EXHIBIT A

MI/DEQ/WRD-16/001

WATER QUALITY AND POLLUTION CONTROL IN MICHIGAN 2016 SECTIONS 303(d), 305(b), AND 314 INTEGRATED REPORT

Michigan Department of Environmental Quality
Water Resources Division
November 2016
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This Integrated Report is available electronically on the Michigan Department of Environmental Quality, Water Resources Division, Web site at http://www.michigan.gov/deqwater under Water Quality Monitoring, Assessment of Michigan Waters.

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LIST OF ACRONYMS

ADB	Assessment Database
AIS	Aquatic Invasive Species
AOC	Areas of Concern
BCC	Bioaccumulative Chemicals of Concern
BEACH Act	Beaches Environmental Assessment and Coastal Health Act of 2000
BPJ	Best Professional Judgment
CAZ	Critical Assessment Zone
CMI	Clean Michigan Initiative
CSO	Combined Sewer Overflow
CWA	Clean Water Act
CWSRF	Clean Water State Revolving Fund
DDT	Dichlorodiphenyltrichloroethane
GIS	Geographic Information System
GLEC	Great Lakes Environmental Center
HAB	Harmful Algal Bloom
HCV	Human Cancer Value
HNV	Human Noncancer Value
HUC	Hydrologic Unit Codes
IR	Integrated Report
LaMP	Lakewide Action Management Plan
LHD	Local Health Department
MCL	Maximum Contaminant Level
MDARD	Michigan Department of Agriculture & Rural Development
MDHHS	Michigan Department of Health and Human Services
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
MGMT	Michigan Groundwater Management Tool
NHD	National Hydrography Dataset
ng/L	Nanograms per liter
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NREPA	Natural Resources and Environmental Protection Act
P51	Procedure 51
PBB	Polybrominated Biphenyl
PCB	Polychlorinated Biphenyl
PFOS	Perflourooctane Sulfonate
SSC	Site-Specific Aquatic Life Criteria
SWPP	Source Water Protection Program
SWQIF	Strategic Water Quality Initiatives Fund
TMDL	Total Maximum Daily Load
TSI	Trophic Status Index
USEPA	United States Environmental Protection Agency
ug/L	Micrograms per liter
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WCMP	Water Chemistry Monitoring Program
WMP	Watershed Management Plan
WQS	Water Quality Standards
WRD	Water Resources Division

EXECUTIVE SUMMARY

The federal Water Pollution Control Act (PL 92-500), also known as the Clean Water Act (CWA), requires states to provide the United States Environmental Protection Agency (USEPA) with an assessment of the quality of their waters [Section 305(b)], a list of waters that do not support their designated uses or attain Water Quality Standards (WQS) and require the development of Total Maximum Daily Loads (TMDLs) [Section 303(d)], and an assessment of status and trends of publicly owned lakes (Section 314). Similar to the 2014 reporting cycle, the Michigan Department of Environmental Quality (MDEQ) is fulfilling these CWA reporting requirements in 2016 through the submission of an Integrated Report (IR).

A primary objective of this IR is to describe attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's WQS. Michigan's WQS are consistent with the Great Lakes Initiative, establish minimum water quality requirements by which the waters of the state are to be managed, and provide the primary framework that guides the MDEQ's water quality monitoring/assessment and water protection activities. To describe the attainment status of surface waters, each water body is placed in at least one of five reporting categories based upon the amount of information known about the water body's water quality status, the degree of designated use support, and the type of impairment preventing designated use support.

This IR includes a description of the scope of Michigan waters covered; a summary of MDEQ activities designed to protect and restore water quality; an overview of water quality monitoring in Michigan; a description of Michigan's current assessment methodology; summaries of monitoring results and designated use support in the Great Lakes (including connecting channels and bays), inland lakes and reservoirs, rivers, and wetlands; information regarding water bodies not supporting designated uses, including water bodies requiring the development of a TMDL [i.e., Section 303(d) listings]; and a summary of the public participation process used in the development of this IR.

With the biennial development of each IR, Michigan continues to refine its data management and assessment methodology. Implementation of data management and assessment methodology changes initiated for the 2014 IR continued in the preparation of this IR. While listing information in the form of maps became available to the public in December 2009 via the Michigan Surface Water Information Management System (MiSWIMS) http://www.michigan.gov/miswims, enhancements like access to use-specific comments within the Assessment Database (ADB) continue to be made. The MiSWIMS serves as a valuable resource for those interested in additional detail in any specific listing decision throughout the state. An additional step toward information availability is planned during this 2016 IR cycle in the form of online access to Geographic Information System (GIS) data.

Detailed lists of designated use support are contained in this report (Appendix B) as well as designated use support summaries for Great Lakes (including connecting channels and bays), inland lakes and reservoirs, rivers, and wetlands (Tables 5.2, 5.3, 6.2, 7.2, and 8.1, respectively). Broadly, many of Michigan's surface waters continue to be impacted by polychlorinated biphenyls (PCBs) and mercury and consequently do not support the other indigenous aquatic life and wildlife designated use and/or the fish consumption designated use. Atmospheric deposition is considered to be the major source of these persistent bioaccumulative chemicals. Excluding PCBs and mercury, physical/chemical and biological assessments of inland lakes and rivers indicate designated uses are supported in a majority of water bodies.

CHAPTER 1
INTRODUCTION

1.1 Purpose

The federal Water Pollution Control Act (PL 92-500), also known as the CWA, requires states to provide the USEPA with an assessment of the quality of their waters [Section 305(b)], a list of waters that do not support their designated uses or attain WQS and require the development of TMDLs [Section 303(d)], and an assessment of status and trends of publicly owned lakes (Section 314). Similar to the 2014 reporting cycle, the MDEQ is fulfilling these CWA reporting requirements in 2016 through the submission of an IR. Where possible, Michigan's 2016 IR was developed consistent with the USEPA's "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b), and 314 of the Clean Water Act" and supplemental guidance information for 2008, 2010, 2012, 2014, and 2016 IRs prepared by the USEPA.

A primary objective of this IR is to describe attainment status of Michigan's surface waters relative to the designated uses specified in Michigan's WQS (available at http://www.michigan.gov/documents/deq/wrd-rules-part4_521508_7.pdf). Michigan's Part 4 Rules, WQS, are promulgated under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA). Michigan's WQS are consistent with the Great Lakes Initiative, establish minimum water quality requirements by which the waters of the state are to be managed, and provide the primary regulatory framework that guides the MDEQ's water quality monitoring/assessment and water protection activities. To describe the attainment status of surface waters, each water body is placed in at least one of five reporting categories (see Section 4.11) based upon the amount of information known about the water body's water quality status, the degree of designated use support, and the type of impairment preventing designated use support. Additionally, the attainment status information described within this IR is used to help inform some of the outcomes associated with various goals identified within the Water Resources Division's (WRD) Measures of Success. The Measures of Success are used to define the expected outcomes of water resource programs geared toward having clean and safe water (http://www.michigan.gov/deq/0,1607,7-135-3306_28610---,00.html).

The remainder of this chapter includes a description of the scope of Michigan waters covered in this IR. Chapter 2 summarizes MDEQ programs designed to protect and restore water quality. Chapter 3 contains an overview of water quality monitoring in Michigan. Chapter 4 details Michigan's current assessment methodology. Chapters 5, 6, 7, and 8 are more technical in nature and provide summaries of monitoring results and designated use support in the Great Lakes (including connecting channels and bays), inland lakes, rivers, and wetlands, respectively. Chapter 9 addresses all water body types not supporting designated uses, including water bodies requiring the development of a TMDL [i.e., Section 303(d) listings]. Chapter 10 includes information regarding the public participation process in the development of this IR.

Data Management and Assessment Methodology Updates

With the biennial development of each Section 305(b) report, Section 303(d) report, and Section 314 report, or IR, Michigan continues to refine its data management and assessment methodology.

Due to data management changes over time, and assessment methodology changes cycle-to-cycle, designated use support summary tables (e.g., Tables 5.2, 5.3, 6.2, 7.2, and 8.1) are not directly comparable to previous IRs. Similar to previous IRs, trends in designated use support are not discussed in this IR. Analysis of designated use support trends based on information presented in this and previous reports (e.g., change in number of river miles supporting designated uses) would be misleading. As assessment coverage increases and water bodies are evaluated for the first time or when more sophisticated and sensitive monitoring techniques are applied (e.g., low level PCB analysis), the proportion of supporting versus not supporting water bodies will change between reporting cycles. However, such a proportion change between reporting cycles often may not constitute a real overall change in water quality but rather an increased accuracy in the ability to assess and account for designated use conditions.

Beginning with the 2008 IR, all data (i.e., records) were stored in the USEPA ADB. This system uses a 12-digit hydrologic unit code (HUC)-based naming convention and the National Hydrography Dataset (NHD) to georeferenced records. The data management and assessment methodology changes implemented in the 2008 and 2010 IRs advanced Michigan's mapping capabilities for Section 305(b), Section 303(d), and Section 314 listings. Listing information in the form of maps are available to the public via the MiSWIMS http://www.michigan.gov/miswims. The MiSWIMS is an interactive application that allows users to view and download surface water-related data and information collected by the MDEQ and Michigan Department of Natural Resources (MDNR). Beginning with the 2016 IR, additional public information access in the form of GIS data are planned for download online.

1.2 Michigan's Waters

Michigan is blessed with a wealth of surface water resources, including Great Lakes and their connecting channels, inland lakes, rivers, and wetlands (Table 1.1). Most of Michigan also has an abundant supply of high quality groundwater.

In general, the open waters of the Great Lakes have good to excellent water quality. The inland waters of Michigan's Upper Peninsula and the northern half of the Lower Peninsula support diverse aquatic communities and are commonly found to have good to excellent water quality. Many lakes and rivers in this mostly forested area of the state support coldwater fish populations. Lakes and rivers in the southern half of Michigan's Lower Peninsula generally have good water quality and support warmwater biological communities as well as some coldwater fish populations. The southern portion of the state contains Michigan's major urban areas with much of the rural land in agricultural production. 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 pollutant loading are problems associated with runoff that can impact surface water quality. Surface water quality is generally showing improvement where programs are in place to correct problems and restore water quality.

Table 1.1 Michigan Atlas (all values are approximations).

Topic	Number	Area	Length	Source
State population	**9.9 Million**			**United States Census Bureau 2010 Estimate**
State surface area		**96,760 mi^2**		**Sommers, 1977**
Great Lakes, Great Lakes bays, and Lake St. Clair		**42,167 mi^2 (~45% of total Great Lakes area)**	**3,049 mi shoreline**	**USGS NHD (1:24,000 scale)**
Inland lakes and reservoirs with surface area ≥ 0.1 acre	**46,000**	**872,109 acres**		**USGS NHD (1:24,000 scale)**
Rivers and streams (including connecting channels)			**76,439 mi**	**USGS NHD (1:24,000 scale)**
Wetlands		**6,465,109 acres**		**USFWS National Wetland Inventory**

1.2.1 Great Lakes, Bays, Connecting Channels, and Lake St. Clair

The Great Lakes contain 20 percent of the world's fresh surface water and are a unique natural resource. The protection of the Great Lakes is shared by the United States and Canadian federal governments; the states of Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York; and the Canadian Provinces of Ontario and Quebec. Various Native American tribal organizations are also stakeholders and play a role in protecting Great Lakes water quality.

Michigan lies almost entirely within the watersheds of Lakes Superior, Michigan, Huron, and Erie (Table 1.2). The state maintains jurisdiction over approximately 45 percent (by surface area) of the 4 bordering Great Lakes (38,865 of a total area of 86,910 square miles) and 3,049 miles of Great Lakes shoreline. Significant Great Lakes bays include Grand Traverse Bay and Saginaw Bay. In this IR, the St. Marys, St. Clair, and Detroit Rivers (connecting channels) and Lake St. Clair are generally discussed in the Great Lakes Chapter (see Chapter 5). The term "connecting channels" used in this report is slightly different than the term "connecting waters" defined in Michigan's WQS. In this IR, the Keweenaw waterway (i.e., the Portage Lake ship canal, Portage Lake, Portage River, etc.) is reported as river miles and inland lakes. Michigan's WQS include the Keweenaw waterway in the "connecting waters" definition.

Generally, the open waters of the upper Great Lakes (Superior, Michigan, and Huron) have excellent water quality. Exceptions include a few impaired locations restricted to nearshore zones influenced by large, densely populated, and heavily industrialized areas. Great Lakes' water quality has benefited from pollutant control and remedial efforts in tributaries. These activities have reduced the discharge of conventional and toxic pollutants, including nutrients, persistent organic compounds, metals, and oils.

Table 1.2 Jurisdictional control of the four Great Lakes bordered by Michigan.

Great Lake	Canadian* (miles^2)	United States* (miles^2)	Michigan† (miles^2)	Total* (miles^2)
Superior	11,100	20,600	16,400	31,700
Michigan	---	22,300	13,250	22,300
Huron	13,900	9,100	9,100	23,000
Erie	4,930	4,980	115	9,910
Total	29,930	56,980	38,865	86,910

*Strum, 2000; †United States Census Bureau 2002 estimate

Aquatic Invasive Species (AIS) continue to have dramatic indirect and direct effects on the Great Lakes (see Section 2.25.1). AIS are responsible for increases in water clarity, loss of organisms and biodiversity, disruption of food webs, and impacts on economically important fish species (International Association for Great Lakes Research, 2002). Emerging research also shows that AIS cause changes in nutrient cycling and availability and may contribute to increased plant and algae growth in many nearshore areas, such as Saginaw Bay and the western basin of Lake Erie.

The Great Lakes have problems with selected persistent bioaccumulative chemicals. Fish consumption advisories in the Great Lakes serve as reminders that certain pollutants, such as PCBs, chlordane, dioxins, and mercury remain elevated in the water column and fish tissue. The use of PCBs and dichlorodiphenyltrichloroethane (DDT) was banned in the 1970s and concentrations of these chemicals in Great Lakes fish have declined; however, concentrations in some species still require consumption advisories. Atmospheric deposition, tributary loadings, and the dynamic exchange and cycling between air, water, and sediment within the Great Lakes basins are the key factors influencing contaminant levels in Great Lakes fish.

1.2.2 Inland Lakes and Reservoirs

Michigan has approximately 46,000 inland lakes (including lakes, ponds, and river impoundments) with a surface area of at least one-tenth of an acre or greater. Lakes with the largest surface area include Houghton (Roscommon County), Torch (Antrim and Kalkaska Counties), Charlevoix (Charlevoix County), Burt (Cheboygan County), Mullett (Cheboygan County), Gogebic (Gogebic and Ontonagon Counties), Manistique (Luce and Mackinac Counties), Black (Cheboygan and Presque Isle Counties), Crystal (Benzie County), Portage (Houghton County), and Higgins (Crawford and Roscommon Counties).

Michigan has 730 inland lakes that are deemed “public access lakes” (Table 1.3). The list of public access lakes includes lakes with a public boat launch and a lake surface area of at least 50 acres as well as a few recreationally important small lakes (less than 50 acres) that have public boat launches. There are 345 public access lakes located in the southern Lower Peninsula, 219 in the northern Lower Peninsula, and 166 in the Upper Peninsula. The average public access lake size is 341 acres in the southern Lower Peninsula, 1,342 acres in the northern Lower Peninsula, and 731 acres in the Upper Peninsula.

Michigan has 156 inland lakes that are deemed “cisco lakes.” The cisco (*Coregonus artedi*) is a member of a trout and salmon (Salmonidae) subfamily that usually occupies the cooler and deeper niches of high quality freshwater inland lakes and many parts of the Great Lakes. In North America, cisco can be found from Alaska to New England. Ciscos are, or were, present in at least 156 lakes in 41 Michigan counties ranging from the Indiana border to Keweenaw County in the Upper Peninsula. The cisco is currently identified as a state threatened species

pursuant to the NREPA. Ciscos require relatively deep inland lakes with cool, well-oxygenated waters. During summer stratification, cisco are rarely found in waters above 20°C or at dissolved oxygen concentrations less than 3.0 parts per million. This species is very sensitive to habitat degradation and has been extirpated from lakes where these minimum thermal and dissolved oxygen conditions are not met. In 2003, the MDNR initiated a study to assess the status of the cisco populations in Michigan. The intent of this ongoing study is to identify inland lakes in which populations are extant and increase awareness of this species so that protective Best Management Practices are promoted.

Although Michigan's inland lakes generally have good to excellent water quality, some water quality issues remain. Of the public access lakes that do not meet WQS, the primary cause is fish consumption advisories for PCBs or mercury. A statewide mercury-based fish consumption advisory applies to all of Michigan's inland lakes, reservoirs, and impoundments. The majority of Michigan's public access lakes have moderate or low nutrient levels; however, nutrient levels are high enough in several lakes to warrant corrective action through the development and implementation of a TMDL. 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 Lower Peninsula and Upper Peninsula where the population density is lower, soils are less fertile, and lakes tend to be larger and deeper. Contaminated sediments are also an issue in several inland lakes, and remediation efforts are being planned or have been undertaken.

Table 1.3 Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

ALCONA	BARRY	CALHOUN	CHIPPEWA
Alcona Dam Pond	Baker	Duck	Caribou
Brownlee	Barlow†	Goguac	Carp
Cedar	Big Cedar†	Homer	Frenchmans
Crooked	Bristol	Lane	Hulbert†
Hubbard*	Carter	Lee	Monacle*
Jewell	Chief Noonday	Nottawa	Shelldrake Impoundment
North	Clear	Prairie	
Vaughn	Cloverdale	Upper Brace	CLARE
	Crooked	Wabascon	Arnold
ALGER	Deep	Warner's	Big Long
AuTrain Basin	Duncan	Winnipeg	Budd
AuTrain Lake	Fine		Cranberry
Deer†	Fish*	CASS	Crooked
Fish	Gun	Baldwin*	Five
Grand Sable	Jordan	Belas	George
Kingston	Leach	Birch*	Lily
Nawakwa	Lime†	Bunker†	Little Long
	Little Cedar†	Chain†	Mud
ALLEGAN	Long (Hope Twp)	Christiana	Perch
Allegan	Long (Johnstown Twp)*	Curtis†	Shingle
Baseline	Long (Yankee Springs Twp)	Day†	Silver
Big	Lower Crooked	Dewey	Windover
Duck	Middle	Diamond	
Eagle	Payne	Donnell*	CLINTON
Green*	Pine	Driskels	Ovid
Hutchins	Thornapple	Fish	Park
Kalamazoo		Harwood*	
Lower Scott	BENZIE	Hemlock	CRAWFORD
Miner	Ann*	Indiana†	Jones
Osterhout	Betsie	Juno/Painter	K.P.
Selkirk	Crystal*	Kirk*	Margrethe
Swan	Herendeene	Lewis†	Section One
Swan Creek Pond	Little Platte	Lime†	Shupac
	Lower Herring	Magician	
ALPENA	Pearl	Mill	DELTA
Beaver*	Platte	North Twin	Boney Falls
Fletcher Pond	Stevens	Paradise	Camp 7
	Turtle	Round†	Corner
ANTRIM	Upper Herring	Shavehead*	Dana
Bellaire*		South Twin	Pole Creek Lake
Benway	BERRIEN	Stone	Round
Birch	Paw Paw	Tharp†	Skeels
Clam			
Elk*	BRANCH	CHARLEVOIX	DICKINSON
Ellsworth	Archer*	Charlevoix*	Antoine
Intermediate*	Bartholomew†	Deer	Bass
Lake of the Woods	Cary	Hoffman	Carney
St. Clair	Coldwater*	Six Mile	Edey
Torch*	Craig	Susan	Hamilton
Wilson	East Long*	Thumb	Louise†
	George	Walloon*	Mary*
BARAGA	Gilead		Norway
Beaufort	Kenyon	CHEBOYGAN	Pickeral
Big Keewaydin	Lavine	Black	Rock
King	Marble*	Burt*	Sawyer
Parent	Matteson	Douglas†	Silver
Prickett Dam	Morrison	Lancaster	Six Mile
Ruth	North	Long	
Vermilac	Oliverda	Mullett*	EATON
	Randall	Silver	Narrow
	Rose (Lake of the Woods)	Twin Central†	Saubee†
	Silver	Twin North†	
	South	Twin South †	
	Union		

Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

EMMET	GRAND TRAVERSE	IOSCO	JACKSON
Crooked	Arbutus	Floyd	Brown†
Larks	Bass	Foote Dam Pond	Center
Paradise	Bass	Indian	Clark
Pickeral	Boardman	Londo	Crispell
Round	Bridge†	Long	Gilletts
	Brown Bridge Pond	Loon*	Grass
GENESEE	Cedar	Loud Dam Pond	Pleasant
C.S. Mott Impoundment	Cedar Hedge*	Round	Portage
Fenton	Dubonnet	Sand	Round
Holloway Reservoir	Duck*	Tawas	South Lime
Kearsley Reservoir	Fife	VanEtten	Swain's*
Lobdell*	Green*	West Londo	Vandercook*
Ponemah	Long		Vineyard
Thread	Silver	IRON	Wampler's
	Spider	Bass	
GLADWIN		Brule	KALAMAZOO
Lake Four	HILLSDALE	Buck	Austin
Pratt	Baw Beese	Cable	Barton
Secord Impoundment	Bear*	Camp	Crooked†
Wiggins	Bird	Chicagon	Eagle
Wixom Impoundment	Carpenter†	Deer	Eagle
	Cub	Ellen	Gourdneck
GOGEBIC	Diane	Emily	Gull*
Allen	Hemlock*	Fire	Hogsett
Bass	Long (Reading Twp)*	First Fortune	Howard†
Beatons	Long (Stubin Co., IN)	Gibson	Indian*
Bobcat	Round	Golden	Long
Chaney	Sand North†	Hagerman	Morrow Pond
Cisco*	Sand Middle†	Hannah Webb	Paw Paw*
Clark*	Sand South†	Indian	Portage (Blue)
Clearwater	Wilson†	Iron	Ruppert
Crooked†		James	Sagmaw†
Dinner	HOUGHTON	Kidney	Sherman
Duck	Bob	Little Smoky	Sugarloaf
Eel	Boston	Long	West
Gogebic*	Emily	Mary	Whitford
Henry Impoundment	Otter*	Michigamme	
Lac Vieux Desert	Pike	Norway	KALKASKA
Loon†	Portage*	Ottawa	Bear
Langford	Rice	Perch	Blue (Big)*
Little Oxbow	Roland	Runkle	Big Guernsey
Lake Pomeroy	Sandy	Smoky*	Cub
Marion	Torch*	Stager	East
McDonald		Stanley	Indian
GOGEBIC cont'd	INGHAM	Sunset	Manistee
Moon	Lansing	Swan	North Blue†
Moosehead		Tamarack	Pickeral
Moraine	IONIA	Tepee	Starvation
Noorwood†	Long	Winslow	Skegmog*
Ormes	Morrison		Twin (Big)*
Sunday	Sessions	ISABELLA	
Taylor*	Woodard	Coldwater*	
Thousand Island*		Halls	
		Littlefield*	
		Stevenson	

Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

KENT	LIVINGSTON	MARQUETTE	MISSAUKEE
Bass	Appleton*	Anderson	Crooked
Big Myers	Baseline*	Ann†	Goose
Big Pine Island	Bass†	Arfelin	Long
Big Wabasis	Bennett†	Bass	Missaukee
Camp	Bishop	Bass	Sapphire
Campau	Chemung*	Big Shag	
Campbell	Fish†	Dead River Storage Basin	MONTCALM
Lime	East Crooked*	Engmans	Baldwin
Lincoln	Hiland	Greenwood Reservoir	Bass
Murray*	Limekiln†	Horseshoe	Clifford
Pratt	Ore†	Independence*	Cowden
Reeds	Portage†	Ives†	Crystal
Ziegenfuss†	Runyan†	Johnson	Derby
	Sandy Bottom†	Little	Dickerson
KEWEENAW	Thompson	Little Shag	Halfmoon
Bailey	West Crooked*	Michigamme	Horseshoe
Desor†	Whitmore	McClure Storage Reservoir	Little Whitefish
Fanny Hoe*	Woodland	Mountain†	Loon
Gratiot	Zukey†	Pike	Montcalm
Lac LaBelle		Pine†	Mud
Medora	LUCE	Rush†	Muskellunge
Ritchie†	Bass	Silver†	Nevins
Sargent†	Bodi	Sporley*	Rainbow
Siskiwit†	Culhane	Squaw	Rock
Thayer's	Kaks	Witch	Tamarack
	Muskallonge	Wolf	Townline
LAKE	North Manistique*		Whitefish
Big Bass	Perch	MASON	Winfield
Big Star	Pike	Bass	
Harper	Twin	Ford	MONTMORENCY
Idlewild		Gun	Atlanta
Little Bass†	MACKINAC	Hackert (Crystal)	Avalon*
Paradise	Brevoort*	Hamlin	Avery
Reed	Little Brevoort	Lincoln	Clear
Wolf	Manistique*	Pere Marquette	East Twin
	Milakokia	Pliness	Ess
LAPEER	Millicoquins	Round	Gaylanta
Big Fish	S. Manistique*		Grass
Davidson		MECOSTA	Lake Fifteen
Long	MACOMB	Bergess	Long*
Minnewanna	Stony Creek Impoundment	Blue	McCormick
Nepessing		Chippewa	Muskellunge
Otter	MANISTEE	Clear	Rush
	Arcadia	Hillsview	Sage
LEELANAU	Bear	Horsehead	West Twin
Cedar	Canfield	Jehnsen	
Davis	Healy	Martiny	MUSKEGON
Glen*	Manistee	Mecosta	Bear
Lime	Pine*	Merrill	Big Blue
Little Glen	Portage	Pretty	Duck
Little Traverse*		Rogers Pond	East Twin
North Lk Leelanau*		Round	Fox
School		School Section	Half-Moon
South Lk Leelanau*		Townline	Mona
			Muskegon
LENAWEE		MENOMINEE	North
Allens		Long	White
Deep			Wolf
Devils		MIDLAND	
Hudson		Sanford	
Round			
Round			
Sand			

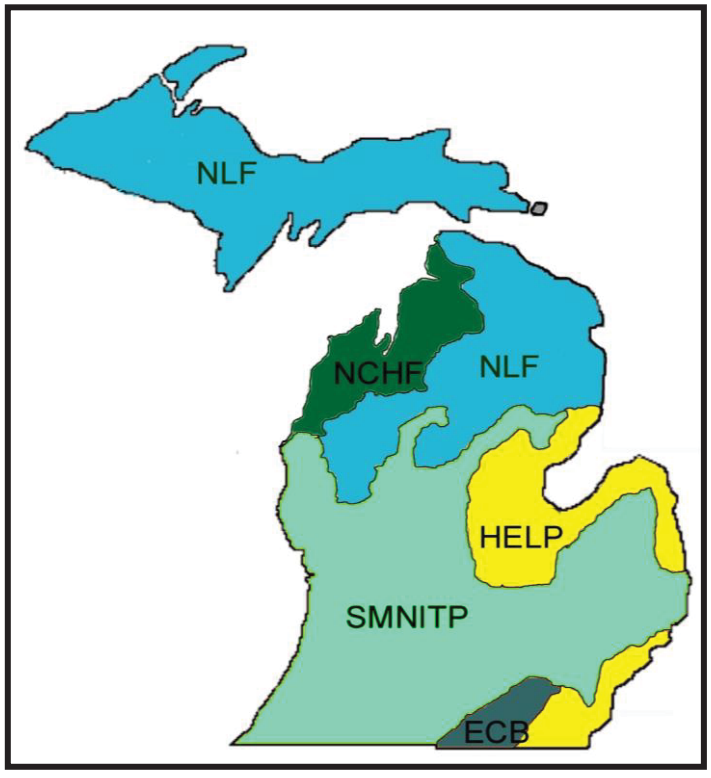
Table 1.3 continued. Michigan's public access and cisco lakes by county. *Indicates that the lake is a public access lake and a cisco lake. †Indicates that the lake is a cisco lake only.

NEWAYGO	OCEANA	PRESQUE ISLE	VAN BUREN
Baptist	Crystal	Big Tomahawk	Ackley
Benton	McLaren	Emma	Banksons
Bills	Pentwater	Essau	Brandywine
Blanch	Schoolsection	Grand	Cedar
Brooks	Silver	Long	Clear
Croton Dam Pond	Stony	Lost	Cora
Crystal		May	Eagle
Diamond	OGEMAW	Nettie	Eleven
Englewright	Au Sable	Shoepac	Fish
Fremont	Bush	Sunken	Fourteen
Hardy	Clear		Gravel
Hess	DeVoe*	ROSCOMMON	Halls
Kimball*	George	Higgins*	Huzzy's
Nichols*	Grousehaven*	Houghton	Lake of the Woods
Pettibone	Hardwood	St. Helen	Maple
Pickerel*	Horseshoe		North Scott
Robinson	Lake George	SCHOOLCRAFT	Round
Sand	Peach	Boot	Rush
Woodland	Rifle	Colwell	Saddle
	Sage	Dodge	School
OAKLAND	Tee	Gemini	Section
Angelus†		Gulliver*	Shafer
Big	ONTONAGON	Indian*	South Scott
Cass*	Bond Falls	Island	Three Legged
Cedar Island*	County Line	Kennedy	Three Mile
Crescent		McDonald	Upper Jeptha
Deer*	OSCEOLA	Petes	Upper Reynolds
Dickinson	Big	Ross	VanAuken
Dunham†	Diamond	Snyder	Wolf†
Green†	Hicks		
Hammond†	Rose	ST JOSEPH	WASHTENAW
Heron	Sunrise	Big Fish	Big Portage
Kent	Todd	Clear	Blind†
Lakeville	Wells	Corey*	Bruin*
Long		Crotch	Cedar
Loon*	OSCODA	Fisher's	Crooked
Lotus*	McCollum	Klinger*	Ford
Lower Pettibone	Mio Dam	Long	Four Mile
Maceday*	Pond	Long	Green
Middle Straits	Tea	Palmer	Half Moon*
Oakland		Pleasant*	Joslin
Orchard*	OTSEGO	Portage	Mill
Orion	Big	Prairie River*	Mud
Oxbow†	Big Bass	Sand	North
Pontiac	Big Bear	Sturgeon	Pickerel†
Seven	Bradford	Tamarack†	South*
Silver†	Dixon	Thompson*	Sugar Loaf
Squaw/Clear	Emerald	Three Rivers Impoundment	Winnewanna
Tipsico	Heart		
Townsend†	Manuka	TUSCOLA	WAYNE
Union*	Opal	Caro Reservoir	Belleville
Upper Proud	Otsego	Murphy	Newburgh
Upper Pettibone†	Pickerel	North	
Valley	Twenty Seven		WEXFORD
White			Berry
Wildwood	OTTAWA		Cadillac
Wolverine	Crockery		Hodenpyl Dam Pond
	Macatawa		Long
	Pigeon		Mitchell
	Spring		

1.2.3 Rivers

Michigan's rivers can be grouped by the distinct ecoregions through which they flow. Each of the five ecoregions in Michigan consists of areas that exhibit relatively similar geological landform characteristics (Omernik and Gallant, 1988). Factors used to delineate ecoregions include climate, soils, vegetation, land slope, and land use. This framework provides information on the environmental characteristics that tend to occur within each ecoregion. In order by size (largest to smallest area), the five ecoregions in Michigan are Southern Michigan/Northern Indiana Till Plains, Northern Lakes and Forests, North Central Hardwood Forests, Huron-Erie Lake Plains, and Eastern Corn Belt Plains (Figure 1.1).

Rivers in the Northern Lakes and Forests and North Central Hardwood Forests ecoregions tend to support coldwater fish within at least a portion of their systems. These rivers commonly have relatively small watersheds, high relief topography, substantial groundwater inputs, and are naturally low in productivity. Most rivers in the Northern Lakes and Forests ecoregion are perennial, often originating from lakes or wetlands. Although relatively free of sediment, surface waters in this ecoregion often have a characteristic brownish color because of elevated concentrations of dissolved organic material, including tannins and lignins. In the North Central Hardwood Forests ecoregion, river flow is highly variable. Flow is entirely intermittent in some portions of the ecoregion and entirely perennial in other areas. These rivers typically drain soils with much poorer nutrient content than in bordering ecoregions to the south.



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 1.1. Ecoregions of Michigan (Level III) (adapted from Omernik and Gallant, 1988).

Rivers in the Southern Michigan/Northern Indiana Till Plains ecoregion are generally of good water quality in the headwaters. This ecoregion is drained predominantly by perennial rivers. Such rivers are typically sluggish and are bordered, often extensively, by wetland tracts. Drainage ditches and channelized rivers have been a common solution to assist drainage of areas that are too wet for settlement and agricultural needs.

Upland features related to poor soil drainage heavily influence the rivers in the Huron-Erie Lake Plains and Eastern Corn Belt Plains ecoregions. Broad and nearly level lake plain is crossed by beach ridges and low moraines, which has resulted in the formation of poorly drained soils. More than half of the rivers in the Huron-Erie Lake Plains ecoregion are intermittent, and river flows are commonly runoff-dependent. In addition to the construction of numerous drainage ditches, the headwaters of many rivers are extensively channelized for quicker drainage and to improve upland field conditions. About half of the rivers in the Eastern Corn Belt Plains ecoregion are perennial and many have been channelized to assist soil drainage. This ecoregion is almost entirely farmland, and river quality is influenced by increased soil and water runoff from agricultural land uses.

1.2.4 Wetlands

About 15 percent of Michigan's land area is wetland. Several inventories of wetlands in Michigan have been undertaken by different agencies. The two most utilized are the Part 303 State Wetland Inventory, and the United States Fish and Wildlife Service (USFWS) National Wetland Inventory. Sources of wetland loss include permitted activities; unpermitted activities (i.e., violations of Section 404 of the CWA and state law); activities that are exempt under state and federal law; the loss of small, isolated wetlands that are not under state or federal jurisdiction; natural processes (e.g., beaver activity); and indirect effects (e.g., alteration of drainage networks due to urbanization). Wetland acreage may increase for some of the same reasons (e.g., changes in drainage pathways). However, most wetland gains are attributed to voluntary wetland restoration projects, pond construction, and mitigation for permitted impacts.

Part 303, Wetlands Protection, of the NREPA requires the MDEQ to make a preliminary inventory of all wetlands in the state on a county-by-county basis. County wetland inventories are now completed for all 83 counties in the state, and have been made available to the public on the Internet at http://www.michigan.gov/deqwater under Wetlands Protection, 'Are there wetlands on my property?'. The county wetland inventories were produced by overlaying data from the following sources: the USFWS National Wetland Inventory maps (1978), Natural Resources Conservation Service soil survey maps, and Michigan Resource Information System land use/land cover maps. County wetland inventories are intended to be used as planning tools that provide potential and approximate locations of wetlands and some information regarding wetland condition, but are not intended to be used to determine the jurisdictional boundaries of wetland areas subject to regulation.

Estimates of wetland losses since European settlement range from 35 percent, based on the Michigan Natural Features Inventory presettlement inventory to 50 percent based on the USFWS Status and Trends reporting. During 2006, the MDEQ, Wetlands, Lakes, and Streams Unit, then housed in the Land and Water Management Division (LWMD), partnered with Ducks Unlimited Great Lakes/Atlantic Regional Office to perform an update to the original National Wetland Inventory dataset that was completed in the late 1970s and early 1980s. The project updated the National Wetland Inventory dataset to the two most recent, statewide, aerial photography flights conducted in the state, that being the 1998 United States Geological Survey (USGS) Digital Ortho Quarter Quads data and the 2005 National Agriculture Imagery Program data. This effort resulted in three distinct temporal wetland inventories for the State from which to draw conclusions and analyze trends. The 1998 inventory shows a total loss of vegetated wetlands of 32,839 acres. The 2005 inventory shows a total loss of vegetated wetlands of

8,096 acres. Subtracting these losses from the original National Wetland Inventory total wetland acreage yields a total of 6,465,109 acres of wetland remaining in Michigan.

The Michigan Natural Features Inventory published a preliminary assessment entitled, “Wetland Trends in Michigan Since 1800” (Comer, 1996), based on a comparison of original land surveys conducted by the General Land Office from 1816 to 1856 and Michigan Resource Information System land use/land cover maps. This publication includes a county-by-county estimate of historical wetland types and losses since pre-European settlement. In addition, the pre-European settlement maps have been digitized and are available for review in a GIS.

The Great Lakes Coastal Wetlands Consortium has completed a GIS-based inventory of Great Lakes coastal wetlands in cooperation with the Great Lakes state and provinces. This inventory is available through the Consortium’s Web site at http://www.glc.org/.

CHAPTER 2
WATER PROTECTION ACTIVITIES

The MDEQ has a number of programs designed to protect and restore water quality. These programs establish WQS, provide regulatory oversight for public water supplies, issue permits to regulate the discharge of industrial and municipal wastewaters, provide technical and financial assistance to reduce pollutant runoff, ensure compliance with state laws, and educate the public about water quality issues. This chapter provides descriptions of Michigan's water quality protection programs and highlights several special initiatives and costs/benefits.

2.1 Aquatic Nuisance Control

The MDEQ has the authority, under Part 33, Aquatic Nuisance Control, and Part 31, Water Resources Protection, of the NREPA, to regulate the chemical control of nuisance aquatic plants, algae, and swimmer's itch. Each application for a permit must undergo a thorough review to assess the environmental impact to the water body and any human health and safety issues. A large majority of these treatments are carried out by commercial pesticide applicators licensed by the Michigan Department of Agriculture and Rural Development (MDARD). The MDEQ works with the MDARD to assure those treatments and the applicators comply with the requirements of the permits and the pertinent laws. Program staff also review new chemical products proposed for use in Michigan waters, survey Michigan lakes to determine the composition of the native plant community and presence of exotic plant species, and seek to educate riparian property owners about the management of aquatic plants and a variety of related lake management issues.

