Biennial Assessment of Ohio River Water Quality Conditions

for Water Years 2000 and 2001

July 2002

The Ohio River Valley Water Sanitation Commission
5735 Kellogg Avenue
Cincinnati, Ohio 45228-1112

PART I: EXECUTIVE SUMMARY

The Ohio River is one of the nation's great natural resources. It provides drinking water to nearly three million people; is a warm water habitat for aquatic life; provides numerous recreational opportunities; is used as a major transportation route; and is a source of water for manufacturing and power generation. The Ohio River forms in Pittsburgh, Pennsylvania at the confluence of the Allegheny and Monongahela rivers and flows in a southwesterly direction for 981 miles to join the Mississippi River near Cairo, Illinois. The first 40 miles of the Ohio River lie within the state of Pennsylvania. The remaining 941 miles form the state boundaries between Illinois, Indiana, and Ohio to the north, and Kentucky and West Virginia to the south.

The Ohio River Valley Water Sanitation Commission (ORSANCO; the Commission) is an interstate agency charged with abating existing pollution in the Ohio River Basin, and preventing future degradation of its waters. ORSANCO was created in 1948 with the signing of the Ohio River Valley Water Sanitation Compact. This report fulfills the following requirements of the Ohio River Valley Water Sanitation Compact:

1) To survey the district to determine water pollution problems.
2) To identify instances in which pollution from a state(s) injuriously affects waters of another state(s).

This report is a biennial assessment of Ohio River water quality conditions in terms of the degree to which the river supports each of its four designated uses: warm water aquatic life; public water supply; contact recreation; and fish consumption. The Ohio River Valley Water Sanitation Compact commits "...each state to place and maintain the waters of the basin in a satisfactory sanitary condition, available for safe and satisfactory use by public and industrial water supplies after reasonable treatment, suitable for recreation, capable of maintaining fish and other aquatic life.…"

This assessment uses three classifications to describe the attainment of Ohio River designated uses: fully supporting (good water quality), partially supporting (fair water quality), and not supporting (poor water quality). ORSANCO conducts water quality monitoring and assessments on behalf of the Ohio River main stem states (Illinois, Indiana, Kentucky, Ohio, Pennsylvania and West Virginia). The data collected from water quality monitoring conducted from November 1999 through September 2001, with the exception of dioxin data, was used to complete this biennial assessment and is reflective of water years 2000 and 2001. Dioxin data from 1997 through 2001 was used in the fish consumption use support assessment.

Warm Water Aquatic Life Use Support

Ohio River warm water aquatic life use support was assessed based on chemical water quality data collected from ORSANCO's nine dissolved metals sampling stations located on the mainstem, data generated from 17 bimonthly sampling sites on the mainstem, as well as direct measurements of fish communities. In October 2000, the Commission adopted dissolved metals criteria. Dissolved metals sampling and analyses measure the portion of metals that are dissolved in the water column. Recent findings demonstrate that widely accepted field sampling methods and laboratory techniques are responsible for significant contamination of total recoverable metals data, and have prompted the development of "clean techniques" for both sample collection and analysis. ORSANCO utilizes a modified Virginia Division of Environmental Quality grab sample collection technique. Low-level metals analyses are performed by the Virginia Department of General Services, Division of Consolidated Laboratory Services (Virginia DGSDCLS). This sampling, which occurs every other month, detected no violations of ORSANCO's dissolved metals criteria during this reporting period.

The Bimonthly Manual Sampling Program entails the collection of water column grab samples from 17 Ohio River stations once every other month. Samples are collected by contract samplers and analyzed for certain physical and chemical parameters by a contract laboratory. Metals data generated from this program are for total recoverable metals.

Fish communities were assessed using ORSANCO's newly developed Ohio River Fish Index (ORFIn) for evaluating fish population data. Although numeric criteria have not yet been adopted into ORSANCO Pollution Control Standards, use of ORFIn allows for the comprehensive assessment of Ohio River fish conditions. Only seven miles of the Ohio River were listed as impaired due to biological data. These segments cover Ohio River miles 354 through 361.

Nine hundred seventy-four miles (more than 99 percent) of the Ohio River are classified as fully supporting the aquatic life use and seven miles (less than one percent) are classified as partially supporting, possibly due to poor habitat conditions.

Public Water Supply Use Support

Ohio River public water supply use support was assessed based on chemical water quality data collected from the Bimonthly Sampling Program, bacteria monitoring, and impacts on Ohio River drinking water utilities caused by source water conditions.

Nine hundred seventy miles (99 percent) of the Ohio River are classified as fully supporting the public water supply use, and approximately 10.5 miles (one percent) are classified as partially supporting. Ohio River mile points 161.7 through 172.2 are classified as partially supporting because the criterion for phenolics was exceeded in greater than ten percent of samples at the Bimonthly Sampling station in Willow Island, West Virginia. These samples indicate impairment of Ohio River source water and do not necessarily indicate finished drinking water problems. Surveys were sent to 27 water utilities that use the Ohio River as a source for drinking water. Of the 19 responses

received, none indicated violations of the Safe Drinking Water Act for maximum contaminant levels in finished water that could be attributable to Ohio River source water quality. Results of bacteria monitoring indicated no violations of stream criteria for the protection of public water supplies from the Ohio River.

Contact Recreation Use Support

Data from ORSANCO's Recreation Season Monitoring Program were used to perform the contact recreation use support assessment. In 2000, ORSANCO conducted recreation season monitoring at six mainstem stations located downstream of urban centers with large combined sewer systems. Monitoring is conducted during the recreation period of May through October. In 2001, ORSANCO added thirteen sites at both upstream and downtown locations of the six established urban sampling areas. These sites provide a valuable comparison of bacteria levels both upstream and downstream of the monitored urban areas on the Ohio River.

There are approximately 52 combined sewer systems located along the Ohio. Combined sewer overflows and other nonpoint sources have been identified as significant causes of bacteria problems in the Ohio River, particularly during heavy rain events.

Approximately 40 miles (four percent) of the Ohio River are classified as partially supporting the contact recreation use and 136.5 miles (14 percent) are classified as not supporting. The remaining 804.3 miles (82 percent) of the Ohio River were not assessed. Unmonitored segments of the Ohio River are classified as not assessed. Monitoring sites are established in "worst case" locations. As a result, all ORSANCO monitoring stations demonstrated impairment for the contact recreation use.

Fish Consumption Use Support

Fish consumption use support was assessed based primarily on the states' issuance of fish consumption advisories and ORSANCO fish tissue contaminants data. The entire Ohio River is covered by a restricted fish consumption advisory based on PCBs. The states of Ohio, Kentucky and Indiana have statewide advisories for mercury; Pennsylvania has a statewide advisory covering all pollutants. West Virginia and Illinois do not have statewide advisories for mercury that affect the Ohio River during the reporting period. In the case of these statewide advisories, each states' individual protocol for issuing a fish consumption advisory was applied to Ohio River fish tissue mercury data. Impairment was determined only if the states' protocols for issuing a *one meal per week* advisory was met. This resulted in the majority of the Ohio River being listed as impaired for fish consumption use due to mercury.

Through the Ohio River Watershed Pollutant Reduction Program, ORSANCO collects "high volume" Ohio River water samples that are analyzed for dioxin. These data were compared to applicable ambient water quality criteria established for the protection of human health due to water and fish ingestion. Dioxin monitoring indicated an additional basis to assess fish consumption as impaired in

many segments of the Ohio River. The dioxin data collected from the high volume water column sampling, in conjunction with the fish consumption advisory issued by the state of West Virginia, comprises the dioxin assessment portion of the fish consumption use.

The entire 981 miles (100 percent) of the Ohio River are classified as partially supporting fish consumption use, due to restrictions in the states' advisories based on PCBs. Six- hundred and seventeen miles of the upper Ohio River are also impaired due to dioxin while 808 miles of the Ohio River are impaired due to mercury.

Table 1 is an overall summary of impaired uses of the Ohio River state-by-state.

Table 1: State By State Use Support Summary-Number of Ohio River Miles Impaired

		Aquatic Life Use Support	Contact Recreation Use Support	Public Water Supply Use Support	Fish Consumption Use Support
PA	0.0-40.2	0	6.2	0	40.2
OH-WV	40.2-317.1	0	51.6	10.5	276.9
OH-KY	317.1-491.1	7	28.5	0	174
IN-KY	491.1-848.0	0	90.4	0	356.9
IL-KY	848.0-981.0	0	0	0	133
TOTAL		7	176.7	10.5	981

PART II: BACKGROUND

The Ohio River Valley Water Sanitation Commission (ORSANCO; the Commission) is an interstate water pollution control agency. ORSANCO was established in 1948 through the signing of the Ohio River Valley Water Sanitation Compact (the Compact) by representatives of the eight member states: Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia and West Virginia. Under the terms of the Compact, the states pledged to cooperate in the control of water pollution within the Ohio River Basin. Article VI of the Compact states that the guiding principal shall be that pollution by sewage or industrial wastes originating in one signatory state shall not injuriously affect the various uses of the interstate waters. ORSANCO carries out a variety of programs that primarily focus on the Ohio River main stem. General program areas include water quality monitoring and assessment, emergency response, pollution control standards, and public information and education. The Commission also provides an excellent forum for information exchange and technology transfer among the states' water pollution control and natural resources agencies.

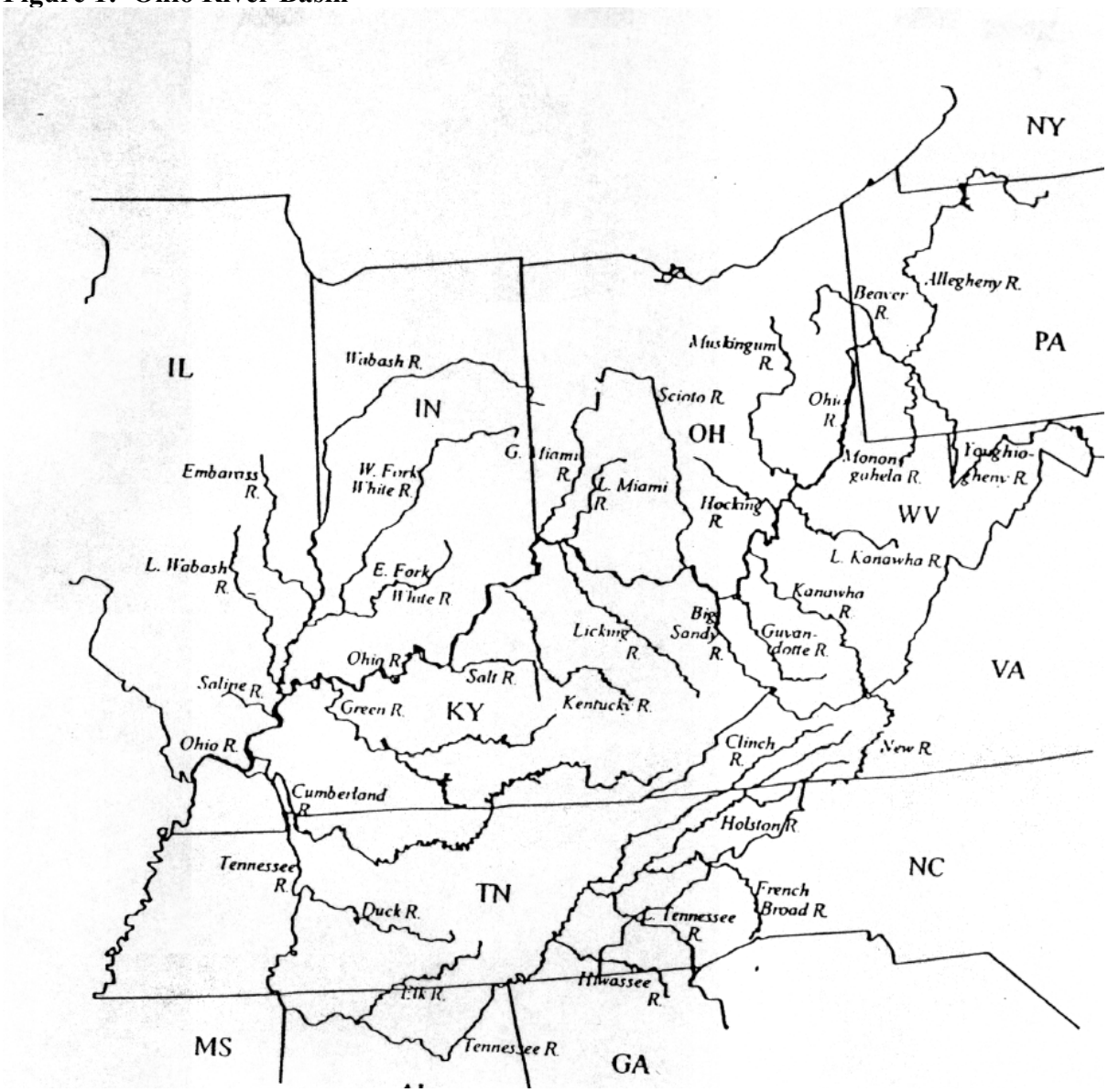
The Compact has designated the Ohio River as available for safe and satisfactory use as public and industrial water supplies after reasonable treatment, suitable for recreational usage, capable of maintaining fish and other aquatic life, and adaptable to such other uses as may be legitimate. No degradation of the water quality of the Ohio River which would interfere with or become injurious to these uses shall be permitted.

This report focuses on the water quality of the main stem of the Ohio River. The Ohio River forms in Pittsburgh, Pennsylvania, at the confluence of the Allegheny and Monongahela rivers. The river is 981 miles long and generally flows southwest to join the Mississippi River near Cairo, Illinois. The first 40 miles of the Ohio River are wholly within Pennsylvania. The remaining 941 miles form the state boundaries between Illinois, Indiana and Ohio to the north, and Kentucky and West Virginia to the south. This report covers water years 2000 and 2001 (November 1, 1999 — September 30, 2001). ORSANCO monitors and assesses the Ohio River on behalf of the compact states. The assessment methodologies and supporting data used to generate this assessment are contained within this report and its appendices.

Basin Characteristics

The Ohio River drains 203,940 square miles, which is approximately five percent of the contiguous United States. Figure 1 shows the Ohio River Basin and selected tributaries. Over 25 million people reside in the Ohio River Basin, which is approximately ten percent of the United States population. An estimated 3.6 million people live in cities and towns adjacent to the Ohio River. In addition, the river provides drinking water to more than three million people. The 49 electric power-generating facilities located along the river provide more than five percent of the United States power generating capacity. In addition, the river is used extensively for commercial navigation. Appendix A contains additional data on basin characteristics including locations of locks and dams, locations of tributaries, and hydrologic data for water years 2000 and 2001.

Figure 1: Ohio River Basin



A series of locks and dams, operated and maintained by the United States Army Corps of Engineers, regulates pool elevation on the Ohio River. These dams create twenty pools with regulated flows and guaranteed minimum flows to assure continued commercial navigation during droughts. Long-term average flows in the Ohio River, depending on location and time of year, range from 14,000 to 497,000 cubic feet per second (cfs). Hydrologic conditions varied considerably over the reporting period. Flow data, reported on a monthly basis by the National Weather Service, are contained in Appendix A.

Summary of Uses

Ohio River water quality is evaluated in terms of the degree of support for each of the following designated uses: warm water aquatic life habitat; public water supply; contact recreation; and fish consumption. Each designated use is evaluated using specific numerical water quality criteria, other factors such as the existence of advisories against consuming fish, and the direct measure of biological communities within the Ohio River. Based on water quality conditions, the Ohio River is classified as fully, partially or not supporting each of the designated uses. Fully supporting indicates minor or no water quality problems; partially supporting indicates that the use is precluded at times; and not supporting indicates that the use is precluded much of the time.

