
**Evaluating Beneficial Use:
Human Health (Fish Consumption)**

E1. Background

The State of Ohio has operated a formal Fish Consumption Advisory (FCA) Program since 1993. Since July 2002, the program's technical and decision-making expertise has been housed at the Ohio Environmental Protection Agency (Ohio EPA). The risk assessment protocols used were developed in the early 1990s under the auspices of the Great Lakes Governors Association.

Ohio has adopted human health water quality standards (WQS) criteria to protect the public from adverse impacts, both carcinogenic and non-carcinogenic, due to exposure via drinking water (applicable at public water supply intakes) and to exposure from the contaminated flesh of sport fish (applicable in all surface waters). The purpose of the water quality criteria for the protection of human health [fish consumption] is to ensure levels of a chemical in water do not bioaccumulate in fish to levels harmful to people who catch and eat the fish. The relationship of the fish consumption human health criterion to the FCA risk assessment protocols is explained below.

E2. Rationale and Evaluation Method

U.S. EPA's guidance for preparing the 2006 Integrated Report (IR) states:

Although the CWA [Clean Water Act] does not explicitly direct the use of fish and shellfish consumption advisories or NSSP [National Shellfish Sanitation Program] classifications to determine attainment of water quality standards, states are required to consider all existing and readily available data and information to identify impaired segments on their section 303(d) lists. For purposes of determining whether a segment is impaired and should be included on a section 303(d) list, EPA considers a fish or shellfish consumption advisory, a NSSP classification, and the supporting data to be existing and readily available data and information that demonstrates non-attainment of a section 101(a) "fishable" use when:

- *the advisory is based on fish and shellfish tissue data,*
- *a lower than "Approved" NSSP classification is based on water column and shellfish tissue data (and this is not a precautionary "Prohibited" classification or the state water quality standard does not identify lower than "Approved" as attainment of the standard),*
- *the data are collected from the specific segment in question, and*
- *the risk assessment parameters (e.g., toxicity, risk level, exposure duration and consumption rate) of the advisory or classification are cumulatively equal to, or less protective than those in the State's WQS" (U.S. EPA, 2005).*

Ohio's WQS regulations do not describe human consumption of sport fish as an explicit element of aquatic life protection. However, the WQS do include human health criteria that are applicable to all surface waters of the State. Certain of these criteria are derived using assumptions about the bioaccumulation of chemicals in the food chain, and the criteria are intended to protect people from adverse health impacts that could arise from consuming fish caught in Ohio's waters. To determine when and how waters should be listed as impaired because of FCAs, the risk assessment parameters on which the human health WQS criteria are based were compared with those used in the Ohio FCA program. If the State has issued an advisory for a specific water body and that advisory is equal to or less protective than the State's WQS, then one can assume there is an exceedance of the WQS. On the other hand, if the advisory is more protective than the WQS, one cannot assume that the issuance of the advisory indicates an exceedance of the WQS. Figure E-1 illustrates this point.

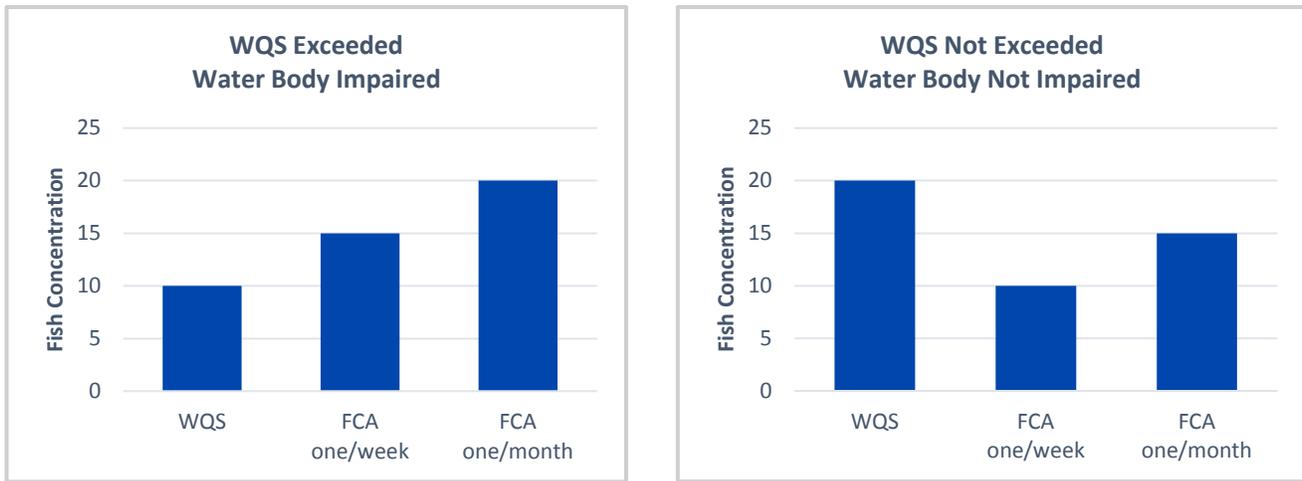


Figure E-1 — Illustration of the relationship among the WQS values, the values that trigger issuance of FCAs and the resulting decision regarding water body impairment associated with an FCA.

A fish consumption advisory is determined based on the quantity of a chemical in fish, such as micrograms of chemical per kilogram of fish tissue ($\mu\text{g}/\text{kg}$). WQS, on the other hand, are expressed as the quantity of chemical in water, such as micrograms of chemical per liter of water ($\mu\text{g}/\text{L}$). The information used to calculate the human health fish consumption WQS criterion can be used to calculate a maximum safe fish concentration. The fish concentration value can then be directly compared to the FCA program values to determine whether the advisory is less or more protective than the WQS criterion. The values in Table E-1 make this comparison for chemicals for which there are both an FCA and an Ohio human health fish consumption water criterion. Because Ohio human health criteria differ between the Lake Erie and Ohio River basins, separate comparisons are presented.

The constituents shown in Table E-1 were chosen based on U.S. EPA's recommendations on page 53 of its 2006 IR Guidance (epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf; U.S. EPA, 2006a). Hexachlorobenzene and mirex were added because of historic fish tissue contamination with those contaminants.

Table E-1 demonstrates that the levels of fish tissue contaminants that trigger a fish advisory have little obvious relation to the levels of fish tissue contaminants on which the WQS criteria are based. This discrepancy exists because different assumptions about fish consumption rates are made in calculating water quality standards than in issuing fish advisories. For example, the fish consumption rate used to calculate the Ohio River Basin WQS criteria is 17.5 grams per day. The fish consumption rate used to calculate a “one meal per week” advisory recommendation is 32.6 grams per day. These values are not the same because the WQS criteria fish consumption rates are based on nutritional studies that attempt to capture approximately how much sport caught fish people are eating, whereas the fish consumption advisory rates are meant to advise people how much fish they can safely consume.

Table E-1 — Comparison between fish concentration values and FCA program values.

Basin/Parameter	Fish concentration on which the WQS is based ¹	Range of fish concentrations triggering an “eat no more than one meal per week” advisory	Range of fish concentrations triggering an “eat no more than one meal per month” advisory
Lake Erie/PCB	23 µg/kg	<u>50 - 220 µg/kg</u>	<u>221 - 1,000 µg/kg</u>
Ohio River/PCB	54 µg/kg	<u>50 - 220 µg/kg</u>	<u>221 - 1,000 µg/kg</u>
Lake Erie/mercury	350 µg/kg	110 - 220 µg/kg	<u>221 - 1,000 µg/kg</u>
Ohio River/mercury	1,000 µg/kg	110 - 220 µg/kg	221 - 1,000 µg/kg
Lake Erie/DDT	140 µg/kg	<u>500 - 2,188 µg/kg</u>	<u>2,189 - 9,459 µg/kg</u>
Ohio River/DDT	320 µg/kg	<u>500 - 2,188 µg/kg</u>	<u>2,189 - 9,459 µg/kg</u>
Lake Erie/Chlordane	130 µg/kg	<u>500 - 2,188 µg/kg</u>	<u>2,189 - 9,459 µg/kg</u>
Ohio River/Chlordane	310 µg/kg	<u>500 - 2,188 µg/kg</u>	<u>2,189 - 9,459 µg/kg</u>
Lake Erie/Hexachlorobenzene	29 µg/kg	<u>800 - 3,499 µg/kg</u>	<u>3,500 - 15,099 µg/kg</u>
Ohio River/hexachlorobenzene	67 µg/kg	<u>800 - 3,499 µg/kg</u>	<u>3,500 - 15,099 µg/kg</u>
Lake Erie/mirex	88 µg/kg	<u>200 - 874 µg/kg</u>	<u>875 - 3,783 µg/kg</u>
Ohio River/mirex	200 µg/kg	<u>200 - 874 µg/kg</u>	<u>875 - 3,783 µg/kg</u>
Key			
Values	Advisory is less protective than the WQS criterion, WQS exceeded, water body impaired		
Values	Advisory is more protective than WQS criterion, WQS not exceeded, no impairment from FCA		
Values	Advisory may be more, or less, protective than WQS criterion		

U.S. EPA stipulates that the risk assessment parameters used to categorize fish tissue contaminant data must be at least as protective as those used in the WQS-based fish concentrations. Fish advisory contaminant levels are not directly related to the WQS criteria contaminant levels and, in some cases, are not as protective. Therefore, Ohio EPA has elected to directly compare fish tissue data with the WQS criteria calculations shown in the above table, instead of using advisory-based categorizations.

The following steps were utilized to determine a 303(d) list category for waters based on fish tissue contaminant data.

Step 1: Determine available data

All data in the fish tissue database were evaluated for the 2018 IR. The most recent 10-years of data collections, 2007-2016, were used for making category 1 (unimpaired) and category 5 (impaired) determinations. In cases where multiple years of data were available in that 10-year window, all data were weighted equally. In cases where the only data available were older than 2007, the category determined by those data became historical (impaired-historical or unimpaired-historical).

