Through CREP, FSA would provide the financial and technical assistance necessary to assist eligible Michigan farmers and ranchers in establishing CPs that would conserve soil and water; filter nutrients and pesticides; and enhance and restore wildlife habitat.

A summary comparison of the two alternatives can be found in Tables 7 and 8 on pages 2-14 and 2-15 respectively.

How to Read this Programmatic Environmental Assessment

The PEA is organized into the following chapters:

- Chapter 1 (Purpose and Need for Action)
- Chapter 2 (Alternatives Including the Proposed Action)
- Chapter 3 (Affected Environment and Environmental Consequences)
- Chapter 4 (List of Preparers)
- Chapter 5 (List of Agencies and Persons Consulted and/or Provided Copies of This Environmental Assessment)
- Chapter 6 (References)
- Appendices A-D

Chapter 1 is an introductory chapter that outlines the purpose and need for preparing a document of this type as well as the purpose and need for CREP. Chapter 1 also briefly introduces the resource issues and also discusses the resource issues that were eliminated and the reasons they were eliminated from further analysis.

Chapter 2 describes the actions proposed in the PEA including the two alternatives described above. Alternatives are compared in summary tables in terms of their individual environmental impacts and their achievement of objectives.

Chapter 3 provides a general description of the resource area including a summary of ecological regions, climate, history of irrigation practices, profile of agricultural activities (baseline conditions), soil, and land use and ownership. Following the background information is a more detailed analysis of each of the resources most likely to receive impacts from the alternatives including:

- Surface Water
- Groundwater
- Drinking Water
- Wetlands
- Floodplains
- Soil Resources
- Coastal Resources
- Biological Resources
- Cultural/Tribal Resources
- Human Health, Social, and Economic Issues

Each resource is discussed in a separate section which has combined the analyses of the Affected Environment (or Existing Conditions) and Environmental Consequences (Effects of Alternative A and B). Each section, in general, is organized as follows:

- Introduction
- Existing Conditions
- Impacts of Agriculture
- Effects of Alternative A
- Effects of Alternative B

The concluding four chapters and the appendices are either lists, tables, or other supplemental information.

How the PEA was Prepared

This document was prepared with the cooperation of State of Michigan including the Michigan Department of Agriculture. The best available information was used in the development of this document with the majority of information being obtained from State and Federal agency reports. The majority of these reports came from the following agencies:

- Great Lakes Basin Program for Soil Erosion and Sediment Control
- Michigan Department of Agriculture
- Michigan Department of Environmental Quality
- Michigan Department of Natural Resources
- Michigan Natural Features Inventory
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- USDA, National Agricultural Statistics Services
- USDA, Farm Service Agency

Public Comments

A Notice of Availability was published in local newspapers concurrent with the Draft PEA. No comments were received concerning the Draft PEA. Any written comments concerning this PEA should be submitted to:

Dale A. Allen, Conservation Chief
Michigan State FSA Office
3001 Coolidge Road, Suite 100
East Lansing, MI 48823
(517) 324-5105

THIS PAGE LEFT INTENTIONALLY BLANK

Table of Contents

List of Figures

List of Tables

Acronyms and Abbreviations

ACHP	Advisory Council on Historic Preservation
AOCs	Areas of Concern
BA	Biological Assessment
Baseline Study	The Michigan Department of Agriculture Groundwater Monitoring Program Domestic Supply Well Baseline Study
Basin Program	Great Lakes Basin Program for Soil Erosion and Sediment Control
BMPs	Best Management Practices
CCC	Commodity Credit Corporation
CEQ	Council on Environmental Quality Regulations
CD	Conservation District
CFR	Code of Federal Regulations
CMI	Clean Michigan Initiative
CP	Conservation Practice
CREP	Conservation Reserve Enhancement Program
CRP	Conservation Reserve Program
CSO	Combined Sewer Overflow
CWA	Clean Water Act
cwt.	Hundredweight
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DDT	Dichlorodiphenyltrichloroethane
DU	Ducks Unlimited-
EA	Environmental Assessment
EE	Environmental Evaluation
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FOTG	Natural Resources Conservation Service Field Office Technical Guide
FPPA	Farmland Protection Policy Act
FR	Federal Register
FSA	Farm Service Agency
FWS	United States Fish and Wildlife Service
GLWQA	Great Lake Water Quality Agreement
HEL	highly erodible land
Integrated Report	Water Quality and Pollution Control in Michigan: 2004 Sections 303(d) and 305(b) Integrated Report
LaMPs	Lakewide Management Plans
lbs.	Pounds
MCL	Maximum Contaminant Level
MDA	Michigan Department of Agriculture
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources

MFB	Michigan Farm Bureau
mg/L	micrograms per liter
MSFW	Migrant and Seasonal Farm Worker
MTBE	Methyl tert-butyl ether
MUCC	Michigan United Conservation Clubs
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
NREPA	Natural Resources and Environmental Protection Act
PA	Public Act
PCEP	Permanent Conservation Easement Program
PCBs	Polychlorinated Biphenyls
PEA	Programmatic Environmental Assessment
PEIS	Programmatic Environmental Impact Statement
PF	Pheasants Forever
PWSSs	Public Water Supply Systems
RAPs	Remedial Action Plans
SDWA	Safe Drinking Water Act
SHPO	State Historic Preservation Office
SRR	soil rental rate
Swampbuster	Wetland Conservation Provisions
SWAP	Source Water Assessment Program
T&E	threatened and endangered
TCP	Traditional Cultural Property
THM	trihalomethane
THPO	Tribal Historic Preservation Office
TMDL	Total Maximum Daily Load
USDA	United States Department of Agriculture
VOCs	volatile organic compounds
WHPA	wellhead protection area
WHPP	Wellhead Protection Program
WQS	Water Quality Standard
WSRA	Wild and Scenic Rivers Act

Chapter 1.0 Purpose of and Need for Action

1.1 Introduction

1.1.1 Conservation Reserve Enhancement Program Overview

The U.S. Department of Agriculture (USDA)/Commodity Credit Corporation (CCC) and the State of Michigan propose to implement the Michigan Conservation Reserve Enhancement Program (CREP), administered by USDA's Farm Service Agency (FSA). The original CREP enrollment period began in 2000 and expired at the end of 2003. Recent amendments continue the enrollment period through December 31, 2007.

CREP is a component of FSA's Conservation Reserve Program (CRP), which targets the specific environmental needs of each State. CRP was established under subtitle D of the Food Security Act of 1985. The purpose of CRP is to cost effectively assist owners and operators in conserving and improving soil, water, and wildlife resources on their farms and ranches. Highly erodible and other environmentally sensitive acreage, normally devoted to the production of agricultural commodities, is converted to a long term resource conservation cover. CRP participants enter into contracts for periods of 10 to 15 years in exchange for annual rental payments and cost-share assistance for installing certain conservation practices (CPs).

The initial goal of CRP was to reduce soil erosion on highly erodible cropland. Subsequent amendments of the CRP regulations have made certain cropland and pastureland eligible for CRP based on its benefits to water quality and wildlife habitat. The environmental impact of this program shift was studied in the 2002 CRP Programmatic Environmental Impact Statement (PEIS),. The Farm Security and Rural Investment Act of 2002 authorized CRP through 2007 and raised the overall enrollment cap to 39.2 million acres.

In 1997, the Secretary of Agriculture initiated CREP as a joint Federal-State partnership that provides agricultural producers with financial incentives to install FSA-approved CPs. CREP is authorized pursuant to the 1996 Federal Agriculture Improvement and Reform Act. CREP agreements are done as partnerships between USDA, State and/or tribal governments, other Federal and State agencies, environmental groups, wildlife groups, and other non-government organizations. This voluntary program uses financial incentives to encourage farmers and ranchers to enroll in contracts of 10 to 15 years in duration to remove lands from agricultural production. Through the CREP, farmers can receive annual rental payments and cost-share assistance to establish long term, resource conserving covers on eligible land. The two primary objectives of CREP are to:

- Coordinate Federal and non-Federal resources to address specific conservation objectives of a State (or Tribal) Government and the nation in a cost-effective manner.
- Improve water quality, erosion control, and wildlife habitat related to agricultural use in specific geographic areas.

This Programmatic Environmental Assessment (PEA) has been conducted in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended 42 USC 4321 – 4347, the NEPA implementing regulations of the Department of Agriculture, 7 CFR Part Ib, and the FSA NEPA implementation procedures found in 7 CFR Part 799. This PEA does not address individual site specific impacts which will be evaluated by FSA on a contract-by-contract basis.

CRP and CREP are administered by FSA in cooperation with the Natural Resource Conservation Service (NRCS), Cooperative State Research and Education Extension Service, State forestry agencies, and local Soil and Water Conservation Districts. FSA is the lead agency developing this PEA.

1.1.2 Purpose of Using an Environmental Assessment to Analyze this Action

FSA's regulations for NEPA are found at 7 CFR part 799. This environmental regulation classifies the Agency's actions into levels of environmental review such as Categorical Exclusions, Environmental Assessments (EAs), and Environmental Impact Statements (EISs). The National Historic Preservation Act (NHPA) compliance and other cultural resource considerations also are incorporated into FSA's NEPA process.

FSA is preparing this PEA to address the implementation of the CREP to comply with NEPA, Council on Environmental Quality Regulations (CEQ), and 7 CFR 799: Environmental Quality and Related Environmental Concerns—Compliance with the National Environmental Policy Act.

FSA has a framework in place to ensure NEPA compliance at the field level, where site specific NEPA evaluations will take place prior to implementing a CREP contract. The review will consist of completing a site specific Environmental Evaluation (EE), which will tier off of this PEA and the CRP PEIS.

A PEA allows FSA to reduce paperwork, identify potential impacts at a State or regional level to be aware of at a site specific level, and address cumulative effects of the proposed action. Regulations promulgated by the CEQ state the following:

Sec. 1500.4 Reducing paperwork:

> (i) Using program, policy, or plan EISs and tiering from EISs of broad scope to those of narrower scope, to eliminate repetitive discussions of the same issues (Secs. 1502.4 and 1502.20).

Sec. 1502.4 Major Federal actions requiring the preparation of EISs:

> (b) EISs may be prepared, and are sometimes required, for broad Federal actions such as the adoption of new agency programs or regulations (Sec. 1508.18). Agencies shall prepare EISs on broad actions so that they are relevant to policy and are timed to coincide with meaningful points in agency planning and decision-making.
>
> (c) When preparing EISs on broad actions (including proposals by more than one agency), agencies may find it useful to evaluate the proposal(s) in one of the following ways:
>
> > 1. Geographically, including actions occurring in the same general location, such as body of water, region, or metropolitan area.
> >
> > 2. Generically, including actions which have relevant similarities, such as common timing, impacts, alternatives, methods of implementation, media, or subject matter.
> >
> > 3. By stage of technological development including Federal or Federally assisted research, development or demonstration programs for new technologies which, if applied, could significantly affect the quality of the human environment. EISs shall be prepared on such programs and shall be available before the program has reached a stage of investment or commitment to implementation likely to determine subsequent development or restrict later alternatives.

FSA plans to use this PEA to address similar actions in the implementation of this program, and to tier off of this document and the PEIS that has been prepared for the CRP for site specific implementation of the program whenever NEPA analysis is required.

1.2 Purpose of the Proposed Action

The purpose of the CREP program is to reduce sediment, phosphorus, and nitrogen loading to the surface waters of the Macatawa River, River Raisin, and Saginaw Bay watersheds; and to improve

water quality, enhance fish and wildlife habitat, and enhance nesting for upland birds, mammals, and waterfowl. Implementation of approved FSA CPs is designed to improve the water quality of nonpoint discharges from agricultural land (Agreement 2000).

The primary goal of the Michigan CREP agreement is to provide an opportunity, through financial and technical assistance within these targeted watersheds, for eligible producers in Michigan to voluntarily establish buffers, filter strips, field windbreaks, wildlife habitat, wetlands, and other approved CPs that improve the water quality of agricultural nonpoint discharges. In addition, implementing CREP would:

- Improve drinking water supplies for local communities;
- Protect and conserve the diversity of aquatic life including threatened and endangered (T&E) species;
- Protect and conserve the diversity of terrestrial wildlife including T&E species;
- Improve water based recreation;
- Decrease the cost of drinking water treatment;
- Decrease the cost of aquatic vegetation control;
- Improve soil quality; and
- Provide economic benefits to the producer.

1.3 Need for the Proposed Action

According to the Environmental Protection Agency (EPA), nonpoint source pollution, primarily due to agricultural practices, is the leading cause of impairment in the nation's rivers and streams (EPA 2005f). High levels of nutrients, sediments, pathogens, and pesticides are common problems in Michigan's waters.

Current agricultural practices in Michigan contribute to poor water conditions within the project area, particularly in the Lower Peninsula where agricultural use accounts for much of the area's land. Agricultural runoff contains high amounts of nutrients, silt, pesticides, and pathogens. Runoff from fertilized crops transports high levels of nitrogen and phosphorus to surface waterbodies, where elevated nutrient levels promote algal growth, negatively impact aquatic wildlife, impair recreational uses, and contaminate drinking water supply.

Apples are one of Michigan's major crops.

CREP aims to improve water quality on a regional scale by targeting watersheds, or areas which drain into a common waterbody such as a lake, wetland, or river. This type of large-scale management creates a foundation for addressing water quality stressors, rather than focusing on site-specific problems while others continue unabated.

Pesticides, used to control insects, fungus, and disease, are harmful to aquatic organisms, decrease recreational opportunities, and introduce carcinogens into public drinking water supply. Pathogens can cause diseases through contact or consumption of contaminated waters and controlling outbreaks is costly.

Tillage and cultivation techniques leave expanses of soil near streambanks susceptible to soil erosion The absence of native vegetation along streambanks due to agricultural conversion exacerbates the problem of soil erosion. Soil erosion increases turbidity and flood susceptibility, degrades aquatic wildlife habitat, and impairs recreational uses. In addition, soil particles can bind toxins and facilitate the transport of nutrients, pesticides, industrial wastes, and metals into surface- and groundwater.

According to U.S. Bureau of the Census and NRCS watershed data, approximately 10.1 million people, or 16 percent of the State's population, lives in the 6,772,000 acres of watersheds addressed in the Michigan CREP. More than 80 percent of the population in the targeted watersheds relies solely on surface water for their drinking water. In addition, many unique natural features are located within the watershed boundaries identified in the CREP area, including seven state parks, the Shiawassee National Wildlife Refuge, and two Blue Ribbon Trout streams. Within CREP counties there are located three National Natural Landmarks (NPS 2005) and 533 places listed on the National Historic Register and 1,016 historical places listed by state (HAL 2005b). Additionally, all three watersheds drain into one of the Great Lakes, directly impacting the water quality of the Great Lakes.

Thirteen federally listed T&E species are found in the counties involved in the Michigan CREP. The State of Michigan has a total of 371 plants and 237 animals on its State species of concern lists. There are a number of existing programs in Michigan working to improve conditions in specific waterbodies and in the watersheds as a whole. The Michigan CREP would complement those programs and their objectives. The CREP project area is of tremendous economic importance internationally, nationally, regionally, and for the State of Michigan.

1.4 Objectives of the Michigan CREP

The primary goal of the Michigan CREP is to provide financial and technical assistance to eligible producers within targeted areas of Michigan. This assistance will help to establish filter strips, buffers, hardwood tree plantings, wildlife habitat, wetland areas, and/or other approved CPs that improve the water quality of agricultural discharges.

The primary objectives of this agreement are to achieve, to the extent practicable, the following:

Objective #1: Reduce nutrient runoff from pasturelands and croplands from entering waterbodies.

Indicators:

- Enrollment of up to 80,000 acres.
- Reduction of phosphorus loading by 784,000 pounds (lbs.)
- Reduction of nitrogen loading by 1,568,000 lbs.
- Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.

Objective #2: Improve surface water quality in the targeted watersheds.

Indicators:

- Enrollment of up to 80,000 acres.

- Reduction of sediment loading by 784,000 metric tons
- Reduction of stream water heating to ambient levels.
- Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.

Objective #3: Improve drinking water quality in the targeted watersheds.

Indicators:

- Enrollment of up to 80,000 acres.
- Decrease nitrate concentrations by reducing nitrogen loading by 784,000 lbs.
- Decreased pesticide and trihalomethane (THM) concentrations.
- Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.

Objective #4: Improve wildlife habitat.

Indicators:

- Enrollment of up to 80,000 acres.
- Reduction of sediment loading by over 784,000 metric tons
- Reduction of nitrogen entering rivers and streams by 1,568,000 lbs.
- Reduction of phosphorus entering rivers and streams by 784,000 lbs.
- Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.

1.5 Area Covered by the Michigan CREP

Agricultural production in Michigan is one of the most diverse in the Nation. Twenty-nine percent of the State's land area is devoted to agriculture, with approximately 10.1 million acres on 53,300 farms. According to the Michigan Agriculture Statistics Service, agriculture generated over $37 billion in 2003 (NASS 2004). This acreage plays a uniquely important water quality function in the United States because of the large number of separate rivers and lakes that receive water from Michigan's watersheds.

Livingston County Farm and Pond. Courtesy of MSU.

The State of Michigan lies almost entirely within the Great Lakes Basin and its waters flow into Lake Erie, Lake Michigan, Lake Huron, and Lake Superior. The Great Lakes, a designated National Treasure, contain 20 percent of the world's fresh water supply and are vital to the agricultural, industrial, and recreational markets of the U.S. and Canada. The River Raisin and Saginaw Bay watersheds are areas of concern as defined by the Great Lakes Water Quality Agreement (GLWQA) between Canada and the U.S.

The CREP project area includes all or portions of 29 Michigan counties in three watersheds (Saginaw, River Raisin, and Lake Macatawa). Figure 1.1 provides the locations of the three watersheds, while Table 1.1 lists counties in their respective watersheds.

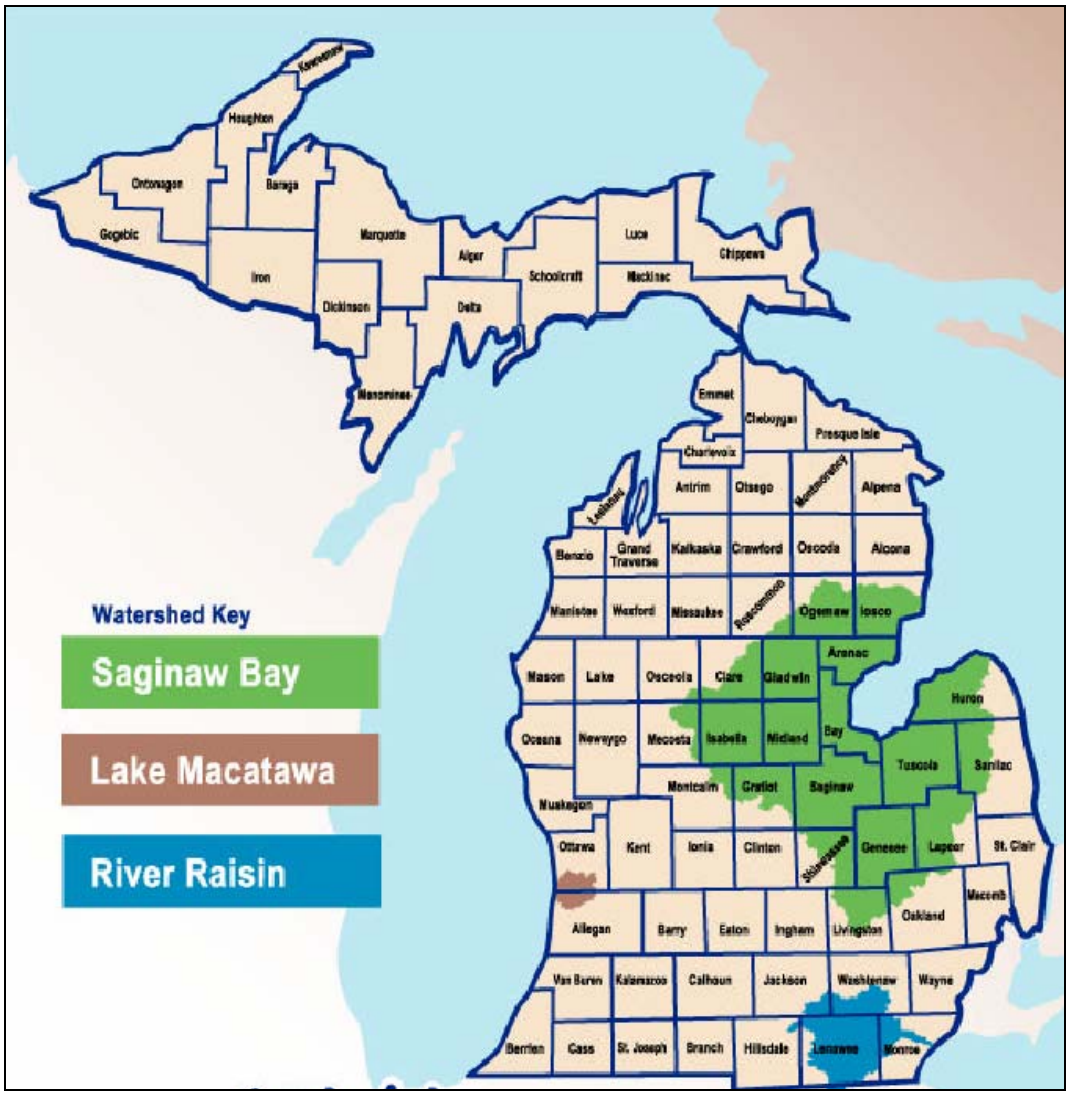


Figure 1.1. CREP area watersheds.
Source: MDA 2005b.

Table 1.1. Counties in the Michigan CREP project area by watershed.

Saginaw Bay Watershed	Arenac	Isabella	Ogemaw
	Bay	Lapeer	Osecola
	Clare	Livingston	Roscommon
	Genesee	Mecosta	Saginaw
	Gladwin	Midland	Sanilac
	Gratiot	Montcalm	Shiawassee
	Huron	Oakland	Tuscola
	Iosco		
River Raisin Watershed	Hillsdale	Lenawee	Washtenaw
	Jackson	Monroe	
Lake Macatawa Watershed	Allegan	Ottawa	

The Saginaw Bay Watershed, Michigan's largest watershed, drains 15 percent of the State's land area. It covers 5,573,000 acres in the eastern part of the State and is comprised of Saginaw Bay, an outlet of Lake Huron, as well as portions of 22 counties. Land use ranges from relatively undisturbed natural areas to heavily urbanized areas and includes the largest freshwater wetland system in the country as well as several major industrial centers. Over half of the watershed is designated agricultural land, with 27,038 farms with a total of 3,817,256 farmland acres. Forty-three percent of the total 8,809,842 acres in these counties is in farmland. The major agricultural products in these counties are grains, legumes, dairy, hay, and cattle (Proposal 1999 and NASS 2004).

The River Raisin Watershed, in the southeastern part of the State, covers 1,089,000 acres and is comprised of portions of five counties. The watershed drains 686,953 acres into Lake Erie at Monroe. Nearly 73 percent of the land area is farmland, with 6,728 farms covering 1,214,090 acres. Fifty-seven percent of the total acreage in the five counties associated with the River Raisin Watershed is in farmland. Agriculture is the top industry in the watershed, and the major agricultural products in these counties are corn, wheat, soybeans, vegetables, nursery and greenhouse products, dairy, and cattle**.** Lenawee County, which comprises the largest portion of the watershed, is ranked first in soybean, second in corn and grain, and third in wheat production statewide (Proposal 1999 and NASS 2004).

The Lake Macatawa Watershed is in the western part of the State and covers 110,000 acres over two counties. The 750 miles of drainage systems includes Lake Macatawa and the Macatawa River and empties into Lake Michigan. Agriculture is the top industry in the watershed, with 2,780 farms totaling 408,754 farmland acres. Forty-six percent of the total 889,767 acres in these counties is in farmland, where livestock comprises a major portion of the agricultural output. Ottawa County is ranked first in the State in poultry production while Allegan County is ranked first in hogs and pigs. These two counties also rank in the top four statewide in vegetables, corn, cattle, nursery, and milk production (Proposal 1999 and NASS 2004).

1.5.1 Relevant Laws, Regulations, and Other Documents

CREP would need to be compliant with a wide range of laws, regulation, and Executive Orders (EOs) and this section includes a list of Federal and State laws and regulations, and EOs that may be applicable to CREP.

It is anticipated that implementation of CREP would complement existing conservation programs and a description of existing Federal and State conservation programs is also included.

Federal Laws, Regulations, and Other Documents

Relevant Federal laws and regulations that may be applicable to implementation of CREP include the following (NASDA 2005):

- Clean Water Act of 1972 (CWA)
- Coastal Barrier Resources Act of 1982
- Coastal Zone Management Act of 1972
- Comprehensive State Groundwater Protection Program
- Endangered Species Act of 1973
- EO 11514: Protection and Enhancement of Environmental Quality
- EO 11988: Floodplain Management (g) Floodplains and Wetlands
- EO 11990: Protection of Wetlands
- EO 12898, Environmental Justice for Minority and Low Income Populations
- Farmland Protection Policy Act (FPPA) of 1981
- Federal Insecticide, Fungicide, and Rodenticide Act of 1947
- Food Security Act of 1985
- National Environmental Policy Act of 1969
- National Historic Preservation Act of 1966
- Safe Drinking Water Act of 1974
- Sustainable Fisheries Act of 1996

A more detailed description of Federal laws and regulations is included in Appendix A.

Michigan State Laws Affecting Agriculture

Individual CREP projects would need to ensure compliance with the following State laws, where necessary (NASDA 2005):

- Clean Michigan Initiative Act of 1998
- Great Lakes Water Quality Bond Authorization Act of 2002
- Natural Resources and Environmental Protection Act of 1994 (NREPA)
- The Right to Farm Act of 1981
- The Groundwater and Freshwater Protection Act of 1993

1.6 Decisions that Must be Made

FSA must determine if the selected alternative would or would not constitute a major Federal action significantly affecting the quality of the human environment. If FSA determines that it would not significantly affect the quality of the human environment, then a Finding of No Significant Impact (FONSI) would be prepared and signed. Pending CREP applications would then go through the environmental evaluation as part of the approval process.

Additional analyses would be required to evaluate site specific impacts.

1.7 Scoping and Resource Issues

1.7.1 Scoping

CREP was initiated in 1997 and is a joint Federal and State land retirement conservation program. CREP uses authorities of the CRP in combination with Michigan State resources to target specific conservation and environmental objectives of Michigan and the nation.

FSA personnel performed scoping internally with the following agencies, interest groups, and special interest organizations:

- NRCS
- Michigan Department of Natural Resources (MDNR)
- Michigan Department of Environmental Quality (MDEQ)
- Michigan Department of Agriculture (MDA)
- Michigan Conservation Districts
- U.S. Fish and Wildlife Service (FWS)
- Ducks Unlimited
- Pheasants Forever
- Michigan United Conservation Clubs
- Michigan Farm Bureau
- Land Trusts and Conservancies
- Cabela's

Consultation with FWS occurred during the development of the proposal and the PEA to comply with Section 7 of the Endangered Species Act (ESA).

Informal consultation was initiated with State Historic Preservation Office (SHPO) during the development of the Draft PEA in order to comply with section 106 of the National Historic Preservation Act of 1966.

The Draft PEA was made available to the public in accordance with NEPA requirements and FSA regulations. No comments were received concerning the Draft PEA.

1.7.2 Relevant Resource Issues

The following resources studied would be affected by the Michigan CREP: surface water, groundwater, drinking water, wetlands, floodplains, soil, coastal, critical habitat and T&E species, cultural/tribal, and human health, social, and economic issues. Chapter 3 discusses each of the issues in more detail. Affected resources issues are introduced below.

Issue #1: Surface Water Resources susceptibility to agricultural practices

Michigan's 2004 303(d) list includes a prioritized list of waterbodies that currently do not support their designated beneficial uses because of poor water quality. River Raisin, Saginaw Bay, and the entire Lake Macatawa watershed are listed, as are numerous tributaries and small lakes within the watersheds. Pathogens, nutrients and pesticides are leading causes of impairment (MDEQ 2004a). Current issues affecting surface water quality are discussed in Section 3.5.

Issue #2: Groundwater Resources susceptibility to agricultural practices

Groundwater supplies water to 45 percent of Michigan citizens and is used for drinking water, irrigation, and industrial uses (MDEQ 2005o). Agricultural chemicals have been detected in groundwater throughout Michigan (MDA 2005c). In the River Raisin, the CREP watershed with the most agricultural land use, pesticides and nitrates are detected with relative frequency (Frey 2001). Irrigation is the largest consumptive use of water in the Great Lakes watershed with groundwater contributing about half of irrigation water (Grannemann et al. 2000). These and other issues are explored further in Section 3.6.

Issue #3: Drinking Water susceptibility to agricultural practices

Surface water supplies provide drinking water to over 55 percent of the State's population, or about 5.5 million people (MDEQ 2004b). Surface water intake types include Great Lakes, Great Lakes connecting channels, and inland river and/or inland lakes. In the CREP project area, the majority of public water is supplied by the Great Lakes (MDEQ 2005m). Over 2.5 million residents, 27.3 percent of Michigan's population, rely on domestic wells for their water supply (MDA 2005c). Section 3.7 discusses current issues affecting drinking water.

Issue #4: Wetland susceptibility to agricultural practices

Wetlands remove excess nutrients and filters sediments from the water that flows through them, provide flood and erosion attenuation, water-quality maintenance, recreation, and wildlife habitat. Over 70 percent of Michigan's original wetlands have been drained or filled, while many remaining wetlands are no longer representative of original landscape types (MDNR 2001). Current issues affecting wetlands are discussed in Section 3.8.

Issue #5: Floodplain susceptibility to agricultural practices

Floodplains are of concern to agricultural practices throughout the State. The prevention of flooding in sensitive areas or utilizing floodwater retention to mitigate nutrient and sediment inflows to watersheds should be addressed. Construction activities (e.g., constructed wetlands) have the potential to modify flowage and storage capacity and should be analyzed. Issues affecting floodplains are discussed in Section 3.9.

Issue #6: Soil susceptibility to agricultural practices

Soil erosion, particularly from agricultural influences, is a significant problem in Michigan. Annual estimates of the amount of soil lost vary from 606 million tons of topsoil eroded from cropland in all the Great Lake states (GLC 2005a) to nine million tons of soil deposited into the Saginaw Bay watershed (GLP 2005a). Although the precise amount of soil erosion resulting from agricultural use has not been determined, it is possible that Michigan farms contribute up to one half of the basin's agriculturally

induced soil erosion from the State's 10.7 million acres of agricultural land (almost half of the total agricultural land in all the Great Lakes states) (GLP 2005b). Soil resource issues are discussed further in Section 3.10.

Issue #7: Coastal Resources susceptibility to agricultural practices

Michigan has 3,288 miles of Great Lakes coastline, the most coastline of any state other than Alaska (EPA 2004). Eight of the 29 counties included in the three CREP watersheds have coastal resources, including coastal barriers, that may be impacted by agricultural nonpoint source pollution upstream. Current issues affecting State water quality are discussed in Section 3.11.

Issue #8: Biological Resources susceptibility to agricultural practices

There are 21 Federal T&E species in the State of Michigan (FWS 2005d). Of these, 13 occur in CREP watersheds (FWS 2005a). Habitat degradation from human population growth, habitat fragmentation, invasive exotic species, and pollution continue to threaten species populations. Current trends and issues affecting critical habitat and T&E species are discussed in Section 3.12.

Issue #9: Cultural / Tribal Resource susceptibility to agricultural practices

Michigan's long history of American Indian culture and European settlement has endowed the State with a remarkably diverse collection of historic and cultural resources worthy of preservation (HAL 2005b). To analyze potential impacts at a statewide level is unrealistic for purposes of this PEA. However, site specific cultural reviews and consultations will ensure protection of these vital resources. A discussion of State cultural resources is found in Section 3.13.

Issue #10: Human Health, Economic, and Social impacts from agricultural practices

The Michigan CREP proposes the potential enrollment of up to 80,000 acres across the three watersheds. Agriculture is one of the top industries in the state, and CREP implementation may affect multiple aspects of the economic climate, including farm laborers, farm owners, and the service industry. Human health and other sociological concerns may also be impacted by CREP implementation. In addition, all Federal programs, including CREP, must comply with EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations. The CREP program has the potential to affect minority populations such as migrant farm workers. A discussion of the issues affecting human health, social, and economic issues is found in Section 3.14.

1.8 Resources / Issues Eliminated from Detailed Study

The Michigan CREP would not affect the following resources:

Air Quality

CREP would have no discernable affect on Michigan's air quality. While the potential exists for minor localized improvements of air quality due some of the CPs, the potential benefits would be so minor and unquantifiable that it would not be practicable to analyze them within this PEA. Since the implementation of the CREP program would not result in impacts to the attainment, non-attainment, or maintenance status of any of the State's airsheds, this issue has been eliminated from further study in this PEA.

Noise

There would be no perceptible impacts from noise as a result of CREP implementation. Following the short term construction noise, as the CPs are installed, there would be no continual impacts on the local soundscape. With the permanent easements and long term nature of the CPs, which will result in decreased agricultural activities on CREP lands, noise level can be expected to decrease slightly. As a result, FSA eliminated noise from further analysis as part of this PEA

Wild and Scenic Rivers

Designated as a Scenic and Recreational River, the Au Sable River extends 23 miles through from Mio Pond in Oscoda County to Alcona Pond in Alcona County (NPS 2005). This region lies outside the boundaries of the targeted watersheds. As CREP implementation would only improve watershed integrity and the quality of waters downstream of the Au Sable, the FSA has determined that there would be no effects of consequence and, subsequently eliminated the issue from further analysis in this PEA.

Wilderness

There are no designated wilderness areas located within the targeted watersheds of the affected environment. Therefore, wilderness was eliminated from further analysis in this PEA.

Sole Source Aquifers

The only sole source aquifer in Michigan is the St. Joseph aquifer on the Michigan-Indiana border. There are no sole source aquifers located within the project area. Therefore, sole source aquifers were eliminated from detailed study in this PEA.

Chapter 2.0 Alternatives Including the Proposed Action

2.1 Introduction

This chapter describes the actions of the Michigan CREP, beginning with the No Action Alternative—Continue Current Agricultural Practices, and ending with the Action Alternative—Implement Michigan CREP. Alternatives will be compared in terms of their individual environmental impacts and their achievement of objectives.

2.2 Description of Alternatives

2.2.1 Alternative A (No Action)—Continue Current Agricultural Practices

Agriculture is the primary land use throughout the 6,772,000 acres of the Saginaw, River Raisin, and Lake Macatawa watersheds. Alternative A would allow the continued degradation of water quality and wildlife habitat currently resulting from agricultural practices.

Nonpoint source pollution of surface water quality and groundwater quality is a widespread problem in Michigan and the surrounding Great Lakes states. Common pollutants include excessive nutrients, sediments, pesticides, and bacteria. Many of Michigan's rivers and lakes receive direct discharge of treated effluent from municipal and industrial sources as well as runoff from urbanized areas, construction sites, and agricultural areas. Sedimentation, nutrient enrichment, and toxic material loading are problems associated with runoff that can impact surface water quality and the biological communities for which water bodies are designated and protected to support. Over 31 percent of public access lakes have high or excessive nutrient levels. Many lakes with moderate to high nutrient levels are located in the southern Lower Peninsula (in the CREP area) where large population centers and fertile soils exist (MDEQ 2004a). Phosphorous concentrations tend to be generally greatest in rivers that drain urban or heavily agricultural areas, and lowest in relatively undeveloped, heavily forested watersheds (MDEQ 2002).

Agricultural nonpoint source pollutants are a primary cause of surface water quality degradation in Michigan and standard farming practices in the CREP area use pesticides and nutrients in the form of fertilizers and manure (NASS 2002). A summary of agricultural chemical use in counties located in the CREP project area can be found in Table 2.1.

Michigan-grown parsley. Courtesy of MSU.

With the selection of the No Action Alternative, modes of agricultural production would remain as they have for decades. There would be no incentives to implement approved CPs. The installation of filter strips, buffers, and other CPs that reduce pollutant loading would not be funded. High levels of pesticides and nutrients would continue to accumulate and pollute watersheds, furthering the degree of negative ecological impacts. The potential for negative economic impacts resulting from reduced water quality and quantity would remain and possibly increase.

Table 2.1. Summary of agricultural chemicals use in 2002 in Michigan and CREP counties.

	Farmland Acres Treated with Commercial Fertilizers, Lime, and Soil Conditioners	Farmland Acres Treated with Manure	Farmland Acres Treated with Chemicals to Control Insects	Farmland Acres Treated with Chemicals to Control Weeds, Grass, or Brush	Total Acres of Land
Michigan State	5,476,283	700,621	990,827	4,387,194	36,354,560
Allegan	133,692	33,005	35,120	88,125	529,280
Arenac	49,324	8,348	8,699	31,637	234,880
Bay	124,536	5,049	25,584	101,404	284,160
Clare	8,730	5,437	173	3,852	362,880
Genesee	81,280	8,222	6,503	72,368	409,600
Gladwin	16,857	3,854	1,605	12,009	324,480
Gratiot	213,670	12,468	19,730	203,217	364,800
Hillsdale	161,382	13,675	15,033	127,160	383,360
Huron	306,677	46,050	65,731	268,442	535,680
Iosco	13,765	3,798	715	8,144	351,360
Isabella	105,055	13,115	12,534	86,961	367,360
Jackson	99,674	5,820	20,694	77,161	452,480
Lapeer	96,360	10,815	6,765	87,691	418,560
Lenawee	221,082	20,363	33,770	204,860	480,000
Livingston	55,461	4,242	4,413	37,777	363,520
Mecosta	31,696	12,168	4,830	19,785	355,840
Midland	47,827	2,551	3,965	36,149	333,440
Monroe	170,399	4,003	32,308	156,107	352,640
Montcalm	141,864	26,966	29,542	101,038	453,120
Oakland	12,119	882	1,308	9,073	558,720
Ogemaw	17,979	8,716	596	9,632	360,960
Osecola	24,156	9,782	2,276	7,928	362,240
Ottawa	107,624	34,508	28,541	63,627	362,240
Roscommon	377	110	203	info withheld	333,440
Saginaw	244,394	7,737	17,851	184,493	517,760

	Farmland Acres Treated with Commercial Fertilizers, Lime, and Soil Conditioners	Farmland Acres Treated with Manure	Farmland Acres Treated with Chemicals to Control Insects	Farmland Acres Treated with Chemicals to Control Weeds, Grass, or Brush	Total Acres of Land
Sanilac	311,386	29,567	38,443	242,877	616,960
Shiwassee	149,977	9,027	9,869	138,091	344,960
Tuscola	243,723	14,224	39,679	189,757	519,680
Washetenaw	110,847	12,131	20,575	97,352	454,400
CREP County Total Acres	**3,281,9143**	**366,633**	**487,055**	**2,669,974**	**11,822,668**
Percentage of State's Total Acres	**60%**	**52%**	**49%**	**61%**	**32%**

Source: USCB 2005b and NASS 2002.

2.2.2 Alternative B—Implement the Michigan CREP

Implementation of Alternative B would target 80,000 acres in the three watersheds for the installation and maintenance of selected CPs. Land enrolled in CREP would be retired from crop production and irrigation for 10-15 years. CREP would provide the financial and technical assistance necessary to assist eligible Michigan farmers and ranchers in voluntarily establishing conservation practices to control water runoff and nonpoint source pollution including nutrient loading, soil erosion, and sedimentation. The landowners would be funded to install FSA approved CPs. The project would be jointly funded by the USDA/CCC and the State of Michigan.

Implementing the Michigan CREP would decrease the amount of nonpoint source pollution throughout the three watersheds. The decrease in watershed contaminants would improve water quality, enhance wildlife habitat, and provide cleaner water sources for drinking, recreation, and other uses of the growing Michigan population.

As of October 31, 2005, there were 4,564 CREP contracts covering 52,808 acres in the CREP area. With approximately 41,514 acres enrolled, the Saginaw Bay watershed has 80 percent of the enrolled CREP acreage. The River Raisin watershed has 10,211 acres enrolled, equaling approximately 20 percent of CREP enrollment; the Macatawa River watershed has 242 acres enrolled, or a half percent of the total enrollment. The counties with the greatest number of acres enrolled in the program are Lenawee (9,190 acres), Huron (7,961 acres), Saginaw (7,629 acres), and Tuscola (6,803 acres). Table 2.2 shows the number of acres enrolled in each county of Michigan CREP (FSA 2005).

Table 2.2. Summary by county of the numbers of acres enrolled in Michigan CREP contracts as of October 31, 2005.

County	Contracts	Acres	County	Contracts	Acres
Allegan	14	57	Mecosta	6	55
Arenac	277	3,808	Midland	239	2,288
Bay	283	2,174	Monroe	61	622

County	Contracts	Acres	County	Contracts	Acres
Clare	23	391	Montcalm	14	154
Genesee	23	320	Oakland	NA	NA
Gladwin	120	1,654	Ogemaw	29	753
Gratiot	401	3,076	Osceola	0	0
Hillsdale	5	37	Ottawa	11	185
Huron	737	7,961	Roscommon	0	0
Iosco	35	730	Saginaw	652	7,629
Isabella	150	1,757	Sanilac	113	1,535
Jackson	NA	NA	Shiawassee	82	93
Lapeer	35	335	Tuscola	797	6,803
Lenawee	429	9,190	Washtenaw	24	361
Livingston	0	0			

NA= Data not available due to privacy restriction required by the Farm Security and Rural Investment Act of 2002
Source: FSA 2005.

Conservation Practices

CPs must meet the minimum specifications outlined in the NRCS Field Office Technical Guide (FOTG) as well as all other applicable Federal, State, and local requirements. Detailed rental and incentive payments, cost-share and maintenance payments, technical requirements, and operating procedures for each practice are outlined in the FSA Handbook 2-CRP and are included in Appendix B of this PEA.

Native grasses in Michigan.

Six CPs were originally selected to meet the goals and objectives of the Michigan CREP. Addendums to the agreement added CPs 23A and CP26 to the list of eligible CPs. As of January 18, 2005, CP9 (Shallow Water Areas for Wildlife) has been removed from the list of eligible CPs (Allen 2005b).

The following is a brief description of the CPs that have been or are currently eligible for enrollment.

CP1 (Permanent Introduced Grasses and Legumes) —The purpose of an introduced grass planting is to establish a vegetative cover of introduced grasses and legumes that will enhance the landscape. Introduced grass plantings provide excellent nesting and brood-rearing cover, and forage for wildlife. The mid-height, stiff, upright grasses grow well along with legumes such as clover and alfalfa to provide

good areas for insect production and pollinating insect foraging areas. They provide excellent early and late season forage for grazers such as rabbits, deer and geese. However, they do not stand up to snow and ice and consequently provide fair to poor wintering habitat.

CP2 (Permanent Native Grasses) — This practice establishes a permanent vegetative cover of native grasses on eligible cropland that would enhance environmental benefits. It is used to reduce soil erosion and sedimentation, improve water quality and create or enhance wildlife habitat.

CP5A (Field Windbreaks) —Field windbreaks are linear plantings of single or multiple rows of trees or shrubs established for environmental purposes. These purposes include reducing wind erosion, protecting growing plants, managing snow, enhancing wildlife habitat and improving aesthetics. Field windbreaks intercept undesirable winds from eroding soils and damaging plants. Field windbreaks slow the velocity of wind, allowing the settling out of suspended snow and soil particles. Field windbreaks provide travel corridors for wildlife and also provide nesting sites, browse, food, and escape cover for many wildlife species.

CP9 (Shallow Water Areas for Wildlife) — The purpose of this practice is to develop or restore shallow water areas to an average depth of 6 to 18 inches for wildlife. The shallow water area must provide a source of water for wildlife for the majority of the year. This practice must include an adequate buffer area of perennial vegetation to protect the water quality and provide wildlife habitat.

Prior to its removal from the list of eligible CPs, CP9 was implemented on 748 acres. These acres will be under contract and CP9 will be maintained for 10- 15 years and the benefits to wildlife and other resources will continue to be realized.

CP21 (Filter Strips) — Filter strips are narrow bands of grass or other permanent vegetation used to reduce sediment, nutrients, pesticides, and other contaminants. Filter strips are located on cropland or degraded pastures immediately adjacent and parallel to streams, lakes, ponds, ditches, sinkholes, wetlands, or groundwater recharge areas.

CP22 (Riparian Buffer) — Riparian buffers are strips of grass, trees, or shrubs established adjacent to streams, ditches, wetlands, or other water bodies. Riparian buffers reduce pollution and protect surface and subsurface water quality while enhancing the aquatic ecosystem.

CP23 (Wetland Restoration) —This practice restores the functions and values of wetland ecosystems devoted to agricultural use. Wetlands provide benefits in terms of water quality (sediment and nutrient filtering and cycling), floodwater storage, and wildlife habitat. These benefits would contribute to meeting CREP objectives and improving conditions in the CREP project areas.

Restored wetlands in Michigan.

CP 23A (Wetland Restoration- Non Floodplain) — Wetland restorations are applicable in areas that used to be wetlands, but have been converted to agricultural uses. Wetlands in Michigan include open water, marsh, meadow, shrub and forested habitats. An important component of wetland restorations is to also restore the upland areas surrounding the wetland to provide a "buffer". Restoring wetlands and the adjacent upland buffers provides soil erosion protection and water quality enhancement, as well as habitat for a variety of wildlife, especially waterfowl, upland game birds and songbirds.

CP 26 (Sediment Retention Control Structures) — These structures are earth embankments or a combination ridge and channel generally constructed across the slope and minor watercourses to form a sediment trap and temporary water detention basin. Vegetation established as a component of the Sediment Retention Control Structure will also provide habitat for a variety of wildlife, especially upland game birds and songbirds.

Of the nine CPs that have been implemented on land enrolled in CREP, more acres are in filter strips (27,071 acres) than in all of the remaining eight practices combined. Wetland restoration (CP23) was second at 9,946 acres. A summary of CREP practice implementation by watershed is given in Table 2.3 (FSA 2005). A breakdown of each county's enrolled acreage by CP is in Appendix C.

Table 2.3. CP summary for active CREP contracts for all program years (1998-2006) as of October 31, 2005.

Conservation Practice	Saginaw Bay Watershed (Acres)	River Raisin Watershed (Acres)	Macatawa Watershed (Acres)	Total Area (Acres)
Introduced Grass Planting (CP1)	2,091	2,304	0	**4,396**
Native Grass Planting (CP2)	494	3,877	0	**4,371**
Field Windbreak (CP5A)	1,160	93	5	**1,258**
Shallow Water Areas For Wildlife (CP9)	693	45	10	**748**
Filter Strips (CP21)	24,359	2,659	54	**27,071**
Riparian Buffers (CP22)	1,744	118	9	**1,871**
Wetland Restoration (CP23)	9,060	1,109	164	**10,333**
Wetland Restoration (CP23A)	1,912	0	0	**1,912**
Sediment Retention Control Structure (CP26)	0	6	0	**6**
Total Area (Acres)	**41,514**	**10,211**	**242**	**51,966**

Source: FSA 2005.