The Ohio River is broken down into a series of water bodies for assessment and reporting purposes. The segments were generally selected using dams and major tributary confluences as dividing points. The degree of use support is assessed for each water body regarding the above-defined uses. The following descriptions include the boundaries of each water body as well as other relative information.

Point-Emsworth (mile point 0-6.2) This water body is bounded by the confluence of the Allegheny and Monongahela rivers (the origin of the Ohio River) on the upstream end and by the Emsworth Locks & Dam on the downstream end. Chartiers Creek, with a drainage area of 277 square miles, intersects this water body at mile point 2.5.

Emsworth-Dashields (mile point 6.2-13.3) This 7.1-mile long water body encompasses the entire Dashields Pool and is bounded by the Emsworth Locks & Dam upstream and the Dashields Locks & Dam on the downstream end.

Dashields-Beaver (mile point 13.3-25.4) This 12.1-mile long water body is bounded by the Dashields Locks & Dam upstream and the confluence of the Beaver River on the downstream end.

Beaver-Montgomery (mile point 25.4-31.7) This 6.3-mile long water body is bounded by the Beaver River upstream and Montgomery Locks & Dam on the downstream end. Raccoon Creek, with a drainage area of 200 square miles, intersects this water body at mile point 29.6.

Montgomery-Pennsylvania State Line (mile point 31.7-40.2) This 8.5-mile long water body is bounded by the Montgomery Locks & Dam upstream and the Pennsylvania/Ohio/West Virginia state borders on the downstream end. The Little Beaver River, with a drainage area of 510 square miles,

intersects this water body at mile point 39.5.

Pennsylvania State Line-New Cumberland (mile point 40.2-54.4) This 14.2-mile long water body is bounded by the Pennsylvania state line upstream and the New Cumberland Locks & Dam on the downstream end. Yellow Creek, with a drainage area of 240 square miles, intersects this water body at mile point 50.4.

New Cumberland-Pike Island (mile point 54.4-84.2) This 29.8 mile-long water body encompasses the entire Pike Island Pool and is bounded by the New Cumberland Locks & Dam upstream and the Pike Island Locks & Dam on the downstream end. The following tributaries intersect this water body: Cross Creek at mile point 71.6 with a drainage area of 128 square miles; Buffalo Creek at mile point 74.7 with a drainage area of 160 square miles; Short Creek at mile point 81.4 with a drainage area of 147 square miles.

Pike Island-Hannibal (mile point 84.2-126.4) This 42.2 mile-long water body encompasses the entire Hannibal Pool and is bounded by the Pike Island Locks & Dam upstream and the Hannibal Locks & Dam on the downstream end. The following tributaries intersect this water body: Wheeling Creek in Ohio at mile point 91.0 with a drainage area of 108 square miles; Wheeling Creek in West Virginia at mile point 91.0 with a drainage area of 300 square miles; McMahon Creek at mile point 94.7 with a drainage area of 91 square miles; Grave Creek at mile point 102.5 with a drainage area of 75 square miles; Captina Creek at mile point 109.6 with a drainage area of 181 square miles; Fish Creek at mile point 113.8 with a drainage area of 250 square miles; and Sunfish Creek at mile point 118.0 with a drainage area of 114 square miles.

Hannibal-Willow Island (mile point 126.4-161.7) This 35.3 mile-long water body encompasses the entire Willow Island Pool and is bounded by the Hannibal Locks & Dam upstream and the Willow Island Locks & Dam on the downstream end. The following tributaries intersect this water body: Fishing Creek at mile point 128.3 with a drainage area of 220 square miles; Middle Island Creek at mile point 154.0 with a drainage area of 560 square miles; and Little Muskingum River at mile point 168.3 with a drainage area of 315 square miles.

Willow Island-Muskingum (mile point 161.7-172.2) This 10.5 mile-long water body is bounded by Willow Island Locks & Dam on the upstream side and the confluence of the Muskingum River on the downstream end. Duck Creek, with a drainage area of 228 square miles, intersects this water body at mile point 170.7.

Muskingum-Belleville (mile point 172.2-203.9) This 31.7 mile-long water body is bounded by the Muskingum River upstream and the Belleville Locks & Dam on the downstream end. The Muskingum River has a drainage area of 8,040 square miles. The following tributaries intersect this water body: Little Kanawha River at mile point 184.6 with a drainage area of 2,320 square miles; Little Hocking River at mile point 191.8 with a drainage area of 103 square miles; and Hocking River at mile point 199.3 with a drainage area of 1,190 square miles.

Belleville-Racine (mile point 203.9-237.5) This 33.6 mile-long water body encompasses the entire

Racine Pool and is bounded by the Belleville Locks & Dam upstream and the Racine Locks & Dam on the downstream end. The following tributaries intersect this water body: Shade River at mile point 210.6 with a drainage area of 221 square miles; Shady Creek at mile point 220.6 with a drainage area of 115 square miles; and Mill Creek at mile point 231.5 with a drainage area of 230 square miles.

Racine-Kanawha (mile point 237.5-265.7) This 28.2 mile-long water body is bounded by the Racine Locks & Dam upstream and Kanawha River on the downstream end. Leading Creek, with a drainage area of 151 square miles, intersects this water body at mile point 254.2.

Kanawha-Gallipolis (mile point 265.7-279.2) This 13.5 mile-long water body is bounded by the Kanawha River upstream and the Gallipolis (Robert C. Byrd) Locks and Dam on the downstream end. The Kanawha River has a drainage area of 12,200 square miles. Raccoon Creek, with a drainage area of 684 square miles, intersects this water body at mile point 276.0.

Gallipolis-Big Sandy (mile point 279.2-317.1) This 37.9 mile-long water body is bounded by the Gallipolis (Robert C. Byrd) Locks & Dam on the upstream and the Big Sandy River on the downstream end. The following tributaries intersect this water body: Guyandotte River at mile point 305.2 with a drainage area of 1,670 square miles; Symmes Creek at mile point 308.7 with a drainage area of 356 square miles; and Twelvepole Creek at mile point 313.2 with a drainage area of 440 square miles.

Big Sandy-Greenup (mile point 317.1-341.0) This 23.9 mile-long water body is bounded by the Big Sandy River upstream and the Greenup Locks & Dam on the downstream end. The Big Sandy River forms the border between West Virginia and Kentucky. The Little Sandy River, with a drainage area of 724 square miles, intersects this water body at mile point 336.4.

Greenup-Scioto (mile point 341.0-356.5) This 15.5 mile-long water body is bounded by the Greenup Locks & Dam upstream and the Scioto River on the downstream end. The following tributaries intersect this water body: Pine Creek at mile point 346.9 with a drainage area of 185 square miles; Little Scioto River at mile point 349.0 with a drainage area of 233 square miles; and Tygarts Creek at mile point 353.3 with a drainage area of 336 square miles.

Scioto-Meldahl (mile point 356.5-436.2) This 79.7 mile-long water body is bounded by the Scioto River upstream and Meldahl Locks & Dam on the downstream end. The Scioto River has a drainage area of 6,510 square miles. The following tributaries intersect this water body: Kinniconnick Creek at mile point 368.1 with a drainage area of 253 square miles; Ohio Brush Creek at mile point 388.0 with a drainage area of 435 square miles; Eagle Creek at mile point 415.7 with a drainage area of 154 square miles; and White Oak Creek at mile point 423.9 with a drainage area of 234 square miles.

Meldahl-Little Miami (mile point 436.2-464.1) This 27.9 mile-long water body is bounded by the Meldahl Locks & Dam upstream and the Little Miami River on the downstream end.

Little Miami-Licking (mile point 464.1-470.2) This 6.1 mile-long water body is bounded by the Little Miami River upstream and the Licking River on the downstream end. The Little Miami River

has a drainage area of 1,670 square miles.

Licking-Great Miami (mile point 470.2-491.1) This 20.9 mile-long water body is bounded by the Licking River upstream and the Great Miami River on the downstream end. The Licking River has a drainage area of 3,670 square miles. Mill Creek, with a drainage area of 166 square miles, intersects this water body at mile point 472.5.

Great Miami-Markland (mile point 491.1-531.5) This 40.4 mile-long water body is bounded by the Great Miami River upstream and the Markland Locks & Dam on the downstream end. The Great Miami River has a drainage area of 5,400 square miles. Tanners Creek, with a drainage area of 136 square miles, intersects this water body at mile point 494.8. Laughery Creek, with a drainage area of 350 square miles, intersects this water body at mile point 498.7.

Markland-Kentucky (mile point 531.5-545.8) This 14.3 mile-long water body is bounded by the Markland Locks & Dam upstream and the Kentucky River on the downstream end.

Kentucky-McAlpine (mile point 545.8-606.8) This 61 mile-long water body is bounded by the Kentucky River upstream and the McAlpine Locks & Dam on the downstream end. The Kentucky River has a drainage area of 6,970 square miles. The following tributaries intersect this water body: Little Kentucky River at mile point 546.5 with a drainage area of 147 square miles; Indian Kentucky River at mile point 550.5 with a drainage area of 150 square miles; and Silver Creek at mile point 606.5 with a drainage area of 225 square miles.

McAlpine-Salt (mile point 606.8-629.9) This 23.1 mile-long water body is bounded by the McAlpine Locks & Dam upstream and the Salt River on the downstream end.

Salt-Cannelton (mile point 629.9-720.7) This 90.8 mile-long water body is bounded by the Salt River upstream and the Cannelton Locks & Dam on the downstream end. The Salt River has a drainage area of 2,890 square miles. The following tributaries intersect this water body: Big Indiana Creek at mile point 657 with a drainage area of 249 square miles; Blue River at mile point 663 with a drainage area of 466 square miles; and Sinking Creek at mile point 700.9 with a drainage area of 276 square miles.

Cannelton-Newburgh (mile point 720.7-776.1) This 55.4 mile-long water body is bounded by the Cannelton Locks & Dam upstream and the Newburgh Locks & Dam on the downstream end. The following tributaries intersect this water body: Anderson River at mile point 731.5 with a drainage area of 276 square miles; Blackford Creek at mile point 742.2 with a drainage area of 124 square miles; and Little Pigeon Creek at mile point 773 with a drainage area of 415 square miles.

Newburgh-Green (mile point 776.1-784.2) This 8.1 mile-long water body is bounded by the Newburgh Locks & Dam upstream and the Green River on the downstream end.

Green-Uniontown (mile point 784.2-846.0) This 61.8 mile-long water body is bounded by the Green River upstream and the Uniontown (John T. Myers) Locks & Dam on the downstream end.

The Green River has a drainage area of 9,230 square miles. Pigeon Creek, with a drainage area of 375 square miles, intersects this water body at mile point 792.9.

Uniontown-Wabash (mile point 846.0-848.0) This two mile-long water body is bounded by the Uniontown (John T. Myers) Locks & Dam upstream and the Wabash River on the downstream end.

Wabash-Smithland (mile point 848.0-918.5) This 70.5 mile-long water body is bounded by the Wabash River upstream and the Smithland Locks & Dam on the downstream end. The Wabash River has a drainage area of 33,100 square miles. The Saline River, with a drainage area of 1,170 square miles, intersects this water body at mile point 867.3. The Tradewater River, with a drainage area of 1,000 square miles, intersects this water body at mile point 873.5.

Smithland-Cumberland (mile point 918.5-920.4) This 1.9 mile-long water body is bounded by the Smithland Locks & Dam upstream and the Cumberland River on the downstream end.

Cumberland-Tennessee (mile point 920.4-934.5) This 14.1 mile-long water body is bounded by the Cumberland River upstream and the Tennessee River on the downstream end. The Cumberland River has a drainage area of 17,920 square miles.

Tennessee-Cairo (mile point 934.5-981) This 46.5 mile-long water body is bounded by the Tennessee River upstream and the Mississippi River on the downstream end (the endpoint of the Ohio River). The Tennessee River has a drainage area of 40,910 square miles. The Cache River, with a drainage area of 720 square miles, intersects this water body at mile point 975.7.

PART III: SURFACE WATER ASSESSMENT

Chapter One: Surface Water Monitoring Programs

ORSANCO operates several monitoring programs on the Ohio River and selected major tributaries. This biennial assessment of water quality conditions is based on monitoring data collected through the Bimonthly Sampling, Clean Metals Sampling, Bacteria Monitoring, Watershed Protection and Fish Population and Fish Contaminants programs. Individual monitoring stations from each program are used to assess one or more water bodies. Data from these monitoring stations are used to make use support determinations on a water body basis. Table 4 shows the monitoring conducted in each of the water bodies, with the exception of biological monitoring which occurs at various mile points along the Ohio River. The following is a detailed description of each monitoring program conducted on the main stem.

Bimonthly Sampling

The Bimonthly Sampling Program entails the collection of water column grab samples from 17 Ohio River stations once every other month. The samples are collected by contract samplers and analyzed for certain physical and chemical parameters by a contract laboratory, including total recoverable metals collected and analyzed using conventional techniques. Results from total recoverable metals testing utilizing a clean technique indicate some level of contamination occurs when conventional sampling techniques are used, resulting in metal concentrations higher than those actually present in the water. In October 2000, ORSANCO changed from total recoverable metals to dissolved metals criteria, concluding that dissolved metals data is much more accurate and representative of metals dissolved in the water column, and therefore available to aquatic life. Dissolved metals results take precedence over total recoverable metals results when sampling data differs. Nonmetal parameters monitored in the Bimonthly Sampling Program are also used to determine the degree of support for public water supply use. Applicable results from main stem bimonthly sampling stations are compared to established stream criteria for the protection of human health. Tables 2 and 3 provide summaries of the bimonthly sampling network and parameters used in this assessment.