Ohio’s Credible Data Law states that all data greater than five years in age will be considered historical and that it can be used if the director has identified compelling reasons as to why the data are credible. In the case of fish tissue, the use of data older than five but ten or fewer years old is necessary. This is because not enough fish tissue samples are gathered from enough locations each year to conduct a thorough assessment of contaminant levels in fish tissue across the state. Frequently, multiple sampling years are needed to determine whether to issue or rescind an advisory. Owing to limited staff time and budget resources, it sometimes takes more than five years to revisit a location and collect more fish tissue samples. A more complete picture of contaminants in fish tissue is presented when data are utilized that reach back 10 years.

¹ See Section E4 for an explanation of how these concentrations were calculated.

Step 2: Determine fish tissue contaminant concentrations

For streams in each assessment unit (AU)², a weighted average based on species and trophic level was calculated for each contaminant. One year of data was considered adequate to categorize the fish as category 5 (impaired) or category 1 (unimpaired). Inland lakes are considered a component of the assessment unit(s) in which they are geographically located, so sample results may affect the assessment status of the AU(s) and the index scores for the AU(s). Inland lakes are also analyzed individually; results are displayed in Table E-12.

Step 3: Determine adequate species data

In order to assess an AU as category 1 or 5, at least four samples from that AU are needed, with at least two samples from each of trophic levels three and four. An exception was made for AUs with 10 or more samples from one trophic level and only one sample from the other trophic level.

A geometric mean was calculated for each species and then a weighted average was calculated for each trophic level. A weighted average for each AU was then calculated using the consumption rates found in the water quality criteria calculations. That weighted average was then compared against the contaminant levels listed in Table E-1 and categorized as category 1 or 5.

In cases where those data requirements were not met, an AU was classified as category 3i. In cases where no data were available, an AU was classified as category 3.

This calculation methodology is derived from the methodology described in Section 4.3.2 of the document *Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion*, Final, U.S. EPA Office of Science and Technology, EPA-823-R-09-002, January 2009 (epa.gov/wqc/human-health-criteria-methylmercury).

Table E-2 — Example data for calculating a weighted average fish tissue value.

Species	Trophic Level	Number of Samples	Geometric mean mercury concentration (mg/kg)
Black Crappie (<i>Pomoxis nigromaculatus</i>)	3	1	0.085
Bluegill Sunfish (<i>Lepomis macrochirus</i>)	3	2	0.098
Channel Catfish (<i>Ictalurus punctatus</i>)	3	2	0.145
Common Carp (<i>Cyprinus carpio</i>)	3	3	0.120
Largemouth Bass (<i>Micropterus salmoides</i>)	4	3	0.212
Smallmouth Bass (<i>Micropterus dolomieu</i>)	4	1	0.421
Spotted Bass (<i>Micropterus punctulatus</i>)	4	1	0.347

² Assessment units include watershed assessment units (12-digit hydrologic units); large river assessment units (generally rivers that drain more than 500 square miles of landscape); and Lake Erie assessment units.

For the Lake Erie Basin:

$$C_{avgLEB} = \frac{3.6 * C_3 + 11.4 * C_4}{15} = 0.27 \text{ mg/kg}$$

For the Ohio River Basin:

$$C_{avgORB} = \frac{11.8 * C_3 + 5.7 * C_4}{17.5} = 0.18 \text{ mg/kg}$$

Where:

C_3 = average concentration for trophic level 3

C_4 = average concentration for trophic level 4

Step 4: Determine appropriate assessment unit divisions

It should be recognized that in determining impairment status based on AUs instead of individual water bodies, extrapolations to water bodies without data are made. In some cases, water bodies that have no data will be categorized as impaired if they are within an impaired AU.

Inland lakes are treated as individual water bodies for impairment purposes regardless of whether they are entirely contained within an AU or straddle more than one AU and results for individual lakes are shown in Table E-12. In addition, any AU containing all or part of an impaired inland lake was considered to be not supporting the beneficial use (see Step 2 above for further explanation).

Step 5: Categorize water bodies within assessment units

Category 5 – Impaired

Any AU meeting the data requirements in step 3 with a weighted average fish tissue concentration of PCBs, mercury, DDT, chlordane, mirex or hexachlorobenzene above the WQS-based fish tissue concentration is placed into category 5. When the data indicating impairment are older than 10 years, the AU remains impaired but is considered impaired-historical, category 5h³.

Category 1 – Not Impaired

To be categorized as category 1, not impaired, an AU must meet the data requirements in step 3 and the weighted average concentration of a contaminant must be below the threshold that would trigger an impairment. AUs that had previously been considered category 1, but with no data since 2007, are reclassified as category 1h³.

Category 3 – Insufficient or No Data

Any AU in which current data are available but those data are insufficient according to step 3 (to categorize the AU as category 1 or 5), the AU is listed as category 3i. If no data is available for an AU, the category is listed as 3. If an AU had previously been classified as category 3 or 3i, and there is no data in the AU since 2007, the AU is classified as category 3.

³ An “h” subcategory could indicate one of two possibilities. In IRs prior to 2010, when Ohio reported on the larger assessment units, categories were assigned based on data collected anywhere in that unit. For the 2010 analysis, the 2008 category was assigned to each of the new, smaller units. If the original data were collected before 1999, a re-analysis of the data could not be completed for the 2010 report, so the smaller units retained the category of the larger unit. In some cases, the data were collected within the smaller assessment unit and in other cases they were not. For the older data, a distinction between the two could not be made for this report. In addition, data collected prior to 2007 are considered historical in the 2018 analysis.

E3. Results

Fish tissue data for six contaminants were reviewed to determine an IR attainment status. The methodology for selecting, reviewing and categorizing fish tissue data is given in Section E2. The six parameters monitored were mercury, PCBs, chlordane, DDT, mirex and hexachlorobenzene. These parameters were chosen for review based on current and recent fish consumption advisories in Ohio caused by these contaminants, as well as existing human health WQS criteria for the six parameters.

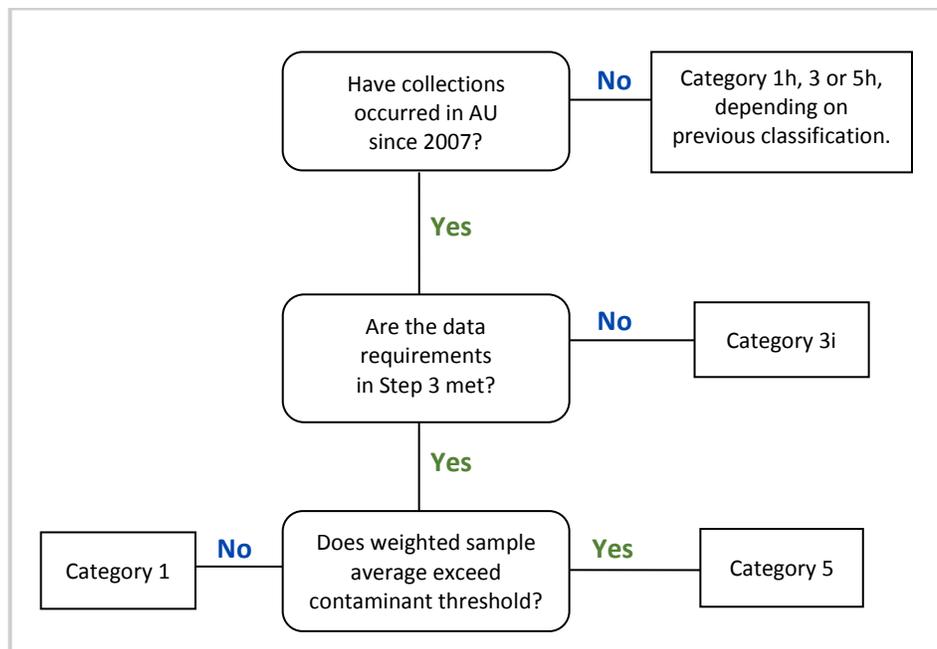


Figure E-2 — Flow chart for the categorization of fish tissue data for the IR.

There was a total of 122 changes to the human health attainment statuses of assessment units for the 2018 IR which are summarized in Table E-3. The primary reasons for change in status include data having become historical and the collection and analysis of new information.

Table E-3 — A summary of changes in attainment status from 2016 to 2018 IR.

Reason for change		Changes	
Data have become historical			55
	Category 1 to 1h	26	
	Category 3i to 3	15	
	Category 5 to 5h	14	
New data			67
	Became category 1	29	
	Became category 3i	13	
	Became category 5	25	
Total changes			122

Detailed results are presented in Table E-4 through E-13. Detailed information on specific fish consumption advisories including geographic extent of the advisory; type and size of fish affected; and consumption advice can be found at epa.ohio.gov/dsw/fishadvisory/index.aspx.

Table E-4 lists waters impaired because fish tissue levels of PCBs or mercury exceed the threshold level upon which the WQS criterion is based, while Table E-5 includes those not impaired. Table E-6 lists water bodies identified as impaired for this use on a previous 303(d) list that are no longer considered impaired, either because of new data or the updated methodology described in Section E1. There is one WAU in Ohio with significant pollution resulting in 303(d) listings from other contaminants that affect fish tissue, as shown in Table E-7. In Table E-8 and Table E-9, the data for all these locations have become historical and

new data would need to be collected before a current impairment status can be determined. Since age of data alone is not a reason for delisting, the water bodies in Table E-9 remain on the 303(d) list. Table E-10 lists waters with current fish tissue data where inadequate samples exist to determine level of impairment. Sites in Table E-10 have never had sufficient data for assessment, now or in the past. Table E-11 lists large rivers and their impairment status. Table E-12 lists inland lake impairment status. Table E-13 lists Lake Erie assessment units and their impairment status.

Table E-4 — Waters not supporting the human health use because levels of PCBs or mercury in fish tissue exceed the threshold level upon which the WQS criterion is based. These waters are category 5.

