1996-97 State of Kentucky's Environment

Water Quality

Kentuckians are greatly concerned about the quality of their waterways. Year after year, public opinion polls rank water pollution among the top environmental problems facing the Commonwealth. While many waterways are degraded by pollution, there are continuing signs of improvement. This *State of Kentucky's Environment Report* documents whether federal, state, local, and private efforts to clean up our waterways are achieving results. The report includes information on water quality trends and conditions of rivers, lakes, and groundwater. The report also looks at how well sewage treatment plants, industries, and other water pollution sources are meeting state and federal clean water rules.

Water Quality of Streams, Lakes, Groundwater

Thirteen major river basins lie within Kentucky **(Figure 1)**. These basins contain 89,431 miles of waterways.[1] In addition, there are an estimated 2,721 lakes and reservoirs in Kentucky, of which 953 are greater than 10 acres in size.[2] The quality of these waterways varies from severely degraded by pollution to clean enough for fishing, swimming, or for use as a drinking water supply.

To measure the water quality of streams and rivers, data from the Division of Water's 44 stream monitoring stations and other monitoring data were reviewed. Waterways are monitored for 32 different parameters including pH, mercury, lead, and fecal coliform bacteria. Unfortunately, the monitoring stations can only assess a small portion, about 7%, of the total stream and river miles in the state. While this data may not represent a statistically valid sample of water quality statewide, it does provide a general indicator of water quality trends and pollution sources in Kentucky. Data on lake and groundwater quality were also reviewed to assess conditions.

Improving Water Quality Trends Continue at Monitored Waterways

Data collected from stream monitoring stations show continuing overall im-

Figure 1 River Basins in Kentucky

Source: Natural Resources and Environmental Protection Cabinet

EQC

Environmental Quality Commission
Environmental Indicators Program
Reporting on Environmental Trends and Conditions in Kentucky.

1996-97 Reports
- Safe Drinking Water
- Air Quality
- Waste Management
- Toxics
- Water Quality
- Natural Resources
- Resource Extraction

EQC is a seven-member citizen commission created under state law with a mission to monitor environmental trends and conditions, promote partnerships to improve and protect the environment, provide a public forum for the discussion of environmental issues, and advise state officials on environmental matters.

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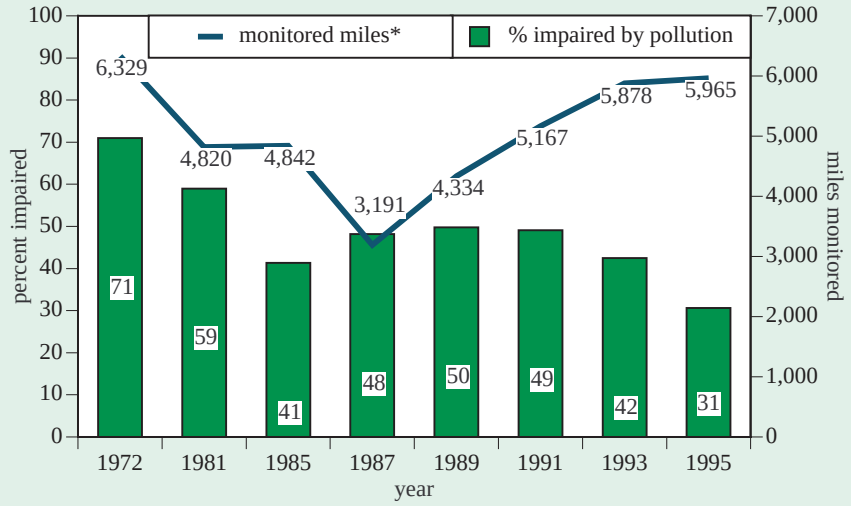
EQC Staff
Leslie Cole, Ex. Director
Scott Richards, Asst. Dir.
Erik Siegel, Research Asst.
Frances Kirchhoff, Adm. Asst.

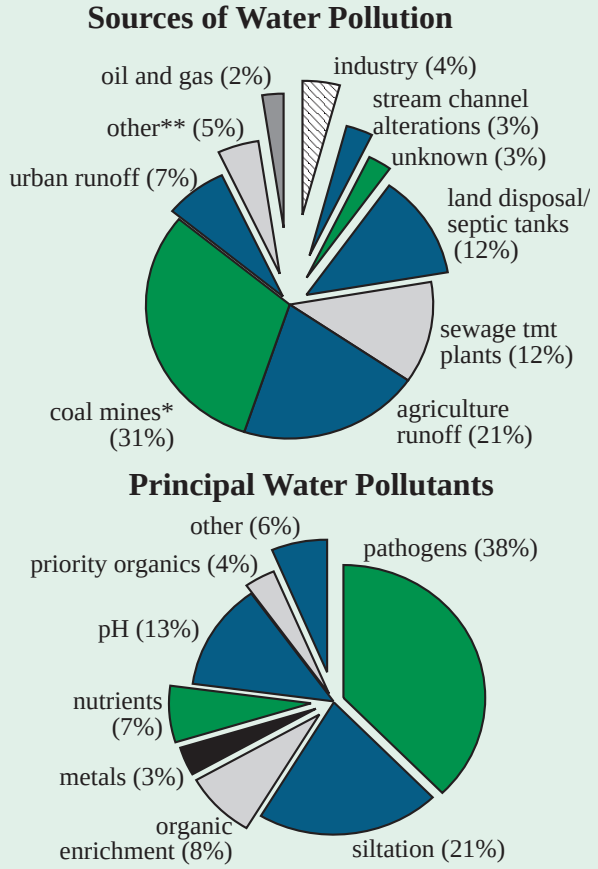
Data collected from stream monitoring stations show continuing improvements in water quality. For example in 1993, 42% or 2,495 of the 5,878 miles of waterways monitored were impaired by pollution, compared to 31% or 1,865 of the 5,965 miles monitored in 1995.

Figure 2 Percent of Monitored Waterways Impacted by Pollution



**1972 and 1981 data include waterways monitored and evaluated. 1985 through 1995 data include just monitored waterways. Source: KY Reports to*

Figure 3 River and Stream Pollution in Kentucky (1995)



*Note: Based on miles of streams and rivers assessed with major pollution impacts. Many waterways have multiple sources of pollution which are reflected in this chart. *Water pollution from abandoned and active mine sites combined (not distinctly separated in 1996 KY Report to Congress on Water Quality). **Logging, construction, development, combined sewer overflows.*
Source: 1996 KY Report to Congress on Water Quality

provements in water quality **(Figure 2)**. For example, in 1993, 42% or 2,495 of the 5,878 miles of the waterways monitored were impaired by pollution, compared to 31% or 1,865 of the 5,965 miles monitored in 1995.

Water quality improvements at monitored waterways in the past few years are attributed to a number of factors. These include a decline in oil production, additional requirements at industrial and municipal wastewater plants to control toxic discharges, and targeted enforcement at problem wastewater treatment plants and other pollution sources combined with improving compliance by the regulated community.

Coal Mining, Agriculture, Sewage Plants Remain Leading Sources of Water Pollution

Figure 3 reveals the various sources of water pollution. Coal mining is the leading source of pollution in monitored and assessed waterways followed by agriculture, sewage plants, and land disposal/septic tanks.

Thirty-one percent of the major pollution problems found in assessed waterways are attributed to coal mining. Siltation from coal mines can impair water quality and destroy aquatic habitat. Contaminated runoff from mines is also contributing to high acidity and elevated levels of toxic metals found in some monitored streams. Information is not available to determine how much of this pollution is caused by active mines as opposed to abandoned mines. However, the data does reveal that acid mine drainage is responsible for about 46% of the 963 miles of streams and rivers impaired by coal mining in Kentucky. Acid mine drainage is primarily associated with abandoned coal mines. The KY Division of Abandoned Mines estimates that there are 80,000 to 150,000 acres of abandoned mine lands

in the state. It is not known how much of this acreage is contributing to water quality problems since no detailed inventory or assessment of these lands has been done. A discussion of coal mining water impacts will be presented in the *Resource Extraction* Report to be published as part of the *1996-97 EQC State of Kentucky's Environment* series.