Table 2: Bimonthly Sampling Stations

Station Name	River	River Mile Point	Bordering States	STORET Code
New Cumberland	Ohio	54.4	OH – WV	OR926.6M
Pike Island	Ohio	84.2	OH – WV	OR896.8M
Hannibal	Ohio	126.4	OH – WV	OR8546M
Willow Island	Ohio	161.7	OH – WV	OR8192M
Belleville	Ohio	203.9	OH – WV	OR7771M
R.C. Byrd	Ohio	279.2	OH – WV	OR7018M
Greenup	Ohio	341.0	OH – KY	OR640M
Meldahl	Ohio	436.2	OH – KY	OR5448M
Anderson Ferry	Ohio	477.5	OH – KY	OR502.2M
Markland	Ohio	531.5	IN – KY	OR4495M

Table 2: Bimonthly Sampling Stations -continued

Station Name	River	River Mile Point	Bordering States	STORET Code
Louisville	Ohio	600.6	IN – KY	OR374.2M
West Point	Ohio	625.9	IN – KY	OR3551M

Cannelton	Ohio	720.7	IN – KY	OR2603M
Newburgh	Ohio	776.1	IN – KY	OR204.9M
Uniontown	Ohio	846.0	IN – KY	OR1350M
Smithland	Ohio	918.5	IL – KY	OR62.5M
Paducah	Ohio	938.9	IL – KY	OR42.1M

Table 3: Bimonthly Manual Sampling Parameters

Ammonia, N	Conductivity	Manganese	*Selenium
Arsenic	Cyanide	Mercury	*Silver
*Barium	Dissolved Oxygen	*Nickel	Sulfate
Cadmium	Hardness, Total	Nitrate-Nitrite, N	Temperature
Chloride	Iron	pH	Total Organic Carbon
*Chromium	Lead	Phenols	Total Suspended Solids
Copper	Magnesium	Phosphorous	Zinc

*Quarterly samples

Table 4: Ohio River Water Bodies

Water Body Description	Water Body ID	States	Mile Points	Monitoring Stations*
Point – Emsworth Dam	OVWB01	PA	0.0 - 6.2	B,X
Emsworth Dam - Dashields Dam	OVWB02	PA	6.2 - 13.3	X
Dashields Dam - Beaver River	OVWB03	PA	13.3 - 25.4	X
Beaver River - Montgomery Dam	OVWB04	PA	25.4 - 31.7	X
Montgomery Dam - PA State Line	OVWB05	PA	31.7 - 40.2	X
PA State Line - New Cumberland Dam	OVWB06	OH-WV	40.2 - 54.4	M,X
New Cumberland Dam - Pike Island Dam	OVWB07	OH-WV	54.4 - 84.2	M,X,D
Pike Island Dam - Hannibal Dam	OVWB08	OH-WV	84.2 - 126.4	B,M,X,D
Hannibal Dam - Willow Island Dam	OVWB09	OH-WV	126.4 - 161.7	X
Willow Island Dam - Muskingum River	OVWB10	OH-WV	161.7 - 172.2	X,D
Muskingum River - Belleville Dam	OVWB11	OH-WV	172.2 - 203.9	M,X
Belleville Dam - Racine Dam	OVWB12	OH-WV	203.9 -237.5	M,X,D
Racine Dam - Kanawha River	OVWB13	OH-WV	237.5 - 265.7	X
Kanawha River - R.C. Byrd Dam -	OVWB14	OH-WV	265.7 - 279.2	M,
R. C. Byrd Dam - Big Sandy River	OVWB15	OH-WV	279.2 - 317.1	B,M,X,D
Big Sandy River - Greenup Dam	OVWB16	OH-KY	317.1 - 341.0	M,X
Greenup Dam - Scioto River	OVWB17	OH-KY	341.0 - 356.5	B,M,
Scioto River - Meldahl Dam	OVWB18	OH-KY	356.5 - 436.2	M,X
Meldahl Dam - Little Miami River	OVWB19	OH-KY	436.2 - 464.1	B,M,X
Little Miami River - Licking River	OVWB20	OH-KY	464.1 - 470.2	B
Licking River - Great Miami River	OVWB21	OH-KY	470.2 - 491.1	B,M,X,D
Great Miami River - Markland Dam	OVWB22	IN-KY	491.1 - 531.5	B,M,X

Markland Dam - Kentucky River	OVWB23	IN-KY	531.5 - 545.8	M
Kentucky River - McAlpine Dam	OVWB24	IN-KY	545.8 - 606.8	B,M,X
McAlpine Dam - Salt River	OVWB25	IN-KY	606.8 - 629.9	B,M,X,D
Salt River - Cannelton Dam	OVWB26	IN-KY	629.9 - 720.7	M,X
Cannelton Dam - Newburgh Dam	OVWB27	IN-KY	720.7 - 776.1	M,X
Newburgh Dam - Green River	OVWB28	IN-KY	776.1 - 784.2	B
Green River - Uniontown Dam	OVWB29	IN-KY	784.2 - 846.0	B,M,
Uniontown Dam - Wabash River	OVWB30	IN-KY	846.0 - 848.0	M,D
Wabash River - Smithland Dam	OVWB31	IL-KY	848.0 - 918.5	M
Smithland Dam - Cumberland River	OVWB32	IL-KY	918.5 - 920.4	M,D
Cumberland River - Tennessee River	OVWB33	IL-KY	920.4 - 934.5	
Tennessee River - Cairo	OVWB34	IL-KY	934.5 - 981.0	B

* B - Bacteria Sampling
D - Dissolved Metals Sampling
M - Bimonthly Manual Sampling
X - Dioxin High Volume Water Sampling

Clean Metals Sampling

The Clean Metals Sampling Program entails the collection of dissolved and total metals by a clean technique from nine main stem stations once every two months. Samples are analyzed for both the total recoverable and the dissolved portions of 18 metals. Samples are collected using a modified Virginia Division of Environmental Quality method and analyzed by the Virginia State Laboratory. Results from the dissolved metals sampling stations were used to determine aquatic life support. Tables 5 and 6 provide summaries of the clean metals sampling stations and parameters.

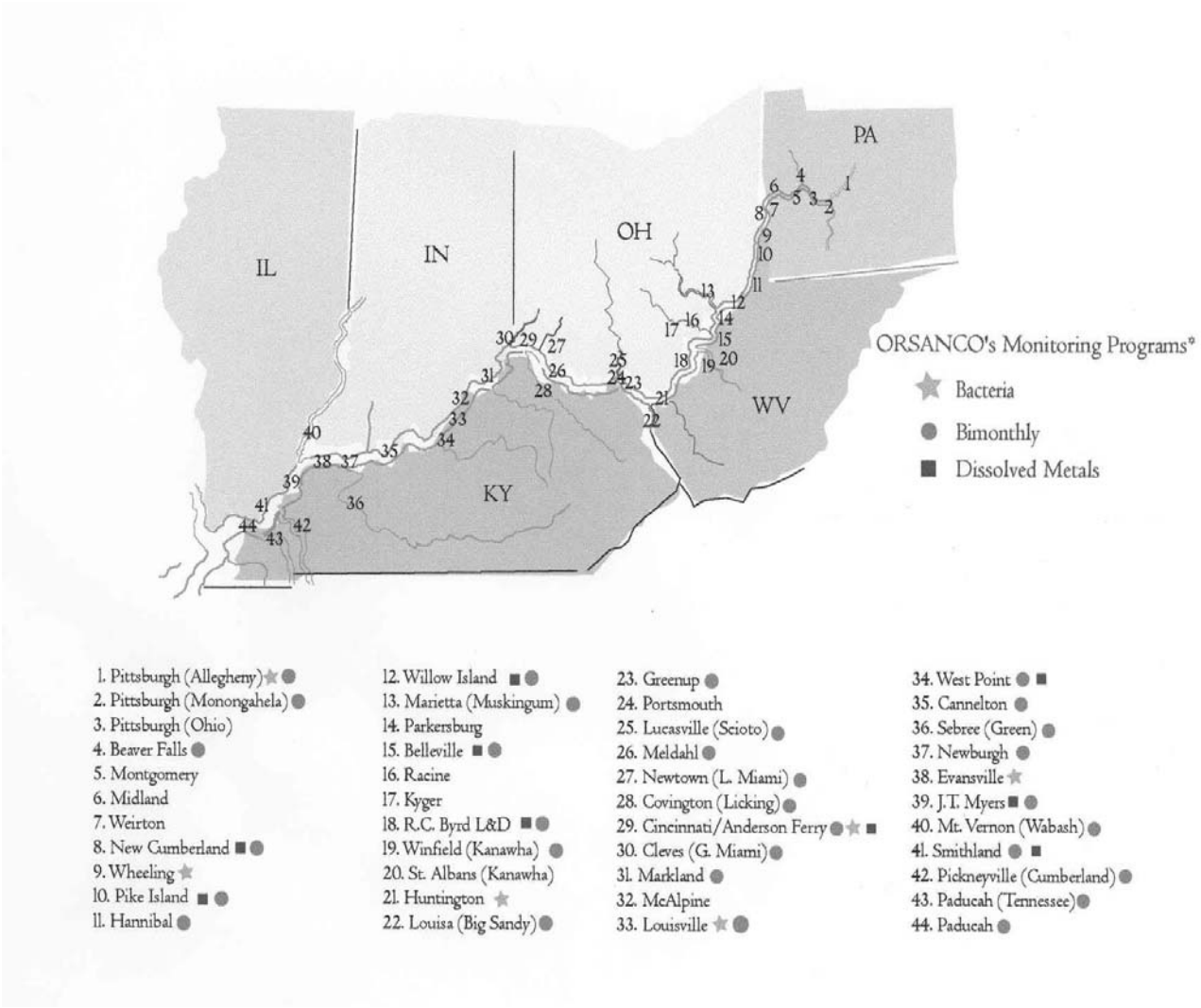
Table 5: Clean Metals Sampling Stations

Station Name	River	River Mile Point	Bordering States
New Cumberland	Ohio	54.4	OH – WV
Pike Island	Ohio	84.2	OH – WV
Willow Island	Ohio	161.8	OH – WV
Belleville	Ohio	203.9	OH – WV
R.C. Byrd	Ohio	279.2	OH – WV
Anderson Ferry	Ohio	477.5	OH – KY
West Point	Ohio	625.9	IN – KY
J.T. Myers	Ohio	846.0	IN - KY
Smithland	Ohio	918.5	IL - KY

Table 6: Clean Metals Sampling Parameters

Aluminum	Calcium	Magnesium	Silver
Antimony	Chromium	Manganese	Thallium
Arsenic	Copper	Mercury	Zinc
Barium	Iron	Nickel	
Cadmium	Lead	Selenium	

Figure 2: ORSANCO Monitoring Stations



Bacteria Monitoring

In 2000, ORSANCO conducted contact recreation season monitoring at six Ohio River main stem stations located downstream of urban areas that have relatively large numbers of combined sewer overflows. In 2001, ORSANCO established 13 additional sites both upstream and at downtown locations of these urban areas. These sites provide valuable comparisons of bacteria levels upstream and downstream of urban areas on the Ohio River. Five samples per month are collected during the May through October recreation season and analyzed for fecal coliform bacteria and *Escherichia coli* (*E. coli*) bacteria. Bacteria data are used to assess the use support for both contact recreation and public water supply. Tables 7 and 8 provide summaries of the Bacteria Monitoring program.

Table 7: 2000 Contact Recreation Season Monitoring Stations and Parameters

Station Name	River	Mile Point	Bordering	Parameters
Pittsburgh	Ohio	4.3	PA	Fecal Coliform, *E. coli*
Wheeling	Ohio	92.8	OH – WV	Fecal Coliform, *E. coli*
Huntington	Ohio	314.8	OH – WV	Fecal Coliform, *E. coli*
Cincinnati	Ohio	477.5	OH – KY	Fecal Coliform, *E. coli*
Louisville	Ohio	619.3	IN – KY	Fecal Coliform, *E. coli*
Evansville	Ohio	797.3	IN – KY	Fecal Coliform, *E. coli*

Table 8: 2001 Contact Recreation Season Monitoring Stations and Parameters

Station Name	River	Mile Point	Bordering	Parameters
Pittsburgh	Ohio	1.4 Right Bank	PA	Fecal Coliform, *E. coli*
Pittsburgh	Ohio	1.4 Midstream	PA	Fecal Coliform, *E. coli*
Pittsburgh	Ohio	1.4 Left Bank	PA	Fecal Coliform, *E. coli*
Pittsburgh	Ohio	4.3	PA	Fecal Coliform, *E. coli*
Wheeling	Ohio	86.8	OH – WV	Fecal Coliform, *E. coli*
Wheeling	Ohio	91.4	OH – WV	Fecal Coliform, *E. coli*
Wheeling	Ohio	92.8	OH – WV	Fecal Coliform, *E. coli*
Huntington	Ohio	305.1	OH – WV	Fecal Coliform, *E. coli*
Huntington	Ohio	308.1	OH – WV	Fecal Coliform, *E. coli*
Huntington	Ohio	314.8	OH – WV	Fecal Coliform, *E. coli*
Cincinnati	Ohio	462.6	OH – KY	Fecal Coliform, *E. coli*
Cincinnati	Ohio	470.0	OH – KY	Fecal Coliform, *E. coli*
Cincinnati	Ohio	477.5	OH – KY	Fecal Coliform, *E. coli*
Louisville	Ohio	594.0	IN – KY	Fecal Coliform, *E. coli*
Louisville	Ohio	608.7	IN – KY	Fecal Coliform, *E. coli*
Louisville	Ohio	619.3	IN – KY	Fecal Coliform, *E. coli*
Evansville	Ohio	791.5	IN – KY	Fecal Coliform, *E. coli*
Evansville	Ohio	793.7	IN – KY	Fecal Coliform, *E. coli*
Evansville	Ohio	797.3	IN – KY	Fecal Coliform, *E. coli*

Biological Monitoring

Biological monitoring programs pertaining to this assessment include fish population surveys and fish tissue contaminants analyses. The Commission conducts fish population studies using electrofishing techniques, in which fish are collected over a 500-meter zone along the shoreline, and through lock chamber studies. Species are identified, counted, measured and weighed. ORSANCO has recently developed the Ohio River Fish Index (ORFIn), which combines thirteen fish community measurements into one index, to evaluate fish population data. ORFIn scores were assigned to both reference (sites upstream of an outfall) and outfall sites on the Ohio River. Outfall sites were not considered in making an attainment decision based on recommendations of ORSANCO's advisory committees that these sites may not be indicative of the overall Ohio River water quality. ORFIn scores augment the dissolved metals sampling data to determine the degree of support concerning the aquatic life use.

ORSANCO's Fish Tissue Collection Program collects fish specimens through electrofishing, gill netting, and rotenone studies for fish tissue analyses. The samples analyzed optimally consist of a composite of five fish samples. Samples are analyzed for PCBs, cadmium, mercury, and lead. Analyses for organochlorine pesticides, including chlordane, are also performed. Results from fish tissue analyses are provided to the states along the Ohio River to develop fish consumption advisories.

Chapter Two: Assessment Methodology & Summary Data

The Ohio River is classified for its degree of support of each of the designated uses. Classifications include fully supporting (good water quality), partially supporting (impaired or fair water quality), and not supporting (poor water quality). The following sections outline use support assessment methodologies for each of the Ohio River's four designated uses: Aquatic Life, Contact Recreation, Public Water Supply, and Fish Consumption.

Aquatic Life Use Support Assessment Methodology

The assessment criteria described below are applied to the fish population data and chemical data collected from nine main stem dissolved metals sampling stations. Dissolved metals provide the best measurement of the portion of a metal present in the water column and therefore available to cause toxicity to aquatic life.

Fully Supporting **-** No pollutant exceeds criteria in as much as ten percent of the samples collected.

AND

Biological data do not indicate aquatic life impairment.*

Partially Supporting **-** One or more pollutants exceed criteria in greater than ten percent of the samples collected.

OR

Biological data indicate aquatic life impairment.*

Not Supporting - One or more pollutants exceed criteria in greater than 25 percent of the samples collected.

OR

Biological data indicate severe aquatic life impairment.*

*Biological Impairment determined by Ohio River Fish Index (ORFIn) scores

Public Water Supply Use Assessment Methodology

Three basic data types are integrated into the public water supply use assessment. One data type is the chemical data collected at the bimonthly manual sampling stations. The remaining data are collected from surveys sent to each of the Ohio River main stem water utilities and atrazine data, which are collected at the Louisville, Kentucky, Evansville, Indiana, and Cairo, Illinois public water utilities. Figure 3 is the survey instrument prepared for water utilities.

Fully Supporting - No pollutant exceeds criteria in as much as ten percent of the samples collected.

Partially Supporting - One or more pollutants exceed human health criteria in eleven to 25 percent of the samples collected.

OR

Frequent intake closures are necessary to protect water supplies due to instream concentrations exceeding finished water maximum contaminant levels (MCLs).

OR

Frequent "non-routine" additional treatment is necessary to protect water supplies due to instream concentrations exceeding finished water MCLs.

Not Supporting - One or more pollutants exceed human health criteria in greater than 25 percent of the samples collected.

OR

Source water quality causes MCL violations which result in noncompliance with provisions of the Safe Drinking Water Act (SDWA).

Figure 3: Ohio River Water Utility Survey

Survey of Ohio River Water Utilities for the 2002 Biennial Assessment of Ohio River Water Quality Conditions
(*For the period October 1999 – July 2001*)

Water Utility Name	Company/Facility

1. Your Name:			
Title:			
Phone Number:			
2. Between October 1999 and July 2001, was your intake closed as a result of Ohio River water quality conditions?		Yes	No
If so, how many times over the period was your intake closed?	How many days total over the period was your intake closed?		
What pollutants were involved?			
What sources were involved?			
3. Between October 1999 and July 2001, did your plant have any MCL violations?		Yes	No
If so, for what contaminants?			
Was it, in whole or part, caused by Ohio River water quality conditions?		Yes	No
4. Was "nonroutine" or additional treatment necessary to comply with SDWA MCLs during the period?		Yes	No
If so, for what contaminants?			
How frequently was nonroutine/ additional treatment required?	How many days total was "nonroutine"/ additional treatment required?		
5. We are trying to identify all Ohio River water quality data suitable for use in this assessment and would like you to list any data from your intake that we might be able to use. Please list Ohio River monitoring data available (i.e., total coliforms), frequency of collection, and format (i.e., spreadsheet, paper only, etc.).	1. 2. 3. 4. 5.		

