

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

Draft Assessment Methodology
May 25, 2009



LIST OF ACRONYMS

ADB	Assessment Database (USEPA)
BCC	Bioaccumulative Chemicals of Concern
BPJ	Best Professional Judgment
CAZ	Critical Assessment Zone
CSO	Combined Sewer Overflow
CWA	Clean Water Act
DDT	Dichlorodiphenyltrichloroethane
HCV	Human Cancer Value
HNV	Human Noncancer Value
HUC	Hydrologic Unit Codes
IR	Integrated Report
MDA	Michigan Department of Agriculture
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	Milligrams per kilogram
NHD	National Hydrography Dataset
ng/L	Nanograms per liter
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NREPA	Natural Resources and Environmental Protection Act
P51	Procedure 51
PCB	Polychlorinated Biphenyl
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
WQS	Water Quality Standards

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 data are reported using five categories. 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 and fisheries biology, limnology, ecology, environmental engineering and chemistry, microbiology, and mammalian/aquatic toxicology.



4.2 Data and Information Used to Determine Designated Use Support

The MDEQ considers readily available 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 data 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 2008 IR, which serves as a baseline for the 2010 IR and is modified using new data and information.

- Fish Consumption Advisories established by the MDCH as of May 2009.
- 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: March 30, April 13, April 27, May 11, and May 25, 2009. Information was also solicited from the MDNR Fisheries Division, Michigan Department of Transportation, MDA, United States Forest Service, USFWS, and USEPA via e-mail on April 14, 2009.
- 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, Environmental Remediation, of the NREPA.

To ensure adequate time for proper data analysis, the MDEQ applies a cutoff date for data considered for the IR. For the 2010 IR, the MDEQ considered all 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 data considered for the 2008 IR. In other words, data collected during the period from January 1, 2007, to December 31, 2008, were considered for the 2010 IR. Data collected prior to January 1, 2007, that were unable to be used for the 2008 IR were considered for the 2010 IR using the current assessment methodology. Data collected after the December 31, 2008, cutoff date were considered for inclusion in the 2010 IR on a case-by-case basis as determined appropriate by the MDEQ. Water quality data collected since January 1, 2007, and submitted to the MDEQ by June 5, 2009, by other parties was evaluated and potentially used to help prepare the 2010 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, 2005c). 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 Quality Assurance Project Plans prior to sample collection (MDEQ, 2002a). 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 (e.g., data collected by volunteers) 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 modified. Data may not be of adequate quality if field or laboratory methods

changed. 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. 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 may be considered.

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 [Rule 100; R 323.1100(1)(a)-(g)] of the Part 4 rules, WQS, promulgated under Part 31, Water Resources Protection, of the NREPA). 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, WQS, 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 concentration in fish tissue or PCB concentration 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 and human noncancer value (HNV) (non-drinking water) (R 323.1057); therefore, both the other indigenous aquatic life and wildlife, and fish consumption designated uses are not supported. Another example includes the situation where water column copper concentrations exceed the WQS and lead to both poor macroinvertebrate and warmwater fish communities; therefore, both the other indigenous aquatic life and wildlife, and warmwater fishery 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.

This section of the IR describes how data and information are generally used by the MDEQ to make a decision to report for a water body, one of the following conditions for each designated use: supporting, not supporting, insufficient information, or not assessed. This assessment methodology attempts to list the main assessment types and parameters that are used to determine support for each designated use. 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 using best professional judgment (BPJ) and are evaluated consistent with WQS. When 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).

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. Information regarding the support of these designated uses 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

4.5.1.1 Dissolved Oxygen Concentration

The number of instantaneous dissolved oxygen measurements needed to make a support determination for the warmwater and coldwater fishery designated uses is made on a case-by-case basis using BPJ. Continuous data collected over a longer time period (e.g., two weeks) are preferred over periodic single samples. Consideration of contextual information is especially important when making designated use determinations using dissolved oxygen concentrations (sample collection time of day, weather conditions, etc.). Ambient dissolved oxygen data are compared to WQS per R 323.1064 and R 323.1065, depending on water body type.