Agricultural activities are responsible for 21% of the major pollution problems found in assessed waterways **(Figure 3)**. Sediment from eroding farmlands along with nutrients and chemicals from fertilizers, manure, and pesticides can impair water quality. Efforts to address agriculture nonpoint pollution have primarily relied on voluntary controls. These include the use of conservation tillage to control erosion and cost-share monies for livestock waste management systems and other practices to prevent water pollution **(see inserted box below - Agriculture and Water Quality: State Measures Focus on Education and Prevention)**.

Poorly operated wastewater treatment plants are contributing 12% of the pollution to impaired waterways while on-site sewage disposal systems including septic tanks, illegal straight pipe sewage discharges, and improper disposal of waste impact another 12% of the streams monitored in the state. Other sources contributing to water pollution include urban runoff (7%), industry (4%), stream channel alterations (3%), and oil and gas production (2%). Pathogens are the greatest cause of water pollution, responsible for 38% of the problems found in monitored rivers and

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Agriculture and Water Quality: State Measures Focus on Education and Prevention

Agriculture is the second leading source of water pollution in Kentucky. Some 88,000 farms cover 56% of the state's 25.4 million acres of land.[3] Farmlands can contribute to water pollution in a number of ways, including:

- sediment - soil eroding from farmlands can cloud water, smother small aquatic organisms, and coat aquatic plants depriving them of sunlight and making it more difficult for fish to feed. Sediment can also reduce the life of lakes and lead to an increase in flooding.
- nutrients - application of fertilizers, manure, and other organic materials increases the chance that nutrients will run off into surface waters and leach into groundwater. Excessive amounts of nutrients in water can lead to a proliferation of algae and a depletion of oxygen resulting in fish kills and impairment of drinking water quality.
- pesticides - pesticides can run off farmlands, degrading surface and groundwater quality and posing drinking water health risks.
- farm animal waste - animal waste can contribute to bacteria problems in lakes and rivers impairing recreational and drinking water uses.

State and federal efforts to address water pollution from agricultural operations have primarily relied on a number of voluntary approaches, including:

- conservation tillage - 68% of the state's 3.6 million acres of planted cropland currently use plowing practices to minimize soil disturbance and reduce erosion.[4]
- conservation reserve - this federal program has paid farmers $22 million since 1986 to set aside 379,109 acres of the estimated 1.4 million acres of highly erodible farmlands.[5]
- integrated pest management - this program promotes the use of various strategies to minimize the use of pesticides.
- demonstration projects -Since 1990, $19.2 million of Section 319 Clean Water Act federal grants and matching funds have been awarded to local governments and others to fund more than 100 demonstration projects to address runoff pollution problems.

Recognizing that more needed to be done to prevent water pollution from agricultural operations, the state passed the **1994 KY Agriculture Water Quality Act.** The act requires all farm and silviculture operations to prepare plans over the next five years to protect surface and groundwater quality. Farmers will be required to use best management practices such as streamside buffer strips, proper storage and use of pesticides, and livestock waste management systems to prevent water pollution. Operations found in noncompliance with their plans could be subject to "bad actor" provisions including fines unless they remedy the problem through the "corrective measures process."

Big Sandy, Kentucky, Green, Upper Cumberland, Ohio Rivers Have Most Miles of Impaired Monitored Waterways

A closer look at monitored and evaluated waterways by river basin reveals that the Kentucky, Big Sandy, Green, Upper Cumberland, and Ohio rivers led the state with the most miles of impaired waterways during 1994-95 **(Figure 4)**. Data was not collected in a manner to assess long-term water quality of monitored waterways by river basin. However, individual stream assessments conducted by the Division of Water in 1994 have shown a general decrease in the levels of various pollutants including chlorides, nutrients, and nitrates at several monitoring stations. A list of the leading water pollution sources by river basin appears in **Figure 5.**

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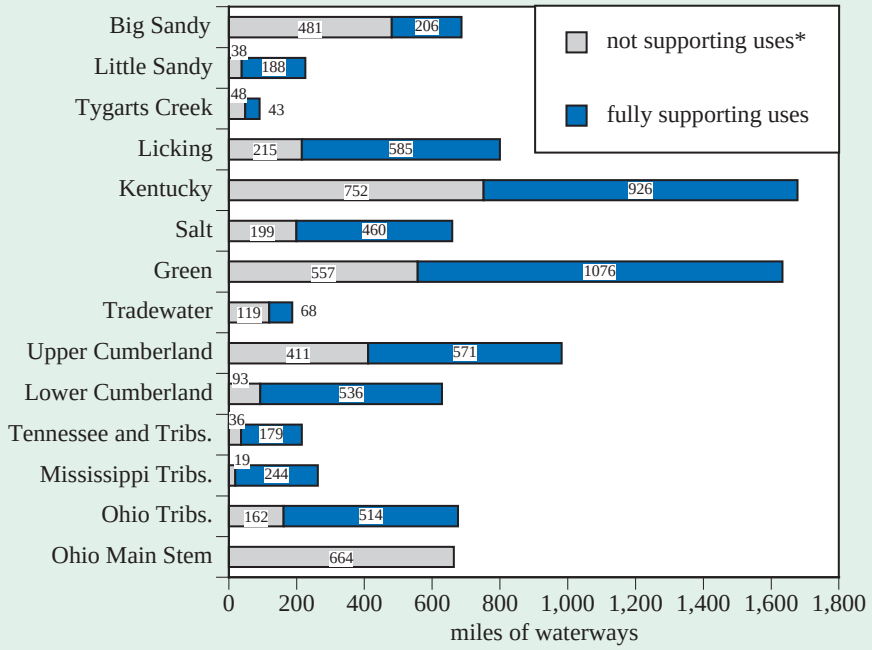
Figure 4 Stream and River Miles in Kentucky Impacted by Pollution, By River Basin (1994-95)



*Note: Based on waterways monitored and evaluated. *Miles not supporting one or more uses (swimming, fishing, or drinking water) due to pollution.*
Source: 1996 KY Report to Congress on Water Quality

Figure 5 Leading Sources of Water Pollution in Kentucky, By River Basin

River Basin	1st	2nd	3rd	4th
Big Sandy	resource extraction	wastewater*	construction	oil and gas
Little Sandy	wastewater*	oil and gas	—	—
Tygarts Creek	wastewater*	agriculture	stream alterations	—
Licking	agriculture	wastewater*	on-site sewage**	resource extraction
Kentucky	wastewater*	agriculture	resource extraction	on-site sewage**
Salt	agriculture	wastewater*	on-site sewage**	urban runoff
Green	acid mine drainage	agriculture	industry	on-site sewage
Tradewater	acid mine drainage	resource extraction	—	—
U. Cumberland	wastewater*	on-site sewage**	resource extraction	agriculture
L. Cumberland	agriculture	industry	urban runoff	resource extraction
Tennessee & Tribs	agriculture	wastewater*	urban runoff	industry
Mississippi Tribs	agriculture	wastewater*	resource extraction	stream alterations
Ohio Tribs.	wastewater*	urban runoff	on-site sewage**	stream alterations

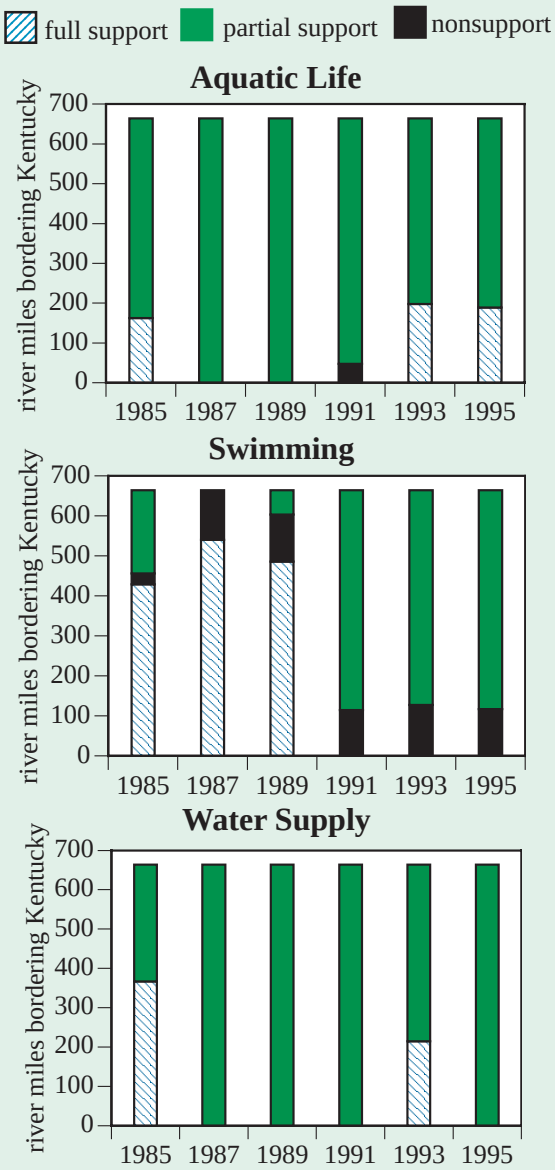
Ohio (KY border)*** agriculture, urban runoff, spills, wastewater*