Enrollment in CREP

Eligible participants include individuals, associations, trusts, local and State governments, Indian tribes, corporations, joint stock companies and operations, estates, and other legal entities. Eligible producers enroll in 14- to 15-year CRP contracts with FSA. Producers may also extend the benefits of the program through separate contracts with Michigan. Applicants must be able to offer eligible acreage and satisfy the basic eligibility criteria for CRP.

Acres eligible for enrollment must meet the following criteria:

- At least 51 percent of any give CREP practice must be located within the Michigan CREP watershed boundaries.
- For the original enrollment period starting in 2000, CPs must be either CP1, CP2, CP5A, CP9, CP21, CP22, CP23, or CP26. As of January 2005, CPs must be either CP1, CP2,

CP5A, CP21, CP22, CP23, CP23A, or CP26. All CPs must meet the practice requirements of Farm Service Agency Handbook 2-CRP and NRCS Field Office Technical Guide (FOTG).

- CP1 and CP2 must be installed on land with a weighted minimum average Erodibility Index (wind or water) of 8 or greater and be located within 1,000 feet of a body of water as defined in Handbook 2-CRP. The practice will not exceed an average maximum width of 1,000 feet from the edge of body of water except where NRCS FOTG requires a width in excess of 1,000 feet to address the water quality concerns.
- The cumulative total acreage enrolled under the CREP Agreement (2000) for CP1 and CP2 will not exceed 12,000 acres; CP 26 shall not exceed 1,000 acres; and practices CP23, CP23A, and CP26 shall not exceed 24,000 acres combined.
- For the purposes of those listed practices which involve a body of water, drainage ditches shall be considered "a body of water," provided that such drainage ditches meet the minimum size requirements as defined in the Michigan's FSA amendment to 2-CRP Handbook.
- CP21 must, when installed, have an average minimum width of 50 feet with a maximum average width not to exceed 150 feet. CP 22 must, when installed, have an average minimum width of 50 feet with a maximum average width not to exceed 180 feet.
- For CP5A, each installation must have one to two rows of trees and two to three rows of shrubs.
- The Water Sediment Control Practice shall be designed according to NRCS FOTG and FSA 2-CRP requirements and must be designed in a manner to trap and store sediment from inflowing waters (Agreement 2000).
- No managed haying and/or grazing shall be permitted on any CREP practice.
- Infeasible to farm provisions shall be applicable, per the Handbook 2-CRP.
- Mid-Contract Management will be required for all new acreage enrolled procedures in Handbook 2-CRP.

Eligible landowners and/or producers will not be denied the opportunity to offer eligible acreage for enrollment during general or other continuous CRP enrollment periods. The 12-month ownership/operatorship requirements will be waived for all enrollment practices.

The State will administer a voluntary easement program that will not detrimentally affect the CRP contracts. The State will solely be responsible for all easement requirements such as securing, monitoring, and enforcing such easements. The purpose of such easements is to maintain the long-term conservation benefits associated with land enrolled under the CREP Agreement (2000). The State will be solely responsible for the monitoring and evaluation of environmental impacts associated with the program objectives. (Agreement 2000).

Michigan Sand Dunes. Courtesy of MDEQ.

Funding for CREP

Total estimated costs of implementing the Michigan CREP Agreement are $177,000,000 over 10 years. Federal funding would provide 80 percent ($142,000,000) of the total cost; the State would provide the remaining 20 percent ($35,000,000) of the total cost (FSA 2000).

Payments in CREP

There are four types of FSA payments for which Michigan CREP participants will be eligible:

- Signing Incentive Payment – is a one-time payment of $100 to $150 per acre for land enrolled in buffer or filter strip practices. This payment is made soon after the contract has been signed and approved.
- Practice Incentive Payment – is an amount equal to about 40 percent of the total eligible costs for establishing filter strips, buffers, or practices on well head protection areas. This incentive payment is in addition to up to 50 percent cost share assistance that USDA will provide.
- Annual Base and Incentive Rental Payments – are comprised of an *initial* annual rental payment consistent with Handbook 2-CRP with a base rate equal to the weighted average soil rental rate for the land offered into CREP. An additional annual *incentive* payment of 145 percent of the initial annual rental rate is also paid. For example, if an initial annual rental rate of $24.50 is multiplied by 145 percent (1.45), a total rental payment of $35.53 per acre results.
- Cost share assistance – up to 50 percent for the installation of eligible conservation practices.
- Table 2.4 shows examples of costs and payments for three different CPs. (MDA 2004a).

Table 2.4. Cost and payment examples for one-acre plots enrolled three different CREP CPs.

Type of Cost or Payment		Filter Strip (15-year contract)	Field Windbreak (14.5-year contract)	Riparian Buffer Strip[1] (15-year contract)
Installation Cost		**$80**	**$300**	**$400**
Federal Annual Payments	Base SRR[2]	$100	$80	$40[3]
	Bonus (40% of SRR)	$40	$32	$16
	Maintenance ($5-$10)	$5	$5	$7
Total Annual Payment		**$145**	**$117**	**$63**
Federal	SIP[4]	$150	$140	$150

Type of Cost or Payment		Filter Strip (15-year contract)	Field Windbreak (14.5-year contract)	Riparian Buffer Strip[1] (15-year contract)
Single Payments	PIP[5] (40% of total installation cost)	$32	$120	$160
	Cost-Share (50% of total installation cost)	$40	$150	$200
State Single Payment	Cost-Share (50% of total installation cost)	$40	$150	$200
Total Single Payment		**$262**	**$560**	**$710**

[1] On marginal pastureland in Huron County.
[2] Weighted average soil rental rate (SRR) per acre for top three soils present in the contract area.
[3] Marginal Pastureland Rates are pre-set for each county, for Huron County it is $40.
[4] Signing Incentive Payment (SIP) is $140 or $150 per acre based on contract length.
[5] PIP = Practice Incentive Payment
Source: MDA 2005d.

Federal Agency Commitments

In addition to administering contracts for lands approved under the CREP, USDA and CCC also work cooperatively with the State and landowners and/or producers to develop and review conservation plans for land accepted for enrollment in the CRP under the CREP and ensure contract compliance through status reviews. They also provide information and technical assistance to the landowners and/or producers.

USDA and CCC are responsible for determining eligibility of the landowners and producers and paying its agreed to costs, including up to 50 percent of the reimbursable costs, annual rental payments to the landowner, maintenance payments and one-time payments if applicable (Agreement 2000).

State Commitments

The State of Michigan contributes no less than 20 percent of the overall annual program costs. They also are responsible for paying the costs of the State's annual monitoring program and paying all easement costs. The State will also search for eligible CREP applicants and work with the Federal agencies facilitating technical and administrative assistance. They will also develop a public information outreach campaign.

The State is also responsible for providing to FSA a summary of the enrollment status and progress on fulfilling the other commitments of the CREP Agreement and a summary of

Flower crop strips with windbreak in background. Allegan County, Michigan.

costs associated with the CREP (Agreement 2000).

As CREP enrollment is over half completed, roles and responsibilities have already begun. Table 2.5 outlines the roles for each partner in Michigan CREP.

Table 2.5. Partner responsibilities for Michigan CREP.

Partner	Role
Michigan Department of Natural Resources (MDNR)	Coordinating development of wildlife population monitoring efforts. Will begin to collect data during conclusion of 4th growing season or FY'04. Have contributed $60,000.00 toward purchase and maintenance of 4 specialized drills for warm season native grass plantings. (Cumulative total of $260,000 and 20 drills for combined.) Coordinate scheduling seed drills in 2 of 3 CREP watersheds. Delivered 3 warm season grass planting workshops in FY'03 to Federal and state technical staff.
Michigan Department of Environmental Quality (MDEQ)	Principle components of water quality monitoring project identified to evaluate effectiveness of CREP practices on surface water quality and aquatic habitat. Project to demonstrate short-term improvements in water quality (two to five years). Continue pre-CREP monitoring and use as baseline data. New monitoring sites identified. Plan collaboration, data sharing and GIS strategy executed with Michigan Department of Agriculture. Hired subcontractors. Initiated preliminary CREP Modeling Plan.
Michigan Department of Agriculture (MDA)	Administrate technical assistance grants with the local Conservation Districts. Facilitate quarterly technician Technical Advisory Committee (TAC) meetings. Maintain state contract and database for recording and processing landuser payments. Manage state sponsored Permanent Conservation Easement and Livestock Access Programs. Develop and distribute promotional/educational materials to CREP audiences. Maintain official Michigan CREP website. Coordinate development and management of GIS data management project.
Michigan Conservation Districts (CD)	Thirteen technicians provide technical assistance to landowners, including fieldwork, writing conservation plans, and coordination of practice construction. CD administrators and technicians coordinate efforts with USDA - FSA and NRCS, MDNR, MSU, and DU staff. CDs purchase grass seed, provide education, and promote CREP and Permanent Conservation Easement Program (PCEP).
USDA, Farm Service Agency (FSA)	In conjunction with Commodity Credit Corporation, FSA administers CREP, services individual Federal contracts, and issues Federal rental/incentive/cost share payments to participants.
USDA, Natural Resources Conservation Service (NRCS)	Provides technical assistance to landowners, including determining land eligibility, suitability of conservation practices, and writing and/or amending conservation plans of operation. Provide wetland technical training to NRCS field staff and CREP technicians.
USDI, Fish and Wildlife Service (FWS)	Participates in monthly CREP State Steering committee meetings.

Partner	Role
Ducks Unlimited (DU)	Landowner has option to use DU as project agent, providing experience and technical assistance in the implementation of wetland practice installation. Using the USDA-NRCS design implementation, DU facilitates the permitting process, reviews project bids, hires contractors, supervises construction, and manages establishment of upland grass plantings. Participates in monthly CREP State Steering Committee meetings. Lobby state legislators in support of CREP.
Pheasants Forever (PF)	Promote use of warm season native grasses through contribution of seed through local PF chapters and active involvement in CREP State Steering Committee. Actively promotes CREP though local PF chapters. Lobby state legislators in support of CREP.
Michigan United Conservation Clubs (MUCC)	Lobbies state legislators in support of CREP. Participate in PCEP steering committee task subgroups.
Michigan Farm Bureau (MFB)	Lobbies state legislators in support of CREP. Participate in PCEP steering committee task subgroups.
Land Trusts and Conservancies	Assist in facilitation of CREP PCEP. On behalf of landowners, applied for grants for permanent easements. Will assume easement monitoring and enforcement duties on upon receipt of grant funding.
Cabela's	Subsidize purchase of CREP/Cabela's ballcap type hats given to landowners that enroll into CREP. Over 2000 landowners have received CREP/Cabela's hats.

Source: MDA 2004a.

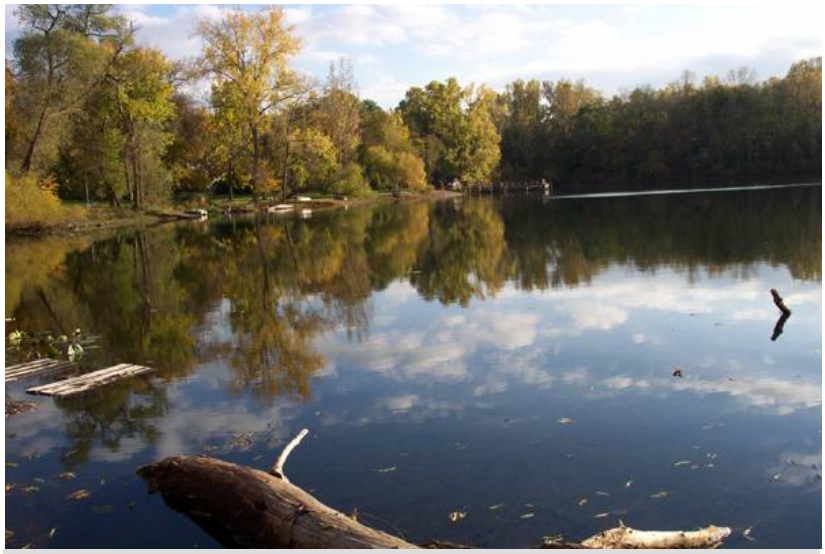
Monitoring Program

MDEQ is responsible for conducting and reporting on water quality monitoring projects in order to evaluate the effectiveness of CREP at improving surface water quality and aquatic habitat. The guiding principles used to design this water quality monitoring project include (MDEQ 2004c):

- Make use of existing sampling programs on large watersheds;
- Link water quality monitoring with land management monitoring;
- Use multiple assessment tools; and
- Monitor selected small watersheds to demonstrate short-term improvements in water quality (two to five years).

Large Watershed Monitoring

There are 14 water quality monitoring sampling locations that were monitored by MDEQ as part of Michigan's water quality monitoring strategy in the Saginaw, River Raisin and Macatawa large watersheds prior to CREP. Seven of the sampling stations are located in the Saginaw Bay watershed, five are in the Macatawa River watershed, and one is in the River Raisin watershed. A second River Raisin watershed monitoring station at Ida-Maybee Road has been historically sampled by Heidelberg College and, with support from MDEQ, sampling continues to provide water quality data to the CREP monitoring program.



Lake in Southern Michigan. Courtesy of NOAA.

Historically, sampling strategies at the MDEQ stations used primarily monthly and quarterly fixed time intervals. Beginning in 1998, however, a flow-stratified strategy was adopted at some stations. The Heidelberg College sampling protocols at the Ida-Maybee Road has always been a flow-stratified approach.

The raw drinking water intakes at Deerfield and Blissfield on the River Raisin are two existing monitoring stations that may provide useful information for CREP evaluation. At these stations, samples are analyzed for various parameters at various frequencies, including daily analysis of nitrate and turbidity (MDA 2004a).

Small Watershed Monitoring

The two small watershed monitoring studies in the CREP area focus on excluding animals from streams. Located in Clare County, the Carrow Creek project evaluates the effectiveness of pasture animal exclusion and barnyard improvements in reducing nutrient runoff to Carrow Creek. This site was selected because preliminary reconnaissance indicated there is a significant source of nutrients to this small stream, and because the landowner was willing to treat the problem. This project includes sampling before implementation of CREP practices (Fall 2001 and Spring 2002), as well as sampling after improvements have been completed in Fall 2003 and Spring 2004. Samples are being analyzed for total phosphorus, nitrate + nitrite nitrogen, total organic carbon, Kjeldahl nitrogen and ammonia. In addition to nutrient sampling, water samples are being analyzed for the bacterium *E. coli*.

The Little Sugar River project in Gladwin County is the other small watershed monitoring study focusing on animal exclusion. A pasture on a South Branch Sugar River tributary has been selected as a demonstration site to illustrate improvements in stream habitat, channel morphology, and biological communities that can result from improved management practices. Planned treatments for this project include cattle exclusionary fencing, stabilized permanent stream crossings, and new tree plantings. The goal of the project is to improve stream bank stability and reduce stream sediment load by restricting the majority of the cattle's access to the waterbody (MDA 2004a).

Public Outreach and Support

A multi-media public outreach campaign is initiated using all of the public relations resources available to the partners in the proposal. Specific emphasis is placed on an educational campaign that would promote water conservation and resource utilization within the project area. All supporting agencies and entities assist with the public outreach and educational campaign by applying their full resources. Additional funding are sought through grants.

Training of Staff

A team of Federal and State staff coordinates the necessary training sessions to reach persons involved with the sign-up, promotion, maintenance, and monitoring of the accepted CREP. Specific details and procedures are shared during this training, as well as contact information for future support.

Communication Plan

A detailed communication plan was developed upon acceptance of the Michigan CREP Agreement (2000). The communication plan shares project goals, objectives, criteria, and most recent updates on project accomplishments. All available resources are used to disseminate information including organizational newsletters, brochures, displays, magazine articles, agency internet pages, and TV/radio spots if funds are available. Sign-up are monitored annually and barriers to enrollment identified via a non-user survey.

2.3 Comparison of Alternatives

The two alternatives both respond to project objectives in varying degrees. Implementing either alternative also has specific environmental implications for the State's watersheds. Tables 2.6 and 2.7 provide a summary comparison of the alternatives. To provide consistency, the following impact terminology will be used in the comparison table below and throughout the document.

- No Effect – A change to a resource's condition, use, or value that is not measurable or perceptible.
- Beneficial Effect – An action that would improve the resource's condition, use, or value compared to its current condition, use, or value.
- Minor Adverse Effect – A measurable or perceptible, minor, localized degradation of a resource's condition, use, or value that is of little consequence.
- Moderate Adverse Effect – A localized degradation of a resource's condition, use, or value that is measurable and of consequence.
- High Adverse Effect – A measurable degradation of a resource's condition, use, or value that is large and/or widespread and could have permanent consequences for the resource.
- Short-term Effect – An effect that would result in the change of a resource's condition, use, or value lasting less than one year.
- Long-term Effect – An effect that would result in the change of a resource's condition, use, or value lasting more than one year and probably much longer.

Table 2.6. Summary comparison of achievement of project objectives of Alternatives A and B.

Objectives	Indicators	Alternative A: No Action	Alternative B: Implement CREP
Objective #1: Reduce nutrient runoff from pasturelands and croplands from entering waterbodies.	Enrollment of up to 80,000 acres. Reduction of phosphorus loading by 784,000 lbs. Reduction of nitrogen loading by 1,568,000 lbs. Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.	Current agricultural practices would continue. FSA CPs would not be implemented or funded. High levels of nutrients would continue to discharge into the watersheds.	Up to 80,000 acres would be enrolled as a part of CREP implementation. FSA CPs would be implemented to reduce contaminants entering the watersheds. Water quality would be improved. Nitrogen loading would be reduced by 1,568,000 lbs per year. Phosphorus loading would be reduced from 145,284 lbs. per year to 72,642 lbs. per year.
Objective #2: Improve surface water quality in the targeted watersheds.	Enrollment of up to 80,000 acres. Reduction of sediment loading by 784,000 metric tons Reduction of stream water heating to ambient levels. Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.	Current agricultural practices would continue. FSA CPs would not be implemented or funded. Sediment loading would remain at current levels with increases likely over the long term.	Long-term moderate to high beneficial effects to surface water quality and quantity. Significant improvements to water quality. CREP implementation would reduce sediment loading by 784,000 metric tons per year.
Objective #3: Improve drinking water quality in the targeted watersheds.	Enrollment of up to 80,000 acres. Decrease nitrate concentrations by reducing nitrogen loading by 784,000 lbs. The decrease of pesticide and trihalomethane (THM) concentrations. Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.	Current agricultural practices would continue. Land currently in agriculture would remain in current production, with its associated pesticide and herbicide applications.	Long-term, minor to moderate beneficial effects on drinking water would result from CREP implementation. Each CP improves surface water quality and potentially could improve the quality of water that recharges groundwater. Decreases in sediment and nutrient loading would reduce nitrate, pesticide, and THM concentrations drinking water.

Objectives	Indicators	Alternative A: No Action	Alternative B: Implement CREP
Objective #4: Improve wildlife habitat.	Enrollment of up to 80,000 acres. Reduction of sediment loading by over 784,000 metric tons Reduction of nitrogen entering rivers and streams by 1,568,000 lbs. Reduction of phosphorus entering rivers and streams by 784,000 lbs. Implementation of FSA CPs 1, 2, 5A, , 21, 22, 23, 23A, and 26.	Current agricultural practices would continue. Current wildlife habitat would continue to degrade and fragment in response to ongoing environmental stressors.	CREP implementation would improve and create habitat for a variety of species. Protected riparian areas would improve aquatic habitat and provide corridors for terrestrial species.

Table 2.7. Summary comparison of the effects of Alternatives A and B on the affected resources.

Issues	Alternative A: No Action	Alternative B: Implement CREP
Issue #1: Surface Water susceptibility to agricultural practices.	Long term, moderate adverse effect – State surface water quality would continue to decline. Any improvement in water quality would be dependant upon existing programs. However, because these programs do not directly address agricultural practices, runoff from farms would continue to introduce pollutants to the system.	Long term, moderate to high beneficial effect – Implementation of CREP would provide significant localized impacts on water quality and would help to achieve CREP's goals of reducing sedimentation, phosphorus, nitrogen, and other water-borne pollutants. These improvements would occur throughout all three of the watersheds.
Issue #2: Groundwater susceptibility to agricultural practices.	Long term, minor adverse effect – Groundwater quality would continue to decline as a partial result of polluted agricultural runoff.	Long term, minor beneficial effect – Minor positive effects on aquifers would occur. CPs would directly reduce the impacts of agricultural runoff. Well heads and recharge areas would be indirectly improved, benefiting the aquifers.
Issue #3: Drinking Water susceptibility to agricultural practices.	Long term, minor adverse effect – Drinking water quality would continue to decline. Incremental negative impacts from agricultural and industrial activities would continue.	Long term, minor to moderate beneficial effect – CREP implementation would reduce contamination of wellheads and drinking water sources by filtering agricultural runoff. Retiring 80,000 acres of actively cropped agricultural land would reduce application of agricultural pesticides and fertilizers, would reduce amount of groundwater used for irrigation, and would improve the quality of aquifer and wellhead recharge.
Issue #4: Wetland susceptibility to agricultural practices.	Long term, moderate adverse effect – Wetland values would continue to slowly decline as a result of existing and projected agricultural runoff. Total wetland acres will likely be stable or slightly reduced.	Long term, moderate beneficial effect – Wetland acreage would likely increase and help create new wildlife habitat for traditional species in the combined watersheds. CP22 (Riparian Buffer) would create more wetland areas and CP23 (Wetland Restoration) would return previously altered wetlands to a more beneficial state.
Issue #5: Floodplain susceptibility to agricultural practices.	No effect – Since floodplains are routinely used for agricultural production which normally has little adverse effect on flowage areas or floodways, these effects are considered to be negligible.	Minor long term improvements would be made to floodplains and stream values. CPs would assist in controlling flood events.

Issues	Alternative A: No Action	Alternative B: Implement CREP
Issue #6: Soil susceptibility to agricultural practices.	Long-term, minor to moderate adverse effect – Land currently in crop production will also continue to be plowed, further contributing to the wind and water erosion.	Long-term, minor to moderate beneficial effect – Once initial installation of CPs, enrolled land would not be plowed, reducing susceptibility to water and wind erosion.
Issue# 5: Coastal Resources susceptibility to agricultural practices.	Long term, minor adverse effect – Current agricultural practices will continue to contribute to the nonpoint source pollution (including pesticides and herbicides) of the coastal resources.	Long term, minor beneficial effect – Direct benefits would occur from all of the CPs designed to filter sediment and nutrients from water and/or prevent soil erosion. By reducing sediment and nutrient loads, CREP is expected to have long-term moderate to high beneficial effects on shoreline waters. Reductions in sediment and nutrient load would increase vegetative and faunal diversity while reducing cover of invasive alien algae.
Issue #6: Biological Resources susceptibility to agricultural practices.	Long term, minor adverse effect – Wildlife, fisheries, and habitat values would not benefit from the leveraged effects of habitat restoration and watershed improvement CPs and may continue to decline.	Long term, moderate beneficial effect – CPs would improve habitat values. Improvements to water quality alone would have beneficial effects for all wildlife and fisheries as well as potential increases in critical habitat, such as wetlands.
Issue #7: Cultural / Tribal susceptibility to agricultural practices.	Without a mandated assessment process, minor to moderate adverse impacts would continue to occur on cultural resources. These include disturbance and destruction of prehistoric and historic sites and structures, either through ongoing land conversion for development or agricultural use.	Minimal to no impact would occur. If cultural resources are discovered on enrolled lands, coordination with the State and/or Tribal Historic Preservation Office and Tribes would occur to minimize impacts. Some CPs may serve to protect inappropriate access to cultural resources.
Issue #9: Human Health, Social, and Economic impacts from agricultural practices.	Long term, minor adverse effect – No FSA actions are required or necessary to address existing or ongoing issues with environmental justice.	Long term, minor beneficial effect – By enrolling marginal, less productive agricultural lands, landowners should be able to reduce overall input costs for farming operations and maintain or increase production by being able to concentrate resources on the remaining farmland. Disproportionate effects on minority or underrepresented groups are unlikely.

THIS PAGE LEFT INTENTIONALLY BLANK

Chapter 3.0 Affected Environment and Environmental Consequences

3.1 Introduction

In an effort to simplify the document, the analyses of Affected Environment and Environmental Consequences have been integrated in this section. Relevant resource issues related to the Michigan CREP are discussed below in Sections 3.5 through 3.14. This section will explore the environmental resources affected by the No Action Alternative and the Proposed Action Alternative (Implementation of the Michigan CREP).This chapter discusses resources most likely to receive impacts from the alternatives, and compares the potential impacts of each alternative on the resource issue. Resources discussed in this chapter include:

- Surface Water (3.5);
- Groundwater (3.6);
- Drinking Water (3.7);
- Wetlands (3.8);
- Floodplains (3.9);
- Soil (3.10);
- Coastal Resources (3.11);
- Biological Resources (3.12);
- Cultural/Tribal Resources (3.13); and
- Human Health, Social, and Economic Issues (3.14).

The general nature of this PEA limits discussion of the resources to a broad scale. A site specific EE will be completed by FSA for each contract as part of the conservation plan. As impacts become clear at each site, the appropriate steps will be taken to ensure compliance with NEPA and related environmental and cultural resource laws and regulations.

3.2 General Description

3.2.1 Ecoregions

For purposes of analysis and discussion, the project area can be divided into several ecological regions as shown in Figure 3. Ecoregions can be identified through the analysis of the patterns and the composition of biotic and abiotic phenomena. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. The ecoregions identified in Figure 3.1 are classified by the EPA as Level III ecoregions (EPA 2005b).

Northern Lakes and Forests

The Northern Lakes and Forests is a region of nutrient poor glacial soils, coniferous and northern hardwood forests, undulating till plains, morainal hills, broad lacustrine basins, and extensive sandy outwash plains. Soils in this ecoregion are thicker than in those to the north and generally lack the arability of soils in adjacent ecoregions to the south. The numerous lakes that dot the landscape are clearer and less productive than those in ecoregions to the south (EPA 2005b).

North Central Hardwood Forests

The North Central Hardwood Forests is transitional between the predominantly forested Northern Lakes and Forests to the north and the agricultural ecoregions to the south. Land use/land cover in this ecoregion consists of a mosaic forests, wetlands and lakes, cropland agriculture, pasture, and dairy operations (EPA 2005b).

Huron/Erie Lake Plains

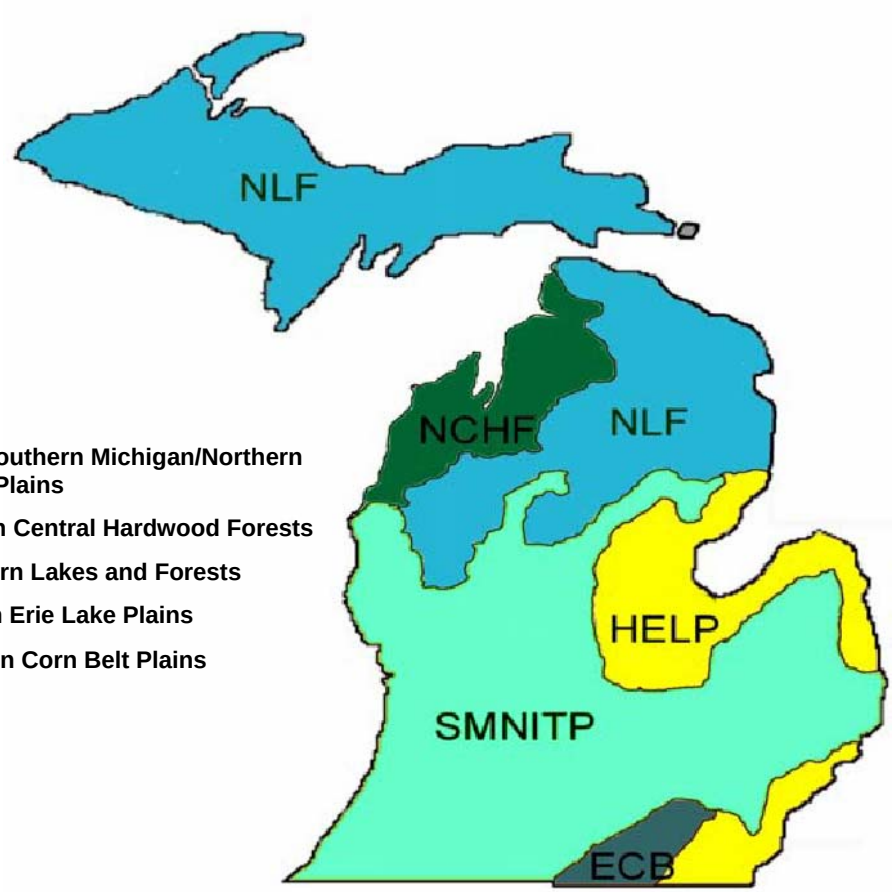
The Huron/Erie Lake Plain is a broad, fertile, nearly flat plain punctuated by relic sand dunes, beach ridges, and end moraines. Originally, soil drainage was typically poorer than in the adjacent Eastern Corn Belt Plains, and elm-ash swamp and beech forests were dominant. Oak savanna was typically restricted to sandy, well-drained dunes and beach ridges. Today, most of the area has been cleared and artificially drained and contains highly productive farms producing corn, soybeans, livestock, and vegetables; urban and industrial areas are also extensive. Stream habitat and quality have been degraded by channelization, ditching, and agricultural activities (EPA 2005b).

Southern Michigan/Northern Indiana Till Plains

Bordered by Lake Michigan on the west, this ecoregion is less agricultural than the Central and Eastern Corn Belt Plains ecoregions to the south, is better drained and contains more lakes than the flat agricultural lake plain of the Huron/Erie Lake Plain to the east, and its soils are not as nutrient poor as the Northern Lakes and Forests ecoregion to the north. The region is characterized by many lakes and marshes as well as an assortment of landforms, soil types, soil textures, and land uses. Broad till plains with thick and complex deposits of drift, paleobeach ridges, relict dunes, morainal hills, kames, drumlins, meltwater channels, and kettles occur. Oak-hickory forests, northern swamp forests, and beech forests were typical. Feed grain, soybean, and livestock farming as well as woodlots, quarries, recreational development, and urban-industrial areas are now common (EPA 2005b).

Eastern Corn Belt Plains

The Eastern Corn Belt Plains is primarily a rolling till plain with local end moraines; it had more natural tree cover and has lighter colored soils than the Central Corn Belt Plains. The region has loamier and better drained soils than the Huron/Erie Lake Plain. Glacial deposits of Wisconsinan age are extensive. They are not as dissected nor as leached as the pre-Wisconsinan till which is restricted to the southern part of the region. Originally, beech forests were common on Wisconsinan soils while beech forests and elm-ash swamp forests dominated the wetter pre-Wisconsinan soils. Today, extensive corn, soybean, and livestock production occurs and has affected stream chemistry and turbidity (EPA 2005b).



SMNITP – Southern Michigan/Northern Indiana Till Plains

NCHF- North Central Hardwood Forests

NLF- Northern Lakes and Forests

HELP Huron Erie Lake Plains

ECB- Eastern Corn Belt Plains

Figure 3.1. Michigan State ecoregions.
Source: MDEQ 2004a.

3.3 Profile of Agricultural Activities (Baseline Conditions)

Michigan is one of the largest agricultural producers in the country, leading the nation in production of seven crops and ranking in the top five in 34 agricultural commodities (NASS 2004). Of the 10.1 million acres of farmland in Michigan, 7.98 million acres (78.7 percent) is cropland, of which 6.83 million acres (85 percent) is harvested and 5.7 percent of harvested cropland is irrigated. Pastureland accounts for 250,000 acres (2.5 percent) of the total farmland, and 300,000 acres (3 percent) are enrolled in conservation or wetland reserve programs (NASS 2004).

Table 3.1 includes production, cash value, and national ranking for a few of Michigan's top agricultural products in fiscal year 2003. Over 60 percent of the total value in cash receipts is generated by the sale of a limited number of products, including dairy products, corn, soybeans, and cattle and calves. In addition to these commodities, Michigan has a successful floriculture sector which earned nearly $342 million dollars (9 percent of cash receipts value) in 2003. Michigan is the leading producer of flowering baskets, geraniums, impatiens, and petunias, and ranks second in marigold and hosta production (NASS 2004).

Table 3.1. Michigan State agricultural products (fiscal year 2003).

Crop	Nationwide Standing	Production[1]	Amount Generated (Millions of Dollars)
Blueberries	First	62 million lbs.	63.1
Cherries, tart	First	154 million lbs.	57.9
Cucumbers (pickles)	First	180,900 tons	36.2
Apples	Second	840 million lbs.	75.0
Carrots	Second	1.6 million cwt.	21.9
Celery	Second	1.2 million cwt.	17.6
Asparagus	Third	317,000 cwt.	19.3
Beans dry, all	Third	2.5 million cwt.	60.3
Cherries, sweet	Fourth	13,000 tons	11.7
Grapes, all	Fourth	94,500 tons	24.8
Pumpkins	Fourth	770,000 cwt.	14.3
Squash	Fourth	1.2 million cwt.	15.3
Sugarbeets	Fourth	3.4 million tons	122
Tomatoes	Fourth	117,800 tons	16.5
Beans, snap	Fifth	45,000 tons	11.2
Milk	Eighth	6.4 billion lbs.	794
Corn, for grain	Eleventh	263 million bushels	425
Hogs	Thirteenth	950,000 head	174
Soybeans	Thirteenth	53.7 million bushels	398
Hay, all	Twenty-second	3.1 million tons	57
Cattle	Thirtieth	1 million head	208

[1] lbs. = pounds, cwt. = hundred weight.
Source: MDA 2003.

Specific to this analysis, the combined watersheds included in the Michigan CREP cover over six million acres. Cropland and pasture within those watersheds total 5,577,000 acres. Table 3.2 provides insight into the high agricultural productivity of several counties within the Michigan CREP area. In 2003, 14 of the 29 counties within the CREP project area were in the top five agricultural producers for several field crop and livestock commodities (NASS 2004). CREP counties are highlighted in bold in Table 3.2.

Table 3.2. Michigan's top producing counties, selected commodities, 2003.

		County Rank				
		1	2	3	4	5
Field Crops	Corn for Grain	Lenawee	Huron	Saginaw	Branch	Tuscola
	Dry Beans	Huron	Tuscola	Bay	Sanilac	Gratiot
	Hay	Sanilac	Huron	Isabella	Osecola	Barry
	Oats	Sanilac	Isabella	Montcalm	Huron	Shiawassee
	Soybeans	Lenawee	Sanilac	Monroe	Branch	Saginaw
	Sugarbeets	Huron	Tuscola	Sanilac	Saginaw	Gratiot
	Wheat	Huron	Sanilac	Lenawee	Saginaw	Tuscola
Livestock	Cattle & Calves	Huron	Sanilac	Clinton	Allegan	Ionia
	Hogs & Pigs	Allegan	Cass	Ottawa	Branch	Calhoun, Huron
	Milk Cows	Sanilac	Clinton	Huron	Allegan	Ottawa

Source: NASS 2004.

3.4 Leveraged Benefits

An understanding of the planned effect of the 80,000 acres of the Michigan CREP is essential to the discussion of resource impacts. CREP implementation is designed to leverage and multiply beneficial effects and each acre enrolled in CREP could potentially benefit many acres outside of the CREP contract areas. For example, if 10 acres were enrolled in CREP and CP23 (wetland restoration) was implemented, the new wetland could intercept agricultural runoff from a hundred or thousands of acres of farmland and reduce phosphorus and pesticide loads significantly. Wetlands can maintain good water quality and improve degraded water quality conditions by intercepting and treating surface runoff. Suspended sediments and contaminants in the water are trapped, retained, and/or transformed through a variety of biological and chemical processes before they reach downstream water bodies. Implementing such CPs allows the relatively small footprint of CREP acreage to leverage much greater benefits for the watershed downstream (USGS 1997).

In another example, a producer can enroll three or four acres of agricultural land bordering a stream or wetland in CREP and provide restorative and retention properties that may filter discharges and regulate water flow from several hundred acres. Small enrollments in CREP can have large impacts on watersheds.

Specific impacts and the degree to which the CPs can be effective will depend on site specific analysis of each CREP contract. Acreage is limited for some of the CPs, yet the overall benefits are measured as impacts to larger acreage. Mitigation measures would be in place and outlined steps would be followed to ensure compliance with Federal, State, and loca statutes and regulations for each implementation area.

3.5 Surface Water

3.5.1 Introduction

Water resources in Michigan include the Great Lakes, inland lakes, rivers, and wetlands. Michigan borders four of the five Great Lakes and maintains jurisdiction over a combined Great Lakes surface area of approximately 24,870,000 acres, or 45 percent of the total Great Lakes area. Michigan also has over 35,000 inland lakes and ponds with surface areas of at least one-tenth of an acre or greater. These inland lakes and ponds cover over 889,600 acres of the State. Perennial and intermittent river miles in Michigan total approximately 54,301 of which 33,856 are perennial (MDEQ 2004a).

Of the water resources in Michigan, the CREP project area includes the Saginaw Bay watershed, Lake Macatawa watershed, and the River Raisin watershed. Water uses in these watersheds include recreation, industrial processes, navigation, agriculture, aquatic life, and drinking water. This section will discuss surface water quality and quantity issues in these watersheds and how they are affected by current agricultural practices in the CREP project area.

3.5.2 Water Quality

Clean Water Act Integrated Report

The MDEQ is responsible for administering Federal and State laws pertaining to water quality. The CWA of 1972 requires states to report on the water quality of waterbodies and their attainment of beneficial uses (e.g., recreation, aquatic life, agriculture). Under Section 303(d), states are required to identify and establish a priority ranking of all waterbodies that are not meeting State water quality standards and to biennially develop a Water Quality Limited Segments List (commonly called a 303(d) List). Section 303(d) requires a total maximum daily load (TMDL) for waters that do not meet State water quality standards. A TMDL is described as a pollution budget for a specific river, lake, or stream, and is an established wasteload allocation for point and nonpoint sources (MDEQ 2004a).

Section 305(b) of the CWA directs states to prepare a report biennially that describes the status and trends of existing water quality, the extent to which designated uses are supported, pollution problems and sources, and the effectiveness of the water pollution control programs (MDEQ 2004a).

In 2003, EPA issued guidance for the 2004 waterbody assessments and reporting requirements for Section 303(d) and Section 305(b) of the CWA and allowed states to combine these reports into one product. The final product is referred to as an integrated report and fulfills EPA's goal to provide the general public with a comprehensive summary of state and national water quality. Following these guidelines, the MDEQ prepared an integrated water quality report in March 2004 titled: *Water Quality and Pollution Control in Michigan: 2004 Sections 303(d) and 305(b) Integrated Report* (Integrated Report) (MDEQ 2004a).

In the Integrated Report, numerous waterbodies in the CREP project are have been designated as not supporting their designated uses. These waterbodies will be discussed further under Existing Conditions.

Watershed Management Plans

Michigan's Nonpoint Source Program assists local units of government, non-profit entities, and numerous other State, Federal, and local partners to reduce nonpoint source pollution statewide. The basis for the program is watershed management; most of the funded projects either develop watershed management plans or implement nonpoint source activities (MDEQ 2005q).

A Watershed Management Plan considers all uses, pollutant sources, and impacts within a drainage area. More than 130 Watershed Management Plans have been developed at the local level using MDEQ grants from the CWA Section 319 Nonpoint Source Pollution Control grant program. Watershed Management Plans serve as guides for communities to protect and improve water quality. Additional grant funding for implementing best management practices (BMPs) identified within the Watershed Management Plans is available through the Clean Michigan Initiative (CMI) Nonpoint Source Pollution Control Grant program. To be eligible for the CMI funds, the Watershed Management Plan must meet certain criteria and be approved by the MDEQ (MDEQ 2005q). Watersheds in the CREP project area with a Watershed Management Plan are:

- Macatawa
- Mid-Shiawassee River
- Cedar River (Gladwin County)
- Rifle River
- Sebewaing River
- Sturgeon Creek (Midland County)

Areas of Concern

The GLWQA was first developed in 1972 and is a cooperative agreement between the United States and Canada and concerns the restoration and enhancement of water quality in the Great Lakes system. The GLWQA, as amended in 1978 and 1987, requires the U.S. and Canadian governments to identify Areas of Concern (AOCs) (Figure 3.2). An AOC is a specific location in the Great Lakes that has serious water quality problems causing known impairments to the beneficial uses of the aquatic resource. The U.S. and Canadian governments are directed to cooperate with State and provincial governments to develop and implement Remedial Action Plans (RAPs) for each AOC (MDEQ 2004a).

Each RAP is required to identify the problems that have led to impairments of beneficial uses, identify actions needed to restore the beneficial uses, and provide documentation when beneficial uses are restored. RAPs have been developed for all of Michigan's 14 AOCs and are at various stages of implementation (MDEQ 2004a). Within the CREP project area there are two AOCs; Saginaw Bay and River Raisin. These AOCs will be discussed further under Existing Conditions.

Figure 3.2. Great Lakes Areas of Concern.
Source: MDEQ 2004a.

The GLWQA also requires the development and implementation of Lakewide Management Plans (LaMPs) for each Great Lake. The purpose of these plans is to provide a strategy to protect and restore beneficial uses in the open waters of each Great Lake. EPA, in cooperation with other Federal and State agencies, has completed three management plans: Lake Erie, Lake Michigan, and Lake Superior. Each LaMP includes an assessment of impaired uses and causes of impairment and recommends actions necessary to restore beneficial uses. The LaMPs were updated in 2002 and subsequent progress reports will be written biennially (MDEQ 2004a).

3.5.3 Existing Conditions

Saginaw Bay Watershed

Located in the east central portion of Michigan's Lower Peninsula, Saginaw Bay is a southwestern extension of Lake Huron. The Saginaw Bay watershed consists of all the land area and waterways that drain into Saginaw Bay. It is Michigan's largest watershed and includes all or part of 22 counties. It features more than 175 inland lakes, about 7,000 miles of rivers and streams, and drains approximately 15 percent of Michigan's total land area (EPA 2005g). Saginaw Bay itself covers 1,143 square miles and has 240 miles of shoreline (Fielder and Baker 2004). Water is used for recreation, fish and wildlife,

Saginaw Bay. Courtesy of NASA.

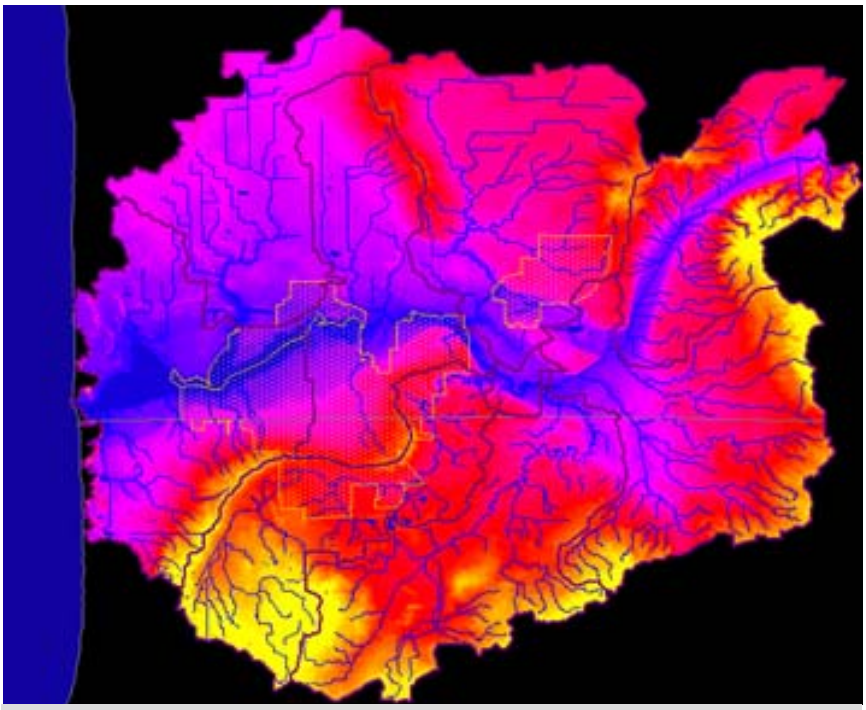
irrigation, electrical power generation, industrial processes, and drinking water. Subwatersheds in the Saginaw Bay watershed include:

- Au-Gres-Rifle
- Kawkawlin- Pine
- Pigeon- Wiscoggin
- Titabawasee
- Pine
- Shiawassee
- Flint
- Cass
- Saginaw

Although 28 rivers, streams, and agricultural drains flow directly into Saginaw Bay, approximately 75 percent of the flow into Saginaw Bay comes from the Saginaw River (PSC 2002). The Saginaw River generally runs north-south within the northern portion of Saginaw County, through the southeast corner of Bay County, and then empties into the Saginaw Bay approximately 90 miles north of Detroit, Michigan. The Saginaw River channel is a federally authorized commercial navigation project. The entire navigation channel extends from deep water, 14 miles out in Saginaw Bay at the north end of the channel, through the mouth of Saginaw River, and 22 miles upstream to the city of Saginaw (USACE 2005).

Lake Macatawa Watershed

The Lake Macatawa Watershed extends into Ottawa and Allegan Counties, covers approximately 110,000 acres, and includes Lake Macatawa, the Macatawa River, and numerous small tributaries. Lake Macatawa, in southern Ottawa County, Michigan, is an 1,800 acre drowned river mouth that empties into Lake Michigan (MACC 2005a).



Lake Macatawa Watershed. Image Courtesy of MDEQ.

The Macatawa River receives waters from numerous tributaries as it winds westward through the watershed. The main branch of the river is 16.8 miles long. The river empties into five-mile long Lake Macatawa which outlets through a short channel that discharges into Lake Michigan. The shape of the Macatawa River basin is nearly circular. It is approximately 15.5 miles in length from the eastern upper reaches to Lake Michigan. The six main tributaries take shape in the

upper reaches of the basin and flow downstream to the central part of the basin to feed the Macatawa River. Pine Creek, which flows directly into Lake Macatawa, is the only tributary in the watershed that does not join the Macatawa River upstream of Lake Macatawa (MDEQ n.d.).

River Raisin Watershed

The River Raisin and its tributaries flow into Lake Erie and form a network draining approximately 1,070 square miles of southeastern Michigan and northwestern Ohio. There are 429 lakes and ponds in the River Raisin basin, ranging in size from 800 acres (Lake Columbia, an artificial lake) to less than an acre. Most lakes are in glacial areas to the west and northwest. Elsewhere, lakes are widely scattered and generally small in size (Dodge 1998).