4.5.1.2 Temperature

The amount of temperature data needed to make a support determination for the warmwater and coldwater fishery designated uses is made on a case-by-case basis using BPJ. Continuous data collected over a longer time period (e.g., two weeks) are preferred over periodic single samples. Ambient temperature data are compared to WQS per R 323.1069, R 323.1070, R 323.1072, R 323.1073, and R 323.1075, depending on water body type.

4.5.1.3 Ammonia (un-ionized) Concentration

The number of total ammonia measurements needed to make a support determination for the warmwater fishery designated use is made on a case-by-case basis using BPJ. Supporting site-specific pH and temperature data are generally required. Continuous pH and temperature data over a longer time period are preferred. Calculated un-ionized ammonia data are compared to standards per R 323.1057.

4.5.1.4 Dissolved Solids

Designated use support determination using dissolved solids data is made on a case-by-case basis using BPJ and R 323.1051.

4.5.1.5 pH

The number of pH measurements needed to make a designated use support determination is made on a case-by-case basis using BPJ. Ambient pH data are compared to WQS per R 323.1053.

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 selected using targeted study designs.

Rivers and streams with no site-specific fish community biosurvey results are considered not assessed.

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.

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 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%, or 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) depending on the quality and amount of supporting contextual information available. For example, a poor fish community result may require the collection of additional information to determine data representativeness. In this case, a determination of insufficient information is made. 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, 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. 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 was expected to recover.

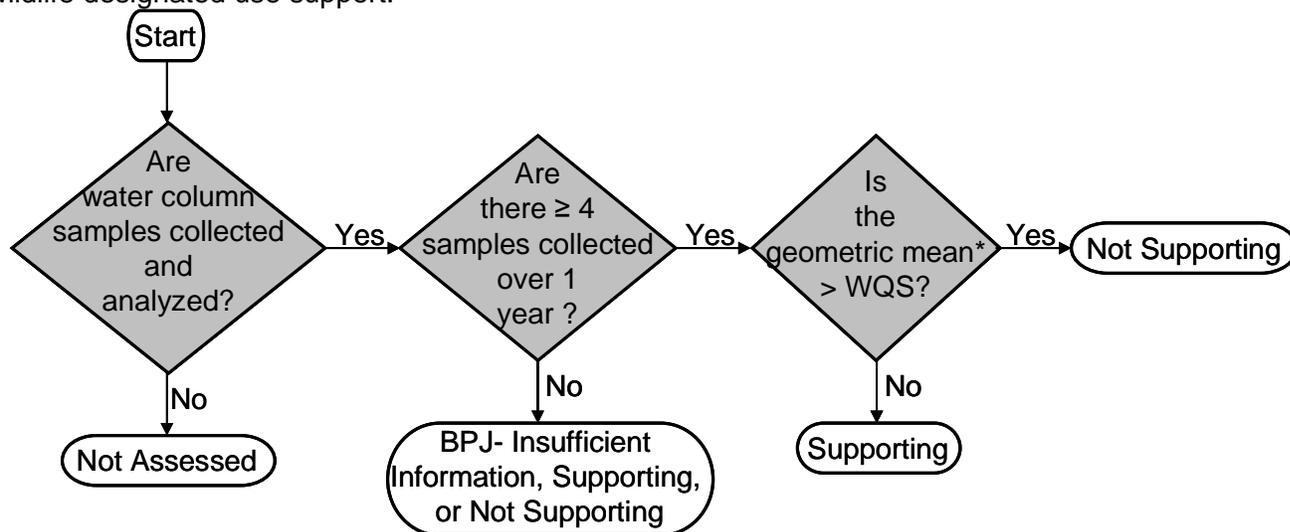
Fish community data for wadeable streams and rivers collected using methods other than P51 are evaluated on a case-by-case basis using BPJ. Biological integrity data regarding instances where P51 is not appropriate (e.g., wetlands, lakes, ephemeral water bodies, nonwadeable rivers, etc.) will be evaluated on a case-by-case basis using BPJ. For example, one of the factors considered to determine support of the coldwater fishery designated use in coldwater lakes is the presence of indicator species such as cisco.