**Municipal and package wastewater treatment plants, sanitary sewer overflows. **Septic tanks. ***Sources not ranked. Source: 1996 KY Report to Congress on Water Quality, ORSANCO*

Aquatic Habitat Improves in the Ohio River

The Ohio River, which flows 981 miles through six states, has been greatly impaired by pollution but continues to show signs of recovery. Data collected by Ohio River Valley Water Sanitation Commission (ORSANCO), an interstate agency, from 11 monitoring stations along the 664-mile stretch of the Ohio River bordering Kentucky indicate that about 31% of the river can now fully support healthy communities of fish, shellfish, and other aquatic organisms compared to none in 1989 **(Figure 6)**. Improvements in aquatic life conditions are likely due to better monitoring and assessment methodologies as well as improvements in water quality, according to ORSANCO officials. However, contaminated runoff from farms, urban areas, sewers, and spills continues to limit the Ohio River's ability to fully support swimming and drinking water uses **(Figure 5 & 6).**

Figure 6 Ohio River Water Use Support Trends Along the Kentucky Border



Source: Ohio River Valley Water Sanitation Commission

North Fork of KY River Leads as Most Polluted

While overall water quality of monitored waterways appears to be improving, as seen in **Figure 2**, a closer look at individual streams reveals that a number remain degraded. Water quality of waterways varies greatly based on the type and level of pollution. The Division of Water lists 124 polluted streams in its 1996 303 (d) list of impaired waterways. Some of these streams are unfit for swimming due to high levels of bacteria while others cannot support fishing or drinking due to siltation or chemical pollution. **Figure 7** lists 25 of the most severely polluted monitored waterways in the state based on the number of miles not supporting two or more uses (fishing, swimming, or drinking). More than half of these waterways cannot support fishing or swimming due to high pH problems caused by acid mine drainage.

Leading the list of the 25 most polluted monitored waterways is a 96.2 mile stretch of the North Fork of the Kentucky River **(Figure 7)**. The segment is degraded by sewage from treatment plants, septic systems, and illegal straight pipes. Efforts to restore water quality of the North Fork have been ongoing since 1990 when a swimming advisory was issued for the entire length (162.6 miles) due to fecal coliform bacteria. In 1992, the Division of Water stepped up its enforcement efforts in the watershed and found half of the 51 package plants and three of the seven municipal sewage plant exceeded their permit limits for bacteria resulting in $35,000 in fines.[7] Since then, new plants have been built in Jackson and Hindman with new facilities planned in Vicco and Hazard. As a result, water quality improved along 76 miles of the lower drainage, and the swimming advisory for that part of the river was lifted in 1993. However, problems remain, and a swimming advisory was issued for 86 miles of the upper North Fork in 1996. Efforts to bring problem wastewater plants into compliance and educate the public about proper on-site sewage disposal continue in the watershed.

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Watershed-Based Management Planned in Kentucky River

Continued water quality improvements in the Kentucky, Ohio, and other river basins in Kentucky will require a more focused approach to addressing water pollu-

Figure 7 25 Most Polluted Monitored Waterways Segments in KY

Stream	County/River Basin	Miles Impaired	Source
North Fork	Lee/Kentucky	96.2	resource extraction, sewage
Licking River	Bracken/Licking	92.6	re. extraction, ag., sewage
Floyd's Fork	Bullitt/Salt	68	urban, agriculture, sewage
Drakes Creek	Hopkins/Green	29.8	acid mine drainage
Clear Creek	Hopkins/Tradewater	25.8	acid mine drainage
Rockhouse Creek	Letcher/Kentucky	24.3	resource extraction
Martins Fork	Harlan/U. Cumberland	23.4	resource extraction, sewage
Pond Creek	Muhlenburg/Green	23.8	acid mine drainage
Leatherwood Creek	Perry/Kentucky	20.5	resource extraction
Banklick Creek	Kenton/Licking	19	sewage
Lick Creek	Hopkins/Tradewater	18.1	acid mine drainage
Fleming Creek	Nicholas/Licking	16.5	agriculture
S. Fork Beargrass Cr.	Jeff/Ohio Tribs.	14.6	sewage, metals
L. Fork Straight Cr.	Bell/U. Cumberland	13	sewage
Little Reedy Creek	Butler/Green	12	acid mine drainage
Lewis Creek	Ohio/Green	11.8	acid mine drainage, ag.
Goose Creek	Jefferson/Ohio	11.7	sewage
Caney Creek	Hopkins/Tradewater	11.3	acid mine drainage
Flat Creek	Hopkins/Green	10.6	acid mine drainage
Cypress Creek	McLean/Green	10.4	acid mine drainage
Little Cypress Cr.	Muhlenburg/Green	10.4	acid mine drainage
Fern Creek N. Ditch	Jefferson/Salt	10.1	sewage
Buffalo Creek	Hopkins/Tradewater	8.6	acid mine drainage
Pleasant Run	Hopkins/Green	7.9	acid mine drainage
Little Raccoon Cr.	Laurel/U. Cumberland	7.7	resource extraction

Note: Based on monitored waterway segments not supporting two or more uses by miles impaired. Source: 1996 KY Report to Congress on Water Quality

tion. ORSANCO has developed a Watershed Pollutant Reduction Program to better identify pollution problems, sources, and reductions needed to achieve water quality objectives.

The KY Division of Water also plans to begin to tackle water pollution problems by focusing on each watershed beginning with the Kentucky River Basin. More than 600,000 Kentuckians depend on the river for drinking water.[6] The Kentucky River is also a vital economic resource supporting the economy and tourism. But the basin has been degraded by pollution.

Through a watershed-based approach the Division of Water hopes to gain a better understanding of overall conditions and pollutants impairing the watershed. The premise of the watershed initiative is to target priority pollution problems, involve various agencies and the public in the design of effective solutions, and measure success through monitoring and data gathering. Among some of the activities to occur as part of the watershed approach are:

- Synchronize issuance of water permits and renewals by basin.
- Redesign the ambient monitoring network by basin.
- Track and assess physical impacts to streams and wetlands in the basin.
- Target enforcement efforts to address pollution problems within the basin.
- Conduct drinking water source assessments by basin.

In the summer of 1997, the state will embark on the Kentucky Watershed Management Initiative. An interagency work group, made up of representatives of local, state, and federal agencies and various interest groups, has drafted a framework to guide cooperative efforts in managing and protecting the watershed.

Most Improved Waterways in KY

Waterway (County)	miles
Beech Fork (Washington, Nelson)	15.6
Little River (Trigg)	10.2
Tradewater River (Union, Crittenden)	9.6
Clarks Run (Calloway)	21.5
Levisa Fork (Lawrence)	14.4

Note: Waterway segments improved from non- or partial support to full support between 1994 and 1996.
Source: 1996 KY Report to Congress on Water Quality

120 Public Lakes Assessed, 34 Impaired by Pollution

Determining the health of a lake is not an easy task. Many factors combine to affect the water quality of a lake including geology, lake depth, weather, discharges, flow rates, and land-use activities in the watershed. The best way to assess the health of a lake is to look at each one in-depth over time. Unfortunately, the state does not have the resources to study many lakes in this manner. The Division of Water does routinely test a number of publicly owned lakes every five to seven years which provides a general indicator of their health. During 1994-95, water quality was tested at 13 lakes and earlier data was used to determine the health of another 107 lakes. Of the 120 public lakes reviewed, 34 were impaired by pollution **(Figure 8)**.