Drainage in the River Raisin Watershed is aided by 3,000 miles of artificial drains that are connected to tributaries of the River Raisin (Figure 3.3). The River Raisin is approximately 150 miles long and major tributaries of the River Raisin include (Dodge 1998):

- South Branch of River Raisin
- Wolf Creek
- Macon Creek
- Black Creek
- Saline River

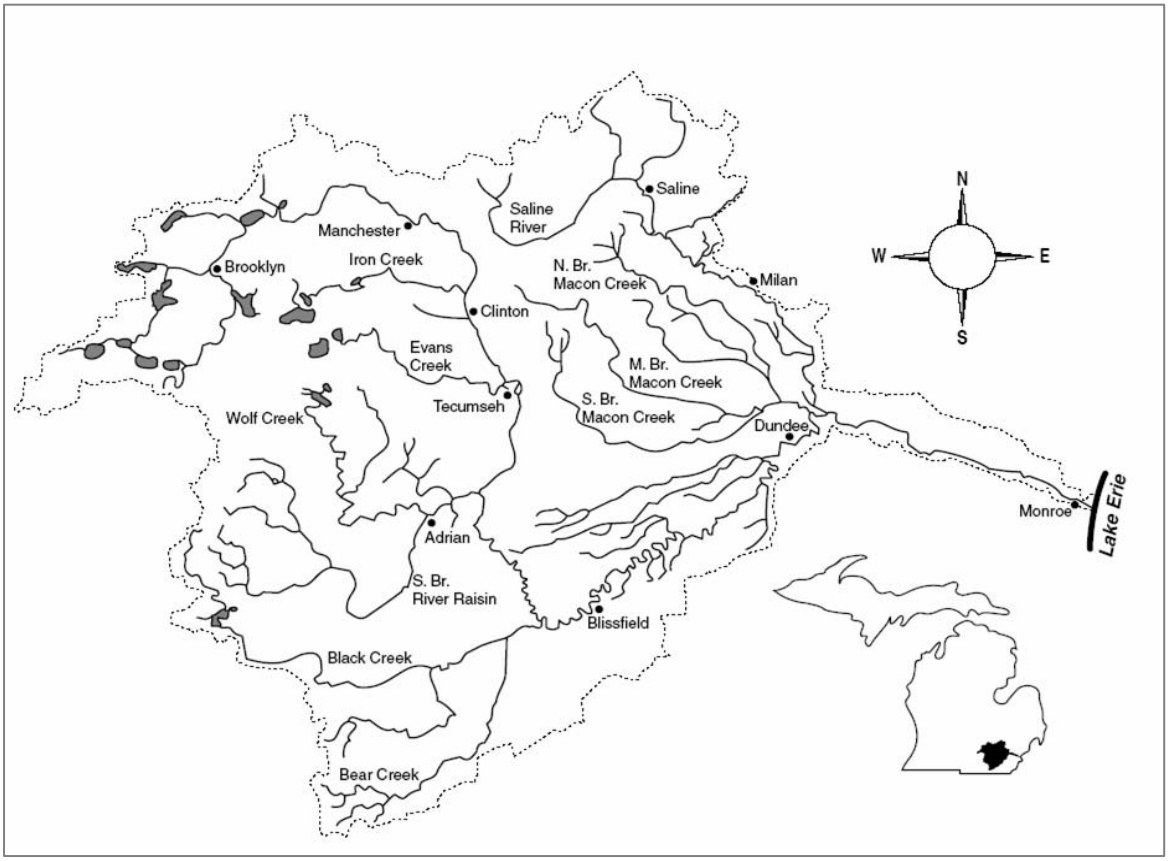


Figure 3.3. River Raisin watershed.
Source: Dodge 1998

Water Quality

Clean Water Act Integrated Report

Five categories were used to characterize and inventory waterbodies for the Integrated Report (MDEQ 2004a). These categories are summarized in Table 3.3.

Table 3.3. Summary of Water quality assessment and water quality attainment categories.

Category	Description
1	All designated uses met.
2	Some uses are met but there is insufficient data to determine if remaining uses are met.
3	Insufficient data to determine whether any uses are met.
4a	Water quality standards nonattained (EPA approved TMDL but unverified water quality standards restoration).
4b	Water quality standards nonattained (Other corrective action used but unverified water quality standards restoration).
4c	Water quality standards nonattained (Highly modified water body).
5	Water is impaired or threatened and a TMDL is needed.

Source: MDEQ 2004a

Michigan does not list waterbodies in Category 1 because comprehensive information is not available for most locations. Waterbodies in Category 2 are considered to be supporting designated uses, while waterbodies in Categories 4 and 5 are listed as not supporting designated uses. Category 3 encompasses the unassessed waterbodies or waterbodies that require further assessment (MDEQ 2004a).

Streams and Rivers

Many of the nonattainment stream sites are located in the southern half of the Lower Peninsula. This area of the State has the greatest concentration of the general population, housing development, industries, municipalities, roads, expressways, and prime agricultural lands (MDEQ 2004a). Table 3.4 summarizes streams and rivers in CREP project watersheds that have been placed in nonattainment categories.

Table 3.4. Summary of nonattainment stream and river miles in CREP project area.

	Stream and River Miles		
	Saginaw Bay	**River Raisin**	**Lake Macatawa**
Category 4a	1,339.59	81	99
Category 4b	297	0	20
Category 4c	400.5	92	56.5
Category 5	304	84	10.5

	Stream and River Miles		
	Saginaw Bay	**River Raisin**	**Lake Macatawa**
Pollutant Causing Impairment or Impaired Parameters	combined sewer overflow (CSO) DDT PCBs dioxins poor fish and macroinvertebrate communities Fish Tissue-Mercury mercury nuisance plant growths pathogen phosphorus untreated sewage discharges dissolved oxygen (DO) hexavalent chromium	chlorides CSO FCA-PCBs pathogens siltation turbidity atrazine nitrates mercury TDS	PCBs Chlordane poor fish and macroinvertebrate communities nuisance algal growths phosphorus highly modified stream channel and flows

Source: MDEQ 2004a.

The most common nonattainment causes are habitat alterations and elevated concentrations of persistent bioaccumulative toxic organic chemicals (usually Polychlorinated Biphenyls (PCBs), pathogens, sedimentation, and mercury) (Table 3.5). The major sources of pollutants contributing to nonattainment are hydromodification, inconclusive sources (including atmospheric deposition), and agriculture (Table 3.6) (MDEQ 2004a).

Table 3.5. Causes of impairments for Michigan rivers not supporting designated uses.

Causes	Impaired River Miles
Habitat Alterations	3,258
Priority Organic Compounds	1,559
Pathogens	586
Sedimentation	536
Mercury	478
Organic Enrichment/Low Dissolved Oxygen	228
Flow Alterations	191
Nutrients/Nuisance Plant Growths	136
Metals other than Mercury, Copper, or Chromium	39
Total Dissolved Solids	35
Thermal Modifications	20
Oil and Grease	17
Copper	16
Ammonia	15

Causes	Impaired River Miles
Cause Unknown	13
Chlorine	11
Bacterial Slimes	6
Chromium	3
Taste and Odor	3
Pesticides	2
Unknown Toxicity	2
Other Inorganics	0.5

Source: MDEQ 2004a.

Table 3.6. Sources of impairments for Michigan rivers not supporting designated uses.

Sources	Impaired River Miles
Hydromodification	3,094
Inconclusive Source(s) including Atmospheric	2,136
Agriculture	1,655
Contaminated Sediments	602
Industrial Point Source	480
Habitat Modification (other than Hydromodification)	400
Combined Sewer Overflows	321
Municipal Point Sources	251
Construction	154
Intensive Animal Feeding Operations	117
Domestic Wastewater Lagoon	60
Resource Extraction	57
Sediment Resuspension	54
Point Source(s) Unspecified	31
Land Disposal	19
Groundwater Loadings	16
Aquaculture	15
Urban Runoff/Storm Sewer	15

Sources	Impaired River Miles
Natural Source	12
Collection System Failure (Storm Sewer)	11
Waster Storage/Storage Tanks Leaks (Above Ground)	9
Municipal Pretreatment (Indirect Dischargers)	3

Source: MDEQ 2004a.

Lakes and Reservoirs

Many lakes with moderate to high nutrient levels are located in the southern Lower Peninsula where large population centers and fertile soils exist. Many lakes with low nutrient levels are located in the northern part of Michigan's Lower Peninsula where the population density is lower, soils are less fertile, and lakes tend to be larger and deeper. Lakes and reservoirs not attaining designated beneficial uses in the CREP project are summarized in Table 3.7.

Table 3.7. Summary of impaired lakes and reservoirs in CREP watersheds.

	Lakes and Reservoirs (Acres)		
	Saginaw Bay	**River Raisin**	**Lake Macatawa**
Category 4a	0	0	0
Category 4b	0	0	0
Category 4c	0	0	0
Category 5	5,626	1,360	1,930
Pollutant Causing Impairment or Impaired Parameters	• PCBs • Fish Tissue-Mercury • pathogens • Untreated sewage discharge	Fish Tissue-Mercury	• PCBs • chlordane • Nuisance algal growths • phosphorus

Source: MDEQ 2004a

Use impairments for Michigan's inland lakes are most commonly caused by mercury, PCBs, and pesticides (Table 3.8). The most common sources of pollutants are atmospheric deposition (inconclusive sources), contaminated sediments, municipal point sources, industrial point sources, and agriculture (MDEQ 2004a) (Table 3.9).

Table 3.8. Causes of impairments for Michigan inland lakes not supporting designated uses.

Causes	Impaired Acres
Mercury (includes Mercury Lakes and all FCA for Mercury)	203,583
Priority Organic Compounds (PCBs)	141,965
Pesticides (Chlordane and DDT)	26,667
Nutrient Enrichment/Nuisance Plant Growths (Phosphorus)	6,045
Metals Excluding Mercury and Copper	3,159
Copper	2,659
Pathogens	1,090
Taste and Odor	500
Nonpriority Organic Compounds	500

Source: MDEQ 2004a.

Table 3.9. Sources of impairments for Michigan inland lakes not supporting designated uses.

Sources	Impaired Acres
Atmospheric Deposition/Inconclusive Sources	354,761
Contaminated Sediments	10,685
Municipal Point Sources	8,646
Industrial Point Sources	7,575
Agriculture	3,245
Mine Tailings	2,659
Land Disposal	1,589
Waste Storage/Storage Tank Leaks (Above Ground)	1,320
Urban Runoff/Storm Sewers	1,265
Combined Sewer Overflow	930
Point Source(s)- Unspecified	513
Illicit Connections/Illegal Hook-Ups/Dry Weather Flows	160
Pasture Grazing	27
Intensive Animal Feeding Operations	27

Source: MDEQ 2004a.

Approved TMDLs

All three of the CREP watersheds have approved TMDLs in place (Table 3.10). The water quality concern for the majority of waterbodies with an approved TMDL is the impairment of recreational use by the presence of *E. coli.* Phosphorus, sediments and PCBs are also contaminants of concern. Agricultural land use, raw sewage inputs, urban runoff, illicit sewer connections, atmospheric deposition, and point source discharges are listed as pollutant sources (Table 3.10).

Table 3.10. Summary of approved TMDLs in CREP watersheds. For waterbodies highlighted in yellow, agriculture is potential source of pollutants.

Saginaw Bay Watershed			
Waterbody Description	**Impaired Use**	**Pollutant**	**Source(s) of Pollutant**
Coldwater River, a warmwater designated waterbody, is located in Isabella County and extends from Vernon Road upstream to its origin at Outlet Lake	aquatic life	Poor habitat quality, affected by elevated sedimentation that coated and obscured surfaces of larger substrate	periodic nonpoint source erosion and runoff from muck farming and erosion from two road crossings
Mickles Creek, a tributary to the Shiawassee River, located in Saginaw County	recreational uses	E. coli	illicit connections and raw sewage inputs
Potters Lake and 0.5 miles of Burdick Drain in Elba Township, both located in Lapeer County	recreational uses	E. coli	primarily due to failing and/or leaking septic systems Other possible sources could be from storm water runoff, animals (i.e., domestic and non-domestic), and to a lesser degree agriculture
approximately nine miles of the Cedar River in the vicinity of Gladwin	recreational uses	E. coli	Unregulated storm water runoff, illicit sewer connections, and agricultural inputs , particularly unrestricted livestock access in the upper portion of the watershed
Kintz Creek and Hunter's Creek, tributaries to the south branch of the Flint River	recreational uses	E. coli	illicit connections from residential areas poor land use practices as noted by unrestricted cattle access.
Kawkawlin River, a warmwater designated waterbody, is located in Bay County and extends 5 miles upstream from the Saginaw Bay confluence	aquatic life	PCBs	atmospheric deposition, upstream migration of contaminated anadromous fish from Saginaw Bay

Lake Macatawa Watershed			
Waterbody Description	**Impaired Use**	**Pollutant**	**Source(s) of Pollutant**
Lake Macatawa Watershed	aquatic life	Phosphorus, nuisance algal growths	Point source discharges (9%), nonpoint sources (91%) including urban and agricultural runoff.
River Raisin Watershed			
Waterbody Description	**Impaired Use**	**Pollutant**	**Source(s) of Pollutant**
Lenawee County Drain No. 70	recreational uses	E. coli	illicit sewer connections
eight miles of River Raisin near Clinton	recreational uses	E. coli	Point sources, storm water runoff, agricultural land use
Saline River near Mooreville	recreational uses	E. coli	Permitted point discharges, illicit sewer connections

Source: MDEQ 2005r.

There are two draft TMDLs that are awaiting approval from EPA in the River Raisin watershed. Nitrates and *E. coli* have both been listed as pollutants of concern in River Raisin reaches. Agricultural land use is the source of both of these pollutants and the impaired uses are public water supply for nitrates and recreational use for *E. coli* (MDEQ 2005s and MDEQ 2005t).

Areas of Concern

Saginaw Bay

The boundaries of the Saginaw Bay AOC include the entire 22 mile length of the Saginaw River and all of Saginaw Bay's 1,143 square miles -- out into its interface with open Lake Huron at an imaginary line drawn between Au Sable Point and Point Aux Barques. Over half of the land use in the region is agricultural. The primary urban and industrial centers are Flint, Saginaw, Bay City and Midland (EPA 2005g).

Contaminated sediments, fish consumption advisories, degraded fisheries and loss of significant recreational values are the major reasons for the AOC designation. These problems are mainly caused by high amounts of soil erosion, excessive nutrients such as phosphorus and nitrogen entering the water, and contaminated sediments. Saginaw Bay priorities include remediation of PCB contaminated sediment, nonpoint pollution control, wetland restoration, and habitat restoration. Beneficial use impairments include (EPA 2005g):

- Restrictions on Fish & Wildlife Consumption
- Degradation of Fish & Wildlife Populations
- Bird or Animal Deformities or Reproductive Problems
- Degradation of Benthos
- Restrictions on Dredging Activities

- Eutrophication or Undesirable Algae
- Restrictions on Drinking Water Consumption or Taste & Odor
- Beach Closings
- Degradation of Aesthetics
- Degradation of Phytoplankton and Zooplankton Populations
- Loss of Fish & Wildlife Habitat

These environmental problems are caused by cultural eutrophication (nutrients), toxic substances, bacterial contamination, and sedimentation. There are a variety of sources that continue to contribute contaminants to the Saginaw River and Bay, including sediment bedload and transport, industrial and municipal discharges, combined sewer overflows, contaminated sediments in the river and bay bottom, urban and agricultural nonpoint source runoff, old waste disposal sites, and atmospheric deposition (EPA 2005g).

River Raisin

The River Raisin AOC has been defined as the lower 2.6 miles of the River Raisin, downstream from the low head dam (Dam #6) at Winchester Bridge in the City of Monroe, extending one-half mile out into Lake Erie following the Federal Navigation Channel and along the nearshore zone of Lake Erie, both north and south, for one mile (EPA 2005h)

The River Raisin. Courtesy of USGS.

River Raisin priorities include remediation of PCB contaminated sediments, nonpoint source pollution control, and elimination of combined sewer overflows (CSOs). The RAP identified the following beneficial use impairments (EPA 2005h):

- Restrictions on Fish and Wildlife Consumption.
- Degradation of Fish and Wildlife Populations.
- Bird or Animal Deformities or Reproductive Problems.
- Degradation of Benthos.
- Restrictions on Dredging Activities.
- Eutrophication or Undesirable Algae.
- Beach Closings or Restrictions on Body Contact. (Restrictions on Body Contact apply to this AOC).
- Degradation of Aesthetics.
- Loss of Fish or Wildlife Habitat.

These impairments have been primarily caused by historical discharges of oils and grease, heavy metals, and PCBs to the river from industrial facilities in the area. Additionally, industrial and municipal waste disposal sites adjacent to the river are suspected of contaminating river water and sediments with PCBs and heavy metals and have also resulted in a loss of fish and wildlife habitat (EPA 2005h).

3.5.4 Water Quantity

Although water quantity issues are not a major component of the Michigan CREP, surface water is used for irrigation in the CREP watersheds. The amount of irrigation water applied in Michigan supplements natural precipitation and there are usually periods of the growing season when precipitation is not sufficient to meet crop needs. Irrigation water requirements vary greatly depending on the rainfall, the crop grown and its stage of development, weather conditions, and the water holding capacity of the soil. Irrigation is concentrated during the summer months when there is less rainfall and when stream flows and lake levels are at their lowest (MDA 2005e).

In 2001, of all farms irrigating 14 or more acres, St. Joseph County had the largest agriculture irrigation water use. The next largest water withdrawal counties were Montcalm, Branch, Ottawa and Van Buren (Montcalm and Ottawa counties are in the CREP project area). Together these five counties accounted for over 44 percent of the total irrigated agricultural acres and approximately 51 percent of the total agricultural irrigation statewide. The primary source of water for agriculture irrigation in these counties was groundwater (72 percent) (MDA 2005e).

The largest irrigated agriculture crop in Michigan during 2001 was corn grown for grain and seed, accounting for nearly 43 percent of the total irrigated acreage in the State and approximately 31 percent of the total water withdrawn. The next largest irrigated crop categories were soybeans, potatoes, vegetables, and greenhouse crops (including sod). Together, these categories accounted for nearly 75 percent of the total agricultural irrigated acreage in Michigan and 71 percent of the irrigation water withdrawn (MDA 2005e).

3.5.5 Agricultural Impacts to Water Quality

Agriculture is a dominant land use in all three of the CREP watersheds. Agricultural practices such as agricultural chemical use (e.g., pesticides and fertilizer) and manure application introduce sediments, nutrients, pesticides, and bacteria into waterbodies receiving runoff from cropland and other farmland. Sediment, nutrients, bacteria, and pesticides are discussed in more detail below.

Sediment

Michigan is centrally located in the Great Lakes basin and every stream in the State eventually empties into a Great Lake or connecting channel. Soil erosion and sedimentation to the Great Lakes is therefore a significant issue for Michigan (GLP 2005b).

Excessive sediments can cover important fish spawning areas, rendering them unsuitable. Much of the degradation to spawning habitat in the Saginaw Bay is a result of sedimentation and sediment loads remain excessive in the Saginaw River system. Coldwater River, a tributary to the Saginaw River, currently has a TMDL in place that addresses sedimentation. Sediment sources in Coldwater River watershed include multiple erosion runoff sites associated with muck farming land uses, road crossings, and interrupted riparian vegetation in places (Fielder and Baker 2004 and MDEQ 2001).

Sediment in a stream in the Macatawa Watershed. Photo courtesy of MDEQ.

The high rate of sediment deposition is also a problem in the Lake Macatawa watershed and suspended solids are problematic resulting in high turbidity in streams and rivers. Turbidity reduces the aesthetic value of waterbodies, decreases the amount of oxygen available to fish and other aquatic life, and result in poor aquatic habitat quality (MDEQ 1999). Agricultural sources of sediments include field and crop erosion and stream bank erosion caused by unrestricted livestock access to riparian areas (MACC 2005b).

Issues concerning soil erosion are discussed further in Section 3.10, Soil Resources.

Nutrients

Nitrogen and phosphorus are critical nutrients for all plants, including aquatic plant species. Nutrient sources from human activities include sewage, fertilizers, detergents, and surface runoff. In Michigan, rooted aquatic vegetation and algal growth are most commonly limited by the amount of phosphorus in the water column. Generally, as the concentration of phosphorus in the water column increases, rooted plants and algal growth increase. Sediment phosphorus content can also increase the abundance of rooted aquatic vegetation. Elevated levels of phosphorus result in rooted aquatic vegetation and algal growth that can be excessive and lead to nuisance conditions (i.e., eutrophication). Nuisance plant and algal growth conditions caused by elevated nutrient levels are violations of Michigan's Water Quality Standards. Such conditions can reduce the recreational value of the waters by making the water unpleasant and undesirable for swimming, fishing, or boating. Inland lake quality and eutrophication are monitored as part of the goals outlined in Michigan's monitoring strategy (MDEQ 2004a). Nutrients are a problem in all three of the CREP watersheds. Each watershed is discussed in more detail below.

Saginaw Bay Watershed

Since the 1960s, Saginaw Bay waters have contained much higher levels of phosphorus than the remainder of Lake Huron, which has shifted the bay from a mesotrophic (middle of the productivity scale) to a eutrophic (high nutrient level, high productivity) system. When rapid eutrophication occurs, many beneficial uses associated with lower productivity levels are impaired (EPA 2005g).

During the 1970s and 1980s, the Saginaw River added nearly two metric tons of total phosphorus per day to the bay, the largest contribution of phosphorus to the Great Lakes by any river in Michigan. The added phosphorus increased the growth of nuisance blue-green algae that was likely responsible for the foul odors and poor taste of drinking water withdrawn from the bay. This added phosphorus is also linked to associated beach closings (EPA 2005g).

It is estimated that 80 to 90 percent of the current phosphorus load into Saginaw Bay is from nonpoint sources. Water quality monitoring has shown that total phosphorus concentrations entering streams and rivers are highest in agricultural areas (PSC 2002).

River Raisin Watershed

Nitrates have been identified as a pollutant of concern in the River Raisin. Nitrate levels are impairing the public water supply at Deerfield, Michigan. Nonpoint sources contribute over 95 percent of the nitrate load to the River Raisin at Deerfield, with over 59 percent of that load from fertilizers and 10 percent from livestock waste. Other nonpoint sources include atmospheric deposition and runoff from nonagricultural lands (MDEQ 2005t).

Lake Macatawa Watershed

Lake Macatawa is considered to be one of the most nutrient enriched lakes in Michigan. Phosphorus has been identified as the nutrient causing many water quality problems such as nuisance algal blooms and low dissolved oxygen levels (MDEQ 1999).

The phosphorus inputs are distributed throughout the Lake Macatawa Watershed, with nonpoint sources accounting for 91 percent of the annual average phosphorus load. The prevalent land use in Lake Macatawa Watershed is agriculture. Agricultural practices that have been identified as contributing phosphorus to Lake Macatawa include (MACC 2005b):

- Streambank erosion
- Field and crop erosion
- Runoff of fertilizers, sediment, and organic material into streams and ditches
- Fertilizer, manure, and septage misapplication

Bacteria

Bacteria in surface water poses health risks to humans who come in contact with pathogen during recreational activities such as fishing, swimming, wading, and boating.

Septage application to cropland in Michigan. Photo courtesy of MDEQ.

Many of the TMDLs in the CREP project area are for the bacteria *E. coli*, including four TMDLs in the Saginaw Bay watershed and three in the River Raisin watershed. Four of these TMDLs have listed agriculture as a possible source of *E. coli.* Possible agricultural sources of bacteria are unrestricted livestock access to riparian areas and septage (liquid or solid material removed from a septic tank, cesspool, or portable toilet) and manure applications to croplands (MDEQ 2004a). Non-agricultural sources include sewer system overflows, septic tanks, and recreational use (MDEQ 2004a).

A draft TMDL for *E .coli* in the River Raisin watershed indicates that *E .coli* is entering waterbodies from pastureland and land applications of manure. The manure enters through field drainage systems such as tiles. Tile drainage systems have significant transport under all manure application protocols and environmental conditions (MDEQ 2005s).

Pesticides

Pesticides are applied to farmland throughout the CREP project area (Table 2.1) and waterbodies in the CREP project area have been listed in the Integrated Report for impairment because of pesticide concentrations. Table 3.11 summarizes pesticide impairment in CREP watersheds.

Table 3.11. Summary of pesticides causing impairment in CREP watersheds.

Watershed	Pesticide	Common source or use
Saginaw Bay	DDT	Widespread use in contact insecticide, banned in 1972. Current sources include storage in sediments that are mobilized during erosional processes.
River Raisin	Atrazine	Herbicide used primarily on corn and soybean.
Lake Macatawa	Chlordane	Insecticide used on agricultural crops, such as corn, potatoes, and tomatoes.

Source: MDEQ 2004a and Rheaume et al. 2001.

Water Quantity

As stated above, irrigation water use occurs mainly in the summer months when stream flows and lake levels are low. Additional withdrawals for irrigation from surface water and groundwater connected to surface water can lead to excessively low flows and may even result in no flow situations in streams and rivers. This is particularly a problem in the River Raisin watershed during years with low precipitation, particularly in smaller tributaries in the eastern portion. Water withdrawals, primarily for agricultural irrigation, exacerbate this problem, especially since River Raisin derives 90 percent of its flow from groundwater (Frey 2001 and Dodge 1998). This phenomenon has been observed in the River Raisin watershed when drought conditions occurred in late spring and summer of 1988. The flow at the downstream dam in Manchester was zero cubic feet per second and many of the locations on tributary streams had no stream flow on July 13 (Dodge 1998).

3.5.6 Effects of Alternative A (No Action) on Surface Water

Implementation of Alternative A would result in long term, moderate adverse effects to surface water resources. Surface water quality would continue to decline under Alternative A. Agricultural runoff introduces contaminants into surface water and any improvements in water quality would be dependant upon existing and proposed programs. Without CREP, these programs will not be as effective in improving and protecting surface water quality.

Selection of Alternative A would not contribute to achieving any of the CREP Objectives listed in Section 1.4.

3.5.7 Effects of Alternative B (CREP Agreement) on Surface Water

Implementation of Alternative B would provide long term, moderate to high beneficial effects to surface water quality and quantity. Alternative B would result in significant localized improvements to water quality and would help waterbodies achieve and continue to meet State water quality standards. Additionally, acres enrolled in CREP would be removed from irrigation which would result in improvements to water quantity.

Improvements to water quality would come from the installation of all of the approved CPs. For example, CP21 and CP22 (filter strips and riparian buffers) are effective in removing waterborne pathogens, nutrients, pesticides, and sediments, thereby reducing the amount of the contaminants in agricultural runoff. Riparian buffers also create shade to lower water temperature to improve habitat for aquatic organisms, provide a source of detritus and large woody debris for aquatic organisms, help stabilize and restore damaged stream banks, and reduce erosion of stream banks. CPs 23 and 23A (wetlands restoration) would provide larger areas to retain solids, filter and cycle nutrients, and reduce erosion. Additionally, land enrolled in CPs would not receive pesticide and nutrient applications, reducing pollutant loads in agricultural runoff from previously cropped land.

Bush Creek, Gratiot County CREP Filter Strip. Courtesy of MDEQ 2004c.

Preliminary calculations of targeted pollutants indicate substantial reductions in sediment and related nutrients entering waterbodies as a result of just the filter strips alone (Table 3.12) (MDEQ 2004c). Based on these figures, and on the fact that only about 60 percent of CREP acreage has been enrolled to date, it is reasonable to assume that, over time, CREP could be expected to result in considerable improvements to water quality.

Table 3.12. Summary of estimated pollutant load reductions that would be controlled by filter strips in CREP watersheds.

Watershed	Acres of Filter Strip (as of 2003)	Sediment Controlled (Tons/year)		Sediment Borne Phosphorus Controlled (Pounds/year)		Sediment Borne Nitrogen Controlled (Pounds/year)	
		Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
Saginaw Bay	21,049	18,603	41,419	31,790	69,754	63,242	137,775
River Raisin	2,497	2,276	5,060	3,945	8,689	7,890	17,378

Note: To help put these estimates in context, the annual average of total phosphorus from the Saginaw River to Saginaw Bay over the period 1986-1995 has been estimated to be 1.8 million pounds
Source: MDEQ 2004c.

Implementation of CREP could also potentially aid in the attainment of the TMDL goals for waterbodies in each of the three watersheds. For example, cropland that is currently receiving manure applications could possibly be enrolled in CREP, decreasing bacteria loads reaching receiving waterbodies. In addition, many of the CPs (e.g., grass waterways, riparian buffers) could also have the leveraged benefit

of filtering bacteria in runoff from agricultural land (i.e., livestock pastures and animal feeding operations) not enrolled in CREP.

Activities associated with the implementation of CPs could potentially result in short-term, adverse impacts to surface water quality and quantity, including:

- Site preparation— CP establishment could require site preparation activities including building physical structures such as dikes and clearing enrolled land of undesirable plant species using chemicals such as herbicides and/or physical methods such as burning, discing, and plowing.
- Establishment of desirable plants and controlling invasive species or noxious weeds— Until desired plants are established, acres enrolled in CREP may be irrigated, potentially affecting water quantity.
- Maintenance of CPs—Maintaining CPs on enrolled CREP land may include additional shifting soil to repair dikes or buffer strips, applying herbicides and/or pesticides to control invasive species, or irrigating land during critical growing periods of drought years.

A conservation plan for each CP would be prepared and BMPs will be used to mitigate any adverse impacts of implementing specific CPs. These impacts are expected to only last until the CP is permanently established and are minor compared to the overall long-term benefits of the CPs. These temporary impacts could be expected to last anywhere between one to three years.

The beneficial impacts of the CPs discussed above would provide long-term moderate to high beneficial effects, assisting in the achievement of all four CREP Objectives in Section 1.4.

3.6 Groundwater Resources

3.6.1 Introduction

Groundwater can be defined as water that occurs in the open spaces and geologic layers below the surface of the earth. These layers are referred to as aquifers where such geologic units yield sufficient water for human use. Figure 3.4 shows the location of aquifers in Michigan.

Groundwater is a major natural resource in the Great Lakes Region because it indirectly contributes more than 50 percent of the stream discharge to the Great Lakes. In addition, groundwater supplies drinking water for millions of people in the region, is an important source for agriculture and many industries, and provides a relatively uniform supply of water in some ecologically sensitive areas sustaining plant and animal species (Grannemann et al. 2000). Groundwater issues in the Great Lakes Basin mainly concern water quality and quantity; these issues will be addressed in Existing Conditions below.

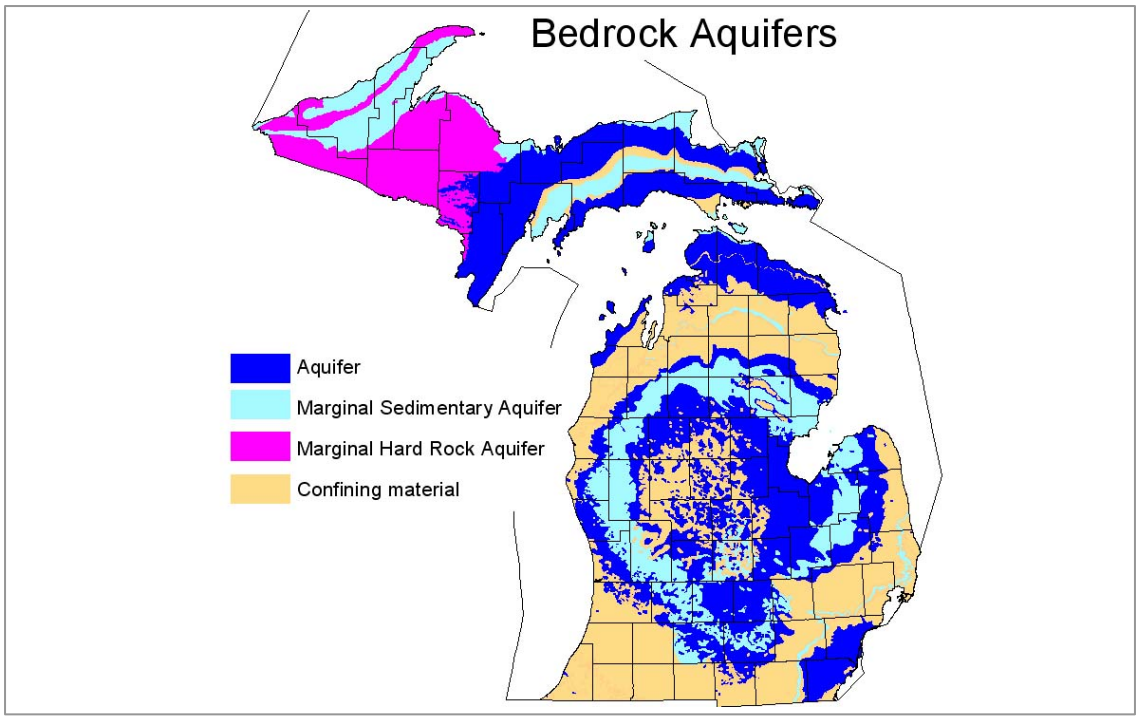


Figure 3.4. Location and characteristics of aquifers in Michigan.
Source: MDEQ 2005n.

Despite the importance of groundwater to the Great Lakes, few studies have been conducted that evaluate groundwater resources in the region; therefore groundwater in the Great Lakes Basin is poorly understood. This is partly because the quantity of water in the Great Lakes and other surface water resources are so abundant that groundwater in the Great Lakes Basin (and subsequently Michigan) is often overlooked when evaluating the hydrology of the region (Grannemann et al. 2000).

Michigan State Laws

Currently, there is no single comprehensive groundwater law in Michigan that regulates the protection and management of groundwater quantity and quality. Michigan laws that incorporate groundwater elements include the Groundwater and Freshwater Protection Act of 1994 and NREPA. State agencies which administer programs which help protect groundwater include (GWPC 1999):

- Department of Environmental Quality
- Waste Management Division
- Storage Tank Division
- Environmental Response Division
- Geological Survey Division
- Drinking Water and Radiological Protection
- Water Division, Groundwater Section
- Michigan Department of Agriculture
- Pesticide and Plant Pest Division
- Farmland Services Division

In August 2003, the Michigan Legislature passed Public Act (PA) 148 and 177, requiring that a groundwater inventory and map be generated for the State by August 2005 and setting up a procedure to

address groundwater withdrawal conflicts in the State (MDEQ 2005n). The groundwater inventory and map will be useful in determining agricultural impacts to groundwater and will include the following information (MDEQ 2005n):

- Location and water-yielding capabilities of aquifers in the State.
- Aquifer recharge rates in the state, if available to the department.
- Static groundwater water levels in the State
- Base flow of rivers and streams in the State.
- Conflict areas in the State.
- Surface waters, including designated trout lakes and streams, and groundwater dependent natural resources identified on the natural features inventory.
- The location and pumping capacity of all of the following:
- Industrial or processing facilities registered under Section 32705 that withdraw groundwater.
- Irrigation facilities registered under Section 32705 that withdraw groundwater.
- Public water supply systems that have the capacity to withdraw over 100,000 gallons of groundwater per day average in any consecutive 30-day period.
- Aggregate agricultural water use and consumptive use by township

3.6.2 Existing Conditions

Groundwater is water source for approximately 45 percent of Michigan citizens and is used for drinking water, irrigation, and industrial uses. Total groundwater use in Michigan is approximately 700 million gallons per day (mgd). Groundwater withdrawals include (MDEQ 2005o):

- 194 mgd for private household wells,
- 100 mgd for irrigation, and
- 180 mgd for industrial use.

The majority of information about groundwater presented in this analysis concerns the Great Lakes Basin and is adapted from a USGS report titled: *The Importance of Ground Water in the Great Lakes Region* (Grannemann et al. 2000). When possible, specific information about groundwater in the CREP project area watersheds is presented. However, since all of the CREP project watersheds are located in the Great Lakes Basin, this information is applicable to all of the watersheds.

Groundwater Quality

Groundwater quality is as important as quantity for most water uses. As groundwater development proceeds, the possibility of altering the quality of groundwater increases. The quality of groundwater can be altered when water levels are drawn below the layer that confines the aquifer or by inducing water of lesser quality into an aquifer. Many local studies of these problems have been conducted, but few regional-scale analyses of groundwater quality changes resulting from groundwater development have been done (Grannemann et al. 2000).

A local study that applies to the CREP project area is the groundwater contamination vulnerability study for the Lake Erie watershed conducted by the USGS, which includes the River Raisin watershed (Frey 2001Frey 2001). This area included the northeastern part of the Corn Belt, where row crop agriculture is the dominant land use and pesticide and fertilizer application is common (Frey 2001).

Rates of pesticide use in the Lake Erie Basin are among the highest in the country; pesticides used include metolachlor, atrazine, cyanazine, acetochlor, and alachlor—all herbicides commonly applied to corn and soybeans. Pesticides or pesticide degradates were detected in 41 percent of the monitoring wells and six percent of the domestic wells. The detected pesticides closely correspond to those most heavily applied (including metolachlor, atrazine, cyanazine, acetochlor, alachlor, and bromoxynil). Pesticide degradates were detected three times more frequently and at higher concentrations than were parent compounds (Frey 2001).

Nitrogen occurs naturally in soil organic matter and the atmosphere. Anthropogenic sources of nitrogen include chemical fertilizers, manure, septic-system effluent, and fossil-fuel combustion products. In the Lake Erie Basin, fertilizer application rates are reported to be among the highest in the country therefore, agricultural fertilizers are assumed to be the major source of nitrogen to the groundwater. Thirty-seven percent of monitoring well samples in the Lake Erie Basin study had nitrate concentrations indicative of human influences such as fertilizer, manure, or septic systems (Frey 2001).

Arsenic is a metal often found in low amounts naturally. Arsenic comes in two forms: organic and inorganic. Elevated levels of inorganic arsenic, the more harmful form to humans, have been found in the groundwater in some areas of Michigan (Figure 3.5). Inorganic arsenic is believed to exist naturally in certain geologic formations in the State (MDCH 2005). More information about groundwater quality related to drinking water is presented in Section 3.7.

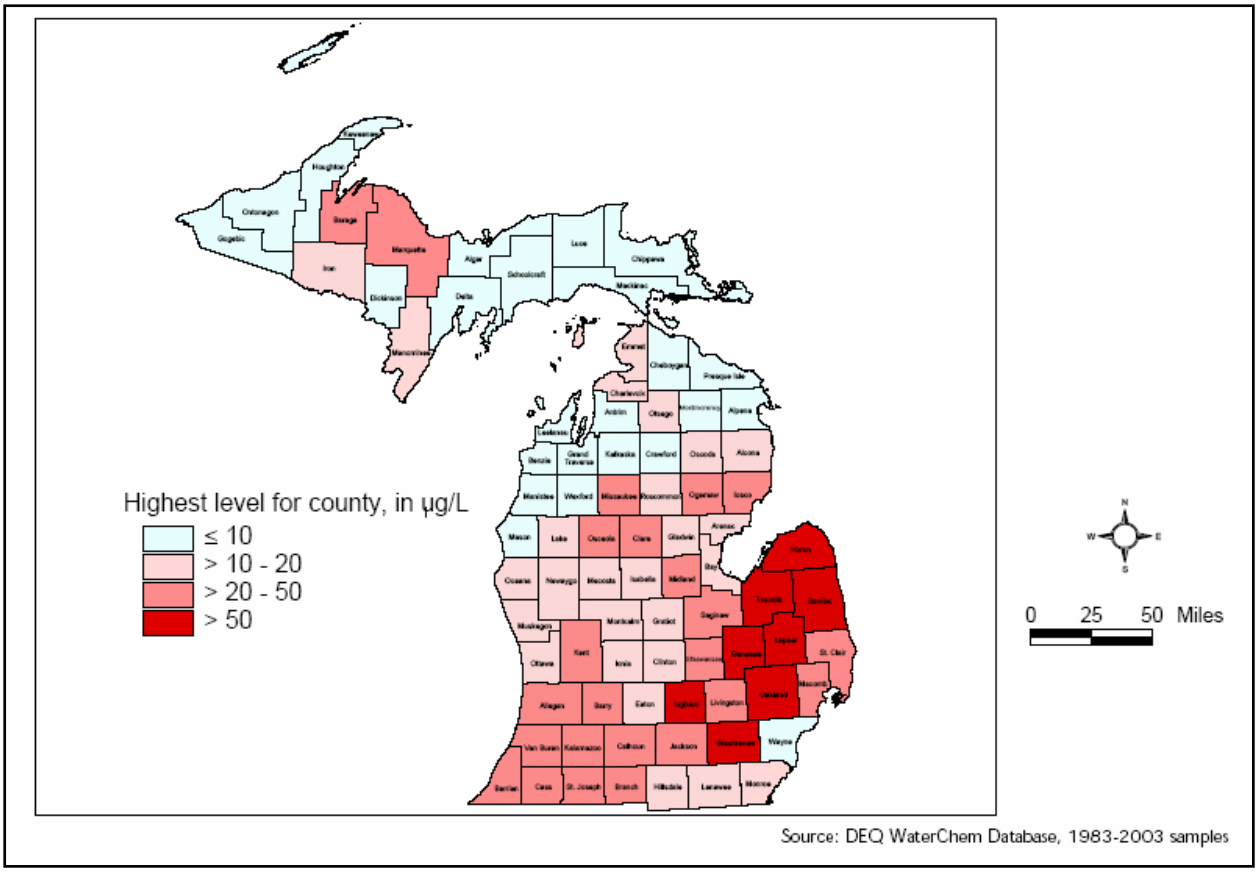


Figure 3.5. Arsenic levels in Michigan's groundwater.
Source: MDEQ 2005p.

Groundwater Quantity

Issues related to groundwater quantity generally focus on two main issues: (1) the balance between groundwater withdrawal and recharge and (2) groundwater-surface water interactions.

Groundwater Withdrawal and Groundwater Recharge

Withdrawal of groundwater removes water from the watershed when the water is consumptively used and/or when the return flow is discharged to another drainage basin. When groundwater withdrawals and consumptive uses exceed recharge, groundwater levels in the aquifer may decline. At present, the effects of groundwater withdrawals in the Great Lakes Region have been quantified in detail at only a few urban locations (Grannemann et al. 2000).

Rainfall records show that Michigan is the driest state east of the Mississippi River during the critical growing months of July and August. However, annual rainfall exceeds annual crop and landscape water use. Therefore, water is typically available to recharge aquifers and supply surface water needs in rivers, lakes and wetlands during other parts of the year (MDA 2005e). Figure 3.6 shows recharge rates for Michigan's Lower Peninsula.

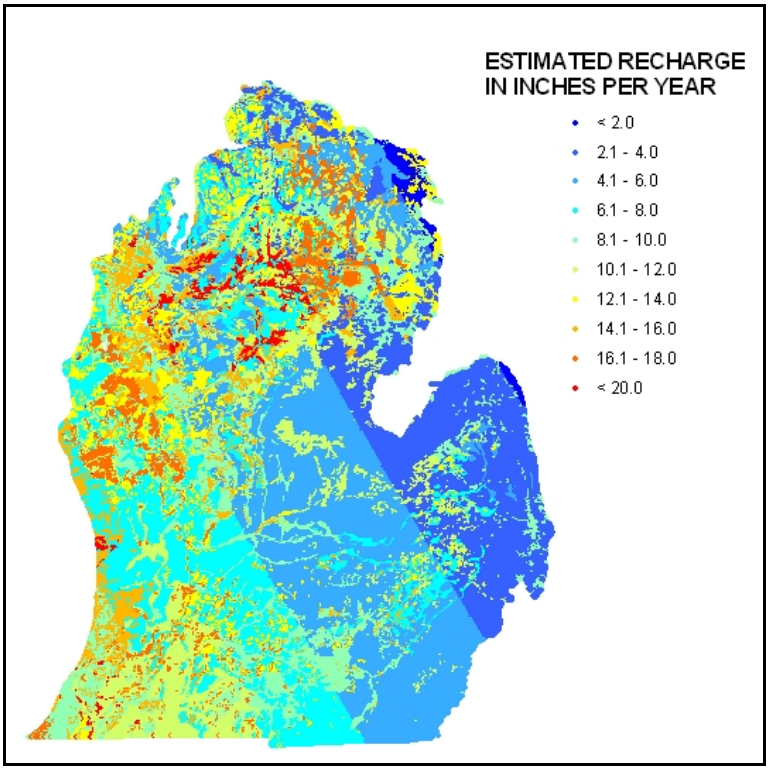


Figure 3.6. A generalized estimate of groundwater recharge rates (inches per year) in the Lower Peninsula of Michigan.
Source: MDEQ 2005n.

Groundwater -Surface Water Interactions

In most instances, the flow of a stream includes both a surface-water runoff component and a groundwater inflow component (groundwater discharge). The fraction of total streamflow originating from groundwater must be known to analyze and understand the interaction between surface water and groundwater in the stream. Groundwater discharge is a long-term, persistent component that results from

that part of precipitation that infiltrates into the soil, percolates into an aquifer, and then flows to a stream (Grannemann et al. 2000). Groundwater withdrawals can potentially lead to declines in surface water flows.

The Great Lakes are in topographically low settings that, under natural flow conditions, cause them to function as discharge areas or "sinks" for the groundwater flow system. Most groundwater that discharges directly into the lakes is believed to take place near the shore. Of all the Great Lakes, Lake Michigan has the largest amount of direct groundwater discharge because it has more sand and gravel aquifers near its shore than any of the other Great Lakes (Grannemann et al. 2000).

Indirect discharge of groundwater to the Great Lakes occurs when groundwater is discharged into tributaries to the Great Lakes. It has been estimated that the average groundwater component of streamflow ranges from 48 percent for Lake Erie to 79 percent for Lake Michigan (Figure 3.7) (Grannemann et al. 2000). In the River Raisin watershed, the groundwater component is estimated to be close to 90 percent (Frey 2001).

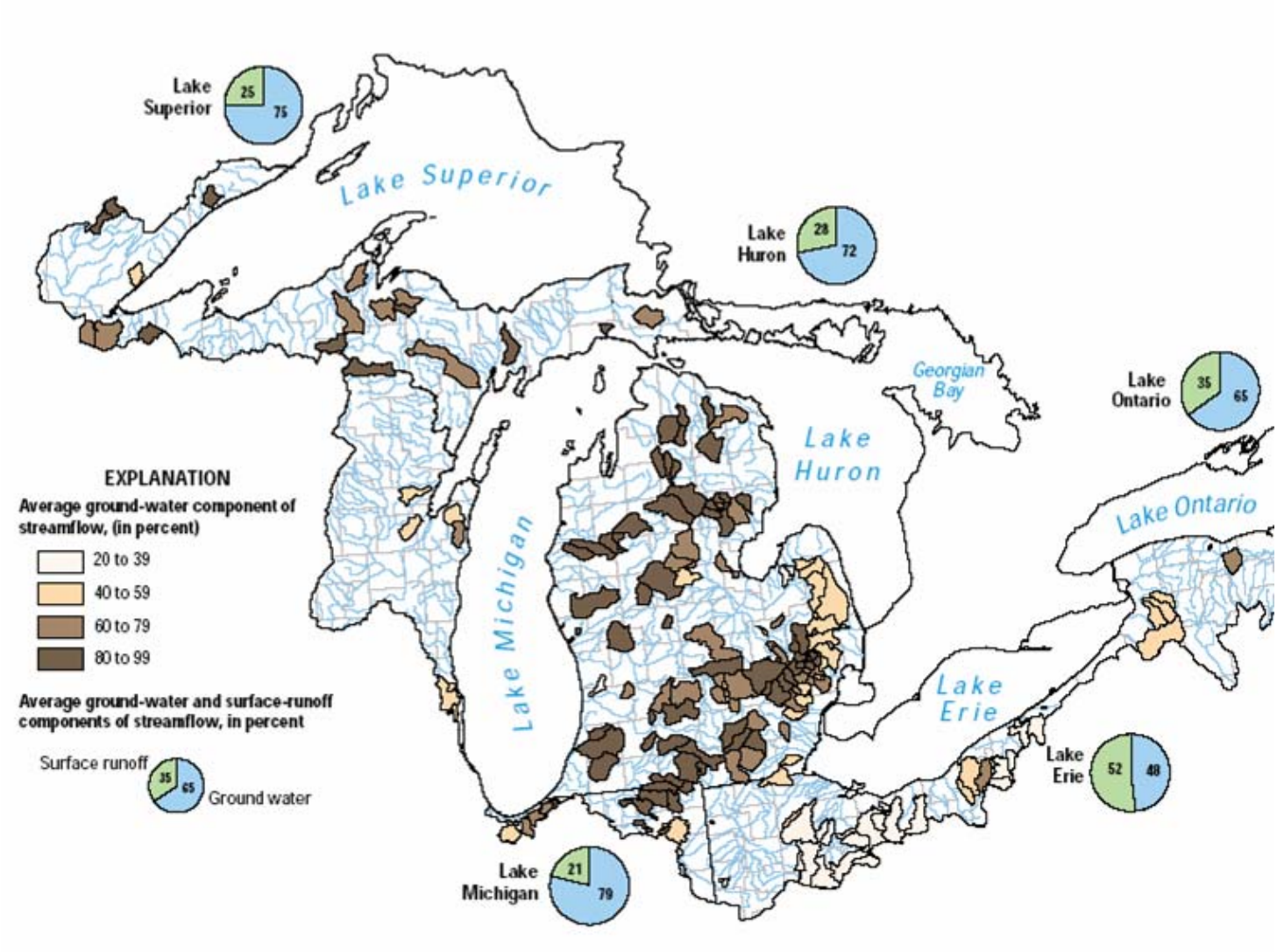


Figure 3.7. Average groundwater component of streamflow in Great Lakes Region.
Source: Grannemann et al. 2000.