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Heldman Ditch-Ottawa River	04100001 03 07	PCBs
Sibley Creek-Ottawa River	04100001 03 08	PCBs
West Branch St Joseph River	04100003 02 04	PCBs
Cogswell Cemetery-St Joseph River	04100003 03 02	PCBs
Willow Run-St Joseph River	04100003 05 05	PCBs, Mercury
Fourmile Creek-St Marys River	04100004 01 06	PCBs
Prairie Creek-St Marys River	04100004 02 05	PCBs
Yankee Run-St Marys River	04100004 03 03	PCBs
Flat Run-Tiffin River	04100006 03 03	Mercury
Village of Stryker-Tiffin River	04100006 05 03	PCBs
Sixmile Creek-Auglaize River	04100007 02 04	PCBs
Lima Reservoir-Ottawa River	04100007 03 06	PCBs
Dog Creek	04100007 08 01	PCBs
Lower Town Creek	04100007 08 04	PCBs
Big Run-Flatrock Creek	04100007 12 06	PCBs
City of Findlay Riverside Park-Blanchard River	04100008 02 05	PCBs
Cutoff Ditch	04100009 05 07	PCBs
Lower Beaver Creek	04100009 05 09	PCBs
Heilman Ditch-Swan Creek	04100009 08 04	PCBs
Rhodes Ditch-South Branch Portage River	04100010 02 04	PCBs
North Branch Portage River	04100010 03 01	PCBs
Portage River	04100010 05 02	PCBs
Lower Toussaint Creek	04100010 06 03	PCBs
Town of Lindsey-Muddy Creek	04100011 14 04	PCBs
Mouth Vermilion River	04100012 02 04	PCBs
Mouth West Branch Huron River	04100012 05 06	PCBs
Mouth East Branch Huron River	04100012 06 04	PCBs
Huron River-Frontal Lake Erie	04100012 06 06	PCBs
Baker Creek-West Branch Rocky River	04110001 01 08	PCBs
Rocky River	04110001 02 03	PCBs
Salt Creek-East Branch Black River	04110001 04 02	Mercury
Jackson Ditch-East Branch Black River	04110001 04 04	Mercury
Lower West Branch Black River	04110001 05 06	PCBs
Black River	04110001 06 02	PCBs
Ladue Reservoir-Bridge Creek	04110002 01 04	PCBs
Lake Rockwell-Cuyahoga River	04110002 02 03	PCBs
Wingfoot Lake Outlet-Little Cuyahoga River	04110002 03 03	PCBs
Boston Run-Cuyahoga River	04110002 04 05	PCBs
Lower Ashtabula River	04110003 01 05	PCBs
Plumb Creek-Grand River	04110004 03 05	Mercury
Town of Jefferson-Mill Creek	04110004 04 03	Mercury
Bronson Creek-Grand River	04110004 05 02	PCBs, Mercury

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Long Run-Yellow Creek	05030101 07 04	PCBs
Hollow Rock Run-Yellow Creek	05030101 08 04	PCBs
Lower Cross Creek	05030101 10 05	PCBs
Fish Creek-Mahoning River	05030103 01 03	PCBs
Kirwin Reservoir-West Branch Mahoning River	05030103 03 04	PCBs
Charley Run Creek-Mahoning River	05030103 03 06	PCBs
Lower Mosquito Creek	05030103 05 03	PCBs
Coffee Run-Mahoning River	05030103 08 09	PCBs
Dry Fork-Short Creek	05030106 02 07	PCBs
Cox Run-Wheeling Creek	05030106 03 03	PCBs
Lower McMahan Creek	05030106 07 04	PCBs
Pea Vine Creek-Captina Creek	05030106 09 05	PCBs
Eightmile Creek-Little Muskingum River	05030201 07 05	PCBs
Sugar Creek-Duck Creek	05030201 09 04	PCBs
Portage Lakes-Tuscarawas River	05040001 01 05	PCBs
Portage Lakes-Tuscarawas River	05040001 01 05	PCBs
Headwaters Sandy Creek	05040001 04 06	PCBs
City of Canton-Middle Branch Nimishillen Creek	05040001 05 04	PCBs
Sherrick Run-Nimishillen Creek	05040001 05 05	PCBs
Town of East Sparta-Nimishillen Creek	05040001 05 06	PCBs
Armstrong Run-Sandy Creek	05040001 06 05	PCBs
Beal Run-Sandy Creek	05040001 06 07	PCBs, Hexachlorobenzene
Charles Mill-Black Fork Mohican River	05040002 02 05	PCBs
Headwaters Clear Fork Mohican River	05040002 03 01	PCBs
Switzer Creek-Clear Fork Mohican River	05040002 04 05	PCBs
Town of Perrysville-Black Fork Mohican River	05040002 08 02	PCBs
Big Run-Black Fork Mohican River	05040002 08 03	PCBs
Delano Run-Kokosing River	05040003 03 04	PCBs
Big Run-Walnut Creek	05060001 18 05	PCBs
Greenbrier Creek-Big Darby Creek	05060001 22 03	PCBs
Lizard Run-Big Darby Creek	05060001 22 04	PCBs
Scippo Creek	05060002 04 05	PCBs
Lick Run-Scioto River	05060002 05 03	PCBs
Queer Creek	05060002 09 02	PCBs
Poe Run-Salt Creek	05060002 09 06	PCBs
Pee Pee Creek	05060002 11 04	PCBs
Leeth Creek-Sunfish Creek	05060002 12 06	PCBs
Dividing Branch-Greenville Creek	05080001 11 03	PCBs
Dry Run-Wolf Creek	05080002 01 03	PCBs
Ice Creek	05090103 01 03	PCBs
Wards Run-Little Scioto River	05090103 06 05	PCBs
Soldiers Run-Ohio Brush Creek	05090201 05 06	PCBs
Newman Run-Little Miami River	05090202 05 04	PCBs
West Fork-Mill Creek	05090203 01 05	PCBs
Grand Lake-St Marys	05120101 02 04	PCBs

Table E-5 — Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based. These waters are category 1.

Water Body (Category 1: Unimpaired)	Assessment Unit
Clear Fork-East Branch St Joseph River	04100003 01 06
Nettle Creek	04100003 03 01
Town of Willshire-St Marys River	04100004 03 05
Bates Creek-Tiffin River	04100006 03 01
Village of Buckland-Auglaize River	04100007 02 02
Sims Run-Auglaize River	04100007 02 03
Lost Creek	04100007 03 05
Wolf Ditch-Little Auglaize River	04100007 06 03
Dry Fork-Little Auglaize River	04100007 06 04
West Branch Prairie Creek	04100007 07 02
Prairie Creek	04100007 07 03
Burt Lake-Little Auglaize River	04100007 08 06
Big Run-Auglaize River	04100007 09 04
Lower Bad Creek	04100009 03 02
North Turkeyfoot Creek	04100009 04 02
East Branch Portage River	04100010 02 02
Green Creek	04100011 12 03
New London Upground Reservoir-Vermilion River	04100012 01 04
Walnut Creek-West Branch Huron River	04100012 04 03
Peru Township-West Branch Huron River	04100012 04 05
City of Medina-West Branch Rocky River	04110001 01 05
Cossett Creek-West Branch Rocky River	04110001 01 06
Headwaters East Branch Rocky River	04110001 02 01
Baldwin Creek-East Branch Rocky River	04110001 02 02
Town of Litchfield-East Branch Black River	04110001 04 01
Wellington Creek	04110001 05 03
East Branch Reservoir-East Branch Cuyahoga River	04110002 01 01
Mogadore Reservoir-Little Cuyahoga River	04110002 03 02
Town Fork	05030101 08 01
Pymatuning Reservoir	05030102 01 05
Booth Run-Pymatuning Creek	05030102 03 04
Deer Creek	05030103 02 01
Town of Newton Falls-West Branch Mahoning River	05030103 03 05
Mouth Eagle Creek	05030103 04 05
Middle Mosquito Creek	05030103 05 02
Lower Meander Creek	05030103 07 03
Andersons Run-Mill Creek	05030103 08 03
Upper McMahan Creek	05030106 07 02
South Fork Captina Creek	05030106 09 02
Wingett Run-Little Muskingum River	05030201 07 03
Headwaters Little Rush Creek	05030204 02 01
Turkey Run-Rush Creek	05030204 02 04
Clear Fork	05030204 06 01
Nimisila Reservoir-Nimisila Creek	05040001 03 02
Sippo Creek	05040001 03 08
Pleasant Valley Run-Indian Fork	05040001 08 02
Buttermilk Creek-Stillwater Creek	05040001 13 04
Brushy Fork	05040001 14 02
Craborchard Creek-Stillwater Creek	05040001 14 03

Water Body (Category 1: Unimpaired)	Assessment Unit
Upper Little Stillwater Creek	05040001 15 03
Weaver Run-Stillwater Creek	05040001 16 03
Headwaters North Branch Kokosing River	05040003 01 01
East Branch Kokosing River	05040003 01 02
Indianfield Run-Kokosing River	05040003 03 07
Little Jelloway Creek	05040003 04 01
Brush Run-Kokosing River	05040003 04 03
Big Run-Killbuck Creek	05040003 08 04
Bucklew Run-Killbuck Creek	05040003 08 05
Reasoners Run-Olive Green Creek	05040004 11 04
Trail Run-Wills Creek	05040005 02 07
Beeham Run-Salt Fork	05040005 04 06
Wills Creek Dam-Wills Creek	05040005 06 04
Buckeye Lake	05040006 04 03
Rocky Fork	05040006 05 03
Dillon Lake-Licking River	05040006 06 03
Town of La Rue-Scioto River	05060001 04 05
Lower Mill Creek	05060001 06 04
Brush Run-Bokes Creek	05060001 07 02
Smith Run-Bokes Creek	05060001 07 03
O'Shaughnessy Dam-Scioto River	05060001 12 02
Hayden Run-Scioto River	05060001 12 04
Hoover Reservoir-Big Walnut Creek	05060001 13 08
Alum Creek Dam-Alum Creek	05060001 14 04
Town of Carroll-Walnut Creek	05060001 17 05
Spain Creek-Big Darby Creek	05060001 19 02
Robinson Run-Big Darby Creek	05060001 19 05
Barron Creek-Little Darby Creek	05060001 20 05
Thomas Ditch-Little Darby Creek	05060001 20 06
Worthington Ditch-Big Darby Creek	05060001 21 01
Silver Ditch-Big Darby Creek	05060001 21 02
Richmond Ditch-Deer Creek	05060002 01 02
Turkey Run-Deer Creek	05060002 01 06
Town of Mount Sterling-Deer Creek	05060002 02 04
Deer Creek Lake-Deer Creek	05060002 02 05
Stony Creek-Scioto River	05060002 10 05
Headwaters Morgan Fork	05060002 12 02
Cliff Creek-Paint Creek	05060003 06 03
Indian Lake-Great Miami River	05080001 01 03
Stoney Creek	05080001 04 03
Lake Loramie-Loramie Creek	05080001 05 03
Mosquito Creek	05080001 07 02
Headwaters Greenville Creek	05080001 10 04
Bridge Creek-Greenville Creek	05080001 11 02
Town of Covington-Stillwater River	05080001 12 05
Ludlow Creek	05080001 14 02
Rush Run-Sevenmile Creek	05080002 05 04
Acton Lake Dam-Four Mile Creek	05080002 06 04
Robinson Run-Raccoon Creek	05090101 05 04
Camp Creek-Symmes Creek	05090101 09 03
Pigeon Creek-Symmes Creek	05090101 10 03
Aaron Creek-Symmes Creek	05090101 10 04