Nutrients from Agriculture Leading Cause of Lake Pollution

Figure 9 indicates that agriculture is the leading source of lake pollution causing 30% of the problems, followed by natural conditions such as shallow lake basins, a common problem of constructed lakes. Coal mining ranked as the third leading source, contributing 12.5% of the pollution problems found in lakes.

Fertilization is also thought to be causing problems in three of the 34 impaired public lakes **(Figure 10)**. Phosphorus is sometimes added to a lake to increase the populations of zooplankton and phytoplankton. Plankton are the primary source of food for many fish. However, phosphorus can increase filamentous algae and aquatic plants, both of which can impair fishing and swimming uses. The KY Department of Fish and Wildlife, the agency responsible for lake fertilization, indicates that they do not undertake this activity when lakes have high nutrient levels. While the Division of Water lists lake fertilization as the source of impairment to Briggs, Mauzy, and Marion lakes, state Fish and Wildlife officials indicate that the nutrient problems are caused by agriculture. Nutrients are contributing to pollution problems in 28 of the 34 impaired public lakes.

Six lakes are seriously polluted and are indicated in bold in **Figure 10**. Nutrients are the leading pollutant. Aquatic habitat is the major use affected in these lakes, but drinking water supplies are impaired in Loch Mary and Corbin lakes. The city of Corbin must treat Corbin Lake at least monthly with copper sulfate to control algae and weeds to alleviate odor and taste problems in the city's drinking water.

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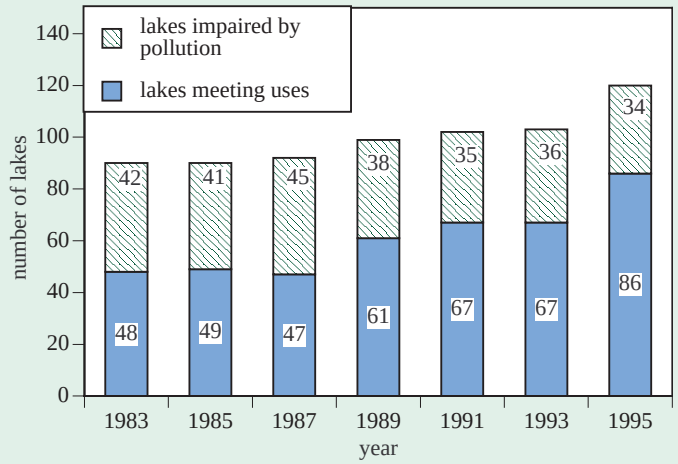
Figure 8 Public Lakes in Kentucky Impaired By Pollution



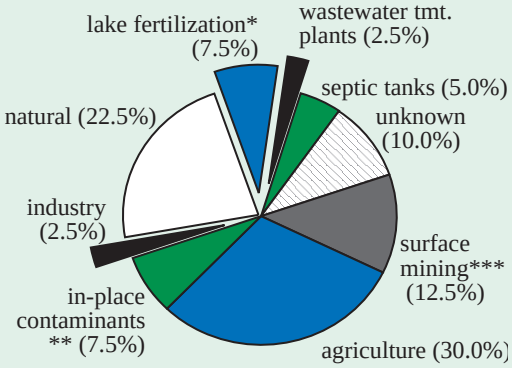
Note: Based on publicly owned lakes monitored and evaluated.
Source: KY Reports to Congress on Water Quality

Water Quality Improves in Seven Lakes

Water quality also improved in seven lakes since 1992 **(Figure 11)**. The water quality of Lake Herrington improved as a result of increased rain in the basin, which flushed out the upper section of the lake, and upgrades at a sewage treatment plant discharging to the lake. The water quality of Martins Fork and Fishtrap lakes improved because of lower amounts of suspended solids (sediment in the water) due to a reduction of coal mining in the area. Carpenter Lake in Daviess County was redesignated to fully supporting swimming and fishing uses after problems with nutrients were resolved using aeration (increasing oxygen levels in the water by mechanical means) and introduction of grass carp by the Department of Fish and Wildlife. Laurel Creek, Liberty, and Morris lakes improved to support drinking water uses after pollution problems affecting taste and odor were resolved.

There are many issues facing lakes and a number of opportunities to protect these important resources. The key to lake protection is dealing with the problem of nutrients. The need to impose stronger phosphorus permit limits for discharges to lakes is being considered by the Division of Water on a case-by-case basis. Some communities have also passed ordinances to protect public lakes. Russellville and Lewisburg passed a joint city ordinance to protect Spa Lake after it was listed as not supporting swimming and fish-

Figure 9 Sources of Lake Pollution in Kentucky



*Note: Based on 34 public lakes assessed (monitored and evaluated) not meeting or partially meeting designated uses. Some of the 34 impaired public lakes may have multiple sources of pollution which are reflected in this chart. *Adds additional nutrients to increase fish stocks. Excessive nutrients can cause a proliferation of weeds and affect aquatic and recreational uses. **Chemicals (PCBs, metals) of unknown origin found in sediment. ***Active, inactive, abandoned coal mines. Source:1996 KY Report to Congress on Water Quality*

Figure 10 Impaired Public Lakes in Kentucky

Lake	County	Listed	Cause	Source
Loch Mary	**Hopkins**	**1980**	**metals,organics**	**acid mine drainage**
Briggs	**Logan**	**1983**	**nutrients**	**lake fertilization**
Corbin	**Laurel**	**1983**	**nutrients**	**wastewater, agriculture**
Metcalfe	**Metcalfe**	**1983**	**nutrients**	**agriculture**
Reformatory	**Oldham**	**1980**	**nutrients**	**livestock**
Mauzy	**Union**	**1991**	**nutrients**	**lake fertilization**
Green River	Adair/Taylor	1990	organics	industrial
Taylorsville	Anderson	1985	nutrients	agriculture
Beshear	Christian	1991	nutrients	natural
George	Crittenden	1991	nutrients	agriculture
Sand Lick	Fleming	1989	nutrients	agriculture
Dewey	Floyd	1980	solids	mining
Caneyville	Grayson	1983	nutrients	natural
Cranks Creek	Harlan	1983	pH	acid mine drainage
Scenic	Henderson	1991	nutrients	sediments
Jericho	Henry	1989	nutrients	agriculture
Grapevine	Hopkins	1990	nutrients	unknown
McNeely	Jefferson	1980	nutrients	in-place contamination
Carr Fork	Knott	1980	solids	mining
Salem	Larue	1983	nutrients	natural
Corbin	Laurel	1983	nutrients	wastewater, agriculture
Wood Creek	Laurel	1989	nutrients	septic tanks
Stanford	Lincoln	1983	nutrients	natural
Spa	Logan	1989	nutrients	agriculture
Wilgreen	Madison	1983	nutrients	septic tanks
Marion County	Marion	1983	nutrients	lake fertilization
Luzerne	Muhlenberg	1990	nutrients	unknown
Washburn	Ohio	1991	nutrients	unknown
Kincaid	Pendleton	1983	nutrients	unknown
Buckhorn	Perry/Leslie	1983	solids	mining
Guist Creek	Shelby	1983	nutrients, metals	agriculture, natural
Shelby County	Shelby	1983	nutrients	agriculture, sediments
Campbellsville	Taylor	1983	nutrients	agriculture
Honker	Trigg	1989	nutrients	natural

Note: Bold lakes are those lakes severely impaired by pollution not supporting uses. Other lakes listed partially support uses. Source: 1996 KY Report to Congress on Water Quality

ing uses in 1989. The ordinance prohibits gas powered boats and livestock in the lake. Studies are also underway at Herrington and Taylorsville lakes which may help set a model for lake protection.

115 Lake Discharges Permitted

There are 115 permits that allow discharges to lakes **(Figure 12)**. Most permits are for small wastewater treatment plants but also include power plants, stone quarries, and coal facilities. Nearly half of the permits are for discharges to Lake Cumberland, Kentucky, and Barkley lakes.