3.6.3 Agricultural Impacts to Groundwater

Groundwater Quality

Agricultural chemicals have been detected in groundwater throughout Michigan (see Existing Conditions above) (MDA 2005c). In the River Raisin watershed, the CREP watershed with the most agricultural land use, pesticides and nitrates are detected with relative frequency (Frey 2001). Since the aquifer characteristics of the River Raisin watershed are similar to the other CREP watersheds (see Figure 6), it is expected that pesticides and nitrates are potentially present in the groundwater underlying these watersheds.

Since groundwater quality affects both public drinking water supplies and domestic drinking water supplies, groundwater quality issues related to agricultural use is also discussed in Section 3.7, Drinking Water.

Groundwater Quantity

Irrigation is the largest consumptive use of water in the Great Lakes watershed and groundwater contributes about half of the irrigation water. In areas where surface water sources are not readily available, it is likely that groundwater would be the water source if new irrigation systems are installed (Grannemann et al. 2000).

3.6.4 Effects of Alternative A (No Action) on Groundwater

Alternative A would result in long term, moderate adverse effects to groundwater quality and quantity. Under Alternative A, current agricultural practices would continue and groundwater quality and quantity would continue to decline as a result of the introduction of pesticides and nutrients. Improvements to groundwater would be dependent on existing programs.

Selection of Alternative A would not contribute to the achievement of any of the CREP Objectives in Section 1.4.

3.6.5 Effects of Alternative B (CREP Agreement) on Groundwater

Implementation of Alternative B would result in moderate to high beneficial long-term effects to groundwater. Enrollment of land in FSA approved CPs would result in benefits to groundwater quality and quantity.

The retirement of 80,000 acres of land from active agricultural practices would result in less fertilizers and pesticides applied in the CREP project area and groundwater recharge from land enrolled in CREP is expected to be of higher quality than recharge from previously cropped land. Filtration of sediment, nutrients, pesticides, and pathogens provided by the CPs would help improve the quality of groundwater recharge.

Converting cropland to CPs would remove numerous acres from active agriculture production and diminish groundwater pumping to irrigate those acres. Groundwater recharge would also increase with the establishment of CP22 (riparian buffer) and CP23 (wetland restoration). Wetlands are reservoirs for rainwater and runoff and as this water is released into the ground, it recharges water tables and aquifers.

Activities associated with the implementation of CPs could potentially result in short-term, adverse impacts to groundwater quality and quantity. These activities and their impacts include:

- Site preparation— CP establishment could require site preparation activities including building physical structures such as dikes and clearing enrolled land of undesirable plant species using chemicals such as herbicides and/or physical methods such as burning, discing, and plowing. These activities have the potential to add sediments and pesticides to surface water that recharges aquifers.
- Establishment of desirable plants and controlling invasive species or noxious weeds— Until desired plants are established, acres enrolled in CREP may be irrigated, potentially affecting water quantity.
- Maintenance of CPs—Maintaining CPs on enrolled CREP land may include additional shifting soil to repair dikes or buffer strips, applying herbicides and/or pesticides to control invasive species, or irrigating land during critical growing periods of drought years.

A conservation plan for each CP would be prepared and BMPs will be used to mitigate any adverse impacts of implementing specific CPs. These impacts are expected to only last until the CP is permanently established (1-3 years) and are minor compared to the overall long-term benefits of the CPs. These temporary impacts could be expected to last anywhere between one to three years.

The beneficial impacts of Michigan CREP as discussed above would provide long-term moderate to high beneficial effects, assisting in the achievement of all four CREP Objectives (Section 1.4)

3.7 Drinking Water

3.7.1 Introduction

The Safe Drinking Water Act (SDWA) was originally passed in 1974 to regulate public drinking water supplies. SDWA established standards for various contaminants to ensure that water is safe for human consumption. The MDEQ has primary enforcement authority in Michigan for SDWA under the legislative authority of the Michigan Safe Drinking Water Act. As such, the division has regulatory oversight for all public water supplies, including approximately 1,500 community water supplies and 11,000 noncommunity water supplies. In addition the program regulates drinking water well drilling. Michigan has more households (1.12 million) served by domestic wells than any other state, with approximately 25,000 domestic wells drilled per year. The MDEQ also investigates drinking water well contamination, and oversees remedial activities at sites of groundwater contamination affecting drinking water wells (MDEQ 2005e).

Additional amendments to SDWA require states to develop programs to assess and protect public water sources. The two programs discussed here are the Wellhead Protection Program (WHPP) and Source Water Assessment Program (SWAP).

Wellhead Protection Program

Amendments to SDWA in 1986 requested states to establish a WHPP for groundwater-based public water supplies. For local communities that use groundwater for their municipal drinking water supply systems, this program assists the protection of their water source. A WHPP minimizes the potential for contamination by identifying and protecting the area that contributes water to municipal water supply wells and avoids costly groundwater clean-ups (MDEQ 2005f).

With public participation, each state was directed to develop a WHPP Plan that was to be reviewed and approved by EPA. Unlike many programs throughout the country, wellhead protection is a voluntary program implemented on a local level through the coordination of activities by local, county, regional,

and State agencies (MDEQ 2005f). The current status of Michigan's WHPP will be discussed under Existing Conditions.

Source Water Assessment Program

Reauthorization of the SDWA in 1996 required states to develop programs that assessed drinking water sources and encouraged the establishment of protection programs. States must develop a SWAP that identifies significant potential sources of contamination and determines a drinking water source's vulnerability to contamination. Throughout the country, all states have developed a SWAP with the following basic components (MDEQ 2004b):

- Delineate the source of each public drinking water system;
- Identify potential contaminants in the source area;
- Determine the drinking water source's susceptibility or vulnerability to contamination; and
- Make the assessments available to the public.

Michigan's SWAP will be discussed in more detail in the Existing Conditions section.

3.7.2 Existing Conditions

Public water supply systems provide drinking water for approximately 73 percent of Michigan's population, with domestic well systems providing drinking water for the remaining 27 percent (MDA 2005c). Water resources in the CREP project area supply drinking water to over 1 million of Michigan's residents (FSA 2000).

Public Water Supply Systems

Both groundwater and surface water supply drinking water to Michigan's residents. Table 3.13 summarizes the public water supply systems for Michigan.

Table 3.13. Michigan public water supply systems.

Groundwater Supplies	
Noncommunity Systems	10,650
Community Systems	1,123
Purchased Groundwater Systems	42
Surface Water Supplies	
Surface Water Intakes	
Inland Rivers	8
Great Lakes	52
Surface Water Intake Subtotal	60
Purchased Surface Water Systems	233
Total Active Community Systems	**1,460**
Total Number of Public Water Supply Systems	**12,108**

Source: MDEQ 2004b.

Surface water supplies provide drinking water to over 55 percent of the State's population, or about 5.5 million people. Surface water intake types include Great Lakes, Great Lakes connecting channels, and inland river and/or inland lakes. Although there are only 60 surface water intakes, these 60 sources

provide drinking water to over 75 percent of the persons served by public water systems (MDEQ 2004b). Figure 3.8 shows the location of community water supplies using surface water and intake locations.

Figure 3.8. Community water supplies using surface water in southern Michigan.
Note: The blue dots show intake location.
Source : MDEQ 2004b.

In the CREP project area, the majority of public water is supplied by the Great Lakes (Table 3.14). In the Saginaw Bay watershed, nearly 69 percent of water withdrawals are from only two watersheds, the Au-Gres Rifle and the Saginaw, which receive 98.8 and 100 percent, respectively, of their water from the Great Lakes (MDEQ 2005m).

Table 3.14. Summary of public water supplies in CREP project area.

Watershed	No. Systems	Water Withdrawn[1]			
		Great Lakes	Surface Water	Groundwater	Total
Black-Macatawa	43	53.81	0	0.51	54.33
River Raisin	36	8.86	3.74	5.88	18.47
Saginaw	244	60.07	0.69	26.4	87.17
Total	323	122.74	4.43	32.79	159.97

[1] Millions of gallons per day.
Source: MDEQ 2005m.

Wellhead Protection Program

The purpose of Michigan's WHPP is to protect those public water supply systems (PWSSs) using groundwater from potential contamination sources. Protection is provided by identifying the area which contributes groundwater to public supply wells, identifying sources of contamination within the area, and developing methods to cooperatively manage the area and minimize the threat to drinking water (MDEQ 2005f).

Although the program is voluntary, PWSSs choosing to participate in wellhead protection must develop a local WHPP consistent with the guidelines established by the State. Local WHPPs must specifically address seven elements, including:

- Establishing roles and duties,
- Wellhead protection area (WHPA) delineation,
- Identifying sources of contamination within the WHPA,
- Developing mechanisms to manage the WHPA and minimize threats to the PWSS,
- Developing contingency plans for water supply emergencies,
- Identifying procedures for the development of new well sites and incorporating them into the local WHPP, and
- Providing opportunities for public participation.

Various State and local regulations are integrated into the local WHPP and provide legal authority for a broad range of activities which help support local wellhead protection efforts (MDEQ 2005f).

As of 2004, there were 120 Community Public Water Supplies that had approved WHPPs and an additional 80 that had an approved Delineation (MDEQ 2004b).

Source Water Assessment Program

Michigan has over 12,000 public water supplies with an estimated 18,000 sources requiring assessment. Approximately 10,650 are noncommunity public water supplies with groundwater as the source. There are approximately 1,250 community systems, including 650 systems using groundwater sources and supplies that purchase water (MDEQ 2004b).

In 1998, the MDEQ convened a SWAP Advisory Committee to assist with developing the Michigan SWAP. This committee included stakeholders from Federal and State regulatory agencies, local health departments, universities, nonprofit organizations, and representative trade associations. The final SWAP document was submitted to the EPA in February 1999 and approved in October 1999 (MDEQ 2004b). Figure 3.9 shows the location of watersheds with source assessment areas in Michigan.

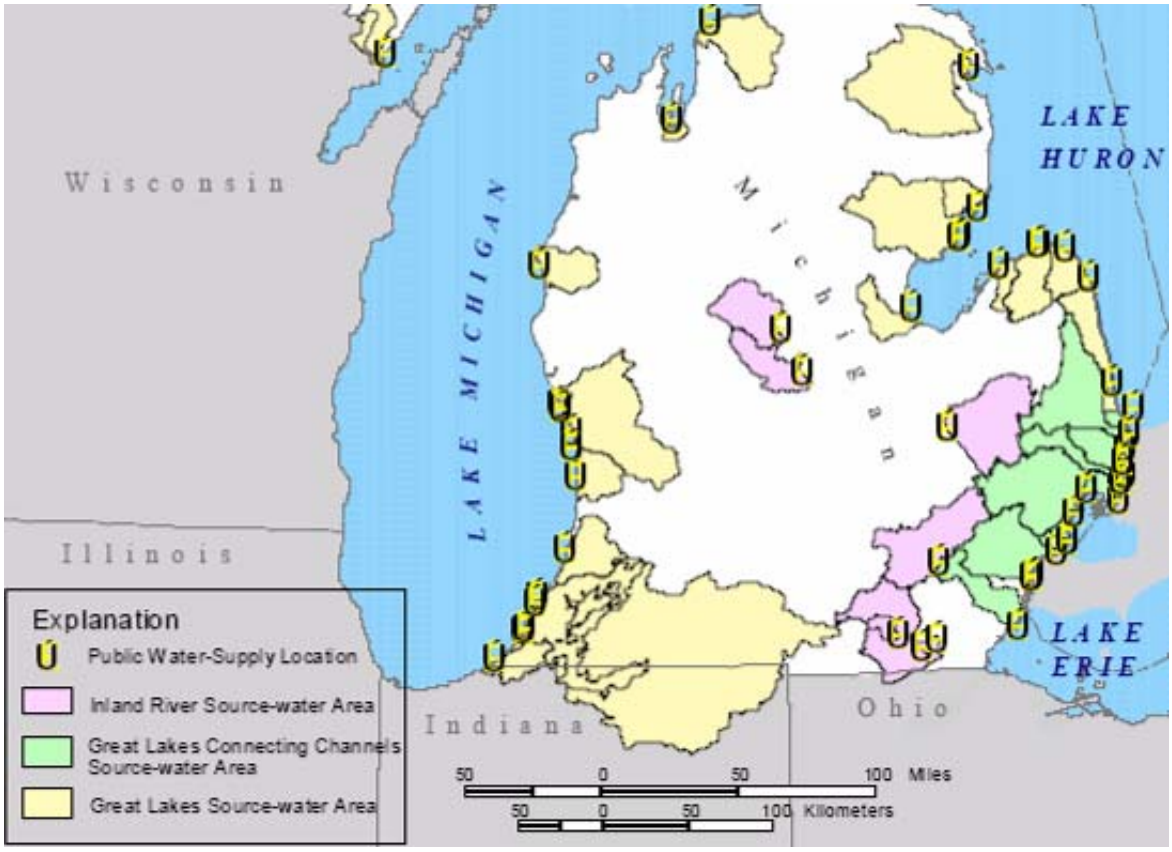


Figure 3.9. Watersheds in Michigan public water supply source water assessment areas.
Source: MDEQ 2005g.

Public Water Supply System Violations

PWSSs are required to regularly monitor for a variety of contaminants harmful to human health. In compliance with 1996 amendments to the SDWA, violations must be reported and made available to the public. In 2003, a total of 1,223 violations were reported in 911 different systems (MDEQ 2005h). Table 22 summarizes the 2003 violations for Michigan. The following are definitions of terms in the 2003 Michigan Annual Compliance Report used in Table 3.15 (MDEQ 2005h).

Public Water Supply System —A PWSS is a system that provides water via piping or other constructed conveyances for human consumption to at least 15 service connections or serves an average of at least 25 people for at least 60 days each year.

Maximum Contaminant Level (MCL)— Under the Federal SDWA, EPA sets national limits on contaminant levels in drinking water to ensure that the water is safe for human consumption. These limits are known as maximum contaminant levels (MCLs).

Table 3.15. Summary of 2003 MCL violations for PWSSs in Michigan.

Contaminant	MCL	MCL Violations	
		Number of Violations	Number of systems with violation
Nitrate	10 mg/L1 (as Nitrogen)	3	3
Radium 226 and Radium 228	5pCi/l	1	1
Total Coliform Rule			
Acute MCL violation	Presence	2	2
Non-Acute MCL violation	Presence	254	233

[1] micrograms per liter.
Source: MDEQ 2005h.

Domestic Drinking Water Wells

Over 2.5 million residents, 27.3 percent of Michigan's population, rely on domestic wells for their water supply. Approximately 1,121,000 of Michigan's housing units, or 29.2 percent, rely on domestic water supply wells as the source of their water (Figure 3.10). These figures include vacation and other seasonal homes, as well as vacant housing units (MDA 2005c).

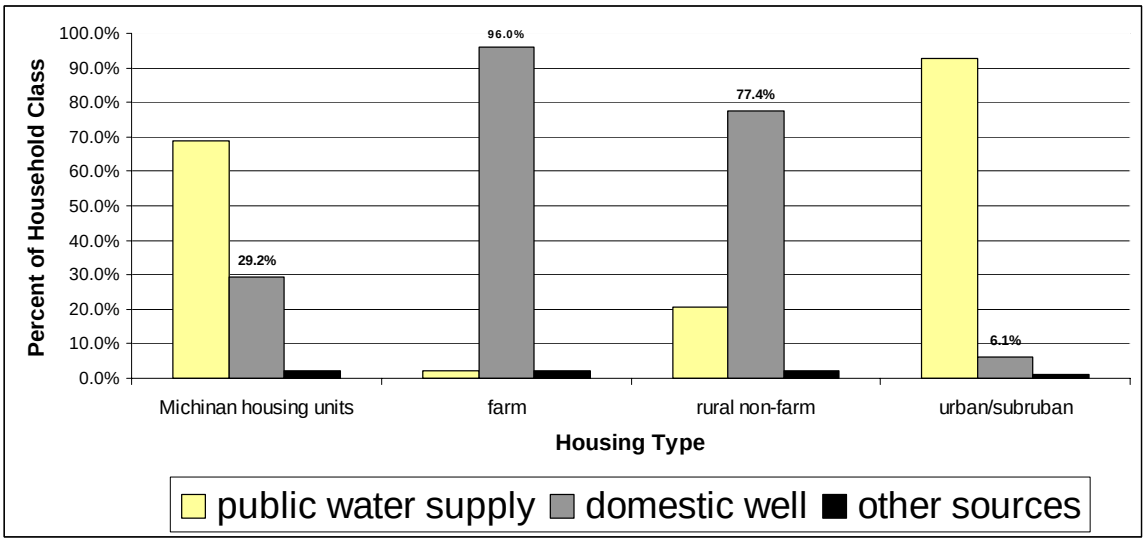


Figure 3.10. Source of water by housing type.
Source MDA 2005c.

Unlike public water supplies, domestic household water systems are not required by law to sample for nitrate or other contaminants on a routine basis. If nitrate contamination is known to the area, or a sample indicates nitrate or nitrite levels approaching the drinking water standards, a minimum of annual sampling is recommended (MDEQ 2005i). The Michigan Groundwater Stewardship Program and the MDA Groundwater Monitoring Program sponsor domestic well water screenings. The screenings are a service to domestic well owners that they can use to evaluate their exposure to nitrate, nitrite, and atrazine. The screenings also serve an educational purpose. Well owners taking part in a sample screening learn about local and State groups working to protect groundwater and about potential sources of groundwater contamination (MDEQ 2005j).

3.7.3 Agricultural Impacts to Drinking Water Quality

There are four broad categories of contaminants that affect the quality of water resources (and potentially drinking water quality) in Michigan: microorganisms, turbidity and sediments, inorganics, and organics (Sweat et al. 2002).

Contaminants can be released to water bodies from a variety of sources. Potential sources of contamination can include, but are not limited to, industrial facilities, sewage- or waste-disposal sites, managed forest or agricultural lands, accidental transportation spills, small businesses, and residential activities. Principal contaminants of concern from nonpoint sources (e.g., agricultural lands, residential stormwater runoff) in Michigan include sediments, nutrients (nitrogen and phosphorus), microorganisms, and pesticides (Sweat et al. 2002).

Excessive nutrients in the municipal drinking water intakes in Saginaw Bay have resulted in periodic taste and odor problems associated with nuisance growths of the blue-green algae, *Microcystis*. As a result of this occasional problem, 80 miles of shoreline are listed as not fully supporting the drinking water designated use (MDEQ 2004a).

A contaminant of concern for the Michigan CREP project area is THM. THM is formed during the drinking water purification process. Chlorine used to disinfect drinking water reacts with organics to form THM (MDA 2005c). A potential agricultural source of organic matter is decaying vegetation present in soils. Soil erosion introduces sediments containing organic matter into agricultural runoff and subsequently into surface water that may be used for drinking water.

Agricultural Impacts to Domestic Water Supplies

Domestic wells provide over 27 percent of Michigan residents' drinking water. Approximately 96 percent of farms and 77 percent of rural non-farm houses in Michigan use domestic wells for drinking water. Domestic water supplies do not need to comply with SDWA regulations and may not be monitored as often as public water supplies nor have the disinfection procedures of PWSSs, making domestic drinking water more vulnerable to contamination (MDA 2005c).

Since World War II, agricultural practices have extensively used agricultural chemicals to improve crop yields. Pesticides are used to control weeds, insects, and other pests to improve crop yields. Improvements in crop yields have also been realized through the widespread use of fertilizers containing nitrates and phosphorus, improving plant growth. There is evidence that groundwater quality has not been fully impacted by post World War II land use practices. In Michigan, groundwater quality, in general, and domestic well water quality are lagging indicators of the cumulative effects that the use of agricultural chemicals have had on groundwater resources. According to the MDA, many domestic wells throughout Michigan are withdrawing water older than 47 years (based on tritium dating). This indicates that impacts from agricultural land use practices may take several decades before they are realized (MDA 2005c).

The analysis presented in this PEA will focus on three types of contaminants that are most likely to be introduced into drinking water supplies by agricultural activities: nitrates, pesticides, and volatile organic compounds (VOCs). The major source of information for this analysis is a study conducted by the MDA titled, *The Michigan Department of Agriculture Groundwater Monitoring Program Domestic Supply Well Baseline Study* (Baseline Study) (MDA 2005c). For the Baseline Study, the MDA monitored water quality of domestic water wells between 1997 and 2000 to estimate the impacts of agriculture on domestic drinking water wells. The monitoring focus was for nitrates, pesticides, and VOCs (MDA 2005c). In

general, the Baseline Study found that contamination from nitrates and VOCs was more widespread than pesticide contamination (MDA 2005c).

Nitrates

Although nitrate occurs naturally in drinking water, elevated levels in groundwater usually result from human activities such as overuse of chemical fertilizers and improper disposal of human and animal wastes. These fertilizers and wastes are sources of nitrogen-containing compounds which are converted to nitrates in the soil. Nitrates are extremely soluble in water and can move easily through soil into the drinking water supply (MSUE 2005a).

Nitrate contamination of drinking water is problematic for both public and domestic drinking water sources. In 2003, three of the four chemical group MCL violations for PWSSs in Michigan were for nitrate (MDEQ 2005h).

According to the Baseline Study, approximately 9.3 percent of Michigan rural domestic wells have been impacted by human-related nitrate sources. It is estimated that less than 1.9 percent of all rural domestic wells in the State have nitrate levels above the PWSS MCL of 10 micrograms per liter (mg/L). Rural domestic wells include both farm and rural non-farm wells. Farm wells are more likely to have nitrate levels above 5 parts per million than are rural non-farm well and it is estimated that 3.9 percent of domestic wells on Michigan farms have nitrate levels above the MCL of 10 mg/L (MDA 2005c). Figure 3.11 shows the nitrate concentrations for groundwater in Michigan. According to this figure some of the highest levels of nitrates are found near Lake Macatawa.

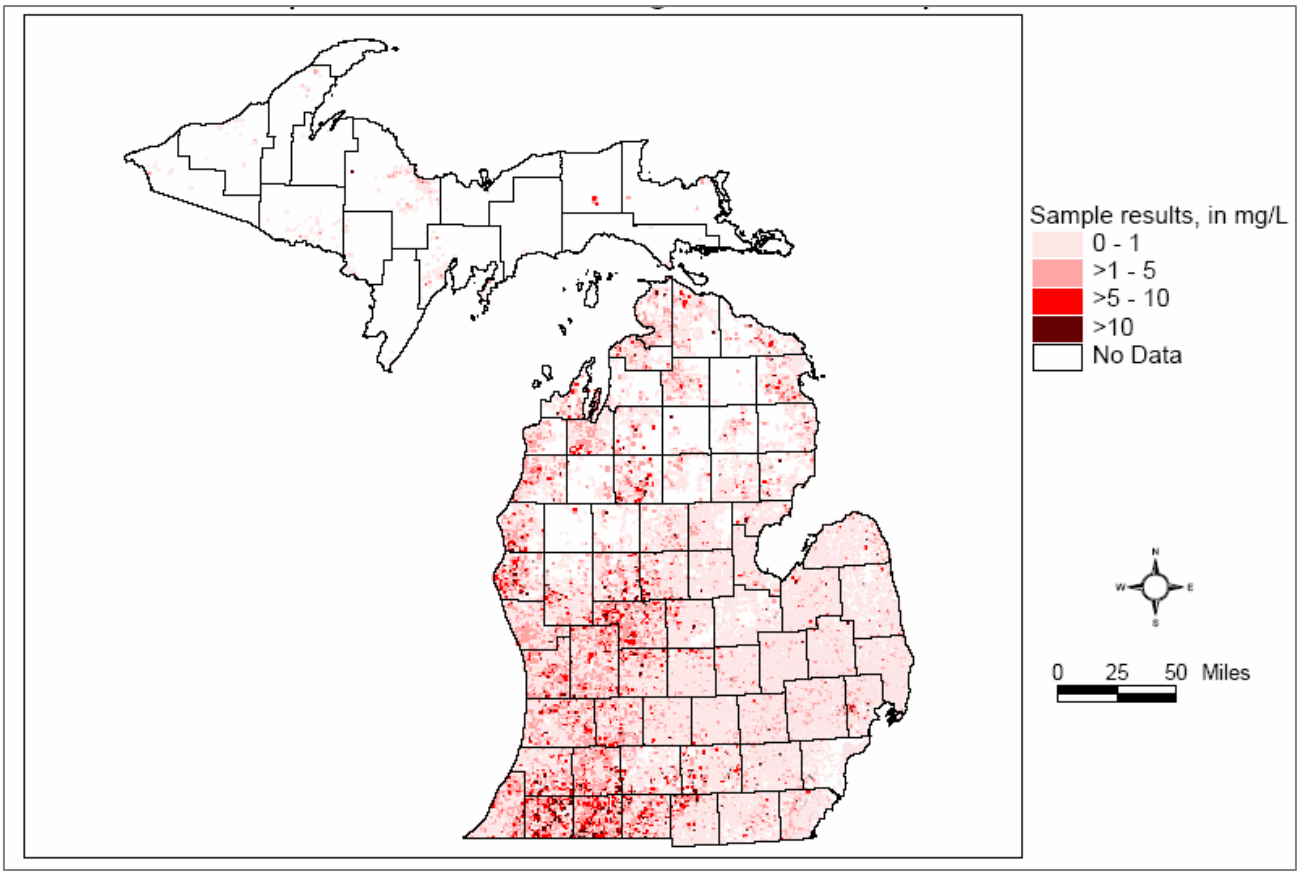


Figure 3.11. Nitrate samples, results averaged over one square mile area.
Source: MDEQ 2005k.

Pesticides

Similar to nitrates, agricultural sources of pesticides include surface water runoff from agricultural land and groundwater recharge from overlying agricultural lands.

According to the Baseline Study, pesticide contamination of domestic supply wells in Michigan is a limited problem. One pesticide, atrazine, was detected in one well at a concentration of 0.2 µg/L, well below the MCL for atrazine. Other projects carried out by the MDA indicate that, in at least some areas, the number of domestic wells with pesticide contaminants may be an order of magnitude higher than the level estimated in the Baseline Study. The MDA has confirmed one or more pesticides in 2.4 percent of the wells sampled through the groundwater monitoring program. Most of the sampling is directed towards areas where pesticides are used to determine the impact to groundwater resources (MDA 2005c). Pesticides, including atrazine, have been detected in groundwater samples in monitoring wells in the River Raisin watershed. However pesticide concentrations did not exceed any established MCLs (Frey 2001).

Once they have migrated below biologically active zones, a number of the products sampled in the Baseline Study are both relatively mobile and resistant to degradation. Under many situations, these products will eventually appear in groundwater supplies. As water impacted by pesticides reaches domestic supply wells, pesticide detection frequencies may increase relative to present figures (MDA 2005c). As indicated above, most domestic wells use water that is older than 45 years and impacts from pesticide use may not be detected in groundwater for several more years (MDA 2005c).

Volatile Organic Compounds

Agricultural sources of VOCs may include farm machine maintenance, underground storage tanks, and soil fumigants. Some of the means by which these VOCs reach groundwater are: leaking gasoline storage tank or spilled gasoline, migration of septic-system effluent containing household chemicals, spills or improper disposal of chemicals used for home or machinery maintenance, or migration from neighboring or previous land use (MDA 2005c). Areas with VOC detections are shown in Figure 3.12.

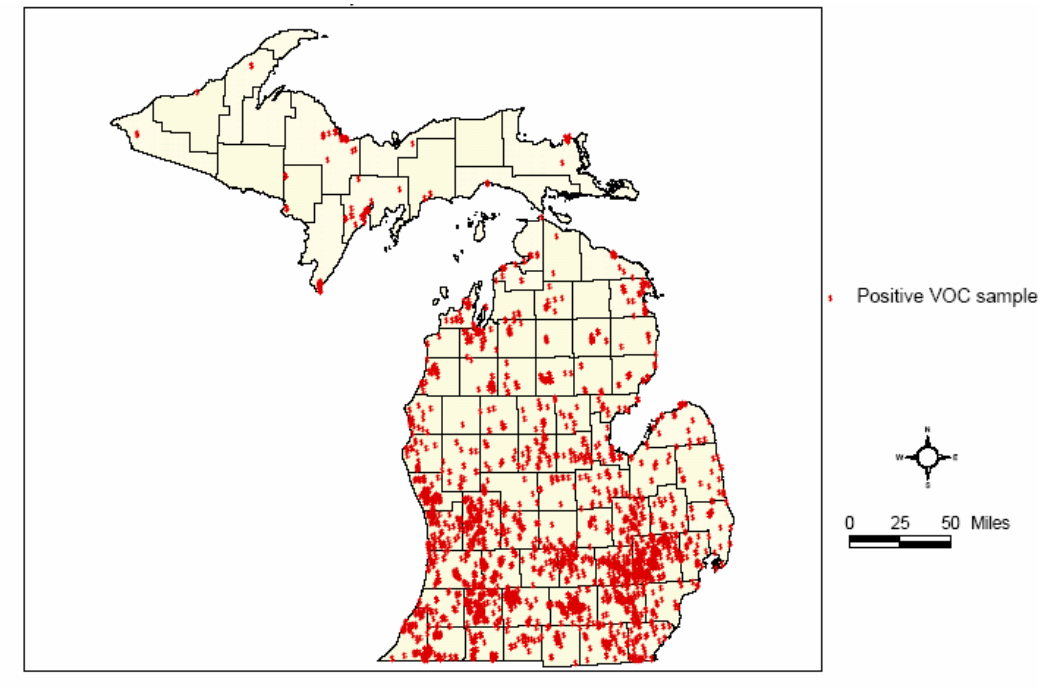


Figure 3.12. Positive VOC samples in Michigan.
Source: MDEQ 2005l.

According to the Baseline Study, VOCs are estimated to occur in 7.1 percent of rural domestic wells in Michigan. Fifteen different VOCs were detected, including products associated with well construction, maintenance, and disinfection; solvents associated with dry cleaning and/or metal degreasing; fuel components; and miscellaneous VOCs. One VOC, 1,2-dichloroethane, detected in one well, has been used both as a solvent and in soil fumigants. There was insufficient information to determine the source of this product and it is possible that the detection of 1,2-dichloroethane resulted from its use as a soil fumigant (MDA 2005c).

THMs, the most frequently detected VOC in the MDA study, were found in 12 of the 26 wells with a VOC detection. The highest concentration of THM detected was 21.7 µg/L, which is below the MCL of 80 µg/L (MDA 2005c).

Tetrachloroethylene, also known as perchloroethylene or "perc", was detected in one well at a level of 2.7 parts per billion, equivalent to 54 percent of its MCL. Other than some nitrate detections, this was the highest concentration relative to the MCL found in the Baseline Study. Other VOCs detected included a refrigerant (chlorodifluoromethane, one of the Freons), a paint solvent and ingredient (chlorobenzene), and other solvents (MDA 2005c).

VOCs not associated with well construction, disinfection, and/or plumbing, were detected in 12 of 379 wells, or 3.2 percent. Chlorinated ethanes and/or ethylenes were detected in five wells. These products are typically used as solvents, particularly for degreasing metal, such as cleaning auto and machinery parts, and in dry cleaning (MDA 2005c). Methyl tert-butyl ether (MTBE) was detected in one well at a

concentration of 10 µg/L. MTBE is used to increase the oxygen content of gasoline, to reduce auto emissions, and as an octane booster (MDA 2005c).

3.7.4 Effects of Alternative A (No Action) on Drinking Water

Declining quality in drinking water would continue to be a long term, minor adverse effect under the No Action alternative. Current State and Federal laws prevent any major discharges that would significantly degrade a drinking water source. Still, the cumulative impacts of agricultural activities and other industrial activities in the CREP project area would have an ongoing adverse effect on drinking water and many of the adverse impacts to groundwater sources may take several decades before they are detected.

Selection of Alternative A would not contribute to the achievement of any of the CREP Objectives cited in Section 1.4.

3.7.5 Effects of Alternative B (CREP Agreement) on Drinking Water

The implementation of Alternative B would result in long term, minor to moderate beneficial effects on drinking water. Either indirectly or directly, each of the CREP CPs improves surface water quality and potentially could improve the quality of water that recharges groundwater. Decreases in sediment and nutrient loading would reduce nitrate, pesticide, and THM concentrations in drinking water (Agreement 2000).

Since CREP CPs have had beneficial effects on surface water quality, it is likely that drinking water groundwater quality would also improve. Land enrolled in CREP would be removed from active agricultural production resulting in reduced agricultural chemical application, which would have the potential to decrease agricultural pollutants in groundwater.

Reducing soil erosion by implementing CPs will reduce the sediments and other nutrients from entering the water sources. Restoration of wetlands would have the expected benefit of increasing the volume and quality of groundwater recharge.

For individual CREP contracts, FSA would ensure through completion of an EE that the CPs employed would not contaminate or contribute to the contamination of wellhead protection areas and to drinking water source areas to the extent that a significant hazard to public health is created.

The water purifying capabilities associated with the CPs would contribute to the achievement of all four CREP objectives listed in Section 1.4.

3.8 Wetlands

3.8.1 Introduction

Section (a) (16) of the Food Security Act, Public Law 99-198, December 23, 1985 defines a wetland as:

> The term “wetland,” except when such term is part of the term “converted wetland,” means land that has a predominance of hydric soils and that is inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of hydrophytic vegetation typically adapted for life in saturated soil conditions.

Numerous laws exist that govern FSA program actions in relation to wetlands. Included are the following:

- EO 11990, Protection of Wetlands

- CWA
- Food Security Act

Michigan's wetland statute, Part 303, Wetlands Protection, of NREPA, 1994 PA 451, as amended, defines a wetland as "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh." The definition applies to public and private lands regardless of zoning or ownership (MDEQ 2005b).

Benefits of Wetlands

Wetlands are a significant factor in the health and existence of other natural resources of the State, such as inland lakes, groundwater, fisheries, wildlife, and the Great Lakes. Michigan's wetland statute recognizes the following benefits provided by wetlands:

- Flood and storm control by the hydrologic absorption and storage capacity of wetlands;
- Wildlife habitat by providing breeding, nesting, and feeding grounds and cover for many types of wildlife, waterfowl, including migratory waterfowl, and rare, threatened, or endangered wildlife species;
- Protection of subsurface water resources and provision of valuable watersheds and recharging ground water supplies;
- Pollution treatment by serving as a biological and chemical oxidation basin;
- Erosion control by serving as a sedimentation area and filtering basin, absorbing silt and organic matter; and
- Sources of nutrients in water food cycles and nursery grounds and sanctuaries for fish (MDEQ 2005b).

In Michigan, wildlife use wetland and riparian areas disproportionately more than other types of habitat. For example, 50 percent of Michigan's native species are wetland species and over 25 percent of the wetland species are threatened or endangered, and more than 40 percent of the 575 vertebrate species live in or utilize wetlands. This includes 15-22 percent of mammals, nearly 48 percent of birds, over 78 percent of reptiles, and 100 percent of amphibian species (MDEQ 2005b).

Wetlands in Michigan.

Wetlands serve important roles ecologically, economically, and socially to the overall health and maintenance of the Great Lakes ecosystem. They provide habitats for many kinds of plants and animals, some of which are found nowhere else. For ducks, geese, and other migratory birds, wetlands are the most important part of the migratory cycle, providing food, resting places, and seasonal habitats. Economically, wetlands play an essential role in sustaining a productive fishery. At least 32 of the 36 species of Great Lakes fish studied depend on coastal wetlands for their successful reproduction. In addition to providing a desirable habitat for aquatic life, wetlands prevent

damage from erosion and flooding, as well as controlling point and nonpoint source pollution (EPA 2005c).

Wetland loss changes the biological and chemical make-up of the waters, which pass through them to the open waters of the Great Lakes. The adverse effects to wetlands from dredging, draining, diking, pollution (particularly sedimentation), hydrologic impacts (increased flooding response of streams and diminished flows during dry periods) and water level management have contributed to degradation of Great Lakes water quality. These adverse effects also have contributed to the decline of fish and wildlife populations dependent on the coastal and river mouth areas of the Great Lakes (MDEQ 2000).

3.8.2 Existing Conditions and Impacts to Wetlands

In last century the rate of wetland loss due to filling and drainage by man has greatly increased. Prior to World War II, drainage to expand agricultural lands accounted for most of this loss. More recently, wetland destruction has been caused by commercial, industrial, and residential expansion. The estimated 11 million acres of Michigan wetlands existing in pre-settlement times has now been reduced to less than 3 million acres. Recent legislation has slowed the loss rate somewhat, but threats to these habitats, particularly the smaller wetlands, continue in many areas (MDEQ 2005b). Over 70 percent of Michigan's original wetlands have been drained or filled, while many remaining wetlands are no longer representative of original landscape types (MDNR 2001).

In general, the impacts of agricultural development on Michigan's wetlands are:

- Field drainage has eliminated large areas of marsh and coastal wetlands;
- Erosion and sedimentation from plowed fields have greatly increased water turbidity and eliminated aquatic plants requiring clear water;
- Nutrient loading has locally reduced oxygen levels, prompted algal blooms, and led to the dominance of species such as cat-tails that thrive on high nutrient levels;
- Heavy agricultural runoff has led to the deposition of rich organic mud in the wet meadows and along the shoreline, favoring the dominance of early successional and weedy species; and
- Introduced aggressive exotic plants have crowded out native plant species and reduced dependent insects and birds (Albert 2003).

More specifically, the different types of wetlands in the project area have undergone extensive alteration resulting from agricultural and other influences. The existing conditions of the various types of wetlands and issues specific to each are briefly described below.

Coastal Plain Marsh

Coastal plain marshes are rare in the Great Lakes Region and typically occur as small (e.g., less than 50 acres), isolated depressions. In Michigan, 41 coastal plain marshes occupying less than 3,300 acres have been identified, including areas of the Lake Macatawa watershed within the CREP project area.

More than 40 rare plants are found associated with coastal plain marshes in Michigan such as bushy aster (*Aster dumosus*), sedge (*Carex scoparia*), and coastal plain flat-topped goldenrod (*Euthamia remota*). The community is very sensitive to hydrologic disturbance

Coastal Plain Marsh. Courtesy of MDNR.

and may be severely degraded by shoreline development, draining, damming, dredging, or filling. Water level fluctuations play a critical role in the ecology of these wetlands by influencing seed germination and dispersal, and protection of the regional and local hydrologic regime and groundwater management is critical to the long-term preservation of coastal plain marsh communities (Kost and Penskar 2004).

Lakeplain Wet Prairie

Lakeplain wet prairies, which experience seasonal flooding, are among the most diverse plant communities in Michigan, with as many as 200 plant species, such as cordgrass (*pectinata*), rush (*Juncus balticus*), and shrubby cinquefoil (*Potentilla fruticosa*). Lakeplain wet prairies have traditionally comprised less that 0.5 percent of wetland acres (circa 1800), and can be found today along the shoreline of Lake Huron in Saginaw Bay in the project area.

Lakeplain Wet Prairie. Courtesy of MDNR.

Historically, accumulation of organic material coupled with drought conditions during the growing season made lakeplain wet prairies prone to wildfires, which limited succession of woodland species. However, suppression of wildfires to protect agricultural and residential development has allowed the community to succeed to shrub and forest communities (Albert and Kost 2000).

Prairie Fen

Prairie fens are geologically and biologically unique wetlands found only in the glaciated Midwest. Currently, about 120 prairie fens (5,000 acres) have been identified in Michigan, including portions of the River Raisin and Lake Macatawa watersheds in the project area. Prior to European settlement, prairie fens were more numerous than they are today. Agriculture, urban development, and fire suppression have reduced the number of prairie fends through land conversion, dispruption of groundwater flow, and shrub-carr succession.

A Michigan fen. Courtesy of MDNR.

Healthy woodlands, savanna, and prairies in uplands adjacent to fens allow infiltration of precipitation into the groundwater. Ecosystem alteration to residential and agricultural use has greatly contributed to the decline of water quality flowing into the area's prairie fens, by warm, nutrient & sediment-laden surface water runoff which then degrades the quality of the wetland. Nutrient addition is suspected of contributing to the dominance of invasive species such as narrow-leaved cat-tail *(Typha angustifolia)*, reed *(Phragmites australis)*, and purple loosestrife in portions of several prairie fens (Spieles et al. 2004).

Relict Conifer Swamp

Less than one percent of relict conifer swamps (Tamarack swamps), a type of rich conifer swamp, remain in southern Lower Michigan (2,839 acres). In the Michigan CREP project area, they occur in Oakland county in the Saginaw River watershed, and Washtenaw county in the River Raisin watershed. It is a groundwater influenced, or minerotrophic, forested wetland community that is typically dominated by tamarack (*Larix laricina*) and occurs on deep organic soils (e.g., peat and muck) in southern Michigan.

The presence of conifer dominated wetlands in southern Michigan contributes significantly to the region's overall biodiversity. Conservation of the relict conifer swamp must include protecting the quantity and quality of the groundwater and surface water inputs from drainage ditches and agricultural fields. Protection of the native plants species surrounding groundwater rechange areas and modification of road construction that allows run-off, resulting in tamarack mortality must also be undertaken, as well as regulation of red maple invasions (Kost 2001a).

Rich Conifer Swamp

Rich conifer (cedar) swamp is a groundwater influenced, or minerotrophic, forested wetland organic soil (e.g., peat and muck), and is dominated by northern white cedar (*Thuja occidentalis*). In the Michigan CREP project area, Gratiot County in the Saginaw Bay watershed contains rich conifer swamps.

A wooded swamp in Michigan. Courtesy of MDNR.

Rich conifer swamps provide habitat for more than 25 percent of northern Michigan's wildlife species, including over 30 rare species, as well as critical winter habitat for deer and snowshoe hare. Their unique structure and high diversity contributes significantly to the overall biodiversity of the northern Great Lakes region. They are also one of the region's most economically important natural communities. Historically, cedar swamps in Michigan were logged or burned in the late 1800's, while today many of these wetlands have been drained and used for agriculture or converted to different wetland types such swamps containing a mixture of hardwoods and conifers, hardwood swamps, alder thickets, aspens, sedge meadows, fens, or bogs (Kost 2002).

Southern Wet Meadow

Southern wet meadows, commonly referred to as sedge meadows, are minerotrophic, sedge dominated wetlands that contribute significantly to the overall biodiversity of southern Michigan. In the Michigan CREP project area, southern wet meadows occur in Washtenaw County in the River Raisin watershed, as well as Oakland and Tuscola counties in the Saginaw River watershed.

Southern wet meadows have been extensively used for agriculture, and less than 1 percent are estimated to remain intact. Wet meadows have been frequently tiled, ditched, drained, and converted to pasture, row crops or mined for peat. In addition, fire suppression has facilitated shrub encroachment and conversion to shrub-carr. This is especially evident where the water table has been lowered though tiling or ditching and the practice of mowing for marsh hay has been abandoned (Kost 2001b).

3.8.3 Effects of Alternative A (No Action) on Wetlands

Implementation of Alternative A would result in long-term, moderate adverse effects to wetland values. With the selection of the No Action Alternative, wetland values (e.g., vegetation, water quality, and habitat) would continue their slow decline. Wetlands that have been converted to agricultural production would remain in operation. Given ongoing Federal involvement, total wetland acres would likely be stable or slightly reduced under No Action because Section 404 of CWA and other Federal laws are very restrictive in allowing draining or conversion of existing wetlands for other uses.

Alternative A would not achieve any of the CREP Objectives listed in Section 1.4.

3.8.4 Effects of Alternative B (CREP Agreement) on Wetlands

Implementation of Alternative B would result in long-term, moderate beneficial effects to wetlands. Under Alternative B, up to 24,000 acres of wetland restoration would help address the need for functional wetlands that are lacking throughout the CREP project area. Converted wetlands and marginal acres would be removed from agricultural production or fallow land and wetlands would be restored or constructed. Another direct effect of Alternative B would be the creation of new wildlife habitat for riparian species in the combined watersheds.

Installation of CPs to restore or enhance wetlands may result in short-term adverse impacts to adjacent land. These include:

- Establishment of desirable plants—Until wetland vegetation is permanently established and until the hydrology of restored wetlands is stabilized, flooding of wetlands may also result in flooding of adjacent land.
- Site preparation— Wetland restoration might require earth moving activities and soil disturbance. These activities have the potential to introduce sediments into nearby waterbodies.

Effects of wetland installation are expected to only last until the CP is permanently established (1-3 years) and they are minor compared to the overall long-term benefits of the CP. In addition, conservation plan for each contract would address impacts of CP installation and would include any mitigation efforts that would be necessary.

Alternative B would help achieve the CREP Objectives listed in Section 1.4.

3.9 Floodplains

3.9.1 Introduction

Floodplains are defined as lowlands or relatively flat areas adjoining inland or coastal waters, including areas subject to a one percent or greater chance of flooding in any given year (NRCS 2005c). Floodplains serve a variety of functions and values including:

- dissipate the energy of floods, reducing flood damage downstream
- floodwater storage which slowly releases water into adjacent streams, maintaining base flows

All Federal actions must meet the standards of EO 11988, Floodplain Management. The purpose of the EO is to avoid incompatible development in floodplain areas. It states, in part, that:

"Each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for (1) acquiring, managing, and disposing of Federal lands and facilities; (2) providing Federally undertaken, financed, or assisted construction and improvements; and (3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities."

In accordance with the EO and prior to any action, Federal Emergency Management Agency (FEMA) floodplain maps will be reviewed to determine if the proposed action is located in or will affect a 100- or 500-year floodplain. Soil survey maps, aerial photography, and topographical maps should be used where no FEMA maps are available. FSA should complete surveys in areas where no flood hazard or flood elevation data are available and the amount of Federal investment in the proposed action is significant if the action could create a significant adverse effect on a floodplain.