Contact Recreation Use Assessment Methodology

Bacteria monitoring for fecal coliform and *E. coli* was conducted at six main stem stations from May through October 2000, and at 19 locations in the same six urban areas in 2001. Bacteria data are assessed in accordance with the following methodology:

Fully Supporting **-** Monthly average or instantaneous maximum bacteria criteria are exceeded during fewer than ten percent of the recreation season months.*

Partially Supporting **-** Monthly average or instantaneous maximum bacteria criteria are exceeded during 11 to 25 percent of the recreation season months.*

Not Supporting - Monthly average or instantaneous maximum bacteria criteria are exceeded during more than 25 percent of the recreation season months.*

* Monthly exceedance occurs when 10% or more of the samples exceed the instantaneous maximum criteria or monthly geometric mean criteria is exceeded

Fish Consumption Use Support Assessment Methodology

The fish consumption use assessment is based primarily on the existence of fish consumption advisories issued by the states along the Ohio River. In the instance of statewide advisories issued for mercury, the Ohio River was assessed as impaired only if Ohio River fish tissue data indicated impairment when compared to each states' individual protocol for issuing a fish consumption advisory for mercury.

ORSANCO analyzes high volume water samples for dioxin through the Ohio River Watershed Pollutant Reduction Program. High volume water column data are compared against the ambient water quality criterion of 0.014 pg/L, which was determined for the protection of human health from fish ingestion. Where high volume dioxin samples exceed the water quality standard (in at least two or more samples at a location), dioxin is listed as a cause of impairment.

Fully Supporting **-** No fish consumption advisories are in effect.

Partially Supporting **-** Restricted fish consumption advisories are in effect or dioxin or mercury data indicate impairment

Not Supporting **-** "No consumption" advisories are in effect for all commonly consumed species.

Numerical Criteria for the Assessment of Ohio River Water Quality Data

The above use support assessment methodologies refer to exceedances of numerical water quality

criteria that apply to the Ohio River. Table 9 presents these numerical criteria, which have been established in the Ohio River Valley Water Sanitation Commission Pollution Control Standards-2000 Revision.

Table 9: ORSANCO Water Quality Criteria for Chemical Constituents

Constituent	Chronic Criterion Concentration (ug/L)	Acute Criterion Concentration (ug/L)
Arsenic (dissolved)	150	340
Chromium (VI)(dissolved)	11	16
Cyanide (free)	5.2	22
Mercury (dissolved)	0.77	1.4
Selenium (total)	5	20

Constituent	Total Recoverable Acute Criterion (ug/L)	Dissolved Criterion Conversion Factor
Cadmium	$e^{(1.128(\ln Hard)-3.6867)}$	1.136672-[ln(Hard)*0.041838]
Chromium (III)	$e^{(0.819(\ln Hard)+3.7256)}$	0.316
Copper	$e^{(0.9422(\ln Hard)-1.700)}$	0.96
Lead	$e^{(1.273(\ln Hard)-1.460)}$	1.46203-[ln(Hard)*0.145712]
Nickel	$e^{(0.846(\ln Hard)+2.255)}$	0.998
Silver	$e^{(1.72(\ln Hard)-6.52)}$	0.85
Zinc	$e^{(0.8473(\ln Hard)+0.884)}$	0.978

Constituent	Total Recoverable Chronic Criterion (ug/L)	Dissolved Criterion Conversion Factor
Cadmium	$e^{(0.7852(\ln Hard)-2.715)}$	1.101672-[ln(Hard)*0.041838
Chromium (III)	$e^{(0.819(\ln Hard)+0.6848)}$	0.860
Copper	$e^{(0.8545(\ln Hard)-1.702)}$	0.960
Lead	$e^{(1.273(\ln Hard)-4.705)}$	1.46203-[ln(Hard)*0.145712]
Nickel	$e^{(0.846(\ln Hard)+0.0584)}$	0.997
Zinc	$e^{(0.8473(\ln Hard)+0.884)}$	0.986

Conventional Pollutants & Chemical Constituents	Aquatic Life	Public Water Supply	Contact Recreation
Ammonia	Temperature and pH Dependent		
Arsenic*		0.05 mg/l	
Bacteria (Fecal Coliform)*		GM** - 2,000 CFU/100 mL	GM** - 200 CFU/100 mL 400 CFU/100 mL in ≥10% samples
Bacteria (*E. Coli*)*			GM** - 130 CFU/100 mL 240 CFU/100 mL in any sample
Barium*		1.0 mg/L	
Chloride*		250 mg/L	
Dissolved Oxygen	5.0 mg/L		
Fluoride*		1.0 mg/L	
Mercury*		0.000012 mg/L	
Nitrite+Nitrate Nitrogen*		10.0 mg/L	
Nitrite Nitrogen*		1.0 mg/L	
pH	6.0 - 9.0 S.U.		
Phenolics*		0.005 mg/L	
Silver*		0.05 mg/L	

Sulfate*		250 mg/L	
Temperature	Seasonally Dependent		

*Criteria are for human health protection

**GM = Monthly geometric mean consisting of at least five samples given in colony forming units per 100 milliliters (CFU/100 mL)

Water Quality Summary

Chapter Three of this section provides more detailed information on each of the individual designated uses. No Ohio River water bodies are classified as fully supporting all uses because the fish consumption use is impaired for the entire river.

Impairment summaries by state are contained in Table 10. Each of the individual uses presented here are discussed in greater detail with supporting data in Chapter Three of this section. Fish consumption and contact recreation use support were the most prevalent impairments identified. PCBs, mercury, and dioxin levels in the Ohio River caused fish consumption use support impairment. Bacteria levels in the river caused contact recreation impairment. Potential sources of bacteria include, but are not limited to, combined sewer overflows, urban runoff, storm water discharges, industrial point sources, and municipal wastewater effluent. Table 11 provides a summary of causes of impaired use support on the Ohio River. Causes of impairment include chemical and physical conditions that result in degraded water quality.

Table 10: State By State Use Support Summary-Number of Ohio River Miles Impaired

		Aquatic Life Use Support	Contact Recreation Use Support	Public Water Supply Use Support	Fish Consumption Use Support
PA	0.0-40.2	0.0	6.2	0.0	40.2
OH-WV	40.2-317.1	0.0	51.6	10.5	276.9
OH-KY	317.1-491.1	7.0	28.5	0.0	174.0
IN-KY	491.1-848.0	0.0	90.4	0.0	356.9
IL-KY	848.0-981.0	0.0	0.0	0.0	133.0
TOTAL		7.0	176.7	10.5	981.0

Table 11: Summary of Causes of Use Impairment

Cause Category	Number Impaired Miles	Impaired Use
Biological/Habitat	7.0	Aquatic Life
Metals	769.4 (Mercury)	Fish Consumption
Pathogens	176.7	Contact Recreation
Priority Organics	981.0 (PCBs)	Fish Consumption
	617.7 (Dioxin)	Fish Consumption
Priority Toxics	10.5 (Phenolics)	Public Water Supply

Chapter Three: Individual Use Support Assessments

Warm Water Aquatic Life Use

Table 12 presents results of the warm water aquatic life use support assessment for each Ohio River water body. Water quality data from ORSANCO's Clean Metals Sampling Program are compared to applicable criteria for the protection of aquatic life. Dissolved metals sampling data from November 1999 through September 2001 and biological data are the primary data sources used in this assessment. Appendix C contains the dissolved metals sampling data. There are nine dissolved metals sampling stations located on the Ohio River. The dissolved metals sampling data did not indicate any exceedances of water quality criteria. In addition to the dissolved metals samples taken at these nine sites, total recoverable metals are also sampled using a "clean" method. Three violations of the ORSANCO chronic aquatic life protection criterion for lead were detected. These violations occurred at three different sites, and do not indicate impairment based on the assessment methodology defined in the previous chapter (one violation at a site does not constitute impairment). The three locations with total recoverable lead violations were the sampling sites in Cincinnati, Ohio; West Point, Kentucky; and J.T. Meyers Locks & Dam near Evansville, Indiana.

Total recoverable metals sampled through the Bimonthly Sampling Program utilizing a conventional technique are collected at 17 locations on the Ohio River main stem. In October of 2000, ORSANCO adopted dissolved metals criteria. As such, ORSANCO reviews total recoverable metals data generated by the bimonthly program for use support assessments and compares it to dissolved metals data where total recoverable violations are detected and dissolved data is available. The side-by-side comparison between total recoverable metals and dissolved metals data has led to the conclusion that dissolved metals data using a clean technique is more accurate and representative of the metals dissolved in the water column, and therefore available to aquatic life. Dissolved metals results take precedence over total recoverable metals results when sampling data differs. Table 13 compares results from the Bimonthly and Clean Metals Sampling Programs at specific Ohio River sites.

In addition to physical/chemical data, biological data are evaluated to identify water bodies having aquatic community health impairments. The newly developed Ohio River Fish Index (ORFIn) was used to score the aquatic communities along the Ohio River. River segments are surveyed and assigned a habitat classification of 0, 1, 2 or 3 based on water depth, substrate composition and woody cover. Figures 4-8 graphically display the habitat classes and scores at various Ohio River mile points. Fish population studies currently utilize electrofishing techniques to collect fish along the Ohio River covering 500-meter shoreline zones, and lock chamber studies. ORFIn scores are developed utilizing information collected in these studies including species diversity, species numbers and biomass of individuals. Higher ORFIn scores represent better fish communities, indicating more fish, larger fish, more species of fish, or some combination of these. The use of the Ohio River Fish Index as a biological index, and the method in which it was used for this report, will be refined over the next assessment period. Potential impairment decisions were determined by looking at whether a site failed to meet the reference value for the specific habitat class in which it was assigned.

Ohio River mile points 354.0 through 361.0, located in the Meldahl Pool, are reported as impaired due to one low score that failed to meet the reference value of its habitat class and a second score that was on the pass/fail line. Overall, 974 miles (over 99 percent) of the Ohio River are classified as fully supporting aquatic life use and seven miles (less than one percent) as partially supporting. Ohio River miles 354 though 361 are classified as partially supporting due to biological data available through the ORFIn described above. Appendix I contains ORFIn data.

Table 12 – Warm Water Aquatic Life

Table 12: 2002 Warm Water Aquatic Life Use Support Assessment

Waterbody ID	States	River Miles	Total Miles in Waterbody	Miles Not Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting	Causes of Impairment	*Potential Sources	Assessment Type
OVWB 01	PA	0.0 - 6.2	6.2		6.2					Monitored
OVWB 02	PA	6.2 - 13.3	7.1		7.1					Monitored
OVWB 03	PA	13.3 - 25.4	12.1		12.1					Monitored
OVWB 04	PA	25.4 - 31.7	6.3		6.3					Monitored
OVWB 05	PA	31.7 - 40.2	8.5		8.5					Monitored
OVWB 06	OH-WV	40.2 - 54.4	14.2		14.2					Monitored
OVWB 07	OH-WV	54.5 - 84.2	29.8		29.8					Monitored
OVWB 08	OH-WV	84.2 - 126.4	42.2		42.2					Monitored
OVWB 09	OH-WV	126.4 - 161.7	35.3		35.3					Monitored
OVWB 10	OH-WV	161.7 - 172.2	10.5		10.5					Monitored
OVWB 11	OH-WV	172.2 - 203.9	31.7		26.6					Monitored
OVWB 12	OH-WV	203.9 - 237.5	33.6		33.6					Monitored
OVWB 13	OH-WV	237.5 - 265.7	28.2		28.2					Monitored
OVWB 14	OH-WV	265.7 - 279.2	13.5		13.5					Monitored
OVWB 15	OH-WV	279.2 - 317.1	37.9		37.9					Monitored
OVWB 16	OH-KY	317.1 - 341.0	23.9		23.9					Monitored
OVWB 17	OH-KY	341.0 - 356.5	15.5		13.0	2.5 *(MP 354-356.5)*		Biological		Monitored
OVWB 18	OH-KY	356.5 - 436.2	79.7		75.2	4.5 *(MP 356.5-361.0)*		Biological		Monitored
OVWB 19	OH-KY	436.2 - 464.1	27.9		27.9					Monitored
OVWB 20	OH-KY	464.1 - 470.2	6.1		6.1					Monitored
OVWB 21	OH-KY	470.2 - 491.1	20.9		20.9					Monitored
OVWB 22	IN-KY	491.1 - 531.5	40.4		40.4					Monitored
OVWB 23	IN-KY	531.5 - 545.8	14.3		14.3					Monitored
OVWB 24	IN-KY	545.8 - 606.8	61.0		61.0					Monitored
OVWB 25	IN-KY	606.8 - 629.9	23.1		23.1					Monitored
OVWB 26	IN-KY	629.9 - 720.7	90.8		90.8					Monitored
OVWB 27	IN-KY	720.7 - 776.1	55.4		55.4					Monitored
OVWB 28	IN-KY	776.1 - 784.2	8.1		8.1					Monitored
OVWB 29	IN-KY	784.2 - 846.0	61.8		61.8					Monitored
OVWB 30	IN-KY	846.0 - 848.0	2		2.0					Monitored
OVWB 31	IL-KY	848.0 - 918.5	70.5		70.5					Monitored
OVWB 32	IL-KY	918.5 - 920.4	1.9		1.9					Monitored
OVWB 33	IL-KY	920.4 - 934.5	14.1		14.1					Monitored
OVWB 34	IL-KY	934.5 - 981.0	46.5		46.5					Monitored
Totals		**981**		**0**	**974.0**	**7.0**	**0.0**			

*Potential sources include municipal point sources, industrial point sources, CSOs, SSOs, agricultural activities and overland runoff sources, unless otherwise indicated.