During its triennial review of water quality standards in 1995, the Division of Water considered regulations to prohibit new or expanded discharges to public lakes unless there were no feasible alternatives. However, the Division chose not to move forward with its proposal after various concerns were raised including that the requirements would impose hardships on communities and facilities located near lakes and create barriers to future growth.[8]

Figure 11 Most Improved Public Lakes in Kentucky

Lake	County
Liberty	Casey
Morris	Christian
Carpenter	Daviess
Martins Fork	Harlan
Laurel Creek	McCreary
Herrington	Mercer
Fishtrap	Pike

Note: Lakes where water quality was impaired but has improved since 1992 to support all uses.
Source: 1996 KY Report to Congress on Water Quality

Problems Remain with Enforcing Boat Sewage Rules at Public Lakes

A 1996 survey of 17 public lakes by the KY Department of Fish and Wildlife counted 4,362 houseboats, 40% of which were docked at Lake Cumberland. While sewage from boats is not considered a significant water quality problem in lakes, it can cause aesthetic, public perception, and localized water quality problems. The discharge of sewage from boats is illegal under state and federal law at most public lakes in Kentucky with the exception of Barkley, Cumberland, Kentucky, and Dale Hollow lakes where boats are required to have certified marine sanitation devices to treat and discharge sewage. But legal and other problems have limited the state's ability enforce boat sewage disposal laws. In 1992, the state focused greater efforts on providing access to sewage pump-out stations for boats at some of the 96 marinas in the state. The state secured federal funds of $323,351 for the construction of 13 pump-out stations at 10 public lakes during 1994-97. Of 17 public lakes surveyed in 1996, 33 of 51 marinas reported having a pump-out station. But only 4 of the 10 marinas on Lake Cumberland have boat sewage pump-out facilities.

Groundwater Quality Remains Unknown; Network to Monitor 100 Sites

Groundwater is an important but vulnerable resource. Each year, thousands of domestic water wells are drilled to supply approximately 1.1 million Kentuckians with drinking water **(Figure 13)**.[9] And each day thousands of gallons of groundwater are withdrawn by businesses, industries, and farmers to meet their water supply needs. Groundwater wells have also been drilled to monitor industrial and other sites for contamination **(Figure 13)**. The state required all groundwater monitoring well drillers to be certified beginning in 1991. The increase in the number of monitoring wells in 1996, as seen in **Figure 13**, is attributed to clarification of monitoring well reporting requirements for underground storage tanks.

As EQC reported in its first environmental trends report in 1992, much is still unknown about the overall quality of groundwater in Kentucky. There has been some progress, however, in gaining a better understanding of groundwater quality and pollution threats. The Division of Water has been collecting groundwater quality data at 100 wells and springs since 1995. Water samples are collected quarterly and tested for nutrients, metals, inorganic chemicals, volatile organic chemicals, and pesticides (insecticides, fungicides, herbicides).

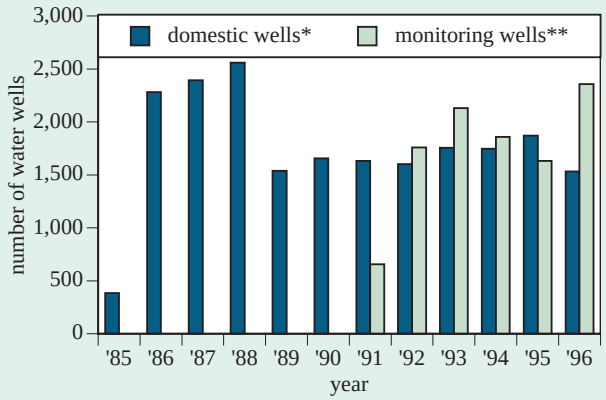
Pesticides Detected in Half of Springs and 16% of Wells Tested

EQC undertook a review of the groundwater network data for pesticides. Findings reveal that pesticides are being detected in wells and springs, but springs appear to be more vulnerable **(Figure 14)**. A review of water samples collected from April 1995 - Oct. 1996 found 54% of the 53 springs tested had detectable levels of pesticides. Sixteen percent of the 44 wells sampled tested positive for pesticides.

Most pesticide detections were below those levels considered to be protective of public health with the exception of atrazine. The presence of atrazine was detected in 37% of the springs sampled and 11% of the wells tested. Two springs exceeded the safe drinking water standard for atrazine **(Figure 14)**. However, six of the ten pesticides detected do not have health-based safe drinking water standards, so it is difficult to determine the degree of risk posed by these pesticides.

An assessment of the groundwater network data by the Division of Water is expected in 1998 which should provide more insight about groundwater quality and pollution threats.

Figure 13 Water Wells Drilled in Kentucky



**Private drinking water, municipal, livestock, irrigation wells. **Wells drilled at hazardous waste sites, underground storage tanks, surface mines, solid waste facilities, landfarms and for environmental audits. Source: KY Div. of Water*

Figure 12 Lake Discharge Permits in Kentucky

Lake	Permits
Barkley	25
Barren River	1
Buckhorn	2
Caneyville	1
Carr Fork	6
Cave Run	4
Cumberland	23
Dale Hollow	3
Dewey	4
Doolin	1
Fishtrap	1
Flemingsburg	1
Game Farm	1
Grayson	1
Greenbo	1
Gunpowder	1
Herrington	5
Kentucky	15
Laurel	2
Lexington	1
Marydale*	1
Nolin	3
Paintsville	1
Railroad	1
Rough River	4
Three Lakes*	1
Valley Lake*	1
Williamstown	1
Willow*	1
Wood Creek	1
Total	**115**

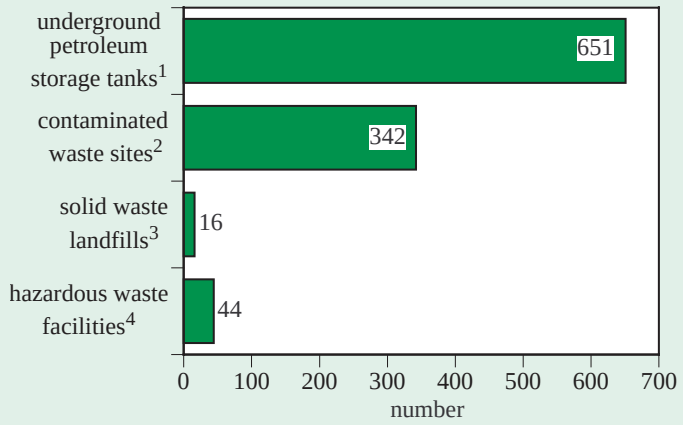
*Note: KPDES permits with discharges to lakes. *Not a public lake. Source: KY Division of Water*

Figure 14 Preliminary Assessment of Samples from Kentucky Ambient Groundwater Monitoring Network

samples	total number	pesticide detects*	atrazine detects	atrazine detects above MCL**
springs	213	103	46	4
wells	107	13	5	0
monitored sites	**total number**	**pesticide detects***	**atrazine detects**	**atrazine detects above MCL****
springs	53	29	20	2
wells	44	7	5	0

*Note: Assessment by EQC of pesticides sampled at groundwater network. *Pesticides detected included atrazine, alachlor, cynazine, enodosulfan I, endosulfan II, linuron, metribuzine, metolachlor, permethrin, simazine. **Atrazine, simazine, and alachlor are the 3 of 10 pesticides detected that have a MCL standard. Atrazine was the only pesticide detected above the safe drinking water MCL (maximum contaminant level) set to protect public health. Source: KY Ambient Groundwater Monitoring Network, April 1995 - Oct. 1996.*

Figure 15 Groundwater Contamination Incidents in KY



[1]Cumulative number of tanks with confirmed groundwater contamination. [2]Cumulative estimate based on 1,100 CERCLA/Superfund sites investigated. [3]Based on 25 active landfills and 56 closed landfills monitoring groundwater. [4]Includes hazardous waste treatment, storage, and disposal RCRA permitted and non-permitted facilities. Source: KY Division of Waste Management

Groundwater Contamination Detected at Tank and Waste Sites

One threat to groundwater is leaking underground storage tanks (USTs). USTs led the state with the most incidents of confirmed groundwater contamination **(Figure 15)**. Of the 6,000 UST sites investigated since 1986, 11%, or 651 tanks, had groundwater contamination requiring remediation.