Flood in Vassar, Michigan. Courtesy of USACE.

The State of Michigan's Floodplain Regulatory Authority, found in Part 31, Water Resources Protection, of the NREPA requires that a permit be obtained prior to any alteration or occupation of the 100-year floodplain of a river, stream or drain. The floodplain is divided into two sections, the floodway which carries most of the flow during a flood event, and the floodway fringe which is an area of very slow moving water or "slack water." A floodway is the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the 100 year flood; these are high hazard areas of rapidly moving water during times of flood. The purpose of Part 31 is to assure that the flow carrying capacity of a watercourse is not harmfully obstructed, and that the floodway portion of the floodplain is not used for residential construction (MDEQ 2005c). One of the goals of the Michigan Geological and Land Management Division is to ensure that development which occurs within the 100-year floodplain is reasonably safe from flooding and does not increase flood damage potential (MDEQ 2005c).

Applicable development permits must be obtained from local authorities prior to construction activities within a floodplain.

3.9.2 Existing Conditions

Floods are the leading cause for disaster declarations in Michigan and the United States. MDEQ (2005c) estimates that six percent of Michigan is flood-prone, including about 200,000 buildings. Flooding has caused major problems in the Lake Macatawa Watershed in the past. The largest floods occurred in 1981,

1982, 1996, and 1997. In a hydrologic study of the Lake Macatawa Watershed, only 30 percent of the current riverfront was buffered in any way (MDEQ 2005d).

In Michigan, floodplain forests are found along major rivers and streams throughout the state but are most extensive in the Lower Peninsula. These forests occupy the low-lying areas adjacent to wide rivers and streams that are subject to seasonal flooding in spring and fall (MSUE 2005b). Floodplain forests are found throughout the CREP project area (Figure ?).

**A floodplain forest. Photo by Joshua G. Cohen.
Source: MSUE 2005b**

The floodplain forest is a highly diverse community and supports a number of plant and animal species (MSUE 2005b). Silver maple, red ash, red maple and cottonwood dominate these forests. Many other hardwood trees, small trees, shrubs, and ground layer plants are also found in floodplain forests (Sargent and Carter 1999). By providing necessary hibernacula (a shelter occupied during the winter by a dormant animal), breeding sites, foraging areas, and travel corridors, floodplain forests often support a high diversity of birds, reptiles, amphibians, and mammals (MSUE 2005b). Species richness is greatest in the southern Lower Peninsula and the southern floodplain forest is one of Michigan's most diverse natural communities as well as one of its most threatened (Sargent and Carter 1999). Southern floodplain forests host a number of rare plant species including winged stemmed monkey flower, prairie trillium, snow trillium, black cottonwood, and twinleaf (Sargent and Carter 1999). Currently there are 36 documented occurrences of southern floodplain forest in Michigan (approximately 6,000 acres), of which only five of these occurrences, constituting just under 2,000 acres, are high-quality (MSUE 2005b).

The damage caused to floodplain forests during logging operations of the late nineteenth and early twentieth centuries was not limited to the removal of overstory trees. Logs from floodplains as well as adjacent upland forests were transported along rollways to rivers and streams where splash dams were used to transport the logs, altering stream flow and channel characteristics. Only 72 acres of unlogged floodplain forest are located in Michigan, which formerly supported approximately 2.7 million acres of floodplain forest circa 1800 (MSUE 2005b).

In addition to disturbances related to the turn-of-the century logging, floodplain forests of Michigan are highly susceptible to ongoing disturbances that alter their hydrology (MSUE 2005b). Damming, dredging, channelization, and urban development are human threats to these forests (Sargent and Carter 1999). By changing the flow of water, such hydrologic alterations interrupt flood pulses, which are critical in the dynamics of seed dispersal, plant establishment, nutrient cycling, channel scouring, sediment deposition, and the maintenance of species richness. Urban development often results in a flashy discharge into nearby rivers (MSUE 2005b).

Changes in land cover surrounding the floodplain have also altered species composition and structure within floodplain forests. Agricultural land cover often leads to high nutrient inputs into the floodplain, and may restrict forest regeneration. Floodplain forests were cleared for cultivation, homesteading, and livestock grazing and where active agriculture is not practiced, these forests have regenerated. This regeneration accounts for the current 53,100 acres of floodplain forests in Michigan that are older than 120 years and for the 242,800 acres that are between 80-120 years old (MSUE 2005b). Figure 3.13 shows the current distribution of floodplain forests in Michigan's Lower Peninsula.

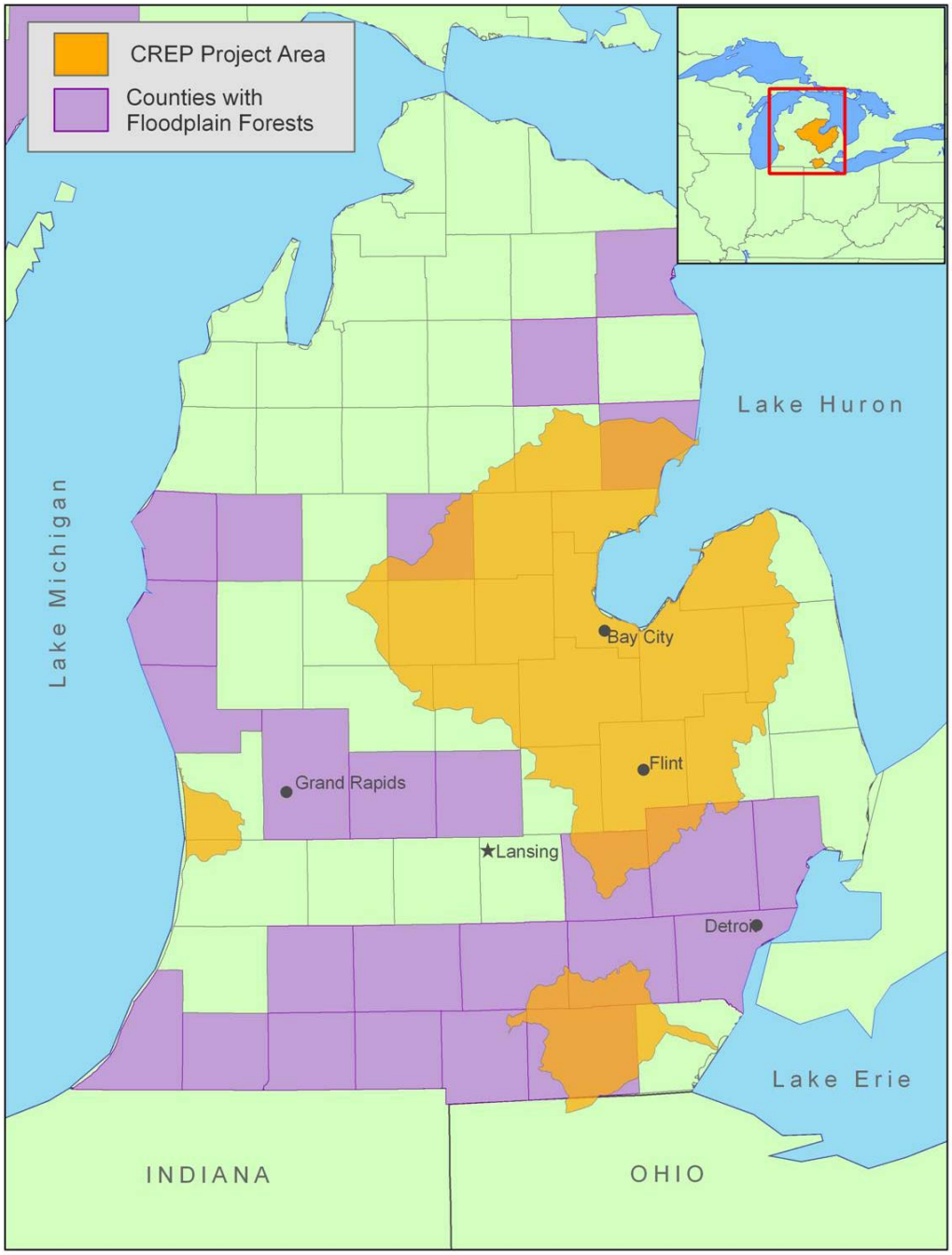


Figure 3.13. Distribution of floodplain forests in Michigan's Lower Peninsula.
Source: MSUE 2005b.

3.9.3 Effects of Alternative A (No Action) on Floodplains

Under the No Action Alternative, CREP funds would not be available to implement CPs that may have beneficial effects on floodplain conditions, especially the ability of floodplains to store floodwaters. Some construction may occur that would alter floodplain flowage, capacity, or other functions.

Alternative A would not contribute to the achievement any of the objectives listed in Section 1.4 and would result in little change to the State's floodplains.

3.9.4 Effects of Alternative B (CREP Agreement) on Floodplains

Under Alternative B, Minor improvements in floodplain functions and stream profiles would occur. CREP funds would be used to increase floodwater storage capacity through wetland restoration, stabilization of floodplains, restorative plantings, and installation of structures within existing floodplains.

Minor adverse effects might occur with the implementation of CREP CPs that would require earth-moving activities or the building of structures. These activities could potentially alter floodplain flowage, capacity, or other functions. Appropriate FSA oversight would help ensure the proper design and installation of structures, thus limiting adverse effects to flowage areas and minimizing indirect effects to areas outside the 100-year floodplain. Analysis of the impact on floodplains, per EO 11988, would require the structures to be able to withstand 100-year flood events and remain functioning. These practices would help control flood events and improve floodplain values. Table 3.16, summarizes the effects of each approved CP. Although CP9 is no longer on the list of approved CPs, it will be analyzed because prior to 2005 approximately 748 acres were enrolled in CP9 and these acres will be maintained over a 10 to 15 year contract period, which could affect floodplain functions. CP23A is not analyzed since this practice cannot be located in the 100-year floodplain of a permanent river or stream.

Table 3.16. Summary of effects of CPs on floodplain functions.

Conservation Practice	Effect on Floodplain Functions		Description of Effects
	Short Term[a]	Long Term[b]	
1, Permanent Introduced Grasses and Legumes	No effect to minor positive effect	No effect to minor positive effect	No structures or earthmoving activities authorized for this CP. Grasses and other plants may increase soil infiltration slowing down runoff.
2, Establishment of Permanent Native Grasses	No effect to minor positive effect	No effect to minor positive effect	No structures or earthmoving activities authorized for this CP. Native grasses may increase soil infiltration slowing down runoff.
5A, Field Windbreaks	No effect to minor positive effect	No effect to minor positive effect	No structures or earthmoving activities authorized for this CP. Grasses and other plants may increase soil infiltration slowing down runoff.
9, Shallow Water Areas	No effect to minor adverse effect	No effect to minor adverse effect	Earthmoving activities are authorized to construct dams, levees, dugouts, or dikes. Structures such as pipes, chutes, and outlets may also be constructed. Construction of dams, levees, dikes, chutes, and other structures may alter the hydrology of the floodplain and could adversely affect floodplain functions.

Conservation Practice	Effect on Floodplain Functions		Description of Effects
	Short Term[a]	Long Term[b]	
21, Filter Strips	No effect to minor adverse effect	No effect to minor positive effect	Earthmoving activities such as grading, leveling, filling may be used during site preparations and could temporarily alter floodplain hydrology and result in minor short term adverse effects to floodplain functions. However, these activities are designed to reduce concentrated flow and once established will disperse surface flow increasing infiltration. Beneficial long term effects may occur since buffers reduce scour erosion in floodplains and slow down runoff through increased infiltration and surface detention.
22, Riparian Buffer	No effect to minor adverse effect	No effect to minor positive effect	Earthmoving activities such as grading, leveling, filling may be used during site preparations and could temporarily alter floodplain hydrology and result in minor short term adverse effects to floodplain functions. However, these activities are designed to reduce concentrated flow and once established will disperse surface flow increasing infiltration. Beneficial long term effects may occur since buffers reduce scour erosion in floodplains and slow down runoff through increased infiltration and surface detention.
23, Wetland Restoration	No effect to minor adverse effect	No effect to minor positive effect	Earthmoving activities such as grading, leveling, filling may be used during site preparations and could temporarily alter floodplain hydrology and result in minor short term adverse effects to floodplain functions. However, these activities are designed to restore hydrology to the site and once hydrology is restored would improve floodplain values. Beneficial long term effects may occur since wetlands slow down runoff through increased infiltration and surface detention.

Conservation Practice	Effect on Floodplain Functions		Description of Effects
	Short Term[a]	Long Term[b]	
26, Sediment Retention Control Structure	Minor to moderate adverse effect	Minor to moderate adverse effect	Earthmoving activities such as grading, leveling, filling may be used during site preparations and could temporarily alter floodplain hydrology and result in minor short term adverse effects to floodplain functions. This practice involves building earthen embankments and other permanent structures that could alter floodplain hydrology and impact floodplain functions.

a. Short term is defined as the implementation period of the conservation practice. Usually one to two years.
b. Long term is defined as the CREP contract period, which is between 10-15 years.

Alternatives would be carefully considered by FSA at the time that site specific EEs are developed for each CREP contract. The direct impacts of all CPs would be generally beneficial, and would contribute to achieving the CREP Objectives discussed in Section 1.4.

3.10 Soil Resources

3.10.1 Introduction

The water and land resources in the bi-national Great Lakes Basin are a valuable environmental and economic resource to not only the Great Lakes region, but all of North America. These resources support a multi-billion dollar recreation/tourism industry, supply drinking water to 40 million people, provide habitat for thousands of fish and wildlife species, offer various transportation opportunities, and support diverse agricultural production, which is a major contributor to the region's economy. The Basin serves as home to 15 percent of the U.S. population and 60 percent of the Canadian population (GLC 2005a).

Soil erosion and sedimentation pose a risk to the environmental and economic assets of the Great Lakes region, including Michigan. Erosion, caused by detachment of soil particles by rain, wind and other forces, robs land of its productivity. Sedimentation occurs when the eroded soil is deposited by runoff into rivers, harbors and lakes (GLC 2005a).

3.10.2 Existing Conditions

Soil erosion and sedimentation are natural processes, but its rate can be altered by different land uses. When rural and urban land use and development activities in the Great Lakes Basin are not conducted responsibly, the processes can be greatly accelerated. Intensive agricultural production, timber harvesting, mining, construction, and other land disturbance activities greatly increase the impact of erosion and sedimentation on Great Lakes waters (GLC 2005a).

Soil erosion, particularly from agricultural influences, is a significant problem in Michigan. Annually, an estimated 606 million tons of topsoil erodes from cropland in Great Lake states (GLC 2005a), including 9 million tons of soil deposited into the Saginaw Bay watershed alone (GLP 2005a). Although the precise amount of soil erosion resulting from agricultural use has not been determined, it is possible given that nearly half of the total agricultural land in all the Great Lakes states is in Michigan, that the State's farms contribute up to one half of the basin's agriculturally-induced soil erosion (GLP 2005b). Soil erosion in Michigan is caused by both wind and water. Estimates indicate that wind erosion is responsible for 42 percent of the erosion damage occurring in Michigan annually (Mikula and Croskey 2004).

Surface water soil erosion. Courtesy of U. of Michigan.

Soil erosion and sedimentation are major sources of nonpoint source pollution, which is classified as pollution of diffuse origin. The physical impact of soil erosion and sedimentation is magnified when rural and urban land runoff carries with it other contaminants such as oxygen-demanding organic wastes, phosphorus and nitrogen, toxic chemicals from manufacturing and industrial processes, pesticide and herbicide residues, and heavy metals. Many of these pollutants are transported by sediment to the Great Lakes, their tributaries, and other bodies of water in the Basin (GLC 2005a).

3.10.3 Impacts of Agriculture on Soil Resources

Agricultural erosion, one of the main causes for nonpoint source pollution, is significant because it carries associated nutrients, phosphorus and nitrogen, as well as pesticides and herbicides, which negatively impact water quality. In addition to degrading water quality, soil erosion and sedimentation reduce agricultural productivity, degrade fish and wildlife habitat, limit water-based recreation, and damage water treatment and conveyance facilities (GLP 2005c). Because of specific water quality concerns, particularly in regard to excessive levels of phosphorus, some sub-basins in the Great Lakes basin have set goals for the reduction of phosphorus loading. These goals have been most often pursued and achieved through reductions in agricultural sediment loading to tributaries of the watershed (USGS 2004).

Nutrients, sediments, and toxic substances have decreased the water quality of Michigan's Saginaw Bay. Sedimentation of bays and rivers in the watershed is caused by numerous sources such as construction sites, agricultural fields, residential lawns, and urban areas. Many of these sources are individually small in size but have a major cumulative impact (GLP 2005d). Extensive agricultural activity in the Saginaw Bay watershed releases heavy loads of sediment, fertilizer, and pesticides into tributaries that flow into Lake Huron. Nutrient enrichment causes high levels of weed growth along the Saginaw Bay shoreline and near-shore zones. The organic debris produced from weed growth is unsightly and its decomposition produces unpleasant odors. Often washed ashore during storm events, the debris limits the use of beaches and its periodic removal adds to costs of swimming area maintenance (GLC 2005a).

3.10.4 Effects of Alternative A (No Action) on Soil Resources

Implementation of Alternative A would result in long-term, moderate adverse effects to soil resources. The soil erosion problems would continue throughout the agricultural areas of Michigan.

Under the No Action Alternative, land currently in cultivation would remain. The tilling and planting would leave bare ground for part of the year, facilitating potential for runoff. Wind erosion resulting from tilling and water erosion resulting from the lack of vegetation on the soil for part of the year would continue, and may worsen with continued production.

Alternative A would not achieve any of the CREP Objectives listed in Section 1.4.

3.10.5 Effects of Alternative B (CREP Agreement) on Soil Resources

Erosion and sedimentation could be reduced with certain types of land use practices. Some of these practices include conservation tillage, vegetative and woodland cover in erosion-prone areas, filter strips, sediment detention ponds and erosion control measures on construction sites (GLC 2005a).

With the implementation of CP1 and CP2, up to 12,000 acres of land currently in cultivation will be converted to native and other permanent grasses. After the initial installation, no other tilling should take place, reducing the disruption of the soil that leaves it exposed for erosion.

Vegetative filters are one of the more effective and economical methods for removing sediment (Mikula and Croskey 2004). Land installed with CP21 (Filter Strips), CP22 (Riparian Buffer), CP23 (Wetlands Restoration) would filter nutrient rich surface water, preventing the nutrients from collecting in receiving waterbodies, including the Great Lakes.

Field Windbreaks (CP5A) are designed to slow the velocity of wind, allowing the settling out of suspended snow and soil particles. These windbreaks would intercept soil particles, preventing them from depositing into receiving waterbodies.

Sediment retention control structures (CP26) are designed to trap sediments and reduce sediment loads in agricultural runoff. These structures will also protect and conserve soil resources by decreasing rill and gully erosion and controlling onsite and downstream runoff from agricultural land.

CP installation may result in short-term adverse impacts to disturbed land. Until vegetation is permanently established, runoff from disturbed land could result in soil erosion. In addition, some CPs, such as wetland restoration, might require earth moving activities and soil disturbance. In addition, exposed soil would be subject to wind erosion during the preparation and planting of certain CPs. These activities have the potential to introduce sediments into nearby waterbodies. However, effects of CREP CPs are expected to only last until the CP is permanently established (1-3 years) and they are minor compared to the overall long-term benefits of the CP.

Alternative B would help achieve the CREP Objectives listed in Section 1.4.

3.11 Coastal Resources

3.11.1 Introduction

The main Federal law that applies to the management of Michigan's coastal resources is the Coastal Zone Management Act of 1972 (CZMA). CZMA established the planning and management program for U.S. coastal land and water resources and directs Federal agencies to preserve, protect and develop, and where possible, to restore or enhance the resources of the nation's coastal zone. Coastal zones include the coastal waters and the adjacent shore land strongly influenced by each other and in proximity to the

shorelines of the coastal states, and includes islands, transitional and intertidal areas, marshes, wetlands, and beaches.

The Coastal Zone Management Program (CZMP), authorized by the CZMA, leaves day-to-day management decisions at the State level in the 34 states and territories with federally approved coastal management programs. Currently, 95,376 national shoreline miles (99.9 percent) are managed by the program. State and Federal coastal zone management efforts are guided by the three major themes of CZMP's strategic framework: Sustain Coastal Communities, Sustain Coastal Ecosystems, and Improve Government Efficiency. Authorized by Section 6217 of the Coastal Zone Act Reauthorization Amendments of 1990, this amendment requires states and territories with approved coastal zone management programs to develop and implement a coastal nonpoint pollution control program (NOAA 2005a).

Warren Dunes State Park, Michigan. Courtesy of EPA.

In 1978, Michigan was among the first states to have its coastal program approved. The program is administered by the Administration Section in the Environmental Science and Services Division. The program includes local pass through grants and administration of coastal related sections of the NREPA. Review of Federal agency activities for consistency with Michigan's approved program is performed by the Great Lakes Shorelands Section in the Land and Water Management Division (MDEQ 2005a).

Coastal management in Michigan encourages responsible growth and development, attempts to improved public access to the coast, and aids in winter navigation. The program manages coastal activities such as shipwreck salvaging, pier and marina construction, development, and coastal alterations. The program is working creatively to find solutions to remedy impacts from the loss of agricultural land and wildlife habitat to sprawling development (NOAA 2005b). Section 305(b) of the CWA requires that EPA report periodically on the condition of the nation’s waters. As part of this process, coastal states provide valuable information about the condition of their coastal resources to EPA. This information is compiled into a report titled: *National Coastal Condition Report*. The first report was published in 2001, the second in 2005. The reports describe the ecological and environmental conditions in U.S. coastal waters, including the Great Lakes (EPA 2004).

3.11.2 Existing Conditions

With 3,250 miles of freshwater coast on four Great Lakes, Michigan has the world's largest freshwater coastline and supports a coastal population of 4,460,981 people. Tourism, recreational boating, sport fishing, commercial shipping, agriculture, and manufacturing are the State's largest coastal industries (MDEQ 2004a and NOAA 2005b).

All Michigan waters of the Great Lakes have been evaluated for their designated uses. Table 3.17 summarizes the designated uses of the 3,250 shoreline miles of Michigan. All 3,250 shoreline miles are assumed to support secondary contact recreational (partial body contact - nonswimming), agricultural, industrial, and navigational uses. Excluding fish consumption advisories, all 3,250 Great Lakes shoreline miles are assumed to be supporting the aquatic life designated use. A small amount of Great Lakes shoreline (approximately 15 miles) is not meeting the total body contact designated use due to beach closings related to bacterial contamination at several beaches. Periodic taste and odor problems

associated with nuisance growths of the blue-green algae, Microcystis, occur in the municipal drinking water intakes in Saginaw Bay. As a result of this occasional problem, 80 miles of shoreline are listed as not fully supporting the drinking water designated use. A nutrient reduction strategy for Saginaw Bay is in place; therefore, a TMDL is not scheduled for this area. In addition, public health fish consumption advisories are in effect for all Michigan waters of the Great Lakes; therefore, no Michigan waters of the Great Lakes are considered to be fully supporting designated uses (MDEQ 2004a).

Table 3.17. Designated use support summary for Michigan waters of the Great Lakes.

Designated Use	Supporting (shoreline miles)	Not Supporting (shoreline miles)
Recreation		
Total Body Contact	**3,235**	**15**
Partial Body Contact	**3,250**	**0**
Fisheries, Aquatic Life, and Wildlife		
Aquatic Life	**3,250**	**0**
Fisheries and Wildlife[1]	**0**	**3,250**
Water Supply		
Drinking Water	**3,170**	**80**
Agriculture	**3,250**	**0**
Industrial	**3,250**	**0**
Navigation	**3,250**	**0**

[1] Based on fish consumption advisories.
Source: MDEQ 2004a.

The water filtration capability of the rapidly invading zebra mussel (*Dreissena polymorpha*) populations is drastically altering the natural ecosystem of the Great Lakes and other lakes in the area. Each mussel processes up to one gallon of water per day, removing almost every microscopic aquatic plant (phytoplankton or algae) and animal (zooplankton) from the lake. In response to this changing food supply, populations of some native animals have begun to decline (USGS and GLSC 2005). Other impacts of the zebra mussel include decreasing the aesthetic and recreational value of lakes (Keniry and Marsden 2005) and the economic costs of unclogging infiltrated water intake pipes (Seagrant 2005).

Fish Consumption Advisories

Fishing in the Great Lakes region is a valued recreational and commercial activity. To protect citizens from the risks of eating contaminated fish, the eight states bordering the Great Lakes had a total of 30 fish consumption advisories in effect in 2002 for the waters and connecting waters of the Great Lakes. During 2002, every Great Lake had at least one advisory, and advisories covered 100 percent of the Great Lakes shoreline. The State of Michigan, which borders four of the five Great Lakes and encompasses four of the six connecting waterbodies, issued the largest number of advisories (EPA 2004).

Great Lakes fish consumption advisories were issued for six pollutants: mercury, mirex, chlordane, dioxins, PCBs, and dichlorodiphenyltrichloroethane (DDT). All of the advisories listed PCBs, and nearly half (47 percent) also listed dioxins. Lake Superior, Lake Michigan, and Lake Huron were under advisory for at least four pollutants each in 2002; however, some of the advisories were of limited

geographic extent, and advisories in most locations applied primarily to older individuals in higher trophic levels (EPA 2004).

3.11.3 Impacts of Agricultural Pollutants on Coastal Resources

Trophic Status

At high concentrations, nutrients over-stimulate the growth of opportunistic aquatic plants and algae. Excessive nutrients can result in accelerated eutrophication and algal blooms. This, in turn, leads to a decrease in animal and plant diversity and affects use of the water for fishing and swimming. As the algae die, they decay and deplete oxygen levels. The algae also prevent sunlight from penetrating the water. Fish and shellfish are deprived of oxygen, and aquatic plants are deprived of light, which decreases productivity (EPA 2005a).

Trophic status is a measure of the nutrient enrichment of a water body. The determination of a lake's trophic status involves an assessment of several parameters including two important plant nutrients, phosphorus and nitrogen, in the water column. Aquatic plant and algal growth in Michigan waters is generally phosphorus-limited; as the amount of phosphorus in the water column increases, the algal and/or aquatic vegetation growth may also increase, possibly causing nuisance conditions that impair designated use(s) (MDEQ 2004a).

Phosphorus sources from human activities include fertilizer runoff and the discharge of treated sewage and detergents. Reductions in phosphorus loading to Lakes Michigan, Huron (Saginaw Bay), and Erie via point source controls have substantially contributed to improved water quality. There are two areas in the Great Lakes surrounding Michigan that have high trophic levels: Saginaw Bay in Lake Huron, a receiving waterbody of the Saginaw Bay watershed, and the Western Basin of Lake Erie, a receiving waterbody of the River Raisin. The current trophic status of each of Michigan's Great Lakes is presented in Table 3.18 (MDEQ 2004a).

Table 3.18. Trophic status of the Great Lakes.

Lake	Trophic Status (nutrient level)
Lake Superior	Oligotrophic (low)
Lake Huron	Oligotrophic (low)
Saginaw Bay	Meso/eutrophic (high)
Lake Michigan	Oligotrophic (low)
Lake Erie	Oligo/mesotrophic (moderate)
Western Basin	Eutrophic (high)

Source: MDEQ 2004a.

Sediments

Intensive agricultural production, timber harvesting, mining, construction, and other land disturbance activities greatly increase soil erosion and sedimentation on Great Lakes waters (GLC 2005a). Soil erosion from agricultural influences, is a significant problem in Michigan. Annually, an estimated 606 million tons of topsoil erodes from cropland in Great Lake states (GLC 2005a), including 9 million tons of soil deposited into the Saginaw Bay watershed alone (GLP 2005a). Although the precise amount of soil erosion resulting from agricultural use has not been determined, it is possible given that nearly half of the total agricultural land in all the Great Lakes states is in Michigan, that the State's farms contribute up to one half of the basin's agriculturally-induced soil erosion (GLP 2005b).

In shoreline zones, sediments muddy the water, preventing sunlight from reaching aquatic vegetation and making the water unappealing to swimmers. Sediments can also carry excess nutrients, pesticides, and toxic substances, causing additional water quality problems (EPA 2005a).

For more information on sedimentation and soil erosion, see Section 3.10, Soil Resources Section.

Pesticides

Toxic contamination from agricultural practices continues to be a concern in the Great Lakes. Shoreline zones are vulnerable to the introduction of pesticides and herbicides found in agricultural runoff (EPA 2005a). Since the national ban on DDT, levels of this harmful pesticide in fish are declining. However, despite being banned, dieldrin, a pesticide once used on corn crops in Michigan, continues to persist in fish at relatively high levels (EPA 2005c). Some toxic substances, such as dieldrin, bind to sediment and are transported to coastal waters through erosional processes. These toxic substances can cause scarring, death, or reproductive failure in fish and organisms. In addition, they can accumulate in fish tissue, leading to fish consumption advisories (EPA 2005a).

For more information on pesticides in receiving waterbodies, see Section 3.5, Surface Water.

3.11.4 Effects of Alternative A (No Action) on Coastal Resources

Coastal resources would continue to decline as Michigan's population increases. The decline would occur despite the CZMA, which require consultation and coordination with federal and state agencies before development is permitted.

Under Alternative A, current agricultural practices would continue to have long-term minor to moderate adverse effects on coastal resources. Shoreline waters would continue to be impacted by sediments, nutrients, and other contaminants in agricultural and urban runoff.

The No Action alternative would not achieve any of the objectives listed in Section 1.4.

3.11.5 Effects of Alternative B (CREP Agreement) on Coastal Resources

Implementation of Alternative B would have a beneficial effect on coastal resources. Direct benefits would occur from implementation of all of the CPs. The CPs are designed to either filter sediment and nutrients from water or prevent soil erosion, resulting in beneficial impacts to coastal areas. CPs 1, 2, 23, and 23A all reduce soil erosion through the establishment of vegetative cover on land that has been degraded by human activities. CPs 21 and 22 remove sediment, nutrients, and other pollutants from surface water through the establishment of buffers. CP26

Direct beneficial effects may occur within planning areas as acres covered under the CZMA that are in agricultural use or adjacent to agricultural use may be enrolled in CREP.

By reducing sediment and nutrient loads, CREP is expected to have long-term moderate to high beneficial effects on shoreline waters. Reductions in sediment and nutrient load would increase vegetative and faunal diversity while reducing cover of invasive alien algae (EPA 2005a).

Selection of Alternative B would meet all the CREP Objectives in Section 1.4.

3.12 Biological Resources

3.12.1 Introduction

ESA was enacted to protect endangered and threatened species and to provide a means to conserve critical habitat. All Federal agencies were mandated to protect species and preserve their habitats by ensuring that Federal actions do not jeopardize the continued existence of listed species.

ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future. T&E designations may be applied to all species of plants and animals except pest insects. A species may be threatened at the State level, but that same designation does not automatically apply nationwide, as species numbers may be greater in other States.

Critical habitat is defined by ESA as areas that are essential to the conservation of listed species. Private, city, and State lands are generally not affected by critical habitat until the property owner needs a Federal permit or requests Federal funding. Because the Michigan CREP is partially funded by Federal dollars, consultation with FWS will be required when T&E species or critical habitat are encountered for CREP contracts and FSA makes a determination that the installation of a CP may affect a listed species.

Section 7 of ESA, called "Interagency Cooperation," is the mechanism by which Federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. Under Section 7, consultation with FWS is initiated when any action the agency carries out, funds, or authorizes may affect a T&E species or critical habitat. This process usually begins as an informal consultation. In the early stages of project planning, a Federal agency approaches FWS and requests informal consultation. Discussions between the two agencies may include what types of listed species may occur in the proposed action area, and what effect the proposed action may have on those species. This process begins with the EE process completed jointly by FSA and NRCS for each contract.

If the Federal agency, after discussions with FWS, determines that the proposed action is not likely to affect any listed species in the project area, and if FWS concurs, the informal consultation is complete and the project moves ahead. If it appears that the agency's action may affect a listed species, that agency may then prepare a biological assessment (BA) to assist in its determination of the project's effect on a species.

When a Federal agency determines, through a BA or other review, that its action is likely to adversely affect a listed species, the agency submits a request to FWS for formal consultation. During formal consultation, the Service and the agency share information about the project and the species likely to be affected. Formal consultation may last up to 90 days, after which FWS will prepare a biological opinion on whether the activity will jeopardize the continued existence of a listed species. The Service has 45 days after completion of formal consultation to write the opinion.

Round-leaf Orchid. Courtesy of MDNR.

In making a determination on whether an action will result in jeopardy, FWS begins by looking at the current status of the species, or "baseline." Added to the baseline are the various effects – direct, indirect, interrelated, and interdependent – of the Federal action. The Service also examines the cumulative effects of other non-Federal actions that may occur in the action area, including State, tribal, local, or private activities that are reasonably certain to occur in the project area (FWS 2003a).

FWS has recently proposed rules that would help remove disincentives from private landowners that wish to manage their property for the benefit of listed species (64 Federal Register (FR) 32706-32716). This would entail the development of Safe Harbor Agreements and Candidate Conservation Agreements with Assurances. These agreements would ensure agricultural landowners that traditional agricultural uses could continue alongside habitat improvements. They would also address the issue of "incidental take" with regard to activities such as habitat restoration.

3.12.2 Existing Conditions

Vegetation

Political boundary surveys from the early 1800s have provided information about Michigan's natural landscape as it appeared prior to intensive lumbering, agricultural, or urban development. Surveyors took detailed notes on the prairies, savannas, forests, wetlands, and lakes. Ecologists from the Michigan Natural Features Inventory developed a methodology to translate these notes into an electronic map that can be used by researchers, land managers, and the general public. Using existing knowledge of the Michigan's native vegetation, approximately 80 different land cover types were recognized from the surveyor's records (MDNR 2005a).

With this historical information, resource managers can now compare acreages of different vegetation types that exist today with what existed around 1800. Roughly 50 percent of Michigan's upland forests have been lost to agriculture and urban development since 1800. Between 28-35 percent of historical wetland acreage has been lost statewide, with losses in southern Lower Michigan the greatest (>40 percent). Over 50 percent of the cedar, black spruce, and tamarack swamps have been either drained or converted to other wetland types (MDNR 2005a).

Currently, there are just over 1,800 species of native Michigan plants. The State has diverse habitats ranging from prairie and southern forests to boreal species with several endemic species of plants associated with the Great Lakes' shorelines. An additional 800 non-native species have been introduced

into the wild flora of Michigan; some intentional and some unintentional. Some invasive species, including Eurasian millfois, garlic mustard, spotted knapweed, and purple loosestrife have become serious problems in some wetlands and natural areas (MDNR 2005b).

Eastern Box Turtle. Courtesy of MDNR.

Michigan's Great Lakes shoreline contains some of the most significant and unique natural features in the State and region. The largest freshwater dune complexes in the world are found in this coastal zone. A rich assortment of natural communities including boreal forests, cedar swamps, Great Lakes marshes, limestone cliffs, and a globally rare bedrock grassland community known as alvar, comprise much of the remainder of these lakeshores (MDNR 2005c).

T&E and Protected Vegetation

The majority of the State protected species are plants. Michigan's Department of Natural Resources (MDNR) estimates that 46 native plant species have been lost recently; the State currently has 51 endangered plants, 210 threatened plants, and 110 plants listed as special concern. About 23 percent of Michigan's native plant species are at risk (Table 3.19) (MDNR 2005b). FWS (FWS 2005a) has identified two threatened plant species found in the counties of the project area: Eastern Prairie Fringed Orchid (*Platanthera leucophaea*) and Pitcher's Thistle (*Cirsium pitcheri*). See Appendix D for a complete list of all the State and Federal protected species found in the counties of Michigan CREP project area.

Table 3.19. Summary of Michigan State's plant species' status.

Category	Quantity	% of Native Plants
Extirpated Species	46	2.6%
Endangered Species	51	2.8%
Threatened Species	210	11.7%
Special Concern Species	110	6.1%
Secure Plant Species	1,383	76.8%
Total Native Plant Species	**1,800**	**100%**
Non-native Plants with Established Populations	**800**	
Total Plant Species	**2,600**	

Source: MDNR 2005b.

Wildlife

MDNR oversees the management of the State's wildlife. They divide wildlife into two categories: game (hunted) species and nongame (not hunted) species. Eighty-two percent of Michigan's vertebrates are listed as nongame species. Not included in this count are the numerous threatened and endangered plants, insects, and mollusks. Table 3.20 is a partial scorecard showing the numbers of vertebrates divided into the two categories and broken out by animal type (MDNR 2005d).

Table 3.20. Number of Total Animal Species and Game Species in Michigan.

Category		Total Number of Species	Number of Game Species
Vertebrate Species	Fish	150	50
	Amphibians	23	1
	Reptiles	28	1
	Mammals	66	23*
	Birds	370	40
	Total	**637**	**115**
Invertebrate Species	Insects	15,000-20,000 species	
	Mollusks	79 species	
	Snails	195 species	

Source: MDNR 2005d.

The shores of the Great Lakes in Michigan also serve as important migration corridors for large concentrations of landbirds and provide critical stopover habitat for neotropical migratory birds (MDNR 2005c).

Wetland habitat is extremely important to the stability of wildlife populations in the project area. Wetlands provide water, forage habitat, breeding habitat, relief from summer and winter extremes, as well as enhance water quality, sediment control, groundwater recharge, and flood storage. Reports indicate that wildlife use riparian areas disproportionately more than other types of habitat. For example, 50 percent of Michigan's native species are wetland species and over 25 percent of the wetland species are threatened or endangered. More than 40 percent of the 575 vertebrate (with a backbone) wildlife species in Michigan live in or utilize wetlands, including 10 to 15 of the 66 mammals, 180 of the 370 birds, 22 of the 28 reptiles, and all of the 23 amphibians (MDNR 2005e).

Fisheries

Michigan possesses a large amount of surface water sources, including the Great Lakes, perennial trout streams, and coastal wetlands. These water sources support a diverse assemblage of aquatic life. Michigan has over 170 species of fish, including 15 T&E species and 11 species of concern (MDNR 2005f). Each of Michigan's surface waters is protected by water quality standards for specific designated uses, including industrial, agricultural, and public water supply; recreation (partial and total body contact); warmwater and coldwater fisheries, other aquatic life, and wildlife; and navigation.

Michigan supports a thriving sport fishery with 30 major game species, including 10 species of bullhead catfishes, 18 species of trout, 12 species of sunfishes, and 18 species of perch (MDNR 2002). Approximately 36 percent of the total inland lake acreage is designated for coldwater fisheries uses; the remaining 64 percent is designated for warmwater fisheries uses. However, elevated mercury concentrations in fish tissue has resulted in a generic, statewide, mercury-based fish consumption advisory that applies to all of Michigan's inland lakes. In addition, public-health fish consumption advisories are in effect for all Michigan waters of the Great Lakes (MDNR 2004a); therefore, no Michigan waters of the Great Lakes are considered to be fully supporting designated uses (Table 3.21).

While a majority of Michigan's surface waters support aquatic life, fish consumption advisories preclude supporting designated uses for fisheries.

Table 3.21. Designated fisheries, aquatic life, and wildlife support summary for Michigan waterbodies.

Waterbody Type	Designated Use	Supporting	Not Supporting
Great Lakes	Aquatic Life	3,250 shoreline miles	0 shoreline miles
	Fisheries and Wildlife[a]	0 shoreline miles	3,250 shoreline miles
Inland Lakes	Aquatic Life	494,285 acres	8,704 acres
	Fisheries and Wildlife[b]	191,136 acres	311,853 acres
Rivers	Aquatic Life	21,487 miles	1,119 miles
	Fisheries and Wildlifea	20,926 miles	1,680 miles
Wetlands	Fisheries, Aquatic Life, and Wildlife Fish Consumption	10 acres	690 acres

[a] Based on fish consumption advisories.
[b] Based on extrapolation of mercury analysis of fish tissue.
Source: MDEQ 2004a.

In the Michigan CREP project area, there are a number of lakes, rivers, marshes, and coastal areas whose fisheries have been impacted by land use changes in the past 50 years, including conversion to agricultural land. The impacts of these land use changes on the surface waters of Michigan are similar across areas and waterbodies types, including sedimentation, increased nutrient loads, and excess pollution. The following sections summarize the current status of fisheries in several systems within the CREP area that are characteristic of the waterbodies in the project area.

River Raisin

The River Raisin watershed has the highest percentage of agricultural land use (92 percent) of any watershed in Michigan. Intensive agricultural land use coupled with fine particle soil types has degraded the river system by decreasing flow stability, altering natural channel morphology, and creating severe erosion and sedimentation problems. Channelization, drainage of wetlands, and installation of surface and tiled artificial drainage courses to facilitate agriculture have also decreased flow stability and altered temperature regimes (Dodge 1998).

The River Raisin watershed is known to have contained at least ninety fish species and fish diversity remains high, although certain species are declining and potamodromous fishes (i.e., those that migrate to spawning grounds within rivers and streams) have been virtually eliminated by the cooling water intake at the Detroit Edison Monroe Power Plant near the mouth and barriers to upstream migration created by various dams. Silt-tolerant fish species have increased, whereas fishes requiring clean gravel substrate or clear water with aquatic vegetation at some point in their life cycles have declined (Dodge 1998).

Agricultural activities have reduced flow stability and increased sediment load in streams throughout the watershed. Mussel species have declined as a result of increased sediment loading while introduced species such as zebra mussels and Eurasian milfoil have had negative effects on native fishes and macroinvertebrates. Wetland drainage and filling, primarily to facilitate agriculture, have also negatively affected populations of fish, amphibians, and reptiles (Dodge 1998).

Fishery management of the mainstem and major tributaries has been neglected. Past municipal and industrial point source pollution, excess turbidity from intense agricultural land use, lack of assured public access, and a very poor public image of the river have combined to discourage fishery management. Enhancement and promotion of angling opportunities on southern Michigan rivers are one of few remaining frontiers available to fishery managers (Dodge 1998).

Flint River

The Flint River is a principal tributary of the Shiawassee River, flowing into the Saginaw River and Saginaw Bay of Lake Huron. Based on post-1950 records, there are 77 species present in the fish community of the Flint River watershed. Five indigenous species are believed extirpated: lake sturgeon, lake trout, lake herring, lake whitefish, and muskellunge. These extirpated fish species are associated with Lake Huron and historically used the Flint River for spawning. Thirteen species of the present fish community have been introduced or have colonized in the basin. No State or federally threatened or endangered fish species occur in the Flint River watershed (Leonardi and Gruhn 2001).

Affects of watershed development have favored tolerant species with broad habitat requirements. As in the River Raisin, silt-tolerant fish species have increased in the watershed, whereas fishes requiring clean gravel substrate or clean cooler water have declined. Degraded water quality, unstable flow, and stream habitat loss from channelization are the three principal factors that have resulted in significant changes in fish species composition in the Flint River basin. Future fisheries management depends on improvement of these limitations. To establish and maintain self-sustaining populations, identifying and protecting river reaches of good water quality and habitat and rehabilitating degraded reaches is necessary (Leonardi and Gruhn 2001).

Tobico Marsh

Tobico Marsh is located in the Tobico Marsh State Game Area, near the western shore of Lake Huron's Saginaw Bay, about five miles north of Bay City. Although the Tobico Marsh receives little fishing activity, it is important from a fisheries standpoint as a nursery and spawning area for fish migrating from Saginaw Bay. Brown bullhead, black crappie, carp, and northern pike are common species. Conversion of Tobico Marsh to agriculture and residential development has altered the marsh ecosystem, particularly water levels. Management of this fishery focuses on modifying water control structures, such as the spillway and flap gate, to allow passage of fish and restore natural water level fluctuations (Schrouder 1997).

Saginaw Bay and the Walleye

Historically, the walleye (*Sander vitreus*) fishery in Saginaw Bay was the second largest in the Great Lakes and was supported by walleye reproduction in the watershed's rivers and on offshore reefs. The earliest commercial fisheries began in the 1830s. The fishery peaked in 1942 at 930,000 kilograms of harvest before collapsing in 1944 due to a series of year-class failures. These failures were principally the result of spawning habitat degradation brought about by a series of human activities. River-based reproduction was lost first, due to accumulation of products and waste from the logging industry. As watershed use gave way to agriculture, sedimentation increased, further degrading the river spawning substrate. By the turn of the 20th Century, numerous dams were constructed impeding the migration of spawning walleyes. As the Saginaw River system became industrialized, water was further polluted. Eventually, the reef-based reproduction sustaining the fishery succumbed to habitat loss resulting from sedimentation and reef degradation.

Walleye release. Courtesy of USGS..

The opportunity for recovery began in the 1970s with improving water quality, largely brought about by the passage of the CWA. Walleye fingerling

stocking increased in the early 1980s and a sport fishery soon developed. However, the walleye fishery plateaued by the mid 1990s, well short of historic yields, as the bay remained dominated by small prey fish species and there was insufficient predation to maintain ecological balance (Fielder and Baker 2004). The abundance of prey resources and low abundance of walleye and other predators cause walleye to grow extremely fast in Saginaw Bay. New recovery objectives based on growth rate, rather than historic yields, were developed, including: predator/prey balance, walleye population at carrying capacity, and self-sustaining natural reproduction. Modern day sources of walleye include natural reproduction from the watershed's rivers (particularly tributaries of the Saginaw River), stocking, and immigration from sources outside Saginaw Bay (Fielder and Baker 2004).

Reproduction in rivers is limited by dams blocking nearly 2/3 of the watershed's river reaches. To remedy this problem and restore walleyes access to spawning areas in rivers, six areas were identified as candidates for either removal of dams or the construction of ladders, including Shiawassee River, Chippewa River, Cass River, Tittabawassee River, Pine River, Flint River. Means for establishing fish passage and/or achieving dam removal will have to be formulated. Dam removal should be opportunity driven; capitalizing on the willingness of dam owners to participate in retirement and removal of dams (Fielder and Baker 2004).

A more widespread obstacle to recovery is to remedy the degradation of spawning habitat. Water quality in the Saginaw Bay watershed remains poor because activities such as agriculture keep sediment loads excessive. Sediment and erosion control is a long-term priority for achieving sustainability within the bay. Both stream spawning habitat and reef habitat will improve with incremental improvements in riparian habitat and regulation of land use. Furthermore, improvement of reef spawning habitat will be fruitless without first reducing the sediment that is delivered to the bay (Fielder and Baker 2004).

There are specific advantages to the recovery of the walleye population in Saginaw Bay, including reducing over abundant prey (especially nonnative planktivores) which will reduce over-grazing of zooplankton resources, reducing interspecific competition between prey species and yellow perch, and encouraging more walleye natural recruitment. In addition, the ecosystem will be more resistant to the invasion of exotic species and better for walleye fishing. Finally, restoration of other native species will be facilitated by recovery of walleye (Fielder and Baker 2004).

T&E and Protected Wildlife

Michigan is home to numerous rare wildlife species, some of which only occur in specific ecosystems, such as along the Great Lakes shoreline (MDNR 2005c). There are 11 T&E wildlife species that have been found in counties of the Michigan CREP project area. These species are identified in Table 3.22 (FWS 2005b).