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 for toxic substances, ambient water column chemical concentrations are compared to Wildlife, Aquatic Maximum, and Final Chronic Values per R 323.1057 using Figure 4.1. 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.



* Geometric mean is used per R 323.1207(1)(g)(iii)

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

4.6.1.2 Water Column Nutrient Concentrations

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 per R 323.1060 using BPJ since Michigan does not have numeric standards for ambient concentrations of plant nutrients. Samples collected during the period of July through

September, when the impacts due to nutrient expression are most likely to occur, are particularly important for making designated use support determinations.

For inland lakes, Carlson trophic status index (TSI) in conjunction with aquatic macrophyte surveys, are considered to determine designated use support. Individual TSI values are calculated 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 TSI values and the trophic status classification is determined based on the criteria listed in Table 4.2. Inland lakes classified as oligotrophic, mesotrophic, or eutrophic are generally determined to support the other indigenous aquatic life and wildlife designated use. Inland lakes that are classified as hypereutrophic are generally listed as insufficient information or not supporting.

$TSI_{SD} = 60 - 33.2 \log_{10}SD$	SD = Secchi depth transparency (m)
$TSI_{TP} = 4.2 + 33.2 \log_{10}TP$	TP = total phosphorus concentration (ug/l)
$TSI_{CHL} = 30.6 + 22.6 \log_{10}CHL$	CHL = chlorophyll a concentration (ug/l)

Trophic State	Carlson 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	48-61	20-50	0.9-2.3	6-22
Hypereutrophic	>61	>50	<0.9	>22

4.6.1.3 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. Biosurvey sites are selected using both targeted and probabilistic study designs. All site-specific 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.

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 insufficient information is made for water bodies with macroinvertebrate communities rated poor (total P51 macroinvertebrate community score -5 to -9) depending on the quality and amount of supporting contextual information available. For example, a poor macroinvertebrate community result from a biosurvey conducted as part of probabilistic monitoring may require the collection of additional information to determine data representativeness. In this case, a determination of insufficient information is made. 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, 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).

Macroinvertebrate data for wadeable streams and rivers collected using methods other than P51 are evaluated on a case-by-case basis using BPJ. Biological integrity data regarding instances where P51 is not appropriate (e.g., wetlands, lakes, ephemeral streams, etc.) will be evaluated on a case-by-case basis using BPJ.

Nonwadeable rivers are assessed using Michigan's Qualitative Biological and Habitat Survey Protocols for Nonwadeable Rivers (MDEQ, Nonwadeable Procedure, in preparation). 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 may 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 made using BPJ, 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, 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).