Waste sites also pose risks to groundwater. The number of state superfund waste sites now number 1,710. Of the 1,100 sites investigated, an estimated 31%, or 342 sites, had groundwater contamination. These sites include the state's 20 federal Superfund sites (those listed by the federal government as some of the worst contaminated sites in the nation), 11 of which have groundwater contamination migrating off-site **(Figure 15)**. And of the 113 hazardous waste facilities with treatment, storage, or disposal units, 44 or 38% have detected groundwater contamination, although some facilities are challenging the status of the contamination. Eleven of these facilities are currently remediating groundwater contamination **(Figure 16)**.

Of the 113 hazardous waste facilities with treatment, storage, or disposal units, 44 have detected groundwater contamination. Eleven of these facilities are currently remediating groundwater contamination.

Monitoring at closed solid waste landfills also indicates groundwater pollution problems. Of the 56 municipal landfills that received closure permits in the spring of 1996, 41% or 23 landfills have detected groundwater contamination. However, groundwater contamination has not been found at the state's 25 active municipal solid waste landfills indicating that new strict construction standards requiring clay or double composite liners appears to be preventing groundwater contamination.

Figure 16 Hazardous Waste Facilities with Groundwater Contamination in Remediation

B.F. Goodrich*	Marshall
Dow Corning	Carroll
Hallmack**	Mercer
Koppers**	Todd
Lexmark	Fayette
Phillips Light *	Boyle
Olin Corp.	Meade
Safety Kleen**	Henry
Safety Kleen**	Boyd
Thomas Ind.	Ohio
Paducah Gas Diffusion Plant*	McCracken

*Note: Permitted RCRA facilities as of 2/97. *On- and off-site contamination. **Off-site contamination under investigation. Source: Division of Waste Management*

Bacteria A Problem Especially in Hand-Dug Water Wells

Groundwater supplies are also threatened by bacteria. Tests by the Division of Water of wells in the Gateway Area Development District and in the Calvert City area several years ago found that almost all the hand-dug wells and 1 out of 10 drilled wells had bacteria contamination. There are some 35,303 hand-dug and 171,220 drilled water wells in Kentucky, according to the 1990 Census. Human and livestock waste are the source of bacteria in contaminated wells. The recent discovery of sewage in an abandoned mine in Floyd County led to an investigation of 30 water wells in the area. All but two wells tested positive for fecal coliform bacteria. The U.S. Environmental Protection Agency suspects that a septic-service operator, whose license expired 12 years ago, illegally dumped 100,000 gallons of raw sewage in the mine for a dozen years. More than 6,000 gallons of contaminated water has been pumped from the mine and water lines have been extended to the area.

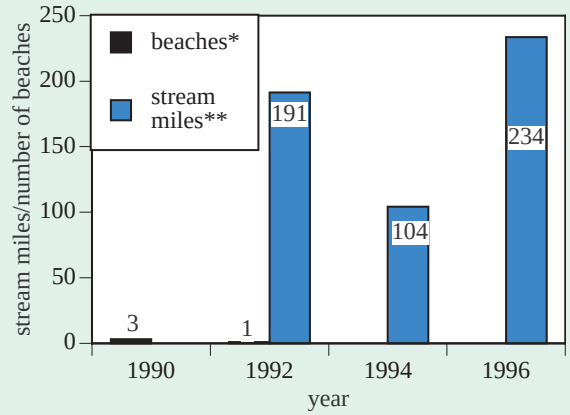
The Department for Health Services regulates septic tank pumpers. Currently, 243 operators are licensed to pump and dispose septic tank sewage. Most septic tank waste is trucked to wastewater treatment plants for disposal; however, a number of pumpers have licenses to land apply wastes. It is not known how much septic waste is illegally disposed or how extensive a problem it is in Kentucky.

In 1994, the state enacted regulations requiring groundwater protection plans for septic tanks and other activities with a potential to pollute groundwater. Plans must identify strategies to prevent groundwater pollution. The Division of Water has reviewed 60 groundwater protection plans, 28 of which have been approved.

Water Issues and Program Trends

Federal and state efforts to clean up Kentucky's water resources have focused on controlling discharges from industries and municipal wastewater plants through regulatory permits as required by the federal Clean Water Act of 1972. The state has issued individual and general water permits, known as Kentucky Pollutant Discharge Elimination System (KPDES) permits, to more than 10,000 industrial, municipal, coal mining, and other facilities. These permits have led to improving water quality conditions across the state, but problems still remain.

Figure 17 Swimming Advisories in KY



**No beach closures in 1994-96. **Advisories were also issued for all urban waterways in 1995 and 1996. Miles of urban waterways not available. Source: KY Div. of Water*

60% of 3,227 Wastewater Treatment Plants Had Violations in 1995

Wastewater treatment plants are the third leading source of water pollution.[10] Sewage from treatment plants and other sources have led to a number of swimming advisories across the state **(Figure 17 & Figure 18)**.

During 1995, 60% of the 3,227 wastewater plants had one or more violations of state water quality regulations **(Figure 19)**. Most of the violations, 27,323, were reporting infractions. Another 9,984 were for monitoring violations. However, 26% of the violations (13,212) were for exceedances of permit limits set to protect public health and the environment. The most common violations of permit limits at wastewater treatment plants were suspended solids (3,259), nitrogen/ammonia (1,754), fecal coliform (1,544), and dissolved oxygen (1,082). Wastewater treatment plant violation trends reveal that Kentucky still has a long way to go in bringing these plants into compliance with state clean water rules. In 1995 alone, more than 50,000 violations were documented at wastewater treatment plants **(Figure 20)**.

Forty percent of the wastewater permit limit violations occurred at small package treatment plants. These prefabricated plants treat wastewater from subdivisions, schools, and mobile home parks. Poor operation and maintenance at package plants has led to state to work with Area Development Districts, sanitation districts, and municipalities to regionalize these plants to improve operations. Regional facilities eliminate discharges from problem package plants by diverting the flow to a larger facility or by combining two or more plants into a regional facility.[11] Between 1990 and 1995, more package plants were deactivated (541) than new plants permitted (306). During 1994-95, the greatest number of package treatment plant deactivations occurred in Northern KY (31) and Jefferson County (30).

Figure 18 Swimming Advisories Issued in Kentucky (1996)

U. Cumberland River
120 miles
North Fork of KY River
86 miles
Licking River
28 miles
Urban Waterways
all urban waterways
Source: KY Division of Water

During 1995, 60% of the wastewater plants had one or more violations of state water quality regulations. Twenty-six percent of the 50,519 violations were for exceedances of permit limits set to protect public health and the environment.

8% of Industries in Significant Noncompliance with Pretreatment Rules

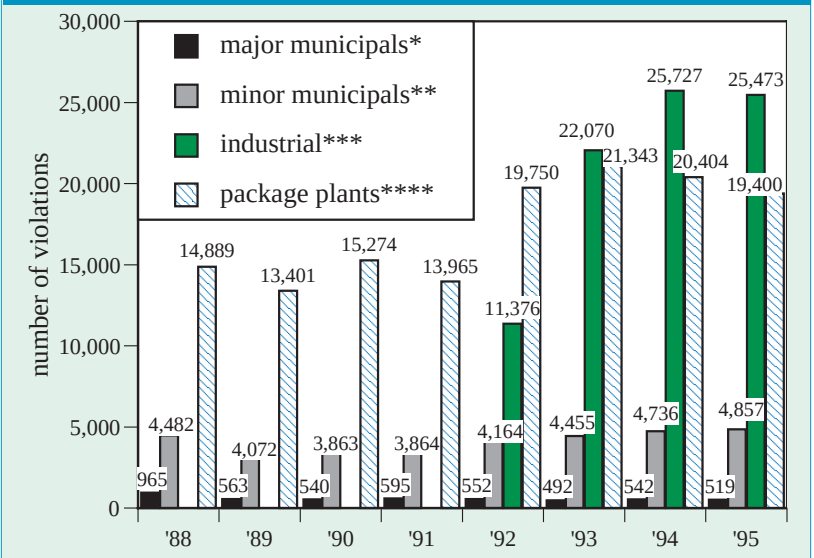
Industrial pretreatment programs are in effect at some 665 industrial facilities in 67 cities. This program requires the pretreatment of industrial wastewater to remove chemicals and other pollutants prior to its discharge to a municipal treatment plant. During 1996, 8% of the in-