The State of Michigan has identified 237 animal species that are either threatened, endangered, or of special concern. The categories and numbers of species are summarized in Table 3.23 (MDNR 2005f). A list of State species of concern is found in Appendix D.

Table 3.22. Federally listed threatened, endangered, and candidate wildlife species in the Michigan CREP project area.

Common Name	Scientific Name	Status[1]
Mammals		
Indiana Bat	Myotis sodalist	E
Birds		
Bald Eagle	Haliaeetus leucocephalus	T
Kirtland's Warbler	Dendroica kirtlandii	E
Piping Plover	Charadrius melodus	E
Reptiles		
Copperbelly Water Snake	Nerodia erythrogaster neglecta	T
Eastern Massasauga	Sistrurus catenatus	C
Clams		
Clubshell	Pleurobema clava	E
Northern Riffleshell	Epioblasma torulosa rangiana	E
Rayed Bean	Villosa fabalis	C
Insects		
Karner Blue Butterfly	Lycaeides melissa samuelis	E
Mitchell's Satyr	Neonympha mitchellii mitchellii	E

[1] T = Threatened, E = Endangered, C = Candidate.
Source: FWS 2005a.

Table 3.23. The State of Michigan's species of concern.

	Endangered	Threatened	Special Concern	Extirpated
Mollusks	10	4	27	0
Insects	8	11	75	0
Fishes	8	7	11	9
Amphibians	1	1	2	0
Reptiles	2	2	6	0
Birds	8	13	21	1
Mammals	4	2	4	0

Source: MDNR 2005f.

Piping Plover Critical Habitat

Piping plovers, a Federal and State listed endangered species, formerly nested throughout much of the Great Lakes region in the north-central United States and south-central Canada, but are currently limited to the coasts of northern Michigan and one site in northern Wisconsin. Piping plovers nest on shoreline and island sandy beaches with sparse vegetation and the presence of small stones (greater than 1 cm (0.4

inch)) called cobble. Their nests are concealed by the cobble and are, therefore, very difficult to see (EPA 2005d). A portion of Tawas Point State Park, in the CREP project area, is one of 23 areas in Michigan (and 35 in the Great Lakes Region) designated as critical habitat for the piping plover (FWS 2003b). Encompassing approximately 2.0 km (1.2 mi) of Lake Huron shoreline in Iosco County, the area provides suitable nesting habitat and foraging opportunities for transient piping plovers. This critical habitat extends from the Tawas State Park boundary on the east side of Tawas Point and offshore sand spits (FWS 2005c).

Piping Plover. Courtesy of DNR.

3.12.3 Impacts of Agriculture on Biological Resources

The rich and diverse wildlife populations of the CREP project area have responded to various habitat changes brought about by settlement and agricultural development. Prior to settlement, fish were limited to the river systems and their tributaries. Construction of ponds and reservoirs allowed an expansion in both the diversity and abundance of species. However, the continued development of land for agricultural and municipal purposes reduced and degraded plant communities, wetlands, and aquatic systems, resulting in lost and fragmented wildlife habitats and declining populations of many species.

Development of uplands and shorelines, wetland drainage, and conversion of woodlands and grasslands to agricultural purposes have diminished Michigan's flora and limited the amount and type of fauna in the area (MDNR 2005b).

Because 50 percent of Michigan's threatened or endangered species require healthy, fully functional wetlands to complete their life cycle, high quality and diverse wetland habitat is increasingly important (NRCS 2005a). The estimated 11 million acres of Michigan wetlands existing in pre-settlement times has now been reduced to less than 3 million acres. Although wetland areas in Michigan have been growing, shrinking and re-forming according to natural cycles since the last Ice Age and before, there has been an increased rate wetland loss resulting from filling and draining by humans in the last century. Prior to World War II, drainage to expand agricultural lands accounted for most of this loss. Recently, much wetland destruction has been caused by commercial, industrial, and residential expansion (MDNR 2005e).

Tawas Point State Park. Courtesy of U. of Michigan.

Michigan agricultural activities that include the use of the herbicide atrazine could have indirect effects on wildlife. Atrazine is listed as a pollutant causing degradation of surface water quality in the River Raisin watershed (see Table 12). Atrazine use could adversely impact terrestrial and aquatic plants in areas adjacent to treated fields and could result in loss of food sources and the loss of vegetative habitat affecting reproduction and the survivorship of both adults and offspring. Loss of food and vegetative habitat could force the animals to leave the affected areas and seek another acceptable habitat. Limits on acceptable habitats would increase stress on species competing for limited resources and may affect the ability to successfully reproduce and feed the young (EPA 2005e).

3.12.4 Effects of Alternative A (No Action) on Biological Resources

Implementation of the No Action Alternative would result in long-term, minor adverse effects to T&E species. Under the No Action alternative, new T&E listings could continue as newly jeopardized species are identified. These new listings and the declining habitat conditions of the currently listed species suggest that overall impacts on T&E species reflect a slow decline as human actions conflict with and adversely affect both species and their habitat. Under Alternative A, the following negative impacts would occur:

- Habitat values would continue to degrade,
- Population growth would continue to crowd natural ecosystems, and
- Pollution levels in agricultural runoff would remain high.

Conservation agreements currently in place would remain for a period of time depending on whether individual producers chose to place land back into agricultural production. Legislation and conservation programs would continue to regulate the dredging, filling, and construction protect in existing wetland habitats. Conservation practices in place would continue to preserve some wetlands, but no additional acres would be se aside to encourage establishment of T&E, special, and sensitive plant and animal species.

Under the No Action Alternative, wildlife and terrestrial habitat in Michigan would not benefit from the leveraged effects of additional habitat restoration and watershed improvement CPs and may continue to decline.

Alternative A would not contribute to the achievement any of the objectives listed in Section 1.4.

3.12.5 Effects of Alternative B (CREP Agreement) on Biological Resources

Implementing Alternative B would result in long-term beneficial effects to wildlife habitat values in the CREP enrolled acreage across the three watersheds. Many of the CREP CPs could potentially affect protected species. Improvements to water quality and increased water availability would have beneficial effects for all wildlife, particularly fisheries, and habitat quality would improve.

As part of the CREP enrollment process, a contract involving appropriate CPs would be developed for each individual site. Each contract would have an EE completed by FSA to determine if any T&E species are present and would be potentially affected by the proposed action. If so, consultation with FWS would be initiated. In addition, any CREP activity that may result in the disturbance of non-cropped areas adjacent to a proposed project site would be coordinated with FWS.

CP1 and CP2 (establishment of introduced and native grasses) together would provide up to 12,000 acres of nesting, brood-rearing, and winter cover and forage areas for insects and wildlife. The trees and shrubs planted for CP5A (field windbreaks) would enhance wildlife habitat by providing cover and protecting other vegetation.

The acreage devoted to wetlands would also increase. CP21 (filter strips) would remove nutrients and sediment, and contribute to overall health of waterbodies and habitat for local species. CP22 (riparian buffer) would provide for removal of nutrients and sediment in areas created for wildlife and aquatic organisms. It would also enhance the potential for wildlife movement along the riparian corridor by buffering the connective habitat from adjacent land uses. CP23 (Wetland Restoration - Floodplain) and CP23A (Wetland Restoration – Non-Floodplain) would provide up to 24,000 acres for retention of solids

and removal of nutrients, while also restoring habitat for species. Filtering provided by all the CPs would contribute to cleaner water entering the watersheds and various water bodies used by wildlife.

Each contract would be evaluated by FSA to determine if the actions resulting from implementing CPs would affect biological resources. Consultation with FWS by FSA would occur when developing a conservation plan where critical habitat or T&E species may be encountered. Alternative B would help achieve the CREP Objectives outlined in Section 1.4.

3.13 Cultural / Tribal Resources

NHPA requires consideration of historic properties and their values in cooperation with other nations and with state and local governments. Amendments designated the SHPO or the Tribal Historic Preservation Office (THPO) as the party responsible for administering programs in the states or reservations (ACHP 2002).

Cultural resources include prehistoric and historic archaeological sites, architectural structures and designs, and American Indian resources. Prehistoric archaeological resources include the physical remnants of human activity that predate written records. They include archaeological sites, structures, artifacts, and other evidence of prehistoric human activities (ACHP 2002).

Historic resources can include materials, properties, or locations that postdate written records. These resources can include archaeological structures, artifacts, documents, and other evidence of human behavior, and may also include locations of historical events or sites associated with the lives of historically significant persons. Resources must normally be greater than 50 years old to be considered as historic and eligible for the National Register of Historic Places. However, it is possible for a resource less than 50 years old to be eligible, such as properties that are of exceptional importance to a community, State, tribe, region, or the nation (ACHP 2002).

American Indian resources may include prehistoric and historic sites and artifacts, areas of occupation and events, historic and contemporary sacred areas, materials used to produce tools and other objects, hunting and gathering areas, and other resources that may be of importance to contemporary American Indians. Traditional Cultural Properties (TCPs) that may be impacted by proposed actions may be referred to but not specifically identified in compliance documents in order to avoid unintended impacts on sacred or significant sites. Tribal consultation should be pursued to determine environmental impacts, if any, to TCPs (ACHP 2002).

Cranbrook. Courtesy of HAL 2005a.

3.13.1 Existing Conditions

Michigan's long history of American Indian culture and European settlement has resulted in a remarkably diverse collection of historic and cultural resources worthy of preservation. Many cultural resources are believed to be associated with this rich legacy, including diverse historic properties like houses, commercial and residential areas, farm and factory complexes, cemeteries and parks, monuments, and ships and shipwreck sites. In total, Michigan has catalogued over 3,000 historic sites statewide (HAL 2005a).

Michigan contains American Indian settlements and burial sites, French and British military and trading outposts, and nineteenth century logging camps, mines and homesteads. Beneath the waters of the Great

Lakes, there are shipwrecks and other remains documenting the maritime trade. The Office of the State Archaeologist maintains records on 18,000 sites on land, and 1,400 shipwrecks (HAL 2005a).

The National Register of Historic Places, maintained by the National Park Service, includes significant properties nominated by State and Federal agencies and all National Historic Landmarks. Michigan State has approximately 1,000 National Register Listings. National Historic Landmarks are nationally significant historic places designated by the Secretary of the Interior because they possess exceptional value or quality in illustrating or interpreting the heritage of the United States (NPS 2005). There are 36 National Historic Landmarks in Michigan; three are in CREP project area counties (HAL 2005b). Table 3.24 displays the number of places on the National Register of Historic Places list as well s those places registered by the State.

Table 3.24. Number of places listed with the National Register of Historic Places and the State in the counties of the Michigan CREP.

County	National Register of Historic Places	State-Listed Places	County	National Register of Historic Places	State-Listed Places
Allegan	28	37	Mecosta	2	14
Arenac	2	5	Midland	19	7
Bay	13	34	Monroe	13	26
Clare	2	8	Montcalm	2	10
Genesee	63	79	Oakland	61	199
Gladwin	0	1	Ogemaw	0	4
Gratiot	4	20	Osecola	0	6
Hillsdale	8	25	Ottawa	19	55
Huron	25	30	Roscommon	1	4
Iosco	3	10	Saginaw	34	44
Isabella	3	13	Sanilac	10	29
Jackson	20	48	Shiawassee	42	36
Lapeer	25	29	Tuscola	11	48
Lenawee	38	69	Washtenaw	74	95
Livingston	11	31	**TOTAL**	**533**	**1016**

Source: HAL 2005b.

There is one Native American Reservation located in the counties of the Michigan CREP. Near the City of Mount Pleasant in Isabella County, the Isabella Reservation is the headquarters of the Saginaw Chippewa Tribe and is 232 square miles (Sagchip 2005). According to the 2000 U.S. Census, the population of the Isabella Reservation and Off-Reservation Trust Land was 25,838. Other prominent Native American tribes of the region include the Ottawa and Potawatomi, both organized and Federally recognized (Census 2005).

3.13.2 Effects of Alternative A (No Action) on Cultural / Tribal Resources

Under the No Action Alternative, minor to moderate adverse impacts on cultural resources would continue to occur. These include disturbance and destruction of prehistoric and historic sites and structures, either through ongoing land conversion for development or agricultural use. Sites and structures, if discovered on private land, may often go unreported. In some instances, destruction of a site or structure may occur before a professional is able to assess its significance. On Federal land or for actions requiring a Federal permit, potential impacts on cultural resources must be considered before the Federal agency can implement, fund, or permit a proposed action.

Without implementation of CREP, areas that could have been enrolled in CREP may not be evaluated for cultural resources.

3.13.3 Effects of Alternative B (CREP Agreement) on Cultural / Tribal Resources

Adverse effects to cultural resources, TCPs, and culturally significant landscapes in the CREP project area may occur during the installation of CPs. Installation activities requiring excavation or other earth moving activities could potentially disturb buried sites or artifacts. Any impacts to cultural resources, if they occur, would be addressed as part of the Section 106 review and consultation process designated by NHPA.

The inventory maintained by SHPO would be referenced when completing site specific EEs. FSA would assess potential impacts to cultural resources as the result of any CREP contract and take appropriate actions to ensure that any adverse impacts are properly mitigated. As part of this process, a cultural resource survey of the property may be required. The review must take into account that deeply buried sites may be present and that implementation CREP CPs may affect them. In addition, tribal consultation may be required if TCPs are indicated.

Alternative B would assist the State in its efforts to meet the CREP objectives outlined in Section 1.4.

3.14 Human Health, Social, and Economic Issues

NEPA and its implementing regulations and guidelines, require consideration of the socioeconomic impacts of Federal actions in preparation of environmental documents. Section 1508.8 of the CEQ's "Regulations for Implementing NEPA" states that:

> Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
>
> Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect would be beneficial.

This PEA will present regional and local information on the socioeconomic conditions in Michigan that are relevant to the implementation of CREP, and the potential impacts of the project on these conditions.

3.14.1 Existing Conditions

State Economy

In Michigan, farms cover over 10 million acres of land, approximately 28 percent of the State's land area (NASS 2002 and USCB 2005a). The State produces and exports numerous agricultural products making agriculture a major contributor to Michigan's economy. In 2003, 53,300 Michigan farms produced and sold approximately $37 billion worth of agricultural commodities. Net farm income rose to $444 million dollars in 2003, a gain of nearly 18 percent from 2002. Value added to the Michigan economy by crop outputs was $2.4 billion in 2003, while livestock products contributed $1.4 billion. In 2001, nearly 14 percent of the State's population was employed in farm-related jobs, primarily in the wholesale and resale trade. Over 90 percent of the farms are individually or family-owned and operated, and only 2,027 acres of farmland were leased in 2002 (NASS 2004).

Agriculture and effects of agriculture impact the State's economy in other ways. For example, commercial fertilizers were applied to 5,476,283 acres on 32,568 farms across the State at a cost of over $241 million (NASS 2004).

Recreation and Tourism

In addition to agriculture, Michigan's thriving leisure and hospitality industry has the potential to be impacted by CREP. Recreation and tourism is the State's third most important economy. Tourism relies heavily on water oriented activities. Michigan has more licensed anglers than any other state and ranks first in the number of boats registered. Sport fishing, boating, lake cottages, and resorts are major income producers and are important to the economy of the State (IWR n.d.).

The 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation revealed that 3.5 million Michigan residents and nonresidents 16 years old and older fished, hunted, or watched wildlife in Michigan. Of the total number of participants, 1.35 million fished, 754,000 hunted, and 2.7 million participated in wildlife watching activities, including observing, feeding, and photographing wildlife. The sum of anglers, hunters, and wildlife watchers exceeds the total number of participants in wildlife-related recreation because many individuals engaged in more than one wildlife activity. In 2001, State residents and nonresidents spent $2 billion on wildlife recreation in Michigan. Of that total, trip-related expenditures were $964 million and equipment purchases totaled $882 million. The remaining $176 million was spent on licenses, contributions, land ownership and leasing, and other items and services (USCB and FWS 2003). Table 3.25 summarizes total expenditures by resident and non-resident sportspersons in Michigan in 2001.

Table 3.25. Total expenditures by resident and non-resident sportspersons in 2001.

Expenditure	Fishing	Hunting	Wildlife-Watching
Trip-related	$519 Million	$163 Million	$282 Million
Equipment	$263 Million	$264 Million	$355 Million
Other	$57 Million	$63 Million	$56 Million
Total	**$839 Million**	**$490 Million**	**$693 Million**

Source: USCB and FWS 2003.

Michigan also has an active winter recreation season, with more than 6,000 miles of snowmobiling and 40 ski properties, as well as hundreds of miles of cross-country ski trails (ACSA 2003). Enhancing this recreational opportunity may contribute to increased local and regional employment opportunities, tax revenue, expenditures, and increased local and State sales and gas tax revenue.

Additional economic activities include agri-tourism. Agri-tourism is defined as the act of visiting a working farm or any agricultural, horticultural or agribusiness operation for the purpose of enjoyment, education, or active involvement in the activities of the farm or operation (Lobo 2005). Michigan State publishes an annual guide including over 300 farm markets, farmers' markets, and U-Pick farms. Many agri-tourism operations also offer other activities and seasonal events like wine tasting, hayrides, corn mazes, picnic areas, or petting farms (MDA 2004b).

A Michigan Blueberry Farm. Courtesy of MSU.

Environmental Justice

All Federal programs, including CREP, must comply with EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Federal agencies are required to incorporate environmental justice as part of the overall agency mission.

The EO details that environmental justice ensures that all people, regardless of race, color, national origin, or income, receive the following treatment:

- Are provided with fair treatment and meaningful involvement with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies;
- Have the opportunity to express comments or concerns before decisions are rendered on the Federal programs, policies, procedures, or activities affecting them; and
- Share in the benefits of, are not excluded from, and are not adversely or disproportionately affected by Federal programs, procedures, policies, or activities.

Application for the Michigan CREP will require the completion of an EE by FSA which addresses potential effects of an action in regards to environmental justice. If the proposed action is found to cause any adverse human health or environmental effects to minority or low-income communities, a discussion of the negative impacts must be attached.

Minority Populations

Historically, Michigan has been a predominately white, non-Hispanic state. In 2000, the population of Michigan was approximately 10 million, with almost 79 percent being white, non-Hispanic. In keeping with the trend of the general population, the majority of farm operators in Michigan are white, non-Hispanic (USCB 2005a). Table 3.26 summarizes the racial diversity of the State and provides information on the racial diversity of farm operators.

Table 3.26. The racial diversity of the State of Michigan in 2000.

Race	Percent of State	Number of Farm Operators
White persons, not of Hispanic/Latino origin	78.6	77,320
Black or African American persons (a)	14.2	243
Persons of Hispanic or Latino origin (b)	3.3	1,145
American Indian and Alaska Native persons (a)	0.6	264
Asian persons (a)	1.8	76
Native Hawaiian and Other Pacific Islander (a)	> 0.5	25
Persons reporting some other race (a)	1.3	n/a
Persons reporting two or more races	1.9	265

(a) Includes persons reporting only one race.
(b) Hispanics may be of any race, so also are included in applicable race categories.
Source: USCB 2005a and NASS 2002.

Migrant Farm Workers

Michigan is the fourth largest migrant employer state in the U.S. (Kossek et al. 2005); nearly 45,000 migrant and seasonal farm workers (MSFWs) farmed 45 Michigan crops in 2000. In 2002, 537 farms in the Michigan CREP counties employed MSFWs (NASS 2004).

Among Michigan's low-income farm workers, half are limited in the English language, nearly all endure multiple barriers to stable employment, a majority have serious or critical nutritional needs, and nearly half require childcare services to be able to work (Telemon 2005). The major needs of the population are for housing and health services (AFOP 2005).

Farm Worker Health

Migrant farm-working jobs require physically and emotionally demanding work in hazardous conditions with exposure to chemicals and a high risk for injury. Skin, eye, and respiratory problems are common occurrences. Additional occupational health hazards of farm work include tuberculosis, diabetes, and cancer, all of which require frequent medical treatment (NCFH 2005). Additionally, the nomadic lifestyle of MSFW makes successful treatment difficult. Finally, many MSFW are fearful of the losing their jobs, and therefore do not ask for needed medical attention (Kossek et al. 2005).

EPA estimates that 300,000 farm workers in the U.S. suffer acute pesticide poisoning each year. Many of these workers do not seek treatment, or are misdiagnosed because symptoms can mimic a viral infection (NCFH 2005). Pesticide exposure can occur from a number of sources such as contaminated soil, dust, work clothing, water, and food. Because of the nature of agriculture and the proximity of homes to the fields, family members can also be exposed to hazardous chemicals through pesticide drift (i.e., the deposition of a pesticide off its target). In addition, agricultural workers can inadvertently expose family members to hazardous materials by carrying materials home from work on their clothes, skin, hair, and tools, and in their vehicles (McCauley et al. 2000). Pesticide exposure represents the greatest health threat to the children in agriculture; they are more susceptible to pesticides because they absorb more per pound of body weight and because their nervous system and organs are still developing (Kossek et al. 2005).

Many migrant workers' lack of education and economic desperation can also contribute to health concerns. For example, a Washington State study of 460 hired farm workers found that 89 percent did not know the name of a single pesticide to which they had been exposed, and 76 percent had not received any information on appropriate protective measures (NCFH 2005).

A Michigan State University study found that, in addition to physical health issues, migrant farm working families have psychological and social concerns. The challenges present in their daily lives pose serious structural constraints to cultural assimilation and the family's ability to manage stress and improve long term overall social and economic well-being (Kossek et al. 2005).

The demanding agricultural lifestyle requires farm workers have access to health care. Yet, farm workers are less likely to have health insurance than other workers. Nationally, only five percent of farm workers nationally report receiving health insurance from their employer. Moreover, since few farm workers have sick leave, they face the loss of badly needed wages, or even the loss of their jobs, if they take time off to seek health care. Finally, most farm workers in Michigan are of Hispanic origin; this group often faces linguistic and cultural barriers when attempting to access health. These factors mean that farm workers often cannot access the health care they need (Kossek et al. 2005).

Poverty

Despite the health concerns, the biggest challenge facing MSFWs is extreme poverty, with household incomes often far below U.S. Federal poverty guidelines. National data shows that one half of all farm working families earn less than $10,000 per year. This income is well below the 2002 U.S. poverty guidelines of $18,100 for a family of four (Kossek et al. 2005).

In 2002, the poverty rate for the State of Michigan was 10.9 percent, less that the national average of 12.1 percent. Within the counties in the project area, the average poverty rate (11.1 percent) was slightly higher than the statewide average but still below the national average (ERS 2005). Table 3.27 outlines the poverty rate and the total number of individuals below the poverty line in 2002.

Table 3.27. Poverty information for counties in the Michigan CREP project area in 2002.

County	Poverty Rate (est. rate) percent	Number in Poverty (est. rate)	County	Poverty Rate (est. rate) percent	Number in Poverty (est. rate)
Allegan	8.3	9,093	Mecosta	15.7	6,050
Arenac	14.6	2,426	Midland	8.1	6,788
Bay	10.2	11,070	Monroe	6.9	10,362
Clare	16.0	5,003	Montcalm	12.0	7,252
Genesee	13.0	57,416	Oakland	6.1	73,491
Gladwin	12.9	3,459	Ogemaw	15.1	3,259
Gratiot	12.3	4,653	Osceola	12.9	3,023
Hillsdale	11.0	5,075	Ottawa	5.9	14,418
Huron	11.9	4,176	Roscommon	15.1	3,932
Iosco	14.1	3,753	Saginaw	13.1	26,920

County	Poverty Rate (est. rate) percent	Number in Poverty (est. rate)	County	Poverty Rate (est. rate) percent	Number in Poverty (est. rate)
Isabella	13.8	8,228	Sanilac	12.2	5,401
Jackson	11.9	18,274	Shiawassee	9.1	6,537
Lapeer	7.1	6,386	Tuscola	10.2	5,865
Lenawee	8.4	8,133	Washtenaw	8.7	27,828
Livingston	4.0	6,976	**Michigan State**	**10.9**	**1,080,996**

Source: USDA 2004.

3.14.2 Effects of Alternative A (No Action) on Human Health, Social, and Economic Issues

Under Alternative A, agricultural practices would continue as they have for years. The degradation of water quality that currently results from agricultural practices, which leads to ancillary impact to wetlands, wildlife, tourism, etc, would continue into the future. Alternative A would not result in any State water quality improvements, unless existing programs (see Section 1.6.21) are greatly expanded.

Implementation of Alternative A would likely have the following effects:

- The total amount of agricultural production in Michigan would continue to respond to market forces and the economy of the State.
- The rental rates and land values of Michigan acreage would continue to be affected by development values and population density.
- The total number of Michigan farms would continue to respond to market forces and the economy of the State.
- Any trends or cycles evident in the labor market would continue and provide the same number of jobs, with fluctuations due to market conditions.
- Agriculture would continue to contribute roughly the same value to the overall economy.
- Agricultural productivity would continue to be reduced topsoil erodes from cropland each year, a loss of nutrients valued at over $3 billion annually throughout all the Great Lakes states (GLC 2005a).
- The continued erosion of the watersheds would reduce the capacity of the soil to absorb flood waters, increasing flooding costs (GLC 2005a).
- The cost to maintain water treatment and drainage systems and ditch and road operations impaired by the effects of sedimentation would continue and possible increase (GLC 2005a).
- Alternative A would not offer mechanisms to improve the water quality of Michigan. Because of the significant income provided by tourism, recreation, fishing, boating, and other water-related businesses, this continued degradation has the potential to negatively impact existing and future growth in the recreation and tourism sector.

- Swimming opportunities and other water-based recreational opportunities would be impaired by increased sediment and nutrient loading that often cause weed growth and high bacteria counts (GLC 2005a).
- A multi-billion dollar sport and commercial fishing industry is threatened by the effects of soil erosion and sedimentation (GLC 2005a).
- Alternative A offers no additional land preservation than the current programs offer. This may result in continued land use changes in the State (i.e., agricultural land conversion) and the socioeconomic impacts associated with these changes would continue.
- Environmental justice would be an ongoing compliance problem because American Indian tribes, migrant workers, and low income or ethnically distinct populations have historically experienced more environmental impacts than the general population. This condition is likely to continue under the No Action alternative. Under this alternative, there would be no CREP funds available for any producers (including minorities). No FSA actions are required or necessary under the No Action alternative to address existing or ongoing issues with environmental justice.

Flower crop strips with windbreak in background. Allegan County, Michigan.

- Exposure to pesticides and other harmful chemicals by farm workers and their families would continue to occur at current levels.
- Alternative A would not offer mechanisms to improve the water quantity and quality of Idaho. MSFW and other low-income populations could be exposed to contaminants in their drinking water from private wells or other water sources.

The No Action Alternative would not meet any of the CREP objectives outlined in Section 1.4.

3.14.3 Effects of Alternative B (CREP Agreement) on Human Health, Social, and Economic Issues

Though ultimately beneficial, long term statewide economic effects from CREP implementation would be minimal. The Michigan CREP proposes the potential enrollment of up to 80,000 acres across the three watersheds. These 40,000 acres are only one percent of the total acres of cropland that are harvested each year. Implementation of Alternative B would result in general improvement to the water quality of Michigan. The degradation of water quality that currently results from agricultural practices, which leads to ancillary impact to wetlands, wildlife, and tourism, would decline as a result of implementing CREP.

Implementation of Alternative B would likely have the following effects:

- If CREP was intensively implemented in a small geographic region, it could create a localized and artificial shift in rental rates and land values. CREP contains safeguards to prevent this from happening. For instance, there is a 25 percent acreage cap on

CREP enrollments within a county, limiting the amount of cropland enrolled in CRP and CREP in a certain geographical region. In addition, the acres enrolled in CREP would likely be spread across the State, since participating landowners typically enroll partial farms or fields.

CREP could create a situation where land enrolled in CREP has a greater value than surrounding lands. This is unlikely to happen in Michigan as income earned through CREP would remain less than the average development value of nearby land. CREP-enrolled lands are also lands that are marginally productive agricultural lands that are non-developable so there is no opportunity cost to enrollees. All of these factors would limit the acres of cropland taken out of production in a given area and, consequently, the local economic impact due to implementation of CREP would be minimal to non-existent. These rental rates and land values of Michigan acreage would continue to be affected by development values and population density and would not be impacted by the Alternative B.

- Alternative B would not result in changes to total number of Michigan ranches/farms. The 25 percent acreage cap on CREP and the practice of participating landowners to enroll partial farms or fields means that entire ranches and farms would not be enrolled in CREP. This total would continue to respond to market forces and the economy of the State and not be impacted by Alternative B.
- CREP implementation would not substantially impact the State's economy. Agriculture would continue to contribute roughly the same value to the overall economy. CREP enrolled lands would provide residual income to enrollees, supporting the overall local economy although possibly at a slightly reduced rate. However, this slight reduction, spread across the entire state, would have an inconsequential effect on the total economy. Michigan's economy would continue to be affected by market forces and would not be impacted by Alternative B.
- Any trends or cycles evident in the labor market would continue and provide the same number of jobs, with fluctuations due to market conditions. CREP enrollments would be spread across the entire State and have only little to no effects to agricultural labor markets.
- Implementation of Alternative B has the potential to slightly reduce total agricultural acreage across the State because the CREP-enrolled land is removed from production. However, even at full enrollment, CREP would only affect one percent of the State's harvested cropland. Additionally, the lands (partial fields, strips, or buffers) enrolled in CREP would most likely be less productive areas of a given farm. By enrolling these areas, the landowner may be able to reduce the overall input costs of farming operations, and in some cases, actually maintain or increase production by being able to concentrate resources on the remaining farmland. These two factors would likely result in minimal

Landowner in a wildflower planting providing wildlife habitat. Mecosta County, Michigan.

to no effects across the State. There would likely be no displacement of migrant farm workers. Agricultural production would continue to respond to market forces and the economy of the State and not be significantly impacted by Alternative B.

- There is a possibility for a slight beneficial effect to farm incomes from the steady and guaranteed receipt of CREP funds by enrolled producers. As discussed above, producers are more likely to enroll marginally productive lands and the residual income from CREP may result in slightly more or at least consistent income than the acreage was capable of producing as farmland. These values, if they occur, would not have a significant impact across the State.
- With the addition of filter strips, buffers, tree plantings, and wetlands, wildlife habitat would be improved and expanded. This has the potential to increase opportunities for hunting and fishing in these areas and may lead to localized increases in the sale of hunting and fishing equipment and licenses. Similar effects may occur in other local resource-based recreation industries (e.g., snowmobiling).
- Alternative B offers an additional land preservation program to the State's producers, the benefits of which can be added to those provided by the current programs. This may slow the future rate of large scale land use changes in the State (i.e., agricultural land conversion) and the socioeconomic impacts associated with these changes.

  Another potential effect is the financial incentive for producers to maintain open space which may help enhance the value and desirability of surrounding residential and commercial land.
- Disproportionate effects on minority or underrepresented groups are unlikely, because most CREP agreements are likely to be widely separated by intervening non-CREP land holdings.
- With CREP-enrolled land taken out of current agricultural production, less pesticide and other chemicals could be used. The reduced exposure could lead to a decrease in health problems for MSFW and their families.
- The improved water quality resulting from Alternative B could decrease the exposure of MSFW and other low-income populations to pesticide and other chemicals in their drinking water.
- Lands enrolled in CREP would augment the hunting and fishing and wildlife watching industry as most of the CPs would enhance wildlife habitat quantity and quality as well as water-based recreation opportunities. Other resource-based recreation activities in the watersheds would similarly be affected by CREP implementation.

Alternative B would assist the State in their efforts to meet the CREP objectives outlined in Section 1.4.

3.15 Cumulative Effects

3.15.1 Introduction

CEQ regulations require that the cumulative effects of a program be considered when evaluating potential environmental impacts for an EA or EIS. CEQ defines cumulative effects as:

> the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR § 1508.7).

Cumulative effects most likely arise when a relationship exists between a proposed action and other actions expected to occur in a similar location during a similar time period. The geographic boundaries considered in the cumulative effects analysis will be limited to the counties where lands are eligible for enrollment in CREP as well as water resources that are located downstream of eligible CREP land. The time frame to be considered in the cumulative effects analysis will be 15 years which is the maximum term of a CREP contract.

3.15.2 Past, Present, and Reasonably Foreseeable Actions

Actions overlapping with, or in proximity, to the proposed action are most likely to have the potential to result in cumulative effects. In addition, programs similar to CREP are also likely to have a cumulative effect. For these reasons and for consideration at the programmatic level, only conservation programs that provide financial or technical assistance to private landowners and are designed to mitigate impacts to natural resources are analyzed for cumulative effects. These programs include NRCS conservation programs, FWS and Forest Service programs, watershed partnerships, and environmental and conservation programs administered by the State of Michigan. The cumulative impacts of ongoing agricultural practices will also be analyzed for each resource issue.

NRCS Programs

The NRCS assists farmers with conservation of the natural resources vital to farmland productivity. A brief description of NRCS conservation programs that are active in CREP counties can be found below. Table 3.28 summarize the number of contracts, acres, and financial assistance for each of the programs.

Environmental Quality Incentives Program (EQIP): The Environmental Quality Incentives Program (EQIP) is a voluntary conservation program that supports production agriculture and environmental quality as compatible goals. It provides financial and technical assistance to farmers and ranchers who install conservation practices that address natural resource concerns on agricultural lands. EQIP provides funds for conservation planning, design and installation on cropland, grazing land, and animal feeding operations Projects in Michigan include noxious weed control, brush management, pasture hayland planting, terraces, and groundcover installation (NRCS 2005b).

Conservation Innovation Grants (CIG): Conservation Innovation Grants (CIG) were established as part of EQIP in the 2002 Farm Bill. The purpose of this grant program is to carry out projects that stimulate innovative approaches to leveraging Federal investment in environmental enhancement and protection in conjunction with agricultural production. http://www.mi.nrcs.usda.gov/programs/cig.html

Grassland Reserve Program (GRP): Grassland Reserve Program (GRP) offers a new opportunity for landowners to protect privately owned grasslands. The GRP was authorized in the 2002 Farm Bill with the intent of protecting grasslands which play a vital role in protecting water quality and providing wildlife habitat (NRCS 2005b).

Wildlife Habitat Incentives Program (WHIP): The Wildlife Habitat Incentives Program (WHIP) is a voluntary program that encourages creation of high quality wildlife habitats that support wildlife populations of National, State, Tribal, and local significance. Through WHIP, the NRCS) provides technical and financial assistance to landowners and others to develop upland, wetland, riparian, and aquatic habitat areas on their property (NRCS 2005b).

Wetlands Reserve Program (WRP): The Wetland Reserve Program (WRP) is used for wetland restoration, enhancement, or creation on private land. The spirit and focus of WRP in Michigan is to provide a wide diversity of high quality wetland, and associated upland as habitat for migratory birds and wildlife. A diversity of wetland types such as emergent marshes, shrub-scrub, and wet prairies, to name a few, is the key to the WRP success in Michigan (NRCS 2005a).

Farm and Ranchland Protection Program (FRPP): This program is used to help State, Tribal, or local government entities purchase the development rights to keep productive farm and ranch land in agricultural use, protecting agricultural land that is at high risk from development. Development for residential uses could result in much greater nutrient runoff into near-shore waters (NRCS 2005b).

Conservation Security Program (CSP): The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. River Raisin, a CREP watershed, was one of the CSP watershed in 2005. The Maple River and Boardman-Charlevoix watersheds are the authorized CSP watersheds in Michigan for 2006. The Maple River watershed includes four counties in the CREP area (Gratiot, Montcalm, Saginaw, and Shiawassee) (NRCS 2005b and NRCS 2005d).

Watershed Protection and Flood Prevention Program (PL-566): The PL-566 watershed program assists Federal, State, local agencies, local government sponsors, tribal governments, and program participants to protect and restore watersheds from damage caused by erosion, floodwater, and sediment, to conserve and develop water and land resources, and to solve natural resource and related economic problems on a watershed basis. The program provides technical and financial assistance to local people or project sponsors and requires local and state funding contributions (NRCS 2005b).

Emergency Watershed Protection (EWP) Program: The Emergency Watershed Protection program (EWP) helps communities repair environmental damage to streams, rivers and other natural resources, caused by natural disasters such as floods and fires. It is designed to relieve imminent hazards to life and property. All EWP projects must be sponsored by a political subdivision of the State, such as a city, county, or Conservation District. The NRCS may bear up to 75 percent of the construction cost of emergency measures. The remaining 25 percent must come from local sources and can be in the form of cash or in-kind services (NRCS 2005b).

Table 3.28. State-wide summary of NRCS conservation programs in Michigan.

Program	Number of Contracts	Acres	Financial Assistance (Dollars)
EQIP	1,819	316,982	62,092,420
WHIP	482	9,001	2,878,388
GRP	80	12,410	1,983,092
CRP **	14,157	208,509	132,509,863
WRP	279	27,457	60,100,000
FRPP	37	8,001	14,638,898
CREP	7,576	88,785	26,946,524
EWP	27	1,468	2,179,744
FIP	139	2,194	246,896
PL-566 New	172	25,654	5,001,567
PL-566 Revised	83	0	379,983
CSP	387	205,773	7,642,424
CIG	1	0	584,500

**Total CRP (General Continuous and CREP) acreage activity by FY. Michigan has 268,420.2 acres under 15,419 CRP contracts as of 10/01/05. CRP Financial Assistance represents payments for all active CRP contracts that FY

irregardless of FY approved.
Source: Allen 2005a.

Federal Landowner Assistance Programs

There are several landowner assistance conservation programs available in Michigan through FWS and watershed partnerships that assist landowners in protecting their forest, wildlife, and watershed resources. These programs are briefly summarized below.

The Landowner Incentive Program (LIP): The Landowner Incentive Program (LIP) is a FWS program that provides funding and technical support to enhance, restore, or preserve natural habitats for at-risk and T&E species. The State is divided into four regions and the projects eligible for each region differs depending on the sensitive and/or rare habitat. Potential projects include (MDNR 2005g):

- Prescribed burns and/or native grass plantings to restore barrens or grasslands.
- Jack pine planting to improve habitat for endangered species.
- Invasive species management (i.e. removal, herbicide application, etc.).
- Prairie plantings and prescribed burns to restore savanna and grassland habitat.
- Wetland restorations by ditch plugging or tile breaks.

Partners for Wildlife (PFW): Since 1987, the FWS PFW program has offered technical and financial assistance to private landowners to voluntarily restore wetlands and other fish and wildlife habitats on their land (FWS 2005e). Since this program began in Michigan in 1988, more than 8,320 acres of wetland have been restored on 1,986 sites, 3,412 acres of upland have been restored at 217 sites, and 168 miles of streams have been restored at 42 sites. Most projects were on lands in the southern 47 counties of Michigan, including counties in CREP watersheds. Much of this land has been farmed at some point in time, providing the greatest opportunity for wetland and grassland restoration projects. These restoration projects increase wildlife abundance and diversity, increase recreational opportunities, and improve soil, air, and water quality (FWS 2005f).

Great Lakes Basin Program for Soil Erosion and Sediment Control: The Great Lakes Basin Program for Soil Erosion and Sediment Control (Basin Program) by providing resources that allow managers to take action to prevent soil erosion and sedimentation, protects the water quality of the Great Lakes basin. Initiated in 1991 and authorized in the 2002 Farm Bill, this Federal/State partnership has supported well over 200 demonstration and technical assistance projects throughout the Great Lakes region. The Basin Program is coordinated by the Great Lakes Commission in partnership with the NRCS, EPA, U.S. Army Corps of Engineers, and the eight Great Lakes States (including Michigan). Nonfederal agencies, academia, and nonprofit organizations are eligible to apply for grants for demonstration, information and education projects taking place within the Great Lakes basin (GLC 2005b).

Watershed Partnerships

Saginaw Bay Watershed Initiative Network (WIN): Saginaw Bay Watershed Initiative Network **(**WIN) is a voluntary, non-regulatory partnership created to protect the Saginaw Bay. Communities, conservation groups, foundations, and businesses work together to enhance the Saginaw Bay Watershed and create a more sustainable future for all of its inhabitants. WIN has formed partnerships to balance environmental, economic, social, recreational, and historic priorities, and to leverage ideas and resources toward a common goal—the greater good of future generations. WIN has launched projects to project habitat, improve access to the bay, foster nature-based tourism, inform people about nonpoint source pollution, and support sustainable agriculture (WIN 2005).

WIN has created the following task groups to develop projects and set priorities (WIN 2005):

- **Agriculture/Pollution Prevention** — Develops projects that address a broad range of agricultural, environmental, and social/community issues and economic concerns, such as value-added production, improving farm profitability, reducing soil erosion, preventing pollution, and protecting farm for the next generation of farmers.
- **Wildlife Stewardship** — This task group focuses on projects that improve and protect important habitats, educate, and provide improved access to significant wildlife-related sites.
- **Water Resources** — Addresses environmental issues of concern to watershed residents, particularly water quality issues.
- **Land Use** — Develops projects to address land use issues in the watershed.
- **Communication** — Three primary responsibilities include improving communication among WIN members, providing training and information to WIN participants about sustainability, and communicating Win's work and activities to the public.

Macatawa Watershed Project: The Macatawa Watershed Project (Project**)** began in 1996 with the purpose to reduce the amount of phosphorus introduced into Lake Macatawa from stormwater runoff. The Project works with the local units of government, homeowners, developers, educators, and the agricultural community to effectively address stormwater pollution prevention. Several wetland restoration sites have already been completed and farmers throughout the watershed have installed grassed waterways and filter strips that are designed to reduce soil erosion and decrease nutrient loads in agricultural runoff (MACC 2005c)

Farmer Advisory Committee was created to provide leadership and help other farmers get involved with the Project. The committee provides advice and guidance to the Project on how to address nonpoint source issues in the watershed (MACC 2005c).

River Raisin Watershed Council: The River Raisin Watershed Council (RRWC) is a non-for-profit membership organization with a growing constituency of individuals, businesses, municipalities and community groups seeking to protect the natural resources of the watershed (RRWC 2005).

Working in partnership with these diverse interests, RRWC acts as a catalyst to improve and protect the watershed through planning, advocacy, education, and science. The goals of the Watershed Management Plan for the River Raisin are to (RRWC 2005):

- Coordinate, inform and improve planning and implementation activities
- Establish eligibility for state and federal grant funds
- Increase stakeholder participation
- Foster stewardship
- Improve river image
- Improve water quality and habitat impairments

Recent notable improvement activities in the watershed have included (RRWC 2005):

- Construction of the regional wastewater treatment plant for Palmyra and Madison Townships (including the Manor Farms subdivision)
- Construction and hook-up of Mooreville area homes to sanitary sewer
- Natural Resources Conservation District CREP program
- Land conservation directed by the Nature Conservancy and the River Raisin Land Trust
- The River Raisin Watershed Initiative project undertaken by the Lenawee County Soil Conservation District (LCSCD), including public education and involvement programs and agricultural and stream stabilization BMP projects
- Creation of the River Raisin Adopt-A-Stream program by the LCSCD and subsequent hand-over to the River Raisin Watershed Council

- Streambank stabilization and clean-up projects near Adrian, Blissfield, Dundee, Pittsfield, Rasinville, Saline, and Somerset

Michigan Conservation and Environmental Programs

The MDA plays a leadership role in innovative environmental stewardship programs. The purpose of these programs is to provide education, technical assistance, and cost-share programs to agricultural producers to minimize and prevent pollution from agricultural sources (MDA 2005f). A summary of these programs is provided below.

Farmland Preservation: The Department of Agriculture currently operates two main programs that work to preserve farmland and open spaces: the Farmland and Open Space Act, commonly known as "P.A. 116," and the Purchase of Development Rights (PDR) program (MDA 2005f).

Forestry Assistance Program (FAP): Under an agreement with the MDNR, the MDA recently awarded grants to Conservation Districts (CD) across the state to provide education and one-on-one technical assistance to private landowners and to communities regarding local forest health issues. Professional foresters working out of 20 District offices will provide coverage for 46 counties in the upper and lower peninsulas in Michigan. The purpose of the program is to assist Conservation Districts in their efforts to help Michigan citizens better understand, plan, manage, protect and utilize their forest resources (MDA 2005f).

Agricultural Pollution Prevention (AgP2): Agricultural Pollution Prevention (AgP2) is defined as source reduction, reuse or environmentally sound recycling, and other prevention activities including nonpoint source approaches. P2 aims to eliminate and/or reduce the generation of pollutants at their source when practicable, environmentally acceptable, and economically feasible (MDEQ 2005u).

The MDEQ has initiated a partnership with the MDA, Michigan agricultural associations, and farmers to promote voluntary pollution prevention in agriculture. Guided by the Michigan AgP2 Strategy, the AgP2 partnership is a coordinated effort among producers, agricultural service providers, and public agencies to promote pollution prevention. Key partnership goals focus on preventing agricultural pollution through increased efficiency while maintaining and improving on-farm profitability (MDEQ 2005u).

Michigan Agriculture Environmental Assurance Program (MAEAP): MAEAP is a voluntary, pro-active program designed by state and federal agencies, farmers and industry partners to reduce producers' legal and environmental risks. It teaches effective land stewardship practices that comply with state and federal regulations and shows producers how to find and prevent agricultural pollution risks on their farms (MDA 2005g).

The program encompasses three systems (livestock, farmstead, and cropping) that are designed to help producers evaluate the environmental risks of their operation. Each system examines a different aspect of a farm, as each has a different environmental impact. Through each phase, producers will develop and implement economically feasible, effective and environmentally sound pollution prevention practices (MDA 2005g).

Michigan Groundwater Stewardship Program (MGSP): The MGSP is a locally driven program that provides one-on-one technical assistance to farmers. The program helps farmers identify risks to groundwater associated with their pesticide and nitrogen fertilizer use practices and it coordinates local, state, and federal resources to help individuals reduce those risks. Two key components of the program are Clean Sweep and Pesticide Container Recycling, which work jointly to collect and properly dispose of outdated pesticides that may cause potential harm to the environment and to recycle containers that burden landfills (MDA 2005f).

Right To Farm Program: Michigan's Right to Farm law recognizes the importance of a farmer's right to farm while at the same time ensuring sound environmental stewardship. Michigan farmers receive

protection from odor and noise related lawsuits by following a series of scientifically-based Generally Accepted Agricultural Management Practices (GAAMPS). GAAMPS have been developed for the following agricultural practices (MDA 2005f):

- Irrigation Water Use
- Site Selection
- Manure Management / Utilization
- Pesticide Utilization/Pest Control
- Nutrient Utilization
- Care of Farm Animals
- Cranberry Production

Ongoing Agricultural Activities

Ongoing agricultural practices are discussed in detail in Chapter 2 and impacts to resources from ongoing agricultural practices are discussed in more detail in Chapter 3. These impacts are summarized briefly for each resource below.

Surface Water Resources: Agricultural practices such as agricultural chemical use (e.g., pesticides and fertilizer) and manure application introduce sediments, nutrients, pesticides, and bacteria into waterbodies receiving runoff from cropland and other farmland.

Groundwater Resources: Agricultural chemicals have been detected in groundwater throughout Michigan (MDA 2005c). In the River Raisin, the CREP watershed with the most agricultural land use, pesticides and nitrates have been detected in groundwater monitoring wells with relative frequency (Frey 2001).