Water Body (Category 1: Unimpaired)	Assessment Unit
Storms Creek	05090103 01 04
Howard Run-Pine Creek	05090103 02 04
Lick Run-Pine Creek	05090103 02 05
Headwaters Turkey Creek	05090201 02 01
Little East Fork-Ohio Brush Creek	05090201 05 01
Lick Fork	05090201 05 02
Bundle Run-Ohio Brush Creek	05090201 05 03
Middle Caesar Creek	05090202 04 04
Lower Caesar Creek	05090202 04 06
Wilson Creek-Cowan Creek	05090202 06 05
Headwaters East Fork Little Miami River	05090202 10 02
Lucy Run-East Fork Little Miami River	05090202 12 03
Headwaters Stonelick Creek	05090202 13 01
Lick Fork-Stonelick Creek	05090202 13 04
Salt Run-East Fork Little Miami River	05090202 13 05

BOLD rows indicate WAUs that would be impaired if the U.S. EPA mercury criterion of 0.3 mg/kg were effective.

Table E-6 — Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based, and which were categorized as impaired in the 2016 IR. These waters have become category 1 with the current assessment.

Water Body (Newly Unimpaired for 2018)	Assessment Unit	Reason for delisting
New London Upground Reservoir-Vermilion River	04100012 01 04	New data
Deer Creek	05030103 02 01	Reevaluation
Lower Meander Creek	05030103 07 03	New data
Sippo Creek	05040001 03 08	New data
Dillon Lake-Licking River	05040006 06 03	Reevaluation
Deer Creek Lake-Deer Creek	05060002 02 05	Reevaluation
Storms Creek	05090103 01 04	Reevaluation

Table E-7 — Waters with contaminants other than PCBs and mercury that affect fish tissue (included on the 303(d) list). These waters are category 5.

Water Body (Impaired by Other Pollutants)	Assessment Unit	Pollutant
Beal Run-Sandy Creek	05040001 06 07	Hexachlorobenzene

Table E-8 — Waters for which the existing unimpaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 1h.

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
Headwaters Tenmile Creek	04100001 03 04
Mud Creek	04100006 06 02
Mouth Tymochtee Creek	04100011 06 05
Little Sandusky River	04100011 07 01
Norwalk Creek	04100012 06 03
Coon Creek-East Branch Black River	04110001 03 03
Charlemont Creek	04110001 05 01
Sawyer Brook-Cuyahoga River	04110002 01 06
Mud Brook	04110002 04 01
Middle Ashtabula River	04110003 01 04
Middle Rock Creek	04110004 02 02
Griggs Creek	04110004 04 01
Peters Creek-Mill Creek	04110004 04 02

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
McIntyre Creek	05030101 10 04
Little Yellow Creek	05030101 11 02
Carpenter Run-Ohio River	05030101 11 03
Hardin Run-Ohio River	05030101 11 06
North Fork Captina Creek	05030106 09 01
Headwaters West Fork Duck Creek	05030201 09 01
Forked Run-Ohio River	05030202 04 04
Groundhog Creek-Ohio River	05030202 08 02
Oldtown Creek-Ohio River	05030202 08 03
West Creek-Ohio River	05030202 08 04
Broad Run-Ohio River	05030202 08 05
Center Branch	05030204 01 01
Headwaters Hocking River	05030204 04 01
East Branch Sunday Creek	05030204 07 01
Willow Creek-Hocking River	05030204 10 01
Fourmile Creek	05030204 10 03
Seymour Run-Black Fork	05040002 02 02
Jug Run-Wakatomika Creek	05040004 01 04
Town of Frazeyburg-Wakatomika Creek	05040004 02 04
Wolf Run-Wills Creek	05040005 05 08
Bacon Run	05040005 06 01
Twomile Run-Wills Creek	05040005 06 02
White Eyes Creek	05040005 06 03
Mouth Wills Creek	05040005 06 05
Big Run	05040006 06 02
Gander Run-Scioto River	05060001 04 01
Headwaters Olentangy River	05060001 08 01
Headwaters Whetstone Creek	05060001 09 02
Claypool Run-Whetstone Creek	05060001 09 03
Beaver Run-Olentangy River	05060001 10 03
Brandige Run-Olentangy River	05060001 10 05
Indian Run-Olentangy River	05060001 10 06
Delaware Run-Olentangy River	05060001 10 07
Deep Run-Olentangy River	05060001 11 01
Rush Run-Olentangy River	05060001 11 02
Mouth Olentangy River	05060001 11 03
West Branch Alum Creek	05060001 14 01
Headwaters Alum Creek	05060001 14 02
Big Run-Alum Creek	05060001 14 03
Headwaters Walnut Creek	05060001 17 02
Hellbranch Run	05060001 22 01
Blue Creek-Salt Creek	05060002 06 05
Little Beaver Creek-Big Beaver Creek	05060002 13 03
Town of Washington Court House-Paint Creek	05060003 01 03
South Fork Rocky Fork	05060003 05 01
Clear Creek	05060003 05 02
Headwaters Rocky Fork	05060003 05 03
Rocky Fork Lake-Rocky Fork	05060003 05 04
Franklin Branch-Rocky Fork	05060003 05 05
Mud Run-North Fork Paint Creek	05060003 08 05
North Fork Great Miami River	05080001 01 01
South Fork Great Miami River	05080001 01 02

Water Body (Category 1h: Unimpaired based on Historic Data)	Assessment Unit
Garbry Creek-Great Miami River	05080001 07 05
South Fork Stillwater River	05080001 09 01
Headwaters Stillwater River	05080001 09 02
North Fork Stillwater River	05080001 09 03
Boyd Creek	05080001 09 04
Woodington Run-Stillwater River	05080001 09 05
Town of Beamsville-Stillwater River	05080001 09 06
Indian Creek	05080001 12 01
Swamp Creek	05080001 12 02
Trotters Creek	05080001 12 03
Harris Creek	05080001 12 04
Clarence J Brown Lake-Buck Creek	05080001 17 05
Lesley Run-Twin Creek	05080002 02 05
Town of Gratis-Twin Creek	05080002 03 04
Town of Germantown-Twin Creek	05080002 03 06
Headwaters Sevenmile Creek	05080002 05 01
Paint Creek	05080002 05 02
Beasley Run-Sevenmile Creek	05080002 05 03
Ninemile Creek-Sevenmile Creek	05080002 05 05
Headwaters Four Mile Creek	05080002 06 01
Little Four Mile Creek	05080002 06 02
East Fork Four Mile Creek-Four Mile Creek	05080002 06 03
Cotton Run-Four Mile Creek	05080002 06 05
Town of Zaleski-Raccoon Creek	05090101 02 05
Headwaters Little Raccoon Creek	05090101 04 01
McDowell Creek-Little Scioto River	05090103 05 04
McConnel Creek-Rocky Fork	05090103 06 03
North Branch Caesar Creek	05090202 04 01
Upper Caesar Creek	05090202 04 02
South Branch Caesar Creek	05090202 04 03
Flat Fork	05090202 04 05
Dutch Creek	05090202 06 01
Headwaters Todd Fork	05090202 06 02
Lytle Creek	05090202 06 03
Headwaters Cowan Creek	05090202 06 04
Little Creek-Todd Fork	05090202 06 06
Turtle Creek	05090202 10 01
Headwaters Dodson Creek	05090202 10 03
Anthony Run-Dodson Creek	05090202 10 04
West Fork East Fork Little Miami River	05090202 10 05
Glady Creek-East Fork Little Miami River	05090202 10 06
Solomon Run-East Fork Little Miami River	05090202 11 01
Fivemile Creek-East Fork Little Miami River	05090202 11 02
Todd Run-East Fork Little Miami River	05090202 11 03
Poplar Creek	05090202 12 01
Cloverlick Creek	05090202 12 02
Backbone Creek-East Fork Little Miami River	05090202 12 04
Brushy Fork	05090202 13 02
Moores Fork-Stonelick Creek	05090202 13 03

Table E-9 — Waters for which the existing impaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 5h.*Note: The waters remain on the 303(d) list.*