Figure 19 Types of Wastewater Treatment Plants Operating in Kentucky and Violations of Regulatory Requirements (1995)

type of plant	number of plants	# of plants in violation	% plants in violation	total violations*	violations of permit limits
Major Municipal	67	52	77%	519	515
Minor Municipal	178	143	80%	4,857	2,127
Industrial	1,276	732	57%	25,743	4,331
Package	1,706	1,016	59%	19,400	6,239
Total	**3,227**	**1,943**	**60%**	**50,519**	**13,212**

**Includes permit, monitoring, reporting violations. Source: KY Division of Water*

Figure 20 Violation Trends at Wastewater Treatment Plants in Kentucky



**Major municipals treat 1,000,000 gallons or more per day. **Minor municipals treat less than 1,000,000 gallons per day. ***Industrial facilities treat industrial related effluent so that it can be discharged to nearby waters. Data on industrial facilites not available prior to 1992. ****Package plants are prefabricated plants of small capacity. Package plants are often used in remote areas or in unincorporated areas and tend to serve subdivisions, schools, institutions, or mobile home parks. Source: KY Division of Water*

Figure 21 Pretreatment Programs in Significant Noncompliance ('96)

wastewater tmt. plant	# industrial users	# in non-compliance
Ashland	7	1
Beaver Dam	8	1
Bowling Green	26	9
Corbin	9	1
Elizabethtown	22	1
Elkton	1	1
Franklin	9	1
Glasgow	15	4
Harrodsburg	5	1
Hopkinsville	15	1
Leitchfield	12	2
Lexington-Town Br.	46	9
London	9	3
Louisville-Mor. For.	93	5
Louisville-West Co.	12	2
Mayfield	5	2
Mount Sterling	5	3
Owensboro-West	22	1
Paris	11	5
Russellville	6	2
Stanford	2	1
Total 21	**340**	**56**

Source: KY Division of Water

Figure 22 Combined Sewer Overflows

Ashland	8
Catlettsburg	14
Campbell & Kenton Counties	74
Frankfort	15
Harlan	3
Henderson	15
Loyall	6
Maysville	11
Morganfield	2
Louisville	118
Owensboro	14
Paducah	10
Pikeville	4
Pineville	6
Prestonsburg	2
Vanceburg	1
Worthington	3

Source: KY Div. of Water, Jefferson County MSD

dustries with pretreatment programs (56 industrial users in 21 cities) were in significant noncompliance with their pretreatment requirements **(Figure 21)**.

Combined Sewer Overflows Number 306 in 17 Cities

Efforts to address combined sewer overflows (CSOs) continue. CSOs are a problem in older cities where stormwater runoff is carried in sanitary sewer pipes. During storms the sewers overflow and discharge raw sewage into receiving waters. The Division of Water has identified 17 cities with a total of 306 CSO outfall points **(Figure 22)**. Louisville, which has the largest number of CSOs in the state (118), has been concentrating on preventing sewage backflow into homes. The city's sewer district has also posted signs at overflow sites warning the public that downstream waters are not safe for recreational use.[12]

Number of Illegal Straight Pipe Sewage Discharges Unknown But Considered Widespread

While most of the focus of the federal Clean Water Act has been on controlling pollution from large municipal and industrial sources, residential septic systems and illegal straight pipe discharges are contributing to pollution problems in many waterways.

About 56% of the state's households are connected to sewers and have their sewage treated at one of the 1,951 municipal or package sewage treatment plants operating in the state. A closer look, however, reveals that in 36 counties less than 25% of the households are connected to sewers **(Figure 23)**. Many households must rely on septic tanks and other on-site systems for wastewater treatment. Since 1982, when the Department of Health was given authority to regulate on-site sewage disposal systems, 140,000 septic systems have been permitted. Each year, an average 10,000 on-site sewage system permits are issued by local health departments. It is not known how many failing septic systems and illegal straight pipes are discharging raw sewage into waterways but it is considered a widespread problem across the state.

Random surveys along some waterways found:

- 1,000 straight pipes along the North Fork of the Kentucky River in Letcher County.
- 660 straight pipes along the Upper Cumberland River in Harlan County.
- 3,100 residences in Floyd County with straight pipes, failing septic systems, and sewers dumping directly into the Cumberland River.
- More than 80% of the 242 households in the Wagerville-Barnes Mountain area of Estill County have straight pipes or failing septic systems.[13] A county-by-county survey would likely reveal that straight pipes and failing septic tanks are a statewide problem.

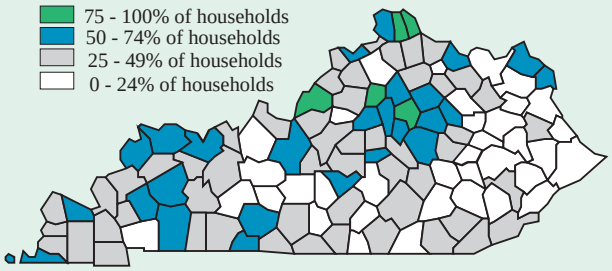
Addressing sewage problems will take state and local solutions. The construction and upgrade of treatment plants and extension of sewer lines is one solution. Funds to finance wastewater infrastructure are available through a number of entities including a low-interest state revolving loan program. Since 1989, 89 projects totaling $193 million have been funded by the loan program **(Figure 25)**. However, the fund falls well short of the projected state wastewater treatment needs of $3.2 billion.[14]

On-site sewage treatment may be a more viable alternative in some areas of the state. A cooperative local/state/federal partnership along the North Fork of the Kentucky River is working to provide education and grants for low-income residents to comply with on-site sewage disposal requirements. On-site sewage disposal demonstration projects are also underway in McLean, Rowan, and Estill counties.

But much more remains to be done to promote proper on-site sewage disposal including stronger enforcement of existing on-site sewage disposal rules, creation of sanitation districts to meet wastewater treatment needs such

About 56% of the state's households are connected to public sewers. Many households must rely on septic tanks and other on-site systems for wastewater treatment. Each year, an average 10,000 on-site sewage system permits are issued by local health departments in Kentucky.

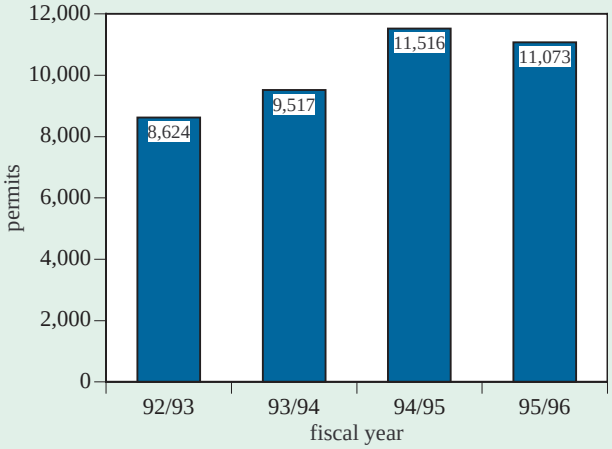
Figure 23 Percent of Households Connected to Public Sewer*



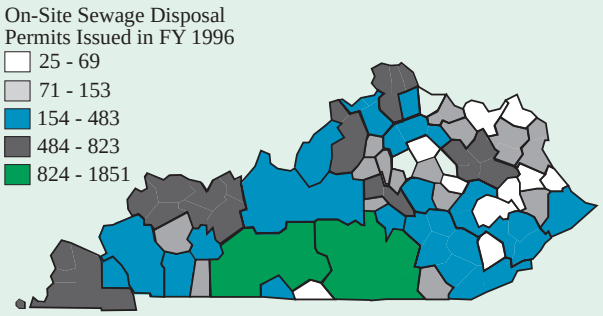
**Public sewer operated by a government body or private organization. Source: U.S. Census, Kentucky Data, 1990*