Drinking Water: Drinking water contaminants from nonpoint sources (e.g., agricultural lands, residential stormwater runoff) in Michigan include sediments, nutrients (nitrogen and phosphorus), microorganisms, and pesticides (Sweat et al. 2002). Another contaminant of concern for the Michigan CREP area is THM, possibly originating from reaction between chlorine used in water purification process and organic matter in sediment present in surface water (MDA 2005c).

Irrigation in Michigan. Courtesy of USGS.

Wetlands: Over 70 percent of Michigan's original wetlands have been drained or filled, while many remaining wetlands are no longer representative of original landscape types (MDNR 2001). Much of the historic wetlands were drained for agricultural use (Kost 2002).

Floodplains: Changes in land cover surrounding the floodplain have also altered species composition and structure within floodplain forests and may restrict forest regeneration. Loss of floodplain forests has altered the hydrology in floodplains and increased flood damages (MSUE 2005b).

Soil Erosion: Soil erosion, particularly from agricultural practices, is a significant problem in Michigan. Although the precise amount of soil erosion resulting from agricultural use has not been determined, it is possible that Michigan farms contribute up to one half of the Great Lake basin's agriculturally induced soil erosion (GLP 2005b).

Coastal Resources: Michigan has 3,288 miles of Great Lakes coastline (EPA 2004). Agricultural practices have contributed to the poor water quality of the Great Lakes, by accelerating eutrophication and soil erosion and applying herbicides and pesticides (EPA 2005a; GLC 2005a; EPA 2005c).

Protected Species: The development of land for agricultural and municipal purposes has reduced and degraded plant communities, wetlands, and aquatic systems, resulting in lost and fragmented wildlife habitats and declining populations of many species. In addition, the development of uplands and shorelines, wetland drainage, and conversion of woodlands and grasslands to agricultural purposes have diminished Michigan's flora and limited the amount and type of fauna in the area (MDNR 2005b).

Cultural Resources: Sediments in agricultural runoff contributes to siltation and damages near-shore waters, affecting historical resources such as shipwrecks (HAL 2005a). Earth moving activities associated with agriculture has the potential to disturb archaeological sites or other historic properties.

Human Health, Social and Economic Issues: Agriculture contributes to the State economy by providing jobs and through the sale of agricultural products. Exposure of farm workers to agricultural chemicals can result in human health issues.

3.15.3 Cumulative Effects Summary

Existing State and Federal conservation programs would continue to strive to collectively improve water quality and wildlife habitat. However, without CREP, a powerful tool in improving water quality and wildlife habitat, the current iterations of these programs would continue to be only as effective as they have in the past. Implementation of Alternative A would result in the continuation of current observable trends in nonpoint source pollution and resource degradation and the cumulative effects that accompany these problems.

Working in conjunction with existing State programs, CREP implementation would contribute to the cumulative improvement of the State’s water quality. Likewise, the enhancement of wildlife habitat across CREP watersheds would add to the State’s resources and provide additional protection for listed State and Federal species. Wetlands, groundwater, soil resources, coastal resources, wildlife, and cultural resources would all benefit from the cumulative effects of protection and enhancement that CREP would provide. CREP is designed to augment and enhance conservation of resources and to promote water quality improvement. It would work in conjunction with other conservation efforts being implemented at both the State and Federal level and result in statewide cumulative improvements to Michigan’s natural conditions. Cumulative effects for each resource are summarized in Table 3.29.

Table 3.29. Summary of cumulative effects by resource.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Surface Water Quality	NRCS conservation programs remove land from active agriculture, reducing soil erosion, and nutrient and chemical applications. CPs associated with these programs improve water quality by filtering sediments and nutrients from agricultural runoff.	Many of the assistance programs available to agricultural producers and private landowners are specifically designed to improve surface water quality. MAEP and AgP2 are programs that provide technical and financial assistance to agricultural producers that aids them in pollution prevention and reduction of soil erosion. The watershed partnerships all have programs that are intended to reduce pollutant loads in surface water.	Ongoing agricultural practices add nutrients, sediment, and pesticides to surface water runoff, degrading water quality of receiving waterbodies and resulting in non-attainment of beneficial use designations.	State and Federal conservation programs would collectively strive to mitigate the adverse impacts of land use practices on water quality.	CREP is designed to complement existing Federal and State conservation programs. Combined with these programs, CREP would result in cumulative benefits to water quality. Over the course of CREP (10-15 years) sediment nutrient, and pesticide loads would be expected to decrease as more land is enrolled in CREP and other conservation programs. In addition, Alternative B specifically targets water quality as an issue and would help accelerate improvements to water quality.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Groundwater Resources	NRCS conservation programs would improve surface water quality, improving the quality of water recharging groundwater and reducing groundwater contamination.	Specifically, MGSP is a State program designed to improve groundwater quality. Other State and Federal programs would improve the quality of water recharging aquifers.	Agricultural practices can contaminate water that recharges aquifers and deplete the amount of groundwater available through pumping for irrigation.	State and Federal programs would continue to address groundwater contamination issues and work towards reducing contamination of surface water recharging aquifers. Since the average age of many groundwater resources in Michigan is older than 45 years, the effects of past and current agricultural activities and conservation programs may not be observed for decades.	CREP combined with other NRCS, Federal, and State conservation programs would cumulatively have a greater impact on groundwater quality. If implemented in the same watershed, these programs could complement each other and potentially improve the effectiveness of each program.
Drinking Water	NRCS conservation programs would improve surface water quality, improving the quality of water recharging groundwater and reducing groundwater contamination.	The purpose of many of these programs is improve the quality of surface water and groundwater, which reduces contamination of drinking water sources.	Agricultural practices that use agricultural chemicals such as fertilizers and pesticides can contaminate surface water and groundwater sources of drinking water.	NRCS and other State and Federal conservation programs improve the quality of water used for drinking water sources.	CREP combined with other NRCS, Federal, and State conservation programs would cumulatively have a greater impact on water quality. If implemented in the same watershed, these programs could complement each other and potentially improve the effectiveness of each program.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Wetlands	Specifically, WRP restores, enhances, and protects wetlands. Additional CPs implemented through the different NRCS programs may include restoration of wetlands. NRCS programs also include improvement of wildlife habitat including wetlands.	Ongoing State and Federal conservation programs maintain and preserve natural areas and native habitat including wetlands.	Conversion of wetlands to agricultural land leads to loss of wetlands; soil erosion on agricultural land adds sediment to runoff and can lead to sedimentation of downstream wetlands and reduce wetland functions.	Conversion of wetlands to agricultural land and other land uses continues to threaten wetlands in Michigan. Ongoing State and Federal programs collectively strive to protect, enhance, and restore wetlands.	Wetlands restored and enhanced through CREP would increase the overall acreage of wetlands in Michigan watersheds protected by State and Federal programs.
Floodplains	NRCS programs restore native vegetation; installs riparian buffers; and protects natural habitats, all of which serve to maintain or enhance floodplain functions.	Other conservation programs maintain and preserve native habitat and vegetation, reducing impacts that occur in floodplains from degradation of these habitats.	Development in floodplains can compact soil and negatively impact floodplain functions. Agriculture in floodplains may alter floodplain functions. Floodplain forests, an important vegetative community in Michigan, are impacted by past and current agricultural development that inhibits their recovery and reduces floodplain values.	Ongoing conservation programs protect and enhance natural habitats in floodplains, helping to preserve a functioning floodplain. However, these benefits are offset by land uses that occur in floodplains. Agricultural and urban land use in floodplains compact soil and channelize streams, resulting in higher flood volumes and more flood damage downstream.	CREP would complement ongoing conservation efforts in floodplains. Together, these programs would lessen impacts to floodplains. CREP would add additional acres to land already protected or enhanced by conservation programs.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Soil Resources	NRCS programs protect native habitats and restores native vegetation, thereby maintaining year-round cover, reducing wind and water erosion.	The Basin Program, a federal/state partnership, specifically targets soil erosion and sedimentation issues in the Great Lakes region. It is the purpose of this program to reduce soil erosion and sedimentation. Other state and federal programs that protect and restore native habitat and that promote sustainable agricultural practices also help protect soil resources and reduce sedimentation.	Practices such as tilling and planting leave bare ground for part of the year, increasing the potential for runoff and wind erosion.	Despite the ongoing conservation programs that are intended to ameliorate soil erosion, soil loss and sedimentation continue to be persistent problems in Michigan.	CREP would complement ongoing soil conservation efforts. Additional acres would be enrolled in CPs that are designed to control erosion, increasing the overall effectiveness of other ongoing programs.
Coastal Resources	Improvements to water quality from NRCS conservation programs lessen the impacts of agricultural practices on coastal resources.	Indirect effects include improvement of water quality through restoration of native habitats and resulting in less sedimentation into the Great Lakes.	Sediment and nutrients adversely affect the Great Lakes. Sedimentation blocks sunlight and leads to decline of native species. Excessive nutrients result in growth of invasive non-native species and increases eutrophication, adversely impacting aquatic wildlife.	Several State and Federal programs strive to improve water quality of surface water that enters the Great Lakes; however, sedimentation and eutrophication that results from pollutants introduced into surface water by urban and agricultural land use practices continue to be an issue.	As CPs become established on CREP enrolled land, benefits to the coastal resources of the Great Lakes would become more evident as runoff from land enrolled in CREP and other conservation programs improves in quality.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Protected Species	Protection and restoration of natural habitats through NRCS programs provides benefits to Michigan's protected species. Specifically, WHIP is a NRCS program that is designed to improve wildlife habitat on private land.	Existing State and Federal conservation programs protect and enhance natural habitats that are important for T&E species and other at-risk species. LIP and PFW, FWS programs, specifically target habitat of T&E species on private land for protection and restoration.	Conversion of land for agricultural purposes has resulted in a decrease in the amount of quality habitat available to T&E species. Sediment and nutrient loads in agricultural runoff impact aquatic species. Land disturbance or fallow agricultural land encourages the establishment of invasive species that out-compete native species and degrade native habitats.	Existing Federal and State programs strive to preserve and restore native habitat and control invasive species.	CREP would complement other conservation programs that are designed to preserve and protect habitat of T&E species. Through CREP, additional acres would be added to those already protected by existing State and Federal programs, increasing the amount of quality habitat available to T&E species. Some of the CPs also are specifically designed to restore and/or enhance wildlife habitat.
Cultural / Tribal Resources	Consultation with SHPO concerning NRCS programs ensures the protection of cultural resources and historic properties on private land enrolled in these programs.	Programs receiving Federal funds need to comply with Section 106 of the NHPA. Compliance with NHPA protects cultural resources located on private land that participates in these programs, protecting cultural resources that might not otherwise be protected.	Earth moving activities associated with agricultural activities has the potential to disturb burial sites and other historical or cultural properties. Discovery and/or disturbance of cultural resources may go unreported by private landowners.	Participation in NRCS and other State and Federal programs provides protection and preservation of cultural properties. Private landowners not participating in these programs may not conduct site surveys or otherwise protect cultural properties.	Under CREP, private land enrolled in contracts would be surveyed for cultural properties increasing the number of historic and cultural properties protected or preserved on private land.

Resource Issue	NRCS Programs	Other Federal and State Programs	Ongoing Agricultural Practices	Cumulative Effects of Alternative A: No Action	Cumulative Effects of Alternative B: CREP
Human Health, Social and Economic Issues	Rental rates from NRCS programs would offset the cost of implementation of CPs and the removal of land from active agricultural production. In addition, removal of land from active agriculture would minimally reduce farm worker exposure to agricultural chemicals.	Existing State and Federal programs offer private landowners some monetary compensation for implementing conservation programs. Additional benefits may come from recreational use (e.g. hunting, bird watching, hiking) of restored or conserved natural habitats.	Agriculture provides jobs and adds to the overall economy through the sale of agricultural products. Application of agricultural chemicals may adversely impact farm worker health.	Existing State and Federal conservation programs may increase local income derived from recreational use of land that has been preserved or restored. Monetary compensation would available to private landowners for conservation efforts. Removal of agricultural land from active production may lessen farm worker exposure to agricultural chemicals.	Through CREP, additional funds would be available to landowners to implement CPs. Rental rates would be available to producers for marginal farmland that has limited agricultural productivity. Additional acres placed into conservation programs could enhance recreational value of the land and could increase local income derived from recreation use. Marginal farmland typically requires greater application of fertilizers and pesticides, enrolling this land into CREP and other conservation programs would reduce application of these chemicals, decreasing farm worker exposure.

3.16 Unavoidable Adverse Impacts

The following sections describe those effects which are adverse and cannot be avoided without mitigation.

3.16.1 Alternative A (No Action)

Nonpoint source pollution attributed to agriculture would increase over time. Continued agricultural practices would likely contribute to long term water quality degradation in watersheds across the State. There is the probability of increased seasonal erosion accompanied by increased sedimentation in regional streams immediately following harvests. Nutrient loading and waterborne pathogens would continue to impact downstream ecosystems and human populations.

3.16.2 Alternative B (CREP Agreement)

Alternative B would reduce the unavoidable adverse impacts listed under Alternative A by providing filter strips to reduce sedimentation; creating wetlands to help filter contaminants; and reducing the overall use of fertilizers and pesticides.

3.17 Relationship of Short Term Uses and Long Term Productivity

3.17.1 Alternative A (No Action)

This alternative would maximize the short term uses of the environment, but would not enhance the long term productivity of eligible lands. Marginal croplands and pasturelands that might otherwise be enrolled in CREP would stay in production and would drain landowners' resources for continued use. Fertilizers and pesticides used on these lands would remain and contribute to watershed pollution.

3.17.2 Alternative B (CREP Agreement)

Under Alternative B, the short term uses of the human environment would be maximized and long term productivity would be simultaneously enhanced. Marginal croplands would be enrolled in CREP and would provide leveraged benefits to other lands and waterbodies in affected watersheds. Resources used to sustain the marginal lands would be diverted to help maximize the productivity of prime croplands. Potential overuse of fertilizers to increase productivity on marginal lands would be reduced.

3.18 Irreversible and Irretrievable Commitments of Resources

3.18.1 Alternative A (No Action)

Irreversible and irretrievable commitments of resources include fuel and time spent conducting agricultural practices. The irreversible loss of soil resources from the State's agricultural lands would continue at the current or perhaps an accelerated rate due to splash, rill, and streambank erosion.

3.18.2 Alternative B (CREP Agreement)

As with Alternative A, the irreversible and irretrievable commitments of resources including fuel and time spent conducting agricultural practices would continue, though perhaps at a decreased rate. Agricultural soil loss would likely continue, but at a much reduced rate as appropriate CPs are implemented.

Chapter 4.0 List of Preparers

Table 4.1. Name, area of expertise, education, and years experience of those who contributed as part of the interdisciplinary team.

Name	Area of Expertise	Education	Experience
Danielle Healey	Writer	B.A. Biology; M.S. Biology	2 years
Kim Richardson Barker	Writer/Editor	B.S., Environmental Studies; M.S., Range Science	2 years
Suzanne Hill	Writer	B.S. Watershed Science; M.A. Science Education	3 years
Kelson Forsgren	Writer/Editor	B.A., English; M.S., Technical Communication	13 years
James Fortner	FSA National Environmental Compliance Manager	B.S., Agriculture and Extension Education	20 years
Kathleen Schamel	FSA Federal Preservation Officer	B.A.; M.A., Anthropology	19 years

THIS PAGE INTENTIONALLY LEFT BLANK.

Chapter 5.0 List of Agencies and Persons Consulted and/or Provided Copies of This Environmental Assessment

Federal

Dale Allen, Michigan State FSA
Natural Resources Conservation Service

State

Michigan Department of Agriculture

Michigan Department of Environmental Quality

Michigan Department of Natural Resources

Tribal

Other Groups or Entities

THIS PAGE LEFT INTENTIONALLY BLANK

Chapter 6.0 References

(ACHP 2002) Advisory Council on Historic Preservation. 2002. The National Historic Preservation Program: Overview. *http://www.achp.gov/overview.html.*

(ACSA 2003) American Council of Snowmobile Associations. 2003. Snowmobiling Economic Impact. *http://www.snowmobileacsa.org/page.cfm/19.*

(AFOP 2005) Association of Farmworker Opportunity Programs. 2005. Farmworkers in the Area. *http://www.afop.org/members/memberinfo.cfm?ID=19* .

(Agreement 2000) Agreement between the U.S. Department of Agriculture/Commodity Credit Corporation and the State of Michigan concerning the implementation of the Michigan Conservation Reserve Enhancement Program. September 2000.

(Albert 2003) Albert, D.A. 2003. Between Land and Lake: Michigan's Great Lakes Coastal Wetlands. Michigan Natural Features Inventory, Michigan State University Extension, East Lansing, Mich.: Extension Bulletin E-2902. *http://web4.msue.msu.edu/mnfi/pub/pdfs/BetweenLandAndLake.pdf.*

(Albert and Kost 2000) Albert, D. A., and M. A. Kost. 1998, updated 2000. Natural community abstract for lakeplain wet prairie. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Lakeplain_wet_prairie.pdf.*

(Allen 2005a) Allen, D. 2005a. Email to Suzy Hill concerning Michigan Farm Bill activity. 22 Nov.

(Allen 2005b) Allen, D. 2005b. Email to Suzy Hill concerning eligible conservation practices. 29 Nov.

(Census 2005) U.S. Census Bureau. 2005. United States Census 2000. *http://www.census.gov/main/www/cen2000.html.*

(Dodge 1998) Dodge, Kenneth E. 1998. River Raisin Assessment. Michigan Department of Natural Resources, Fisheries Division, Special Report 23. Ann Arbor, Michigan. *http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/special/reports/sr23/sr23Text.pdf.*

(EPA 2004) Environmental Protection Agency. 2004. National Coastal Condition Report II. EPA-620/R-03/002. *http://www.epa.gov/owow/oceans/nccr/2005/downloads.html*.

(EPA 2005a) Environmental Protection Agency. 2005a. Coastal Watershed Factsheets. *http://www.epa.gov/owow/oceans/factsheets/.*

(EPA 2005b) Environmental Protection Agency. 2005b. Level III Ecoregions. *http://www.epa.gov/wed/pages/ecoregions/level_iii.htm.*

(EPA 2005c) Environmental Protection Agency. 2005c. The Great Lakes: An Environmental Atlas and Resource Book. *http://www.epa.gov/glnpo/atlas/.*

(EPA 2005d) Environmental Protection Agency. 2005d.Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Great Lakes Breeding Population of the Piping Plover. *http://www.epa.gov/fedrgstr/EPA-SPECIES/2000/July/Day-06/e16815.htm*.

(EPA 2005e) Environmental Protection Agency. 2005e. Reregistration Eligibility Science Chapter for Atrazine Environmental Fate and Effects Chapter. *http://www.epa.gov/oppsrrd1/reregistration/atrazine/efed_redchap_22apr02.pdf.*

(EPA 2005f) Environmental Protection Agency. 2005f. Nonpoint Source Pollution: The Nation's Largest Water Quality Problem. *http://www.epa.gov/OWOW/NPS/facts/point1.htm.*

(EPA 2005g) Environmental Protection Agency. 2005g. Saginaw River/Bay Area of Concern *http://www.epa.gov/glnpo/aoc/sagrivr.html.*

(EPA 2005h) Environmental Protection Agency. 2005h. River Raisin Area of Concern. *http://www.epa.gov/glnpo/aoc/rvraisin.html.*

(ERS 2005) Economic Research Service. 2005. State Facts Sheet: Michigan. *http://www.ers.usda.gov/StateFacts/MI.htm.*

(FEMA 2005) Federal Emergency Management Agency. 2005. Flood Insurance Policy and Claims Statistics. *http://www.fema.gov/nfip/pcstat.shtm.*

(Fielder and Baker 2004) Fielder, D.G. and J.P. Baker. 2004. Strategy and options for completing the recovery of walleye in Saginaw Bay, Lake Huron. Michigan Department of Natural Resources, Fisheries Special Report 29. *http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/special/reports/SR29.pdf.*

(Frey 2001) Frey, J.W. 2001. Occurrence, Distribution, and Loads of Selected Pesticides in Streams in the Lake Erie-Lake St. Clair Basin, 1996–98. USGS Water-Resources Investigations Report 00-4169.

(FSA 2000) Farm Service Agency. 2000. Conservation Reserve Program Michigan Enhancement Program Fact Sheet. *http://www.fsa.usda.gov/pas/publications/facts/html/crpmi00.htm.*

(FSA 2005) Farm Service Agency. 2005. Monthly Active CRP Contract Reports. *http://www.fsa.usda.gov/dafp/cepd/crp_reports.htm*

(FWS 2003a) Fish and Wildlife Service. 2003. Endangered Species Act Section 7 Consultation. *http://midwest.fws.gov/endangered/section7/section7.html.*

(FWS 2003b) Fish and Wildlife Service. 2003. Recovery Plan for the Great Lakes Piping Plover (Charadrius melodus). Region 3. Fort Snelling, MN. *http://nyfo.fws.gov/es/GLplover03.pdf.*

(FWS 2005a) Fish and Wildlife Service. 2005a. County Distribution of Michigan's Federally-Listed Threatened, Endangered, Proposed, and Candidate Species. *http://www.fws.gov/midwest/Endangered/lists/michigan-cty.html.*

(FWS 2005b) Fish and Wildlife Service. 2005b. Michigan List of Threatened, Endangered, Proposed and Candidate Species. *http://www.fws.gov/midwest/Endangered/lists/state-mi.html.*

(FWS 2005c) Fish and Wildlife Service. 2005c. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Great Lakes Breeding Population of the Piping Plover. *http://www.eswr.com/f050701.txt*

(FWS 2005d) Fish and Wildlife Service. 2005d. Threatened and Endangered Species System (TESS). *http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_public.servlets.TESSUsmap?status=listed.*

(FWS 2005e) Fish and Wildlife Service. 2005e. Partners in Wildlife Program.. *http://www.fws.gov/partners/index.htm*

(FWS 2005f) Fish and Wildlife Service. 2005f. Partners in Wildlife Program: Michigan. *http://www.fws.gov/midwest/Partners/Michigan.html*

(GLC 2005a) Great Lakes Commission. 2005a. Keeping it on the Land: Improving Great Lakes Water Quality by Reducing Soil Erosion and Sedimentation. Great Lakes Commission, Ann Arbor, MI. *http://www.glc.org/basin/pubs/keeping/pdf/kiotl-brochure.pdf.*

(GLC 2005b) Great Lakes Commission. 2005b. Great Lakes Basin Program for Soil Erosion and Sediment Control: About Us. *http://www.glc.org/basin/pubs/pdf/brochure72.pdf*

(GLP 2005a) Great Lakes Basin Program for Soil Erosion and Sediment Control. 2005a. Vegetative Barriers to Prevent Soil Erosion and Increase Biological Pest Control in Agricultural Landscapes. *http://www.glc.org/basin/project.html?id=84.*

(GLP 2005b) Great Lakes Basin Program for Soil Erosion and Sediment Control. 2005b. Agricultural Impact Reduction Program. *http://www.glc.org/basin/project.html?id=9.*

(GLP 2005c) Great Lakes Basin Program for Soil Erosion and Sediment Control. 2005c. Agricultural Soil Erosion Reduction Project. *http://www.glc.org/basin/project.html?id=54.*

(GLP 2005d) Great Lakes Basin Program for Soil Erosion and Sediment Control. 2005d. Saginaw Bay Soil Erosion and Sedimentation Control Program. *http://www.glc.org/basin/project.html?id=75.*

(Grannemann et al. 2000) Grannemann, N.G, Hunt R.J., Nicholas J.R., Reilly T.E., and T.C. Winter. 2000. The Importance of Ground Water in the Great Lakes Region. USGS, Water-Resources Investigations Report 00–4008.

(GWPC 1999) Ground Water Protection Council. 1999. Ground Water Report to Congress: Summaries of State Ground Water Conditions. *http://www.gwpc.org/gwreport/Acrobat/michigan.pdf*

(HAL 2005a) History, Arts, and Libraries. 2005a. The National Register of Historic Places in Michigan. *http://www.michigan.gov/hal/0,1607,7-160-17449_18638_20845---,00.html.*

(HAL 2005b) History Arts, and Libraries. 2005b. Historic Sites Online. *http://www.mcgi.state.mi.us/hso/hstypematch.asp?mrkr=nhl.*

(IWR n.d.) The Institute of Water Research, Michigan State University. An Introduction to Michigan's Water Resources. Second Edition. *http://www.hydra.iwr.msu.edu/iwr/publications/documents/Michigans%20Water%20Resources.pdf.*

(Keniry and Marsden 2005) Keniry, T. and J.E. Marsden. 2005. Zebra Mussels in Southwestern Lake Michigan. U.S. Department of the Interior, National Biological Service *http://biology.usgs.gov/s+t/noframe/x186.htm.*

(Kossek 2005) Kossek, E., Meece, D. R., Barratt, P, Prince, E. In press 2005. U.S. Latino migrant farm workers: Managing Acculturative Stress and Conserving Work Family Resources. To appear in Steve Poelmans (Ed.) International and Cross-Cultural Perspectives on Work and Family. Erlbaum Press. *http://www.polisci.msu.edu/kossek/migrantfarmworkers.pdf.*

(Kost 2001a) Kost, M.A. 2001a. Natural community abstract for relict conifer swamp. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Relict_conifer_swamp.pdf.*

(Kost 2001b) Kost, M.A. 2001b. Natural community abstract for southern wet meadow. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Southern_wet_meadow.pdf.*

(Kost 2002) Kost, M.A. 2002. Natural community abstract for rich conifer swamp. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Rich_conifer_swamp.pdf.*

(Kost and Penskar 2004) Kost, M.A. and M.R. Penskar. 2000, updated 2004. Natural community abstract for coastal plain marsh. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Coastal_plain_marsh.pdf.*

(Leonardi and Gruhn 2001) Leonardi, J.M. and W.J. Gruhn. 2001. Flint River Assessment. Michigan Department of Natural Resources, Fisheries Division, Special Report 27.

http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/special/reports/sr27/SR27text&tables.pdf.

(Lobo 2005) Lobo. R. 2005. Helpful Agricultural Tourism (Agri-tourism) Definitions. *http://www.sfc.ucdavis.edu/agritourism/definition.html.*

(MACC 2005a). Macatawa Area Coordinating Council. 2005a. Lake Macatawa Watershed. *http://www.macatawa.org/~macc/Macatawa_Watershed/Watershedproject/whereisthemacatawawatershed.htm.*

(MACC 2005b). Macatawa Area Coordinating Council. 2005b. Nonpoint Source Phosphorus Reduction Plan for the Macatawa Watershed 1999-2009.*http://www.macatawa.org/~macc/Macatawa_Watershed/Watershedproject/Documents.htm*

(MACC 2005c). Macatawa Area Coordinating Council. 2005c. The Macatawa Watershed Project. *http://www.macatawa.org/~macc/Macatawa_Watershed/macatawa_watershed.htm*

(McCauley et al. 2000) McCauley L.A, Lasarev, M.R., Higgins,G., Rothlein, J., Muniz, J., Ebbert, C., and J. Phillips. 2000. Work Characteristics and Pesticide Exposures among Migrant Agricultural Families: A Community-Based Research Approach. Under support of National Institute of Environmental Health Sciences (R21ES08707). *http://ehp.niehs.nih.gov/members/2001/109p533-538mcccauley/mcccauley-full.html.*

(MDA 2003) Michigan Department of Agriculture. 2003. Annual Report Fiscal Year 2003. *http://www.michigan.gov/documents/MDA_2003_Annual_Report_101145_7.pdf.*

(MDA 2004a) Michigan Department of Agriculture. 2004a. Conservation Reserve Enhancement Program 2003 Annual Report. June 1, 2004.

(MDA 2004b) Michigan Department of Agriculture. 2004b. Michigan Farm Market, U-Pick and Ag Tourism Directory. *http://www.michigan.gov/documents/upick_all_110146_7.pdf.*

(MDA 2005a) Michigan Department of Agriculture. 2005a. Michigan Conservation Enhancement Program. *http://www.michigan.gov/mda/0,1607,7-125-1567_1599_1603---,00.html.*

(MDA 2005b) Michigan Department of Agriculture. 2005b. CREP Priority Watersheds. *www.michigan.gov/document/MDA_watersheds_6084_7.pdf.*

(MDA 2005c) Michigan Department of Agriculture. 2005c. Michigan Department of Agriculture Groundwater Monitoring Program Domestic Supply Well Baseline Study Report. *http://www.michigan.gov/documents/MDA_FullBaselineStudyReport_98224_7.pdf.*

(MDA 2005d). Michigan Department of Agriculture. 2005d. CREP Payment Breakdown and Examples. *http://www.michigan.gov/mda/0,1607,7-125-1565-16849--,00.html.*

(MDA 2005e) Michigan Department of Agriculture. 2005e. Generally Accepted Agricultural and Management Practices for Irrigation Water Use. *http://www.michigan.gov/documents/MDA_GAAMPS_Irrigation_Public_Review_Draft_52803_66277_7.pdf.*

(MDA 2005f) Michigan Department of Agriculture. 2005f. Environmental Programs at MDA. *http://www.michigan.gov/mda/0,1607,7-125-1566_2311-5699--,00.html*

(MDA 2005g) Michigan Department of Agriculture. 2005g. Michigan Agriculture Environmental Assurance Program. *http://www.michigan.gov/mda/0,1607,7-125-1567_1599_25432---,00.html*

(MDCH 2005). Michigan Department of Community Health. 2005. Arsenic in Well Water. *http://www.mdch.state.mi.us/pha/epi/eed/arsenic.htm.*

(MDEQ n.d.) Michigan Department of Environmental Quality, Hydrologic Studies Unit. n.d. A Hydrologic Study of the Macatawa River Watershed.

(MDEQ 1999) Michigan Department of Environmental Quality, Surface Water Quality Division. 1999. Total Maximum Daily Load (TMDL) for Phosphorus in Lake Macatawa.

(MDEQ 2000) Michigan Department of Environmental Quality, Michigan Office of the Great Lakes. 2000. Great Lakes Trends: Into the New Millennium. *http://www.deq.state.mi.us/documents/deq-ogl-gltrends.pdf.*

(MDEQ 2001) Michigan Department of Environmental Quality, Surface Water Quality Division. 2001. Total Maximum Daily Load (TMDL) for Biota of the Coldwater River Isabella County, Michigan.

(MDEQ 2002) 2002 Michigan DEQ Environmental Quality Report. Office of Special Environmental Projects, Michigan Department of Environmental Quality, Lansing. 56p. *http://www.deq.state.mi.us/documents/deq-osep-ftp-deqeq02.pdf.*

(MDEQ 2004a) Michigan Department of Environmental Quality. 2004a. Water Quality and Pollution Control in Michigan: 2004 Sections 303(d) and 305(b) Integrated Report. MI/DEQ/WD-04/029. *http://www.deq.state.mi.us/documents/deq-wd-swqas-2004integratedreport.pdf.*

(MDEQ 2004b). Michigan Department of Environmental Quality, Water Bureau. 2004b. Michigan Source Water Assessment Program Report. *http://www.michigan.gov/deq/0,1607,7-135-3313_3675_3693-110933--,00.html.*

(MDEQ 2004c). Michigan Department of Environmental Quality, Water Division. 2004c. Conservation Reserve Enhancement Program 2003 Annual Water Quality Monitoring Report. Report MI/DEQ/WD-03/118. Traverse City, Michigan.

(MDEQ 2005a) Michigan Department of Environmental Quality. 2005a. Coastal Management Program. *http://www.michigan.gov/deq/0,1607,7-135-3313_3677_3696-11188--,00.html.*

(MDEQ 2005b) Michigan Department of Environmental Quality. 2005b. What is a Wetland? *http://www.michigan.gov/deq/0,1607,7-135-3313_3687-10175--,00.html.*

(MDEQ 2005c) Michigan Department of Environmental Quality. 2005c. Chapter 3: Specialized Reviews. *http://www.deq.state.mi.us/documents/deq-glm-water-pcu-JPATMchapter3.pdf.*

(MDEQ 2005d) Michigan Department of Environmental Quality. 2005d A Hydrologic Study of the Macatawa River Watershed. *http://www.michigan.gov/documents/deq-water-mgmt-macatawa_4698_7.pdf.*

(MDEQ 2005e) Michigan Department of Environmental Quality. 2005e. Drinking Water. *http://www.michigan.gov/deq/0,1607,7-135-3313_3675---,00.html.*

(MDEQ 2005f) Michigan Department of Environmental Quality. 2005f. An Overview Of Michigan's Wellhead Protection Program. *http://www.deq.state.mi.us/documents/deq-dwrpd-gws-wpu-WHPP-Overview.pdf.*

(MDEQ 2005g) Michigan Department of Environmental Quality. 2005g. Watersheds in Michigan Public Water Supply Source Water Assessment Areas. *http://www.deq.state.mi.us/documents/deq-wb-dwehs-swp-swareasmap.pdf.*

(MDEQ 2005h). Michigan Department of Environmental Quality, Water Division. 2005h. 2003 Annual Report on Michigan Public Water System Violations. *http://www.michigan.gov/deq/0,1607,7-135-3313_3675_3691-96721--,00.html.*

(MDEQ 2005i). Michigan Department of Environmental Quality. 2005i. Nitrate In Drinking Water, Information for Public and Private Drinking Water Systems. *http://www.michigan.gov/deq/0,1607,7-135-3313_3675_3690-9161--,00.html.*

(MDEQ 2005j). Michigan Department of Environmental Quality. 2005j. Drinking-Water Well Screenings Information and Events Schedule. *http://www.michigan.gov/mda/0,1607,7-125-1565-45741--,00.html.*

(MDEQ 2005k). Michigan Department of Environmental Quality. 2005k. Nitrate Samples, Results Averaged Over 1 Square Mile Area. *http://www.deq.state.mi.us/documents/deq-wd-gws-ciu-statewide-no3.pdf.*

(MDEQ 2005l). Michigan Department of Environmental Quality. 2005l. Positive VOC Samples. *http://www.deq.state.mi.us/documents/deq-wd-gws-ciu-statewide-voc.pdf.*

(MDEQ 2005m) Michigan Department of Environmental Quality. 2005m. 2003 Water Withdrawals for Community Public Water Supply Systems in Michigan, by County. *http://www.deq.state.mi.us/documents/deq-wd-wurp-Public2003.pdf.*

(MDEQ 2005n) Michigan Department of Environmental Quality. 2005n. Groundwater Quality and Inventory Mapping Project. *http://www.deq.state.mi.us/documents/deq-wb-gwcac-gwmapoverview.ppt.*

(MDEQ 2005o) Michigan Department of Environmental Quality. 2005o. Ground Water Statistics. *http://www.deq.state.mi.us/documents/deq-wd-gws-wcu-groundwaterstatistics.pdf.*

(MDEQ 2005p) Michigan Department of Environmental Quality. 2005p. Arsenic Levels in Groundwater. *http://www.deq.state.mi.us/documents/deq-wd-gws-ciu-statewide-as.pdf.*

(MDEQ 2005q) Michigan Department of Environmental Quality. 2005q. Non-Point Source Pollution. *http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714---,00.html.*

(MDEQ 2005r) Michigan Department of Environmental Quality. 2005r. Total Maximum Daily Loads (TMDLs). *http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728-12464--,00.html.*

(MDEQ 2005s). Michigan Department of Environmental Quality. 2005s. Total Maximum Daily Load for E. coli for The River Raisin Lenawee and Monroe Counties. *http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728---,00.html.*

(MDEQ 2005t). Michigan Department of Environmental Quality. 2005t. Total Maximum Daily Load for Nitrate for the River Raisin near Deerfield and Blissfield Lenawee County. *http://www.michigan.gov/deq/0,1607,7-135-3313_3686_3728---,00.html.*

(MDEQ 2005u). Michigan Department of Environmental Quality. 2005u. Agriculture Pollution Prevention (AgP2). *http://www.michigan.gov/deq/0,1607,7-135-3585_4129_4183-11812--,00.html*

(MDNR 2001) Michigan Department of Natural Resources. 2001. Floristic Quality Assessment with Wetland Categories and Examples of Computer Applications for the State of Michigan. *http://www.michigandnr.com/publications/pdfs/HuntingWildlifeHabitat/FQA.pdf* .

(MDNR 2002) Michigan Department of Natural Resources. 2002. Names of Michigan Fishes. *www.michigandnr.com/publications/pdfs/fishing/names_of_Mifishes.pdf.*

(MDNR 2005a) Michigan Department of Natural Resources. 2005a. Michigan's Vegetation circa 1800. *http://www.michigan.gov/dnr/0,1607,7-153-10370_22664-70465--,00.html.*

(MDNR 2005b) Michigan Department of Natural Resources. 2005b. Michigan's Plants (An Overview). *http://www.michigan.gov/dnr/0,1607,7-153-10370_12142-36698--,00.html.*

(MDNR 2005c) Michigan Department of Natural Resources. 2005c. Shoreline Treasures. *http://www.michigan.gov/dnr/0,1607,7-153-10370_22664-58736--,00.html.*

(MDNR 2005d) Michigan Department of Natural Resources. 2005d. Keeping Common Species Common. *http://www.michigan.gov/dnr/0,1607,7-153-10370-70419--,00.html.*

(MDNR 2005e) Michigan Department of Natural Resources. 2005e. Wetlands. *http://www.michigan.gov/dnr/0,1607,7-153-10370_22664-61132--,00.html.*

(MDNR 2005f) Michigan Department of Natural Resources. 2005f. Michigan Special Species Statistics. *http://www.michigan.gov/dnr/0,1607,7-153--30497--,00.html.*

(MDNR 2005g) Michigan Department of Natural Resources. 2005g. Landowner Incentive Program. *http://www.michigan.gov/dnr/0,1607,7-153-10370_36649---,00.html*

(Mikula and Croskey 2004) Mikula, D. and H. Croskey. 2004. Soil Erosion and Sedimentation Control Training Manual. Michigan Department of Environmental Quality, Water Division, Soil Erosion and Sedimentation Control Program. *http://www.deq.state.mi.us/documents/deq-land-sesc-trainingmanual.pdf.*

(MNFI 2005) Michigan Natural Features Inventory. 2005. County Element Data. *http://web4.msue.msu.edu/mnfi/data/county.cfm.*

(MSUE 2005a). Michigan State University Extension. 2005a. Nitrate, A Drinking Water Concern. *http://web1.msue.msu.edu/waterqual//docs/wq19p1.html.*

(MSUE 2005b) Michigan State University Extension. 2005b. Floodplain Forest: Community Abstract. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/floodplain_forest.pdf*

(NASDA 2005) National Association of State Departments of Agriculture, 2005. State Environmental Laws Affecting Michigan Agriculture. *http://www.nasda-hq.org/nasda/nasda/Foundation/state/Michigan.pdf.*

(NASS 2002) National Agricultural Statistics Service. 2002. 2002 Census of Agriculture, Michigan County Level Data. *http://www.nass.usda.gov/census/census02/volume1/mi/index2.htm.*

(NASS 2004) National Agricultural Statistics Service. 2004. Michigan 2003-2004 Agricultural Statistics. *www.nass.usda.gov/mi/stats04/statspdf.html.*

(NCFH 2005) National Center for Farmworker Health, Inc. 2004. Migrant and Seasonal Farmworker Demographics Fact Sheet. *http://www.ncfh.org/docs/fs-Migrant%20Demographics.pdf.*

(NFIP 2005) National Flood Insurance Program. 2005. Federal Emergency Management Agency Federal Insurance Administration, Communities Participating in the National Flood Program. *http://www.fema.gov/cis/MI.pdf.*

(NOAA 2005a) National Oceanic and Atmospheric Administration. 2005a. Coastal Zone Management Program. *http://www.ocrm.nos.noaa.gov/czm/national.html.*

(NOAA 2005b) National Oceanic and Atmospheric Administration. 2005c. Michigan Coastal Zone Management Program. *http://www.ocrm.nos.noaa.gov/czm/czmmichigan.html.*

(NPS 2005) National Parks Service. 2005. National Historic Landmarks Program. *http://www.cr.nps.gov/nhl/.*

(NRCS 2005a) Natural Resource Conservation Service. 2005a. Michigan Wetlands Reserve Program. *http://www.nrcs.usda.gov/programs/wrp/states/mi.html.*

(NRCS 2005b) Natural Resource Conservation Service. 2005b. Michigan NRCS Programs. *http://www.mi.nrcs.usda.gov/programs/.*

(NRCS 2005c) Natural Resource Conservation Service. 2005c. National Environmental Compliance Handbook: 610.90 Floodplain Management. *http://policy.nrcs.usda.gov/scripts/lpsiis.dll/H/H_190_610_F_90.htm*

(NRCS 2005d) Natural Resource Conservation Service. 2005d. Conservation Security Program. *http://www.mi.nrcs.usda.gov/programs/csp.html*

(Proposal 1999) Proposal by the State of Michigan and the Michigan Farm Service Agency. 1999. Conservation Reserve Enhancement Program: State of Michigan. Three Critical Watersheds: Macatawa, River Raisin, Saginaw Bay. *Draft.*

(PSC 2002) Public Sector Consultants. 2002. Targeting Environmental Restoration in the Saginaw River/Bay Area Of Concern (AOC): 2001 Remedial Action Plan Update. Prepared for Great Lakes Commission. Lansing, Michigan. *www.pscinc.com*

(Rheaume et al. 2001). Rheaume S.J., Button D.T., Myers D.N., and D.L. Hubbell. 2001. Areal Distribution and Concentrations of Contaminants of Concern in Surficial Streambed and Lakebed Sediments, Lake Erie-Lake Saint Clair Drainages, 1990–97. USGS Water-Resources Investigations Report 00-4200. Lansing Michigan.

(RRWC 2005.) The River Raisin Watershed Council. 2005. The River Raisin Watershed Council Home Page. *http://www.riverraisin.org/index.html*

(Sagchip 2005) Saginaw Chippewa Indian Tribe. 2005. Home Page. *http://www.sagchip.org/.*

(Sargent and Carter 1999) Sargent, M.S and Carter, K.S., ed. 1999. Managing Michigan Wildlife: A Landowners Guide. Michigan United Conservation Clubs, East Lansing, MI. 297pp. Found at: *http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Forest/Lowland_Hardwoods.htm*

(Schrouder 1997) Schrouder, K.S. 1997. Tobico Marsh Assessment. Michigan Department of Natural Resources, Fisheries Division, Status of the Fishery Report 97-1. *http://www.michigandnr.com/PUBLICATIONS/PDFS/ifr/ifrlibra/status/waterbody/97-1.htm*

(Seagrant 2005) Seagrant Great Lakes Network. 2005. Zebra Mussels and Other Nonindigenous Species. *http://www.seagrant.wisc.edu/communications/greatlakes/GLnetwork/exotics.html.*

(Spieles et al. 2004) Spieles, J.B., P.J. Comer, D.A. Albert, and M.A. Kost. 1999, updated 2004. Natural community abstract for prairie fen. Michigan Natural Features Inventory, Lansing, MI. *http://web4.msue.msu.edu/mnfi/abstracts/ecology/Prairie_fen.pdf.*

(Sweat et al. 2002) Sweat, M.J., Brogren, B.B., Jodoin, R.S., Rossi, T.A., and Loerop, M.W.. 2002. Michigan's Source-Water Assessment Program – Surface-Water Assessments Leading To Protection Initiatives, RTS# MI-0121.

(Telemon 2005) Telemon Corporation. 2005. Welcome To Michigan. *http://www.telamon.org/InYourState/mi/mi.asp.*

(USACE 2005) U.S. Army Corps of Engineers. Upper Saginaw River, Michigan. *http://www.lre.usace.army.mil/who/operationsofficehomepage/dredgedmaterialmanagementplans/status/saginawriver-michigan/.*

(USCB 2005a) U.S. Census Bureau. 2005a. Michigan QuickFacts. *http://quickfacts.census.gov/qfd/states/26000.html.*

(USCB 2005b) U.S. Census Bureau. 2005b. Michigan MapStats. *http://www.fedstats.gov/qf/states/26000.html.*

(USCB and FWS 2003) U.S. Census Bureau and U.S. Fish and Wildlife Service. 2003. 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. *http://www.census.gov/prod/2003pubs/01fhw/fhw01-mi.pdf.*

(USDA 2004) United States Department of Agriculture, Economic Research Service. 2004. The Economics of Food, Farming, and Natural Resources and Rural America. State Fact Sheet: Michigan. *www.ers.usda.gov/statefacts/mi.htm.*

(USGS 1997) United States Geological Survey. 1997. National Water Summary on Wetland Resources, Technical Aspects of Wetlands, Wetland Hydrology, Water Quality, and Associated Functions. *http://www.usgs.gov/nwsum/WSP2425/hydrology.html.*

(USGS 2004) U.S. Geological Survey. 2004. Sediment Reduction in the Great Lakes Basin: A Strategic View. Workshop Outcomes and Proceedings. Great Lakes Science Center, Ann Arbor, Michigan. *http://www.glc.org/basin/pubs/pdf/Mar_2004_Workshop_Proceedings.pdf.*

(USGS and GLSC 2005) U.S. Geological Survey and Great Lakes Science Center. 2005. Zebra Mussels Cause Economic and Ecological Problems in the Great Lakes. GLSC Fact Sheet 2000-6. *http://www.glsc.usgs.gov/_files/factsheets/2000-6%20Zebra%20Mussels.pdf.*

(WIN 2005). Saginaw Bay Watershed Initiative Network. 2005. What is WIN? Our Watershed's Resourcefulness. *http://www.saginawbaywin.org/whatiswin.html*

THIS PAGE LEFT INTENTIONALLY BLANK

Appendix A: Federal Laws

Clean Water Act of 1972

The CWA was passed in 1972, with a goal to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The Act contains a number of provisions that affect agriculture:

Clean Lakes Program is authorized by Section 314 of the CWA. It authorizes EPA grants to states for lake classification surveys, diagnostic/feasibility studies, and for projects to restore and protect lakes.

Nonpoint Source Pollution Program is established by Section 319 of the CWA. It requires states and U.S. territories to identify navigable waters that cannot attain water quality standards without reducing nonpoint source pollution, and then develop management plans to reduce such nonpoint source pollution.

National Estuary Program is established by Section 320 of the CWA. It provides for the identification of nationally significant estuaries that are threatened by pollution for the preparation of conservation and management plans and calls for Federal grants to states, interstate, and regional water pollution control agencies to implement such plans.

National Pollutant Discharge Elimination System Permit Program is established by Section 402 of the CWA. This program controls point source discharge from treatment plants and industrial facilities (including large animal and poultry confinement operations).

Dredge and Fill Permit Program was established by Section 404 of the CWA. Administered by the U.S. Army Corps of Engineers, it regulates dredging, filling, and other alterations of waters and wetlands jointly with EPA, including wetlands owned by farmers. Under administrative agreement, NRCS has authority to make wetland determinations pertaining to agricultural land.

Endangered Species Act of 1973

The ESA was enacted to conserve threatened or endangered species and the critical habitats in which they exist. When a species is designated as threatened with extinction, a recovery plan that includes restrictions on cropping practices, water use, and pesticide use is developed to protect the species from further population declines. All Federal agencies are required to implement ESA by ensuring that Federal actions do not jeopardize the continued existence of listed species.

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range. Threatened means a species is likely to become endangered within the foreseeable future. T & E designations may be applied to all species of plants and animals, except pest insects. A species may be threatened at the state level, but that same designation does not automatically apply nationwide, as species numbers may be greater in other states.