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Shantee Creek	04100001 03 01
Halfway Creek	04100001 03 02
Prairie Ditch	04100001 03 03
North Tenmile Creek	04100001 03 05
Tenmile Creek	04100001 03 06
Eagle Creek	04100003 03 03
Village of Montpelier-St Joseph River	04100003 03 04
Bear Creek	04100003 03 05
West Buffalo Cemetery-St Joseph River	04100003 03 06
Bluff Run-St Joseph River	04100003 05 01
Big Run	04100003 05 02
Russell Run-St Joseph River	04100003 05 03
Sol Shank Ditch-St Joseph River	04100003 05 06
Muddy Creek	04100004 01 01
Center Branch St Marys River	04100004 01 02
East Branch St Marys River	04100004 01 03
Kopp Creek	04100004 01 04
Sixmile Creek	04100004 01 05
Hussey Creek	04100004 02 01
Eightmile Creek	04100004 02 02
Blierdofer Ditch	04100004 02 03
Twelvemile Creek	04100004 02 04
Little Black Creek	04100004 03 01
Black Creek	04100004 03 02
Duck Creek	04100004 03 04
Leatherwood Creek	04100006 03 02
Beaver Creek	04100006 05 01
Brush Creek	04100006 05 02
Buckskin Creek-Tiffin River	04100006 06 04
Headwaters Auglaize River	04100007 01 01
Blackhoof Creek	04100007 01 02
Wrestle Creek-Auglaize River	04100007 01 03
Pusheta Creek	04100007 01 04
Two Mile Creek	04100007 02 01
Upper Hog Creek	04100007 03 01
Middle Hog Creek	04100007 03 02
Little Hog Creek	04100007 03 03
Lower Hog Creek	04100007 03 04
Little Ottawa River	04100007 04 01
Dug Run-Ottawa River	04100007 04 02
Honey Run	04100007 04 03
Pike Run	04100007 04 04
Leatherwood Ditch	04100007 04 05
Beaver Run-Ottawa River	04100007 04 06
Sugar Creek	04100007 05 01
Plum Creek	04100007 05 02
Village of Kalida-Ottawa River	04100007 05 03
Upper Jennings Creek	04100007 09 01
West Jennings Creek	04100007 09 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Lower Jennings Creek	04100007 09 03
Prairie Creek	04100007 09 06
Cessna Creek	04100008 01 01
Headwaters Blanchard River	04100008 01 02
The Outlet-Blanchard River	04100008 01 03
Potato Run	04100008 01 04
Ripley Run-Blanchard River	04100008 01 05
Brights Ditch	04100008 02 01
The Outlet	04100008 02 02
Findlay Upground Reservoirs-Blanchard River	04100008 02 03
Lye Creek	04100008 02 04
Upper Eagle Creek	04100008 03 01
Lower Eagle Creek	04100008 03 02
Aurand Run	04100008 03 03
Howard Run-Blanchard River	04100008 03 04
Tiderishi Creek	04100008 05 01
Ottawa Creek	04100008 05 02
Moffitt Ditch	04100008 05 03
Dukes Run	04100008 05 04
Dutch Run	04100008 05 05
Town of Pemberville-Portage River	04100010 03 02
Sugar Creek	04100010 04 01
Larcarpe Creek Outlet #4-Portage River	04100010 04 02
Little Portage River	04100010 05 01
Upper Toussaint Creek	04100010 06 01
Packer Creek	04100010 06 02
Headwaters Paramour Creek-Sandusky River	04100011 04 01
Loss Creek-Sandusky River	04100011 04 02
Headwaters Middle Sandusky River	04100011 04 03
Grass Run	04100011 04 04
Headwaters Lower Sandusky River	04100011 04 05
Town of Upper Sandusky-Sandusky River	04100011 07 02
Negro Run	04100011 07 03
Cranberry Run-Sandusky River	04100011 07 04
Sugar Run-Sandusky River	04100011 07 05
Clear Creek-Vermilion River	04100012 01 01
Buck Creek	04100012 01 02
Southwest Branch Vermilion River	04100012 01 03
Indian Creek-Vermilion River	04100012 01 05
East Branch Vermilion River	04100012 02 01
East Fork Vermilion River	04100012 02 02
Town of Wakeman-Vermilion River	04100012 02 03
Plum Creek	04110001 01 01
North Branch West Branch Rocky River	04110001 01 02
Headwaters West Branch Rocky River	04110001 01 03
Mallet Creek	04110001 01 04
Plum Creek	04110001 01 07
East Fork of East Branch Black River	04110001 03 01
Headwaters West Fork East Branch Black River	04110001 03 02
Willow Creek	04110001 04 03
Upper West Branch Black River	04110001 05 02
Middle West Branch Black River	04110001 05 04

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Plum Creek	04110001 05 05
French Creek	04110001 06 01
West Branch Cuyahoga River	04110002 01 02
Tare Creek-Cuyahoga River	04110002 01 03
Black Brook	04110002 01 05
Potter Creek-Breakneck Creek	04110002 02 01
Feeder Canal-Breakneck Creek	04110002 02 02
Plum Creek	04110002 03 01
City of Akron-Little Cuyahoga River	04110002 03 04
Fish Creek-Cuyahoga River	04110002 03 05
Yellow Creek	04110002 04 02
Furnace Run	04110002 04 03
Brandywine Creek	04110002 04 04
Pond Brook	04110002 05 01
Headwaters Tinkers Creek	04110002 05 02
Headwaters Chippewa Creek	04110002 05 03
Town of Twinsburg-Tinkers Creek	04110002 05 04
East Branch Ashtabula River	04110003 01 01
West Branch Ashtabula River	04110003 01 02
Upper Ashtabula River	04110003 01 03
Griswold Creek-Chagrin River	04110003 04 02
Dead Branch	04110004 01 01
Headwaters Grand River	04110004 01 02
Baughman Creek	04110004 01 03
Swine Creek	04110004 01 06
Upper Rock Creek	04110004 02 01
Lower Rock Creek	04110004 02 03
Phelps Creek	04110004 03 01
Hoskins Creek	04110004 03 02
Mill Creek-Grand River	04110004 03 03
Mud Creek	04110004 03 04
Three Brothers Creek-Grand River	04110004 05 01
East Branch Middle Fork Little Beaver Creek	05030101 04 01
Headwaters Middle Fork Little Beaver Creek	05030101 04 02
Stone Mill Run-Middle Fork Little Beaver Creek	05030101 04 03
Lisbon Creek-Middle Fork Little Beaver Creek	05030101 04 04
Elk Run-Middle Fork Little Beaver Creek	05030101 04 05
Longs Run	05030101 06 01
Honey Creek	05030101 06 02
Headwaters North Fork Little Beaver Creek	05030101 06 03
Little Bull Creek	05030101 06 04
Headwaters Bull Creek	05030101 06 05
Leslie Run-Bull Creek	05030101 06 06
Dilworth Run-North Fork Little Beaver Creek	05030101 06 07
Brush Run-North Fork Little Beaver Creek	05030101 06 08
Rough Run-Little Beaver Creek	05030101 06 09
Bieler Run-Little Beaver Creek	05030101 06 10
Headwaters Yellow Creek	05030101 07 01
Elkhorn Creek	05030101 07 02
Upper North Fork	05030101 07 03
Headwaters North Fork Yellow Creek	05030101 08 02
Salt Run-North Fork Yellow Creek	05030101 08 03

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Upper Cross Creek	05030101 10 01
Salem Creek	05030101 10 02
Middle Cross Creek	05030101 10 03
Frontal Pymatuning Reservoir	05030102 01 04
Willow Creek	05030103 02 02
Mill Creek	05030103 02 03
Island Creek-Mahoning River	05030103 02 04
Kale Creek	05030103 03 01
Headwaters West Branch Mahoning River	05030103 03 02
Barrel Run	05030103 03 03
Headwaters Eagle Creek	05030103 04 01
South Fork Eagle Creek	05030103 04 02
Camp Creek-Eagle Creek	05030103 04 03
Tinkers Creek	05030103 04 04
Burgess Run-Yellow Creek	05030103 08 06
Crabapple Creek	05030106 03 01
Headwaters Wheeling Creek	05030106 03 02
Flat Run-Wheeling Creek	05030106 03 04
Buffalo Run-West Fork Duck Creek	05030201 09 02
New Years Creek-Duck Creek	05030201 09 03
Horse Cave Creek	05030202 03 01
Headwaters East Branch Shade River	05030202 03 02
Big Run-East Branch Shade River	05030202 03 03
Spruce Creek-Shade River	05030202 03 04
Baldwin Run	05030204 04 02
Pleasant Run	05030204 04 03
Tarhe Run-Hocking River	05030204 04 04
Buck Run-Hocking River	05030204 04 05
Scott Creek	05030204 06 02
Oldtown Creek	05030204 06 03
Fivemile Creek	05030204 06 04
Headwaters Tuscarawas River	05040001 01 01
Pigeon Creek	05040001 01 02
Hudson Run	05040001 01 03
Wolf Creek	05040001 01 04
Headwaters Chippewa Creek	05040001 02 01
Hubbard Creek-Chippewa Creek	05040001 02 02
Little Chippewa Creek	05040001 02 03
River Styx	05040001 02 04
Tommy Run-Chippewa Creek	05040001 02 05
Red Run	05040001 02 06
Silver Creek-Chippewa Creek	05040001 02 07
Pancake Creek-Tuscarawas River	05040001 03 01
Lake Lucern-Nimisila Creek	05040001 03 03
Fox Run	05040001 03 04
Headwaters Newman Creek	05040001 03 06
Town of North Lawrence-Newman Creek	05040001 03 07
Conser Run	05040001 04 01
Middle Branch Sandy Creek	05040001 04 02
Pipes Fork-Still Fork	05040001 04 03
Muddy Fork	05040001 04 04
Reeds Run-Still Fork	05040001 04 05