2.2 Beach Protection

In Michigan, Local Health Departments (LHDs) have jurisdiction to test and otherwise evaluate water quality at bathing beaches to determine whether the water is safe for swimming. The LHDs advise beach owners when beaches should be closed and the local health officer may petition the county circuit court to close a beach if needed. Beach monitoring results collected by the LHDs and swimming advisories are made available to the public by the LHDs via the MDEQ's statewide beach monitoring Web site at http://www.deq.state.mi.us/beach. Signs are posted at bathing beaches stating whether or not the beach has been tested for *E. coli*. Since 2000, the MDEQ has provided grants to LHDs to support and augment beach monitoring throughout Michigan. These grants are funded by a combination of state Clean Michigan Initiative (CMI) bond money and federal Beaches Environmental Assessment and Coastal Health Act (BEACH Act) funds. The BEACH Act authorizes the USEPA to award program development and implementation grants to eligible states, territories, tribes, and local governments. These annual grants support microbiological monitoring of coastal recreation waters, including the Great Lakes, which are adjacent to beaches or similar points of access used by the public. BEACH Act grants also support development and implementation of programs to notify the public of the potential exposure to disease-causing microorganisms in coastal recreation waters. In 2015, the MDEQ provided $500,000 to implement rapid testing

methods using quantitative polymerase chain reaction (QPCR). Equipment and training were provided to ten new labs across the state. At least 200 beaches will begin testing with QPCR methods in conjunction with traditional culture-based methods. Results from both methods will be compared to develop new criteria for the QPCR method.

2.3 Biosolids

The treatment of municipal wastewater generates a residual sewage sludge that may be disposed through incineration or landfilling or these materials can undergo additional stabilization to become biosolids. Recycling biosolids on the land has proven to be a safe and cost-effective alternative for wastewater treatment plants. Biosolids contain essential macro and micro nutrients and are an excellent source as a fertilizer or soil conditioner. The MDEQ encourages the use of biosolids to enhance agricultural and silvicultural production in Michigan and in some cases biosolids can be used for landscaping purposes. However, if biosolids are not properly handled, the potential exists that these materials could enter surface water or groundwater and degrade water quality. To prevent such problems, the land application of biosolids is a highly regulated activity.

Under the federal regulations contained in Title 40 of the Code of Federal Regulations (CFR), Part 503, Standards for the Use or Disposal of Sewage Sludge; and the Michigan Part 24 Rules, Land Application of Biosolids, of the NREPA, criteria for biosolids land application have been established. National Pollutant Discharge Elimination System (NPDES) and state groundwater discharge permits require management of biosolids and other residuals from wastewater treatment facilities. Permittees are required to develop and obtain MDEQ approval of a Residuals Management Program. The MDEQ has district staff dedicated to overseeing the 26 Biosolids Land Application Program by inspecting the facilities generating biosolids and the land application sites.

2.4 Campgrounds

The Campgrounds program is implemented by the MDEQ in cooperation with LHDs. The program requires annual licensure, based on an approved inspection, and construction permits for new facilities or modifications to existing facilities. The focus of the program is to protect public health and safety in accordance with the provisions of Article 12, Part 125, Campgrounds, Swimming Areas, and Swimmers' Itch, of the Public Health Code, 1978 PA 368 (Act 368), as amended, and the administrative rules adopted pursuant to Act 368. The risks to public health primarily include illnesses related to inadequate water supply facilities and improper wastewater treatment practices.

The MDEQ licenses approximately 1,200 campgrounds each year - including those under state, county, and private ownership – under Act 368 and administrative rules. Approximately 1,100 of the 1,200 licensed campgrounds operate and maintain a privately owned drinking water supply and wastewater treatment system. The permitting process includes the submittal of plans prepared by licensed professional engineers for construction of wastewater facilities, water supply and distribution facilities, and water treatment facilities. The MDEQ performs an engineering review of plans to determine compliance with Act 368 and administrative rules; and if the plans are adequate, a permit is issued for construction. The MDEQ contracts with the LHDs to perform annual inspections of each campground to determine compliance with the Act 368 and administrative rules – which is required to obtain the annual operating license.

2.5 Coastal Management

The Michigan Coastal Zone Management Program is one of the 35 programs in the United States coastal states, territories, and commonwealths established under the authority of the

Federal Coastal Zone Management Act of 1972 (PL 92-583). The National Oceanic and Atmospheric Administration (NOAA) provides annual funding to these coastal programs for the protection, preservation, and restoration of coastal cultural and natural resources. Michigan's Coastal Zone Management Program was established as a networked program in 1978 with the central focus to improve administration of existing state shoreline statutes (e.g., Shorelands Act, Submerged Land Act, Sand Dunes Act); provide substantial technical and financial assistance to local units of governments for creative coastal projects; and to improve governmental coordination to reduce time delays, duplication, and conflicts in coastal management decision-making.

2.6 Compliance and Enforcement

The MDEQ, WRD, Enforcement Unit(s) and Field Operations Division staff are responsible for conducting compliance and enforcement actions taken by the WRD. Field Operations Division staff conducts compliance inspections to ensure they are following the requirements of state water pollution control statutes and rules, surface and groundwater discharge permits, and violations of administrative or judicial orders. Other compliance and enforcement activities include response and investigation of complaints and the follow-up of corrective actions.

Enforcement action may be used to bring the entity into compliance as quickly as possible, restore any natural resource damages caused by the violation, assess appropriate penalties, eliminate financial gain that may have been realized as a result of noncompliance, and drive improvements in water quality. Enforcement actions are generally progressive in nature. They include any number of possible actions, including issuance of notices of violation, preparation of final orders of abatement, settlement via administrative consent orders, or referrals to the Michigan Department of Attorney General for civil or criminal litigation. The Enforcement Unit serves as the WRD's liaison with the Michigan Department of Attorney General and also works with the USEPA and the United States Department of Justice on joint state/federal enforcement cases.

MDEQ staff collect effluent samples from NPDES facilities to evaluate compliance with permit limits. Additionally, the MDEQ conducts special studies to support water quality enforcement actions. These studies may include water, sediment, biological, and/or toxicity sampling, depending on the specific issue. Water quality monitoring in response to spills is also conducted. Monitoring activities to support enforcement actions are implemented as needed, and are always developed with input from Enforcement Unit and Field Operations Division staff.

2.7 Conservation Reserve Enhancement Program

The MDEQ works closely with the MDARD to implement the Conservation Reserve Enhancement Program, a federal-state-local conservation partnership designed to reduce significant environmental effects related to agriculture. The Conservation Reserve Enhancement Program is being implemented in four critical watersheds (Saginaw Bay, Macatawa River, River Raisin, and western Lake Erie basin) that have intense agricultural land use. The objectives of the program are to improve and protect water quality and to promote and enhance wildlife habitat by providing incentives to Michigan citizens for implementing conservation practices for a period of 15 years. Eligible conservation practices include grass plantings, filter strips, riparian buffer strips, field windbreaks, and wetland restoration. The MDEQ also supplied Section 319 and CMI funds for livestock exclusion, implementation of Natural Resources Conservation Service approved conservation practices, Conservation Reserve Enhancement Program technical assistance, and permanent conservation easements. The program has enrolled nearly 74,000 acres of the 85,000 acre goal in the priority watersheds.

2.8 Contaminated Sediment

The Contaminated Sediment Program consists of activities to coordinate and implement remediation at sites of environmental contamination that impact water quality. Sites range from current incidents of spills or losses of pollutants due to accidents or poor facility operations, to historic incidents where pollutants have been in the environment for many years. Some of these sites impact surface waters directly. Others may impact surface waters by the movement of contaminated groundwater, through treatment and permitted discharge of contaminated groundwater, or through discharges of contaminated groundwater to treatment facilities. The MDEQ staff members investigate sites of environmental contamination, make recommendations regarding proposed site remediation and treatment, evaluate treatment proposals and pollutant discharges from remediation systems, and provide other technical and project management support as necessary. As part of the CMI, $25 million was set aside for the investigation and remediation of contaminated sediments in Michigan lakes, rivers, and streams. Summaries of these projects are contained in the MDEQ's Consolidated Report (MDEQ, 2015) http://www.michigan.gov/documents/deq/FY2014DEQConsolidatedReport_486950_7.pdf.

2.9 Drinking Water Contamination Investigation

The MDEQ assists LHD staff in drinking water quality/contamination investigations of known, potential, or suspected groundwater contamination. Technical assistance includes consultation, analytical support, toxicological assessment, well construction design, well permitting activities, and development of health advisories.

MDEQ is responsible for administering well replacement activities when drinking water wells are found to be contaminated through no fault of the well owner. Water supply alternatives include temporary provision of bottled water, temporary provision of treatment devices when the concentration of contaminants exceeds body contact advisory levels, construction of a permanent replacement well to a protected aquifer, or connection to community water, if available. Activities related to connection to community water may include construction of a community water system, extension of water main, or connection to an existing water main.

MDEQ administers the statewide drinking water monitoring program for water supplies located in areas of known groundwater contamination. Sites are reviewed on an annual basis for funding eligibility. Contracts are established annually with LHDs for collection of water samples and reporting results to well owners at specified sites of groundwater contamination.

2.10 Drinking Water and Wastewater Infrastructure Financial Assistance

The MDEQ, in conjunction with the Michigan Finance Authority, operates loan and grant programs that provide financial assistance to local units of government and public water suppliers for the construction of needed wastewater and drinking water infrastructure. These programs provide loan assistance at interest rates well below open market, with the intention of supporting the department's goal of improved water quality and reducing the costs to be passed on to the users of water and wastewater systems. Debt service payments are returned to the loan funds and hence "revolved" as they are lent out again. The programs are:

- Clean Water State Revolving Fund (CWSRF): The CWSRF has been in operation in Michigan since 1989 and to date has tendered 551 loans totaling over $4.5 billion. The CWSRF has played a critical role in the state's Combined Sewer Overflow (CSO) and Sanitary Sewer Overflow Control Programs, and will operate in perpetuity to provide assistance to wastewater system owners for ongoing capital improvement needs. In addition to financing Section 212 projects (Publicly Owned Treatment Works) the

CWSRF can also fund Section 319 projects (nonpoint source [NPS] pollution control projects). The fund is capitalized by an annual federal grant and a required state match, with potential access to proceeds from the sale of Great Lakes Water Quality Bonds.

- Drinking Water Revolving Fund: This fund has been in operation in Michigan since 1998 and to date has tendered 277 loans totaling over $857 million. Patterned after the CWSRF, the Drinking Water Revolving Fund continues to play a critical role in furthering the MDEQ's public water system program and ensuring the protection of the health of Michigan citizens who are served by public water supplies.

- Strategic Water Quality Initiatives Fund (SWQIF): The SWQIF program was created in 2002 and is capitalized solely by proceeds from the sale of Great Lakes Water Quality Bonds. The SWQIF can fund two specific kinds of projects that are not eligible under the CWSRF because the facilities constructed would not be in public ownership: (1) The on-site upgrade or replacement of failing septic tanks/tile fields; and (2) The removal of storm water or groundwater from sanitary or combined sewer leads. Through fiscal year 2015 the SWQIF has tendered 21 loans totaling over $24 million.

- The new state-funded Storm Water, Asset Management, and Wastewater Program will make available up to $450 million of additional loan and grant financing to Michigan municipalities as defined in Section 5301 of Part 53, Clean Water Assistance, of the NREPA. The Storm Water, Asset Management, and Wastewater Program began in April 2014 and operates alongside the established CWSRF and SWQIF loan programs, thereby, increasing the total financing options available to support water pollution control efforts in Michigan.

Storm Water, Asset Management, and Wastewater Program grants are available to assist with the development of 1) wastewater and storm water asset management plans, 2) testing and demonstration of innovative storm water and wastewater technologies, 3) planning, design, and user charge development for wastewater and storm water systems, and 4) storm water management plans. To date, 211 grants totaling $169 million and two loans of $10 million have been awarded to Michigan communities.

2.11 Great Lakes

The Great Lakes form a portion of the international boundary between the United States and Canada, and both countries have jurisdiction over their use. The first Great Lakes Water Quality Agreement between the two federal governments was developed in 1972 and established objectives and criteria for the restoration and enhancement of water quality in the Great Lakes system. A revised Great Lakes Water Quality Agreement was signed in 1978 recognizing the need to understand and effectively reduce toxic substance loads to the Great Lakes. The 1978 Great Lakes Water Quality Agreement adopted general and specific objectives and outlined programs and practices necessary to reduce pollutant discharges to the Great Lakes system. Under the 1987 Protocol that amended the 1978 Great Lakes Water Quality Agreement, the United States and Canadian governments identified 43 of the most polluted areas in the Great Lakes basin that had serious water quality problems known to cause Beneficial Use Impairments of the shared aquatic resources. These areas have been formally designated by the two governments as Areas of Concern (AOCs). Seven AOCs (four in the United States and three in Canada) were subsequently restored and delisted.

Ten AOCs are exclusively under Michigan jurisdiction: Clinton River, Deer Lake, Kalamazoo River, Manistique River, Muskegon Lake, River Raisin, River Rouge, Saginaw River/Bay, Torch Lake, and White Lake (Figure 2.1). Two of these, the Deer Lake and White Lake AOCS, are considered restored and were officially delisted in October of 2014. The

Menominee River AOC is shared with Wisconsin, and the Detroit River, St. Clair River, and St. Marys River are binational AOCs. The latter AOCs are managed jointly by a binational governance structure created under the Four Agency Letter of Commitment (also called the Four Agency Agreement) that was signed on April 17, 1998, by the Environment Canada, USEPA, MDEQ, and Ontario Ministry of the Environment.

The 1987 Protocol called for cleanup of the AOCs through the development of Remedial Action Plans. The Great Lakes Water Quality Agreement was revised again in 2012, but the latest revision did not significantly change the requirements for Remedial Action Plans. Each Remedial Action Plan is required to identify problems that have led to Beneficial Use Impairments, identify actions needed to restore the beneficial uses, and provide documentation when beneficial uses are restored. Both federal governments play an active role in the implementation of the Remedial Action Plans. Michigan's Remedial Action Plans are currently at various stages of implementation. Information regarding Michigan's AOCs and Remedial Action Plans is available at http://www.michigan.gov/deqwater in the AOC section under the Great Lakes. A copy of the state's Guidance for Delisting Michigan's Great Lakes AOCs can be found at http://www.michigan.gov/deqwater in the AOC section under Great Lakes.

The 1987 and 2012 Protocols required the development and implementation of Lakewide Action Management Plans (LAMPs) for each of the Great Lakes. The purpose of the LAMPs is to address the status of each Great Lake and address environmental stressors that adversely affect the waters of the Great Lakes, which are best addressed on a lake-wide scale through an ecosystem approach. The development of the LAMPs for Lakes Superior, Huron, Erie, and Ontario is co-led by the USEPA and Environment Canada. The development of the Lake Michigan LAMP is led by the USEPA. The LAMPs are being updated on a five-year rotating schedule, with summary reports issued every year.

2.12 Groundwater Discharge

The MDEQ's Groundwater Discharge Program regulates discharges to the ground through the development and issuance of permits. When reviewing groundwater discharges, the MDEQ must consider impacts to drinking water supplies, surface waters, and adjoining properties. Discharges that are injurious to protected uses or that cause a site of environmental contamination are prohibited.

Permits are issued for a maximum term of five years. Permits contain flow and pollutant limits that are protective of both drinking water supplies and surface water, and include special conditions to assure proper application of wastewater for the specific soil and geological conditions at the discharge site.

2.13 Industrial Pretreatment

The MDEQ implements federal and state rules designed to limit pollution from industrial discharges to municipal wastewater treatment facilities. In 1983, the USEPA approved Michigan's pretreatment program and formally authorized the state of Michigan to oversee the program. To assure that pollutant discharges are controlled, many municipalities have been required to develop and implement local industrial pretreatment programs as a condition of their NPDES permit. Michigan operates under a two-tiered system: municipalities subject to industrial pretreatment program regulation with design flows greater than five million gallons per day must develop a federal local industrial pretreatment program, while municipalities subject to industrial pretreatment program regulation with design flows less than or equal to five million gallons per day must develop a Michigan local industrial pretreatment program.

Municipalities developing industrial pretreatment programs are required to submit them to the MDEQ, WRD, for review and approval. Subsequent changes to an approved local industrial pretreatment program, as well as periodic reports of local program operations, must also be submitted for review. MDEQ field staff conducts periodic inspections of local industrial pretreatment programs to identify deficiencies and initiate actions necessary to assure effective operation. Information derived from inspections and reports submitted by the municipalities are entered into the NPDES Management System database.

2.14 Inland Lakes and Streams

The Inland Lakes and Streams Program is responsible for the protection of the natural resources and the public trust waters of the inland lakes and streams of the state. The program oversees and regulates activities including dredging, filling, constructing or placement of a structure on bottomlands, constructing a marina, interfering with natural flow of water, or connecting a natural or artificially created waterway to an inland lake or stream. Common projects associated with inland lakes and streams regulated under Part 301, Inland Lakes and Streams, of the NREPA, include shore protection, permanent docks or boat hoists, culverts or bridges, and dredging or excavation. Other types of activities may also require permits.

2.15 NPDES

Discharges to state surface waters from municipal, industrial, and commercial facilities must be authorized by permit under the NPDES Program. The purpose of an NPDES permit is to control the discharge of pollutants into surface waters of the state to protect the environment. The USEPA delegated the program to Michigan in 1973, and the MDEQ has responsibility for processing NPDES permits. The maximum term for an NPDES permit is five years, after which they must be reissued.

The MDEQ reissues NPDES permits according to the five-year rotating watershed cycle, two years after the monitoring year (Figure 3.1). Under this approach, all of the permits in each individual watershed expire and are reissued in the same year. This approach allows the MDEQ to consider cumulative impacts of all dischargers on water quality in the watershed. Discharges to lakes, streams, and wetlands must not cause a violation of Michigan WQS. As part of the permit issuance process, limits are developed for pollutants to avoid a violation of WQS and ensure compliance with the treatment technology regulations of the CWA. Draft permits are

prepared containing pollutant limits and any appropriate special conditions. The draft permits are placed on public notice, allowing the opportunity for public comment.

Permits for regulated storm water discharges are also processed and issued by the MDEQ under the NPDES program. The Storm Water Program is also funded by fees collected from the dischargers. Under Phase I of the Storm Water Program, individual NPDES permits were issued to owners or operators of Municipal Separate Storm Sewer Systems serving a population of 100,000 or greater. In 2003, the MDEQ promulgated rules to obtain the legal authority to implement Phase II requirements. As a result, owners or operators of Municipal Separate Storm Sewer Systems serving populations less than 100,000 within urbanized areas were required to apply for NPDES permits by March 2003. Phase II permittees include cities, villages, townships, county road commissions, and county drain commissions, among others. Individual permits are now being issued with site-specific conditions that, though tailored specific to the municipality, still allow for cooperation with programs and other Municipal Separate Storm Sewer Systems in the watershed.

Michigan uses a general permit for industrial storm water discharges. The general permit requires the permittee to have a certified storm water operator and prepare and implement a Storm Water Pollution Prevention Plan, among other requirements. The applicability of this permit includes storm water discharges associated with industrial activity as defined in the federal regulations, and from special use areas (state- or federally-mandated secondary containment structures, areas designated on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA, and other activities subject to federal storm water regulation where storm water monitoring is necessary on a case-by-case basis). Monitoring is required only from the special use areas. Industrial storm water general permits and Certificates of Coverage are reissued on a watershed-basis with approximately one-fifth of the five-year permits reissued each year.

The MDEQ has continued implementation of the state's CSO Control Program, which has resulted in annual reductions of the volume of untreated combined sewage discharged to the surface waters of the state. Through implementation of the CSO Control Program, numerous CSO discharges are being eliminated at various locations around the state, while at other locations, treatment and disinfection of combined sewage discharges that comply with WQS and protect public health are being provided on an increasing basis.

2.16 NPS Control

The NPS Program assists local units of government, nonprofit entities, and other state, federal, and local partners to restore impaired waters, protect high quality waters, and reduce NPS pollution statewide. The basis for the program is watershed management; the MDEQ provides assistance and funding to develop Watershed Management Plans (WMP) and to implement NPS control activities in these plans. The NPS Program conducts or supports the following activities to accomplish the Program's restoration and protection goals:

- Technical assistance to help organizations develop and implement WMPs, including Best Management Practice selection, land use planning activities, and engineering review of site plans.
- Information and education, including activities/tools created by the MDEQ and grantees, to educate people about NPS of pollution.
- Grants to implement WMPs.
- Compliance and enforcement, including response and investigation of complaints, follow-up requiring corrective actions, and occasionally participating in escalated enforcement actions.

- Monitoring and field investigations to identify NPS problems and evaluate the effectiveness of corrective or preventive actions.

Approximately 148 WMPs have been developed at the local level and most of these were developed by local watershed groups utilizing MDEQ grants. WMPs serve as guides for communities to protect and improve water quality. A list of MDEQ-approved WMPs that meet CMI and/or Section 319 criteria for implementation is available at http://www.michigan.gov/deqnps.

The NPS Program has identified a number of priority watersheds in which to focus pollution control activities to achieve the restoration and protection goals identified in Michigan's NPS Program Plan. The priority watersheds are identified in Appendix 4 of Michigan's NPS Program Plan.

2.17 On-site Wastewater Treatment

The On-Site Wastewater Treatment Program, administered by the MDEQ and LHDs, serves to protect public health and the groundwater of the state that is used for drinking water by assuring proper treatment of effluent from individual residential, community residential, and commercial wastewater treatment systems utilizing subsurface dispersal.

The MDEQ recognizes that all LHDs through their sanitary codes are responsible for the issuance of permits pertaining to wastewater discharges at private, single, and two-family residences. Section 2435 of the Public Health Code, Act 368, as amended, allows LHDs to "adopt regulations to properly safeguard the public health and to prevent the spread of diseases and sources of contamination." To accomplish this, all LHDs have sanitary codes that address permitting requirements for on-site wastewater systems, which are intended to safeguard public health and the environment. There are an estimated 1.3 million on-site wastewater systems in Michigan with approximately 40,000 servicing non-residential facilities.

In each jurisdiction, on-site wastewater treatment regulations establishing site suitability and design standards for single and two-family on-site wastewater treatment systems have been promulgated through a local decision-making process involving the Board of Commissioners, the public, and the LHDs. Complementing these local environmental regulations are statewide guidelines for large on-site wastewater systems generating flows up to 10,000 gallons per day and MDEQ rules for proposed subdivisions and condominium developments. These regulations are based upon the underlying premise of affording an adequate degree of protection for public health and the environment deemed appropriate at the state or local level. Variations in local and state regulations, to some degree, are influenced by soils, and natural geologic and environmental conditions. Regulations promulgated at the state and local level are reflective of an inclusive decision-making process that has resulted in standards whose goal is to protect public health and the environment.

Current state guidelines that relate to on-site wastewater systems include, "Michigan Criteria for Subsurface Sewage Disposal" and Part 4, Department of Environmental Quality On-Site Water Supply and Sewage Disposal for Land Divisions and Subdivisions, of Michigan's Public Health Code, Act 368. The Michigan criteria apply to sources other than single and two-family home systems with flows up to 10,000 gallons per day that receive sanitary wastewater. Administrative rules apply to all proposed subdivision lots, condominium units, and also to other land divisions. These programs are conducted by authorized LHDs with MDEQ oversight.

2.18 Public Drinking Water Supply

There are approximately 11,000 public water supplies in Michigan. Approximately 1,400 are community water supplies that furnish drinking water year-round to residential populations of 25 or more. The remaining approximately 9,600 are defined as either nontransient noncommunity water supplies or transient noncommunity water supplies. A nontransient noncommunity water supply serves 25 or more of the same people for at least 6 months out of a year; examples of these supplies are schools, factories, and businesses. A transient noncommunity water supply serves 25 or more people at least 60 days out of a year; examples of these are motels, restaurants, golf courses, campgrounds, and convenience stores.

The MDEQ and LHDs under contract with the MDEQ are responsible for enforcing compliance with requirements in the Michigan Safe Drinking Water Act, 1976 PA 399, as amended, at all public water supplies. Michigan is a Primacy state, meaning it has received authority from the USEPA to enforce compliance with the National Drinking Water Standards at public water supplies in Michigan.

All public water supplies must collect samples of their water on a set schedule and analyze the samples for contaminants regulated by the drinking water standards. The sampling results are reviewed by the MDEQ and LHDs. If contaminants are present at levels that exceed drinking water standards, the supply must post notice to the public and, if required, issue a boil water or do not drink notice until the underlying problem is corrected and the drinking water meets drinking water standards.

The MDEQ conducts sanitary surveys of all the community water supplies every 3 years to insure the supply is properly operated and maintained. A sanitary survey is a comprehensive evaluation of the entire supply to determine the ability of the supply to produce, treat, and distribute adequate quantities of water to the public. During the survey, staff review maintenance and operation practices and records to ensure that the drinking water produced meets all federal and state drinking water standards. Survey findings often lead to the identification of potential concerns that can be corrected before they become significant problems. LHDs are required to conduct sanitary surveys at the nontransient and transient noncommunity drinking water supplies at least once every 5 years.

One of the multiple barriers employed to ensure safe drinking water is requiring public water systems be supervised by properly trained and certified operators. To that end, the MDEQ administers a drinking water operator training and certification program. There are approximately 4,500 certified operators in Michigan licensed to provide oversight of public water systems. The classification and level of certification is determined by the size and complexity of the system. The MDEQ offers examinations twice a year, with approximately 1,400 applicants annually. To stay current with technology and regulations, as well as maintain their certification, operators must also meet continuing education requirements every three years. The MDEQ partners with technical assistance providers to offer targeted training to enhance the capability of operators and assist in meeting continuing education requirements.

2.19 Septage Waste

Septage is a domestic waste pumped from septic tanks, portable toilets, etc. The Septage Waste Program regulates the septage hauling industry and septage disposal practices. Companies, as well as the vehicles they use, must be licensed; Michigan has approximately 390 licensed septage waste haulers and 850 licensed septage waste hauling vehicles. Septage may be taken to a municipal wastewater treatment facility or may be applied to agricultural land. A permit must be obtained before septage waste can be land applied. The MDEQ administers the program with assistance from participating LHDs.

2.20 Soil Erosion and Sedimentation Control

The Soil Erosion and Sedimentation Control Program is administered under the authority of Part 91, Soil Erosion and Sedimentation Control, of the NREPA. Part 91 provides for the control of erosion and prevention of off-site sedimentation from earth change activities. Part 91 is administered and enforced by state, county, and municipal agencies with oversight by the MDEQ.

The MDEQ's major responsibilities are to train staff members of the Part 91 agencies in the proper administration and enforcement of Part 91 and to conduct periodic audits of the administering agencies to ensure their Soil Erosion and Sedimentation Control Programs are in compliance with Part 91.

2.21 Source Water Protection

The Source Water Assessment Program was developed in response to the 1996 amendments to the federal Safe Drinking Water Act. The MDEQ, Office of Drinking Water and Municipal Assistance, is responsible for identifying areas that supply public drinking water, inventory contaminants, determine susceptibility of the source(s), and inform the public of the results. This process helps to prioritize systems with higher susceptibility to develop and implement source water protection activities.

The MDEQ's Source Water Protection Program (SWPP) was also developed in response to 1986 amendments to the federal Safe Drinking Water Act. The SWPP is a voluntary program that is implemented on a local level through the coordination of activities by local, county, regional, state, and federal agencies. Although the program is voluntary, public water supply systems who choose to participate in source water protection must develop a local SWPP consistent with the guidelines established by the MDEQ. Local SWPPs must specifically address seven elements, which include the establishment of roles and duties, a source water protection area, identification of potential sources of contamination within the source water protection area, development of strategies to manage potential sources and minimize threats to the public water supply systems, development of contingency plans for water supply emergencies, identification of procedures for the development of new well sites and incorporate them into the local SWPP, and provide opportunities for public education.

Funding for the SWPP is available through a grant program designed to assist public water supply systems in the development and implementation of SWPPs. The program is a 50% grant program, which must be matched with 50% local funds. Grant money will be awarded to public water supply systems based on a scoring system as outlined in the grant application.

The Office of Drinking Water and Municipal Assistance staff routinely coordinate with other MDEQ, state, and federal water and environmental resource programs to best integrate drinking water protection in other program activities. Until recently, one of the biggest hurdles to doing so had been the inability to effectively evaluate the vulnerability of public water supplies relative

to potential sources of contamination. A means of assessing groundwater flow regimes and identifying the wellhead protection area for public water supply systems throughout the state was needed in order to enhance the integration of drinking water protection into other MDEQ programs. The Michigan Groundwater Management Tool (MGMT) was developed to bridge this gap. The MGMT is a groundwater modeling software system that provides for the mapping, display, and analysis of groundwater flow direction. The primary application of MGMT is to analyze and evaluate the groundwater flow regime for public water sources on a statewide basis. However, it can be employed in contaminant migration as well as capture zone (wellhead protection area) analysis. Other MDEQ regulatory programs may access these MGMT generated wellhead protection areas, thereby allowing these programs to provide a greater level of protection to areas that are contributing to public drinking water supplies.

Additionally, as discussed in Section 2.25.2, the MDEQ's Office of Drinking Water and Municipal Assistance is working with the WRD on the issue of harmful algae bloom conditions at potentially susceptible water supply intakes.

2.22 Well Construction

In Michigan there are approximately 1.1 million household drinking water wells, the most of any other state in the country. Drinking water wells must be properly constructed and maintained for two important reasons: to protect the quality of the water pumped by the well so that it is safe to drink; and to protect the groundwater aquifer from contamination that a poorly constructed or unsafe well could create. Michigan's Well Construction program assures that drinking water wells are properly constructed, operated, and decommissioned in a technically sound manner under the authority of Part 127, Water Supply and Sewer Systems, of Act 368.

The MDEQ annually registers well drilling contractors, pump installers, dewatering contractors, and well drilling machines; and administers exams before the initial registration. The MDEQ also administers a comprehensive database, Wellogic, which is used to store all of the drinking water well and pump records submitted by water well contractors since 2000.

Under contract, Michigan's LHDs implement the Well Construction Program statewide by issuing well construction permits, reviewing drilling and plugging records, and conducting inspections to assure wells are installed in conformance with state and local codes. LHDs also ensure that abandoned wells are properly plugged to prevent groundwater contamination. The MDEQ evaluates the performance of the LHDs in implementing the Well Construction Program and provides compliance assistance and training to ensure successful implementation of the program.

2.23 Wetlands Protection

The MDEQ, WRD, has administered a statewide wetland regulatory program for over 30 years. The WRD also manages Michigan's wetland resources through public education programs that encourage wetland preservation and restoration, cooperation with governmental and nongovernmental agencies to encourage the evaluation and management of wetlands on a local and watershed basis, and development of a monitoring and assessment program. Michigan's Goemaere-Anderson Wetland Protection Act was passed in 1979 (Part 303 of the NREPA). Through passage of the Wetland Protection Act, Michigan took direct legislative action to regulate and minimize wetland losses. This act provides for the preservation, management, protection, and use of wetlands; requires permits to alter wetlands; and provides penalties for illegal wetland alteration. A wetland is defined in Part 303 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 Wetland Protection Act further defines regulated wetlands as those wetlands contiguous to the Great Lakes or Lake St. Clair, an inland lake, pond, river, or stream; and noncontiguous wetlands greater than five acres in size. The state also has the authority to regulate any noncontiguous wetlands that are determined to be essential to the preservation of the natural resources of the state once the landowner has been notified. Part 303 requires that persons planning to conduct certain activities in regulated wetlands apply for, and receive, a permit from the state before beginning the activity.

Michigan's regulatory program generally requires mitigation for all wetland impacts, although the MDEQ staff may waive this requirement for projects impacting less than one-third acre if no reasonable opportunity for mitigation exists, or for projects having a basic purpose of creating or restoring wetlands. Mitigation may be considered only after the applicant has demonstrated avoidance and minimization of impacts, and it has been determined that a project is otherwise permitable. A mitigation proposal must result in no net loss of wetlands upon completion of a project. Mitigation requirements and ratios are established by rule and are defined by staff as a condition of the permit decision. Financial assurances are required to ensure completion of any mitigation project that is not completed in advance of associated impacts. Mitigation sites must be permanently protected through a conservation easement. Administrative rules defining the establishment and use of mitigation banks were promulgated in 1997 (see R 281.951, Wetland Mitigation Banking). Seventeen mitigation banks are currently listed in Michigan's Wetland Mitigation Bank Registry. A number of other mitigation bank sites are currently under consideration or development. Recent changes to state and federal laws have resulted in preference for wetland banks to mitigate for unavoidable losses to wetland resources. New legislation was enacted in Michigan in 2013 to develop a Wetland Mitigation Bank Funding Program to provide grants and low interest loans to eligible municipalities interested in pursuing a wetland bank. The legislation was aimed at promoting wetland banking in Michigan. In 2014, a total of $3,000,000 is available for this program.

Michigan also has developed other regulatory and nonregulatory programs to manage Michigan's wetland resources, including:

- Part 303 authorizes regulation of wetlands by a local unit of government provided that the local unit uses the same definition of wetlands as Part 303, and permit criteria that are consistent with Part 303. Currently, over 40 communities in Michigan have local wetland protection ordinances.

- The MDEQ has organized and leads the Wetland Work Group, an informal interagency team including various state, federal, and nongovernmental organizations concerned with wetland restoration and management.

- To encourage consideration of wetland issues, the WRD provides technical assistance to local watershed planning organizations. WRD staff have been working closely with watershed groups to assist in locating areas that have a high potential for wetland restoration. Using existing datasets and GIS technology, WRD staff created a GIS layer that highlights these wetland restoration areas and ranks them in terms of their potential (high, moderate, and low).

- The WRD has developed a landscape-scale wetland assessment method to assist watershed groups in managing, protecting, and restoring wetlands in the context of watershed management planning. Originally developed by the USFWS, the WRD makes

use of GIS data, including National Wetland Inventory maps, to provide an evaluation of wetland functions to make more effective decisions regarding the need for wetland protection, restoration, or management in watershed. Landscape-scale wetland assessment information is available on the MDEQ online GIS tool - Wetlands Map Viewer (http://www.mcgi.state.mi.us/wetlands/)

- The MDEQ provides for protection of wetlands through the use of conservation easements that offer comprehensive and permanent protection to high quality wetlands. Conservation easements over exceptional wetland sites may be provided to fulfill mitigation requirements, when appropriate, or wetlands that are avoided during the planning of an authorized construction project may also be protected under an easement.

The WRD is working with partners to develop a wetland monitoring and assessment program to assess the quality and quantity of Michigan's wetland resources and guide future program development. This includes recent development of the Michigan Rapid Assessment Method and Landscape Level Wetland Assessment, as well as working with Great Lakes researchers on coastal wetland monitoring, developing Indices of Biological Integrity, and the National Wetland Condition Assessment. The Michigan Rapid Assessment Method was finalized in 2010, and is used by regulatory staff as appropriate to propose preservation mitigation sites, compliance sites, etc. Future plans exist to implement a monitoring program, on a five-year cycle. The *Great Lakes Coastal Wetland Monitoring Plan (Great Lakes Coastal Wetland Consortium, 2008; http://www.glc.org/library/2008-great-lakes-coastal-wetland-monitoring-plan)* was developed addressing Fish, Invertebrates, Amphibians, Birds, Vegetation, and Chemistry indicators. Additionally, future plans include implementation an intensification of the National Wetland Condition Assessment, to continue partnership with Great Lakes Coastal Wetland monitoring group, and to incorporate AIS and climate change monitoring protocols when they become available.

2.24 CWA Section 404 Permit Program

Michigan's Wetland Protection Program was approved by the USEPA in accordance with the requirements of Section 404(h) of the CWA in August 1984. With this approval, Michigan became the first state to assume administration of Section 404. Although at least 34 states have their own wetlands program, only 2 states, Michigan and New Jersey, have been able to meet all the requirements to assume the CWA Section 404 Program. The CWA limits state assumption of Section 404 authority in "traditionally navigable waters." The United States Army Corps of Engineers, Detroit District, retains Section 404 jurisdiction in these waters, which includes the Great Lakes, connecting channels (such as the Detroit River), and river mouth areas upstream to the limits of the traditional navigational channel or the Great Lakes ordinary high water mark.

To maintain Michigan's authorization under Section 404, state law must remain consistent with federal regulation including exemptions, general permits, public notice procedures, and review criteria. In addition to meeting these requirements, Michigan's law provides the citizens of the state with a significant savings in time and money while providing efficient and effective protection of wetland, lake, and stream resources by clearly defining wetlands that are regulated, providing permitting time frame requirements, and streamlining and consolidating permit review.

The MDEQ processes approximately 4,000 to 6,000 permit applications per year under Section 404. About 1,500 of these applications propose wetland impacts; the remainder propose to alter lakes and streams only. The MDEQ staff work with permit applicants to redesign proposals, when necessary, to avoid and minimize resource impacts. The MDEQ is currently working, under an EPA Water Permits Division Grant, to develop a comprehensive database for

Michigan's Section 404 Program that will incorporate new technologies and methods for screening, evaluating, and tracking impacts.

In 2008, the USEPA published findings from a 10-year review of Michigan's Section 404 Program and although the USEPA found that, in general, Michigan's administration of the program was good, they identified changes that are needed to maintain federal consistency. These changes include administrative actions/procedures, revision of administrative rules, statute amendments to clarify exemptions, and updating the program Memorandum of Agreement. After working with stakeholders on the changes required to maintain our state program, Michigan's legislature passed a new law in 2013 that includes many of the necessary changes for Michigan's 404 program as well as several other programmatic changes. The USEPA is currently evaluating these changes to determine whether they are consistent with the CWA.

2.25 Water Protection Special Initiatives

2.25.1 Aquatic Invasive Species

Michigan's aquatic ecosystems are experiencing significant negative effects from AIS that are already present and the state's waters are continually threatened by new invasions. An invasive species is defined as a species that is not native and whose introduction causes, or is likely to cause, economic or environmental harm, or harm to human health.