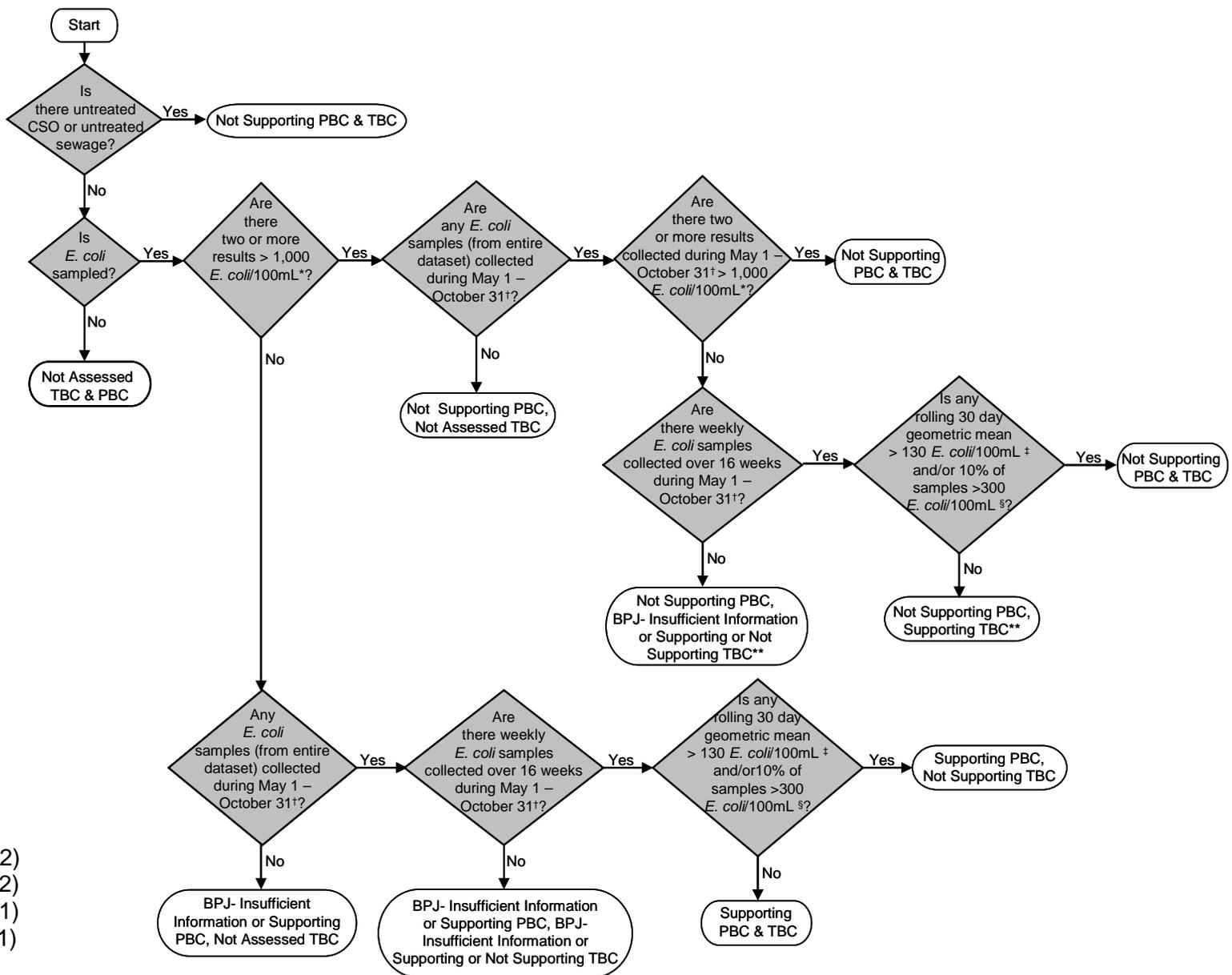
4.7 Designated Use: Partial Body Contact Recreation and Total Body Contact Recreation

The partial body contact designated use applies to all water bodies year-round while the total body contact 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 to determine partial body contact and total body contact designated use support using Figure 4.2.



* See R 323.1062(2)
 † See R 323.1100(2)
 ‡ See R 323.1062(1)
 § See R 323.1062(1)

** It is possible to arrive at a decision of supporting for total body contact (TBC) and not supporting for partial body contact (PBC) if *E. coli* concentrations are low during the total body contact recreation season (May 1 – October 31) and high during the nonrecreation season.

Figure 4.2. Determination of partial body contact and total body contact designated use support using ambient *E. coli* water column concentration.

4.8 Designated Use: Fish Consumption

Michigan uses a variety of assessment types and parameters to determine fish consumption designated use support. Data considered include the concentration of bioaccumulative chemicals of concern (BCCs) (as listed in Table 5 of the Part 4 rules) in the water column, fish tissue mercury concentration, fish consumption advisories issued by the MDCH, and final chronic values.