Table 13: Summary of Exceedances from the Bimonthly and Clean Metals Sampling Programs

Location/ORM	Sample Date	Parameter	Method/Program	Result ug/L	Criterion ug/L
Pike Island, WV/84.2	**3/13/2000**	**Cu**	**Total Recoverable Metals**	**8.0**	**7.7161**
Pike Island, WV/84.2	*3/13/2000*	*Cu*	*Dissolved Metals*	*1.1*	*NO VIOLATION*
Pike Island, WV/84.2	*3/13/2000*	*Cu*	*Dissolved Metals Duplicate*	*1.0*	*NO VIOLATION*
Pike Island, WV/84.2	*3/13/2000*	*Cu*	*Total Clean Metals*	*1.5*	*NO VIOLATION*
Hannibal, OH/126.4	**5/2/2001**	**Phenol**	**Total Recoverable Metals**	**8**	**5**
Willow Island, WV/161.8	**11/7/1999**	**Phenol**	**Bimonthly Sampling Program**	**9**	**5**
Willow Island, WV/161.8	**11/28/2000**	**Phenol**	**Bimonthly Sampling Program**	**29**	**5**
Willow Island, WV/161.8	**5/2/2001**	**Phenol**	**Bimonthly Sampling Program**	**6**	**5**
Belleveille, OH/203.9	**11/7/1999**	**Phenol**	**Bimonthly Sampling Program**	**11**	**5**
Anderson Ferry, OH/477.5	**1/5/2000**	**Pb**	**Total Recoverable Metals**	**3.5**	**3.3169**
Anderson Ferry, OH/477.5	*1/5/2000*	*Pb*	*Dissolved Metals*	*0.1*	*NO VIOLATION*
Anderson Ferry, OH/477.5	*1/5/2000*	*Pb*	*Total Clean Metals*	*3.0*	*NO VIOLATION*
Anderson Ferry, OH/477.5	**5/24/2001**	**Pb**	**Total Clean Metals**	**3.58**	**2.3948**
Markland, KY/531.5	**1/5/2000**	**Pb**	**Total Recoverable Metals**	**8.3**	**3.6229**
Markland, KY/531.5	**1/5/2000**	**Zn**	**Total Recoverable Metals**	**263**	**157.1113**
Louisville, KY/600.6	**3/21/2000**	**Pb**	**Total Recoverable Metals**	**9**	**3.7623**
West Point, KY/625.9	**3/21/2000**	**Pb**	**Total Recoverable Metals**	**3.6**	**3.4281**
West Point, KY/625.9	**3/21/2000**	**Pb**	**Total Clean Metals**	**5.0**	**3.5419**
West Point, KY/625.9	*3/21/2000*	*Pb*	*Dissolved Metals*	*0.1*	*NO VIOLATION*
West Point, KY/625.9	*3/21/2000*	*Pb*	*Dissolved Metals Duplicate*	*<0.1*	*NO VIOLATION*
West Point, KY/625.9	**5/18/2000**	**Pb**	**Total Recoverable Metals**	**3.3**	**3.6507**
West Point, KY/625.9	*5/18/2000*	*Pb*	*Dissolved Metals*	*<0.1*	*NO VIOLATION*
West Point, KY/625.9	*5/18/2000*	*Pb*	*Dissolved Metals Duplicate*	*<0.1*	*NO VIOLATION*
West Point, KY/625.9	*5/18/2000*	*Pb*	*Total Clean Metals*	*1.3*	*NO VIOLATION*
Cannelton, IN/720.7	**3/23/2000**	**Pb**	**Total Recoverable Metals**	**4.5**	**3.1228**
Newburgh, IN/776.1	**3/23/2000**	**Pb**	**Total Recoverable Metals**	**4.2**	**3.1782**
Newburgh, IN/776.1	**3/8/2001**	**Pb**	**Total Recoverable Metals**	**3.7**	**3.5115**
J.T.Myers, KY/846.0	**1/13/2000**	**Pb**	**Total Recoverable Metals**	**4.1**	**3.4281**
J.T.Myers, KY/846.0	**3/23/2000**	**Pb**	**Total Recoverable Metals**	**4.4**	**3.2892**
J.T.Myers, KY/846.0	**11/29/2001**	**Pb**	**Total Clean Metals**	**6.4**	**6.3**
J.T.Myers, KY/846.0	**11/29/2001**	**Hg**	**Total Clean Metals**	**1.910E-02**	**0.012**
Paducah, KY/938.9	**3/1/2001**	**Pb**	**Total Recoverable Metals**	**5.5**	**3.9578**

Comments: The exceedances highlighted in grey indicate an impairment due to phenol for public water use support.

Figure 4: Ohio River Fish Index (ORFIn) Scores (possible scores of 0-1-2-3)

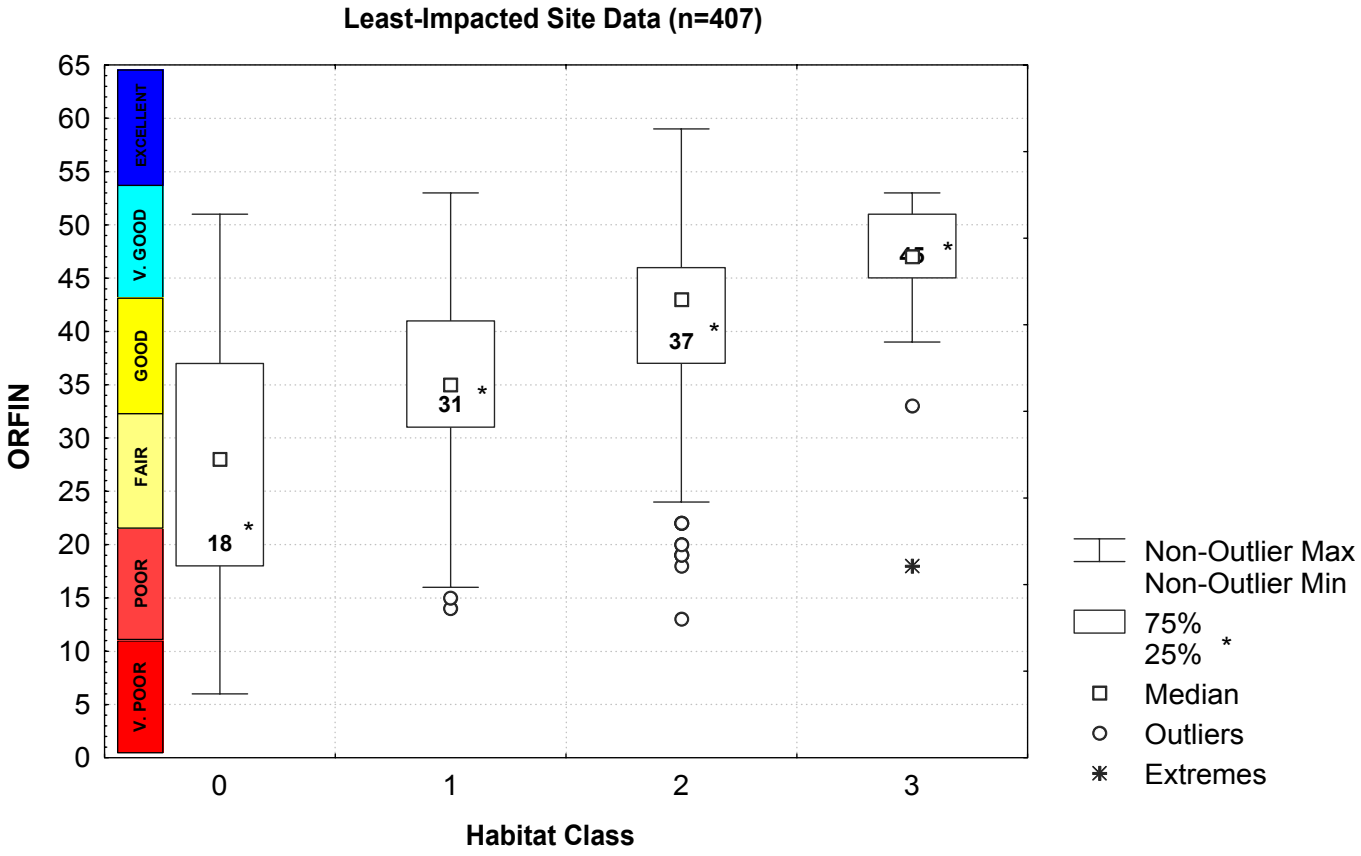


Figure 5: ORFIn Habitat Type 0

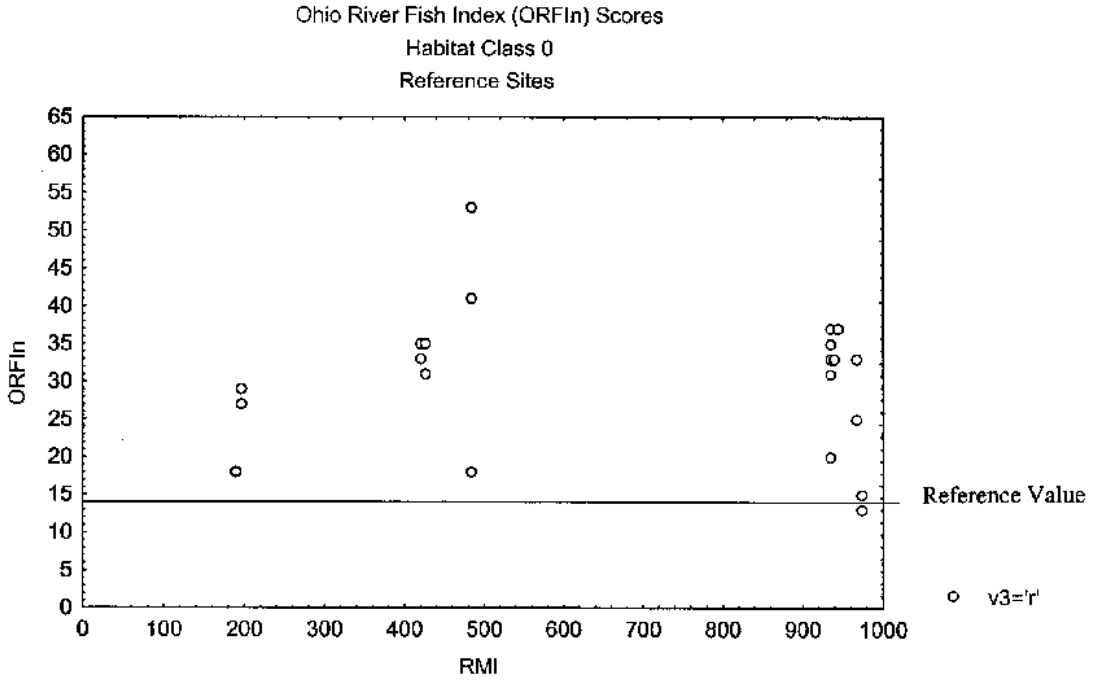


Figure 6: ORFIn Habitat Type 1

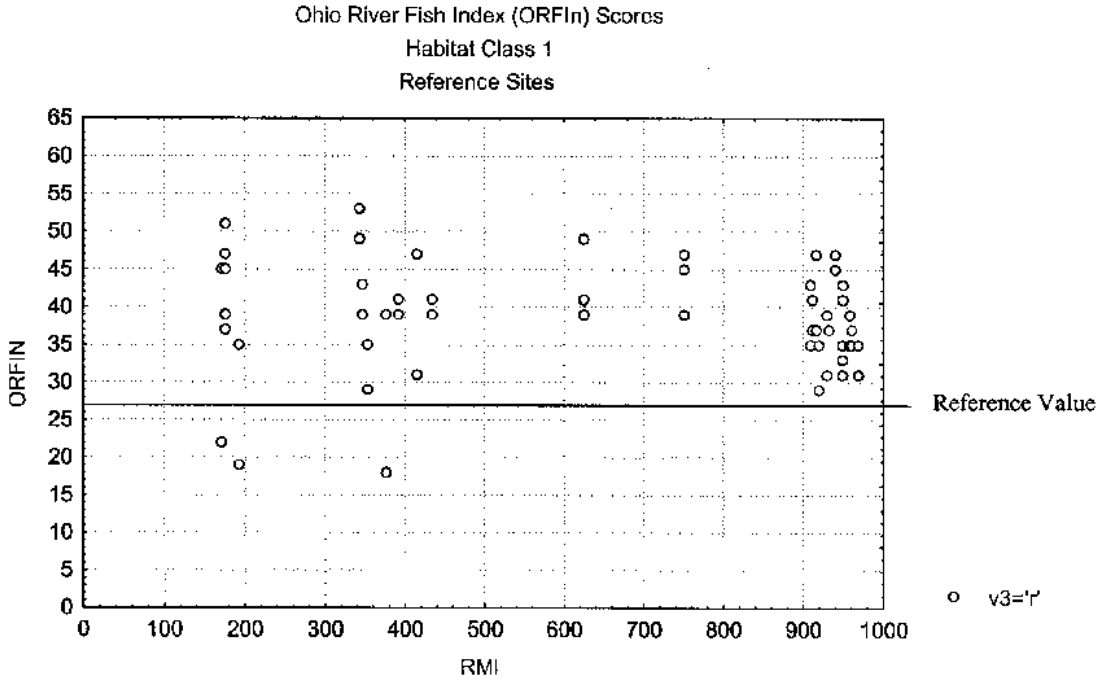


Figure 7: ORFIn Habitat Type 2

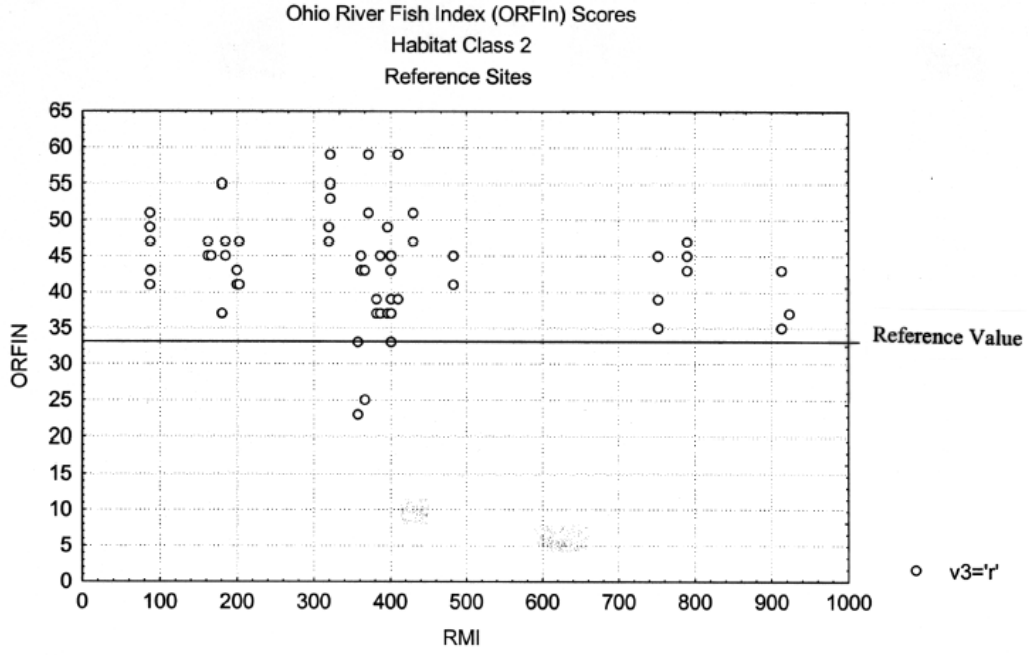
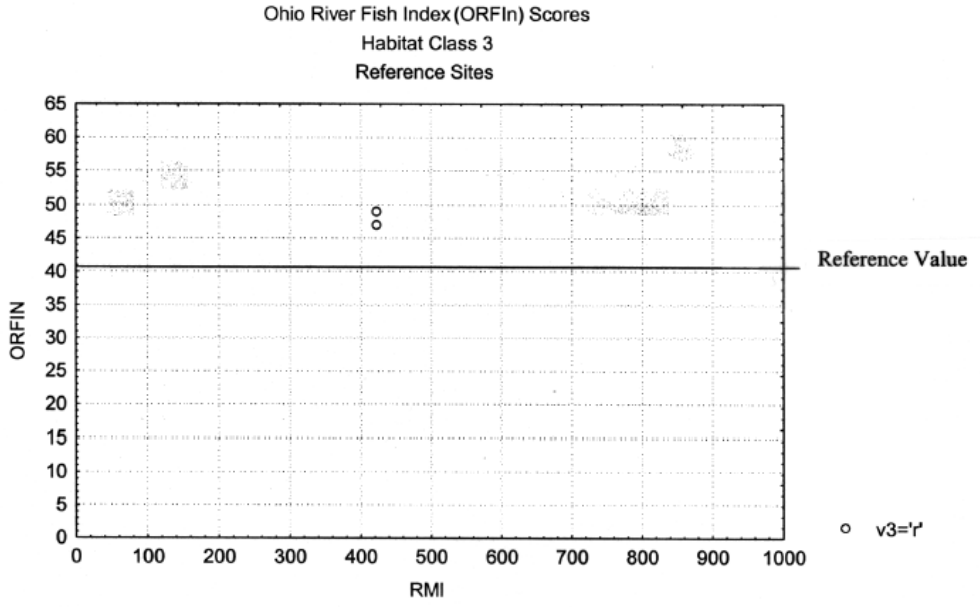


Figure 8: ORFIn Habitat Type 3



Public Water Supply Use

Table 14 presents results of the public water supply use support assessment for the Ohio River on a water body-by-water body basis. The Ohio River public water supply use support was assessed based on chemical water quality data and water utility surveys. Chemical water quality data were collected through the Bimonthly Sampling Program and the Contact Recreation Season Monitoring Program. Atrazine data were provided by public water utilities in Louisville, Kentucky, Evansville, Indiana, and Cairo, Illinois.