The introduction of AIS into the Great Lakes and inland state waters is a source of biological pollution that has significant negative effects throughout the state and region. AIS may compete with native species for food and habitat, and can directly or indirectly harm or displace native species, degrade habitat, and alter food webs and energy flow. AIS can also have significant economic effects on waterfront property values, tourism, utilities, and other industries (Lovell et al., 2005). The Great Lakes region has been impacted by both the intentional and unintentional introduction of AIS since the settlement of the region by Europeans. Since the 1800s, at least 182 nonindigenous aquatic organisms have colonized habitats of the Great Lakes ecosystem.

AIS enter and disperse in Michigan waters through various human-assisted vectors including: maritime commerce (e.g., oceangoing ship ballast water and hull fouling), fishing and aquaculture, canals and diversions, the trade of live organisms, and tourism and development activities (Lodge and Finnoff, 2008; Pimentel et al., 2000). Actions taken to date to prevent the introduction of new AIS include regulatory and voluntary efforts by both public and private entities. A wide variety of educational programs have increased awareness of the introduction pathways to prevent new AIS, such as those aimed at recreational boating and invasive organisms in trade (both at the industry level and the consumer level). Government agencies and nongovernmental partners monitor for existing and new AIS and provide assessments of AIS management efforts. However, much work remains to protect Michigan waters from new introductions of AIS from around the world, other waters across the country, and adjacent areas of the Great Lakes watershed as well as minimize the harmful effects of AIS already in Michigan waters.

Michigan's first Aquatic Nuisance Species State Management Plan was approved in 1996, updated in 2002, and most recently updated in 2013. This plan, now called the AIS State Management Plan, was approved by the Aquatic Nuisance Species Task Force in June 2013. The updated comprehensive AIS State Management Plan outlines new actions in addition to maintaining and enhancing existing efforts to adequately prevent and control AIS in Michigan waters, including the Great Lakes, connecting channels, rivers, streams, inland lakes, and wetlands.

The AIS State Management Plan identifies strategic actions in categories including legislative and policy, regulation (including compliance, enforcement, and inspection), information and education, research and monitoring, and early detection and response. The prevention of nonnative, aquatic organisms including microorganisms (pathogens), invertebrates, algae, aquatic vascular plants, fish, other animals, and parasites that enter and establish populations in Michigan waters and cause harm to the environment, economy, or human health are considered using a vector and pathway approach. The AIS State Management Plan also integrates and builds upon existing AIS prevention and control efforts.

The AIS State Management Plan addresses four goals:

- Goal I: Prevent new introductions of AIS into Michigan waters.
- Goal II: Limit the dispersal of established populations of AIS.
- Goal III: Develop a statewide interagency early detection and response program to address new invasions.
- Goal IV: Manage and control AIS to minimize the harmful effects.

Michigan recognizes the potential threats of new AIS to the Great Lakes; therefore, measures are being taken to prevent introductions via three specific high priority pathways: ballast water discharges, canals in the Chicago Area Waterway System, and organisms in trade.

Ballast water discharges from oceangoing vessels, water taken onboard large vessels to provide stability and balance during a voyage, is a significant contributor to the introduction of AIS; therefore, Michigan passed ballast water control legislation in 2005. Pursuant to this legislation, in 2007 the MDEQ began implementing a state ballast water discharge permit program for oceangoing vessels. Michigan reissued its ballast water general permit in February 2012. In addition, as a result of a 2005 United States court ruling the USEPA issued a federal Vessel General Permit in 2008 and subsequently reissued the second iteration of the Vessel General Permit in March 2013. The United States Coast Guard issued final regulations pertaining to ballast water discharges in March 2012. Due to delays in implementation of the United States Coast Guard final regulations and continued legal challenges to the USEPA Vessel General Permit, Michigan's ballast water legislation and state permit remain effective in order to prevent further AIS introductions to Michigan waters.

Michigan continues to promote actions to prevent Asian carps (i.e., silver and bighead carp) from invading the Great Lakes via hydrologic connections with the Mississippi River Basin. Despite unsuccessful attempts to prompt immediate action to close some of the locks on the Chicago Sanitary and Ship Canal and connecting channels via legal actions beginning in 2009, Michigan is continuing to participate in the Asian Carp Regional Coordinating Committee and other groups to ensure continued operation of existing preventative measures and the development of interim actions and long-term plans to address hydrologic separation in the Chicago Area Waterway System. Michigan also continues to support federal legislation that would direct the United States Army Corps of Engineers to implement measures to keep Asian carp out of the Great Lakes.

Prevention of AIS associated with organisms in trade is another set of high priority pathways. Aquatic plants and animals are popular for aquaria, ornamental ponds, or as culinary products as well as use by anglers as live bait. Channels of trade include traditional sales to and through retail stores or markets, as well as increasing sales through the global internet marketplace. AIS obtained through trade find their way into lakes and streams through a variety of pathways. Although well intentioned, uneducated consumers may purposefully release unwanted pets or plant species and associated pathogens, believing it is a humane action

without knowing the damaging consequences to the environment. AIS can also be distributed unintentionally and unknowingly through sales of aquatic species as contaminant species associated with legitimately sold species, or through misidentification and unfamiliarity with a given species' common or scientific name. Part 413, Transgenic and Nonnative Organisms, of the NREPA, provides a list of prohibited and restricted invasive species within the state. In addition to creating a list of both restricted and prohibited species, the act defines possession regulations, lays out a permitting process, and lists violations, penalties, and liabilities. Recent updates to Part 413 became effective in 2015 that require the use of science-based risk assessment methods to support decision making and require the development of new permitted species lists. The MDNR and MDARD are working to implement these statutory requirements, increase inspections of industries, as well as enhance education and outreach to industries and consumers.

Michigan's AIS State Management Plan, additional information on these priority pathways, and information on the AIS program in general is available at www.michigan.gov/aquaticinvasives.

2.25.2 Harmful Algae Blooms

Following the historic cyanobacteria bloom of 2011 in the western basin of Lake Erie, the MDEQ began a monitoring initiative to better understand the impacts of harmful algal blooms (HABs) and other nutrient-related impacts (e.g. nearshore attached algae, beach/shoreline 'muck') on Michigan Designated Uses in the Michigan portion of Lake Erie; at the same time a workgroup was convened to address algae blooms at a statewide scale. The workgroup's tasks include developing an approach to monitor, assess, and report on nuisance and harmful algal conditions, and improving our understanding of the nature, extent, and frequency of algal blooms in inland waters and near-shore Great Lakes. The tasks undertaken by the workgroup with support by the WRD include:

- The ongoing development of recreational water-quality criteria for microcystin by the WRD following the release by the USEPA of drinking water Health Advisory levels for microcystin in June, 2015.

- Developing a working definition of HABs to help frame the issue for the MDEQ as: "An algal bloom in recreational waters is harmful if microcystin levels are at or above the 20 ug/L World Health Organization non-drinking water guideline, or other algal toxins are at or above appropriate guidelines that have been reviewed by MDEQ-WRD. Additionally, a bloom should be considered *potentially* harmful when "the chlorophyll *a* level is greater than 30 µg/L and visible surface accumulations/scum are present, or cells are visible throughout the water column."

- A continued focus on monitoring and assessment. Between 2003 and 2009, the MDEQ-WRD awarded a number of grants to various organizations to monitor for HABs and associated toxins. Additional monitoring of microcystin concentrations in Michigan inland lakes was conducted as part of the USEPA's National Lake Assessment surveys, which were conducted in 2007 and 2012. In 2007, 50 randomly-selected and 4 reference inland lakes (greater than 10 acres) in Michigan were sampled for a variety of chemical, physical, and biological indicators. In 2012, the MDEQ sampled 53 randomly-selected inland lakes (greater than 2.5 acres) in Michigan for a suite of chemical, physical, and biological indicators. Additionally, microcystin sampling was conducted in 2008 as part of the Lake Water Quality Assessment of Michigan's public access lakes that was conducted by the USGS and MDEQ from 2001-2010 (http://pubs.usgs.gov/sir/2011/5233/pdf/sir2011-5233_web.pdf).

- MDEQ water sampling at seven beaches along the Michigan shoreline of western Lake Erie to investigate possible HAB impacts and other nutrient-related effects (e.g.

nearshore attached algae, beach/shoreline 'muck') on Michigan's Designated Uses. Since 2012, seven beaches extending from Luna Pier north to Estral Beach have been sampled roughly every other week from June through September each year, for a total of 8-10 visits a year. The monitoring includes photos, nutrient grab sampling and a qualitative assessment of beach and splash-zone debris. Microcystin sampling was primarily focused on bloom conditions from 2012-2014, but was increased in frequency in 2015 to include all visits in an effort to better understand the presence and permanence of toxins in these bathing beach areas.

- Starting in 2015, the incorporation of toxin monitoring into existing lake monitoring programs (e.g. MDNR- Fisheries Division status and trend lake monitoring) and targeted toxin monitoring of lakes with known algal and/or cyanobacteria bloom conditions, including at Lake Erie beaches. Additional HAB monitoring and assessment is expected in 2016.

- Investigating the usefulness of various forms of cyanotoxin analyses including the enzyme-linked immunosorbent assay method for counting total microcystins, high performance liquid chromatography with mass spectrometry which provides a more accurate assessment of the individual microcystin congeners, and commercially available colorimetric field test strips which may not provide reliable specific concentrations but can indicate whether total microcystin concentrations are present and their approximate concentrations (e.g. around 2.5, 5, or greater than the 10 µg/l).

- Development of fact sheets and HABs related web content for increased communication on this issue.

- Division-level work with the MDHHS and county health departments to establish a procedure for issuing human health advisories due to HABs. This improved communication with the MDHHS will help in providing guidance on HAB-related health concerns to local health departments.

Although not part of the algae bloom workgroup, it is worth noting that the MDEQ's Office of Drinking Water and Municipal Assistance is working with the WRD on the issue of HAB conditions at potentially susceptible water supply intakes. The USEPA issued microcystin Health Advisory values in 2015 for finished drinking water guidance. Raw and finished water monitoring have demonstrated that Lake Erie water supply intakes in Michigan are able to successfully treat any microcystin present to below detectable levels and thus achieve the USEPA Health Advisory values. However, because there is no microcystin water quality standard for source water protection, investigation continues into appropriate raw water triggers that may be useful in assessing the public water supply designated use relative to algal toxins in source water.

The significance of cyanobacteria blooms in Lake Erie is further evidenced by the Great Lakes Water Quality Agreement Annex 4 (Nutrients) workgroup, including representatives from the State of Michigan, focusing first and foremost on the Lake Erie issues of algal community imbalance, cyanotoxins, hypoxia, and maintenance of trophic conditions. There is broad agreement that excessive nutrients are the primary cause, from a pollutant perspective, of these changes to Lake Erie's ecosystem. As such, total phosphorus has been identified as the target nutrient for necessary reductions, with the acknowledgement that other relevant nutrients (particularly bioavailable phosphorus forms and nitrogen sources) will also be reduced concomitantly.

The Annex 4 Objectives and Targets Task Team was charged with identifying target reductions to achieve a level of algal growth that supports a healthy and productive Lake Erie,

acknowledging that the complete elimination of algae is not in keeping with a healthy aquatic ecosystem. Load reductions were set using the 2004 and 2012 cyanobacteria blooms as the targets at, or below which, future blooms should be maintained 90% of the time following target reductions.

The Annex 4 Objectives and Targets Task Team Final Report (May 11, 2015) went through a significant deliberative process to identify sources and loading estimates of total phosphorus to Lake Erie. Data from extensive monitoring data sets as well as NPDES discharge monitoring reports were used to develop load estimates by major tributary with particular focus on the Detroit River and the Maumee River watershed, widely acknowledged as the two primary sources of total phosphorus. Based on the above goals, the subcommittee set the load targets of 40 percent reductions in total phosphorus entering the western basin, including, and of particular relevance for Michigan, a 40 percent reduction in spring total and soluble reactive phosphorus (SRP) from the River Raisin, and a 40 percent reduction in spring SRP from the Maumee River, some headwaters to which are in Michigan. Other specific tributaries were targeted as well, but are not in Michigan. Because cyanobacteria blooms are not bound by political borders, understanding the drivers of blooms in Michigan waters and multi-jurisdictional collaboration to address those drivers will be key to addressing the issue.

2.25.3 Saginaw Bay Coastal Initiative

The Saginaw Bay Coastal Initiative was formed in August 2006. Through the Saginaw Bay Coastal Initiative, the MDEQ and other state agencies started working with citizens, local government officials, and multiple regional and federal agencies to develop and implement a comprehensive approach to promoting environmentally sound economic development and resource restoration in the Saginaw Bay coastal areas. The MDEQ continues to be engaged in the process, but the leadership of this effort has shifted to the local stakeholders

The Saginaw Bay Coastal Initiative encourages regular discussions to determine how state, federal, and local interests can work together to achieve resource protection, improve environmental quality, and expand economic development. This includes opportunities to discuss the local impact of state and federal programs and to look for opportunities to meet the goals of these programs through new and innovative means. Additional information regarding the Saginaw Bay Coastal Initiative can be found at http://www.baycounty-mi.gov/executive/saginawbaycoastalinitiativesbci.aspx.

2.26 Cost/Benefit Assessment

The activities described in this chapter are carried out by several MDEQ divisions and offices. Full quantification of expenditures is not possible at this time. However, the WRD alone spent approximately $57.1 million in fiscal year 2013 and $60 million in fiscal year 2014 for the implementation of water quality protection, restoration, and monitoring programs. Sources include federal funds, state general funds, CMI state bond funds, and fees. These expenditures support MDEQ staffing and operating expenses as well as grants and loans to local governments and organizations. A variety of water quality protection activities are implemented through these funds, including regulatory requirements, technical and financial assistance, and education/outreach efforts. These expenditures also leverage substantial local funds and services, since many of the programs and grants have cost-share or match requirements.

The benefits associated with the implementation of these programs are numerous, although it is not possible to accurately quantify the benefits in strictly monetary terms. From a financial perspective, citizens and out-of-state tourists are estimated to spend over $10 billion each year on Michigan tourism, much of that on outdoor sports and recreation that depend on clean water,

air, and forests. Popular activities include hunting, fishing, boating, and swimming at Great Lakes and inland beaches. The revenues from these activities far exceed the money spent on water quality protection and monitoring activities each year. Aside from strictly financial considerations, clean water is also essential to protect human health, drinking water quality, biological diversity, and quality of life issues, which attract many businesses and citizens to live and work in Michigan.

CHAPTER 3
WATER QUALITY MONITORING

Environmental monitoring is an essential component of the MDEQ mission. Comprehensive water quality monitoring is necessary to improve natural resource management, maintain sustainable ecosystems, and protect public health. Although the MDEQ is the lead state agency responsible for monitoring, assessing, and managing the state's surface water and groundwater, effective water resource management is best achieved through the formation and implementation of meaningful coalition partnerships with outside entities including other state and federal agencies, Canadian organizations, local governments, tribes, universities, industry, environmental groups, and citizen volunteers. Wherever possible, the MDEQ strives to organize and direct the resources and energies created by these partnerships through a "watershed approach" to protect the quality and quantity of the state's water resources.

Many MDEQ water quality monitoring and water pollution control programs are integrated and implemented according to a 5-year rotating watershed cycle to facilitate effective watershed management. Michigan has 57 major watersheds based on the USGS's 8-digit HUCs. Water quality assessment efforts focus on a subset (approximately 20 percent) of these major watersheds each year (Figure 3.1).

In January 1997, the MDEQ completed a monitoring report entitled, "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters" (Strategy) (MDEQ, 1997). It was developed specifically to identify the activities and resources needed to establish a comprehensive, state-of-the-art water quality monitoring program, and has guided Michigan's monitoring program implementation. The Strategy consists of nine interrelated elements: fish contaminants, water chemistry, sediment chemistry, biological integrity, wildlife contaminants, bathing beaches, inland lake quality and eutrophication, stream flow, and volunteer monitoring. The Strategy specifically identifies four monitoring goals:

- Assess the current status and condition of waters of the state and determine whether WQS are being met.
- Measure spatial and temporal water quality trends.
- Evaluate the effectiveness of water quality protection programs.
- Identify new and emerging water quality issues.

The evolving nature of management and program needs, technology, and technical monitoring guidance/science requires continuous evaluation of existing activities to ensure effective, comprehensive monitoring and to identify opportunities for improvement. Program assessment led to an update of the 1997 Strategy in May 2005 (MDEQ, 2005a) (available at http://www.michigan.gov/deqwater under Water Quality Monitoring, Assessment of Michigan Waters). Another impetus for the update was a requirement by the USEPA that states produce a comprehensive monitoring program strategy that serves all water quality management needs

and addresses all state waters. The purpose of the 2005 update was to: (1) describe ongoing monitoring activities (including monitoring objectives, study design, indicators, data analysis, data management, and reporting); (2) identify potential future monitoring activities, to the extent possible; (3) identify program gaps and a timeline for addressing them; and (4) specify resource needs (staff, funding, and technical).

Regarding to wetland monitoring, the four goals of Michigan's Water Quality Monitoring Strategy are addressed in a separate document entitled the "State of Michigan Wetland Monitoring and Assessment Strategy," which was updated in 2013. This strategy follows the 3-Tiered Technical Approach – Level 1: Landscape Assessment, Level 2: Rapid Wetland Assessment, and Level 3: Intensive Site Assessment - outlined of the EPA publication *Application of Elements of a State Wetland Monitoring and Assessment Program* (USEPA, 2006). The objectives of the wetland monitoring and assessment strategy are:

Objective 1: Complete an inventory of Michigan's wetland resources that provides both fundamental resource information and a baseline for evaluating gains and losses over time.

Objective 2: In order to support state and national no net loss/net gain goals for wetlands, cooperate in updating of National Wetland Inventory maps for use in status and trends reporting.

Objective 3: Assess the effectiveness of Michigan's state-administered Section 404 permit program by tracking authorized impacts and mitigation for those impacts, as well as documented unauthorized impacts and restoration measures.

Objective 4: Apply Landscape Level Functional Wetland Assessment methods to support the protection, management, and restoration of wetlands on a watershed scale.

Objective 5: Evaluate individual wetland sites using the Michigan Rapid Assessment Method to quickly assess the wetland functions and values on an equal scale regardless of ecological type.

Objective 6: Use full scale biological assessment of wetlands for resource management purposes. Develop and document wetland Indices of Biological Integrity and related methods.

Objective 7: In cooperation with other public and private agencies and organizations, provide for the evaluation of Michigan's most outstanding wetland resources, especially Great Lakes coastal wetlands, by supporting the long-term monitoring of wetlands through the Great Lakes Coastal Wetland Consortium and similar cooperative efforts.

Objective 8: Assess statewide wetland quality by establishing a routine wetland monitoring program that parallels other basin-wide water quality monitoring, including the National Wetland Condition Assessment.

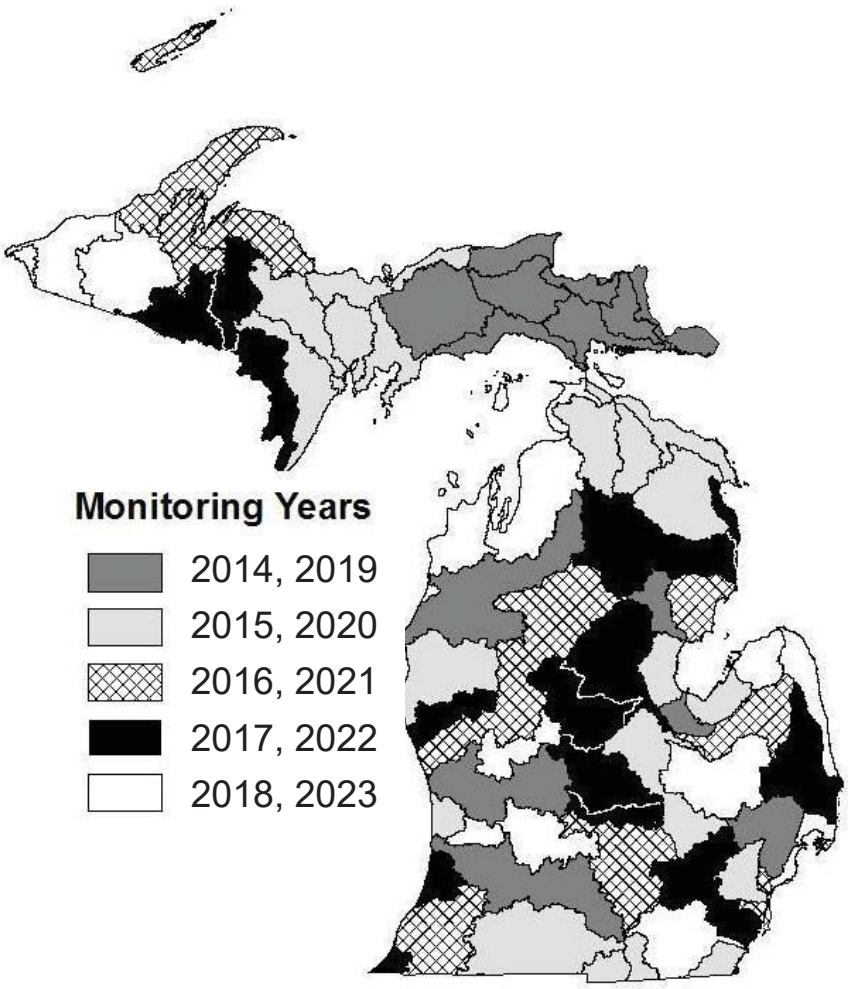


Figure 3.1. Five-Year Rotating Watershed Cycle.

CHAPTER 4
ASSESSMENT METHODOLOGY

4.1 Introduction

Michigan's assessment methodology describes the data and information used to determine designated use support, explains how these data and information are used to determine designated use support for surface waters of the state, and describes how surface water resources are reported using five categories (fully supporting, partially supporting, not supporting, insufficient information, or not assessed, described in more detail in Section 4.11). Ultimately, this methodology describes the process used to develop several of the appendices and summary tables included in this IR to satisfy the requirements of Sections 305(b) and 303(d) of the federal CWA.

The internal coordination and review process used to generate Sections 305(b) and 303(d) lists is carried out by a team of MDEQ technical staff and managers with considerable knowledge of local watershed conditions/issues and expertise in aquatic biology, limnology, ecology, environmental engineering, chemistry, microbiology, and mammalian/aquatic toxicology.

4.2 Data and Information Used to Determine Designated Use Support

The MDEQ considers readily available, adequately georeferenced, and quality checked data and information collected and submitted by the MDEQ, its grantees and contractors, other agencies, and the public (including volunteer monitoring groups). Sources of data and information include:

- The MDEQ's water quality monitoring program that includes eight interrelated elements: fish contaminants, water chemistry, sediment chemistry, biological integrity and physical habitat, wildlife contaminants, bathing beach monitoring, inland lakes monitoring, and stream flow (see Chapter 3).

  As part of the MDEQ's water quality monitoring program, sites for biological integrity and water chemistry monitoring are selected using both targeted and probabilistic study designs. The probabilistic monitoring approach is used to address statewide and regional questions about water quality. Targeted monitoring is used to fulfill specific monitoring requests, assess known or potential problem areas or areas where more information is needed, achieve assessment coverage of a watershed, and provide information to support and evaluate the effectiveness of MDEQ water protection programs (e.g., NPDES, NPS, and Site Remediation). All site-specific data are considered to determine designated use support. Generally, the other types of monitoring are conducted using targeted study designs.

- Michigan's 2014 IR (Goodwin et al., 2014), which serves as a baseline for the 2016 IR and is modified using new data and information.

- Fish Consumption Advisories established by the Michigan Department of Health and Human Services (MDHHS) as of February 2015.

- Dilution calculations, trend analyses, or predictive models for determining the physical, chemical, or biological integrity of surface water bodies.

- Reports of fish kills and chemical spills.

- Surface water quality monitoring data submitted by the general public or outside agencies. This information was solicited by the MDEQ in a notice on the MDEQ Web-based Calendar in the following publications: January 12, January 26, February 9, and February 23, 2015. Information was also solicited directly from governmental and non-governmental groups including the Michigan Department of Transportation, MDARD, MDNR, United States Forest Service, USFWS, USGS, USEPA, National Parks Service, Alliance for the Great Lakes, Michigan Tribal contacts, various Michigan Colleges and Universities, watershed organizations, private consulting firms, and industrial water users via e-mail on January 12, 2015. Data received from outside sources, and if and how they were used are summarized in Section 10.2.

- Surface water, drinking water, and source water quality assessments conducted under Section 1453 of the federal Safe Drinking Water Act, enacted by Public Law 93-523, December 16, 1974, as amended, through August 6, 1996, being Title 42 of the United States Code (U.S.C.), Section 300j-13.

- Remedial investigation/feasibility studies to support Records of Decision under the Comprehensive Environmental Response, Compensation, and Liability Act, 1980 PL 96-510 or Part 201 of the NREPA.

To ensure adequate time for proper data analysis, the MDEQ applies a cutoff date for newly collected data considered for the IR (i.e., data that were not used for development of the 2014 IR). For the 2016 IR, the MDEQ considered all new readily available and quality-checked water quality data and information collected by the MDEQ and its grantees/contractors within the two-year period immediately following the cutoff date considered for the 2014 IR. In other words, data collected during the period from January 1, 2013, to December 31, 2014, were considered for the 2016 IR. Data collected prior to January 1, 2013, that were unable to be used for the 2014 IR or that were helpful to understand conditions over a longer period of time given limited datasets were considered for the 2016 IR using the current assessment methodology. Water Chemistry Monitoring Program (WCMP) data collected through 2013 were used for this IR. WCMP data collected in 2014 were not quality-checked in sufficient time to be broadly used for this IR. However, data collected in 2014 and after the December 31, 2014, cutoff date were considered for inclusion in the 2016 IR on a case-by-case basis as determined appropriate by the MDEQ. TMDL documents completed through 2015 were used to prepare this IR. Water quality data collected since January 1, 2013, and submitted to the MDEQ by March 1, 2015 , by other parties (e.g., in response to the data solicitation described in the above bulleted list, from the Michigan Clean Water Corps volunteer monitoring database, etc.) were evaluated according to this assessment methodology and potentially used to help prepare the 2016 IR.

The quality assurance/quality control requirements for water, sediment, and fish tissue chemistry and biological data collected by the MDEQ are described in the MDEQ's Quality Management Plan (MDEQ, 2005b). To ensure acceptable data quality, the MDEQ also requires all grantees or vendors receiving state or federal money for the purpose of conducting water quality monitoring to prepare and follow Quality Assurance Project Plans prior to sample collection (MDEQ, 2007). Other data, such as data submitted by outside agencies or the public,

must satisfy the MDEQ's quality assurance/quality control requirements to be used to make designated use support determinations of supporting or not supporting, to change the designated use support, or to reassign water bodies to different categories. Data that do not fully satisfy the MDEQ's quality assurance/quality control requirements or data that are collected and analyzed using techniques that are less rigorous than techniques used by the MDEQ to make designated use support determinations may be used to list a water body for further evaluation (i.e., as insufficient information).

Each dataset for a water body is evaluated to determine if the data are representative of existing conditions and of adequate quality to make designated use support decisions. Data may not be representative of existing conditions if land use, point sources, or hydrologic conditions were substantially changed since the point of last data collection. Data may not be of adequate quality if field or laboratory methods changed to address quality concerns subsequent to data collection. In addition, the quantity of data; duration, frequency, magnitude, and timing of WQS exceedances; analytical method sensitivity; and contextual information (e.g., naturally occurring, weather, and flow conditions, etc.) are considered to ensure the data are representative of critical conditions. Target sample sizes may be given in this assessment methodology to determine designated use support; however, these sample sizes are not applied as absolute rules. Generally, data that are collected to determine compliance with permitted activities, such as NPDES discharge data, are not used to determine designated use support; however, ambient data that are collected for this purpose will be considered.

Water body, assessment, or data types that are not specifically discussed in this assessment methodology (including uncommon data or unusual circumstances) are considered on a case-by-case basis and are evaluated consistent with WQS.

4.3 Determination of Designated Use Support

At a minimum, all surface waters of the state are designated and protected for all of the following designated uses: agriculture, navigation, industrial water supply, warmwater fishery, other indigenous aquatic life and wildlife, partial body contact recreation, and fish consumption (R 323.1100[1][a]-[g] of the Part 4 rules). In addition, all surface waters of the state are designated and protected for total body contact recreation from May 1 to October 1 (R 323.1100[2]). Specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fisheries (R 323.1100[4]-[7]). Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources (R 323.1100[8]). The Part 4 rules form the basis for this assessment methodology.

Most designated uses have one or more types of assessment that may be used to determine support. For example, to determine support for the other indigenous aquatic life or wildlife designated use, biological or physical/chemical assessment (e.g., rapid bioassessment of the macroinvertebrate community or chemical analysis of water samples) may be used. The assessment types include biological, habitat, physical/chemical, toxicological, pathogen indicators, other public health indicators, and other aquatic life indicators (default types from the USEPA ADB). In addition, a variety of parameters may be considered for the same assessment type. For example, physical/chemical assessments to determine fish consumption designated use support may include analysis of mercury or PCB concentrations in the water column.

Michigan uses the principle of independent applicability when making a support determination for each designated use for each water body. If data for more than one parameter are available that are used to determine support for the same designated use, then each data type is evaluated independently to determine support for the designated use. If any one type of data

indicates that the designated use is not supported, then generally, the water body is listed as not supporting that designated use. In some instances, data require reevaluation to resolve discrepancies. Some particular data types or situations may require consideration of multiple data types in combination. If no data are available for any assessment methods, then a water body is considered not assessed.

A single parameter may be used to make support determinations for more than one designated use. For example, appropriate data for a water body may reveal that water column mercury concentrations exceed the wildlife value and human noncancer value (HNV) (nondrinking water) (R 323.1057); therefore, both the other indigenous aquatic life and wildlife, and fish consumption designated uses are not supported. The inclusion of a parameter under a specific designated use in this assessment methodology does not preclude the use of that parameter to make support determinations for a different designated use.

Though infrequent, when best professional judgment (BPJ) is used to make a designated use support determination, justification is documented in the designated use comment field in the ADB record.

Water bodies listed as having insufficient information will generally be revisited in the correct basin year as resources allow (Figure 3.1). Comments specific to the development of each assessment are also accessible via the MiSWIMS (http://www.michigan.gov/miswims) by selecting the 'Designated Use' layer under the Map Search, choosing the designated use of interest as well as the category(ies) of interest, then using the "I"dentify Tool to bring up information linked directly from the ADB.

4.4 Designated Uses: Agriculture, Navigation, and Industrial Water Supply

4.4.1 Assessment Type: No Specific Indicator or Assessment Method

The MDEQ does not conduct specific assessments to evaluate support of the agriculture, navigation, and industrial water supply designated uses. These uses are assumed to be supported unless there is site-specific information indicating otherwise. In a scenario where site-specific information is used, the information is evaluated on a case-by-case basis using BPJ.

4.5 Designated Use: Warmwater Fishery and Coldwater Fishery

All surface waters of the state are designated and protected for warmwater fishery. In addition, specific rivers and inland lakes as well as all Great Lakes and specific Great Lakes connecting waters are designated and protected for coldwater fishery per R 323.1100(4)-(7).

4.5.1 Assessment Type: Physical/Chemical

For the following parameters the ideal dataset for assessments will come from continuous data collection or similar frequent collection over a target time frame. Collecting data of a sufficient frequency over an appropriate duration is important to fully investigate fluctuations in parameter quality over time and during critical periods (e.g., predawn and midday dissolved oxygen monitoring to investigate diurnal swings).

4.5.1.1 Dissolved Oxygen Concentration

Support determinations using dissolved oxygen data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other

monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment following the manufacturer's guidelines. Current quality assurance/quality control (QA/QC) procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day, etc.) is especially important when making designated use determinations using dissolved oxygen concentrations. In general, a decision of "not supporting" for dissolved oxygen will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1064 and R 323.1065, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using ambient dissolved oxygen for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

4.5.1.2 Temperature

Support determinations using temperature data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination.= Data should be collected with properly maintained equipment using manufacturer's guidelines. Current QA/QC procedures should be followed. Consideration of environmental conditions (e.g. weather, sample collection time of day) is especially important when making designated use determinations using temperature. In general, a decision of "not supporting" for temperature will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative measurements (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1069, R 323.1070, R 323.1072, R 323.1073, or R 323.1075, depending on water body type, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using ambient temperature for the warmwater and coldwater fishery designated uses. During periods of extreme ambient air temperatures, it is assumed that stream temperatures will also rise. In some cases, this alone may cause temperatures to exceed criteria. BPJ to list a waterbody will be used in these situations. Likewise, it is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

4.5.1.3 Ammonia (un-ionized) Concentration

Support determinations of chronic conditions using un-ionized ammonia data will typically be based on grab sample data collected over a time period (e.g., one week) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Consideration of other relevant parameters (e.g.,

temperature, pH, total ammonia) is especially important when calculating un-ionized ammonia concentration to make designated use determinations. In general, a decision of "not supporting" for un-ionized ammonia will be based on more than one exceedance of the monthly average (chronic) WQS per R 323.1057 over the period of review (typically two years, see 4.2) following USEPA guidance (USEPA, 1999).

Support determinations of daily maximum (acute) conditions using un-ionized ammonia data will be based on following USEPA guidance; when comparing ambient water column data to Aquatic Maximum Values, more than one exceedance of the acute un-ionized ammonia WQS over the period of review will typically result in assessing the site as not supporting (USEPA, 1999).

In addition to the guidelines outlined above, BPJ remains a factor in any case of support determinations using un-ionized ammonia for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent, that in using BPJ, a water body may be assessed with a less rigorous set of data (e.g., than the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

4.5.1.4 pH

Support determinations using pH data will typically be based on continuous data collected over a time period (e.g., two weeks) that is representative of conditions and captures environmental variability. Limited individual grab samples (e.g., 1 or 2 collected during other monitoring efforts) may generally be used only to assess a site as "insufficient information," thereby recognizing the need for more specific and detailed monitoring to make a use support determination. Data should be collected with properly maintained equipment using the manufacturer's guidelines. Current QA/QC procedures should be followed. Consideration of environmental conditions (e.g., weather, sample collection time of day) is especially important when making designated use determinations using pH. In general, a decision of "not supporting" for pH will be based on a 10 percent exceedance threshold following USEPA guidance (USEPA, 2002). If more than 10 percent of representative samples (with continuous monitoring being the preferred method) exceed the criteria set forth in R 323.1053, the site is listed as "not supporting." In addition to the guidelines outlined above (e.g., continuous monitoring preferred over a two-week period), BPJ remains a factor in any case of support determinations using pH for the warmwater and coldwater fishery designated uses. It is conceivable, although likely infrequent that in using BPJ, a water body may be listed with a less rigorous set of data (e.g., the preferred continuous monitoring over a two-week period), based on other environmental data concerns and/or multiple grab samples, showing degradation of water quality, collected over consecutive years or particularly egregious exceedance of WQS indicating obviously degraded conditions.

4.5.1.5 Water Column Toxic Substance Concentrations

To determine warmwater and coldwater fishery designated use support using toxic substances that are non-Bioaccumulative Chemicals of Concern (BCC), ambient water column chemical concentrations are compared to Aquatic Maximum Values and Final Chronic Values per R 323.1057 using Figures 4.1a and following the process described in 4.6.1.1.

4.5.2 Assessment Type: Biological

4.5.2.1 Fish Community

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of fish communities in wadeable streams and rivers [generally Procedure 51 (P51) (MDEQ, 1990)] to determine support for the warmwater fishery and coldwater fishery designated uses. Fish community biosurvey sites are generally selected using targeted study designs.

Rivers and streams with no site-specific fish community biosurvey results are considered not assessed unless other data are available to assess this use as described elsewhere in this Section (4.5).

Using P51, warmwater fish communities are scored with metrics that rate water bodies from excellent (+5 to +10) to poor (-10 to -5). Fish ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Water bodies with warmwater fish communities rating acceptable or excellent using P51 are determined to support the warmwater fishery designated use. Fish communities collected from designated coldwater streams using P51 are determined to support the coldwater fishery designated use if the relative abundance of salmonids is equal to or greater than 1%. One bioassessment result is generally considered sufficient to make this determination.

Using P51, a determination of not supporting or, infrequently, insufficient information is made for water bodies that have metrics that rate the warmwater fish community poor, have coldwater fish communities with salmonid relative abundance of less than 1%, if fewer than 50 fish are collected, or if the relative abundance of fish with anomalies exceeds 2% (applies to both warmwater and coldwater fisheries). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. However, instances where other supporting information raise concerns over data quality and representativeness (e.g., a poor fish community result during high-water conditions or when equipment function was in question) may require the collection of additional information to determine data representativeness. In this case, a determination of insufficient information is made.

For fish communities that rate poor, current and past weather conditions, assessments of biological communities in adjacent stream or river segments, historic data, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary. If conditions are determined to be temporary, a water body may be listed as having insufficient information. For example, a water body with a temporarily poor biological community due to a short-term chemical spill may be listed as having insufficient information if remediation occurred and the community is expected to recover.

Fish community data for streams, rivers, and lakes collected using methods other than P51 are evaluated on a case-by-case basis. For example, fish community data collected as part of the MDNR Fisheries Division's Status and Trend monitoring can be evaluated based on community structure and compared to the definitions for coldwater and warmwater fishery Use as stated in R 323.1043 and R 323.1044. Additional factors considered in determining support of the fishery designated uses are the presence of indicator species such as cisco in coldwater lakes or walleye in warmwater lakes at densities sufficient to indicate waterbody support of a healthy food web that could maintain taxa of such trophic levels.

When evaluating this information, two biologists with fisheries experience independently assess fish community data relative to the definitions in the Rules and their assessments are subsequently compared. Assessments with agreement (e.g., both biologists rating the data as

'fully supporting' the fishery designated use) are used to assess the appropriate assessment unit as such. Assessments with disagreement (e.g., one biologist rating the data as 'fully supporting' while the other rates it as 'not supporting') result in discussions of the data and agreement reached or a rating as 'insufficient information' to generate additional data collection to fully assess the assessment unit in question.