4.8.1 Assessment Type: Physical/Chemical

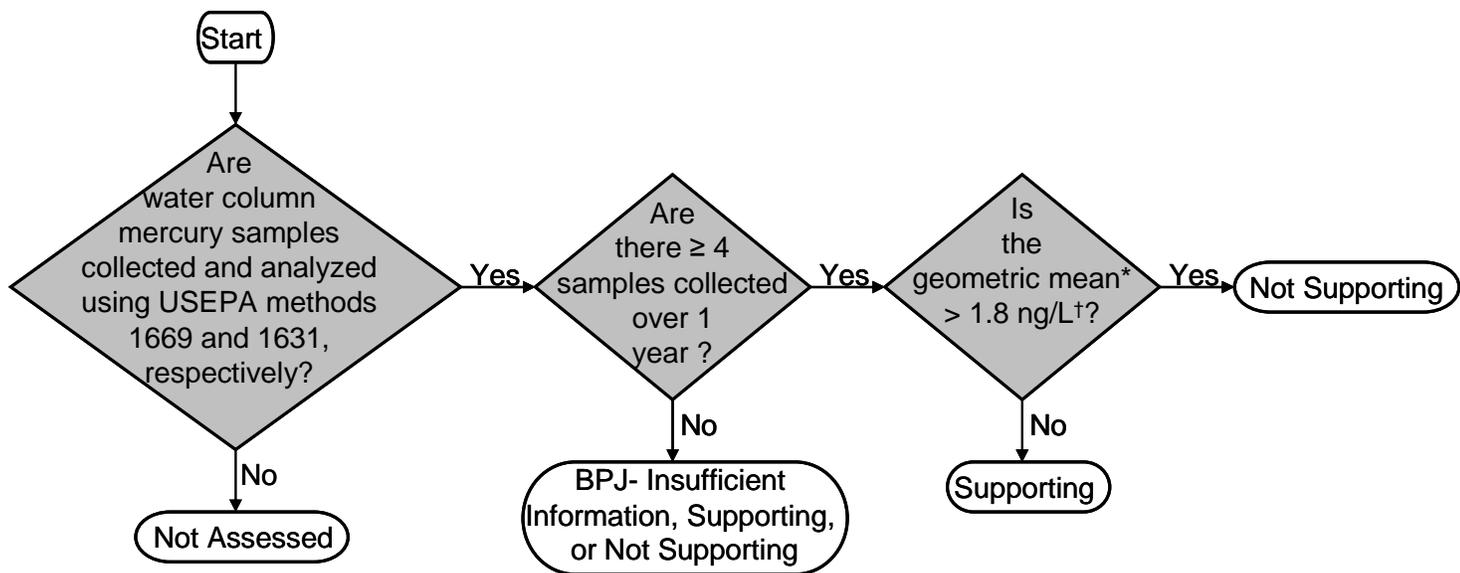
4.8.1.1 Water Column and Fish Tissue Mercury Concentrations

To be conservative, site-specific water column and fish tissue data are used together to determine fish consumption designated use support. Ambient water column mercury concentrations are compared to the HNV (non-drinking water) WQS (1.8 ng/L); and fish tissue mercury concentrations in edible portions are compared to Michigan's fish tissue value for mercury (0.35 mg/kg).

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 mg/kg) was derived using the same exposure scenario used to derive Michigan's HNV (non-drinking 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.

The fish tissue mercury value is not an ambient WQS; however, the MDEQ considers the direct use fish tissue mercury data appropriate to help determine fish consumption designated use support.