The FWS and the National Marine Fisheries Service (NMFS) are mandated the responsibility of ensuring that other agencies plan or modify Federal projects so that they will have minimal impact on listed species and their habitats. Section 7 of the ESA requires that project areas must be checked against FWS and state listings of critical habitat and T&E species. FSA ensures that all CREP contract meet this requirement by including T&E species in its EE.

The ESA also requires the delineation of the "critical habitat" of sensitive species. Critical habitat is defined by the ESA as areas that are "essential" to the conservation of listed species. Private, city, and state lands are generally not affected by critical habitat until the property owner needs a Federal permit or requests Federal funding. Because the Idaho CREP is partially funded by Federal dollars, consultation

with FWS would be required when critical habitat is encountered. Critical habitat designations are published in the Federal Register and can be located at the FWS website—http://endangered.fws.gov/.

Farmland Protection Policy Act (FPPA) of 1981

The aim of the FPPA is to minimize Federal programs (including technical or financial assistance) contribution to the conversion of important farmland to non-agricultural uses. The act seeks to encourage alternative, if possible, that would lessen the adverse effects to important farmlands. For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forest land, pastureland, cropland, or other land, but not water or urban built-up land.

NRCS uses a land evaluation and site assessment system to establish a farmland conversion impact rating score on proposed sites of Federally funded and assisted projects. This score is used as an indicator for the project sponsor to consider alternative sites if the potential adverse impacts on the farmland exceed the recommended allowable level. The assessment is completed on form AD-1006, Farmland Conversion Impact Rating.

Federal Insecticide, Fungicide, and Rodenticide Act of 1947

The Federal Insecticide, Fungicide, and Rodenticide Act provides the legal basis under which pesticides are regulated. A pesticide can be restricted or banned if it poses unacceptable risks to human health or the environment. The re-registration process, mandated in 1988 for all active ingredients then on the market, has resulted in manufacturers dropping many less profitable products rather than paying the registration fees.

Food Security Act of 1985

FSA is authorized under this Act, as amended, and 7 CFR 1410 to institute the actions contemplated in this PEA (i.e. the proposed implementation of CREP). The FSA is authorized to enroll land into CREP through December 2007. Sections 1230, 1234, 1242 of the Act and 7 CFR 1410.50 authorize FSA to enter into agreements with states to use the CRP in a cost-effective manner to further specific conservation and environmental objectives of a given state and the nation. The following provisions are especially applicable to the implementation of CREP:

> Highly Erodible Land Conservation Compliance Provisions require that producers of agriculture commodities must protect all cropland classified as being highly erodible land (HEL) from excessive erosion. The provisions were amended in the 1990, 1996, and 2002 Farm Bills. The purpose of these provisions is to remove the incentive to produce annually tilled agricultural commodity crops on HEL unless it is protected from excessive soil erosion.
>
> Wetland Conservation Provisions (Swampbuster) help preserve the environmental functions and values of wetlands, including flood control, sediment control, groundwater recharge, water quality, wildlife habitat, recreation, and aesthetics. The 1996 Farm Bill modified Swampbuster to give USDA participants greater flexibility to comply with wetland conservation requirements and to make wetlands more valuable and functional. The 2002 Farm Bill changed the other Swampbuster provisions, including those associated with wetland determinations, mitigation (offsetting losses), "Minimal Effect" determinations, abandonment, and program eligibility.

National Environmental Policy Act of 1969 and Regulations

NEPA is intended to help Federal officials make decisions that are based on consideration of the environmental consequences of their actions, and to take actions that protect, restore, and enhance the

environment. NEPA mandates that the FSA consider and document the impacts that major projects and programs would have on the environment.

CEQ Implementation Regulations

The NEPA implementation regulations found at 40 CFR 1500.

National Historic Preservation Act of 1966 and Regulations

This National Historic Preservation Act (NHPA) as amended (16 USC 470, P.L. 95-515), establishes as Federal policy the protection of historic properties and their values in cooperation with other nations and with state and local governments. Amendments designated the State Historic Preservation Office (SHPO) or the Tribal Historic Preservation Office (THPO) as the party responsible for administering programs in the states or reservations.

The Act also creates the Advisory Council on Historic Preservation (ACHP). Federal agencies are required to consider the effects of their undertakings on historic resources, and to give the SHPO/THPO and, if necessary, the ACHP a reasonable opportunity to comment on those undertakings.

NHPA Implementation Regulations

The NHPA implementation regulations found at 36 CFR 800, Protection of Historic Properties. This regulation, governing compliance with Section 106 of NHPA must be followed in planning any agency activity and in the ongoing management of agency resources.

Safe Drinking Water Act of 1974

The Safe Drinking Water Act requires EPA to set standards for drinking water quality and requirements for water treatment of public water systems while also requiring states to establish a wellhead protection program to protect public water system wells from contamination by chemicals, including pesticides, nutrients, and other agricultural contaminants.

Sustainable Fisheries Act of 1996

The Sustainable Fisheries Act amended the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) to establish new requirements for “essential fish habitat” (EFH) descriptions in Federal fishery management plans, it also requires Federal agencies to consult with National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. Under the Magnuson-Stevens Act, NMFS must be consulted by any Federal agency undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location.

Wild and Scenic Rivers Act of 1968

The purpose of the Wild and Scenic Rivers Act (WSRA) is to preserve the free-flowing state of rivers that are listed in the National Wild and Scenic Rivers System or under study for inclusion in the System because of their outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values. Rivers in the System are classified as wild river areas, scenic river areas, or recreational river areas. The WSRA establishes requirements applicable to water resource projects and protects both the river, or river segments, and the land immediately surrounding them. Section 7 of the WSRA specifically prohibits Federal agencies from providing assistance for the construction of any water resources projects that would adversely affect Wild and Scenic Rivers.

Section 5 (d) of WSRA requires the National Park Service to compile and maintain a Nationwide Rivers Inventory (NRI), a register of river segments that potentially qualify as national wild, scenic or recreational river areas. A river segment may be listed on the NRI if it is free-flowing and has one or more "outstandingly remarkable values." All agencies are required to consult with the National Park Service prior to taking actions which could effectively foreclose wild, scenic or recreational status for rivers on the NRI.

Executive Order 11514: Protection and Enhancement of Environmental Quality

This EO directed the Federal government to provide leadership in protecting and enhancing the quality of the nation's environment to sustain and enrich human life. Federal agencies were directed to initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals. In order to achieve these goals agencies were directed to:

- Monitor, evaluate, and control on a continuing basis their activities so as to protect and enhance the quality of the environment;
- Encourage timely public information processes to foster understanding of Federal plans and programs with environmental impact;
- Insure that information regarding existing or potential environmental issues be shared and coordinated with other; and
- Comply with the regulations issued by the CEQ.

Executive Order 11988: Floodplain Management—Floodplains and Wetlands

Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. In accomplishing this objective, "each agency shall provide leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health, and welfare, and to restore and preserve the natural and beneficial values served by flood plains in carrying out its responsibilities" for the following actions:

- Acquiring, managing, and disposing of Federal lands and facilities;
- Providing Federally-undertaken, financed, or assisted construction and improvements;
- Conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulation, and licensing activities

Each Federal agency is responsible for preparing implementing procedures for carrying out the provisions of the Order. Federal Agencies consult with FEMA concerning implementation of this EO.

Executive Order 11990: Protection of Wetlands

In order to protect wetlands, EO 11990 was signed. EO 11990 sought to "minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands" and minimize “to the extent possible the long and short term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.” To meet these objectives, the EO requires Federal agencies, in planning their actions, to:

- Avoid and minimize direct or indirect loss of wetlands whenever there is a practicable alternative
- Achieve a no net loss of wetland quantity and quality through wetland replacement
- Preserve and enhance the natural and beneficial values of wetlands

Executive Order 12898, Environmental Justice for Minority and Low Income Populations

EO 12898 directs Federal agencies "to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States." Each Federal agency must make achieving environmental justice one of their goals particularly when such analysis is required by NEPA. The EO and guidance emphasize the importance of NEPA's public participation process, directing each Federal agency to provide opportunities for community input in the NEPA process by providing access to public documents and providing notices and hearings

Executive Order 13061, Federal Support of Community Efforts along American Heritage Rivers

EO 13061 established the American Heritage Rivers Initiative. The Initiative has three objectives: natural resource and environmental protection, economic revitalization, and historic and cultural preservation. Executive agencies, to the extent permitted by law and consistent with their missions and resources, shall coordinate Federal plans, functions, programs, and resources to preserve, protect, and restore rivers and their associated resources important to our history, culture, and natural heritage. Agencies are encouraged, to the extent permitted by law, to develop partnerships with state, local, and tribal governments, community and non-governmental organizations.

Comprehensive State Groundwater Protection Program

The program was initiated by EPA in 1991. It coordinates the operation of all Federal, state, tribal, and local programs that address groundwater quality. States have the primary role in designing and implementing the program based on distinctive local needs and conditions.

CRP Programmatic Environmental Impact Statement

The Federal Register dated April 24, 2002 announced the Notice of Intent of FSA to prepare a PEIS for the CRP and its counterpart the CREP. The Final PEIS was published in January 2003 and provides FSA decision makers with programmatic level analyses that provides context for state-specific EAs. The ROD was published in the Federal Register on May 8, 2003 (68 FR 24847-24854).

USDA Departmental Regulation 9500-3

Section 1540 (c) of the Farmland Protection Policy Act and DR 9500-3 established four general categories of farmlands meriting Federal protection. They are cumulatively referred to as "important farmland." Important farmland categories are:

- Prime
- Unique
- Farmland of statewide importance

- Farmland of local importance

DR 9500-3 also made it USDA policy to promote land use objectives responsive to current and long-term economic, social, and environmental needs.

Appendix B: FSA Handbook Conservation Practices

THIS PAGE INTENTIONALLY LEFT BLANK.

Appendix C: Current Michigan CREP Enrollment.

Table C-1. Summary of CREP CP implementation in the three Michigan watersheds as of October 31, 2005 (acres).

	County	Introduced Grass Planting (CP1)	Native Grass Planting (CP2)	Field Windbreak (CP5A)	Shallow Water Areas For Wildlife (CP9)	Filter Strips (CP21)	Riparian Buffers (CP22)	Wetland Restoration (CP23)	Wetland Restoration (CP23A)	Sediment Retention Control Structure (CP26)	Total Acres Enrolled
Saginaw River Watershed	Arenac	8	0	91	4	1,957	42	1,208	498	0	**3,808**
	Bay	0	0	111	3	1,284	4	538	233	0	**2,174**
	Clare	154	88	18	29	8	90	4	0	0	**391**
	Genesee	99	88	1	7	50	61	14	0	0	**320**
	Gladwin	454	78	59	62	517	455	22	9	0	**1,654**
	Gratiot	0	0	15	8	2,637	14	218	184	0	**3,076**
	Huron	11	0	243	296	4,318	0	2,661	431	0	**7,961**
	Iosco	52	12	4	0	262	401	0	0	0	**730**
	Isabella	408	171	307	31	345	146	187	162	0	**1,757**
	Lapeer	12	8	6	9	248	0	40	14	0	**335**
	Livingston	0	0	0	0	0	0	0	0	0	**0**
	Midland	0	0	135	14	1,806	1	78	255	0	**2,288**
	Montcalm	76	31	12	0	25	0	10	0	0	**154**
	Mecosta	27	0	0	0	17	0	11	0	0	**55**
	Oakland	0	0	0	0	0	0	0	0	0	**0**
	Ogemaw	116	0	0	0	138	500	0	0	0	**753**
	Osceloa	0	0	0	0	0	0	0	0	0	**0**
	Roscommon	0	0	0	0	0	0	0	0	0	**0**
	Saginaw	0	0	20	29	5,573	13	1,935	59	0	**7,629**
	Sanilac	244	18	38	140	826	14	211	44	0	**1,535**
	Shiawassee	0	0	7	0	70	5	11	0	0	**93**
	Tuscola	432	0	95	62	4,278	0	1,912	24	0	**6,803**
Watershed Subtotal		**2,091**	**494**	**1,160**	**693**	**24,359**	**1,744**	**9,060**	**1,912**	**0**	**41,514**

Macatawa Watershed	Allegan	0	0	2	8	45	3	0	0	0	57
	Ottawa	0	0	3	2	9	7	164	0	0	185
Watershed Subtotal		**0**	**0**	**5**	**10**	**54**	**9**	**164**	**0**	**0**	242
River Raisin Watershed	Monroe	12	4	13	3	527	36	29	0	0	622
	Lenawee	2,283	3,619	26	38	2,070	69	1,080	0	6	9,190
	Jackson	0	0	0	0	0	0	0	0	0	0
	Hillsdale	10	0	0	0	14	14	0	0	0	37
	Washtenaw	0	254	55	4	48	0	0	0	0	361
Watershed Subtotal		**2,304**	**3,877**	**93**	**45**	**2,659**	**118**	**1,109**	**0**	**6**	**10,211**
State Total		**4,396**	**4,371**	**1,258**	**748**	**27,071**	**1,871**	**10,333**	**1,912**	**6**	**51,966**

Source: FSA 2005.

Appendix D: Listed Species

Table D-1. Federal- and State-listed species in counties involved in the Michigan CREP.

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Accipiter cooperii	Cooper's Hawk		SC	Iosco, Oakland, Ottawa, Saginaw
Accipiter gentilis	Northern Goshawk		SC	Bay, Clare, Iosco ,Midland, Ogemaw, Tuscola
Acella haldemani	Spindle Lymnaea		SC	Huron
Acipenser fulvescens	Lake Sturgeon		T	Allegan, Huron, Iosco
Acris crepitans blanchardi	Blanchard's Cricket Frog		SC	Allegan, Hillsdale, Jackson ,Lapeer, Lenawee, Livingston, Monroe, Montcalm, Oakland, Ottawa
Adlumia fungosa	Climbing Fumitory		SC	Allegan, Huron, Lenawee ,Ottawa, Sanilac, Washentenaw
Agalinis gattingeri	Gattinger's Gerardia		E	Monroe, Montcalm, Oakland
Agrimonia rostellata	Beaked Agrimony		SC	Hillsdale, Lenawee
Alasmidonta marginata	Elktoe		SC	Clare, Gratiot, Hillsdale, Lenawee, Mecosta, Osecola, Rocommon, Saginaw, Sanilac, Shiawassee
Alasmidonta viridis	Slippershell Mussel		SC	Allegan, Clare, Gratiot, Hillsdale, Jackson, Lapeer, Mecosta, Osecola, Rocommon, Shiawassee
Ambystoma opacum	Marbled Salamander		T	Allegan
Ambystoma texanum	Smallmouth Salamander		E	Hillsdale, Monroe, Montcalm, Washentenaw
Ammocrypta pellucida	Eastern Sand Darter		T	Lenawee, Livingston, Oakland, Sanilac
Ammodramus henslowii	Henslow's Sparrow		T	Gratiot, Jackson, Livingston, Sanilac, Washentenaw
Ammodramus savannarum	Grasshopper Sparrow	PS	SC	Jackson, Lapeer, Mecosta ,Osecola, Tuscola, Washentenaw
Amorpha canescens	Leadplant		SC	Livingston, Oakland

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Angelica venenosa	Hairy Angelica		SC	Genesee, Jackson, Lapeer ,Lenawee, Livingston, Monroe, Montcalm, Oakland, Shiawassee, Washentenaw
Anguispira kochi	Banded Globe		SC	Jackson, Washentenaw
Anodonta subgibbosa	Lake Floater		T	Ottawa
Appalachia arcana	Secretive Locust		SC	Clare, Iosco, Ogemaw, Rocommon
Appalachina sayanus	Spike-lip Crater		SC	Huron, Ogemaw
Arabis missouriensis var. deamii	Missouri Rock-cress		SC	Allegan, Monroe, Montcalm, Oakland
Aristida longespica	Three-awned Grass		T	Gratiot, Midland, Monroe, Montcalm, Oakland
Aristolochia serpentaria	Virginia Snakeroot		T	Lenawee, Washentenaw
Armoracia lacustris	Lake Cress		T	Gratiot, Iosco
Asclepias hirtella	Tall Green Milkweed		T	Bay, Huron, Jackson, Monroe, Montcalm, Tuscola
Asclepias purpurascens	Purple Milkweed		SC	Jackson, Lenawee, Livingston, Monroe, Montcalm, Washentenaw
Asclepias sullivantii	Sullivant's Milkweed		T	Lenawee, Monroe, Montcalm, Oakland, Tuscola, Washentenaw
Asio flammeus	Short-eared Owl		E	Hillsdale, Osecola
Asio otus	Long-eared Owl		T	Oakland
Aster praealtus	Willow Aster		SC	Washentenaw
Astragalus canadensis	Canadian Milk-vetch		T	Lapeer, Lenawee, Livingston, Oakland, Washentenaw, Bay, Genesee, Gratiot, Lapeer, Tuscola, Washentenaw
Atrytonopsis hianna	Dusted Skipper		T	Iosco, Mecosta, Monroe, Montcalm
Baptisia lactea	White or Prairie False Indigo		SC	Allegan, Hillsdale, Jackson, Lenawee, Monroe, Montcalm, Oakland, Shiawassee, Washentenaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Bartonia paniculata	Panicled Screw-stem		T	Allegan
Basilodes pepita	Gold Moth		SC	Lenawee
Battus philenor	Pipevine Swallowtail		SC	Lenawee, Washentenaw
Beckmannia syzigachne	Slough Grass		T	Bay, Gratiot
Berula erecta	Cut-leaved Water-parsnip		T	Allegan
Besseya bullii	Kitten-tails		T	Jackson
Betula murrayana	Murray Birch		SC	Washentenaw
Botaurus lentiginosus	American Bittern		SC	Arenac, Bay, Gratiot, Huron, Jackson, Livingston, Saginaw, Tuscola, Washentenaw
Bouteloua curtipendula	Side-oats Grama Grass		T	Livingston, Oakland, Washentenaw
Brachionycha borealis	Boreal Brachionyncha		SC	Rocommon
Buteo lineatus	Red-shouldered Hawk		T	Allegan, Arenac, Clare, Gladwin, Iosco, Livingston, Midland, Oakland, Ogemaw, Ottawa, Rocommon, Tuscola
Cacalia plantaginea	Prairie Indian-plantain		SC	Bay, Huron, Lenawee, Tuscola
Calephelis mutica	Swamp Metalmark		SC	Hillsdale, Jackson, Lenawee, Livingston, Montcalm, Oakland, Shiwasee, Washentenaw
Calypso bulbosa	Calypso or Fairy-slipper		T	Isabella, Rocommon
Camassia scilloides	Wild-hyacinth		T	Lenawee, Monroe, Montcalm
Carex albolutescens	Greenish-white Sedge		T	Allegan, Lenawee
Carex conjuncta	Sedge		T	Hillsdale, Lenawee
Carex crus-corvi	Raven's-foot Sedge		T	Monroe, Montcalm

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Carex davisii	Davis's Sedge		SC	Lenawee, Monroe, Montcalm, Ottawa, Washentenaw
Carex festucacea	Fescue Sedge		SC	Allegan, Monroe, Montcalm, Washentenaw, Lenawee, Monroe, Montcalm, Washentenaw
Carex haydenii	Hayden's Sedge		X	Isabella, Midland
Carex lupuliformis	False Hop Sedge		T	Bay, Genesee, Gratiot, Hillsdale, Oakland, Washentenaw
Carex richardsonii	Richardson's Sedge		SC	Lapeer, Livingston, Oakland
Carex seorsa	Sedge		T	Midland, Washentenaw, Lenawee, Livingston, Monroe, Montcalm, Washentenaw
Carex trichocarpa	Hairy-fruited Sedge		SC	Lenawee, Washentenaw
Castanea dentata	American Chestnut		E	Monroe, Montcalm, Oakland, Washentenaw
Catocala illecta	Magdalen Underwing		SC	Lenawee
Celtis tenuifolia	Dwarf Hackberry		SC	Jackson, Lenawee, Livingston, Washentenaw
Charadrius melodus	Piping Plover	LE	E	Huron
Chelone obliqua	Purple Turtlehead		E	Washentenaw
Chlidonias niger	Black Tern		SC	Allegan, Arenac, Bay, Iosco, Jackson, Midland, Rocommon, Saginaw
Circus cyaneus	Northern Harrier		SC	Bay
Cirsium hillii	Hill's Thistle		SC	Clare, Hillsdale, Iosco, Jackson, Oakland, Ogemaw, Rocommon
Cirsium pitcheri	Pitcher's Thistle	LT	T	Allegan, Arenac, Huron, Iosco, Ottawa
Cistothorus palustris	Marsh Wren		SC	Arenac, Bay, Gratiot, Huron, Lenawee, Livingston, Monroe, Montcalm, Saginaw, Saginaw, Tuscola
Clemmys guttata	Spotted Turtle		T	Allegan, Genesee, Gladwin, Gratiot, Jackson, Lapeer, Lenawee, Livingston, Oakland, Oakland, Ottawa, Rocommon, Saginaw, Tuscola,

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
				Washentenaw
Clinostomus elongatus	Redside Dace		E	Hillsdale, Lenawee, Mecosta, Oakland, Washentenaw
Clonophis kirtlandii	Kirtland's Snake		E	Lenawee, Ottawa, Washentenaw
Coregonus artedi	Cisco or Lake Herring		T	Oakland
Coregonus reighardi	Shortnose Cisco		X	Iosco
Coturnicops noveboracensis	Yellow Rail		T	Rocommon
Cryptotis parva	Least Shrew		T	Allegan, Jackson, Livingston, Oakland, Washentenaw
Cuscuta campestris	Field Dodder		SC	Lenawee
Cuscuta polygonorum	Knotweed Dodder		SC	Lenawee, Monroe, Montcalm
Cyclonaias tuberculata	Purple Wartyback		SC	Allegan, Jackson, Lenawee, Monroe, Montcalm, Washentenaw
Cygnus buccinator	Trumpeter Swan		T	Iosco, Ogemaw
Cyperus acuminatus	Nut-grass		X	Oakland
Cyperus flavescens	Yellow Nut-grass		SC	Allegan, Washentenaw
Cypripedium arietinum	Ram's Head Lady's-slipper		SC	Gratiot, Iosco, Isabella, Livingston, Midland, Rocommon, Washentenaw
Cypripedium candidum	White Lady-slipper		T	Genesee, Hillsdale, Huron, Jackson, Lenawee, Livingston, Oakland, Tuscola, Washentenaw
Dalea purpurea	Purple Prairie-clover		X	Lapeer
Dalibarda repens	False-violet		T	Ogemaw
Dendroica cerulea	Cerulean Warbler		SC	Allegan, Hillsdale, Jackson, Lapeer, Livingston, Oakland, Tuscola, Washentenaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Dendroica discolor	Prairie Warbler		E	Allegan, Iosco, Oakland
Dendroica dominica	Yellow-throated Warbler		T	Allegan, Ottawa
Dendroica kirtlandii	Kirtland's Warbler	LE	E	Clare, Iosco, Ogemaw, Rocommon
Dennstaedtia punctilobula	Hay-scented Fern		X	Shiawassee
Dentaria maxima	Large Toothwort		T	Arenac
Diarrhena americana	Beak Grass		T	Lapeer, Lenawee, Midland, Monroe, Montcalm, Tuscola
Discus patulus	Domed Disc		SC	Jackson, Washentenaw
Disporum maculatum	Nodding Mandarin		X	Oakland
Draba reptans	Creeping Whitlow-grass		T	Livingston
Drosera anglica	English Sundew		SC	Livingston, Oakland
Echinacea purpurea	Purple Coneflower		X	Hillsdale, Washentenaw
Echinodorus tenellus	Dwarf Burhead		E	Allegan
Elaphe obsoleta obsoleta	Black Rat Snake		SC	Allegan, Hillsdale, Jackson, Lenawee, Oakland, Saginaw, Washentenaw
Elaphe vulpina gloydi	Eastern Fox Snake		T	Huron, Iosco, Monroe, Montcalm, Saginaw
Eleocharis caribaea	Spike-rush		T	Jackson, Washentenaw
Eleocharis engelmannii	Engelmann's Spike-rush		SC	Allegan, Jackson, Lenawee, Midland
Eleocharis equisetoides	Horsetail Spike-rush		SC	Hillsdale, Jackson, Livingston, Washentenaw
Eleocharis melanocarpa	Black-fruited Spike-rush		SC	Allegan
Eleocharis microcarpa	Small-fruited Spike-rush		E	Allegan
Eleocharis radicans	Spike-rush		X	Livingston, Washentenaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Eleocharis tricostata	Three-ribbed Spike-rush		T	Allegan
Emys blandingii	Blanding's Turtle		SC	Allegan, Bay, Clare, Genesee, Gladwin, Hillsdale, Huron, Iosco, Isabella, Jackson, Lapeer, Lenawee, Livingston, Mecosta, Monroe, Montcalm, Oakland, Ogemaw, Osecola, Ottawa, Rocommon, Saginaw, Sanilac, Shiawassee, Tuscola, Washentenaw
Epioblasma obliquata perobliqua	White Catspaw	LE	E	Monroe, Montcalm
Epioblasma torulosa rangiana	Northern Riffleshell	LE	E	Monroe, Montcalm, Sanilac
Epioblasma triquetra	Snuffbox		E	Gratiot, Huron, Livingston, Midland, Monroe, Montcalm, Oakland, Saginaw, Washentenaw
Eragrostis capillaris	Love Grass		SC	Washentenaw
Eragrostis pilosa	Small Love Grass		SC	Lenawee, Saginaw, Washentenaw
Erimyzon oblongus	Creek Chubsucker		E	Allegan, Hillsdale, Jackson, Lenawee, Monroe, Montcalm, Hillsdale, Monroe, Montcalm
Erynnis baptisiae	Wild Indigo Duskywing		SC	Hillsdale, Monroe, Montcalm, Oakland, Washentenaw
Erynnis persius persius	Persius Duskywing		T	Allegan, Bay, Livingston, Mecosta
Euonymus atropurpurea	Wahoo		SC	Lenawee, Oakland, Washentenaw
Eupatorium fistulosum	Hollow-stemmed Joe-pye-weed		T	Oakland
Eupatorium sessilifolium	Upland Boneset		T	Jackson, Washentenaw
Euphorbia commutata	Tinted Spurge		T	Allegan, Ottawa
Euphyes dukesi	Dukes' Skipper		T	Lenawee, Monroe, Montcalm, Washentenaw
Euxoa aurulenta	Dune Cutworm		SC	Ottawa

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Falco peregrinus	Peregrine Falcon	PS:LE	E	Genesee, Monroe, Montcalm, Ottawa
Festuca scabrella	Rough Fescue		T	Ogemaw, Rocommon
Flexamia delongi	Leafhopper		SC	Allegan
Flexamia huroni	Huron River Leafhopper		SC	Oakland
Flexamia reflexus	Leafhopper		SC	Lenawee
Fontigens nickliniana	Watercress Snail		SC	Huron
Fraxinus profunda	Pumpkin Ash		T	Hillsdale, Oakland
Fuirena squarrosa	Umbrella-grass		T	Allegan, Oakland, Washentenaw
Fundulus dispar	Starhead Topminnow		SC	Hillsdale
Galearis spectabilis	Showy Orchis		T	Bay, Genesee, Gratiot, Hillsdale, Lenawee, Oakland, Ottawa, Saginaw, Shiawassee, Tuscola, Washentenaw
Gallinula chloropus	Common Moorhen	PS	SC	Bay, Jackson, Monroe, Montcalm, Rocommon, Saginaw
Gavia immer	Common Loon		T	Allegan, Clare, Gladwin, Iosco, Isabella, Mecosta, Midland, Oakland, Ogemaw, Osecola, Rocommon
Gentiana flavida	White Gentian		E	Washentenaw
Gentiana puberulenta	Downy Gentian		E	Allegan, Oakland, Washentenaw
Gentianella quinquefolia	Stiff Gentian		T	Oakland, Washentenaw
Geum triflorum	Prairie-smoke		T	Allegan, Mecosta
Geum virginianum	Pale Avens		SC	Lenawee, Livingston, Washentenaw
Glyptemys insculpta	Wood Turtle		SC	Allegan, Arenac, Clare, Gladwin, Iosco, Isabella, Mecosta, Midland, Ogemaw, Osecola, Rocommon, Saginaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Gomphus lineatifrons	Splendid Clubtail		SC	Isabella, Jackson
Gomphus quadricolor	Rapids Clubtail		SC	Isabella
Gymnocladus dioicus	Kentucky Coffee-tree		SC	Allegan, Gratiot, Hillsdale, Jackson, Lenawee, Monroe, Montcalm, Ottawa, Washentenaw
Haliaeetus leucocephalus	Bald Eagle	LT,PDL	T	Allegan, Arenac, Bay, Clare, Gladwin, Gratiot, Huron, Iosco, Mecosta, Midland, Monroe, Montcalm, Ogemaw, Ottawa, Rocommon, Saginaw
Helianthus hirsutus	Whiskered Sunflower		SC	Allegan, Lapeer, Lenawee, Washentenaw
Helianthus mollis	Downy Sunflower		T	Jackson, Monroe, Montcalm
Hemicarpha micrantha	Dwarf-bulrush		SC	Allegan, Monroe, Montcalm, Washentenaw
Hemileuca maia	Barrens Buckmoth		SC	Livingston, Monroe, Montcalm, Washentenaw
Hesperia ottoe	Ottoe Skipper		T	Allegan
Hibiscus laevis	Smooth Rose-mallow		SC	Monroe, Montcalm
Hibiscus moscheutos	Swamp Rose-mallow		SC	Allegan, Monroe, Montcalm, Oakland
Hieracium paniculatum	Panicled Hawkweed		SC	Allegan, Oakland
Hybanthus concolor	Green Violet		SC	Lenawee, Oakland, Ottawa, Washentenaw
Hybopsis amblops	Bigeye Chub		X	Hillsdale, Lenawee
Hydrastis canadensis	Goldenseal		T	Allegan, Genesee, Jackson, Lapeer, Lenawee, Livingston, Monroe, Montcalm, Oakland, Washentenaw
Hypericum gentianoides	Gentian-leaved St. John's-wort		SC	Monroe, Montcalm, Ottawa
Hypericum sphaerocarpum	Round-fruited St. John's-wort		T	Monroe, Montcalm

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Ictiobus niger	Black Buffalo		SC	Allegan, Huron
Incisalia irus	Frosted Elfin		T	Allegan, Bay, Mecosta, Monroe, Montcalm
Isoetes engelmannii	Appalachian Quillwort		E	Allegan
Isotria verticillata	Whorled Pogonia		T	Genesee, Gratiot, Saginaw, Washentenaw
Ixobrychus exilis	Least Bittern		T	Arenac, Bay, Jackson, Monroe, Montcalm, Rocommon
Jeffersonia diphylla	Twinleaf		SC	Genesee, Isabella, Lapeer, Lenawee, Oakland, Saginaw, Shiawassee, Washentenaw
Juncus brachycarpus	Short-fruited Rush		T	Allegan, Monroe
Juncus brachycarpus	Short-fruited Rush		T	Montcalm
Juncus scirpoides	Scirpus-like Rush		T	Allegan
Juncus vaseyi	Vasey's Rush		T	Allegan, Shiawassee
Justicia americana	Water-willow		T	Livingston, Monroe, Montcalm, Washentenaw
Kuhnia eupatorioides	False Boneset	PS	SC	Jackson, Livingston
Lactuca floridana	Woodland Lettuce		T	Lenawee, Monroe, Montcalm
Lampsilis fasciola	Wavy-rayed Lampmussel		T	Hillsdale, Jackson, Lenawee, Livingston, Monroe, Montcalm, Oakland, Sanilac, Washentenaw
Lanius ludovicianus migrans	Migrant Loggerhead Shrike		E	Allegan, Clare, Huron, Osecola
Lechea minor	Least Pinweed		SC	Monroe, Montcalm, Washentenaw
Lechea pulchella	Leggett's Pinweed		T	Allegan, Monroe, Montcalm
Lepyronia angulifera	Angular Spittlebug		SC	Jackson, Lenawee

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Leucospora multifida	conobea		SC	Monroe, Montcalm
Linum virginianum	Virginia Flax		T	Allegan, Livingston, Oakland, Washentenaw
Liparis liliifolia	Purple Twayblade		SC	Hillsdale, Jackson, Lenawee, Livingston, Oakland, Washentenaw
Lithospermum latifolium	Broad-leaved Puccoon		SC	Gratiot, Midland, Ottawa, Washentenaw
Ludwigia alternifolia	Seedbox		SC	Genesee, Monroe, Montcalm, Oakland, Saginaw
Ludwigia sphaerocarpa	Globe-fruited Seedbox		T	Allegan
Lycaeides melissa samuelis	Karner Blue	LE	T	Allegan, Mecosta, Monroe, Montcalm
Lycopodium appressum	Northern Prostrate Clubmoss		SC	Allegan, Ottawa
Lycopus virginicus	Virginia Water-horehound		T	Lenawee, Shiawassee
Macrhybopsis storeriana	Silver Chub		SC	Monroe, Montcalm
Merolonche dolli	Doll's Merolonche		SC	Arenac, Rocommon
Mertensia virginica	Virginia Bluebells		T	Ottawa
Mesodon elevatus	Proud Globe		SC	Monroe, Montcalm
Microtus pinetorum	Woodland Vole		SC	Allegan, Clare, Genesee, Gratiot, Livingston, Oakland, Shiawassee, Washentenaw
Morus rubra	Red Mulberry		T	Lenawee, Livingston, Monroe, Montcalm, Oakland, Ottawa, Washentenaw
Moxostoma carinatum	River Redhorse		T	Iosco, Mecosta, Ottawa
Muhlenbergia richardsonis	Mat Muhly		T	Jackson, Livingston, Oakland, Washentenaw
Myotis sodalis	Indiana Bat or Indiana Myotis	LE	E	Hillsdale, Jackson, Lenawee, Livingston, Washentenaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Nelumbo lutea	American Lotus		T	Monroe, Montcalm, Ottawa
Neonympha mitchellii mitchellii	Mitchell's Satyr	LE	E	Jackson, Lenawee, Washentenaw
Nerodia erythrogaster neglecta	Copperbelly Watersnake	PS:LT	E	Hillsdale, Oakland
Nicrophorus americanus	American Burying Beetle	LE	E	Arenac, Livingston, Oakland, Washentenaw
Notropis anogenus	Pugnose Shiner		SC	Gladwin, Hillsdale, Lenawee, Mecosta, Oakland, Washentenaw
Notropis photogenis	Silver Shiner		E	Hillsdale, Livingston, Monroe, Montcalm, Washentenaw
Notropis texanus	Weed Shiner		X	Allegan, Jackson, Ottawa, Saginaw
Noturus miurus	Brindled Madtom		SC	Hillsdale, Jackson, Lenawee, Oakland, Washentenaw
Noturus stigmosus	Northern Madtom		E	Washentenaw
Nycticorax nycticorax	Black-crowned Night-heron		SC	Allegan, Arenac, Bay, Monroe, Montcalm
Oarisma poweshiek	Poweshiek Skipperling		T	Jackson, Lenawee, Livingston, Oakland, Washentenaw
Obovaria olivaria	Hickorynut		SC	Saginaw
Obovaria subrotunda	Round Hickorynut		E	Lenawee, Monroe, Montcalm, Sanilac
Oecanthus laricis	Tamarack Tree Cricket		SC	Allegan, Hillsdale, Jackson, Lapeer, Lenawee, Livingston, Oakland, Washentenaw
Oecanthus pini	Pinetree Cricket		SC	Jackson, Oakland
Ophioglossum vulgatum	Southeastern Adder's Tongue		T	Lenawee
Opuntia fragilis	Fragile Prickly-pear		E	Ogemaw
Oxalis violacea	Violet Wood-sorrel		T	Monroe, Montcalm

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Panax quinquefolius	Ginseng		T	Allegan, Clare, Hillsdale, Iosco, Jackson, Monroe, Montcalm, Oakland, Ottawa, Tuscola, Washentenaw
Pandion haliaetus	Osprey		T	Allegan, Clare, Gratiot, Iosco, Isabella, Mecosta, Ogemaw, Osecola, Rocommon
Panicum leibergii	Leiberg's Panic-grass		T	Hillsdale, Jackson, Monroe, Montcalm, Washentenaw
Panicum longifolium	Long-leaved Panic-grass		T	Allegan
Panicum microcarpon	Small-fruited Panic-grass		SC	Oakland
Panicum polyanthes	Round-seed Panic Grass		E	Lenawee
Papaipema beeriana	Blazing Star Borer		SC	Allegan, Jackson, Livingston, Monroe, Montcalm, Washentenaw
Papaipema maritima	Maritime Sunflower Borer		SC	Allegan, Jackson, Monroe, Montcalm
Papaipema sciata	Culvers Root Borer		SC	Allegan, Jackson, Monroe, Montcalm
Papaipema silphii	Silphium Borer Moth		T	Jackson, Monroe, Montcalm, Tuscola, Washentenaw
Papaipema speciosissima	Regal Fern Borer		SC	Allegan, Jackson, Lenawee, Livingston
Paronychia fastigiata	Low-forked Chickweed		SC	Washentenaw
Penstemon pallidus	Pale Beard Tongue		SC	Gladwin, Lenawee, Washentenaw
Percina copelandi	Channel Darter		E	Arenac, Huron, Iosco, Monroe, Montcalm, Ogemaw, Saginaw, Tuscola
Percina shumardi	River Darter		E	Huron, Iosco, Monroe, Montcalm, Saginaw, Tuscola
Phalaropus tricolor	Wilson's Phalarope		SC	Monroe, Montcalm
Phoxinus erythrogaster	Southern Redbelly Dace		E	Lenawee, Livingston, Washentenaw
Plantago cordata	Heart-leaved Plantain		E	Hillsdale, Shiawassee, Tuscola

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Platanthera ciliaris	Orange or Yellow Fringed Orchid		T	Allegan, Bay, Jackson, Lapeer, Livingston, Monroe, Montcalm, Oakland, Washentenaw
Platanthera leucophaea	Prairie Fringed Orchid	LT	E	Bay, Genesee, Gratiot, Huron, Livingston, Monroe, Montcalm, Saginaw, Tuscola, Washentenaw
Pleurobema clava	Clubshell	LE	E	Hillsdale
Pleurobema coccineum	Round Pigtoe		SC	Clare, Gratiot, Hillsdale, Jackson, Lenawee, Mecosta, Oakland, Osecola, Shiawassee
Poa paludigena	Bog Bluegrass		T	Jackson, Livingston, Oakland, Ottawa, Washentenaw
Polemonium reptans	Jacob's Ladder or Greek-valerian		T	Lapeer, Lenawee, Washentenaw
Polygala cruciata	Cross-leaved Milkwort		SC	Allegan, Jackson, Monroe, Montcalm
Polygonum careyi	Carey's Smartweed		T	Allegan
Pomatiopsis cincinnatiensis	Brown Walker		SC	Jackson, Lenawee, Monroe, Montcalm, Washentenaw
Populus heterophylla	Swamp or Black Cottonwood		E	Lenawee, Washentenaw
Potamogeton bicupulatus	Waterthread Pondweed		T	Allegan
Potamogeton vaseyi	Vasey's Pondweed		T	Oakland
Potentilla paradoxa	Sand Cinquefoil		T	Monroe, Montcalm
Prosapia ignipectus	Red-legged Spittlebug		SC	Clare, Jackson, Lapeer, Lenawee, Livingston, Oakland, Tuscola
Proserpinaca pectinata	Mermaid-weed		E	Ottawa
Protonotaria citrea	Prothonotary Warbler		SC	Allegan, Saginaw
Prunus alleghaniensis var. davisii	Alleghany or Sloe Plum		SC	Iosco, Lenawee, Ogemaw, Rocommon

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Psilocarya scirpoides	Bald-rush		T	Allegan, Oakland, Washentenaw
Pterospora andromedea	Pine-drops		T	Iosco, Mecosta, Ottawa
Pycnanthemum pilosum	Hairy Mountain-mint		T	Monroe, Montcalm, Saginaw
Pycnanthemum verticillatum	Whorled Mountain-mint		SC	Allegan, Huron, Ottawa
Pygarctia spraguei	Sprague's Pygarctia		SC	Allegan
Pyrgulopsis letsoni	Gravel Pyrg		SC	Livingston, Monroe, Montcalm, Oakland, Washentenaw
Quercus shumardii	Shumard's oak		SC	Monroe, Montcalm
Rallus elegans	King Rail		E	Allegan, Bay, Gratiot, Isabella, Jackson, Lapeer, Livingston, Monroe, Montcalm, Ottawa, Rocommon, Saginaw, Sanilac, Washentenaw
Ranunculus ambigens	Spearwort		T	Ottawa
Ranunculus rhomboideus	Prairie Buttercup		T	Washentenaw
Rhexia mariana var. mariana	Maryland Meadow-beauty		T	Allegan, Ottawa
Rhexia virginica	Meadow-beauty		SC	Allegan, Ottawa
Rhynchospora globularis	Globe Beak-rush		E	Allegan
Rhynchospora macrostachya	Tall Beak-rush		SC	Allegan
Rotala ramosior	Tooth-cup		SC	Allegan, Monroe, Montcalm, Ottawa
Ruellia humilis	Hairy Ruellia		T	Washentenaw
Ruellia strepens	Smooth Ruellia		T	Lenawee
Sabatia angularis	Rose-pink		T	Washentenaw
Sagittaria montevidensis	Arrowhead		T	Monroe, Montcalm

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Sanguisorba canadensis	Canadian Burnet		T	Washentenaw
Scirpus clintonii	Clinton's Bulrush		SC	Bay, Jackson, Livingston, Oakland, Shiawassee, Washentenaw
Scirpus hallii	Hall's Bulrush		T	Allegan
Scirpus olneyi	Olney's Bulrush		T	Gratiot
Scirpus torreyi	Torrey's Bulrush		SC	Allegan, Lapeer, Shiawassee
Scleria reticularis	Netted Nut-rush		T	Allegan
Scleria triglomerata	Tall Nut-rush		SC	Allegan, Jackson, Livingston, Washentenaw
Seiurus motacilla	Louisiana Waterthrush		SC	Allegan, Hillsdale, Tuscola
Silene stellata	Starry Campion		T	Hillsdale, Jackson
Silene virginica	Fire Pink		T	Bay
Silphium integrifolium	Rosinweed		T	Washentenaw
Silphium laciniatum	Compass-plant		T	Oakland, Washentenaw
Silphium perfoliatum	Cup-plant		T	Lenawee, Monroe, Montcalm, Washentenaw
Simpsonaias ambigua	Salamander Mussel		E	Lenawee, Monroe, Montcalm, Sanilac
Sistrurus catenatus catenatus	Eastern Massasauga	C	SC	Allegan, Arenac, Clare, Genesee, Hillsdale, Huron, Iosco, Jackson, Lapeer, Lenawee, Livingston, Oakland, Saginaw, Shiawassee, Washentenaw
Sisyrinchium atlanticum	Atlantic Blue-eyed-grass		T	Allegan, Ottawa
Sisyrinchium strictum	Blue-eyed-grass		SC	Gratiot, Hillsdale, Isabella, Jackson
Speyeria idalia	Regal Fritillary		E	Jackson, Lenawee, Livingston, Oakland, Shiawassee, Washentenaw
Spiranthes ochroleuca	Yellow Ladies'-tresses		SC	Saginaw

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Spiranthes ovalis	Lesser Ladies'-tresses		T	Washentenaw
Spiza americana	Dickcissel		SC	Jackson, Washentenaw
Sporobolus clandestinus	Dropseed		SC	Allegan
Sporobolus heterolepis	Prairie Dropseed		SC	Allegan, Jackson, Lenawee, Livingston, Oakland, Washentenaw
Sterna caspia	Caspian Tern		T	Arenac, Bay
Sterna forsteri	Forster's Tern		SC	Arenac, Bay, Huron, Tuscola
Sterna hirundo	Common Tern		T	Arenac, Bay, Huron, Midland, Monroe, Montcalm, Tuscola
Strophostyles helvula	Trailing Wild Bean		SC	Allegan, Monroe, Montcalm, Ottawa, Washentenaw
Stylurus amnicola	Riverine Snaketail		SC	Jackson, Midland
Stylurus laurae	Laura's Snaketail		SC	Gladwin, Jackson, Ogemaw, Washentenaw
Terrapene carolina carolina	Eastern Box Turtle		SC	Allegan, Clare, Hillsdale, Isabella, Jackson, Lenawee, Livingston, Mecosta, Monroe, Montcalm, Oakland, Ottawa, Washentenaw
Toxolasma lividus	Purple Lilliput		E	Monroe, Montcalm, Oakland, Tuscola
Tradescantia bracteata	Long-bracted Spiderwort		X	Allegan
Tradescantia virginiana	Virginia Spiderwort		SC	Midland, Monroe, Montcalm, Washentenaw
Trichostema brachiatum	False Pennyroyal		T	Lenawee
Trichostema dichotomum	Bastard Pennyroyal		T	Allegan, Mecosta, Oakland
Trillium nivale	Snow Trillium		T	Ottawa, Shiawassee
Trillium sessile	Toadshade		T	Lenawee, Oakland, Washentenaw
Trimerotropis huroniana	Lake Huron Locust		T	Huron, Iosco

Scientific Name	Common Name	Federal Status[1]	State Status[2]	County(ies) where Found
Triphora trianthophora	Three-birds Orchid		T	Allegan
Tyto alba	Barn Owl		E	Lapeer, Monroe, Montcalm
Utricularia subulata	Zigzag Bladderwort		T	Allegan
Valeriana edulis var. ciliata	Edible Valerian		T	Hillsdale, Jackson, Lenawee, Livingston, Oakland, Washentenaw
Valerianella umbilicata	Corn-salad		T	Monroe, Montcalm
Venustaconcha ellipsiformis	Ellipse		SC	Gratiot, Hillsdale, Jackson, Shiawassee
Viburnum prunifolium	Black Haw		SC	Hillsdale, Lenawee
Villosa fabalis	Rayed Bean		E	Hillsdale, Lenawee
Villosa iris	Rainbow		SC	Gratiot, Hillsdale, Jackson, Mecosta, Oakland, Rocommon, Sanilac, Shiawassee
Viola pedatifida	Prairie Birdfoot Violet		T	Oakland
Williamsonia fletcheri	Ebony Boghaunter		SC	Mecosta
Wilsonia citrina	Hooded Warbler		SC	Allegan, Hillsdale, Jackson, Lapeer, Livingston, Oakland, Ottawa, Washentenaw
Woodsia obtusa	Blunt-lobed Woodsia		T	Huron
Xanthocephalus xanthocephalus	Yellow-headed Blackbird		SC	Bay, Saginaw, Tuscola
Zizania aquatica var. aquatica	Wild-rice		T	Allegan, Iosco, Jackson, Monroe, Montcalm, Ottawa, Washentenaw

[1] LE = listed endangered, LT = listed threatened, LELT = partly listed endangered and partly listed threatened, PDL = proposed delist, E(S/A) = endangered based on similarities/appearance, PS = partial status (Federally listed in only part of its range), C = species being considered for Federal status.

[2] E = endangered, T = threatened, SC = special concern.

Source: MNFI 2005.