4.6 Designated Use: Other Indigenous Aquatic Life and Wildlife

4.6.1 Assessment Type: Physical/Chemical

4.6.1.1 Water Column Toxic Substance Concentrations

To determine other indigenous aquatic life and wildlife designated use support using toxic substances, ambient water column chemical concentrations are compared to Wildlife, Aquatic Maximum, and Final Chronic Values per R 323.1057 using Figures 4.1a and b, as described below. Water chemistry monitoring sites are selected using both targeted and probabilistic study designs. All site-specific water column chemistry data are used to determine other indigenous aquatic life and wildlife designated use support. Additionally, site-specific water column chemistry data for non-BCCs are also used to determine warmwater and coldwater fishery designated use support, as described in Section 4.5.1.5. and illustrated in Figure 4.1a, below.

A minimum of four data points are generally used to assess toxic substances per USEPA guidance (USEPA, 2002). In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting; if so, the basis for these decisions will be reflected in the ADB.

Following USEPA guidance, when comparing ambient water column data to Final Chronic Values for non-BCCs, more than one exceedance of the WQS over the period of review (typically two years in Michigan's review process) will typically result in assessing the site as not supporting, as illustrated in Figures 4.1a and 4.1b (USEPA, 2002). Similarly, to be reflective of the need to protect aquatic life against acute impacts, when comparing ambient water column data to Aquatic Maximum Values for BCCs and non-BCCs, one or more exceedance of the WQS over the period of review will typically result in assessing the site as not supporting, as illustrated in Figures 4.1a and b. For BCCs, comparisons of ambient water column data to Wildlife Values (the most sensitive chronic value) will be made using geometric means of available data as illustrated in Figure 4.1b. Geometric mean is chosen to help interpret the data when Wildlife Values are most sensitive because these criteria are based on long-term exposure of wildlife to surface water for drinking and consuming fish tissue. This is an analogous approach to that used when assessing human health protection as recommended per USEPA guidance (USEPA, 2002).

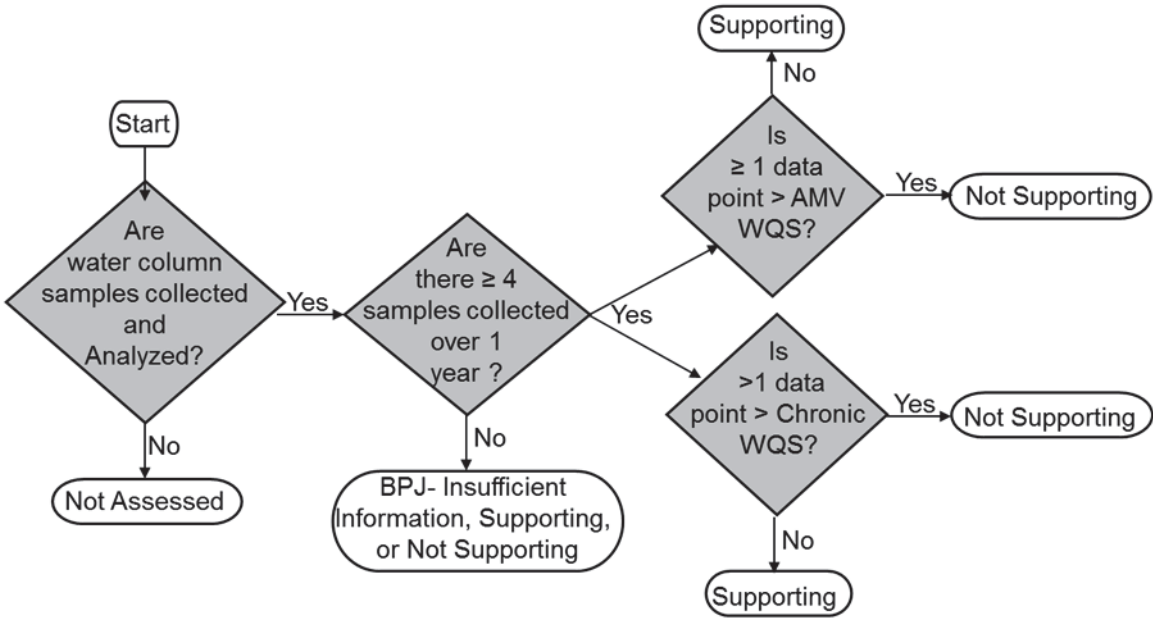


Figure 4.1a. Determination of other indigenous aquatic life and wildlife and warmwater/coldwater fishery designated uses support using water column toxic substance concentration for non-BCCs.

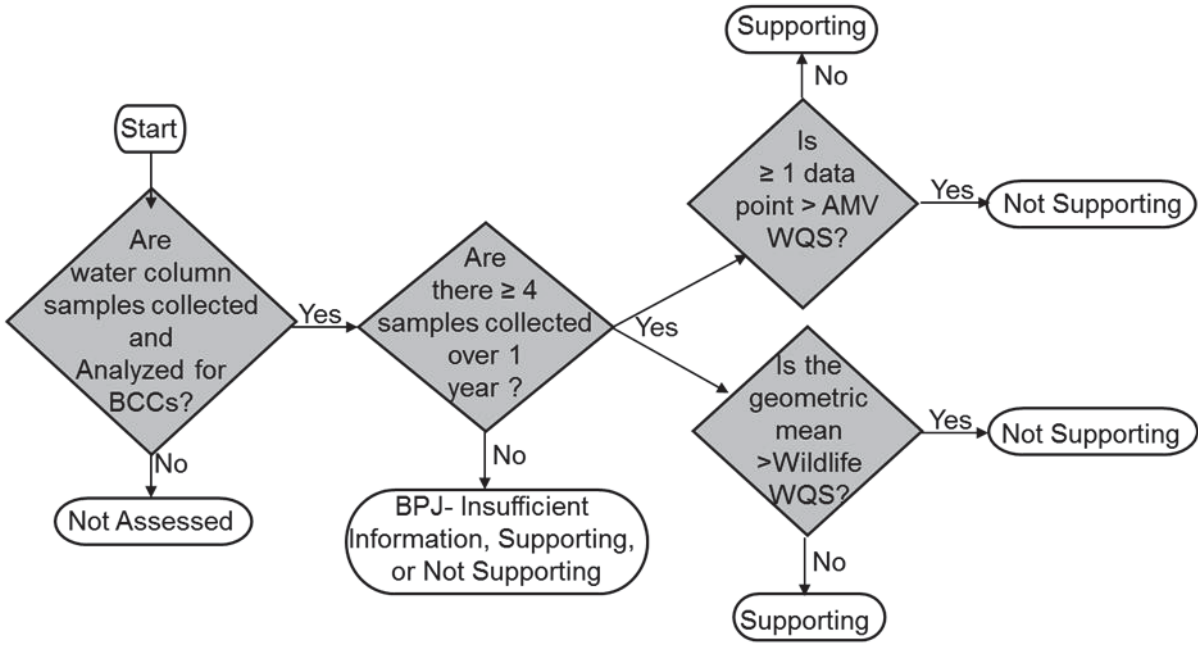


Figure 4.1b. Determination of other indigenous aquatic life and wildlife designated use support using water column toxic substance concentration for BCCs.

Site-Specific Aquatic Life Criteria (SSC) may be developed following Rule 323.1057(2)(r)(ii). If SSCs are developed, determination of designated use support status will be assessed following the processes in Figures 4.1a and b, as appropriate with water column data assessed against the corresponding SSC.

4.6.1.2 Water Column Nutrient Concentrations

For all waters, ambient water column nutrient concentrations are used in conjunction with biological indicators to determine support of the other indigenous aquatic life and wildlife designated use in all surface waters per R 323.1060 using BPJ to interpret conditions related to this narrative standard. Samples collected during July through September, when the impacts due to nutrient expression are most likely to occur, are particularly important for making designated use support determinations. In addition, use support determinations will be influenced by excessive/nuisance algal and macrophyte growth (see Section 4.6.2.2.).

Nutrient concerns may generate the need to conduct additional studies on possible ecological effects, including indirect effects to dissolved oxygen concentrations that may impact the fish community. If so, the results of those studies may be used to assess the warmwater and coldwater fishery designated uses following Section *4.5.1.1* thereby linking nutrient impacts to those uses as well as depending on the monitoring outcome.

For inland lakes, Carlson's trophic status index (TSI) in conjunction with aquatic macrophyte surveys, are considered to determine designated use support. Individual TSI values are calculated using summer data for each trophic state indicator: summer secchi depth (transparency), total phosphorus concentration (epilimnetic), and chlorophyll *a* concentration (photic zone) (Table 4.1). An overall TSI is determined from the mean of the individual indicator TSI values to provide a way of reducing the effects of individual sampling and measurement errors, thus developing a more robust estimate of the index. Based on these index values the trophic status classification is determined as listed in Table 4.2 (Fuller and Taricska, 2012). Carlson's index may underestimate the trophic state of lakes dominated by macrophytes. Therefore, the relative abundance of submergent macrophytes, if available, is used to indicate more productive conditions than indicated by the TSI values. It is assumed that moderate and dense growths of macrophytes are indicative of mesotrophic and eutrophic conditions, respectively. Therefore, if Carlson's TSI indicate mesotrophic conditions, but dense macrophytes are present, the lakes will be classified eutrophic (MDNR, 1982).

Trophic state determinations for inland lakes in Michigan has typically used data collected during comparable late summer time frames with consistent sample collection methods [e.g., primarily MDEQ TMDL monitoring data, USGS Lake Water Quality Assessment data (Fuller and Taricska, 2012), or Cooperative Lake Monitoring Program volunteer data (https://micorps.net/lake-monitoring/clmp-documents/)]. However, data from other sources and gathered using somewhat different methods or time frames is not completely discounted and may be used to calculate TSI values at lakes where no other TSI information is available. For example, the use of data collected during the USEPA-sponsored National Lakes Assessments of 2007 and 2012, by Michigan tribes, the National Park Service, and potentially other sources (e.g., MDNR, Fisheries Division) data collected prior to 2013 is considered on a case-by-case basis. The total phosphorus and chlorophyll *a* samples collected during these efforts may deviate from the standard sampling methods used by the MDEQ at Michigan lakes to characterize TSI, but remains useful for assessments.

Inland lakes classified as oligotrophic, mesotrophic or eutrophic are generally determined to support the other indigenous aquatic life and wildlife designated use, unless other information exists regarding designated use impacts resulting from excess nutrients (e.g., persistent and significant algal blooms). Inland lakes that are classified as hypereutrophic, but without

additional supporting information regarding nutrient expression, are generally listed as insufficient information with the goal of conducting additional, site specific, monitoring to confirm the trophic designation and whether impairments of the designated uses are realized

Table 4.1. Carlson's TSI Equations.	
TSI_{SD} = 60 - 14.40 lnSD	SD = Secchi depth transparency (m)
TSI_{TP} = 4.15 + 14.42 lnTP	TP = total phosphorus concentration (ug/l)
TSI_{CHL} = 30.6 + 9.81 lnCHL	CHL = chlorophyll *a* concentration (ug/l)

Table 4.2 Michigan Inland Lakes Trophic Status Classification Criteria.				
Trophic State	Carlson's TSI	TP (ug/l)	SD (m)	CHL (ug/l)
Oligotrophic	<38	<10	>4.6	<2.2
Mesotrophic	38-48	10-20	2.3-4.6	2.2-6
Eutrophic	49-61	21-50	0.9-2.2	6.1-22
Hypereutrophic	>61	>50	<0.9	>22

4.6.1.3 Ammonia (un-ionized) Concentration

Support determinations of chronic and acute conditions using un-ionized ammonia data to assess the other indigenous aquatic life and wildlife designated use follow the processes found in Section 4.5.1.3.

4.6.1.4 pH

Support determinations using pH data to assess the other indigenous aquatic life and wildlife designated use will follow the process found in Section 4.5.1.4.

4.6.1.5 Physical Characteristics

R 323.1050 addresses the following physical characteristics of a water body: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, and deposits. Michigan does not have specific assessment methods or numeric standards for these physical characteristics; therefore, BPJ (including visual observation) in conjunction with other assessment types (e.g., biological) is used to determine the other indigenous aquatic life and wildlife designated use support based on this narrative standard.

4.6.2 Assessment Type: Biological

4.6.2.1 Macroinvertebrate Community

In addition to chemical and physical assessment types, Michigan uses rapid bioassessment of macroinvertebrate communities in wadeable streams and rivers (generally P51; MDEQ, 1990) to determine support for the other indigenous aquatic life and wildlife designated use. Using P51, macroinvertebrate communities are scored with metrics that rate water bodies from excellent (+5 to +9) to poor (-5 to -9). Macroinvertebrate ratings from -4 to +4 are considered acceptable (Creal et al., 1996). Biosurvey sites are selected using both targeted and probabilistic study designs. All biosurvey data are considered to determine other indigenous aquatic life and wildlife designated use support.

Rivers and streams with no site-specific macroinvertebrate community biosurvey results are considered not assessed unless other data are available to assess the use as described elsewhere in this Section (4.6).

Water bodies with macroinvertebrate communities rating acceptable or excellent (i.e., total P51 macroinvertebrate community score -4 to +9) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

A determination of not supporting or, infrequently, insufficient information is made for water bodies with macroinvertebrate communities rated poor (total P51 macroinvertebrate community score -5 to -9). Generally, targeted biosurvey results should have sufficient supporting information available to determine survey representativeness and to list the water body as not supporting using one survey result. For biological communities that rate poor, current and past weather conditions, relevant available historic data, assessments of biological communities in adjacent stream or river segments, and the source and frequency of pollutant exposure are considered to determine if conditions are ongoing or temporary (see Section 4.5.2.1). In all cases, the ADB reflects the information used to support the assessment decisions.

Macroinvertebrate data for wadeable streams and rivers collected using methods other than P51 are evaluated on a case-by-case basis. Similarly, biological integrity data regarding water bodies where P51 is not appropriate (e.g., wetlands, lakes, ephemeral streams, etc.) will be evaluated on a case-by-case basis using BPJ to assess community characteristics like taxa balance, diversity, and other indicators of system health and function.

Nonwadeable rivers are assessed using Michigan's Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers (MDEQ, 2013a). Using this nonwadeable procedure, macroinvertebrate communities are scored with metrics that rate water bodies from excellent to poor. Macroinvertebrate ratings from 76-100 are considered excellent, 50-75 good, 25-49 fair, and 0-24 are considered poor.

Nonwadeable rivers with macroinvertebrate communities rating excellent, acceptable, or fair (i.e., total macroinvertebrate community score ≥25) are determined to support the other indigenous aquatic life and wildlife designated use. One bioassessment result is generally considered sufficient to make this determination.

Similar to determinations made for wadeable streams and rivers, a determination of not supporting or insufficient information is made for nonwadeable rivers with macroinvertebrate communities rated poor (total macroinvertebrate community score 0-24) depending on the quality and amount of supporting contextual information available.

4.6.2.2 Bacteria, Algae, Macrophytes, and Fungi

Site-specific visual observation of bacteria, algae, macrophytes, and fungi may be used to make a support determination for the other indigenous aquatic life and wildlife designated use. In addition, water column nutrient concentrations may also be used to support this determination (see Section 4.6.1.2).

A determination of not supporting will be made if excessive/nuisance growths of algae (particularly, *Cladophora*, *Rhizoclonium*, and cyanobacteria) or aquatic macrophytes are present. Although the determination of excessive, nuisance conditions is generally made using BPJ in accordance with narrative WQS, P51 offers the following guidance to make these determinations for streams:

- *Cladophora* and/or *Rhizoclonium* greater than 10-inches long covering greater than 25% of a riffle.
- Rooted macrophytes present at densities that impair the designated uses of the water body.

- Presence of bacterial slimes.

For inland lakes and impoundments, chlorophyll *a* (used as a surrogate for algal biomass) is a component of the TSI calculation and is used quantitatively to determine the trophic state (see Section 4.6.1.2).

4.7 Designated Use: Partial Body Contact Recreation and Total Body Contact Recreation

The partial body contact recreation designated use applies to all water bodies the entire year- while the total body contact recreation designated use applies to all water bodies during May 1 to October 31.

4.7.1 Assessment Type: Pathogen Indicators

4.7.1.1 E. coli

Michigan uses ambient *E. coli* concentration, and the presence of raw sewage discharges, to determine partial body contact and total body contact recreation designated use support using Rule 323.1062 and following Figures 4.2a and 4.2b, respectively. A minimum of 5 sampling events are needed to assess the partial and total body contact recreation designated uses using *E. coli* data. For the 30-day geometric mean total body contact WQS to be evaluated, the sampling events must be "representatively spread over a 30-day period" (Rule 323.1062). A sampling event is defined by Rule 323.1062 as "three or more samples taken during the same sampling event at representative locations within a defined sampling area." Larger datasets (e.g., weekly over the total body contact season or over multiple years) should be used to their fullest extent when available to assure that changing conditions during the year or over multiple years are adequately represented. A 10 percent exceedance threshold is targeted for making designated use determinations following USEPA guidance (USEPA, 2002). However, discretion may be used when considering a single violation and the magnitude of the exceedance under certain circumstances using small datasets (USEPA, 2002).

The representativeness of *E. coli* data is critical in assessing use attainment. It is important that the *E. coli* data used be spaced over time to represent a range of conditions rather than be clustered around a single event (e.g., single rain event or a single dry weather event). It is acceptable to sample during a critical 30-day period that may be driving *E. coli* concentrations (e.g., summer low flow, wet weather conditions) as long as they are distributed representatively over that time frame. Data used for reassessing an assessment unit previously listed as not supporting should, at a minimum, capture conditions that were reflected in the data used to make the initial assessment. For example, if wet weather events were captured as part of an initial dataset used to list an assessment unit as not supporting, it would be inappropriate to use only dry weather data to assess for delisting purposes. Additionally, when using more extensive datasets, the breadth of the data used is contingent on confidence that it represents conditions and variability typical of the water body being assessed.

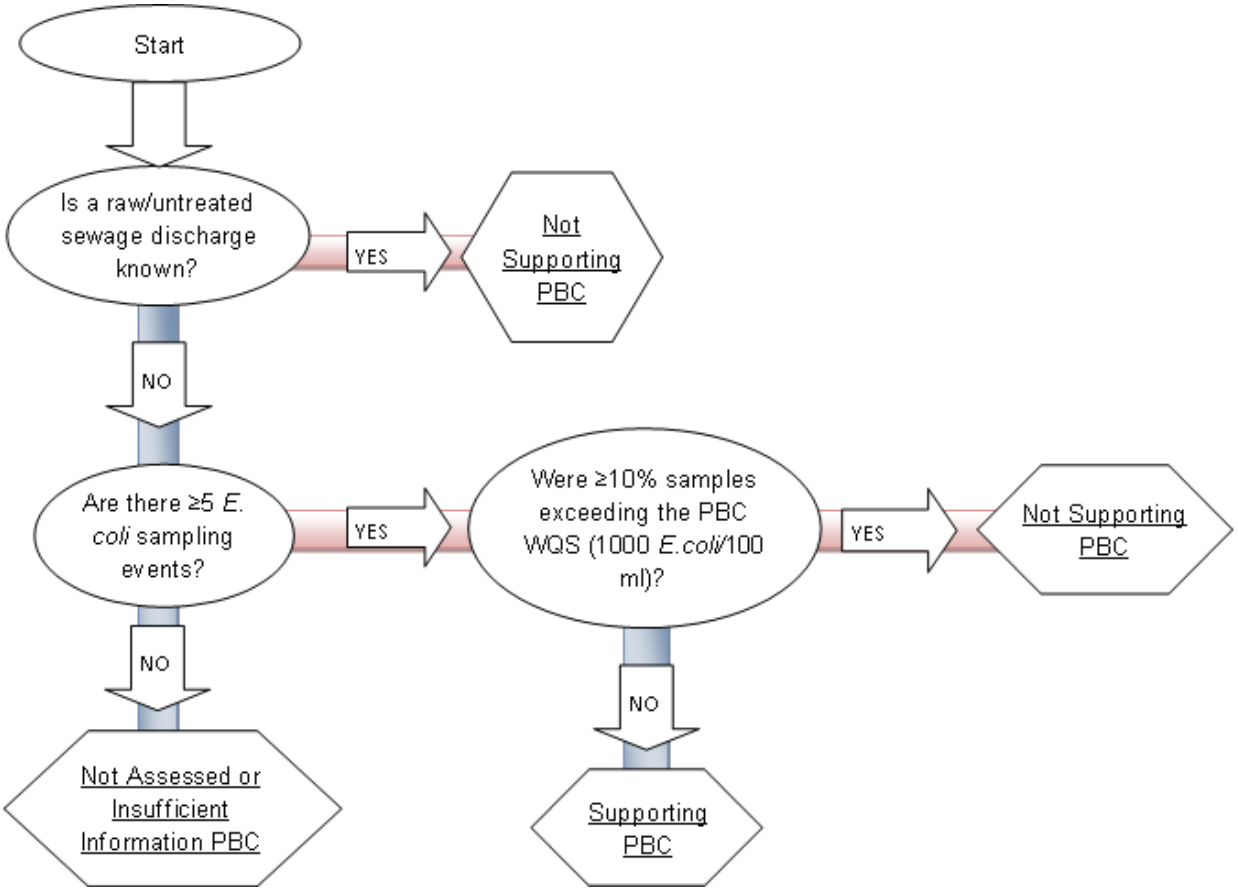


Figure 4.2a. Determination of partial body contact designated use support using ambient *E. coli* water column concentration. See Section 4.7.1.1 for additional details.

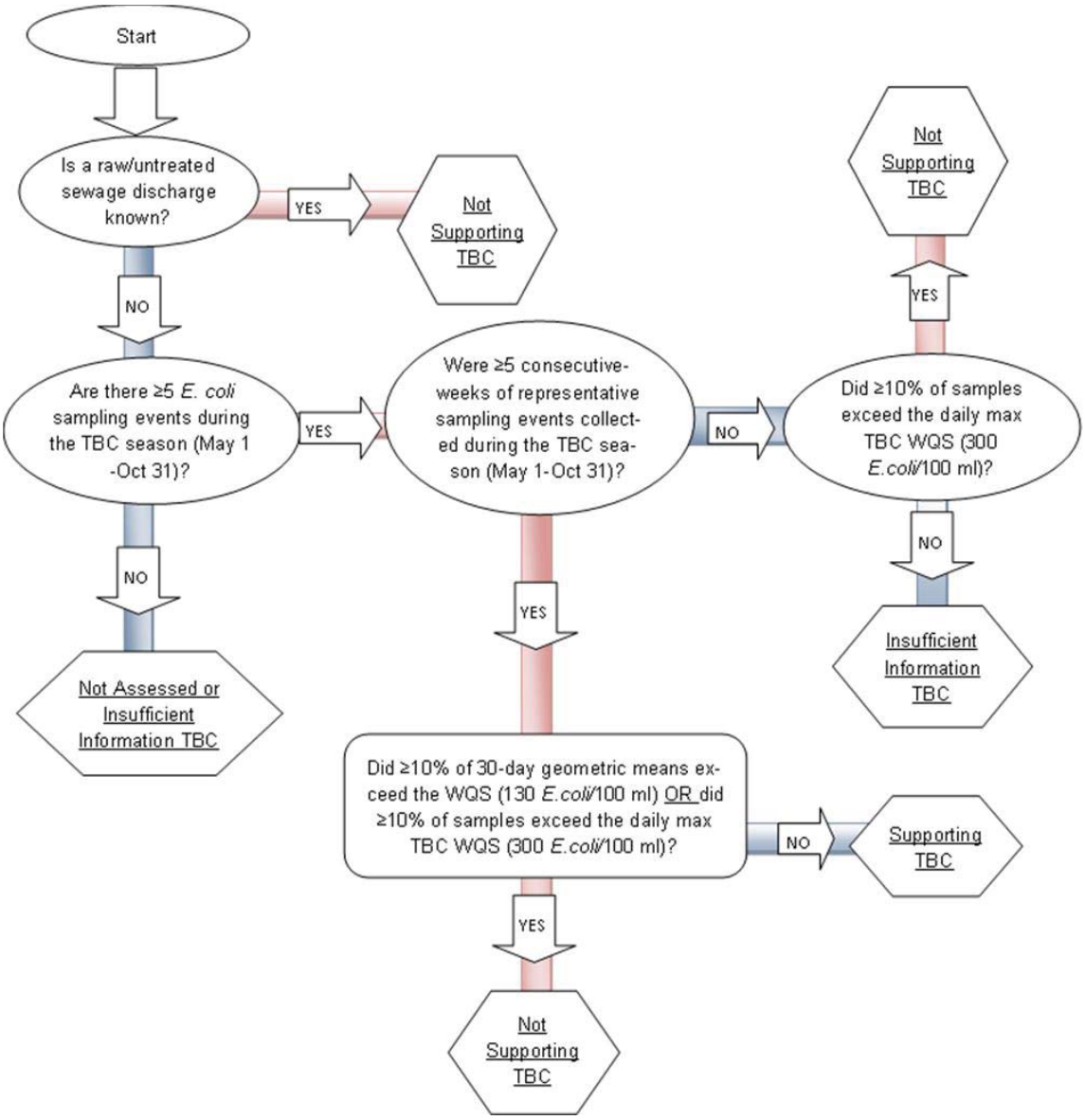


Figure 4.2b. Determination of total body contact designated use support using ambient *E. coli* water column concentration. See Section 4.7.1.1 for additional details.

4.7.2 Assessment Type: Physical/Chemical

4.7.2.1 pH

A determination of not supporting may be made in situations where the pH of surface water is such that direct human contact presents an opportunity for physical danger (e.g., contaminated groundwater venting from cement kiln dust disposal sites). Although infrequent, in such situations decision processes will be captured in relevant comment fields under affected Assessment Units within the ADB.

4.8 Designated Use: Fish Consumption

Michigan uses the concentration of BCCs (as listed in Table 5 of the Part 4 Rules) and other bioaccumulative substances (selenium and perfluorooctane sulfonate) in the water column, and fish consumption advisories issued by the MDHHS to determine fish consumption designated use support. A water body is considered to not support the fish consumption designated use if either the MDHHS has issued a site-specific fish consumption advisory for that water body or ambient water column concentrations exceed WQS, as described below.

4.8.1 Assessment Type: Physical/Chemical

4.8.1.1Water Column and Fish Tissue Mercury Concentrations

A fish consumption designated use decision based on ambient water column mercury concentrations is made by comparing mercury concentrations in the water with the HNV (nondrinking water) WQS (1.8 nanograms per liter [ng/L]) following the flow chart in Figure 4.3. In keeping with the assessment process spelled out in Section 4.6.1.1, geometric mean is chosen to help interpret the data when comparing to HNV because these criteria are based on long-term exposure to surface water for consuming fish tissue.

Michigan's fish tissue mercury value development method is similar to the USEPA's development method for the national fish tissue criterion (USEPA, 2001). Michigan's fish tissue mercury value (0.35 milligrams per kilogram [mg/kg]) was derived using the same exposure scenario used to derive Michigan's HNV (nondrinking water) WQS of 1.8 ng/L. Michigan's fish tissue value for mercury is the concentration that is not expected to pose a health concern to people consuming 15 grams or less of fish per day. This fish tissue value of 0.35 mg/kg for mercury is used as the decision point for making nonattainment listing decisions using the associated MDHHS advisory level, which encompasses that concentration. Therefore, the presence of MDHHS fish consumption advisories of two meals per month, or more restrictive, are used as a basis for a not supporting assessment. The two meal per month MDHHS advisory level based on mercury equates to tissue mercury concentrations in edible portions over a range (0.27-0.53 mg/kg wet weight), encompassing Michigan's fish tissue value for mercury (0.35 mg/kg wet weight).

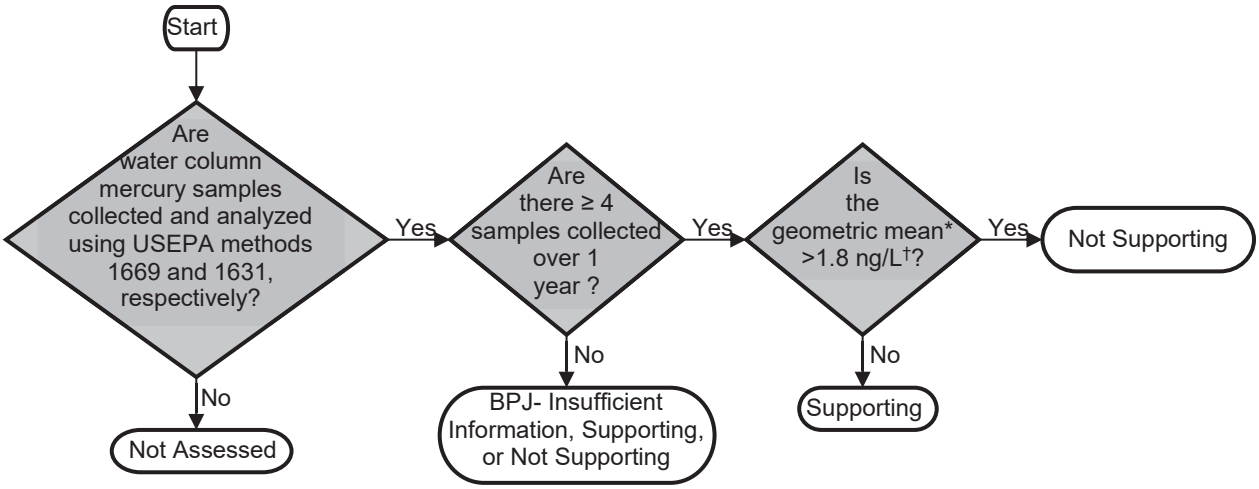


Figure 4.3. Determination of fish consumption designated use support using water column mercury concentration.

4.8.1.2 Water Column PCB Concentration

To determine fish consumption designated use support for PCBs, the ambient water column PCB concentration is compared to the non-drinking water Human Cancer Value (HCV) (0.026 ng/L) (R 323.1057). PCB samples should be collected and analyzed according to protocols published by the USEPA (1997a and 1997b), with the exception that dissolved and particulate fractions are combined. For PCBs, a sample size of 1 is considered sufficient information to determine WQS nonattainment. This approach is justified by the existence of a large PCB dataset for the state as a whole, which shows virtually 100% exceedance of the HCV for total PCBs. If there are no appropriate PCB data, then a water body is considered not assessed. Water bodies with one or more ambient water column PCB sample results greater than the non-drinking water HCV are determined to not support the fish consumption designated use.

4.8.1.3 Water Column BCCs Concentration other than Mercury and PCBs

To determine fish consumption designated use support for BCCs other than mercury and PCBs in the water column, ambient water column chemical concentrations are compared to the HNV and HCV for nondrinking water per R 323.1057 using Figure 4.1b (see Section 4.6.1.1).

4.8.2 Assessment Type: Other Public Health Indicators

The MDHHS bases their “Eat Safe Fish” Guidance (advisory) on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, the MDEQ considers the use of the MDHHS advisory based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/Kg (wet weight). The MDHHS has developed advisory screening values for mercury, total PCBs, total DDT, dioxins, toxaphene, selenium, and perfluorooctane sulfonate. Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS Web site (http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html).

4.8.2.1 Fish Consumption Advisories for Mercury

As described in 4.8.1.1, the presence of MDHHS fish consumption advisories of two meals per month, or more restrictive, are used as a basis for a not supporting assessment.

4.8.2.2 Fish Consumption Advisories for BCCs and other bioaccumulative substances other than Mercury

For contaminants other than mercury, a water body is considered to not support the fish consumption designated use if the MDHHS has issued a site-specific fish consumption advisory for that water body recommending a consumption rate of 12 meals or less per month. The MDHHS bases their advisories on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program. The fish tissue value is not an ambient WQS; however, the MDEQ considers the use of the MDHHS advisory listing based on fish tissue data as appropriate for determining fish consumption designated use support. For example, a fish consumption advisory due to PCBs on a water body specific basis occurs when the upper 95% confidence limit on the mean total PCB concentration in fillet samples of any species exceeds 0.01 mg/Kg (wet weight). Information specific to the MDHHS fish consumption advisory issuance process can be found on the MDHHS Web site (http://www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_54785-170340--,00.html). The MDHHS is developing advisory screening values for all fish contaminants.

4.9 Designated Use: Public Water Supply

Several specific segments or areas of inland waters, Great Lakes, Great Lakes bays, and connecting channels are designated and protected as public water supply sources [R 323.1100(8)].

4.9.1 Assessment Type: Physical/Chemical

4.9.1.1 Toxic Substances in Water Column

Assessment of public water supply designated use support determination is problematic because the HNV and HCV for drinking water (surface WQS) calculations assumes exposure via the consumption of 2 liters of untreated water per day, but it also assumes exposure via the consumption of 15 grams of fish per day. The majority of human exposure to compounds that are shown to have a potential to bioaccumulate using this exposure scenario would be from the consumption of fish. In other words, based on the process used to develop the HNV and HCV WQS the relative human exposure to a BCC and many non-BCC toxics in surface waters via strictly water consumption is minimal. Currently, Michigan's Part 4 rules do not contain a methodology to derive human health values that protect humans solely for the consumption of two liters of untreated surface water per day. However, for compounds that do not have the potential to bioaccumulate (generally, a bioaccumulation factor of 1) the drinking water HNV and HCV WQS can be used directly to assess the public water supply designated use.

Conversely, for compounds where bioaccumulation has been demonstrated to be an important component in human exposure (generally, a bioaccumulation factor >1), a surrogate screening value will be used to assess the public water supply designated use. In these cases, the MCLs will be used to compare to water column data from an assessment standpoint. The MCLs are used by the MDEQ, Drinking Water Program, as the maximum permissible level of a contaminant in water that is delivered to any user of a public water system. The MCLs are solely based on the consumption of two liters of water and do not include a fish consumption

component in the calculation; because of this, it was decided that MCLs were reasonable to use as a screening value for water column comparison for toxics where bioaccumulation makes direct comparison to WQS inappropriate. Because the MCL is a standard applicable after treatment, an exceedance of an MCL will not be used as the basis for a nonattainment determination. Instead, the water body will be assessed as "Insufficient Information" indicating the need for further investigation and additional coordination with the MDEQ, Drinking Water Program, to complete a full assessment.

Data used for public water supply assessments should be reflective of conditions within the Critical Assessment Zone (CAZ; described in Section 4.10) for a particular intake. Similar to the assessment methods used in Section 4.6.1.1, and USEPA guidance, a minimum of four annual data points are generally used to assess toxic substances following Figure 4.4 (USEPA, 2002). The geometric mean of ambient water sample results from a CAZ will be compared to either the WQS or the MCL, as appropriate following the process in Figure 4.4. Geometric mean is chosen to help interpret the surface water data for WQS or MCL comparison because these levels are based on long-term exposure of humans to surface water for drinking. In rare instances, limited data (less than 4 data points) demonstrating extreme exceedance of WQS may be used to assess a water body as not supporting the Public Water Supply designated use; if so, the basis for these decisions will be reflected in the ADB.

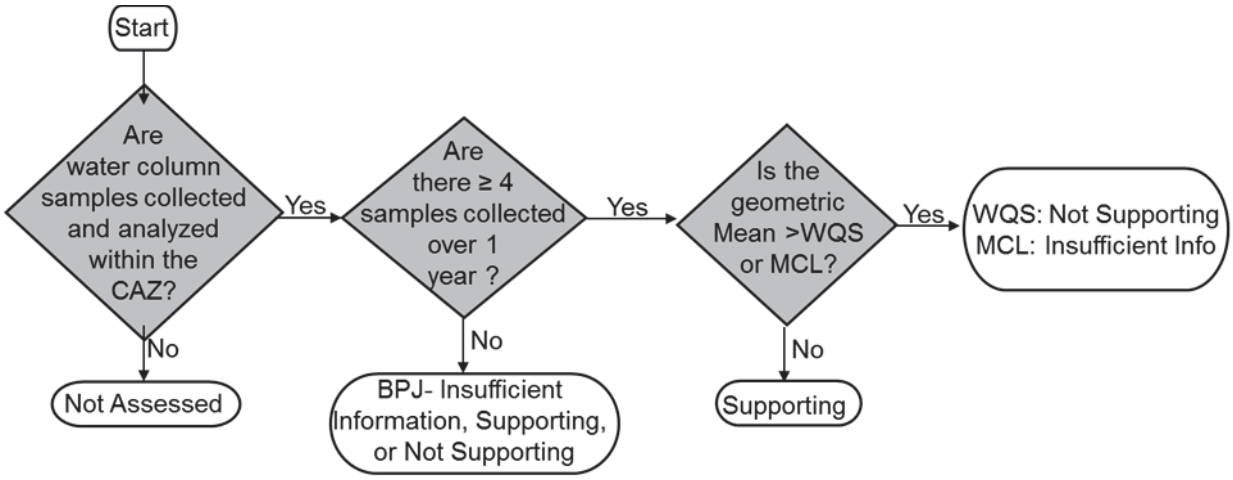


Figure 4.4. Determination of the Public Water Supply designated use support using WQS or MCLs.

4.9.1.2 Chlorides

Designated use support determination using chlorides data is made on a case-by-case basis where one or more representative monthly average calculations can be made and compared to R 323.1051(2). With consistent ambient monitoring data (e.g., ambient drinking water intake data) the WQS will be considered not supporting the Public Water Supply designated use if more than 10 percent of samples during the period of review exceed the applicable WQS.

4.9.1.3 Taste and Odor

To determine public water supply designated use support, site-specific complaints of taste and odor causing substances in community source waters are considered on a case-by-case basis.