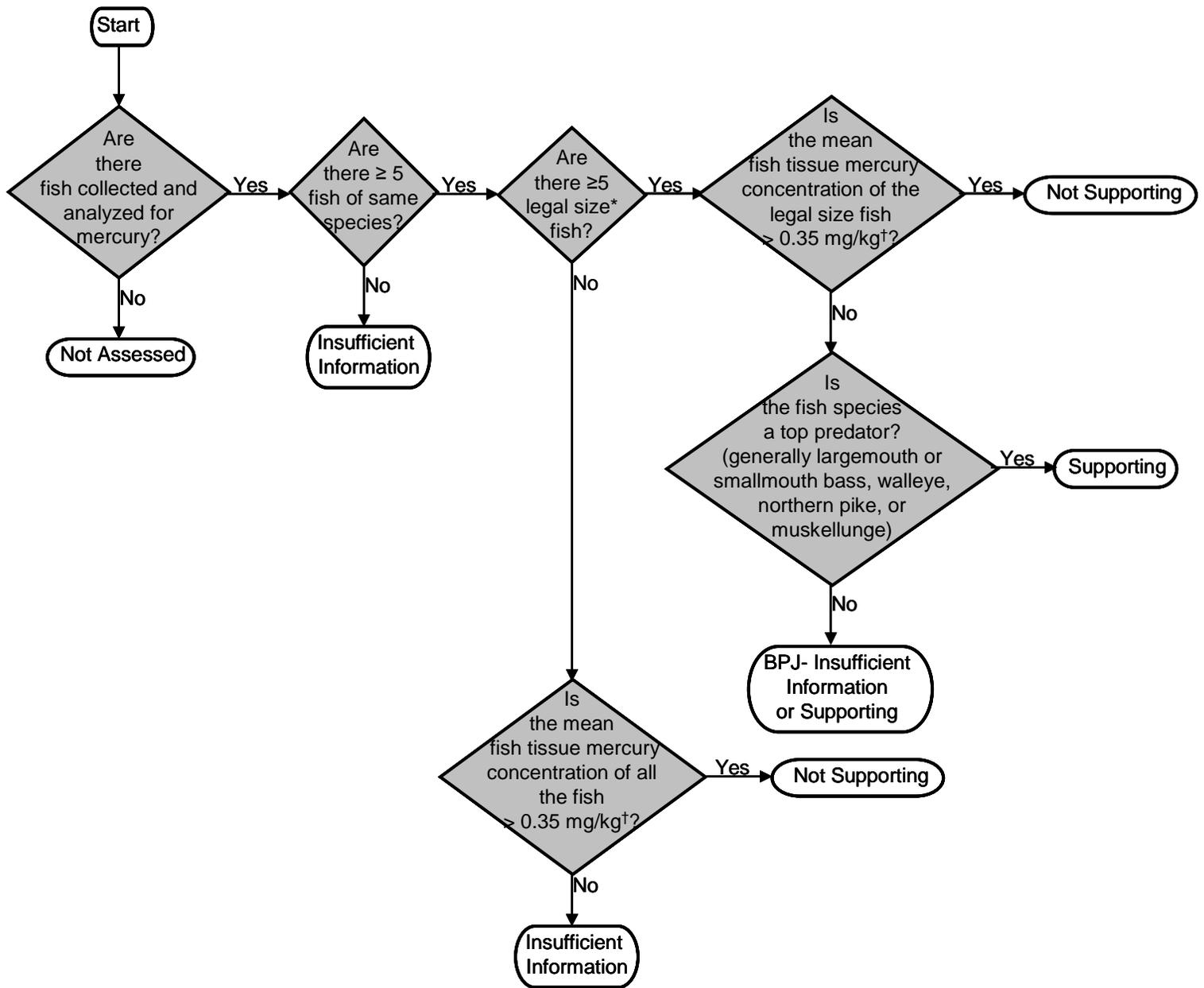
Fish consumption designated use support for mercury is determined by using Figure 4.3 to make a decision for water column mercury concentration, using Figure 4.4 to make a decision for fish tissue mercury concentration, and finally using Table 4.3 to determine overall fish consumption designated use support for mercury using the results from the Figures 4.3 and 4.4 decision processes. The overall designated use support for mercury determination from Table 4.3 is used for the Sections 305(b) and 303(d) reporting process.



* Geometric mean is used per R 323.1207(1)(g)(iii).

† Michigan WQS HNV (non-drinking water) for mercury.

Figure 4.3. Determination of fish consumption designated use support using water column mercury concentration. This figure must be used in conjunction with Figure 4.4. The final overall fish consumption designated use support determination using mercury data is made using Table 4.3.



* Legal size fish refers to the current minimum size limit regulations described in Michigan's Fishing Guide and Inland Trout and Salmon Guide published by the MDNR.

† Michigan's fish tissue value for mercury.

Figure 4.4. Determination of fish consumption designated use support using fish tissue mercury concentration. This figure must be used in conjunction with Figure 4.3. The final overall fish consumption designated use support determination using mercury data is made using Table 4.3.