For this assessment, Ohio River atrazine levels were evaluated by reviewing whether additional nonroutine treatment was required to meet the atrazine MCL (3.0 ug/L) in finished drinking water. Based on a 1997 Commission report, atrazine was identified as a possible concern from Louisville, Kentucky downstream. Figure 9 graphically presents atrazine data from the Louisville, Kentucky, Evansville, Indiana, and Cairo, Illinois water utilities for the reporting period. Atrazine sampling at these water utilities is concentrated during the spring and summer months when atrazine values are expected to be higher based on herbicide use. The finished water MCL was not exceeded in the Ohio River, therefore, no public water supply use impairments resulted from atrazine monitoring. Appendix D contains atrazine data.

Table 9 on page 22 shows the applicable stream criteria that ambient water quality monitoring data are compared against. Phenolics levels, detected through the Bimonthly Sampling Program, exceeded the ORSANCO human health criterion of 0.005 mg/L in three of the ten samples collected at Ohio River Mile 161.8 in Willow Island, West Virginia. This resulted in a 10.5 mile water body being classified as partially supporting for public water supply use. No public water supply use impairments resulted from bacteria monitoring data.

Nineteen of 27 main stem water utilities responded to a survey that inquired about conditions of the Ohio River as a source for public drinking water. None of these utilities indicated the occurrence of SDWA compliance problems due to MCL exceedances. Several utilities indicated infrequent, short-term closures of their intakes due to spills; however, no spills have resulted in public water supply use support impairment classifications during this reporting period. Infrequent occurrences of elevated ammonia levels and algal blooms caused nonroutine additional treatment to be necessary at some locations. These instances do not indicate impairment, however.

Nine hundred seventy miles (99 percent) of the Ohio River are classified as fully supporting the public water supply use and approximately ten miles (one percent) are classified as partially supporting. Ohio River miles 161.7 through 172.2 are classified as partially supporting because the human health criterion for phenolics was exceeded in greater than ten percent of the samples at the Willow Island, West Virginia station. These samples indicate impairment of Ohio River source water and do not indicate impairment of finished water. Surveys were sent to 27 water utilities that use the Ohio River as a source for drinking water. Of the 19 responses received, none indicated violations of the SDWA for MCLs that could be attributable to Ohio River source water quality. Results of the Bacteria Monitoring Program indicated no violations of stream criteria for the protection of public water supplies in the Ohio River.

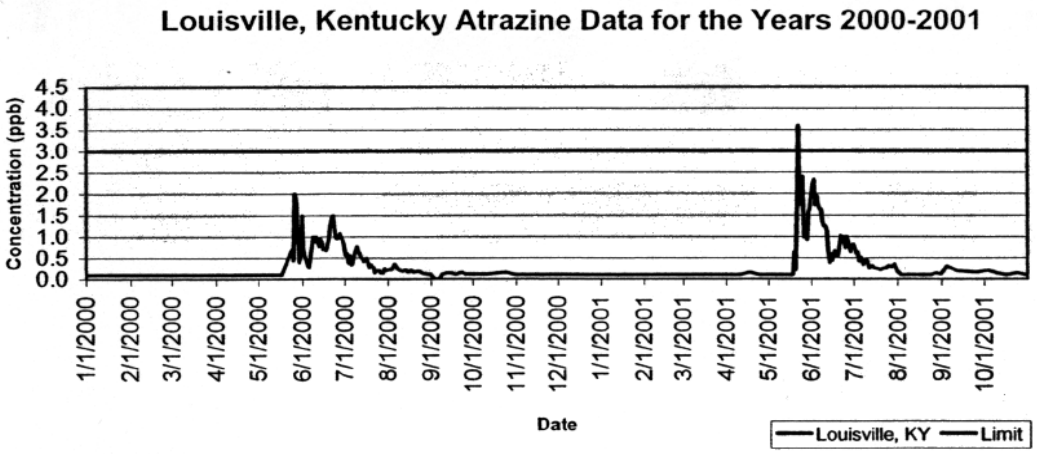
Insert table 14: Public Water

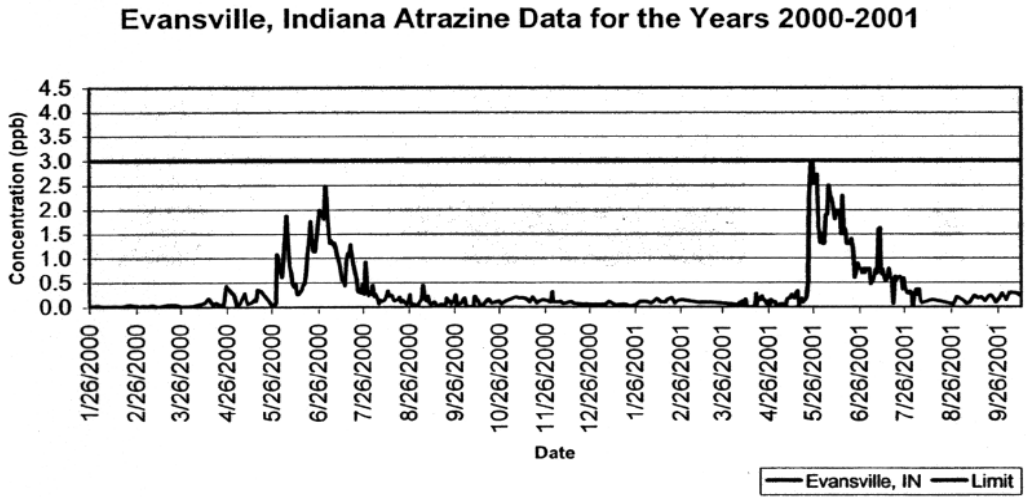
Table 14: 2002 Public Water Supply Use Support Assessment Summary

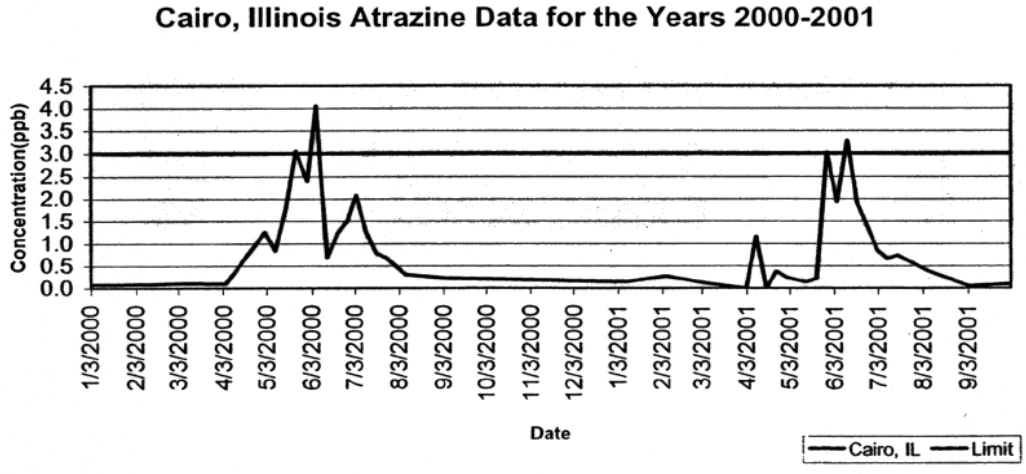
Waterbody ID	States	River Miles	Total Miles in Waterbody	Miles Not Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting	Causes of Impairment	*Potential Sources	Assessment Type
OVWB 01	PA	0.0 - 6.2	6.2		6.2					Monitored
OVWB 02	PA	6.2 - 13.3	7.1		7.1					Monitored
OVWB 03	PA	13.3 - 25.4	12.1		12.1					Monitored
OVWB 04	PA	25.4 - 31.7	6.3		6.3					Monitored
OVWB 05	PA	31.7 - 40.2	8.5		8.5					Monitored
OVWB 06	OH-WV	40.2 - 54.4	14.2		14.2					Monitored
OVWB 07	OH-WV	54.5 - 84.2	29.8		29.8					Monitored
OVWB 08	OH-WV	84.2 - 126.4	42.2		42.2					Monitored
OVWB 09	OH-WV	126.4 - 161.7	35.3		35.3					Monitored
OVWB 10	OH-WV	161.7 - 172.2	10.5		0.0	10.5		Phenol		Monitored
OVWB 11	OH-WV	172.2 - 203.9	31.7		31.7					Monitored
OVWB 12	OH-WV	203.9 - 237.5	33.6		33.6					Monitored
OVWB 13	OH-WV	237.5 - 265.7	28.2		28.2					Monitored
OVWB 14	OH-WV	265.7 - 279.2	13.5		13.5					Monitored
OVWB 15	OH-WV	279.2 - 317.1	37.9		37.9					Monitored
OVWB 16	OH-KY	317.1 - 341.0	23.9		23.9					Monitored
OVWB 17	OH-KY	341.0 - 356.5	15.5		15.5					Monitored
OVWB 18	OH-KY	356.5 - 436.2	79.7		79.7					Monitored
OVWB 19	OH-KY	436.2 - 464.1	27.9		27.9					Monitored
OVWB 20	OH-KY	464.1 - 470.2	6.1		6.1					Monitored
OVWB 21	OH-KY	470.2 - 491.1	20.9		20.9					Monitored
OVWB 22	IN-KY	491.1 - 531.5	40.4		40.4					Monitored
OVWB 23	IN-KY	531.5 - 545.8	14.3		14.3					Monitored
OVWB 24	IN-KY	545.8 - 606.8	61.0		61.0					Monitored
OVWB 25	IN-KY	606.8 - 629.9	23.1		23.1					Monitored
OVWB 26	IN-KY	629.9 - 720.7	90.8		90.8					Monitored
OVWB 27	IN-KY	720.7 - 776.1	55.4		55.4					Monitored
OVWB 28	IN-KY	776.1 - 784.2	8.1		8.1					Monitored
OVWB 29	IN-KY	784.2 - 846.0	61.8		61.8					Monitored
OVWB 30	IN-KY	846.0 - 848.0	2.0		2.0					Monitored
OVWB 31	IL-KY	848.0 - 918.5	70.5		70.5					Monitored
OVWB 32	IL-KY	918.5 - 920.4	1.9		1.9					Monitored
OVWB 33	IL-KY	920.4 - 934.5	14.1		14.1					Monitored
OVWB 34	IL-KY	934.5 - 981.0	46.5		46.5					Monitored
Totals			**981.0**		**970.5**	**10.5**	**0.0**			

*Potential sources include municipal point sources, industrial point sources, CSOs, SSOs, agricultural activities and overland runoff sources, unless otherwise indicated.

Insert Figure 9: Atrazine







Contact Recreation Use

Table 15 presents results of the contact recreation use support assessment for the Ohio River on a water body-by-water body basis. Appendix E contains individual sample results from bacteria monitoring. Fecal coliform and *E. coli* bacteria data are used to make use support decisions as described in the previous chapter. In 2000, ORSANCO monitored for bacteria at six stations on the Ohio River located downstream of urban areas with large numbers of combined sewer overflows (CSOs). In 2001, ORSANCO added 13 sampling sites at upstream and downtown locations in those same six urban areas. Where no bacteria monitoring stations are present, the river has been evaluated as not assessed. Permitted discharges from the more than 180 publicly owned treatment works (POTWs) on the Ohio River were found to have little impact on instream criteria exceedances based on an evaluation conducted by ORSANCO in the early 1990s. This holds true even when assuming effluent concentrations associated with untreated waste, with the exception of the Pittsburgh, Pennsylvania, Cincinnati, Ohio, and Louisville, Kentucky facilities that have flows large enough to impact bacteria levels. Nonpoint sources of pollution may also contribute to bacteria levels in the Ohio River. Appendix F shows the spatial distribution of communities with CSOs along the Ohio River. CSOs are potential sources of permitted, untreated wastewater discharges during heavy rain events and unpermitted discharges due to mechanical failure or improper maintenance.

Approximately 136 miles (14 percent) of the Ohio River are classified as not supporting the contact recreation use. Waters are classified as not supporting when 25 percent or more of recreation season months do not meet standards for bacteria. An additional 40.2 miles (four percent) of the river are classified as partially supporting the contact recreation use. Waters are classified as partially supporting when greater than ten but less than 25 percent of the recreation season months do not meet standards for bacteria. All monitored areas of the Ohio River demonstrated impairment for contact recreation use based on bacteria levels. Figures 10 and 11 graphically display the number of individual exceedances that occurred at each monitoring station during the contact recreation seasons in 2000 and 2001. Appendix G displays graphs of both the monthly geometric means and individual exceedances for the contact recreation seasons during 2000 and 2001. A monthly exceedance occurs when ten percent or more of the monthly samples exceeds the instantaneous maximum criterion (400/100ml fecal coliform or 240/100ml *E. coli*) or the monthly geometric mean criterion (200/100ml fecal coliform or 130/100ml *E. coli*) is exceeded. Since five bacteria samples are collected on a monthly basis at each station, one fecal coliform sample greater than 400/100 mL or *E. coli* sample greater than 240/100mL is sufficient to cause a monthly violation. All 19 stations exhibited violations at least 17 percent of the sampling times during the contact recreation seasons of 2000 and 2001, and most stations exceeded the criteria in greater than 50 percent of the samples. This includes violations of the monthly geometric mean as well as violations of the instantaneous maximum for both fecal coliform and *E. coli.* The bacteria data from all stations is listed in Appendix E.