4.10 Assessment Units and Determination of Geographic Extent

Michigan uses the NHD coding scheme (1:24,000 resolution) to georeference water bodies when generating the Sections 305(b) and 303(d) lists. As a base assessment unit, Michigan uses 12-digit HUCs (Appendix A). The geographic extent of a designated use support determination for each water body is made on a case-by-case basis. The 12-digit HUC base assessment unit is used as a default when listing streams and rivers to facilitate record keeping and mapping. Each 12-digit HUC base assessment unit may be split into multiple assessment units if site-specific information supports a smaller assessment unit (e.g., contextual information such as land use, known areas of contamination, point source pollution location, specific fish consumption advisory geographic information, barriers such as dams that restrict fish migration, etc.). An assessment unit may consist of all water bodies in a 12-digit HUC (as a maximum) or specific stream segments or lakes in a 12-digit HUC.

Beyond using the 12-digit HUC as a base assessment unit, contextual information is considered when making a determination of the geographic extent that data collection points represent. For example, if a macroinvertebrate community survey conducted in the lower reach of a branch of a river indicates support of the other indigenous aquatic life and wildlife designated use and a second survey conducted farther upstream (several 12-digit HUCs upstream) in the same river branch also indicates designated use support, then contextual information may be considered to make a determination that the spanned river miles also support the designated use. In this example, contextual information may include similar physical habitat, similar land use, absence of point sources, absence of contaminated sites, etc. In other words, if contextual information indicates that it is appropriate, data collected from an assessment unit may be used to make designated use determinations for surrounding water body segments in different assessment units that lack data.

Generally, 12-digit HUCs are used as a base assessment unit for the public water supply designated use. For the public water supply designated use in inland intakes, the geographic extent of the assessment unit is the 12-digit HUC in which the intake is located.

For public water supply intakes that are located in the Great Lakes or connecting channels, a concept of a CAZ around each intake was developed based on a Sensitivity Factor calculated for each intake. The two attributes used to develop the Sensitivity Factor are the water depth above the intake structure and the perpendicular distance from shore or length of the intake pipeline. Other factors such as localized flow patterns, thermal effects, wind effects, lake bottom characteristics, benthic nepheloid layers, etc., may be used to complete the sensitivity analysis. A radius for the CAZ, ranging from 3,000 feet for the most sensitive intakes to 1,000 feet for the least sensitive intakes, is assigned based on the Sensitivity Factor. A shape with this radius is then drawn around the intake to illustrate the CAZ. If the CAZ intersects the shoreline, then the geographic extent of the assessment unit is determined on a case-by-case basis as the most influential 12-digit HUCs that are along the shoreline within the CAZ. For intakes that are located in open waters of the Great Lakes where the CAZ does not intersect the shoreline, the geographic extent of the assessment unit is 1.5 square miles.

Ultra low-level PCB monitoring conducted by the MDEQ indicates that PCB concentrations exceed the HCV WQS (0.026 ng/L) in all waters sampled. Based on these results, all river miles in the individual watersheds sampled for PCBs are listed as not supporting the fish consumption designated use for PCBs in the water column.

The geographic extent of some beaches is not currently available. In these instances, a geographic extent of 0.2 shoreline miles was used as a default value.

Streams and rivers are listed in terms of miles. Wetlands are listed in terms of acres. Generally, inland lakes are listed in their entirety as acres, and Great Lakes and bays are listed in terms of square miles, except for Great Lake and inland lake beaches, which are listed in terms of shoreline miles for pathogen concerns.

4.11 Assessment Unit Assignment to Categories

After support determinations for all designated uses and geographic extent decisions are made for an assessment unit, categories are assigned using a multiple category system. The following categories and subcategories are used:

Category 1: All designated uses are supported, no use is threatened.

Category 2: Available data and/or information indicate that some, but not all of the designated uses are supported.

Category 3: There is insufficient available data and/or information to make a designated use support determination.

Category 4: Available data and/or information indicate that at least one designated use is not being supported or is threatened, but a TMDL is not needed.

- Category 4a: A TMDL to address the impairment-causing pollutant has been approved or established by the USEPA.
- Category 4b: Other approved pollution control mechanisms are in place and are reasonably expected to result in attainment of the designated use within a practical time frame.
- Category 4c: Impairment is not caused by a pollutant (e.g., impairment is due to lack of flow or stream channelization).

Category 5: Available data and/or information indicate that at least one designated use is not being supported or is threatened, and a TMDL is needed.

An assessment unit is considered threatened and is placed in Categories 4 or 5 when water quality data analysis demonstrates a declining trend that is expected to cause that water body to not attain WQS by the next listing cycle (2018). An assessment unit is not attaining WQS when any designated use is not supported (i.e., Category 4 or 5). Assessment units placed in Category 5 form the basis for the Section 303(d) list and the TMDL development schedule (see Chapter 9 for additional information regarding TMDLs).

A statewide TMDL has been developed for PCBs and is currently under review by the USEPA. It is anticipated that, upon approval of the TMDL, future assessments involving PCB data determined to be atmospheric in source (vs. an otherwise locally controllable source from legacy contamination or point-source conditions) will be assigned to Category 4a based on the existence of the approved statewide PCB TMDL. More information on this process is described in the statewide PCB TMDL.

A few instances exist where the MDEQ has determined that assessment units do not support one or more designated uses, but other appropriate pollution control mechanisms are in place. These assessment units are placed in Category 4b. As described above, the pollution control mechanism for a Category 4b water body is expected to result in the attainment of the

designated use within a practical timeframe. Considerations to determine if a pollution control mechanism is appropriate to place a water body in Category 4b include, but are not limited to: the scale of the project (e.g., geographic extent affected, duration, etc.) and the anticipated level of impact on water quality. The MDEQ works closely with the USEPA to develop any new listings in Category 4b.

Assessment methodologies used for streams and rivers are also used for channelized streams, when appropriate, including rapid bioassessment of macroinvertebrate and fish communities according to the five-year rotating watershed cycle.

An assessment unit is listed in Category 4c when sufficient water quality data and information are available to determine all of the following:

- A specific designated use is not supported (e.g., the other indigenous aquatic life and wildlife designated use is not supported based on a P51 poor macroinvertebrate community rating).

- The cause of the designated use nonattainment is due to something other than a pollutant (e.g., channel maintenance activity or beaver dam).

- No pollutant would cause the designated use nonattainment if the above cause did not occur.

Assessment units are only placed in Category 4c when MDEQ monitoring staff determines (using P51 or other appropriate techniques) that sufficient water quality data and information are available to clearly indicate that the Category 4c listing requirements explained in the preceding paragraph fully apply.

Key factors considered by MDEQ monitoring staff to help differentiate whether pollutants or other causes are responsible for the observed nonattainment include: water/sediment chemistry and microbiological data when such data are available for the assessment unit, riparian land use characteristics, and P51 habitat metric scores, particularly those for the epifaunal substrate/available cover, embeddedness, sediment deposition, channel alteration, channel sinuosity, bank stability, bank vegetative protection, and riparian vegetative zone width metrics.

It should be noted that the MDEQ recognizes sediment to be a pollutant. If MDEQ aquatic biologists determine that a pollutant (including riparian sediment) is responsible for an assessment unit not supporting a designated use, then that assessment unit is listed in Category 5. Additionally, if channel modification activities in an upstream assessment unit result in sedimentation problems in a downstream assessment unit to a point which causes a designated use to not be supported, then that downstream assessment unit is listed in Category 5.

Michigan uses a multiple category system; therefore, placement of an assessment unit in Category 4c based on a determination that a designated use is not supported and the cause is not a pollutant does not preclude placement of that assessment unit in Category 5 (or any other category) based on a designated use support determination for a different designated use.

Assessment units that do not support a designated use due to multiple causes may be listed in multiple categories for that designated use. For example, an assessment unit may have a TMDL completed for sedimentation; therefore, the assessment unit is listed in Category 4a for

the other indigenous aquatic life and wildlife designated use. The same assessment unit may have a mercury TMDL scheduled but not yet completed; therefore, the assessment unit is also listed in Category 5 for the other indigenous aquatic life and wildlife designated use (see Table 4.3, Assessment Unit 10). In this case, the assessment unit is reported in both Categories 4a and 5 for the other indigenous aquatic life and wildlife designated use.

The following example (Table 4.3) adapted from USEPA guidance, illustrates Michigan's use of a multiple category system.

Table 4.3. Examples of assessment unit assignment to categories using a multiple category system with three designated uses. S = Supporting, NS = Not Supporting, - = Not Assessed, ? = Insufficient Information, / = Designated use does not apply to assessment unit. In designated use support summary tables (e.g., Tables 5.2, 5.3, 6.2, 7.2, and 8.1) Category 3 is reported as two subcategories: Insufficient Information and Not Assessed.

	Designated use A	Designated use B	Designated use C	Assigned Categories
Assessment Unit 1	S	S	S	1
Assessment Unit 2	NS	NS	NS	5
Assessment Unit 3	S	S	-	2, 3
Assessment Unit 4	S	S	?	2, 3
Assessment Unit 5	S	-	?	2, 3
Assessment Unit 6	S	NS (nonpollutant)	S	2, 4c
Assessment Unit 7	S	?	NS	2, 3, 5
Assessment Unit 8	S	NS (nonpollutant)	/	2, 4c, 3*
Assessment Unit 9	-	NS (TMDL approved)	NS	3, 4a, 5
Assessment Unit 10	-	NS (TMDL approved) NS	-	3, 4a, 5

* Currently designated uses that do not apply to an assessment unit are assigned not assessed in the ADB (e.g., coldwater fishery).

Justification for designated use support determination for each assessment unit is contained in the ADB. A comprehensive list of designated use support determinations is provided in Appendix B.

4.12 Impairment Cause and Source

When a determination is made that a designated use is not supported (i.e., an assessment unit is placed in Category 4 or 5), the cause and source of impairment are identified. Generally, the cause of impairment is the parameter(s) used to determine that the designated use is not supported unless a biological indicator is used. The source of impairment is determined using supporting contextual information and BPJ.

In addition, sediment toxic substance concentration data may be used to support other assessment types to make support determinations for the other indigenous aquatic life and wildlife, fish consumption, or other designated uses. Sediment data are collected from water bodies when there is direct knowledge or reasonable expectation of heavy metal or organic chemical contamination at levels that may impair biological communities by direct toxicity or cause fish consumption problems. Contaminated sediments may be listed as the source of impairment when sediment pollutant concentrations exceed screening concentrations (MacDonald et al., 2000; Jones and Gerard, 1999; and Ontario Ministry of the Environment, 1993) or when sediment toxicity test results demonstrate excessive toxicity.

4.13 Delisting Category 5 Assessment Units

Assessment units are removed from the Section 303(d) list (i.e., moved from Category 5 to another category) by the MDEQ using representative data and the current assessment methodology. Data analysis used to remove an assessment unit from the Section 303(d) list must be at least as rigorous a data analysis as was originally used to list the water body. Specific instances that justify the removal of assessment units from Category 5 include:

- A TMDL has been developed for all pollutants and approved by the USEPA (assessment unit is placed in Category 4a).

- A corrective, remediation action plan has been approved to be implemented or the problem source(s) has been removed, thereby, eliminating the need for a TMDL (assessment unit is placed in Category 4b or when water quality is reevaluated and it is determined that the designated use is supported, the assessment unit is placed in Category 2 or Category 1).

- The source of impairment for the initial designated use support determination was an untreated CSO and updated information reveals that the untreated CSO has been eliminated or control plan elements have been implemented in a legally binding document that includes a schedule for elimination of the untreated discharge but data are not yet available to document restoration (assessment unit is placed in Category 3 unless the corrective action program has not yet been completed, then it is placed in Category 4b).

- Reassessment of the assessment unit using updated monitoring data or information, techniques, or WQS, indicates that the water body now supports the designated use (assessment unit is placed in Category 1 or Category 2), or that additional monitoring or information is needed to determine whether the designated use is supported (assessment unit is placed in Category 3). For example, a water body may be moved from Category 5 to Category 3 if one year of new data indicated designated use support, but additional monitoring is needed to ensure continued designated use support.

- Reexamination of the monitoring data or information used to make the initial designated use support determination reveals that the decision was either incorrect or inconsistent with the current assessment methodology.

- Reassessment of a water body indicates that the cause of impairment is not a pollutant (assessment unit is placed in Category 4c).

- The assessment unit is determined to be within Indian Country, as defined in 18 U.S.C., Section 1151. These water bodies are not considered waters of the state of Michigan, and therefore, are not appropriate to include on the Section 303(d) list.

4.14 Assessment Methodology Changes

In addition to the minor edits and clarification changes made to update the 2014 assessment methodology for the 2016 IR, the following updates were made under the noted Sections:

- ***4.5.1.5***: Water column toxics (for non-BCCs) was added as an indicator to the Warmwater/Coldwater Fishery designated use following consideration of past comments received from the USEPA.

- ***4.6.1.1***: The assessment of water column toxics that are non-BCCs was changed from using geometric means of chronic data for comparison to using individual data points. The use of geometric means remains the assessment process for BCCs. Figure 4.1a is new and Figure 4.1b was edited to reflect this change. Additionally, changes were made to the process by comparisons are made between available ambient water column data and Aquatic Maximum Values for both BCCs and non-BCCs so that any exceedance of the WQS over the period of review will typically result in a not supporting assessment. Figures 4.1a and b were edited to reflect this change.

- ***4.6.1.3 and 4.6.1.4***: Ammonia and pH indicators were added to the Other Indigenous Aquatic Life and Wildlife designated use following consideration of past comments received from the USEPA.

- ***4.8***: Changes were made throughout this Section to reflect an assessment process based on the MDHHS's new fish consumption advisory guidance.

- ***4.9.1.1:*** Methodology was added within the water column toxics indicator for the Public Water Supply designated use to address past difficulties with making assessments using this indicator and to better support the MDEQ's Drinking Water Program with the assessment process.

CHAPTER 5 ASSESSMENT RESULTS: THE GREAT LAKES, BAYS, CONNECTING CHANNELS (ST. MARYS, ST. CLAIR, AND DETROIT RIVERS), AND LAKE ST. CLAIR

5.1 Trophic Status

Overall phosphorus loading reductions in the Great Lakes are attributable, in part, to effluent nutrient limits in NPDES permits issued to municipal and industrial facilities. For Great Lakes protection, Michigan's WQS restrict point source discharges of phosphorus to 1 milligram per liter (mg/L) as a maximum monthly average. Lower limits may be, and often are, imposed to protect designated uses in receiving or downstream waters.

Legislation passed in 1977 that reduced the allowable phosphorus content in household laundry detergents sold in Michigan to less than 0.5% phosphorus by weight has contributed to the reduction of phosphorus discharged from point sources. Legislation passed in 2009 reduced the allowable phosphorus content in any cleaning agent sold in Michigan intended for use in household clothes washing machines and, beginning July 1, 2010, dishwashers to 0.5% by weight expressed as elemental phosphorus. This legislation has the effect of further reducing phosphorus loads from wastewater treatment plants and on-site treatment systems. NPS phosphorus reduction efforts have also contributed to improved Great Lakes water quality and were aided by legislation that went into effect in 2012 banning the use of phosphorus-containing lawn fertilizers. The current trophic status of each of Michigan's Great Lakes is presented in Table 5.1.

Table 5.1 Trophic status of the Great Lakes bordering Michigan.

Lake	Trophic Status (nutrient level)
Superior	Oligotrophic* (low)
Huron	Oligotrophic* (low)
Saginaw Bay	Eutrophic† (high)
Michigan	Oligotrophic* (low)
Erie (Central Basin)	Oligotrophic/mesotrophic* (moderate)
Western Basin	Mesotrophic* (moderate)

*USEPA, 2015; †USEPA, 2011b

5.2 Water Chemistry of the Great Lakes Connecting Channels

Quality assured data through 2013 were used for assessment updates for this reporting cycle. However, only data through 2008 was available for discussions of broader trends and results around Michigan as analyzed in the most recent WCMP report. Great Lakes connecting channel (St. Marys, St. Clair, and Detroit Rivers) monitoring efforts and results from 1998 through 2008 are summarized in the report released in 2013 (MDEQ, 2013b). Additional annual reports prepared by the Great Lakes Environmental Center (GLEC) under contract with the

MDEQ were used to provide this summary (most recent reports - GLEC, 2006a and 2007a). Key findings from water chemistry monitoring of the three Great Lakes connecting channels bordering Michigan (Detroit, St. Clair, and St. Marys Rivers) follow:

- Detroit River nutrient concentrations have decreased significantly since the late 1960s, with an order-of-magnitude decline in total phosphorus concentrations from a high of 0.13 mg/L in 1969. Data collected between 1998 and 2008 indicate seasonal fluctuations in nitrogen parameters, with an overall increase in median total phosphorus concentration upstream to downstream although inconsistent year-to-year and with no trend in changes over time. Mercury and trace metals data (chromium, copper, and lead) obtained from 1999 to 2008 found no changes over this time period. In general, statistically significant differences ($p<0.05$) between upstream and downstream concentrations were not apparent, with the exception of mercury, which was significantly higher at the upstream station.

- St. Clair River total phosphorus concentrations showed a decreasing trend at the upstream station from 1998 to 2008 and median concentrations were higher downstream versus upstream. Mercury and trace metals data (chromium, copper, and lead) obtained from 1999 to 2008 indicate no trends. Spatial analyses indicate that chromium, copper, lead, and mercury concentrations increased from upstream to downstream.

- Little historic water chemistry data are available for the St. Marys River, but data obtained from 1998 to 2008 indicate no trends for nutrients or trace metals (mercury, chromium, copper, and lead). Total phosphorus concentrations increased from upstream to downstream, as did chromium, copper, lead, and mercury concentrations.

5.3 Water Chemistry of Saginaw Bay and Grand Traverse Bay

Quality assured data through 2013 were used for assessment updates for this reporting cycle. However, only data through 2008 was available for discussions of broader trends and results around Michigan as analyzed in the most recent WCMP report. Saginaw Bay and Grand Traverse Bay monitoring efforts and results from 1999 through 2008 are summarized in the report released in 2013 (MDEQ, 2013b). Additionally, annual reports prepared by the GLEC under contract with the MDEQ were used to prepare this summary (most recent reports - GLEC, 2006b and 2007b). Key findings from water chemistry monitoring of Saginaw and Grand Traverse Bays are summarized below.

- Saginaw Bay total phosphorus concentrations remain relatively constant with annual median concentrations between 0.015 and 0.019 mg/L (except 0.013 mg/L in 2005) and mean concentrations between 0.015 and 0.021 mg/L; generally above the target total phosphorus concentration of 0.015 mg/L established by the “Michigan Phosphorus Reduction Strategy for the Michigan Portion of Lake Erie and Saginaw Bay” (MDNR et al., 1985). The overall median chlorophyll *a* concentration (using all years, months, and stations) was 5.65 micrograms per liter (ug/L) with individual values ranging from 35 ug/L to 1 ug/L at the various monitoring locations. The highest median chlorophyll *a* value at an individual monitoring station was 7.7 ug/L. Chlorophyll *a* showed seasonal variability with levels during August, September, and October higher than other months.

- Grand Traverse Bay nutrient, chlorophyll *a*, and water clarity data reflect oligotrophic conditions and excellent water quality. During 1998-2008, the bay-wide median total

phosphorus and chlorophyll *a* concentrations in Grand Traverse Bay were 0.005 mg/L and 1.55 ug/L, respectively.

- Comparison of recent Saginaw Bay and Grand Traverse Bay trace metals and mercury water chemistry data with applicable Michigan WQS showed that average mercury concentrations in both bays met the mercury Rule 57 water quality value of 1.3 ng/L. All mean concentrations of chromium, copper, and lead at all sampling locations in Grand Traverse Bay and Saginaw Bay met applicable Rule 57 water quality values.

Saginaw Bay and Grand Traverse Bay monitoring efforts continue and will continue to be summarized in reports with connecting channels (see Section 5.2) and rivers and streams (see Section 7.2), every 3-5 years.

5.4 Fish Contaminants

Several projects have been implemented in the Great Lakes basin to monitor temporal and spatial trends in fish contaminant levels:

- The USEPA, Great Lakes National Program Office, collects and analyzes whole lake trout from the open waters of Lakes Superior, Michigan, Huron, and Ontario, and walleye from Lake Erie.

- The federal-state coordinated fillet trend monitoring program collected and analyzed chinook and coho salmon from Lakes Superior, Michigan, and Huron, and rainbow trout from Lake Erie. This program was discontinued as of 2009.

- Michigan's whole fish contaminant trend monitoring effort, initiated in 1990, focuses on fish collected from ten fixed stations located in the Great Lakes bays and connecting channels.

In addition, edible portion fish tissue contaminant monitoring was conducted in 2012 in Little Bay De Noc (northern Lake Michigan), Les Cheneaux Islands (northern Lake Huron), St. Marys River, St. Clair River, Lake St. Clair, and western Lake Erie. In 2013 edible portion samples were collected from Keweenaw and Huron Bays (Lake Superior), Little Bay De Noc and Little Traverse Bay (northern Lake Michigan), and Lake Huron at Oscoda. Fish tissue samples from top predators in these water bodies all had elevated mean mercury concentrations indicating the fish consumption designated use was not supported. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access.

5.5 Beaches

In 2013, 239 public beaches (owned by a city, county, etc.) on the Great Lakes were monitored and 175 reported no exceedances of the *E. coli* WQS for total body contact. There were 64 beaches that reported a total of 107 exceedances.

In 2014, 160 public beaches were monitored and 108 reported no exceedances of the *E. coli* WQS for total body contact. There were 52 beaches that reported a total of 94 exceedances.

The Michigan Beach Web site (http://www.deq.state.mi.us/beach) provides access to a database containing beach closings and *E. coli* data collected by LHDs and annual reports

summarizing the data. Currently, 604 public beaches located along the Great Lakes are listed in the database; although, water quality data are not available for all beaches. Data for Great Lakes beaches in Michigan are also available at http://watersgeo.epa.gov/beacon2/.

Since 2012, the MDEQ has been sampling water, including the algal toxin microcystin, and documenting beach conditions at seven beaches along the Michigan shoreline of western Lake Erie to investigate possible HAB impacts and other nutrient-related effects (e.g. nearshore attached algae, beach/shoreline 'muck').

5.6 Decaying Organic Matter Deposits

Deposits of dead and decaying organic matter continue to periodically foul beaches along Michigan's Great Lakes shoreline including, but not limited to, Grand Traverse Bay, Saginaw Bay, and western Lake Erie. While increased aquatic vegetation growth is typically associated with elevated nutrient concentrations, many of the shoreline deposits are occurring where ambient phosphorus and nitrogen concentrations are very low or declining. Similar problems are being reported along the Wisconsin Lake Michigan shoreline, the Ohio and Pennsylvania Lake Erie shoreline, and the New York Lake Ontario shoreline, where, like Michigan, shorelines are being fouled by decaying organic matter that may interfere with the enjoyment of beaches and nearshore waters.

Once thought to be caused primarily by the presence of excessive nutrients (phosphorus), there is growing evidence that the increased organic matter deposits may be the result of a complex interaction between nutrients and exotic mussel species (Hecky et al., 2004), changes in wind patterns over the Great Lakes (Waples and Klump, 2002), and fluctuating water levels (Harris, 2004). Research is ongoing to identify the causes and sources for these shoreline deposits with the hope that effective solutions can be found. Although phosphorus concentrations do not appear to be solely responsible for the shoreline deposits, programs and policies intended to reduce phosphorus in all waters of the state remain important components of efforts to improve and protect water quality.

5.7 Designated Use Support Summary

Designated use support summaries for Michigan waters of the Great Lakes, bays, connecting channels, and Lake St. Clair are presented in Tables 5.2 and 5.3. Michigan uses a multiple category system (i.e., assessment units may be placed in one or more category, see Section 4.11); therefore, Great Lake square miles and Great Lake shoreline miles and connecting channel miles are not totaled. Key designated use support results for Michigan waters of the Great Lakes, connecting channels, and Lake St. Clair follow. Impairment cause and source information for assessment units not supporting designated uses is presented in Chapter 9.

- The western basin of Lake Erie has been experiencing widespread and persistent cyanobacteria blooms over the past ten or more years; some reaching historic record sizes (International Joint Commission, 2014). The narrative nutrient criteria under Rule 323.1060(2) of the Part 4 Rules states: "In addition to the protection provided under subrule (1) of this rule, nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the surface waters of the state."

Rule 1060(2) may be assessed to support of the other indigenous aquatic life and wildlife designated use, among other ways, by using nutrient expression by biological indicators. Following Section 4.6.2.2., a determination of not supporting will be made if excessive/nuisance growths of algae (particularly, Cladophora, Rhizoclonium, and cyanobacteria) or aquatic macrophytes are present.

The repeated, persistent, and extensive cyanobacteria blooms impacting the western basin of Lake Erie have been determined to be excessive/nuisance conditions leading to ecological imbalance. Both internal and external information were reviewed, leading to the assessment of the other indigenous aquatic life and wildlife designated use as not supported. The routine observation of visible blooms at seven monitored Michigan beaches typically starting in early July through September from 2012 to 2015 confirmed the shoreline extent that cyanobacteria blooms and associated surface scums may affect. Additionally, the confirmation of widespread, persistent blooms often throughout much of Michigan's Lake Erie waters during the same period were demonstrated by satellite imagery processed by the NOAA (www.glerl.noaa.gov/res/HABs_and_Hypoxia/lakeErieHABArchive/). The data from both sources lend support to adding to the entirety of Michigan's Lake Erie waters a designation of not supporting for the other indigenous aquatic life and wildlife designated use based on excessive and nuisance cyanobacteria conditions. Michigan's Lake Erie jurisdiction is already listed as not supporting for the fish consumption designated use based on extensive fish tissue data from multiple species for bioaccumulative chemicals.

The significance of the cyanobacteria bloom issue in Lake Erie is further evidenced by the Great Lakes Water Quality Agreement Annex 4 (Nutrients) workgroup, including representatives from the State of Michigan, focusing first and foremost on the Lake Erie issues of algal community imbalance, cyanotoxins, hypoxia, and maintenance of trophic conditions. There is broad agreement that excessive nutrients are the primary cause, from a pollutant perspective, of these changes to Lake Erie's ecosystem. As such, total phosphorus has been identified as the target nutrient for necessary reductions, with the acknowledgement that other relevant nutrients (particularly bioavailable phosphorus forms and nitrogen sources) will also be reduced concomitantly.

The Annex 4 Objectives and Targets Task Team was charged with identifying target reductions to achieve a level of algal growth that supports a healthy and productive Lake Erie, acknowledging that the complete elimination of algae is not in keeping with a healthy aquatic ecosystem. Load reductions were set using the 2004 and 2012 cyanobacteria blooms as the targets at, or below which, future blooms should be maintained 90% of the time. Similarly, it is anticipated that success at eliminating nuisance cyanobacteria bloom conditions will be demonstrated within Michigan waters of Lake Erie based on evaluation of future conditions aligning with the goals identified by the Task Team.

The Annex 4 Objectives and Targets Task Team Final Report (May 11, 2015) went through a significant deliberative process to identify sources and loading estimates of total phosphorus to Lake Erie. Data from extensive monitoring data sets as well as NPDES discharge monitoring reports were used to develop load estimates by major tributary with particular focus on the Detroit River and the Maumee River watershed, widely acknowledged the two primary sources of total phosphorus. Based on the above goals, the subcommittee set the load targets of 40 percent reductions in total phosphorus entering the western basin, including, and of particular relevance for Michigan, a 40 percent reduction in spring total and soluble reactive phosphorus (SRP)

from the River Raisin, and a 40 percent reduction in spring SRP from the Maumee River, some headwaters to which are in Michigan. Other specific tributaries were targeted as well, but are not in Michigan and so are not discussed in the context of this listing.

The 40 percent reduction of total phosphorus loads to Lake Erie are expected to be met by 2025, with an interim goal of 20 percent reduction by 2020, as stated in the Western Basin of Lake Erie Collaborative Agreement signed in June 2015 by Michigan's Governor Rick Snyder with Premier Kathleen Wynne of the Province of Ontario and Lieutenant Governor Mary Taylor of Ohio.

Michigan's Implementation Plan, developed under the Collaborative Agreement, spells out the Department's commitment to track progress on reductions using discharge monitoring data for the Detroit Water and Sewerage Department (Detroit River), Wayne County Downriver Wastewater Treatment Plant (Detroit River), and Monroe Publicly-Owned Treatment Works (River Raisin) NPDES permits as well as using USGS gauging station data (River Raisin). A monitoring strategy will be developed for the Maumee River tributaries to enable tracking effectiveness. Michigan will report annually on the status of total phosphorus reductions relative to the 2008 baseline loading year for the Detroit River, River Raisin, and Michigan's portion of the Maumee River watershed.

The MDARD and MDNR are actively working alongside the MDEQ to address the algae blooms and nutrient loading to the WLEB. Plans from the three state agencies will be merged into a draft Domestic Action Plan early in 2017 as part of the Annex 4 process and using the Collaborative Agreement as a primary building block. When combined with Domestic Action Plans from other states and Canada we will have established a road map for addressing this problem.

Similarly, other jurisdictions are developing Domestic Action Plans under Annex 4 to achieve target nutrient reductions using approaches that are most sensible under their programs, rules, and other guidance. Differences in how various jurisdictions define their water quality criteria, gather data, and assess their designated uses leads to potential differences in how they define and address water quality concerns. The Collaborative Agreement and Annex 4 process allows for these variations, while collectively acknowledging current problems in western Lake Erie and establishing a common goal toward which all jurisdictions are working.

Because of the complexity of the cyanobacteria bloom problem Michigan believes the best approach for solving the issues in western Lake Erie is through the collaborative process established under Annex 4 of the Great Lakes Water Quality Agreement and the Western Basin of Lake Erie Collaborative Agreement as they afford a holistic, multi-jurisdictional perspective that does not exist in a traditional TMDL process. Nonetheless, if the current collaborative processes fail to restore designated use support we recognize that a TMDL or other approach allowed by the USEPA to address impaired waters under the CWA will be required.

Michigan's TMDL schedule is aligned with the TMDL vision process described in Section 9.3.3 and Michigan's 2015 TMDL vision identifies TMDL expectations through 2022. The TMDL vision process will continue in 2022 by establishing the next series of priorities for Michigan's TMDL program; part of this next prioritization will be the evaluation of progress under the collaborative agreements related to the WLEB. Michigan is strongly committed to reducing phosphorus loadings to western Lake Erie as outlined in the Implementation Strategy noted above.

- Considerable progress has been made to eliminate untreated CSO discharges to the Great Lakes connecting channels. The majority of the St. Clair River, 33.3 miles, supports the total body contact and partial body contact recreation designated uses. A small portion of the St. Clair River, 7.5 miles located from Marysville upstream to Lake Huron, is listed in Category 4b. Similarly, CSO discharges still exist in the upper 16 miles of the St. Marys River miles and so the total body contact and partial body contact recreation designated uses are listed in Category 4b, recognizing that a compliance schedule to remedy the uncontrollable CSOs is in place and being adhered to by the Sault Ste. Marie wastewater treatment plant. An *E. coli* TMDL was completed for the Detroit River in 2008; therefore, these 25.7 miles are listed in Category 4a.

- The Michigan waters of the Great Lakes, their connecting channels, Saginaw and Grand Traverse Bays, and Lake St. Clair are listed as not supporting the fish consumption designated use due to elevated concentrations of PCBs, DDT, mercury, chlordane, and/or dioxin. Atmospheric deposition is considered to be the major source of these persistent bioaccumulative chemicals.

- Water chemistry results indicate that all 125 Great Lakes connecting channel miles are not supporting the fish consumption and other indigenous aquatic life and wildlife designated uses due to elevated concentrations of PCBs in the water column. The primary source of PCBs is atmospheric deposition. Mercury concentrations in the St. Marys and St. Clair Rivers are usually below the 1.3 ng/L WQS, but mercury concentrations in the Detroit River often exceed 1.3 ng/L.

- Deposits of decaying organic matter along some Great Lakes shorelines continue to be a significant problem and may interfere with beach recreational use and access to the water in some places along Saginaw Bay and western Lake Erie, particularly during periods of lower lake levels. Microorganisms have been identified in the decaying matter; however, the standards apply only to ambient water. Water quality is routinely monitored at Saginaw Bay beaches, western Lake Erie beaches, as well as other Great Lakes shoreline beaches around the state and areas where WQS are exceeded are listed as not supporting the total and/or partial body contact recreation designated use and a TMDL is scheduled according to the assessment methodology.

  The WQS (Rule 323.1050) require that the state's surface waters not have any "deposits" in "unnatural quantities which are or may become injurious to any designated use." Deposits of decaying organic material occur naturally in aquatic systems, and are frequently observed along the Great Lakes and inland lakes.

  A careful evaluation of available data and scientific information, and a comparison against WQS reveals that there is insufficient information to determine whether designated uses are not supported as a result of the decaying organic matter. Consequently, 142 miles of Saginaw Bay and 37.5 miles of western Lake Erie shoreline are listed as having insufficient information to determine support of the total and partial body contact recreation designated uses. In addition, 1,147 square miles of Saginaw Bay are listed as having insufficient information to determine support of the other indigenous aquatic life and wildlife designated use.

  The WQS require that nutrients be limited to the extent necessary to prevent stimulation of plant/algae growths that are or may become injurious to the designated uses. However, it is widely believed that nutrients are only one of the many factors contributing

to this problem and the relative importance of nutrients compared with other causes is unclear. The presence of the shoreline deposits where phosphorus concentrations are significantly less than those in Saginaw Bay (e.g., Grand Traverse Bay and Lake Michigan's eastern shore) indicate that this is a legitimate question.

- Beyond the observations of cyanobacteria blooms noted above, qualitative monitoring every 2 weeks at 7 Lake Erie beach locations during the 2012-2014 seasons (May-Sept) was undertaken, and ongoing, in an effort to understand the scope and persistence of HAB conditions as well as organic material deposited in these beach-zone areas. Additional water chemistry nutrient and periodic algal toxin data (during bloom conditions) have been collected concurrently to better understand the presence and permanence of toxins in these bathing beach areas. Development of a recreational water quality criterion for microcystin (the most pervasive algal toxin) is being investigated and, if established, may provide a decision point to compare available toxin data.

- Fish tissue monitoring statewide to identify the presence of Perflourooctane Sulfonate (PFOS) has identified the compounds in fish from the mouth of the AuSable River in Oscoda, Iosco County. A primary source of PFOS for fish in this area is likely the former Wurtsmith Air Force Base, an area of which was used regularly for fire suppression training with fire-fighting foams containing perflourinated compounds. Similarly, walleye sampled from northern Lake Michigan were found to contain PFOS. Because the fish collected in both locations were highly migratory species (steelhead and walleye) PFOS was added as a cause to the fish consumption designated use impairment and applied to the entirety of Michigan waters in Lake Michigan, Lake Huron as well as the AuSable River up to the first dam (Table 9.1).

Table 5.2 Designated use support summary for the Great Lakes, bays, and Lake St. Clair (approximately 42,167 square miles / 3,049 shoreline miles). No Great Lakes and bays are listed in Category 1 since comprehensive water quality data and/or information are not available for any locations.

Designated Use	Supporting	Insufficient Information	Not Assessed	Not Supporting			
	Category 2	Category 3	Category 3	Category 4a	Category 4b	Category 4c	Category 5
Agriculture (mi^2 / shoreline mi)*	42,167 / 3,049	0	0	0	0	0	0
Navigation (mi^2/ shoreline mi)*	42,167 / 3,049	0	0	0	0	0	0
Industrial Water Supply (mi^2/ shoreline mi)*	42,167 / 3,049	0	0	0	0	0	0
Warmwater Fishery (mi^2)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coldwater Fishery (mi^2/ shoreline mi)*	0	0	42,167 / 3,049	0	0	0	0
Other Indigenous Aquatic Life and Wildlife (mi^2 /shoreline mi)*†	280 / 4.2	1,147 / 1	40,625/ 3,006	0	0	0	115 / 37.5
Partial Body Contact Recreation (shoreline mi) †	70.5	196	2,779	0.5	0	0	3.2
Total Body Contact Recreation (shoreline mi) †	60.1	204.3	2,779	0.8	0	0	4.9
Fish Consumption (mi^2/ shoreline mi)*	0	0	0 / 0	0	0	0	42,167 / 3,049
Public Water Supply (mi^2) ‡	4.5	13.5	55.5	0	3	0	0

* Geographic extent may be reported in two different measurement units for this designated use (square miles (mi^2)/shoreline mi). These values represent different assessment units (i.e., shoreline miles do not correspond to the mi^2 listed).

† These designated uses apply to all surface waters of the state; however, these particular values represent shoreline miles/beaches. Not all designated uses have been assessed for all shoreline miles.

‡ Approximately 76.5 mi^2 of the Great Lakes and bays are protected for the public water supply designated use.

N/A indicates that the designated use is not applicable.

Table 5.3 Designated use support summary for the Great Lakes connecting channels (St. Marys, St. Clair, and Detroit Rivers) in Michigan (approximately 125 total miles). No connecting channels are listed in Category 1 since comprehensive water quality data and/or information are not available for any locations.

Designated Use	Supporting	Insufficient Information	Not Assessed	Not Supporting			
	Category 2	Category 3	Category 3	Category 4a	Category 4b	Category 4c	Category 5
Agriculture (mi)	125	0	0	0	0	0	0
Navigation (mi)	125	0	0	0	0	0	0
Industrial Water Supply (mi)	125	0	0	0	0	0	0
Warmwater Fishery (mi)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Coldwater Fishery (mi)	31.3	0	93.2	0	0	0	0
Other Indigenous Aquatic Life and Wildlife (mi)	0	0	0	0	0	0	125
Partial Body Contact Recreation (mi)	75.3	0	0	25.7	23.5	0	0
Total Body Contact Recreation (mi)	75.3	0	0	25.7	23.5	0	0
Fish Consumption (mi)	0	0	0	0	0	0	125
Public Water Supply (mi) *	0	2	3	0	0	0	0

* Approximately 5 of the 125 connecting channel miles are protected for the public water supply designated use.

N/A indicates that the designated use is not applicable.