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Swartz Ditch-Middle Branch Nimishillen Creek	05040001 05 01
East Branch Nimishillen Creek	05040001 05 02
West Branch Nimishillen Creek	05040001 05 03
Hugle Run	05040001 06 01
Pipe Run	05040001 06 02
Black Run	05040001 06 03
Little Sandy Creek	05040001 06 04
Indian Run-Sandy Creek	05040001 06 06
Village of Pavonia-Black Fork Mohican River	05040002 02 01
Headwaters Rocky Fork	05040002 02 03
Outlet Rocky Fork	05040002 02 04
Headwaters Wakatomika Creek	05040004 01 01
Winding Fork	05040004 01 02
Brushy Fork	05040004 01 03
Black Run-Wakatomika Creek	05040004 02 01
Mill Fork	05040004 02 02
Little Wakatomika Creek	05040004 02 03
Claylick Creek	05040006 05 01
Lost Run	05040006 05 02
Dudley Run-Rush Creek	05060001 02 03
Rock Fork	05060001 03 01
Honey Creek-Little Scioto River	05060001 03 04
Panther Creek	05060001 04 02
Wolf Creek-Scioto River	05060001 04 03
Wildcat Creek	05060001 04 04
Glade Run-Scioto River	05060001 04 06
Mud Run	05060001 08 02
Flat Run	05060001 08 03
Town of Caledonia-Olentangy River	05060001 08 04
Shaw Creek	05060001 09 01
Otter Creek-Olentangy River	05060001 10 01
Grave Creek	05060001 10 02
Qu Qua Creek	05060001 10 04
Pawpaw Creek	05060001 17 01
Poplar Creek	05060001 17 03
Sycamore Creek	05060001 17 04
Georges Creek	05060001 18 01
Tussing Ditch-Walnut Creek	05060001 18 02
Turkey Run	05060001 18 03
Little Walnut Creek	05060001 18 04
Mud Run-Walnut Creek	05060001 18 06
Headwaters Big Darby Creek	05060001 19 01
Buck Run	05060001 19 03
Sugar Run	05060001 19 04
Headwaters Treacle Creek	05060001 20 01
Proctor Run-Treacle Creek	05060001 20 02
Headwaters Little Darby Creek	05060001 20 03
Spring Fork	05060001 20 04
Gay Run-Big Darby Creek	05060001 22 02
Grove Run-Scioto River	05060001 23 04
Hargus Creek	05060002 04 01
Yellowbud Creek	05060002 04 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Congo Creek	05060002 04 04
Beech Fork	05060002 06 01
Headwaters Salt Creek	05060002 06 02
Laurel Run	05060002 06 03
Pine Creek	05060002 06 04
Sour Run-Little Salt Creek	05060002 08 05
East Fork Queer Creek	05060002 09 01
Pretty Run	05060002 09 03
Pike Run	05060002 09 04
Village of Eagle Mills-Salt Creek	05060002 09 05
Indian Creek	05060002 10 01
Dry Run	05060002 10 02
Headwaters Walnut Creek	05060002 10 03
Lick Run-Walnut Creek	05060002 10 04
Big Run-Scioto River	05060002 16 02
Headwaters Paint Creek	05060003 01 01
East Fork Paint Creek	05060003 01 02
Indian Creek-Paint Creek	05060003 06 01
Farmers Run-Paint Creek	05060003 06 02
Cherokee Mans Run	05080001 03 01
Rennick Creek-Great Miami River	05080001 03 02
Rum Creek	05080001 03 03
Blue Jacket Creek	05080001 03 04
Bokengehalas Creek	05080001 03 05
Brandywine Creek-Great Miami River	05080001 03 06
McKees Creek	05080001 04 01
Lee Creek	05080001 04 02
Indian Creek	05080001 04 04
Plum Creek	05080001 04 05
Turkeyfoot Creek-Great Miami River	05080001 04 06
Machochee Creek	05080001 15 01
Headwaters Mad River	05080001 15 02
Kings Creek	05080001 15 03
Glady Creek-Mad River	05080001 15 04
Muddy Creek	05080001 16 01
Dugan Run	05080001 16 02
Nettle Creek	05080001 16 03
Anderson Creek	05080001 16 04
Storms Creek	05080001 16 05
Chapman Creek	05080001 16 06
Bogles Run-Mad River	05080001 16 07
Moore Run	05080001 18 01
Pondy Creek-Mad River	05080001 18 02
Mill Creek	05080001 18 03
Donnels Creek	05080001 18 04
Rock Run-Mad River	05080001 18 05
Jackson Creek-Mad River	05080001 18 06
Mud Creek	05080001 19 01
Mud Run	05080001 19 02
Poplar Creek-Great Miami River	05080001 20 05
North Branch Wolf Creek	05080002 01 01
Headwaters Wolf Creek	05080002 01 02

Water Body (Category 5h: Impaired Based on Historic Data)	Assessment Unit
Holes Creek	05080002 01 04
Millers Fork	05080002 02 01
Headwaters Twin Creek	05080002 02 02
Swamp Creek	05080002 02 03
Price Creek	05080002 02 04
Bantas Fork	05080002 03 01
Aukerman Creek	05080002 03 02
Toms Run	05080002 03 03
Little Twin Creek	05080002 03 05
Elk Creek	05080002 07 01
Shaker Creek	05080002 07 03
Dicks Creek	05080002 07 04
Gregory Creek	05080002 07 05
Beals Run-Indian Creek	05080002 08 03
Pleasant Run	05080002 09 01
Paddys Run	05080002 09 03
Taylor Creek	05080002 09 05
Hales Creek	05090103 02 01
Headwaters Pine Creek	05090103 02 02
Little Pine Creek	05090103 02 03
Big Threemile Creek	05090201 06 04
Headwaters Little Miami River	05090202 01 01
North Fork Little Miami River	05090202 01 02
Buffenbarger Cemetery-Little Miami River	05090202 01 03
Yellow Springs Creek-Little Miami River	05090202 01 04
North Fork Massies Creek	05090202 02 01
South Fork Massies Creek	05090202 02 02
Massies Creek	05090202 02 03
Little Beaver Creek	05090202 02 04
Beaver Creek	05090202 02 05
Shawnee Creek-Little Miami River	05090202 02 06
Sugar Creek	05090202 05 01
Town of Bellbrook-Little Miami River	05090202 05 02
Glady Run	05090202 05 03
East Fork Mill Creek-Mill Creek	05090203 01 01
West Fork Mill Creek	05090203 01 02
Sharon Creek-Mill Creek	05090203 01 03
Congress Run-Mill Creek	05090203 01 04
Chickasaw Creek	05120101 02 01
Headwaters Beaver Creek	05120101 02 02
Coldwater Creek	05120101 02 03

Table E-10 — Waters with current fish tissue data where inadequate samples exist to determine impairment status. These waters are category 3i.

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Cornell Ditch-Fish Creek	04100003 04 06
Lower Lick Creek	04100006 04 04
Dry Run-Auglaize River	04100007 01 05
Middle Creek	04100007 08 05
Lower Blue Creek	04100007 10 04
Upper Powell Creek	04100007 11 02
Lower Powell Creek	04100007 11 03

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Middle South Turkeyfoot Creek	04100009 01 04
Lower South Turkeyfoot Creek	04100009 01 06
Lower Yellow Creek	04100009 05 06
Middle Beaver Creek	04100009 05 08
Delaware Creek-Maumee River	04100009 09 04
Town of Bloomdale-South Branch Portage River	04100010 02 03
Mills Creek	04100011 01 03
Pickrel Creek	04100011 02 03
Raccoon Creek	04100011 02 04
Beaver Creek	04100011 12 02
Muskellunge Creek	04100011 13 01
Red Creek-Grand River	04110004 06 07
Piney Creek-Captina Creek	05030106 09 04
Cat Run-Captina Creek	05030106 09 06
Lower Sunfish Creek	05030201 01 04
Mouth Clear Creek	05030204 03 02
Dog Run-Conotton Creek	05040001 08 05
Boggs Fork	05040001 13 03
Town of Uhrichville-Stillwater Creek	05040001 16 04
Evans Creek	05040001 19 01
Jerome Fork-Mohican River	05040002 06 05
Job Run-North Branch Kokosing River	05040003 01 03
Granny Creek-Kokosing River	05040003 02 03
Buckeye Fork	05040004 04 04
Painter Creek-Jonathon Creek	05040004 04 07
Manns Fork Salt Creek	05040004 06 05
Depue Run-Seneca Fork	05040005 01 04
Chapman Run	05040005 02 06
Salt Fork Lake-Sugartree Fork	05040005 04 05
Sarchet Run-Wills Creek	05040005 05 04
Headwaters Little Scioto River	05060001 03 02
City of Marion-Little Scioto River	05060001 03 03
Eversole Run	05060001 12 01
Deer Creek Dam-Deer Creek	05060002 02 07
State Run-Deer Creek	05060002 03 04
Buckeye Creek	05060002 08 02
Horse Creek-Little Salt Creek	05060002 08 03
Big Branch-Rattlesnake Creek	05060003 04 07
Dismal Creek	05080001 10 01
Sinking Creek	05080001 17 03
Town of New Miami-Great Miami River	05080002 07 06
Banklick Creek-Great Miami River	05080002 09 02
Flat Run-Raccoon Creek	05090101 03 04
Meadow Run-Little Raccoon Creek	05090101 04 03
Deer Creek-Little Raccoon Creek	05090101 04 04
Flatlick Run-Raccoon Creek	05090101 05 03
McKinney Creek-Symmes Creek	05090101 10 05
Bear Creek-Ohio River	05090201 11 06
Mouth Anderson Fork	05090202 03 03
East Fork Todd Fork	05090202 07 01

Table E-11 — Large rivers and their impairment status.