Table 4.3. Overall fish consumption designated use support determination for mercury using water column and fish tissue mercury concentration.		
Decision based on mercury water column data (from Figure 4.3)	Decision based on mercury fish tissue data (from Figure 4.4)	Overall fish consumption designated use support for mercury
Supporting	Supporting	Supporting
Supporting	Not Supporting	BPJ*- Supporting, Not Supporting, or Insufficient Information
Supporting	Not Assessed/ Insufficient Information	Supporting
Not Supporting	Supporting	Not Supporting
Not Supporting	Not Supporting	Not Supporting
Not Supporting	Not Assessed/ Insufficient Information	Not Supporting
Not Assessed/ Insufficient Information	Supporting	Supporting
Not Assessed/ Insufficient Information	Not Supporting	Not Supporting
Not Assessed/ Insufficient Information	Not Assessed/ Insufficient Information	Not Assessed/ Insufficient Information

* In addition to the elements discussed in Section 4.2, the size and species of fish collected and analyzed, and the existence or potential for site-specific mercury fish consumption advisories, are considered when making designated use support decisions using BPJ.

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 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 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 (non-drinking water) per R 323.1057 using Figure 4.1 (see Section 4.6.1.1).

4.8.2 Assessment Type: Other Public Health Indicators

4.8.2.1 Fish Consumption Advisories for BCCs other than Mercury (Primarily PCBs, DDT, Chlordane, and Dioxin)

For contaminants other than mercury, a water body is considered to not support the fish consumption designated use if the MDCH has issued a site-specific fish consumption advisory

for that water body. The MDCH bases their advisories on fish tissue contaminant data collected as part of the Michigan Fish Contaminant Monitoring Program and recommendations made by the MDEQ.

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

To determine public water supply designated use support for toxic substances other than BCCs, ambient water column chemical concentrations are compared to the HNV and HCV for drinking water per R 323.1057 using Figure 4.1 (see Section 4.6.1.1).

Public water supply designated use support determination for BCCs is problematic and there is generally insufficient information available to make a determination. The HNV and HCV for drinking water (surface WQS) calculations use an exposure scenario that includes human consumption of 15 grams of fish and two liters of water daily. The majority of human exposure to a BCC using this scenario would be from the consumption of fish. In other words, the relative human exposure to a BCC in surface waters via water consumption is minimal. Currently, Michigan's rules do not contain a methodology to derive human health values that protect solely for the consumption of two liters of untreated surface water per day. Maximum contaminant levels, the maximum permissible level of a contaminant in water that is delivered to any user of a public water system, used by the MDEQ, Drinking Water and Environmental Health Section, do not include a specific fish consumption component in the calculation.

WQS (HNV and HCV for drinking water) and maximum contaminant levels are calculated differently and have different purposes. Due to the inconsistency between these values, comparisons of ambient water column BCC concentration to HNVs and HCVs for drinking water are not made. For example, the ambient PCB concentration at the point of a community water supply intake may exceed the PCB HCV drinking water value (0.026 ng/L) while the finished (i.e., treated) water may be determined to be below the PCB maximum contaminant level (0.5 micrograms per liter [ug/L]). The MDEQ, Surface Water Assessment Section and Drinking Water and Environmental Health Section, will work together and with the USEPA to determine a long-term solution for this issue.

4.9.1.2 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 National Hydrography Dataset (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. 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 Critical Assessment Zone (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 3000 feet for the most sensitive intakes to 1000 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 in the Great Lakes connecting channels and selected tributaries 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 (2012). 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).

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 determine (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 4.4 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 4.4) adapted from USEPA guidance, illustrates Michigan's use of a multiple category system.

Table 4.4. 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). This issue will be corrected over the next five-year rotating watershed cycle through specific record review process.

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 BPJ and supporting contextual information.

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 (McDonald 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 (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.

A summary of all assessment units removed from the Section 303(d) list since the 2006 IR is provided in Appendix D of this IR.

4.14 Assessment Methodology Changes

Minor edits and clarification changes were made to update the 2008 assessment methodology for the 2010 IR. There were no substantial changes to data interpretation methods; however, some of the other updates include:

- Transfer of data from the Michigan-developed Water Body System to the USEPA ADB was reflected in the 2008 IR. Due to this transfer, modification of information in the ADB has continued in the 2010 IR and will continue over the next reporting cycle.
- Change from using the NHD 1:100,000 resolution to 1:24,000 resolution resulted in the listing of various water bodies (e.g., headwater stream reaches) that were previously not included in the 2008 IR (see IR highlight in Chapter 1).