CHAPTER 6
ASSESSMENT RESULTS: INLAND LAKES AND RESERVOIRS

6.1 Trophic Status

Carlson's TSI is used by the MDEQ to assess and classify Michigan's 730 public access lakes (see Section 1.2.2). This classification system is based on an index derived from a combination of four field measurements: (1) summer Secchi depth (transparency); (2) total phosphorus concentration (epilimnetic); (3) chlorophyll *a* concentration (photic zone), and (4) macrophyte abundance. The numerical value of the index increases as the degree of eutrophication increases. Historically, inland lake monitoring efforts have been directed toward obtaining baseline data for all 730 public access lakes.

The MDEQ and USGS completed a cooperative project in 2010 that sampled 730 public access inland lakes greater than 25 acres as part of the Lake Water Quality Monitoring Assessment Project. The majority (72%) of Michigan's public access lakes that were sampled from 2001 through 2010 have moderate (mesotrophic) or low (oligotrophic) nutrient levels (Table 6.1) (Fuller and Taricska, 2012).

Table 6.1 Trophic status summary of Michigan's public access lakes sampled from 2001 through 2010 (N=730).

Trophic Status	Number of Lakes
Oligotrophic (low nutrients)	129 (18%)
Mesotrophic (moderate nutrients)	399 (54%)
Eutrophic (high nutrients)	174 (24%)
Hypereutrophic (excessive nutrients)	28 (4%)

During 2013 and 2014, over 200 lakes were sampled each year as part of the Cooperative Lakes Monitoring Program, under the Michigan Clean Water Corps (for additional information see http://www.micorps.net). During 2013, 111 of these lakes were sampled for the three primary trophic status indicators (Secchi depth, total phosphorus, and chlorophyll *a*). Of these lakes, 44 were classified as oligotrophic, 56 mesotrophic, and 11 eutrophic. During 2014, 108 lakes were sampled for all three primary trophic status indicators and 41 were classified as oligotrophic, 60 mesotrophic, 6 eutrophic, and 1 was hypereutrophic.

6.2 Fish Contaminants

In 1990, Michigan initiated a fixed station fish contaminant trend monitoring project to measure spatial and temporal trends of certain bioaccumulative contaminants. Adult fish are collected from each site at a target interval of two to five years, and analyzed as whole fish samples. Fish have been collected from seven inland lakes (Gogebic, South Manistique, Higgins, Houghton, Gun, Gull, and Pontiac) as part of the fish contaminant trend monitoring project. Whole fish

fixed station trend monitoring data collected since 1990 were reviewed and general trend conclusions for inland lakes are summarized below:

- Lindane, terphenyl, PBB, heptachlor, and aldrin were quantified only rarely in the fish sampled. However, heptachlor epoxide and dieldrin (breakdown products of heptachlor and aldrin) were quantified in most of the samples analyzed.

- In addition to heptachlor epoxide and dieldrin, several chemicals were quantified in fish consistently, indicating that they are ubiquitous in the aquatic environment. These include mercury, hexachlorobenzene, total PCB, total chlordane, and total DDT.

- Fish from inland lakes tended to have higher concentrations of mercury than the same species from the Great Lakes or connecting channels.

- Total PCB concentrations declined at all of the inland lake trend sites monitored between 1990 and 2013, with an average decline of 8% per year.

- Total DDT concentrations declined at all of the inland lake trend sites monitored between 1990 and 2013, with an average decline of 7% per year.

- Total chlordane concentrations declined at all of the inland lake trend sites monitored between 1990 and 2013 where a trend could be detected, and the average decline was 10% per year. No trend was detected at 2 inland lakes because chlordane concentrations were consistently below the analytical quantification level.

- Significant trends in mercury concentrations have been detected at 3 of the 7 inland lake trend sites. Mercury concentrations in walleye from Lake Gogebic declined 5% per year between 1991 and 2009, declined in largemouth bass from Gull Lake at a rate of 1% per year between 1991 and 2012, and increased 4% per year in lake trout from Higgins Lake between 1991 and 2011.

In addition, edible portion fish tissue contaminant monitoring was conducted in 2012 and 2013 at 27 inland lakes and reservoirs. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access. Results of the edible portion monitoring are used by the MDEQ in determining the status of the Fish Consumption designated use for a given water body. All 27 locations monitored in 2012 and 2013 were assessed as not supporting the Fish Consumption designated use. The edible portion fish tissue results are also used by the MDHHS to update fish consumption advisories.

6.3 Beaches

In 2013, a total of 174 public beaches (owned by a city, county, etc.) on inland lakes were monitored and 140 had no exceedances of the *E. coli* WQS for total body contact. There were 34 beaches that reported a total of 55 exceedances.

In 2014, a total of 174 public beaches on inland lakes were monitored and 150 had no exceedances of the *E. coli* WQS for total body contact. There were 24 beaches that reported a total of 35 exceedances.

The Michigan Beach Web site (http://www.deq.state.mi.us/beach) provides access to a database containing beach closings and *E. coli* data collected by LHDs and annual reports summarizing the data. Currently, 564 public beaches located on inland lakes are listed in the database; although, not all beaches are monitored.

6.4 Designated Use Support Summary

A designated use support summary for Michigan inland lakes and reservoirs is presented in Table 6.2. Michigan uses a multiple category system (i.e., assessment units may be placed in one or more category, see Section 4.11); therefore, inland lake and reservoir acres and shoreline miles are not totaled. Key designated use support results follow. Impairment cause and source information for assessment units not supporting designated uses is presented in Chapter 9.

- Physical and chemical monitoring indicates that approximately 98% of the assessed inland lake and reservoir acres support the other indigenous aquatic life and wildlife designated use. Several water bodies are not supporting this designated use due to nuisance plant/algae growth problems caused by elevated phosphorus concentrations in the water column and/or sediments. Torch Lake (Houghton County) and Crooked Lake (Missaukee County) are not supporting this designated use and are listed in Category 4b due to historical copper stamp sand contamination and sediment problems from a historic wood chemical factory, respectively.

- Water chemistry and fish tissue monitoring indicates that about 9% of the assessed inland lake and reservoir acres support the fish consumption designated use. Ninety-one percent of the assessed acres do not support the fish consumption designated use because atmospheric deposition continues to be a major source of PCBs and mercury to Michigan's inland lakes and reservoirs; however, localized sources are still contributing to mercury and PCB fish contamination problems in some inland lakes and impoundments.

- MDNR Fisheries Division lake survey data, including cisco population monitoring indicates that approximately 68% of the inland lakes designated and assessed for the coldwater fishery designated use, support the use, while the remaining 32% have insufficient information to make a designated use support determination. A significant increase in fish community survey data received from the MDNR for this review cycle resulted in the ability to assess over 70,000 additional acres of warmwater and over 30,000 additional acres of coldwater fishery uses.

- Generally, the total body contact and partial body contact recreation designated use is reported as shoreline miles for beaches. Monitoring for *E. coli* found that approximately 96% and 90% of the assessed inland lake and reservoir shoreline miles support the partial body contact and total body contact designated uses, respectively.

- Biological survey data were collected in 2011 from Bass Lake and Little Lake, both near the town of Gwinn in Marquette County. Portions of each of these lakes have been impacted by historic saw mill operations and sawmuck deposits; the data collected supported the finding that the impacted areas are not supporting their Other Indigenous Aquatic Life and Wildlife designated use.

- Fish tissue monitoring statewide to identify the presence of PFOS has identified the compounds in fish from Van Etten Lake, Iosco County. The source of PFOS for fish in this area is the former Wurtsmith Air Force Base, an area of which was used regularly for fire suppression training with fire-fighting foams containing perflourinated compounds. PFOS was added as a cause to the fish consumption designated use impairment for Van Etten Lake.

Table 6.2 Designated use support summary for inland lakes and reservoirs (approximately 872,037 acres). No inland lakes or reservoirs are listed in Category 1 since comprehensive water quality data and/or information are not available for any locations.

Designated Use	Supporting	Insufficient Information	Not Assessed	Not Supporting			
	Category 2	Category 3	Category 3	Category 4a	Category 4b	Category 4c	Category 5
Agriculture (acres)	872,037	0	0	0	0	0	0
Navigation (acres)	871,572	465	0	0	0	0	0
Industrial Water Supply (acres)	872,037	0	0	0	0	0	0
Warmwater Fishery (acres)	72,472	2,717	796,518	295	0	0	34.8
Coldwater Fishery (acres)	161,742	74,890	635,404	0	0	0	0
Other Indigenous Aquatic Life and Wildlife (acres)	488,266	17,039	355,974	6,658	3,139	0	961
Partial Body Contact Recreation (acres/shoreline mi) *†	110 / 70.4	126 / 15.8	869,719 / 0.8	1,113 / 1.2	969 / 0	0 / 0	0 / 1.2
Total Body Contact Recreation (acres/shoreline mi) *†	346 / 41.6	126 / 43.2	869,372 / 0.2	1,223 / 1.4	969 / 0	0 / 0	0 / 3
Fish Consumption (acres)	32,021	17,172	496,404	554	173	0	325,799
Public Water Supply (acres) ‡	203	129	81	0	0	0	0

***** Geographic extent may be reported in two different measurement units for this designated use (acres/shoreline mi). These values represent different assessment units (i.e., shoreline miles do not correspond to the acres listed).

† These designated uses apply to all surface waters of the state; however, some of these values represent shoreline miles. In most cases shoreline miles are bathing beaches. Shoreline records are created and entered into the ADB on a case-by-case basis where information is available. Records have not been established for all shoreline miles. The total number of inland lake and reservoir shoreline miles in the ADB is 89.4 miles. A small number of records exist for shoreline miles that have no data available and therefore are not assessed; however, this is not a comprehensive value for all not assessed inland lake and reservoir shoreline miles. The total number of inland lake and reservoir shoreline miles is not known.

‡ Approximately 414 acres of inland lakes and reservoirs are protected for the public water supply designated use.

CHAPTER 7
ASSESSMENT RESULTS: RIVERS

7.1 Biological Integrity

All available biological assessments (e.g., fish and macroinvertebrate communities, targeted and probabilistic study designs) are evaluated using the assessment methodology (Chapter 4) and potentially used to determine designated use support. As part of the MDEQ's water quality monitoring program, sites are selected using both targeted and probabilistic study designs to assess the biological integrity of rivers and streams using macroinvertebrate communities. Procedure 27 (MDEQ, 2015) is used to estimate the number of river miles supporting the other indigenous aquatic life and wildlife designated use. Results are available for watersheds monitored in 2010 through 2014 (draft data) (Figure 3.1 and Table 7.1). Results from the 2010 through 2014 cycle were combined to determine a statewide designated use support status estimate of 95% for the other indigenous aquatic life and wildlife designated use in Michigan rivers and streams. Results from this project will also be used to assess temporal trends in biological integrity.

Table 7.1 Proportion of river miles (draft data) supporting the other indigenous aquatic life and wildlife designated use based on macroinvertebrate community assessment results for watersheds monitored in 2010 through 2014 using the MDEQ's Procedure 27. Proportion of river miles is shown with 95% confidence interval range.

Watershed/watershed group	Year monitored	Number of survey stations	River miles (%) supporting the other indigenous aquatic life and wildlife designated use	95% Confidence Interval Range (%)
Maumee Tribs	2010	35	94	86 - 100
Rouge	2010	48	79	68 - 90
Shiawassee	2010	49	84	73 - 95
Kawkawlin/Wiscoggin	2010	2	100	22 - 100
Thunder Bay/Cheboygan/ Black	2010	31	100	91 - 100
Pere Marquette/Pentwater	2010	28	100	90 - 100
Macatawa	2010	12	100	78 - 100
Upper St. Joseph	2010	31	96	84 - 100
Central Upper Peninsula	2010	29	100	90 - 100
AuGres/Tawas	2011	17	100	84 - 100
Cass	2011	23	96	87 - 100
Detroit/Ecorse	2011	5	40	0-100
Keweenaw	2011	14	100	81 - 100
Muskegon	2011	15	93	79 - 100
Upper Grand	2011	22	86	71 - 100
Lower St. Joseph	2011	27	100	89 - 100

Watershed/watershed group	Year monitored	Number of survey stations	River miles (%) supporting the other indigenous aquatic life and wildlife designated use	95% Confidence Interval Range (%)
Maple/Looking Glass	2012	15	100	82 - 100
Au Sable	2012	14	100	81 - 100
Black (Alcona Co.)	2012	4	100	47 - 100
St. Clair	2012	22	86	71 - 100
Galien/Black	2012	11	100	76 - 100
White	2012	13	100	79 - 100
Menominee	2012	15	100	82 - 100
Tittabawassee	2012	14	93	78 - 100
Huron	2012	32	84	71 - 97
Western Upper Peninsula	2013	14	100	81 - 100
Northwest Michigan	2013	16	100	83 - 100
Rogue/Flat	2013	14	100	81 - 100
Thornapple River/Rabbit	2013	21	90	78 - 100
Pigeon – Cherry	2013	26	69	51 - 87
Flint River	2013	24	96	88 - 100
Lake St. Clair Tribs	2013	1	100	5 - 100
River Raisin	2013	14	100	81 - 100
Clinton	2014	21	21	81 - 100
Saginaw	2014	6	33	0 - 81
Rifle	2014	14	100	81 - 100
Kalamazoo	2014	14	93	78 - 100
Lower Grand	2014	15	87	68 - 100
Manistee/Big Sable	2014	14	100	81 - 100
Eastern Upper Pen. - East	2014	14	86	66 - 100
Eastern Upper Pen. - West	2014	14	100	81 - 100

7.2 Water Chemistry

The MDEQ and its partners collect water samples from many rivers and streams throughout the state as part of the WCMP and other special studies and analyze them for a variety of parameters. Results from monitoring conducted from 1998 through 2008 are summarized below. Quality assured data through 2013 were used for assessment updates for this reporting cycle. However, only data through 2008 was available for discussions of broader trends and results around Michigan as analyzed in the most recent WCMP report. Tributary monitoring efforts continue and results through 2008 are summarized with connecting channels (see Section 5.2) and bays (see Section 5.3) in greater detail in a report released in 2013 (MDEQ, 2013b).

Key results from monitoring through 2008 (except where noted as being for 2012-2013) include the following:

- PCB analysis was conducted from 1998 to 2007, and then discontinued. The goal of this sampling was to determine if PCBs were ubiquitous in Michigan. While concentrations varied widely, PCBs were present in all samples and only met the WQS of 0.026 ng/L (HCV per R 323.1057) on one occasion at the Cheboygan River site, although total PCB concentrations exceeded this standard at this station on other dates.

Because the industrial use of PCBs has been banned, the primary sources of PCBs to water are likely historical sediment contamination and ongoing atmospheric deposition.

- Elevated levels of mercury were relatively common in water samples analyzed between 2012 and 2013. Of the 146 sites monitored during this period, 77 (52%) had geometric mean mercury concentrations exceeding the most restrictive mercury WQS of 1.3 ng/L (Wildlife Value per R 323.1057). Geometric mean mercury concentrations were highest (7.14 ng/L) at Black River, Gogebic County, and lowest (0.35 ng/L) at the South Ore Creek, Livingston County. Atmospheric deposition is the primary source of elevated mercury levels.

- Nearly all trace metal samples (other than mercury) that had sufficient information to make a determination met applicable WQS between 2012 and 2013. The exceptions during the two-year period were the Ontonagon River in Ontonagon County (2 exceedances of chronic WQS [Final Chronic Values] of 12.6 ug/L copper at a hardness of 93 mg/L CaCO3 and 13.4 ug/L copper at a hardness of 100 mg/L]); tributary to West Branch Firesteel River in Ontonagon County (2 exceedances of chronic WQS [Final Chronic Values of 9.4 ug/L copper at a hardness of 66 mg/L CaCO3 and 6.4 ug/L copper at a hardness of 42 mg/L]); and Begunn Creek (6 exceedances of chronic WQS [copper Final Chronic Value range: 14.0-26.7 ug/L; hardness range: 77-180 mg/L CaCO3]).

- Median total phosphorus concentrations statewide ranged from 0.168 mg/L at the Clinton River to 0.009 mg/L at the Cheboygan River tributary stations. The highest median concentrations were typically in the Huron-Erie Lake Plains and Southern Michigan/Northern Indiana Till Plains ecoregions. Orthophosphorus concentrations followed the same pattern.

7.3 Fish Contaminants

In 1990, Michigan initiated a fixed station fish contaminant trend monitoring project to measure spatial and temporal trends of certain bioaccumulative contaminants. Adult fish are collected from each site at a target interval of two to five years, and analyzed as whole fish samples. Carp were collected periodically from five river impoundment trend monitoring sites since 1990. These sites were located on the Muskegon, Grand, Kalamazoo, St. Joseph, and Raisin Rivers. Whole fish fixed station trend monitoring data collected between 1990 and 2011 were reviewed and general trend conclusions for rivers are summarized below:

- Lindane, terphenyl, PBB, heptachlor, and aldrin were quantified only rarely in the fish sampled. However, heptachlor epoxide and dieldrin (breakdown products of heptachlor and aldrin) were quantified in most of the samples analyzed.

- In addition to heptachlor epoxide and dieldrin, several chemicals were quantified in fish consistently, indicating that they are ubiquitous in the aquatic environment. These include mercury, hexachlorobenzene, total PCBs, total chlordane, and total DDT.

- Average total PCB concentrations were highest in carp from the Kalamazoo River site. The Kalamazoo River has extensive areas of PCB contaminated sediments, a problem that is being addressed under state and federal programs.

- Total PCB concentrations declined at all 5 river trend sites, with an average decline of 7% per year between 1990 and 2013.

- Total DDT concentrations declined at all river trend sites, with an average decline of 7% per year between 1990 and 2013.

- Total chlordane concentrations declined at all 5 river trend sites, with an average decline of 8% per year between 1990 and 2013.

- Mercury concentrations decreased 3% per year in fish from the River Raisin and 1% per year in fish from the Kalamazoo River. No significant trends in mercury concentration were measured in the Grand, Muskegon, or St. Joseph Rivers.

Edible portion fish tissue contaminant monitoring was conducted in 2012 and 2013 in 14 rivers. Edible portion sampling is often targeted toward known sites of contamination, sites popular with sport anglers, and sites with public access. Results of the edible portion monitoring are used by the MDEQ in determining the status of the Fish Consumption designated use for a given water body and by the MDHHS to update the fish consumption advisories. Of the 14 locations monitored in 2012 and 2013, 13 were assessed as not supporting the Fish Consumption designated use; there was insufficient information for one site (Tahquamenon River mouth) to make a determination.

7.4 Microorganisms

In 2013, a total of 15 public beaches on rivers were monitored and 11 reported no exceedances of the *E. coli* WQS for total body contact. There were 4 beaches that reported a total of 5 exceedances.

In 2014, a total of 12 public beaches on rivers were monitored and 11 reported no exceedances of the *E. coli* WQS for total body contact. One beach reported 3 exceedances.

The Michigan Beach Web site (http://www.deq.state.mi.us/beach) provides access to a database containing beach closings and *E. coli* data collected by LHDs. Currently, 71 public beaches located on rivers are listed in the database.

In 2013 and 2014, the MDEQ monitored 28 river sites across the state; including tributaries in the city of Grand Rapids, the Bass River (lower Grand River) and the Rouge, Au Gres, and Clinton Rivers watersheds. An additional 98 riverine sites were monitored by conservation districts, universities, and watershed councils through grants administered by the MDEQ; including tributaries such as the Flat, Thornapple, Huron, Red Cedar, Grand, and Kawkawlin Rivers. Based on this monitoring an additional 1,800 miles exceeded the *E. coli* WQS for total body contact.

Additionally, *E. coli* data collected through the WCMP program, while not of sufficient quality for assessments, may be used to estimate designated use attainment in monitored waters. In 2014 an estimated 60% of monitored rivers and streams met the total body contact designated use using WCMP data.

7.5 Designated Use Support Summary

A designated use support summary for Michigan rivers and streams is presented in Table 7.2. Michigan uses a multiple category system (i.e., assessment units may be placed in one or more

category, see Section 4.11); therefore, river miles are not totaled. Key designated use support results follow. Impairment cause and source information for assessment units not supporting designated uses is presented in Chapter 9.

- Approximately 96% of the 55,387 assessed river miles are determined to not support the fish consumption designated use (Figure 7.1). Mercury in fish tissue, mercury in water column, PCB in fish tissue, and PCB in water column are the primary causes for river miles to not support the fish consumption designated use (Figures 7.2 through 7.5). Atmospheric deposition is considered to be the primary source of these persistent bioaccumulative chemicals. Water column PCB monitoring using highly sophisticated and sensitive sampling/analytical techniques indicates that 100% of the assessed river miles are not attaining PCB WQS; therefore, a significant number of river miles are listed as not supporting the fish consumption designated use. A statewide TMDL for PCB was submitted for the USEPA's approval in 2013 addressing this wide-spread issue. A statewide TMDL for mercury is under development.

  Sampling locations that do not overlay river miles that are not supporting the fish consumption designated use may have insufficient information to determine use support or may indicate designated use support. Please note that a color copy of Figure 7.1 is required to view all information. This IR is available in color at http://www.michigan.gov/deqwater under Water Quality Monitoring, Assessment of Michigan Waters.

- A majority of the river miles support the other indigenous aquatic life and wildlife designated use (Figure 7.6). The primary causes for river miles to not support the other indigenous aquatic life and wildlife designated use are PCB in water column, mercury in water column, and habitat alterations (Figures 7.7 and 7.8). PCB and mercury in the water column have been sampled at many locations statewide (Figures 7.7 and 7.8).

  Sampling locations that do not overlay river miles that are not supporting the other indigenous aquatic life and wildlife designated use may have insufficient information to determine use support or may indicate designated use support. Please note that a color copy of Figure 7.6 is required to view all information. This IR is available in color at http://www.michigan.gov/deqwater under Water Quality Monitoring, Assessment of Michigan Waters.

- The majority of the river miles that are not supporting one or more designated uses indicated by poor biological communities have been highly modified by channel maintenance activities carried out primarily by Michigan's county drain commissions. These channel maintenance activities (including channel straightening, dredging, riparian vegetation removal, and snag removal) may result in poor biological communities caused by nonpollutants (habitat and/or flow alterations); therefore, these river miles are placed in Category 4c.

- Of the approximately 9,242 river miles assessed for the total body contact recreation designated use, about 2% were determined to support this designated use (Figure 7.9). Approximately 48% of the assessed river miles have TMDLs completed.

- A 17.1-mile reach of the River Raisin (Lenawee County) is not supporting the public water supply designated use because nitrate-nitrogen concentrations in the source water are above the USEPA's MCL (10 mg/L) for nitrates. A USEPA-approved TMDL is in place to remediate this problem. This listing for River Raisin does not strictly follow the

assessment methodology (i.e., the listing encompasses an area much larger than the 12-digit HUC; see Section 4.10) since the listing was created prior to the 2008 assessment methodology update and was meant to encompass a stretch of the river between two distinct drinking water intakes.

- During 2013 and 2014 the TMDL Program focused on the continued development of a statewide TMDL for mercury directed at addressing broad water quality concerns affecting many of Michigan's water bodies. A statewide TMDL for PCBs was submitted to the USEPA in 2013. The development of a statewide *E. coli* TMDL was initiated in 2015 following the USEPA's agreement to the approach.

- Continuous Dissolved Oxygen monitoring during the summer of 2015 at 8 sites in branches of the Rouge River Watershed found wide-spread attainment of the DO minimum WQS of 5.0 mg/l. Based on these data and significant CSO elimination efforts throughout the watershed and supported by the Rouge River National Wet Weather Demonstration Project, over 400 river miles of the Rouge River watershed had dissolved oxygen (oxygen depletion) removed as a cause for impairment of the warmwater fishery designated use.

- Fish tissue monitoring statewide to identify the presence of PFOS has identified the compounds in fish from the mouth of the Au Sable River, Iosco County as well as from both the Rogue River at Rockford, Kent County and the Flint River near Montrose, Genesee County. PFOS was added as a cause to the fish consumption designated use impairment and applied to the various affected river reaches.

Table 7.2 Designated use support summary for rivers in Michigan (approximately 76,421 total miles). No rivers are listed in Category 1 since comprehensive water quality data and/or information are not available for any locations.

Designated Use	Supporting	Insufficient Information	Not Assessed	Not Supporting			
	Category 2	Category 3	Category 3	Category 4a	Category 4b	Category 4c	Category 5
Agriculture (mi)	76,421	0	0	0	0	0	0
Navigation (mi)	76,421	0	0	0	0	0	0.06
Industrial Water Supply (mi)	76,421	0	0	0	0	0	0
Warmwater Fishery (mi)	9,888	921	63,478	1,604	3.2	321	434
Coldwater Fishery (mi)	6,102	1,319	68,527	169	3.5	147	182
Other Indigenous Aquatic Life and Wildlife (mi)	47,642	2,277	13,535	1,884	206	2,549	9,404
Partial Body Contact Recreation (mi)	2,184	8,778	58,456	3,974	2.5	17	3,009
Total Body Contact Recreation (mi)	185	8,739	58,422	4,435	2.5	113	4,525
Fish Consumption (mi)	2,482	82	21,817	786	1,867	94	50,158
Public Water Supply (mi) *	99	0.1	475	17	0	0	0

* Approximately 592 of the 76,433 river miles are protected for the public water supply designated use.

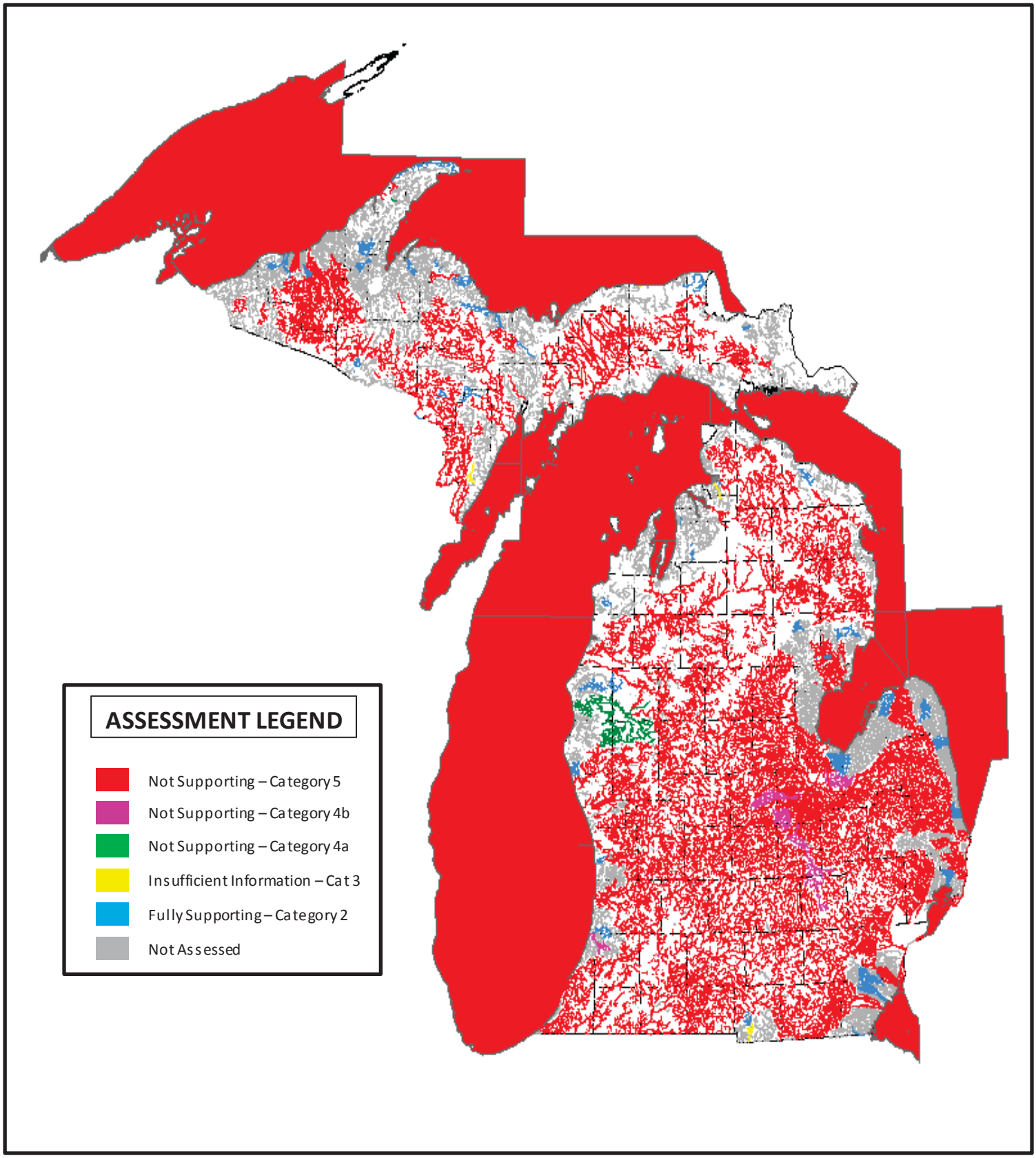


Figure 7.1 Fish Consumption Designated use Support for Michigan Waters

Figure 7.2 Waters Not Supporting the Fish Consumption Designated Use Based on Mercury in Fish Tissue (Category 5)

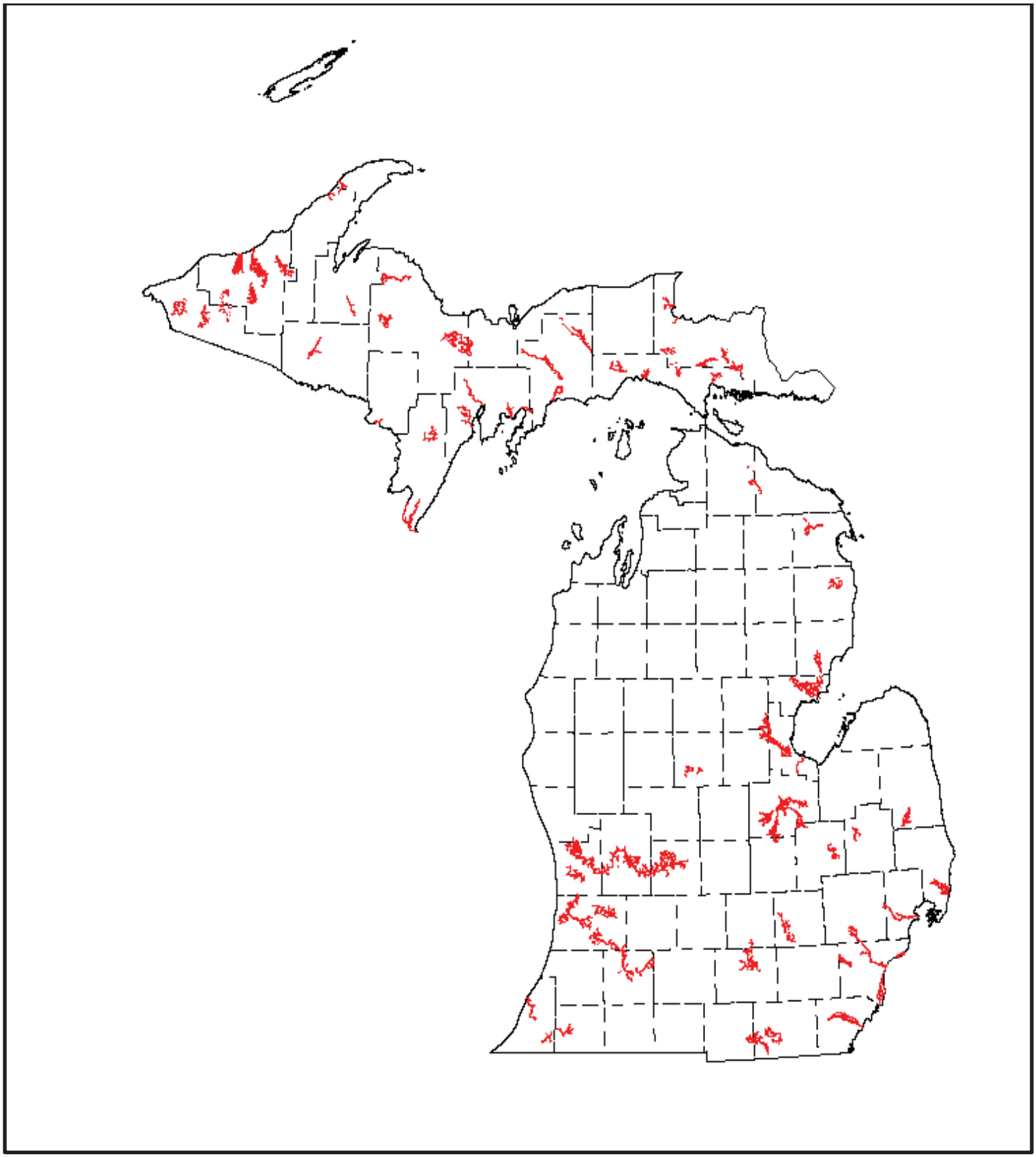


Figure 7.3 Waters Not Supporting the Fish Consumption Designated Use Based on Mercury in Water Column (Category 5)

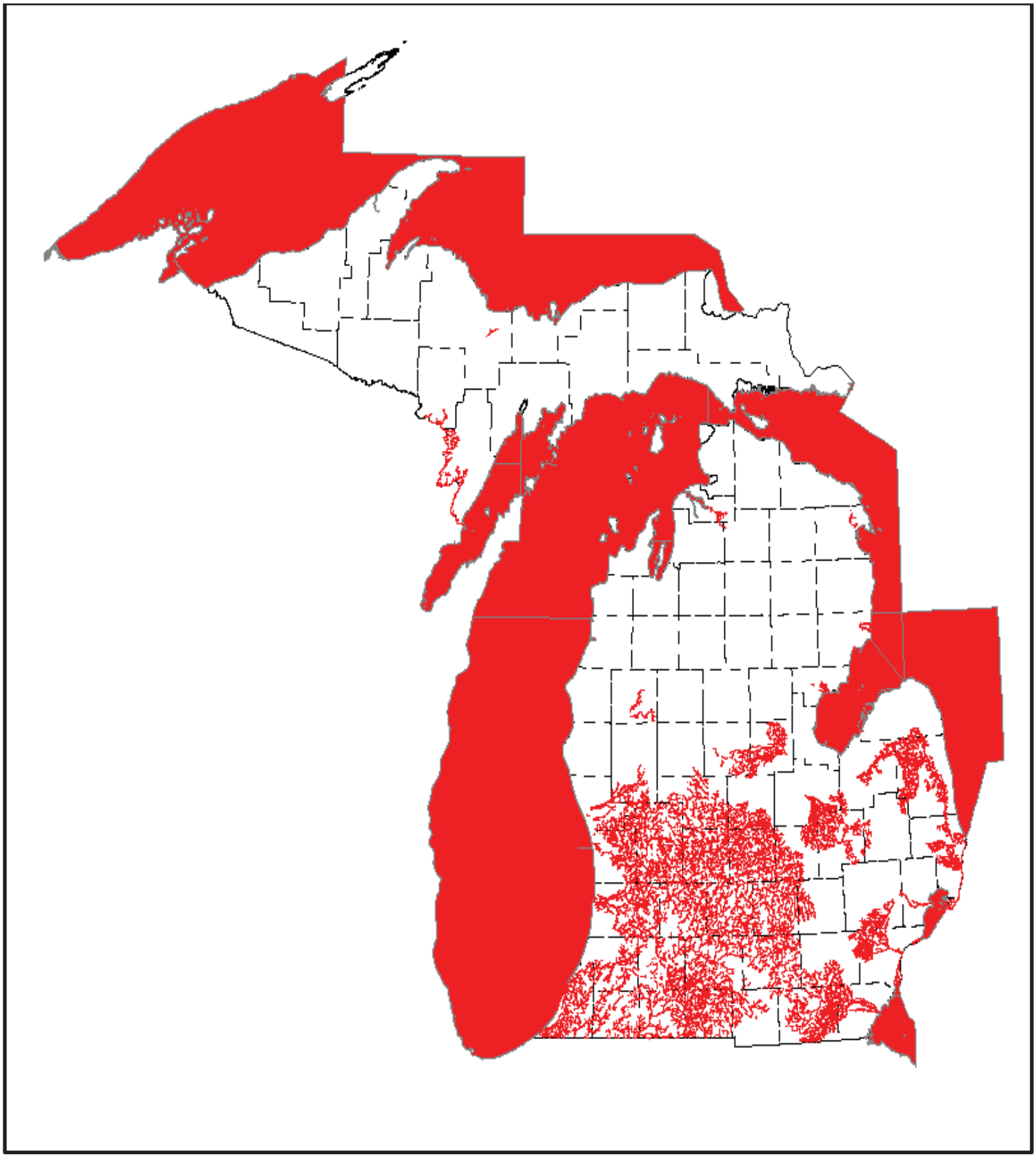


Figure 7.4 Waters Not Supporting the Fish Consumption Designated Use Based on PCB in Fish Tissue (Category 5)