Table 15: Contact Recreation

Table 15: 2002 Contact Recreation Use Support Assessment Summary

Waterbody ID	States	River Miles	Total Miles in Waterbody	Monitoring Station at River Mile Point (MP)	Miles Not Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting	Causes of Impairment	*Potential Sources	Assessment Type
OVWB 01	PA	0.0 - 6.2	6.2	1.4R,1.4M,1.4L,4.3				6.2	Pathogen		Monitored
OVWB 02	PA	6.2 - 13.3	7.1		7.1						Not Assessed
OVWB 03	PA	13.3 - 25.4	12.1		12.1						Not Assessed
OVWB 04	PA	25.4 - 31.7	6.3		6.3						Not Assessed
OVWB 05	PA	31.7 - 40.2	8.5		8.5						Not Assessed
OVWB 06	OH-WV	40.2 - 54.4	14.2		14.2						Not Assessed
OVWB 07	OH-WV	54.5 - 84.2	29.8		29.8						Not Assessed
OVWB 08	OH-WV	84.2 - 126.4	42.2	86.8, 91.4, 92.8	2.6 (MP 84.2-86.8)			39.6	Pathogen		Monitored
OVWB 09	OH-WV	126.4 - 161.7	35.3		35.3						Not Assessed
OVWB 10	OH-WV	161.7 - 172.2	10.5		10.5						Not Assessed
OVWB 11	OH-WV	172.2 - 203.9	31.7		31.7						Not Assessed
OVWB 12	OH-WV	203.9 - 237.5	33.6		33.6						Not Assessed
OVWB 13	OH-WV	237.5 - 265.7	28.2		28.2						Not Assessed
OVWB 14	OH-WV	265.7 - 279.2	13.5		13.5						Not Assessed
OVWB 15	OH-WV	279.2 - 317.1	37.9	305.1,308.1,314.8	25.9 (MP 279.2-317.1)			12	Pathogen		Monitored
OVWB 16	OH-KY	317.1 - 341.0	23.9		23.9						Not Assessed
OVWB 17	OH-KY	341.0 - 356.5	15.5		15.5						Not Assessed
OVWB 18	OH-KY	356.5 - 436.2	79.7		79.7						Not Assessed
OVWB 19	OH-KY	436.2 - 464.1	27.9	462.6	26.4 (MP 436.2-462.6)		1.5(MP 462.6-464.1)		Pathogen		Monitored
OVWB 20	OH-KY	464.1 - 470.2	6.1	470			6.1		Pathogen		Monitored
OVWB 21	OH-KY	470.2 - 491.1	20.9	477.5			7.3 (MP 470.2-477.5)	13.6 (MP 477.5-491.1)	Pathogen		Monitored
OVWB 22	IN-KY	491.1 - 531.5	40.4		40.4						Not Assessed
OVWB 23	IN-KY	531.5 - 545.8	14.3		14.3						Not Assessed
OVWB 24	IN-KY	545.8 - 606.8	61.0	594	48.2 (MP 545.8-594)		12.8 (MP 594-606.8)		Pathogen		Monitored
OVWB 25	IN-KY	606.8 - 629.9	23.1	608.7, 619.3			12.5(MP 606.8-619.3)	10.6(MP 619.3-629.9)	Pathogen		Monitored
OVWB 26	IN-KY	629.9 - 720.7	90.8		90.8						Not Assessed
OVWB 27	IN-KY	720.7 - 776.1	55.4		55.4						Not Assessed
OVWB 28	IN-KY	776.1 - 784.2	8.1		8.1						Not Assessed
OVWB 29	IN-KY	784.2 - 846.0	61.8	791.5, 793.7,797.3	7.3(MP 784.2-791.5)			54.5(MP 791.5-846.0)	Pathogen		Monitored
OVWB 30	IN-KY	846.0 - 848.0	2.0		2						Not Assessed
OVWB 31	IL-KY	848.0 - 918.5	70.5		70.5						Not Assessed
OVWB 32	IL-KY	918.5 - 920.4	1.9		1.9						Not Assessed
OVWB 33	IL-KY	920.4 - 934.5	14.1		14.1						Not Assessed
OVWB 34	IL-KY	934.5 - 981.0	46.5		46.5						Not Assessed
Totals			**981.0**		**804.3**		**40.2**	**136.5**			

*Potential sources include municipal point sources, industrial point sources, CSOs, SSOs, agricultural activities and overland runoff sources, unless otherwise indicated.

Figure 10

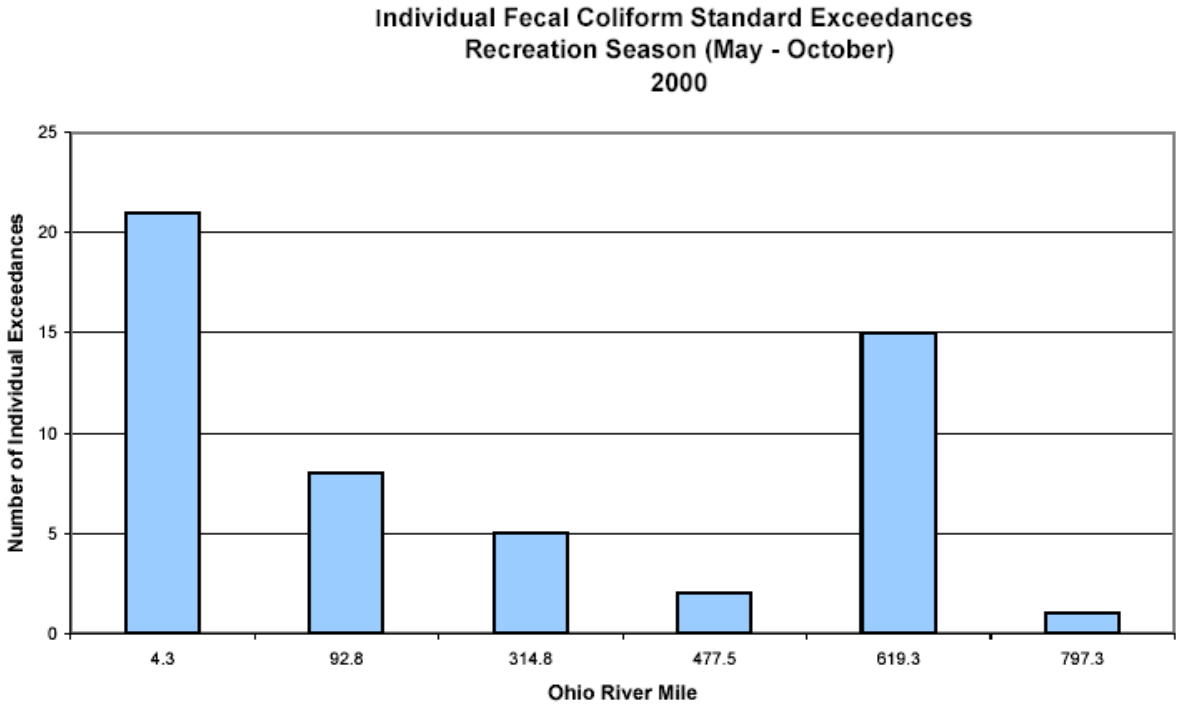
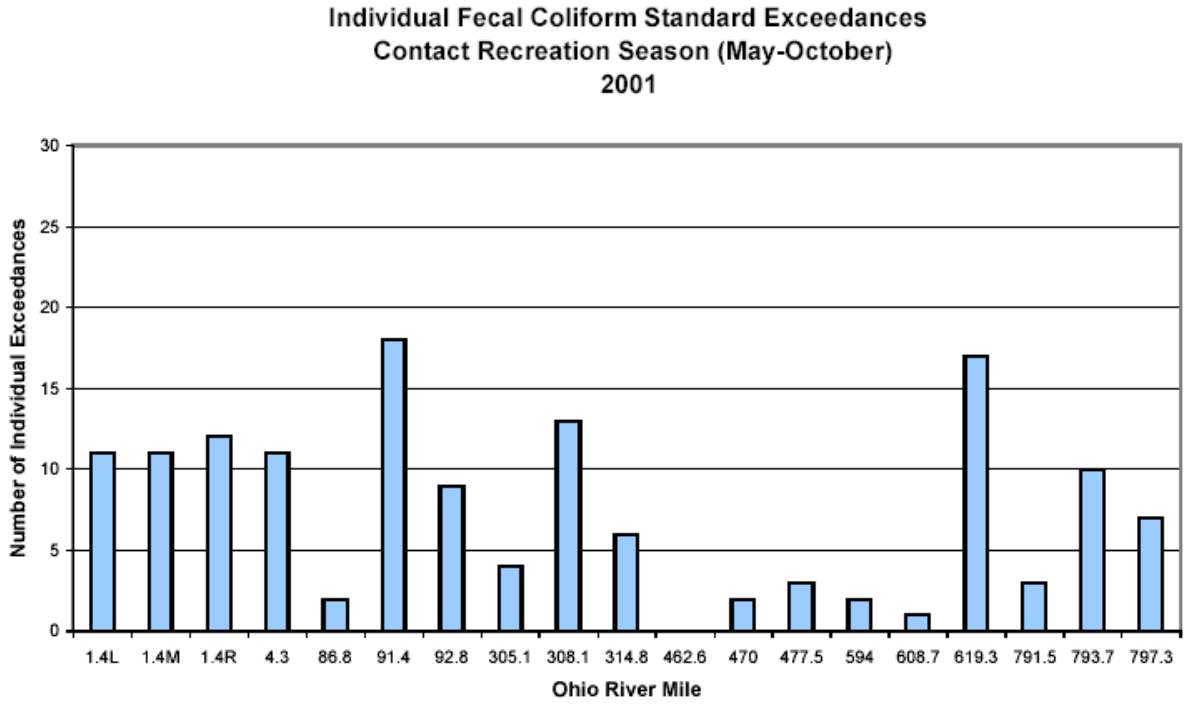


Figure 11



Fish Consumption

The methodology for fish consumption use assessments specifies that a classification of partial support be given to Ohio River waters having "restricted consumption" fish advisories in place, and a classification of nonsupport be given to waters with "no consumption" advisories. Table 15 summarizes the 2000-2001 fish consumption use support assessment. Appendix H contains fish tissue mercury data and Appendix J contains states' fish consumption advisories. In the instance of statewide advisories issued for mercury, the Ohio River was assessed as impaired only if ORSANCO fish tissue data indicated impairment when compared to each states' individual protocol for issuing a one meal per week mercury fish consumption advisory. Appendix L contains an Environmental Protection Agency fact sheet regarding mercury and its impact on fish advisories.

The entire 981 miles of the Ohio River are classified as partially supporting the fish consumption use, primarily driven by "restricted consumption" fish advisories issued by all main stem states due to levels of PCBs. In addition, Ohio, Indiana and Kentucky have statewide fish consumption advisories in place based on levels of mercury, while Pennsylvania has a statewide advisory covering all pollutants. Illinois and West Virginia do not have statewide advisories in effect for mercury. A review of fish tissue data for mercury for 1999 and 2000 (the latest fish tissue data available) supports an assessment of partially supporting due to mercury for the majority of the river, approximately 769 miles.

In previous reports, chlordane has been an issue of inconsistency. A review of carp tissue data analyzed for chlordane from the years 1990-2000 reveals a declining level in the Ohio River. Figure 12 graphically displays Ohio River chlordane levels on a river-wide basis. A new chlordane criterion has been established since the last biennial assessment. This new limit removed chlordane as an impairment of fish consumption. All states have since removed chlordane from their fish consumption advisories, therefore removing chlordane as a source of impairment and inconsistency among the states.

Dioxin

In addition to impairments caused by PCBs and mercury, Table 15 indicates 618 miles of the Ohio River are impaired due to dioxin. Through the Ohio River Watershed Pollutant Reduction Program, ORSANCO has analyzed high volume water samples for dioxin in the Ohio River from Pittsburgh , Pennsylvania to the Cannelton Locks & Dam (ORM 4-722). These data, contained in Appendix K, were compared against applicable ambient water quality criteria established for the protection of human health due to fish ingestion. Figure 13 graphically displays the dioxin monitoring results from 1997 through 2001. Many high volume dioxin samples exceeded the ambient water quality criterion for human health protection resulting from fish ingestion of 0.014 pg/L (parts per quadrillion). The high volume dioxin water column data was used in this assessment by evaluating all river segments with two or more criterion exceedances (0.014 pg/L) as partially supporting. River segments with one criterion exceedance, except water body OVWB 04, are considered to have insufficient data to determine dioxin impairment. Water body OVWB 04 was assessed as "Partially Supporting." This assessment is based on the fact that one of the two samples from this reach

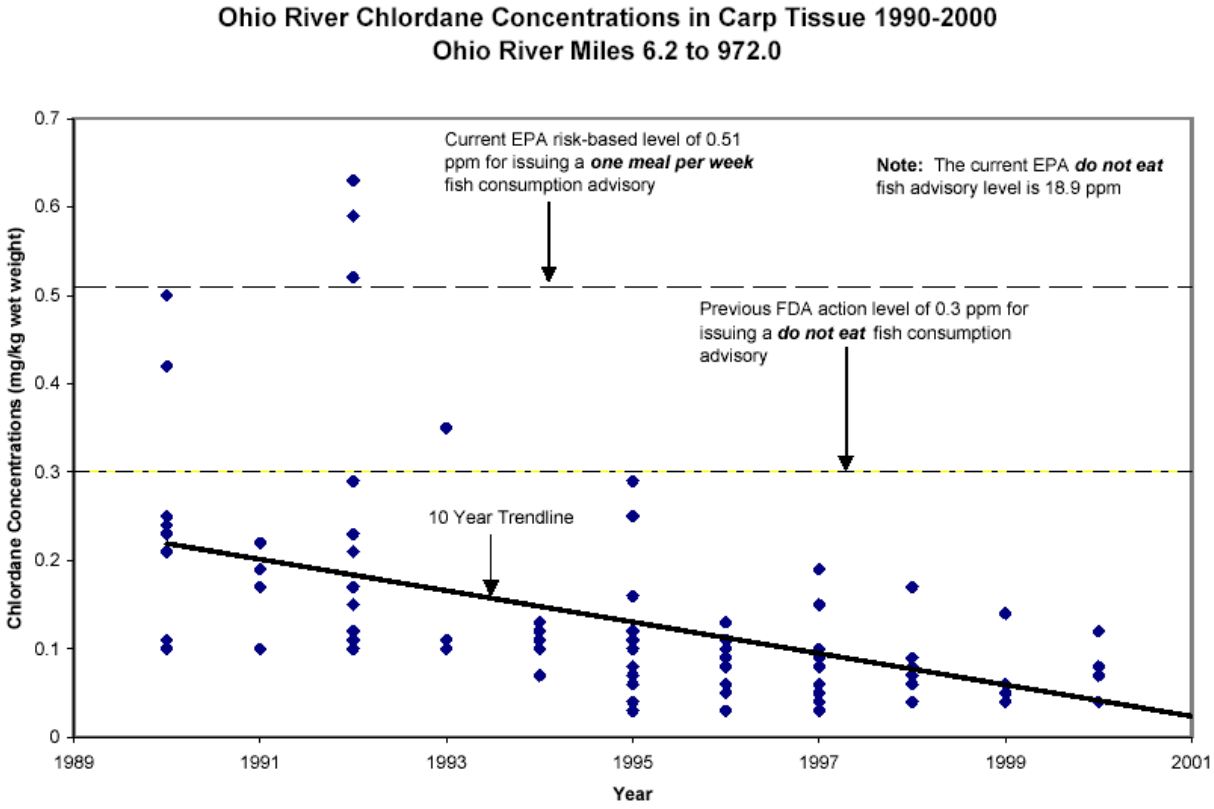
exceeded the criterion AND because all ten samples collected in the segments immediately upstream and downstream of OVWB 04 exceeded the criterion. All river segments that were sampled only once are classified to have insufficient data to determine dioxin impairment. Segments that were not sampled, except water body OVWB 14, are considered not assessed. Water