Water Body (Large Rivers)	Assessment Unit	Impairment Status
Auglaize River Mainstem (Ottawa River to mouth); excluding Defiance Power Dam Reservoir	04100007 90 01	Impaired (PCBs)
Blanchard River Mainstem (Dukes Run to mouth)	04100008 90 01	Impaired (historical)
Cuyahoga River Mainstem (Brandywine Cr. to mouth); including old channel	04110002 90 01	Impaired (PCBs)
Grand River Mainstem (Mill Creek to mouth)	04110004 90 01	Impaired (PCBs)
Great Miami River Mainstem (Four Mile Creek to Ohio River)	05080002 90 02	Impaired (PCBs)
Great Miami River Mainstem (Mad River to Four Mile Creek)	05080002 90 01	Impaired (PCBs)
Great Miami River Mainstem (Tawawa Creek to Mad River)	05080001 90 01	Impaired (PCBs)
Hocking River (Margaret Creek to Ohio River)	05030204 90 02	Not impaired
Hocking River Mainstem (Scott Creek to Margaret Creek)	05030204 90 01	Not impaired
Licking River Mainstem (entire length); excluding Dillon Lake	05040006 90 01	Impaired (PCBs)
Little Miami River Mainstem (Caesar Creek to O'Bannon Creek)	05090202 90 01	Impaired (historical)
Little Miami River Mainstem (O'Bannon Creek to Ohio River)	05090202 90 02	Impaired (PCBs)
Mad River Mainstem (Donnels Creek to mouth)	05080001 90 03	Impaired (PCBs)
Mahoning River Mainstem (Eagle Creek to Pennsylvania Border)	05030103 90 01	Impaired (PCBs)
Maumee River Mainstem (Beaver Creek to Maumee Bay)	04100009 90 02	Impaired (PCBs)
Maumee River Mainstem (IN border to Tiffin River)	04100005 90 01	Impaired (PCBs)
Maumee River Mainstem (Tiffin River to Beaver Creek)	04100009 90 01	Impaired (PCBs)
Mohican River Mainstem (entire length)	05040002 90 01	Impaired (PCBs)
Muskingum River Mainstem (Licking River to Meigs Creek)	05040004 90 02	Impaired (PCBs)
Muskingum River Mainstem (Meigs Creek to Ohio River)	05040004 90 03	Impaired (PCBs)
Muskingum River Mainstem (Tuscarawas/Walhonding confluence to Licking River)	05040004 90 01	Impaired (PCBs)
Paint Creek Mainstem (Rocky Fork to mouth)	05060003 90 01	Impaired (historical)
Raccoon Creek Mainstem (Little Raccoon Creek to mouth)	05090101 90 01	Not impaired
Sandusky River Mainstem (Tymochtee Creek to Wolf Creek)	04100011 90 01	Impaired (PCBs, Mercury)
Sandusky River Mainstem (Wolf Creek to Sandusky Bay)	04100011 90 02	Impaired (PCBs)
Scioto River Mainstem (Big Darby Creek to Paint Creek)	05060002 90 01	Impaired (PCBs)
Scioto River Mainstem (L. Scioto R. to Olentangy R.); excluding O'Shaughnessy and Griggs reservoirs	05060001 90 01	Impaired (PCBs)
Scioto River Mainstem (Olentangy River to Big Darby Creek)	05060001 90 02	Impaired (PCBs)
Scioto River Mainstem (Paint Creek to Sunfish Creek)	05060002 90 02	Impaired (PCBs)
Scioto River Mainstem (Sunfish Creek to Ohio River)	05060002 90 03	Impaired (PCBs)
Stillwater River Mainstem (Greenville Creek to mouth)	05080001 90 02	Not impaired
Tiffin River Mainstem (Brush Creek to mouth)	04100006 90 01	Impaired (PCBs)
Tuscarawas River Mainstem (Chippewa Creek to Sandy Creek)	05040001 90 01	Impaired (historical)
Tuscarawas River Mainstem (Sandy Creek to Stillwater Creek)	05040001 90 02	Impaired (historical)
Tuscarawas River Mainstem (Stillwater Creek to Muskingum River)	05040001 90 03	Impaired (historical)
Walhonding River Mainstem (entire length)	05040003 90 01	Not impaired
Whitewater River Mainstem (entire length)	05080003 90 01	Impaired (PCBs)
Wills Creek Mainstem (Salt Fork to mouth); excluding Wills Creek Lake	05040005 90 01	Not impaired

BOLD text indicates impaired rivers.

Table E-12 — Inland lakes and their impairment status.

Water Body (Inland Lakes)	Impairment status (cause)
Acton Lake	Not impaired
Adams Lake	Insufficient information
Alum Creek Lake	Not impaired
Apple Valley Lake	Not impaired
Archibold Reservoir #2	Insufficient information
Atwood Lake	Not impaired
Barnesville Reservoir #1	Insufficient information
Barnesville Reservoir #2	Insufficient information
Barnesville Reservoir #3	Insufficient information
Belmont Lake	Not impaired
Buckeye Lake	Not impaired
Caesar Creek Lake	Not impaired
Caldwell Lake	Insufficient information
Charles Mill Lake	Insufficient information
Chippewa Lake	Insufficient information
CJ Brown Reservoir	Insufficient information
Clark Lake	Insufficient information
Clear Fork Reservoir	Impaired (PCBs)
Clendening Lake	Not impaired
Cowan Lake	Not impaired
Cutler Lake	Insufficient information
Deer Creek Lake	Not impaired
Delphos Reservoir	Insufficient information
Delta Reservoir #2	Not impaired
Dillon Lake	Not impaired
East Branch Reservoir	Not impaired
East Fork Lake	Not impaired
East Reservoir	Insufficient information
Ferguson Reservoir	Not impaired
Findley Lake	Not impaired
Findley Reservoir #2	Impaired (PCBs)
Friendship Park Lake	Insufficient information
Grand Lake St Marys	Insufficient information
Griggs Reservoir	Not impaired
Hammertown Lake	Insufficient information
Hargus Lake	Insufficient information
Hinckley Lake	Insufficient information
Hoover Reservoir	Not impaired
Indian Lake	Not impaired
Jackson Lake	Insufficient information
Jefferson Lake	Not impaired
Kiser Lake	Not impaired
Knox Lake	Not impaired
LaDue Reservoir	Impaired (PCBs)
Lake Glacier	Not impaired
Lake Isabella	Insufficient information
Lake Jisco	Insufficient information
Lake Katherine	Insufficient information
Lake Logan	Not impaired
Lake Loramie	Not impaired
Lake Milton	Impaired (PCBs)

Water Body (Inland Lakes)	Impairment status (cause)
Lake Nesmith	Impaired (PCBs)
Lake Olander	Insufficient information
Lake Rockwell	Impaired (PCBs)
Lake Vesuvius	Not impaired
Lake White	Not impaired
Long Lake	Insufficient information
Madison Lake	Insufficient information
Marysville Reservoir	Insufficient information
Meadowbrook Lake	Insufficient information
Metzger Reservoir	Insufficient information
Mogadore Reservoir	Not impaired
Mosquito Creek Lake	Not impaired
Nettle Lake	Insufficient information
New London Reservoir	Not impaired
Nimisila Reservoir	Not impaired
North Fork Kokosing Reservoir	Not impaired
O'Shaughnessy Reservoir	Not impaired
Paint Creek Lake	Not impaired
Piedmont Lake	Not impaired
Pike Lake	Not impaired
Pleasant Hill Lake	Not impaired
Pymatuning Reservoir	Not impaired
Rose Lake	Impaired (PCBs)
Rush Creek Lake	Not impaired
Rush Run Lake	Not impaired
Salt Fork Reservoir	Not impaired
Seneca Lake	Insufficient information
Sippo Lake	Not impaired
Stewart Lake	Insufficient information
Stonelick Lake	Not impaired
Summit Lake	Impaired (PCBs)
Swift Run Lake	Insufficient information
Tappan Lake	Not impaired
Turkey Creek Lake	Not impaired
Van Wert Reservoir #1	Insufficient information
Van Wert Reservoir #2	Insufficient information
Veteran's Memorial Reservoir	Not impaired
Wellington Upground Reservoir	Insufficient information
West Branch Reservoir	Impaired (PCBs)
Westville Lake	Impaired (PCBs)
Wills Creek Reservoir	Not impaired
Wingfoot Lake	Not impaired

BOLD text indicates impaired lakes.

Table E- 13 — Lake Erie assessment units and their impairment status.

Lake Erie Assessment Unit	Assessment Unit	Impairment Status
LE Central Basin Shoreline	041202000203	Impaired (PCBs)
LE Central Basin Open Water	041202000303	Insufficient information ⁴
LE Islands Shoreline	041202000101	Impaired (PCBs)
LE Sandusky Basin Shoreline	041202000202	Impaired (PCBs)
LE Sandusky Basin Open Water	041202000302	Insufficient information
LE Western Basin Shoreline	041202000201	Impaired (PCBs)
LE Western Basin Open Water	041202000301	Insufficient information

BOLD text indicates impaired units.

E4. Supplemental Information

E4.1 Calculation of Fish Concentrations from Water Quality Standards Inputs

For carcinogens:

$$\text{Fish Concentration (mg/kg)} = \frac{\left[\frac{\text{Cancer Risk Level}}{q1 * ((\text{mg/kg/d})^{-1})} \right] \times \text{Body Weight (kg)}}{\text{Fish Consumption (kg/d)}}$$

For noncarcinogens:

$$\text{Fish Concentration (mg/kg)} = \frac{\text{RfD (mg/kg/d)} \times \text{Body Weight (kg)} \times \text{RSC}}{\text{Fish Consumption (kg/d)}}$$

For wildlife:

$$\text{Fish Concentration (mg/kg)} = \text{Wildlife WQC (mg/L)} \times \text{BAF TL}_n (\text{L/kg})$$

⁴ A revised assessment method for the new Lake Erie units is scheduled for development, including collaboration with Ohio Department of Natural Resources data collectors to evaluate appropriate sampling locations and frequencies.

Lake Erie Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro- benzene	Mirex
HHWQC	3.1 ng/L	2.4 µg/L	0.15 ng/L	0.026 ng/L	0.45 ng/L	0.074 ng/L
Wildlife Criteria	1.3 ng/L	N/A	0.011 ng/L	0.12 ng/L	N/A	N/A
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	1E-04 mg/kg/d	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 (mg/kg/d) ⁻¹	0.34 (mg/kg/d) ⁻¹	2.0 (mg/kg/d) ⁻¹	1.6 (mg/kg/d) ⁻¹	0.53 (mg/kg/d) ⁻¹
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	65 kg	70 kg	70 kg	70 kg	70 kg	70 kg
Trophic Level Three Bioaccumulation Factor (BAF TL ³)	27,900	116,600	376,400	520,900	43,690	353,000
Trophic Level Four Bioaccumulation Factor (BAF TL ⁴)	140,000	154,200	1,114,000	1,871,000	71,080	1,461,000
Fish Consumption	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d
Relative Source Contribution Factor (RSC)	0.8	N/A	N/A	N/A	N/A	N/A

Source: U.S. EPA. 1995. Great Lakes Water Quality Initiative Criteria Documents for the Protection of Human Health. EPA-820-B-95-006. March 1995.