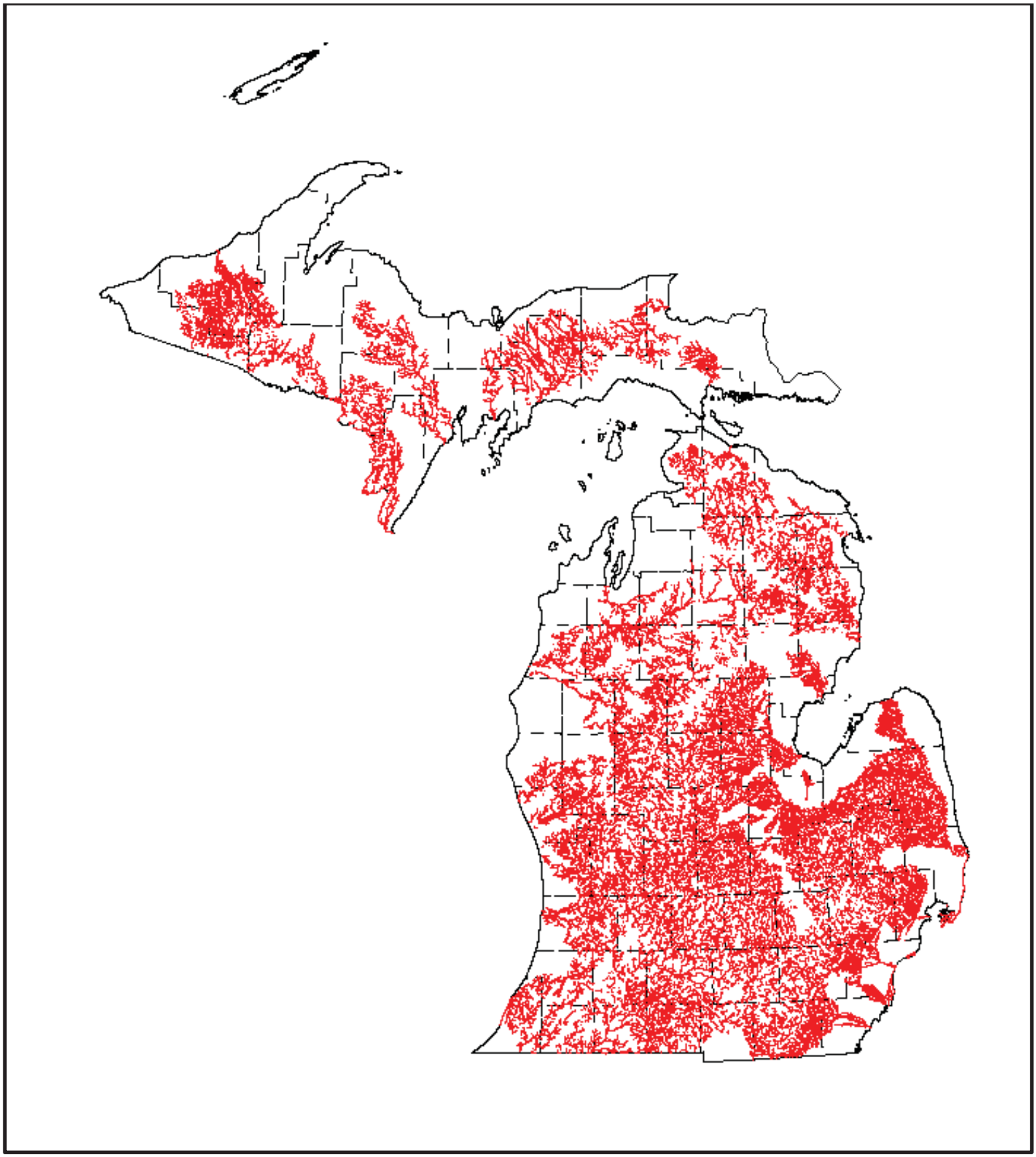


Figure 7.5 Waters Not Supporting the Fish Consumption Designated Use Based on PCB in Water Column (Category 5)

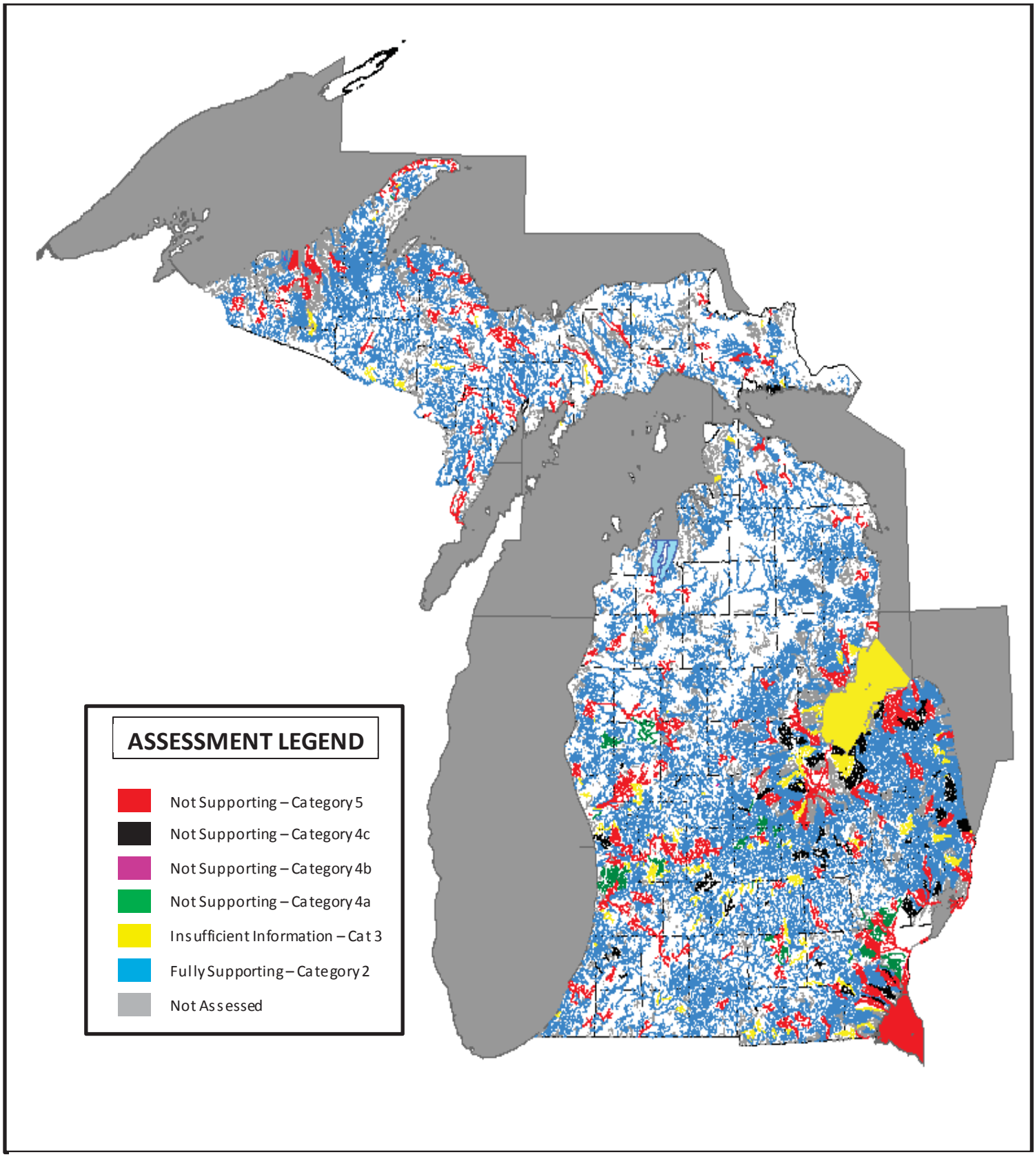


Figure 7.6 Other Indigenous Aquatic Life and Wildlife Designated Use Support Summary for Michigan Waters

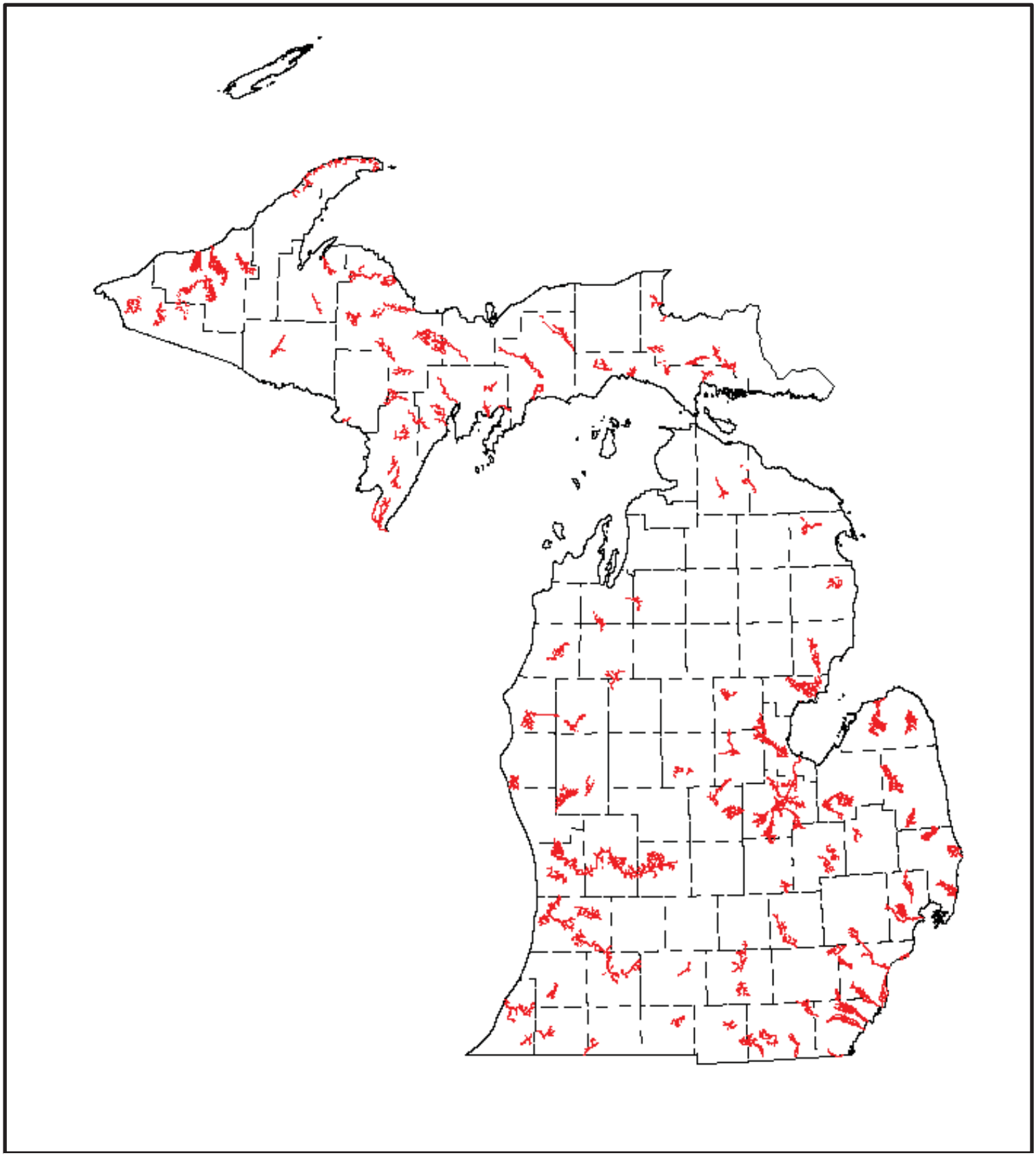


Figure 7.7 Waters Not Supporting the Other Indigenous Aquatic Life and Wildlife Designated Use Based on Mercury in Water Column (Category 5)

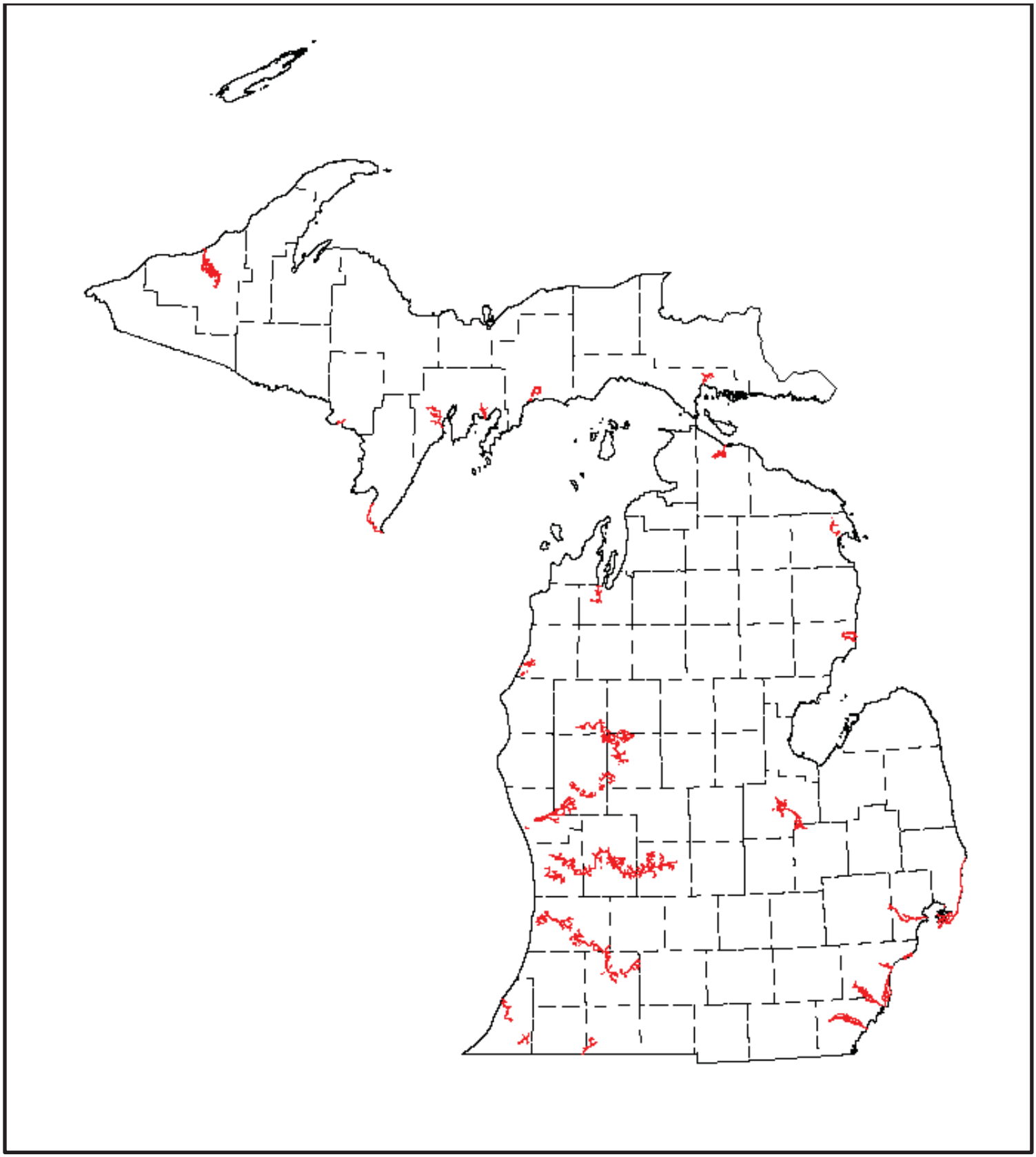


Figure 7.8 Waters Not Supporting the Other Indigenous Aquatic Life and Wildlife Designated Use Based on PCB in Water Column (Category 5)

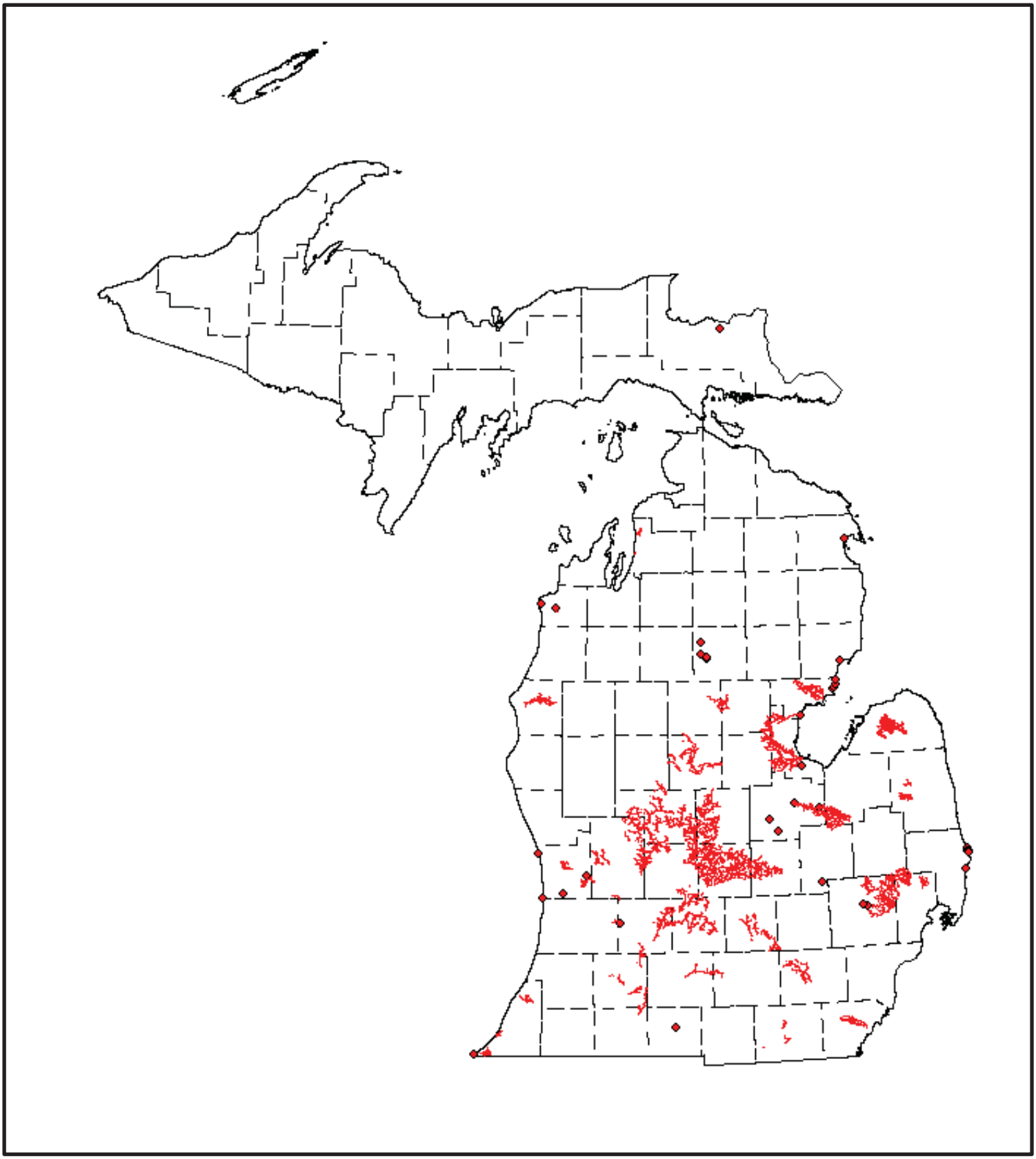


Figure 7.9 Waters and Beaches Not Supporting the Total Body Contact Designated Use Based on E. coli Concentration (Category 5)

CHAPTER 8
ASSESSMENT RESULTS: WETLANDS

8.1 Designated Use Support Summary

Michigan's WQS apply to all surface waters of the state, including wetlands. However, some criteria may not be applicable to wetlands. For example, a highly productive wetland with abundant vegetation in shallow water and high organic content in the sediment may naturally exhibit low dissolved oxygen levels in the water column. Based on Rule 100(10) of the WQS, use attainability studies are allowed for certain wetlands to address this situation.

Michigan's wetlands are currently assessed for designated use support on an as needed basis. The known designated use support information is listed in Table 8.1. Michigan uses a multiple category system (i.e., assessment units may be placed in one or more category, see Section 4.11); therefore, wetland acres are not totaled. Details regarding the five listed wetlands follow. Impairment cause and source information for assessment units not supporting designated uses is presented in Chapter 9.

- A small wetland area in the Grand River watershed (0.25 acres in Jackson County) is listed as having insufficient information to determine if the other indigenous aquatic life and wildlife designated use is supported due to point sources discharges and contaminated groundwater.

- Tobico Marsh (Bay County), a 680-acre marsh adjacent to Saginaw Bay, is not supporting the fish consumption designated use due to elevated PCB concentrations in carp and northern pike populations. Carp and northern pike were collected and analyzed between 2007 and 2012. These new data did not result in a change to the fish consumption advisory.

- Ruddiman Creek Lagoon (21 acres in Muskegon County) is not supporting the fish consumption, and total and partial body contact recreation designated uses. This wetland was the subject of a major sediment remediation project completed in 2006 that involved the removal of approximately 86,000 cubic yards of sediments contaminated with PCBs, metals, and polynuclear aromatic hydrocarbons.

- Clark's Marsh (Iosco County), a 420-acre marsh adjacent to the Au Sable River, is not supporting the fish consumption designated use due to elevated PFOS in bluegill and pumpkinseed sunfish sampled in 2011. This marsh is adjacent to the former Wurtsmith Air Force Base, an area of which was used regularly for fire suppression training with fire-fighting foams containing perflourinated compounds.

Table 8.1 Designated use support summary for Michigan wetlands (approximately 6,432,461 total acres). All wetland acres are not entered in the ADB. Wetlands that have specific information are entered into the ADB on a case-by-case basis. No wetlands are listed in Category 1 since comprehensive water quality data and/or information are not available for any locations. N/A indicates that the designated use is not applicable.

Designated Use	Supporting	Insufficient Information	Not Assessed	Not Supporting			
	Category 2	Category 3	Category 3	Category 4a	Category 4b	Category 4c	Category 5
Agriculture	6,432,461	0	0	0	0	0	0
Navigation	6,432,461	0	0	0	0	0	0
Industrial Water Supply	6,432,461	0	0	0	0	0	0
Warmwater Fishery	0	0	6,432,461	0	0	0	0
Coldwater Fishery	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other Indigenous Aquatic Life and Wildlife	10	0.25	6,432,020.75	0	0	0	430
Partial Body Contact Recreation	0	0	6,432,440	21	0	0	0
Total Body Contact Recreation	0	0	6,432,440	21	0	0	0
Fish Consumption	0	0	6,431,330	0	0	0	1131
Public Water Supply	N/A	N/A	N/A	N/A	N/A	N/A	N/A

CHAPTER 9
WATER BODIES NOT SUPPORTING DESIGNATED USES AND CWA SECTION 303(D) REQUIREMENTS

9.1 Introduction

The purpose of this chapter is to provide additional information regarding water bodies that are determined to not support one or more designated uses (i.e., water bodies that are listed in Categories 4 or 5; see Section 4.11 for a description of the categories). Section 303(d) of the CWA and the USEPA's Water Quality Planning and Management Regulations (40 CFR, Part 130) require states to develop TMDLs for water bodies that are not meeting WQS (i.e., water bodies that are listed in Category 5). The TMDL process establishes the allowable loadings of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. TMDLs provide states a basis for determining the pollutant reductions necessary from both point sources and NPS to restore and maintain the quality of their water resources.

9.2 Impairment Cause and Source

When a determination is made that a designated use is not supported (includes both Categories 4 and 5), the cause and source (when known) of impairment is identified (see Section 4.12). Each assessment unit may be listed for one or more causes and sources of impairment. The following tables are sorted by cause or source with the greatest geographic extent listed first.

9.2.1 Great Lakes and Connecting Channels

All of Michigan's Great Lakes, bays, and Lake St. Clair are listed as not supporting one or more designated use with various causes and sources of impairment (statewide total approximately 42,167 mi^2 / 3,049 shoreline miles; Tables 9.1 and 9.2).

Table 9.1 Michigan Great Lakes and bays not supporting designated uses listed by cause of impairment.

Cause	Total mi^2 / shoreline mi
Toxic organics	
PCBs in fish tissue	42,167 / 3,049
PCBs in water column	13.5 shoreline mi
PFOS in fish tissue	25,466 / 1,992
Dioxin	41,937 / 2,947
Pesticides	
Chlordane	29,944 / 1,975
DDT	13,250 / 1,058
Metals	
Mercury in fish tissue	41,943 / 2,998
Nutrients	118 / 37.5
Taste and odor	3 mi^2
Pathogens	5.7 shoreline mi

Table 9.2 Michigan Great Lakes and bays not supporting designated uses listed by source of impairment.

Source	Total mi^2 / shoreline mi
Atmospheric deposition	44,077 / 3,049
Agriculture	4,488 / 567
Contaminated sediment	1,137 / 0
Industrial point source discharge	3 / 0.2
Municipal point source discharge	118 / 37.6
NPS	118 / 37.9
On-site treatment systems	3.2 shoreline mi
Illicit connections	0.6 shoreline mi
Waterfowl	0.4 shoreline mi
Source unknown	936 shoreline mi

All Great Lakes connecting channel miles are listed as not supporting one or more designated use with various causes and sources of impairment (statewide total approximately 125 miles; Tables 9.3 and 9.4).

Table 9.3 Michigan connecting channel river miles not supporting designated uses listed by cause of impairment.

Cause	Total miles
Toxic organics	
PCBs in water column	125
PCBs in fish tissue	125
Dioxin	26
Metals	
Mercury in fish tissue	125
Mercury in water column	26
Pathogens	49
Pesticides	
DDT	26

Table 9.4 Michigan connecting channel river miles not supporting designated uses listed by source of impairment.

Source	Total miles
Atmospheric deposition	125
CSOs	49
Illicit connections	33
Source unknown	24

9.2.2 Inland Lakes and Reservoirs

Many inland lakes and reservoirs that do not support one or more designated uses are impacted by atmospheric deposition of mercury and/or PCBs. Several other causes and sources of impairment are also identified (statewide total approximately 872,037 acres; Tables 9.5 and 9.6).

Table 9.5 Michigan inland lake and reservoir acres not supporting designated uses listed by cause of impairment.

Cause	Total acres
Metals	
Mercury in fish tissue	292,536
Copper	3,174
Zinc	480
Mercury in water column	559
Toxic organics	
PCBs in fish tissue	150,162
Dioxin	20,137
Polycyclic Aromatic Hydrocarbons	480
PCBs in water column	806
PBBs	86
PFOS	1,412
Pesticides	
Chlordane	14,376
DDT	278
Nutrients	6,658
Pathogens	2,193 4.4 shoreline mi
Selenium	408
Excess algal growth	4284

Table 9.6 Michigan inland lake and reservoir acres not supporting designated uses listed by source of impairment.

Source	Total acres
Atmospheric deposition	326,347
Source unknown	17,033 3.6 shoreline mi
Contaminated groundwater	1,412
Contaminated sediment	8,700
Municipal point source discharges	3,741
Agriculture	6,698 0.6 shoreline mi
Mine tailings	3,102
Copper	35
Industrial point source discharges	1,375
CSOs	1,161
Internal nutrient recycling	408
Unspecified storm sewer	2,167
Sewerage discharge in unsewered areas	734
Construction- site clearance	2
Waterfowl	0.2 shoreline mi
Non-point source	4,466
Illicit Connection/Urban Runoff/Storm Sewers	1,038

9.2.3 Rivers

Many rivers that do not support one or more designated uses are impacted by atmospheric deposition of mercury and/or PCBs. Several other causes and sources of impairment are also identified (statewide total approximately 76,421 miles; Tables 9.7 and 9.8).

Table 9.7 Michigan river and stream miles not supporting designated uses listed by cause of impairment.

Cause	Total mi
Toxic organics	
PCBs in water column	49,710
PCBs in fish tissue	22,142
Dioxin	727
PBBs	189
PAHs	2
PFOS in fish tissue	87
PFOS in water	49
Metals	
Mercury in fish tissue	7,988
Mercury in water column	7,904
Copper	107
Flow alterations	3,722
Pathogens	8,962
Habitat alterations	3,045
Bacterial slimes	25
Sedimentation/siltation	1,909
Oxygen depletion	901
Nutrients	581
Organic enrichment (sewage)	76
Pesticides	
DDT	189
DDT in fish tissue	3
Chlordane	285
Cause unknown	709
Excess algal growth	80
Thermal impacts	54
Aquatic plants	28
Selenium	168
Total suspended solids	27
Total dissolved solids	118
pH (caustic)	1

Table 9.8 Michigan river and stream miles not supporting designated uses listed by source of impairment.

Source	Total mi
Atmospheric deposition	52,552
Source unknown	9,498
Habitat alterations	4,187
Hydromodifications	3,379
Municipal permitted discharges	2,245
Storm water permitted discharges	2,473
Agriculture - grazing	1,969
Agriculture - crop production	1,952
Agriculture - animal feeding/handling	1,898
Spills and unpermitted discharges	1,611
Urban related runoff/storm water	2,102
Legacy/historical pollutants	802
Industrial permitted discharges	716
NPS	3,271
Land application/waste sites	537
Natural	125
Resource extraction	148
Groundwater loadings	77
Construction	22

9.2.4 Wetlands

Three wetlands, Tobico Marsh (680 acres in Bay County) Ruddiman Creek Lagoon (21 acres in Muskegon County), and Clark's Marsh (430 acres in Iosco County) are not supporting the fish consumption designated use. PCBs are the cause of impairment for the first two with multiple sources listed; PFOS is the cause of impairment for the latter with non-point and groundwater sources listed (statewide total approximately 6,432,461 acres; Tables 9.9 and 9.10).

Table 9.9 Michigan wetland acres not supporting designated uses listed by cause of impairment.

Cause	Total acres
Toxic organics	
PCBs in fish tissue	701
PCBs in water column	430
PFOS in fish tissue	430
Pathogens	21

Table 9.10 Michigan wetland acres not supporting designated uses listed by source of impairment.

Source	Total acres
Atmospheric deposition	1,131
Groundwater loadings	1,110
Land application/waste sites	680
Non-point source	430
Sewage discharge in unsewered area	21

9.3 TMDL Development

9.3.1 The TMDL Process

Michigan's Section 303(d) list consists of assessment units that are listed in Category 5. A TMDL is developed for each cause (see Section 9.2) or a TMDL may address more than one related cause.

Development of a TMDL is typically preceded by collection of water quality data by the MDEQ or its contractors to document current pollutant loads within the water body of concern and further define potential sources of the pollutant. These data, in addition to any other relevant information, form the basis for determining the necessary pollutant load reductions. A TMDL document is comprised of several sections including identification of the impaired assessment unit and cause of impairment, description of water quality studies conducted to identify the extent and source(s) of the impairment, and calculation of necessary load reductions for the point source and NPS to achieve WQS. The TMDL also identifies any past, current, or future known actions to remedy the impairment and a monitoring schedule to track improvements following implementation of the TMDL.

The TMDL document is typically developed by staff members of the MDEQ. The draft document is made available for public review on the MDEQ's Web site for at least 30 days. The

announcement for the public comment period is published in the MDEQ calendar. During the public comment period, the MDEQ staff normally hold a public meeting in a community near the impaired water body to describe the TMDL and receive comments. Local stakeholders, including the general public, LHDs, local government, and county extension officials are sought to attend the meetings to contribute their expertise in identifying pollutant sources and discuss source reduction/elimination. Following the comment period, the TMDL is modified as appropriate to address comments received.

The TMDL is finalized following the public comment period and submitted to the USEPA, Region 5, for their review and approval. The USEPA has 30 days to review and approve or disapprove a TMDL. After a TMDL is approved by the USEPA, the water body is removed from the Section 303(d) list (Category 5) and reclassified as Category 4a. For additional information regarding delisting Category 5 assessment units see Section 4.13.

9.3.2 TMDLs Completed

The DEQ submitted the statewide PCB TMDL in 2013, but as of the drafting of this report it had not yet been approved by USEPA. In 2014, the DEQ shifted the TMDL focus from the strict pace requirements to the newly-developed Long-term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program. The DEQ developed an approach to TMDL prioritization for the 2016-2022 time period, and as a result did not submit any TMDLs in 2014. Although not completed, progress was made on the statewide mercury TMDL, copper TMDLs, and Cass River E. coli TMDL. Additional information regarding approved TMDLs is available at http://www.michigan.gov/deqwater under Water Quality Monitoring, Assessment of Michigan Waters, TMDLs.

9.3.3 TMDL Schedule per Michigan's 2016-2022 Prioritization Framework for the Long-Term Vision for Assessment, Restoration, and Protection Under the Clean Water Act Section 303(d) Program

In December 2013, the USEPA announced the "Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303(d) Program" (TMDL Vision). The TMDL Vision includes six goals: Engagement, Prioritization, Protection, Integration, Alternatives, and Assessment. An evaluation of the accomplishments of the TMDL Vision's goals is to be completed in 2022.

"Prioritization" is defined by the TMDL Vision as a systematic approach developed by individual states to prioritize watersheds or waters for TMDL development, restoration, and protection for incorporation into the 2016 Integrated Report. Once a state identifies its priorities, it will be expected to address all of them between 2016 and 2022 through a combination of TMDLs, alternative approaches, program integration, public engagement improvements, and protection activities. In keeping with this approach, priorities identified in the TMDL Vision document will be assigned a TMDL date of 2022, signifying their anticipated completion by the end of 2022. Similarly, those TMDLs that were not identified as a priority in this first TMDL Vision document will be assigned a TMDL date of post-2022 (denoted as > '22 in the ADB), signifying their reevaluation for prioritization during the next TMDL Vision review process. The full TMDL Vision document can be found in Appendix F. This document was submitted by the MDEQ and agreed upon by USEPA Region 5 in September, 2015.

In the past, Michigan did not prioritize TMDLs based solely on watershed location, cause, or pollutant. When a water body was identified as impaired, it was added to the TMDL schedule

with a goal of completing a TMDL within 13 years of the first listing (per USEPA guidance). The TMDL schedule published in the 2014 IR ran through 2031. In contrast, the TMDL Vision approach focuses less on TMDL production and more on how the Section 303(d) Program can support water quality objectives of Michigan. Therefore, the TMDL Vision allows the opportunity to better align TMDL priorities with WRD priorities.

In 2009, the WRD identified five major goals to define aspects of this mission: (1) Enhance Recreational Waters; (2) Ensure Consumable Fish; (3) Protect and Restore Aquatic Ecosystems; (4) Ensure Safe Drinking Water; and (5) Protect Public Safety. For each goal, measurable outcomes (measures of success) are identified. The 2016 TMDL Vision priorities are linked to these goals and measures of success to ensure better engagement and integration with other WRD programs. The 2016 TMDL Vision priorities are summarized below and described more fully along with the associated linkages to the WRD goals in Appendix F.

9.3.3.1 *Statewide Pathogen TMDL*

Michigan has 615 public beaches on the Great Lakes and connecting channels, 602 inland lake beaches, and over 1,400 publicly maintained boat launches making our waters accessible to everyone. Michigan also has over 76,000 miles of rivers, almost 900,000 acres of inland lakes and reservoirs, and over 40,000 square miles of Great Lakes and bays (including Lake St. Clair), all of which are designated for Total Body Contact recreation from May 1 through October 31 and for Partial Body Contact Recreation year-round. Michiganders and the MDEQ are proud of their beautiful beaches and care about water quality and keeping the people of Michigan and our visitors safe while recreating in Michigan's waters.

The MDEQ has worked toward achieving its priority goal of clean beaches for recreation through an extensive investment of resources. However, in 2013, the MDEQ estimated that 48 percent of the rivers and streams exceed the Total Body Contact Recreation designated use and 20 percent of monitored beaches have had closures due to bacterial pollution (MDEQ, 2014). To help attain the goal of enhancing recreational waters and tie together the efforts that Michigan continues to expend on reducing *E. coli* contamination of surface waters, the MDEQ has made it a priority to develop a pathogen TMDL that will address all waters impaired by *E. coli.*

This TMDL will identify waters where action is needed, set an *E. coli* concentration target based on protecting the Total and Partial Body Contact Recreation designated uses, and identify needed pollutant reductions in all waters that are not meeting these designated uses. The statewide *E. coli* TMDL will apply to impaired waters only, including inland lakes, rivers, and streams, beaches, and the Great Lakes.

In 2014, pathogen TMDLs were scheduled to be developed annually in Michigan for the next 17 years. The statewide *E. coli* TMDL will eliminate the need for numerous individual watershed-based *E. coli* TMDLs and the associated repetitive paperwork burden, long wait periods, and staff time spent on TMDL development. A statewide TMDL will save the MDEQ a significant amount of resources that would have been spent writing watershed-based TMDLs, while providing a faster path to implementation. For example, we can accelerate water quality restoration through implementation in National Pollutant Discharge Elimination System (NPDES) permits, particularly MS4 permits, by more than a decade. Interested stakeholders can be assisted with source assessment, monitoring, and restoration solutions in their watershed to provide more site-specific information to enhance TMDL implementation at the local level. In these ways, our statewide *E. coli* TMDL aligns with the purpose of the USEPA's

TMDL Vision, which emphasizes a path to better implementation of the Clean Water Act Section 303(d) program, water quality restoration, and coordination of water programs.

9.3.3.2 Statewide Mercury TMDL

Reducing human and wildlife exposure of mercury is also a priority in Michigan. The Michigan Department of Community Health continues to issue general fish consumption advisories and guidelines for all inland lakes in Michigan, and specific recommendations for Lakes Huron, Michigan, and Superior, and several hundred miles of rivers and streams due to mercury concentrations in fish tissue. Because of the widespread impairment of Michigan's waters due to mercury, a statewide TMDL is being developed for inland waters primarily impacted by atmospheric deposition of mercury. The statewide mercury TMDL will include needed mercury reductions from air sources and water dischargers to protect and restore inland waters.

MDEQ has already submitted a statewide inland water TMDL for PCBs (August 2013) and is awaiting USEPA approval.

9.3.3.3 Additional TMDL Activities per Michigan's Vision

In addition to the statewide E. coli, Mercury, and PCB TMDLs, the following TMDLs will be submitted for USEPA approval prior to 2022 as part of Michigan's TMDL Vision.

- Grand River/Red Cedar River Dissolved Oxygen TMDL.
- Ox Creek Sediment/Biota TMDL.
- Trap Rock River and Owl Creek Copper TMDLs.
- Bad Axe Creek *E. coli* and Phosphorus TMDL (with USEPA contract support).
- Cass River watershed *E. coli* TMDLs. (Already public noticed and complete, but not submitted) It is expected that work to reduce *E. coli* will also result in reducing levels of nutrients and sediment entering surface waters, since many best management practices designed to mitigate sources of *E. coli* may also remove other pollutants.)

Michigan's 303(d) list, including assessment unit information and TMDL year, is presented in Appendix C.