Table 16: 2002 Fish Consumption Use Support Assessment Summary

Waterbody ID	States	River Miles	Total Miles In Waterbody	Miles Not Assessed	Miles Fully Supporting	Miles Partially Supporting	Miles Not Supporting	Causes of Impairment	*Potential Sources	Assessment Type
OVWB 01	PA	0.0 - 6.2	6.2			6.2		PCBs		Monitored**
OVWB 02	PA	6.2 - 13.3	7.1			7.1		PCBs, Dioxin		Monitored**
OVWB 03	PA	13.3 - 25.4	12.1			12.1		PCBs, Dioxin		Monitored**
OVWB 04	PA	25.4 - 31.7	6.3			6.3		PCBs, Dioxin		Monitored**
OVWB 05	PA	31.7 - 40.2	8.5			8.5		PCBs, Hg, Dioxin		Monitored
OVWB 06	OH-WV	40.2 - 54.4	14.2			14.2		PCBs, Hg, Dioxin		Monitored
OVWB 07	OH-WV	54.5 - 84.2	29.8			29.8		PCBs, Hg, Dioxin		Monitored
OVWB 08	OH-WV	84.2 - 126.4	42.2			42.2		PCBs, Hg, Dioxin		Monitored
OVWB 09	OH-WV	126.4 - 161.7	35.3			35.3		PCBs, Hg, Dioxin		Monitored
OVWB 10	OH-WV	161.7 - 172.2	10.5			10.5		PCBs, Hg, Dioxin		Monitored
OVWB 11	OH-WV	172.2 - 203.9	31.7			31.7		PCBs, Dioxin		Monitored
OVWB 12	OH-WV	203.9 - 237.5	33.6			33.6		PCBs, Dioxin		Monitored
OVWB 13	OH-WV	237.5 - 265.7	28.2			28.2		PCBs, Hg, Dioxin		Monitored
OVWB 14	OH-WV	265.7 - 279.2	13.5			13.5		PCBs, Hg, Dioxin		Monitored
OVWB 15	OH-WV	279.2 - 317.1	37.9			37.9		PCBs, Hg, Dioxin		Monitored
OVWB 16	OH-KY	317.1 - 341.0	23.9			23.9		PCBs, Hg, Dioxin		Monitored
OVWB 17	OH-KY	341.0 - 356.5	15.5			15.5		PCBs, Hg		Monitored
OVWB 18	OH-KY	356.5 - 436.2	79.7			79.7		PCBs, Hg, Dioxin		Monitored
OVWB 19	OH-KY	436.2 - 464.1	27.9			27.9		PCBs, Hg, Dioxin		Monitored
OVWB 20	OH-KY	464.1 - 470.2	6.1			6.1		PCBs		Monitored
OVWB 21	OH-KY	470.2 - 491.1	20.9			20.9		PCBs, Dioxin		Monitored
OVWB 22	IN-KY	491.1 - 531.5	40.4			40.4		PCBs, Dioxin		Monitored
OVWB 23	IN-KY	531.5 - 545.8	14.3			14.3		PCBs, Hg		Monitored
OVWB 24	IN-KY	545.8 - 606.8	61.0			61.0		PCBs, Hg		Monitored
OVWB 25	IN-KY	606.8 - 629.9	23.1			23.1		PCBs, Dioxin		Monitored
OVWB 26	IN-KY	629.9 - 720.7	90.8			90.8		PCBs, Hg, Dioxin		Monitored
OVWB 27	IN-KY	720.7 - 776.1	55.4			55.4		PCBs, Hg		Monitored
OVWB 28	IN-KY	776.1 - 784.2	8.1			8.1		PCBs		Monitored
OVWB 29	IN-KY	784.2 - 846.0	61.8			61.8		PCBs, Hg		Monitored
OVWB 30	IN-KY	846.0 - 848.0	2.0			2.0		PCBs, Hg		Monitored
OVWB 31	IL-KY	848.0 - 918.5	70.5			70.5		PCBs, Hg		Monitored
OVWB 32	IL-KY	918.5 - 920.4	1.9			1.9		PCBs		Monitored**
OVWB 33	IL-KY	920.4 - 934.5	14.1			14.1		PCBs		Monitored**
OVWB 34	IL-KY	934.5 - 981.0	46.5			46.5		PCBs, Hg		Monitored
Totals			**981.0**			**981.0**				

*Potential sources include municipal point sources, industrial point sources, CSOs, SSOs, agricultural activities and overland runoff sources, unless otherwise indicated.
**These waterbodies were not monitored for Hg

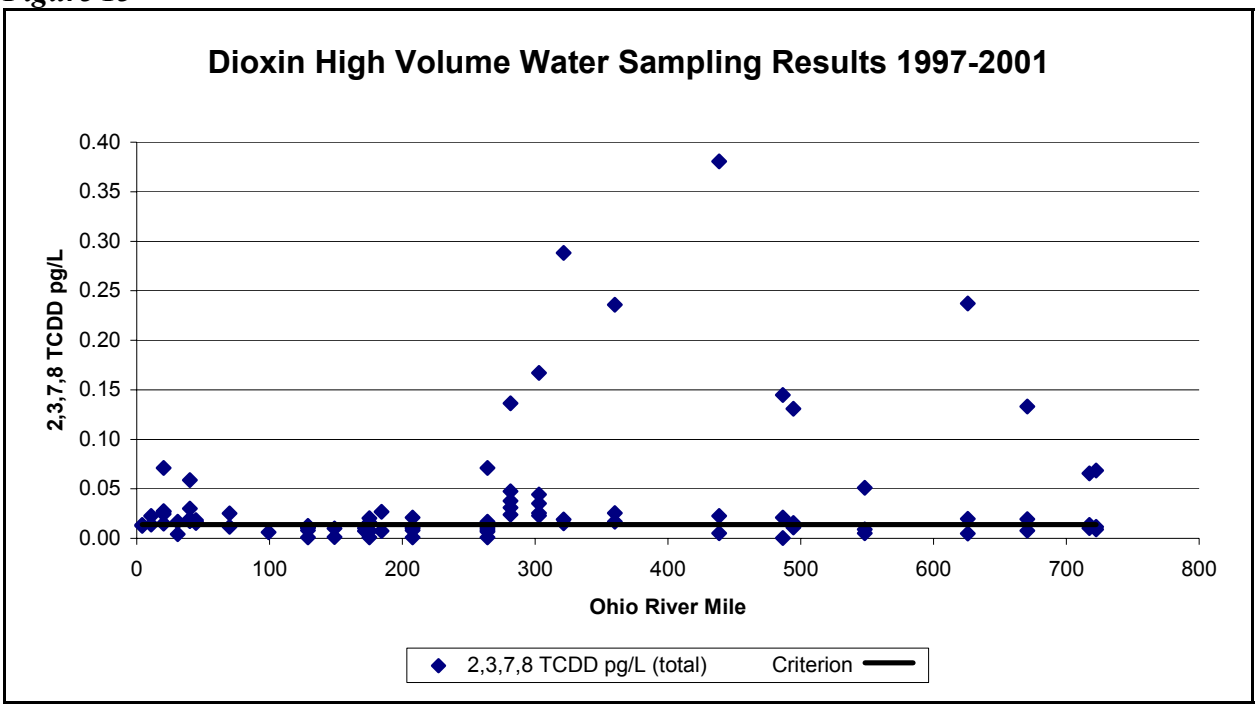
Insert chlordane graph – Fig. 12



body OVWB 14 was assessed as partially supporting. Though no samples were collected within this river segment, extensive modeling of this reach has been conducted in conjunction with the dioxin Total Maximum Daily Load (TMDL) that was completed in September 2000. The modeling, based on upstream monitoring of the Ohio and Kanawha rivers, strongly suggests that instream dioxin concentrations exceed the stream criterion in this river segment.

In addition to the above dioxin assessment based on high volume water sampling on the Ohio River, West Virginia also has an Ohio River advisory for the length of their border for dioxin, PCBs, and mercury. The entire West Virginia border is therefore classified as impaired due to dioxin because of either the high volume dioxin data or the West Virginia issued fish consumption advisory for dioxin.

Figure 13



PART IV: SUMMARY AND RECOMMENDATIONS

The Biennial Assessment Process and Integrated Reporting Guidelines

ORSANCO's biennial assessment was generated through the coordination of several workgroups that are comprised of state representatives from each of the Ohio River main stem states. These workgroups met via meetings and teleconferences multiple times during the report preparation process. Through these meetings, the assessment parameters, methodology, and schedule were established. These groups, along with ORSANCO staff, reviewed Ohio River monitoring data and provided input into the generation of this report. Monitoring data from ORSANCO's Bimonthly Sampling, Clean Metals Sampling, Bacteria Monitoring, Watershed Protection, Fish Population and Fish Contaminants programs, along with information from public drinking water facilities, provided the information needed to generate this assessment. The involvement of state personnel during the development of this report was essential to promote consistency among the states as they assess Ohio River water quality.

Most Ohio River states incorporate ORSANCO's biennial assessment into their own 305(b) reports. This either occurs directly as an attachment to their reports, or by reference within their reports. Most states do not conduct water quality monitoring on the Ohio River as extensively as ORSANCO, so this opportunity to share resources and promote consistency among the states that border the Ohio River is extremely valuable.

In October 2001, the Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds issued the 2002 Integrated Water Quality Monitoring and Assessment Report Guidance. This guidance recommends that states submit a *2002 Integrated Water Quality Monitoring and Assessment Report* (*Integrated Report*) that will satisfy the Clean Water Act requirements for both Section 305(b) and Section 303(d). Contained within this guidance are five assessment categories used to evaluate each assessment unit (or water body). In an attempt to incorporate this newly released assessment methodology, the *Integrated Report* assessment categories have been applied to the results of the biennial assessment in this summary. The *Integrated Report* assessment categories are as follows:

1. Attaining the water quality standard.
2. Attaining some of the designated uses; and insufficient or no data and information is available to determine if the remaining uses are attained.
3. Insufficient or no data and information to determine if designated use is attained.
4. Impaired for one or more designated uses but does not require the development of a TMDL.
   A. TMDL has been completed.
   B. Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
   C. Impairment is not caused by a pollutant.
5. The water quality standard is not attained. The assessment unit is impaired for one or more

designated uses by a pollutant(s) and requires a TMDL.

Table 17: Ohio River Assessment Summary Utilizing the 2002 Integrated Water Quality Monitoring and Assessment Report Guidance

Waterbody ID/ Assessment Unit	States	River Miles	Total Miles in Waterbody	Warm Water Aquatic Life Use Support	Public Water Supply Use Support	Contact Recreation Use Support	Fish Consumption Use Support
OVWB 01	PA	0.0 - 6.2	6.2	1	1	5	5*
OVWB 02	PA	6.2 - 13.3	7.1	1	1	3	5*
OVWB 03	PA	13.3 - 25.4	12.1	1	1	3	5*
OVWB 04	PA	25.4 - 31.7	6.3	1	1	3	5*
OVWB 05	PA	31.7 - 40.2	8.5	1	1	3	5*
OVWB 06	OH-WV	40.2 - 54.4	14.2	1	1	3	5
OVWB 07	OH-WV	54.5 - 84.2	29.8	1	1	3	5
OVWB 08	OH-WV	84.2 - 126.4	42.2	1	1	5	5
OVWB 09	OH-WV	126.4 - 161.7	35.3	1	1	3	5
OVWB 10	OH-WV	161.7 - 172.2	10.5	1	3	3	5
OVWB 11	OH-WV	172.2 - 203.9	31.7	1	1	3	5
OVWB 12	OH-WV	203.9 - 237.5	33.6	1	1	3	5
OVWB 13	OH-WV	237.5 - 265.7	28.2	1	1	3	5**
OVWB 14	OH-WV	265.7 - 279.2	13.5	1	1	3	5**
OVWB 15	OH-WV	279.2 - 317.1	37.9	1	1	5	5**
OVWB 16	OH-KY	317.1 - 341.0	23.9	1	1	3	5
OVWB 17	OH-KY	341.0 - 356.5	15.5	3	1	3	5
OVWB 18	OH-KY	356.5 - 436.2	79.7	3	1	3	5
OVWB 19	OH-KY	436.2 - 464.1	27.9	1	1	5	5
OVWB 20	OH-KY	464.1 - 470.2	6.1	1	1	5	5
OVWB 21	OH-KY	470.2 - 491.1	20.9	1	1	5	5
OVWB 22	IN-KY	491.1 - 531.5	40.4	1	1	3	5
OVWB 23	IN-KY	531.5 - 545.8	14.3	1	1	3	5
OVWB 24	IN-KY	545.8 - 606.8	61.0	1	1	5	5
OVWB 25	IN-KY	606.8 - 629.9	23.1	1	1	5	5
OVWB 26	IN-KY	629.9 - 720.7	90.8	1	1	3	5
OVWB 27	IN-KY	720.7 - 776.1	55.4	1	1	3	5
OVWB 28	IN-KY	776.1 - 784.2	8.1	1	1	3	5
OVWB 29	IN-KY	784.2 - 846.0	61.8	1	1	5	5
OVWB 30	IN-KY	846.0 - 848.0	2	1	1	3	5
OVWB 31	IL-KY	848.0 - 918.5	70.5	1	1	3	5
OVWB 32	IL-KY	918.5 - 920.4	1.9	1	1	3	5
OVWB 33	IL-KY	920.4 - 934.5	14.1	1	1	3	5
OVWB 34	IL-KY	934.5 - 981.0	46.5	1	1	3	5

1: Attaining the water quality standard.
2: Attaining some of the designated uses; and insufficient or no data and information is available to determine if the remaining uses are attained.
3: Insufficient or no data and information to determine if designated use is attained.
4: Impaired for one or more designated uses but does not require the development of a TMDL:
4A: TMDL has been completed
4B: Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future.
4C: Impairment is not caused by a pollutant.
5: The water quality standard is not attained. The assessment unit is impaired for one or more designated uses by a pollutant(s), and requires a TMDL.
* A TMDL for PCBs has been completed and approved for these waterbodies.
** A TMDL for dioxin has been completed and approved for these waterbodies.

There are 34 water bodies that comprise the Ohio River for assessment purposes. Each water body has been assessed for four designated uses; warm water aquatic life, public water supply, contact recreation, and fish consumption. Table 17 applies the *Integrated Report* assessment category that most closely concurs with ORSANCO's assessment results based on available data for each water body. Summaries of each designated use assessment follow.

Warm Water Aquatic Life Use Support Summary

Nine hundred seventy-four miles (over 99 percent) of the Ohio River are classified as fully supporting for aquatic life use and seven miles (less than one percent) are classified as partially supporting due to current biological data that indicate impaired fish communities. The segments listed as partially supporting are Ohio River miles 354 through 361.

An *Integrated Report* assessment category of 3 has been assigned to the two water bodies (OVWB 17 and OVWB 18) because further monitoring data is needed to determine the cause of this impairment or even if these water bodies will be classified as impaired once further monitoring has been conducted. ORSANCO's determination of impairment was based on the available data for this segment of the river, which consists of two monitoring samples. Further monitoring is planned.

Public Water Supply Use Support Summary

Nine hundred seventy miles (99 percent) of the Ohio River are classified as fully supporting the public water supply use and approximately 10.5 miles (one percent) are classified as partially supporting. Ohio River mile points 161.7 through 172.2 are classified as partially supporting because the human health criterion for phenolics was exceeded in greater than ten percent of the samples at the bimonthly sampling station located in Willow Island, West Virginia. These samples indicate impairment of Ohio River source water and do not indicate impairment of finished water. Surveys were sent to 27 water utilities that use the Ohio River as a source for drinking water. Of the 19 responses received, none indicated violations of the Safe Drinking Water Act for MCLs that could be attributable to Ohio River source water quality. Results of the Bacteria Monitoring Program indicated no violations of stream criteria for the protection of public water supplies in the Ohio River.

An *Integrated Report* assessment category of 3 has been assigned to OVWB 10 because further monitoring data is needed to determine the cause of this impairment, the need for a TMDL, or whether this water body will be classified as impaired once further monitoring has occurred.

Contact Recreation Use Support Summary

Approximately 40 miles (four percent) of the Ohio River are classified as partially supporting the contact recreation use and 136.5 miles (14 percent) are classified as not supporting. The remaining 804.3 miles (82 percent) of the Ohio River were not assessed. Unmonitored segments of the Ohio River are classified as not assessed.

Integrated Report categories of 3 or 5 have been assigned accordingly to all 34 waterbodies. All monitored water bodies of the Ohio River demonstrated impairment of the contact recreation use due to bacteria levels. Water bodies that have not been monitored are listed as a category 3 because monitoring data is still needed to make a use support determination.

Fish Consumption Use Support Summary

The entire 981 miles (100 percent) of the Ohio River are classified as partially supporting the fish consumption use due to the restrictions in the states' advisories for PCBs. Six hundred and seventeen miles of the upper Ohio River are also impaired due to dioxin, while 808 miles of the Ohio River are impaired due to mercury.

An *Integrated Report* category of 5 has been assigned to the Ohio River for the fish consumption use. Details on the causes and sources of the impairment can be found in Part III (Table 16, page 38). This assessment category indicates the need for a Total Maximum Daily Load. It should be noted that a TMDL has been completed for dioxin for three waterbodies (OVWB 13-OVWB15) along the Ohio/ West Virginia border. A TMDL has also been completed for PCBs for five waterbodies (OVWB 01-OVWB 05) in Pennsylvania. A TMDL for PCBs is under development for the entire West Virginia portion of the river.