Derivation of Concentrations

Lake Erie Drainage Basin Mercury Human Health Fish Concentration

$$\frac{1E-04 \text{ (mg/kg/d)} \times 65 \text{ (kg)} \times 0.8}{0.015 \text{ (kg/d)}} = 0.35 \text{ (mg/kg)} = 350 \text{ (}\mu\text{g/kg)}$$

Lake Erie Drainage Basin Mercury Wildlife Fish Concentration

Trophic Level 3:

$$1.3E-06 \text{ (mg/L)} \times 27,900 \text{ (L/kg)} = 0.036 \text{ (mg/kg)} = 36 \text{ (}\mu\text{g/kg)}$$

Trophic Level 4:

$$1.3E-06 \text{ (mg/L)} \times 140,000 \text{ (L/kg)} = 0.18 \text{ (mg/kg)} = 180 \text{ (}\mu\text{g/kg)}$$

Lake Erie Drainage Basin Chlordane Human Health Fish Concentration

$$\frac{\left[\frac{1E-05}{0.35 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.015 \text{ (kg/d)}} = 0.13 \text{ (mg/kg)} = 130 \text{ (}\mu\text{g/kg)}$$

Lake Erie Drainage Basin DDT Human Health Fish Concentration

$$\frac{\left[\frac{1E-05}{0.34 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.015 \text{ (kg/d)}} = 0.14 \text{ (mg/kg)} = 140 \text{ (}\mu\text{g/kg)}$$

Lake Erie Drainage Basin DDT Wildlife Fish Concentration

Trophic Level 3:

$$1.1E - 08 \text{ (mg/L)} \times 376,400 \text{ (L/kg)} = 0.0041 \text{ (mg/kg)} = 4.1 \text{ (\mu g/kg)}$$

Trophic Level 4:

$$1.1E - 08 \text{ (mg/L)} \times 1,140,000 \text{ (L/kg)} = 0.012 \text{ (mg/kg)} = 12 \text{ (\mu g/kg)}$$

Lake Erie Drainage Basin PCB Human Health Fish Concentration

$$\frac{\left[\frac{1E - 05}{2.0 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.015 \text{ (kg/d)}} = 0.023 \text{ (mg/kg)} = 23 \text{ (\mu g/kg)}$$

Lake Erie Drainage Basin PCB Wildlife Fish Concentration

Trophic Level 3:

$$1.2E - 07 \text{ (mg/L)} \times 520,900 \text{ (L/kg)} = 0.062 \text{ (mg/kg)} = 62 \text{ (\mu g/kg)}$$

Trophic Level 4:

$$1.2E - 07 \text{ (mg/L)} \times 1,871,000 \text{ (L/kg)} = 0.22 \text{ (mg/kg)} = 220 \text{ (\mu g/kg)}$$

Lake Erie Drainage Basin Hexachlorobenzene Human Health Fish Concentration

$$\frac{\left[\frac{1E - 05}{1.6 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.015 \text{ (kg/d)}} = 0.029 \text{ (mg/kg)} = 29 \text{ (\mu g/kg)}$$

Lake Erie Drainage Basin Mirex Human Health Fish Concentration

$$\frac{\left[\frac{1E - 05}{0.53 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.015 \text{ (kg/d)}} = 0.088 \text{ (mg/kg)} = 88 \text{ (\mu g/kg)}$$

Ohio River Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro- benzene	Mirex
HHWQC	12 ng/L*	21 ng/L	5.9 ng/L	1.7 ng/L	7.5 ng/L	0.11 ng/L
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	N/A	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 (mg/kg/d) ⁻¹	0.34 (mg/kg/d) ⁻¹	2.0 (mg/kg/d) ⁻¹	1.6 (mg/kg/d) ⁻¹	0.53 (mg/kg/d) ⁻¹
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	N/A	70 kg	70 kg	70 kg	70 kg	70 kg
Fish Consumption	N/A	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d
Relative Source Contribution Factor (RSC)	N/A	N/A	N/A	N/A	N/A	N/A

* Based on the FDA action level of 1 mg/kg divided by the BCF of 83,333 L/kg.

Ohio River Drainage Basin Mercury Fish Concentration

1 mg/kg based on FDA action level

Ohio River Drainage Basin Chlordane Fish Concentration

$$\frac{\left[\frac{1E-05}{0.35 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.0065 \text{ (kg/d)}} = 0.31 \text{ (mg/kg)} = 310 \text{ (\mu g/kg)}$$

Ohio River Drainage Basin DDT Fish Concentration

$$\frac{\left[\frac{1E-05}{0.34 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.0065 \text{ (kg/d)}} = 0.32 \text{ (mg/kg)} = 320 \text{ (\mu g/kg)}$$

Ohio River Drainage Basin PCB Fish Concentration

$$\frac{\left[\frac{1E-05}{2.0 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.0065 \text{ (kg/d)}} = 0.054 \text{ (mg/kg)} = 54 \text{ (\mu g/kg)}$$

Ohio River Drainage Basin Hexachlorobenzene Fish Concentration

$$\frac{\left[\frac{1E-05}{1.6 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.0065 \text{ (kg/d)}} = 0.067 \text{ (mg/kg)} = 67 \text{ (\mu g/kg)}$$

Ohio River Drainage Basin Mirex Fish Concentration

$$\frac{\left[\frac{1E-05}{0.53 \text{ (mg/kg/d)}^{-1}} \right] \times 70 \text{ (kg)}}{0.0065 \text{ (kg/d)}} = 0.20 \text{ (mg/kg)} = 200 \text{ (\mu g/kg)}$$

Fish Tissue Concentrations for Determining Impairment for the 2018 IR ($\mu\text{g/kg}$)

	Lake Erie HH	Lake Erie – wildlife TL3	Lake Erie – wildlife TL4	Ohio River
Mercury	350	36	180	1000
Chlordane	130	N/A	N/A	310
DDT	140	4.1	12	320
PCBs	23	62	220	54
Hexachlorobenzene	29	N/A	N/A	67
Mirex	88	N/A	N/A	200

E4.2 What's the difference between the Fish Consumption Advisory decision and the impairment decision?

Some question may arise as to how the methodology for determining impairment status for the 2018 IR for fish tissue relates to the fish advisories issued by the State of Ohio. Rather than building on FCA decisions, the revised methodology draws directly from the fish tissue contaminant database. This change was possible because of better accessibility to the raw data.

In short, the basis for determining impairment for the IR for fish tissue is similar but unrelated to the basis for determining advisories. The WQS calculations assume a certain amount of fish consumption and ensure that level of consumption is safe. The advisory calculations determine what level of fish consumption is safe. Therefore, both are protective of human health. However, advisories and IR impairment status are not directly related.

Advisory thresholds are given as one meal per week, one meal per month, one meal every other month and do not eat. Each threshold is associated with a particular contaminant concentration that is based on consuming an 8-ounce meal. For both PCBs and mercury, those thresholds are 50 parts per billion (ppb) for one meal per week, 220 ppb for one meal per month, 1,000 ppb for one meal every other month and 2,000 ppb for do not eat.

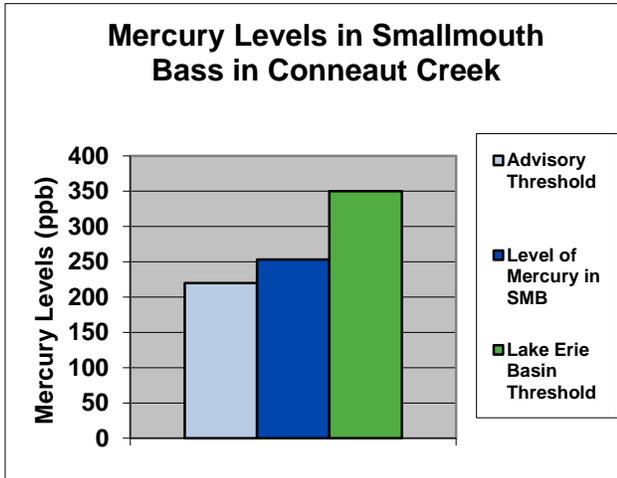
The thresholds used for determining IR categories are based on water quality standards for human health. The water quality standards assume that people are eating a certain quantity of different types of fish over time. The Lake Erie basin WQS calculations for mercury and PCBs assume that people are eating 15 grams of fish per day. The Ohio River basin calculations for PCBs and mercury assume that people are eating 6.5 grams of fish per day.

Advisory thresholds are prescriptive, indicating to people how much fish is safe to eat given a certain level of fish contamination. Water quality standard-based thresholds are descriptive, indicating how much contamination is acceptable in fish given that people are eating a certain amount of certain types of fish. In other words, the advisories tell people how much fish they can safely eat and the water quality standards assume how much fish people are eating and use that information to calculate a "safe" level of contamination in fish.

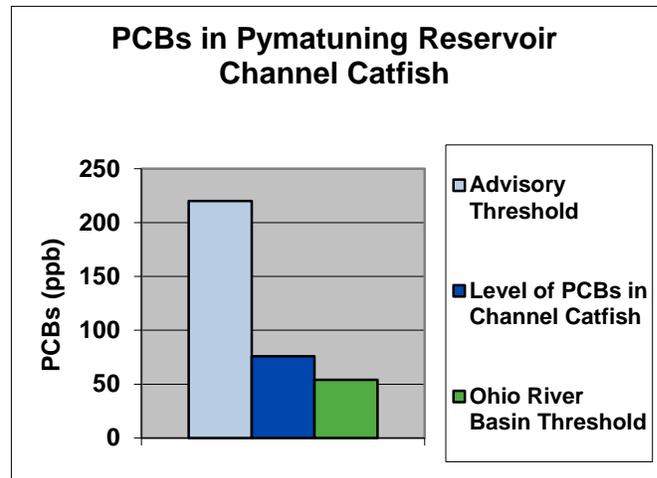
U.S. EPA, in its guidance on developing the IR, indicates that water quality standards are to be used as the basis for determining impairment categories for fish tissue. Because the assumptions used to calculate the advisories are different than the assumptions used to calculate the WQS, this results in cases where some water bodies have advisories against fish consumption, but are not listed as impaired; and some water bodies are listed as impaired, but no fish advisory is in place. This situation is demonstrated in the following table:

Parameter	Lake Erie Basin	Ohio River Basin	One meal per week advisory	One meal per month advisory
Fish Consumed	15 grams/day	6.5 grams/day	32.6 grams/day	7.6 grams/day
Maximum Allowable Fish Concentration				
PCB Threshold	23 ppb	54 ppb	50 ppb	220 ppb
Mercury Threshold	350 ppb	1000 ppb	50 ppb	220 ppb

The reason the thresholds are different between the two basins is that the assumed fish consumption levels are different. And the reason the water quality standard thresholds are different from the advisory thresholds is both because the fish consumption levels are different, and because for PCBs, a cancer slope factor is used to calculate the water quality standard criteria, which is stricter than the health protection value used to calculate the advisory threshold.



Data for smallmouth bass in Conneaut Creek provide an example where there is an advisory, but the water body is not impaired.



Channel catfish in Pymatuning Reservoir show a case where there is no advisory, but the water is listed as impaired.