9.3.4 Changes to the Section 303(d) List

Modifications to the 2014 Section 303(d) list to create the 2016 Section 303(d) list are provided in Appendix D. This list reflects the deletion and addition of assessment units or causes of impairment since the 2014 IR. Section 303(d) delisted assessment units may or may not support designated uses. For example, it may have been determined that the assessment unit is not supporting one or more designated uses but a TMDL is not required, or a cause of impairment may have been removed but a TMDL is still required to address a different cause of impairment. A brief delisting reason is provided in Appendix D; detailed information may be found in the comment field in the ADB via the MiSWIMS (http://www.michigan.gov/miswims). Deletions and additions to the Section 303(d) list presented in Appendix D are also displayed on the following maps (Figures 9.1 and 9.2).

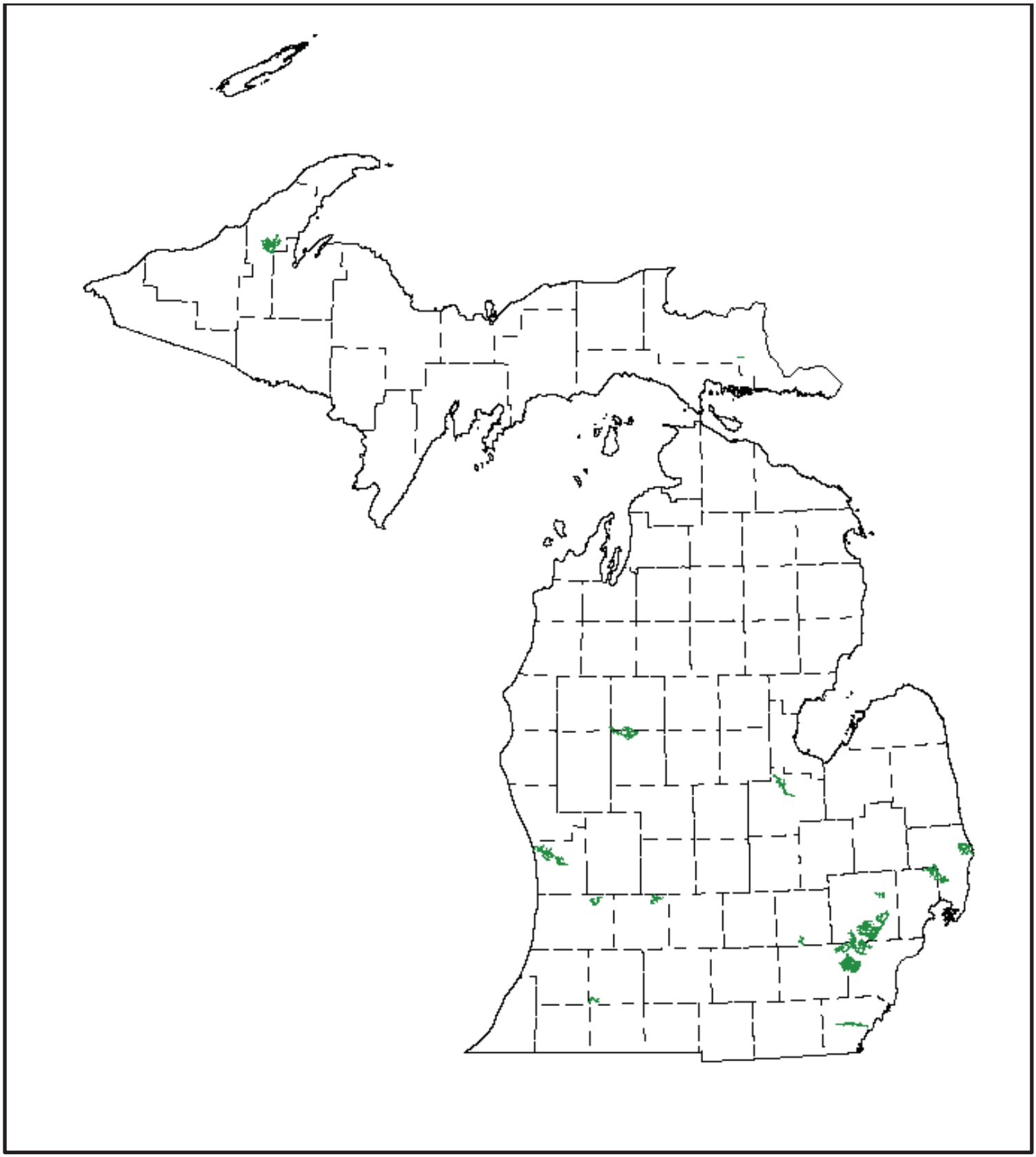


Figure 9.1 Section 303(d) Delistings. This information is displayed in table format in Appendix D1.

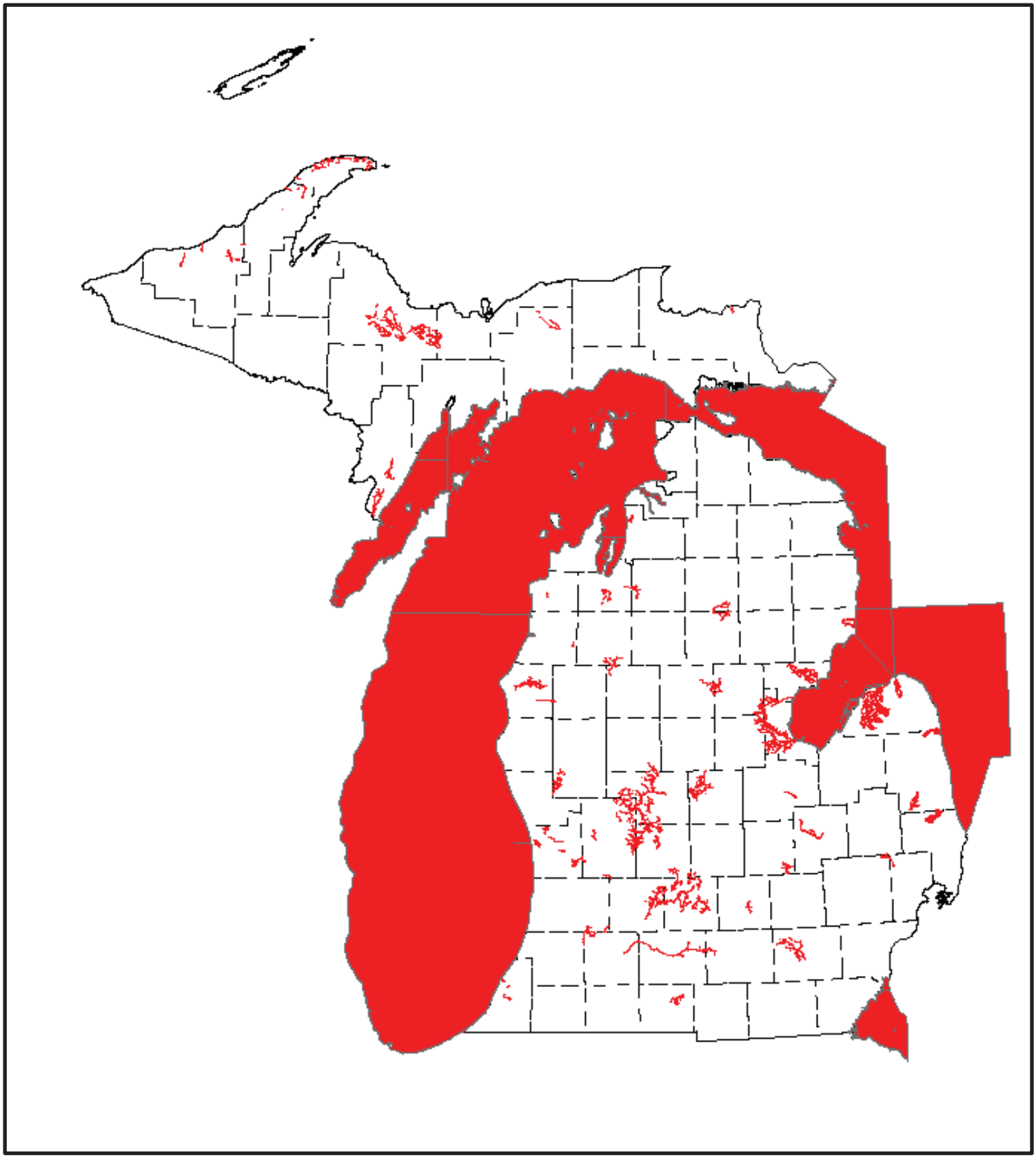


Figure 9.2 Section 303(d) New Listings. This information is displayed in table format in Appendix D2.

CHAPTER 10
PUBLIC PARTICIPATION IN THE IR

10.1 Introduction

The MDEQ provides opportunities for public participation in the development of the IR. The following information is a summary of those opportunities, the comments or information received from the public, and the MDEQ's response.

10.2 Request for Data

The MDEQ, WRD, requested ambient water quality data (chemical, biological, or physical) that was obtained by other governmental agencies, nongovernmental organizations, or the public for Michigan surface waters since January 1, 2013. All water quality data submitted to the MDEQ, WRD, before March 6, 2015 was evaluated according to the MDEQ's assessment methodology (see Chapter 4) and potentially used to help prepare this IR. This request was published on the MDEQ's calendar on January 12, January 26, February 9 and February 23, 2015, and e-mailed to key individuals in the MDNR's Fisheries Division, MDARD-Right to Farm, United States Forest Service, USFWS, University of Michigan, Alliance for the Great Lakes, and the USEPA. Additionally, the MDEQ, WRD, held a Webinar related to the final 2014 IR submittal and solicited contact information from those in attendance if they felt they had data that would be potentially useful in future IR processes; e-mail requests for data submittal were also sent to these respondents. Data were received from the following organizations: USEPA, Delhi Charter Township, USFWS, United States National Parks Service, Nottawaseppi Huron Band of Potawatomi Indians, LittleTraverse Bay Bands of Odawa Indians, Pokagon Band of Potawatomi Indians, Saginaw Chippewa Indian Tribe, Tip of the Mitt Watershed Council, Verso Paper Quinnesec Mill, City of Port Huron, Axalta Coating Systems, LLC, City of Saginaw, Muskegon River Watershed Assembly, Inland Seas Education Association, Trout Unlimited, The Watershed Center Grand Traverse Bay, Friends of the Rouge, and the Barry Conservation District. Table 10.1 summarizes whether these outside data were used, if so, how, and, if not, why.

10.3 Public Notice of Draft Assessment Methodology

A draft version of Chapter 4, the assessment methodology, was made available on the MDEQ's Web site for public review and comment. This announcement was published on the MDEQ's calendar on February 23 and March 9, 2015. Public comments to be considered in the development of Chapter 4 were due March 23, 2015. No public comments on the draft assessment methodology were received. Comments on the draft assessment methodology were received from the USEPA and are presented in their entirety in Appendix E.

Table 10.1 Summary of outside data received and their use in the 2016 IR.

Organization	Data Used?	How (if Yes or Partial), Why (if No)
Michigan Department of Natural Resources - Fisheries Division	Yes	Fisheries Data used to update relevant river and lake AUIDs
United States Geological Survey	No	C
National Park Service	Yes	Data reviewed and used to update relevant AUIDs
Pokagon Band of Potawatomi Indians	Partial	A; Data compared to current assessments and did not indicate changes necessary
Saginaw Chippewa Indian Tribe	Yes	E. coli data used for assessment decisions
Tip of the Mitt Watershed Council	Partial	A, B; Stover water chemistry/biological information used to update relevant AUID
Verso Paper Quinnesec Mill	No	A
Inland Seas Education Association	No	A, B
Trout Unlimited	Yes	Temperature and biological data used to support assessments in relevant AUID updates
The Watershed Center Grand Traverse Bay	Yes	E. coli data used to support assessments in relevant AUID updates
Friends of the Rouge	Yes	Biological data used to support assessments in relevant AUID updates
City of Saginaw Wastewater Treatment Facility	No	A, B
City of Saginaw - Water Treatment Division	No	A, B
United States Forest Service	Partial	A; Data compared to current assessments and did not indicate changes necessary
Little Traverse Bay Band of Odawa Indians	No	A, B
Barry County Conservation District	Yes	E. coli data used for assessment decisions.
Delhi Charter Township	No	A

A. Data did not meet minimum requirements for sample size and/or duration
B. Data for parameters not currently used as assessment indicators
C. Data retrieval and manipulation problems

10.4 Public Notice of the Draft IR

A draft version of this IR was made available on the MDEQ's Web site for public review and comment from December 2, 2015, through January 8, 2016. This announcement was published on the MDEQ's calendar on November 30, December 14, and 28, 2015. A Webinar was held during the public review and comment period to present information on the IR process, highlight changes between the 2014 and 2016 IR, present the MDEQ's new TMDL prioritization vision, and solicit input and comment on the draft document. Comments on the draft IR were received from the Alliance for the Great Lakes / Michigan League of Conservation Voters, Bay County Director of Environmental Affairs and Community Development, Michigan Farm Bureau, Huron River Watershed Council, Great Lakes Indian Fish and Wildlife Commission, Southeast Michigan Council of Governments, and the USEPA.

The MDEQ recognizes the importance of public comments and thanks individuals and organizations that provide input, express water quality concerns, or pose questions. The following section summarizes the MDEQ's response to the comments received pertaining to the Draft 2016 IR. Public and USEPA comments to the Draft Integrated Report are presented in their entirety in Appendix E

Comment #1:

Michigan improperly avoids making a listing decision on nutrients and algae impairment of western Lake Erie and Saginaw Bay. Michigan continues to report 1,262 square miles of Saginaw Bay and western Lake Erie as not having sufficient information to determine whether designated uses are supported due to algae and nutrient pollution. Michigan's failure to make an impairment determination for these areas is improper since Michigan is required to evaluate and list all waters failing to meet any applicable water quality standard. Michigan should assemble and evaluate all existing and readily available water quality-related data and information against its narrative standards. (Alliance for the Great Lakes/Michigan League of Conservation Voters)

MDEQ Response:

As you appropriately comment, based on what we know about persistent significant algal blooms mid-late summer in western Lake Erie from both our own shoreline monitoring and satellite imagery data available from the NOAA an impairment assessment based on the narrative standard is not unreasonable. Michigan has made the decision to add a Not Supporting (Category 5) listing for the Other Indigenous Aquatic Life and Wildlife designated use for all waters of Michigan's portion of Lake Erie based on nuisance conditions related to nutrient expression. As discussed in Section 5.7 of this report, the MDEQ, along with the MDARD and MDNR, believe the best approach for solving the issues in western Lake Erie is through the collaborative process established under Annex 4 of the Great Lakes Water Quality Agreement and the Western Basin of Lake Erie Collaborative Agreement as they afford a holistic, multi-jurisdictional perspective that is outside the scope of a TMDL process.

Nonetheless, we recognize that a TMDL or other approach allowed by the USEPA to address impaired waters under the CWA will be required unless designated uses are restored first. Michigan's TMDL schedule is aligned with the TMDL vision process described in Section 9.3.3. and Michigan's current TMDL vision, which identifies TMDL expectations through 2022, completed in 2015. Michigan is strongly committed to reducing phosphorus loadings to western Lake Erie; further information regarding this assessment decision is outlined in Section 5.7.

The Final 2016 IR has been edited to reflect this change in assessment for Michigan's portion of Lake Erie and submitted to the U.S. EPA for review.

Comment #2:

Maumee River basin tributaries. Additional effort should be made to address nonpoint agricultural runoff into Lake Erie, particularly from sources in the Maumee River basin. (Alliance for the Great Lakes/Michigan League of Conservation Voters)

MDEQ Response:

We concur that this is an important component to addressing Lake Erie nutrient issues. As noted in Michigan's Implementation Plan (January 14, 2016), the MDEQ has developed a specific monitoring plan to better understand current conditions in the Michigan portion of the Maumee River watershed, explained in further detail in Appendix C of the Implementation Plan. In addition to the monitoring work planned for the 2016 season, the MDEQ is working with Indiana and Ohio to understand information needs and synchronize the focus and approaches with these states to achieve target nutrient reductions.

Comment #3:

Raisin River. Michigan should continue to monitor and implement actions to reduce phosphorus discharge from Raisin River. (Alliance for the Great Lakes/Michigan League of Conservation Voters)

MDEQ Response:

We agree that this is another important component to addressing Lake Erie nutrient issues. As noted in Michigan's Implementation Plan (January 14, 2016), the MDEQ has committed to evaluating the need to control phosphorus in the Monroe POTW discharge as well as continuing to understand and implement actions in the River Raisin watershed aimed at maintaining and furthering the phosphorus reductions already realized.

Comment #4:

Huron River watershed TMDLs. Michigan should monitor existing nutrient TMDLs and accelerate completion of nutrient TMDLs within the Huron River watershed. (Alliance for the Great Lakes/Michigan League of Conservation Voters)

MDEQ Response:

The impaired water bodies within the Huron River watershed, and throughout the state, were reviewed and prioritized as part of the new TMDL Vision as described in Section 9.3.3 and Appendix F of the 2016 IR. Through the TMDL Vision process, some impaired waters have been prioritized for TMDL development over the next 6 years (e.g. Statewide E. coli and Mercury TMDLs) while others will be addressed in/beyond 2022. However, there are currently no additional water bodies within the Huron River watershed that are listed as impaired and for which nutrients have been identified as causing the impairment. Specifically, portions of Letts Creek, Smith Creek, and Silver Creek are currently listed as needing a TMDL to address the Other Indigenous Aquatic Life and Wildlife non-attainment, but the specific impairment cause has yet to be identified. The MDEQ conducts routine follow-up monitoring related to the Ford and Belleville Lakes TMDLs every two years, with 2016 being the next sampling cycle. This monthly monitoring at multiple stations within both impoundments collects data on water quality which includes total phosphorus and ortho-phosphorus, among others.

Comment #5:

Monitoring and assessment of harmful algae blooms (HABs). Michigan should work with other Lake Erie jurisdictions to develop consistent and coordinated monitoring efforts. (Alliance for the Great Lakes/Michigan League of Conservation Voters)

MDEQ Response:

The MDEQ has initiated intradepartmental efforts to better link the Water Resources Division (charged with water quality assessments, Integrated Report development, and TMDL development) and the Office of Drinking Water and Municipal Assistance (ODWMA) with respect to surface water quality assessment. Staff in the Source Water Assessment (ODWMA) and the Surface Water Assessment Section (WRD) continue to meet to investigate ways to increase data availability and use between programs, and to reflect source water concerns as they relate to the Public Water Supply designated use in the IR process. Staff from the WRD are participants in the HABs Collaboratory, organized by the Great Lakes Commission, aimed at identifying data availability, coordination opportunities, and gaps with regard to HABs in the Great Lakes. Staff from both the WRD and ODWMA were also recent participants in an EPA Region 5 HAB Clean Water Act/Safe Drinking Water Act workshop aimed at identifying shared HAB-related goals, needs, and barriers, particularly as they relate to source water protection and identifying next steps and key actions that programs can take to address them. Additionally, Michigan continues to work alongside Indiana and Ohio in addressing nutrient reduction to western Lake Erie as indicated in the Implementation Strategy.

Comment #6:

The table of contents (TOC) does not reflect the actual page and contents within the document. This is a housekeeping issue but please do check and remedy this as it is significant in places. For example Chapter 2 is titled Water Protection Activities and then presents 16 pages of 26 programs and funding activities that might be better presented in tabular form. (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:

Thank you for your comment, we have reviewed the TOC and edited, where appropriate, to ensure that the TOC matches the document. As a point of clarification, Chapter 2 is titled correctly in that it presents information on the broad array of programs within the MDEQ that address water protection; the narrative format used is able to provide more description of various program activities in a readable format. Chapter 2, however, as it is revised during each IR cycle is something that we keep discussing in terms of format and usefulness so the suggestion for a tabular format is one we'll consider for future cycles.

Comment #7:

The Saginaw Bay Coastal Initiative was created with encouragement from the DEQ and is a unique local grass roots collaborative working with DEQ and other agencies to improve and protect water quality and shoreline use of the Saginaw Bay. It should be included in the Integrated Report (IR) as it is still active and previous versions of the IR described activities undertaken and an update could be provided if requested. (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:

We appreciate the comments and perspective on the SBCI as an ongoing, relevant program attribute. We have reinserted that section into the IR as Section 2.25.3 to maintain its acknowledgement as a component in the ongoing protection of Saginaw Bay.

Comment #8:

If (Table of Contents) 2.26 Cost/Benefit Assessment is to remain in the document, the contribution of local funding, support and operations should be included and expanded to reflect the real local costs of water treatment, wastewater treatment, on-going maintenance of water protection systems, and the value of local stewardship as reported (at minimum) in DEQ grant records. (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:

We appreciate that 2.26 is far from complete, as stated in the second sentence. The numbers used in this section only help provide a brief description of the scale of activities in which the MDEQ is involved and are not meant to address the significant efforts and costs realized by local governmental entities as well.

Comment #9:

The TOC 4.7 Designated Use: Recreation Assessment Type: Physical/Chemical should include language here to address the Water Quality Standard that requires the state's surface waters not have any physical "deposits" in "unnatural quantities which are or may become injurious to any designated use." And include "Muck" here where currently only pH is presented. (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:
This suggestion to add Rule 323.1050 Physical Characteristics as an indicator for the Partial/Total Body Contact Recreation designated uses will be considered for incorporation during the 2018 IR process. This timing will allow discussion on the addition of Physical Characteristics as an appropriate indicator here, similar to its incorporation under 4.6.1.5. The WRD does not feel the term 'muck' will be useful as an indicator, specifically, due to the ambiguity of its meaning and the redundancy with the term 'deposits' under Rule 323.1050.

Comment #10:

At 5.1 and 5.3 Trophic Status, as in all previous IR's, the Saginaw Bay is listed as Eutrophic, having a high nutrient load, yet as we have previously commented in earlier IR's there still is no TMDL proposed to control nutrient loading into the Saginaw River and Bay...
... The MDEQ needs to include Saginaw Bay and western Lake Erie on the Section 303(d) list of waters that do not support their designated uses and require the development of Total Maximum Daily Loads. (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:

As a point of clarification, a eutrophic classification doesn't necessarily imply impairment nor require a TMDL, as specified in Section 4.6.1.2, fifth paragraph. Recent monitoring conducted by the Water Resources Division at beaches along Michigan's shoreline of Lake Erie, combined with extensive satellite imagery of cyanobacteria blooms in Lake Erie available from the NOAA

supports the addition of an impairment determination based on algae bloom impacts to Michigan's Lake Erie waters. Michigan is listing the Other Indigenous Aquatic Life and Wildlife designated use as Not Supporting (Category 5) for open and shoreline waters of the Michigan portion of Lake Erie based on nuisance conditions related to nutrient expression. As discussed in Section 5.7 of this report, the MDEQ, along with the MDARD and MDNR, believe the best approach for solving the issues in western Lake Erie is through the collaborative process established under Annex 4 of the Great Lakes Water Quality Agreement and the Western Basin of Lake Erie Collaborative Agreement as they afford a holistic, multi-jurisdictional perspective that is outside the scope of a TMDL process.

Nonetheless, we recognize that a TMDL or other approach allowed by the USEPA to address impaired waters under the CWA will be required unless designated uses are restored first. Michigan's TMDL schedule is aligned with the TMDL vision process described in Section 9.3.3. and Michigan's current TMDL vision, which identifies TMDL expectations through 2022, completed in 2015. Michigan is strongly committed to reducing phosphorus loadings to western Lake Erie; further information regarding this assessment decision is outlined in Section 5.7.

The Final 2016 IR has been edited to reflect this change in assessment for Michigan's portion of Lake Erie and submitted to the U.S. EPA for review. Additionally, efforts to conduct monitoring to better understand beach conditions at select Saginaw Bay beaches is being discussed with monitoring starting during the 2016 summer .

Comment #11:

…at the public beachfront at the Bay City State Recreational Area, the landowner Michigan Department of Natural Resources (DNR) Parks is prohibited from removing the muck on the shore or otherwise disturbing the non-vegetated sandy shoreline due to deed restrictions the US Army Corps of Engineers… (Bay County Environmental Affairs and Community Development Director)

MDEQ Response:

Based on information provided by MDEQ staff familiar with this area, it appears that the area where grooming currently isn't permitted would be potentially eligible for a permit to do so in the sand fore-dune area. It is our understanding that a permit for such activity, which it seems would help address the issue of muck on the beaches, could be applied for through the U.S. Army Corps of Engineers if the desire to pursue it exists.

Comment #12:

We appreciate being able to see the Department's assessment of sources and causes for impairment of those waters, and would like to have the opportunity to discuss further DEQ's process for identifying how different nonpoint sources contribute to overall water quality.

We request to be kept informed and to have the ability to participate in the development of any implementation plans for this new Vision that might affect how farmers in Michigan operate as a part of the landscape. (Michigan Farm Bureau)

MDEQ Response:

We appreciate Michigan Farm Bureau's interest and willingness to be active participants in working toward water quality improvements in Michigan. Your information has been added to contact lists related to the Integrated Report and the Statewide E. coli TMDL development process so that you'll be kept up to date and aware of opportunities for involvement in those processes. We encourage you to continue to reach out to the WRD if there are topics which you'd like to discuss or if there is information we can share with the Farm Bureau, as you have in the past with issues surrounding Lake Erie Harmful Algae Blooms, and Biological Monitoring.

Comment #13:

(Great Lakes Indian Fish and Wildlife Commission) staff, in cooperation with Scott Cardiff of the University of Wisconsin- Madison, have conducted water quality sampling and field investigations in several areas of the Michigan Upper Peninsula. Our review of the draft listing for 2016 Michigan Impaired Waters is informed by that work. We are concerned about inadequacies in the current draft listing for 2016 Michigan Impaired Waters for the Escanaba River system as well as gaps in monitoring data in other areas of the Upper Peninsula. (Great Lakes Indian Fish and Wildlife Commission)

MDEQ Response:

We appreciate the thorough review the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) has given the draft 2016 IR, particularly as it relates to selenium. Your comments prompted Fish Consumption Monitoring Program staff to revisit changes needed in the Escanaba River watershed. They were able to confirm that many of the above reaches you commented on needed to be updated based on the Department of Health and Human Services selenium-based fish consumption advisory. The following list of waterbodies and associated AUIDs have had their Fish Consumption designated uses updated with selenium as an added cause to reflect that omission.

040301100111-01	Bear Creek, Flopper Creek, Middle Branch Escanaba River
040301100110-01	East Branch Escanaba River, Halfway Creek, O'Neal Creek, Uncle Tom Creek
040301100108-03	Warner Creek, upstream M-35
040301100108-02	Warner Creek, downstream M-35
040301100108-01	East Branch Escanaba River, Fifteen Creek
040301100106-01	Schweitzer Creek, Ely Creek, Green Creek
040301100105-01	Bell Creek, Middle Branch Escanaba River
040301100107-01	Goose Lake Outlet
040301100107-03	Goose Lake Inlet

With regard to selenium data collected by the GLIFWC or it's partners in 2015, we would appreciate the submittal of that data for use in our 2018 IR review and development. Because the assessment and development timing for each IR cycle is an almost 2-year process, those data collected in 2015 will be reviewed for the 2018 IR cycle along with data collected in 2016. The MDEQ will release a call for data submittal, likely in early January, 2017, for consideration in the development of the 2018 IR, but data submittal any time leading up to that schedule will be held and considered in the 2018 IR cycle.

Comment #14:

GLIFWC staff are concerned with the proposed timelines for addressing the water quality standard exceedances through the development of a TMDL. (Great Lakes Indian Fish and Wildlife Commission)

MDEQ Response:

While you are correct that the TMDL development timeline has been modified, this in no way implies a lack of focus by the MDEQ and its partners on the important issue of selenium in the Escanaba River watershed. Because the selenium problem is due to nearby mining activity, a great deal of effort and expense have gone into, and are planned for, this area by the mine ownership working with the MDEQ. Cleveland Cliffs has submitted a compliance report and management plan to MDEQ concerning the selenium issues in and around the Empire and Tilden mines near Ishpeming, MI. This is a large and time consuming process addressing contaminated storm water management, onsite treatment, and storm water replacement to maintaining natural hydrology in seep watersheds; all with the goal of meeting selenium water quality standards by 2017.

Although the TMDL date has been revised, we anticipate selenium concentrations in these watersheds impacted by these mines will be below 5 micrograms per liter by the end of 2017. Selenium concentrations in fish tissue will take some time to respond to the >90% reduction in selenium discharges. DEQ and Cleveland Cliffs will monitor fish tissue over time and determine whether additional management of selenium is needed. We believe that fish tissue concentrations will drive future TMDL decisions. The TMDL schedule allows time for the ecosystem to react to the reduction in selenium discharge so that an appropriate TMDL can be developed, if necessary.

Comment #15:

The discussion and characterization of stamp sand impacts in the draft listing for 2016 Michigan Impaired Waters is inadequate. The report mentions impacts to Torch Lake and Crooked Lake and nothing more. Stamp sands are, in point of fact, severely impacting the nearshore areas of Lake Superior throughout the Keweenaw Peninsula. Impacts to fish habitat in Buffalo Reef near Gay, MI have been documented. The loss of Buffalo Reef would reduce genetic diversity in Lake Superior whitefish by 10%. In the Keweenaw Bay region, stamp sands have covered beaches and impacted the Keweenaw Bay Indian Community Reservation. (Great Lakes Indian Fish and Wildlife Commission)
MDEQ Response:

We recognize the historic impacts of copper mining, and particularly stamp sands, on portions of the Keweenaw Peninsula and nearshore Lake Superior. While historic data have generated impairment listings for water bodies such as Crooked and Torch lakes, additional information or new approaches to using existing data may provide additional information to aid in better assessing other water bodies. Based on your comments, we will be working with MDEQ Upper Peninsula District Staff to investigate identifying and using existing data (e.g. MDEQ and Michigan Technological University) to better assess historic stamp sand impacted areas for the 2018 IR process.

Comment #16:

We appreciate the new listings of bacteria impairments in Mill Creek in Appendix C and D2. From our water quality monitoring, we have observed increasing concentrations of *E. coli* and

shared this data with you. We have completed some limited source tracking as well (also shared with MDEQ), but more work is needed to determine sources. (Huron River Watershed Council)

MDEQ Response:

We appreciate this input and the data received from the HRWC that assisted with the new listings for Mill Creek this IR cycle. These specific listings are planned to be incorporated into the statewide E. coli TMDL currently in development.

Comment #17:

Have you received any updated information on the Wagner-Pink Drain *E. coli* impairment? Our understanding is that the cause was a discharge violation from many years ago and some work was done in collaboration with the Monroe County Drain Commissioner. We have not received any updates. Is further enforcement action warranted? (Huron River Watershed Council)

MDEQ Response:

Based on the illicit connections addressed by the Monroe County Drain Commissioner, it appears that updated monitoring information is needed. Our staff will be submitting a targeted monitoring request to propose follow-up monitoring during 2017, the next watershed year for the Wagner-Pink Drain. If so desired, the HRWC may also submit a targeted monitoring request as well to reflect your concern and interest in additional attention being paid to this water body. For your reference the Assessment Unit ID (AUID) is 040900050407-01.

Comment #18:

In the 2014 Integrated Report, the broad listings for PCB and Mercury impairments were listed for TMDL development in 2014. Now they are listed for 2022. The TMDL Vision indicates that the statewide PCB TMDL is completed and being reviewed by U.S. EPA, however, it does not appear to be publicly available. Please share. (Huron River Watershed Council)

MDEQ Response:

The date of 2022 indicates that, based on the new TMDL Vision, these TMDLs will be developed by 2022. Some, PCBs for instance, have already been developed and are currently in review by the USEPA, others (e.g. Mercury and E. coli) are under development and expected to be completed by, and likely well before, 2022. The Statewide PCB Draft TMDL can be found on the MDEQ web site at the following location: http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3686_3728-301290--,00.html .

Comment #19:

Many of the impaired waters listings do not have TMDL development dates listed (e.g. Appendix B, p. B-2821). Why is that? It would be helpful for us to have a better understanding of why those sections are listed as impaired, but there is no plan to address the impairments. (Huron River Watershed Council)

MDEQ Response:

The specific listing provided above (Appendix B2, page B-2821; Pleasant Lake Drain Tributary to Mill Creek) is listed as impaired for the Other Indigenous Aquatic Life and Wildlife designated use. However, the causes of impairment (Direct Habitat Alteration and Other Flow Regime Alterations) are not pollutants (signified by a "Y", meaning Yes, in the Pollutant column) and therefore not scheduled for a TMDL as described in Section 4.11 of the IR. Typically these non-pollutant impairments are the result of physical habitat alterations that preclude a healthy biological community from persisting, even in the presence of adequate water quality.

Comment #20:

We find it appalling that the State of Michigan is only able to commit 1.5 FTE addressing impaired waters across the entire state through the TMDL regulatory program. We understand the WRD has little input into the budgeting process, but we recognize that it represents a great misalignment in priorities. (Huron River Watershed Council)

MDEQ Response:

We appreciate this comment with regard to staffing levels associated with TMDL development. To clarify, the 1.5 FTE is associated specifically with TMDL development and not problem identification, monitoring, or implementation.

Comment #21:

It would be very helpful if MDEQ published GIS layers that include AUID segments and impairment attribute information. We only recently obtained 2014 impairment layers and find them very useful in our work to improve our water resources. (Huron River Watershed Council)

MDEQ Response:

The ability to readily access GIS data is input that we've received from a number of interested parties and something that we plan on providing following submission of the Final Draft IR to the USEPA. We mention this in the text box under Section 1.1 of the current Draft IR.

Comment #22:

Overall, the TMDL Vision is outlining a process that eliminates the watershed-based approach for improving the quality of our region's water resources while transferring the responsibility of defining the water quality problem to the local level through the NPDES program. Local agencies are not equipped to define the extent of the water quality problem in an approach similar to that of the MDEQ historically. TMDLs have historically defined the watershed, sources, loading capacity of the water body and have provided an estimate of the loading distribution by both point and nonpoint sources using the *E. coli* concentration standard as a target. Local agencies do not have the tools, staffing nor the financial resources to develop such a detailed assessment. (Southeast Michigan Council of Governments)

MDEQ Response:

The statewide approach of the E. coli TMDL applies only to E. coli and not other pollutants. Although a statewide approach, watersheds will still be integral to the process as well, in helping delineate problems as well as in monitoring and restoration. By devoting less time to TMDL

development, we expect to devote more time to monitoring, source identification, and restoration.

To be clear, impaired areas will still be defined by the MDEQ through our monitoring and IR processes. It is not expected that local stakeholders will help delineate the problem unless there is local desire to do so; if so, data may be submitted for consideration and assessment as is currently encouraged under the IR process.

Given the early stages of the development process for the statewide E. coli TMDL, it is premature to anticipate specifics with regard to links to the NPDES program. However, that information will be explained and shared during the development of the draft E. coli TMDL. Comments and input are welcomed during that process.

Comment #23:

As a prioritization framework, this document should clearly state how the MDEQ will identify priority areas and determine funding allocations for monitoring activities, especially relating to the Statewide Pathogen TMDL. The inability to define the statewide pathogen problem is evident by the lack of historical monitoring as compared to the needs for monitoring. Only 413 public beaches were monitored in 2013, but the state has 615 public beaches, 602 inland lake beaches and approximately 76,000 miles of rivers.

Given the lack of resources for defining the extent of the problem, it is important to prioritize the efficient use of public funds for this task. (Southeast Michigan Council of Governments)

MDEQ Response:

We agree that the lack of resources is a hindrance to defining the broad extent of problems that pathogens present. This recognition of limited resources is one reason the MDEQ's targeted monitoring solicitation process plays an important role in working toward addressing priority monitoring needs for stakeholders. Monitoring efforts by other agencies and groups, like the beach monitoring that occurs statewide through the efforts of local health departments, are also important in defining pathogen problems. The statewide pathogen TMDL approach helps shift effort that would previously be spent on watershed-specific TMDLs to efforts like improved monitoring and implementation. The TMDL Vision is a 6-year prioritizations framework, in order to maintain flexibility, the state chose not to summarize our prioritization in the VISION, but to focus first on developing the TMDL. Implementation is phase 2 and will be described more fully as the process progresses. We agree that prioritization is critical and it will be addressed through the implementation phase.

Comment #24:

Finally, the discussion about the proposed statewide pathogen TMDL should include the relevance and connection to the AOC program and specifically the Beach Closings Beneficial Use Impairment. Conversations with MDEQ staff have implied that once Beach Closings BUI is removed, then the statewide E. coli TMDL can include those beach areas. The impacts to removing the Beach Closings BUIs while there is still an *E.coli* problem are significant. First of all, there will be confusion amongst local agencies and the public as to what has actually been achieved.

Secondly, when the statewide TMDL is implemented through the NPDES program as a permit requirement, then those beach areas will no longer be eligible for various sources of funding. If the state places a high priority on cleaning up Michigan's beaches for recreation and tourism, then the state should not be eliminating potential sources of funding for AOC restoration while thinking that local compliance requirements through the NPDES program will solve the problem. (Southeast Michigan Council of Governments)

MDEQ Response:

It should be clarified that Beneficial Use Impairments removals under the AOC program are unrelated to the designated use impairment status. Based on the State's BUI removal criteria, with concurrence from EPA, the BUI can be removed when human sources of pathogens regulated by NPDES permits are scheduled to be controlled through implementation of permit requirements. From a funding perspective, grant projects that include BMPs already required by NPDES permits are not eligible for funding, regardless if a TMDL is present. Proposals that focus on mitigating storm water BEFORE it enters the MS4 infrastructure are eligible for 319 funding (if all the other requirements are met). The EPA has provided additional guidance for storm water control projects in urban areas (United States Environmental Protection Agency's Supplemental Guidance: Watersheds In and Near Metropolitan Areas -Preventing, Reducing, and/or Eliminating Impacts Associated with Urban Runoff). TMDL areas, or impaired areas, are generally given a higher priority for nonpoint source 319 grant funding. From an AOC perspective, the removal of the Beach Closings BUI would prevent the use of AOC funds to address that BUI, but green infrastructure projects could potentially be funded through the AOC program if intended to address other BUIs (such as the habitat degradation BUI); this is an AOC program issue and should be discussed with the appropriate AOC coordinating staff.

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