Figure 24 On-Site Sewage Disposal Permits

On-Site Sewage Disposal Permits Issued

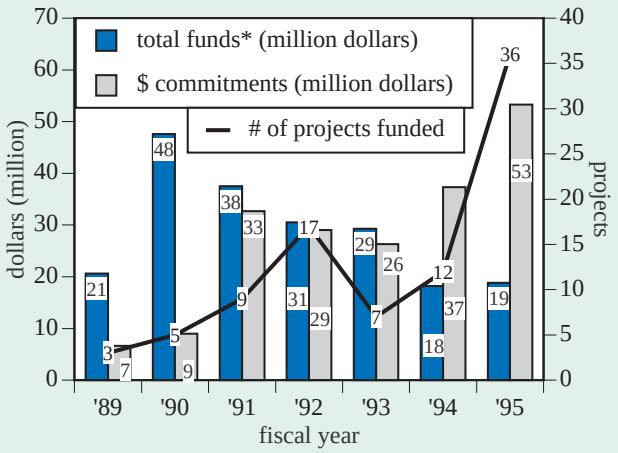


On-Site Sewage Disposal Permits Issued By Health Districts* (FY 1996)



*Note: Data on septic tank permits issued prior to 1992-93 not available. *Larger shaded areas represent multi-county health districts. There are also 37 independent county health districts represented in the chart.*
Source: KY Department for Health Services

Figure 25 Kentucky Wastewater Revolving Loan Fund



**Includes federal grants, state match, and interest incurred. There is also $20 million in principal and interest repayments available for additional projects. Source: KY Division of Water*

Letcher County Adopts Ordinances to Address Sewage Problems

Letcher County is working to address the problem of sewage disposal with a number of recent initiatives. Many rural areas of Letcher County do not have suitable sanitary sewer or septic systems. As such, sewage pollution has had a significant impact on waterways. In May 1996, the county created a special district to better organize and provide water and sewer services to the residents of Letcher County. A committee is in the process of conducting a study to provide county-wide water and sewer service.

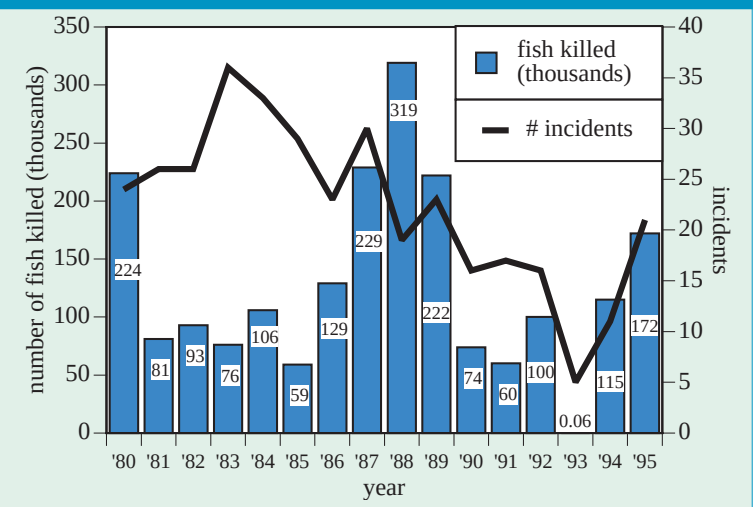
Letcher County officials are also working to address on-site sewage disposal. The county passed an ordinance in February 1996 to better regulate on-site sewage disposal in new dwellings. The ordinance requires proper sewer hook up or an approved septic system before new electric service will be provided. The person requesting state approval of electrical wiring for a new structure must obtain a release from the local health department indicating that the facility is in compliance with sewage disposal laws.

as the 21 existing sewer and five water/sewer sanitation districts in Kentucky, and adoption of local ordinances or agreements requiring proper on-site sewage disposal like those passed by 21 counties[15] **(see shaded box - Letcher County Adopts Ordinances to Address Sewage Problems)**.

Fish Kill Incidents Increase in Past Few Years

An average of ten spills occur each day along Kentucky roadsides and at industrial sites. Some of these spills have degraded water quality and have led to fish kills. **Figure 26** reveals that fish kill incidents steadily declined between 1983 and 1993. However, reports have increased in the past few years. During 1994-95, 31 incidents were reported along 50 miles of streams killing 172,306 fish. Oil and chemical spills were responsible for seven of the fish kill incidents followed by sewage (4), natural causes (3), agriculture (2), and mining (1). Fifteen incidents were of unknown origin.

Figure 26 Fish Kill Incidents in Kentucky



Source: KY Reports to Congress on Water Quality

Fish Kill Incidents By River Basin (1994-95)

Kentucky	12
Licking	5
Salt	5
Green	4
U. Cumberland	2
Tennessee	2
Ohio Tribs.	1
Total	**31**

Source: 1996 KY Report to Congress on Water Quality

Reported Industrial Toxic Water Discharges Decline 77% Since 1988

Each year, thousands of pounds of toxic chemicals are discharged to waterways, impairing water quality and aquatic habitat. The sources of these chemicals are numerous and include industries, waste sites, farmlands, underground storage tanks, transportation spills, and even the pesticides applied to our yards. It is difficult to fully assess the affects these chemicals are having on water quality since only a few of the more than 70,000 chemicals registered for use are monitored at ambient water quality stations, and relatively limited information has been collected on chemical concentrations in stream and lake sediments or in fish tissue.

Industries reported discharging 403,292 pounds of toxic chemicals to state waterways during 1994, the most recent year for which data is available **(Figure 27 & Figure 28, also see EQC Toxics Report)**. But many companies are doing a better job in reducing the generation and release of toxic chemicals. For example, reported industrial toxic water discharges dropped 77% since 1988. The discharge of toxics from industrial facilities to municipal wastewater treatment plants also fell 64%, from 2.8 million pounds in 1988 to 1.8 million pounds in 1994 **(Figure 28)**.

Toxicity testing at municipal wastewater and industrial plants also shows that these facilities are doing a better job in removing chemicals from their effluent prior to discharging it to a waterway **(Figure 29)**. During 1995, 16% of the 81 industrial and 43 municipal plants tested failed to meet toxicity effluent limits.

Toxic Chemicals Detected in Lake Fish

Figure 30 shows that toxic chemicals have found their way into lake fish tissue. Some of the chemicals detected in fish, such as lead and copper, occur naturally in

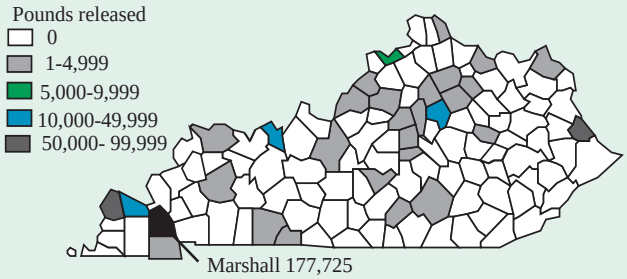
nature or can be produced as a waste byproduct while other chemicals, like PCBs and chlordane, are synthetic. Testing of lake fish has been conducted by the Division of Water at nine public lakes in the past few years. The chemical levels detected in the fish rarely exceeded those set to protect public health with the exception of PCBs in Green River Lake and chlordane in McNeely Lake. There is no trend data on chemical concentrations found in lake fish tissue in Kentucky since testing has only recently been initiated. However, national studies generally indicate that concentrations of several chemicals such as DDT, mercury, lead, cadmium, and arsenic in freshwater fish tissue peaked in 1970 and has since declined.[16]

A fish consumption advisory has been in effect for Green River Lake since 1994 after unsafe levels of PCBs were found in carp and channel catfish. PCBs are highly toxic chemicals that were used as lubricants in transformers and other electrical equipment. PCBs were banned for use in 1977 after they were found to cause harmful health effects.[17] The source of PCBs in the lake is a gas pipeline compressor station. Cleanup of the site is scheduled for the summer of 1997. However, no decision has been made regarding the cleanup of PCBs in Green River Lake sediment. Fish consumption advisories are also in effect at five ponds in Western Kentucky and along 788 miles of waterways **(Figure 31)**.

The Division of Water resampled McNeely Lake in 1996 to verify high chlordane levels found in fish tissue during 1994 **(Figure 30)**. Chlordane is an insecticide primarily used to control termites. It was banned from domestic use in 1988 due to health risks.[18] The 1996 tests found that levels of chlordane in bass, carp, and catfish were below the FDA action levels. It is not known what caused the high chlordane levels in 1994. The Division of Water hopes to retest the lake next year.

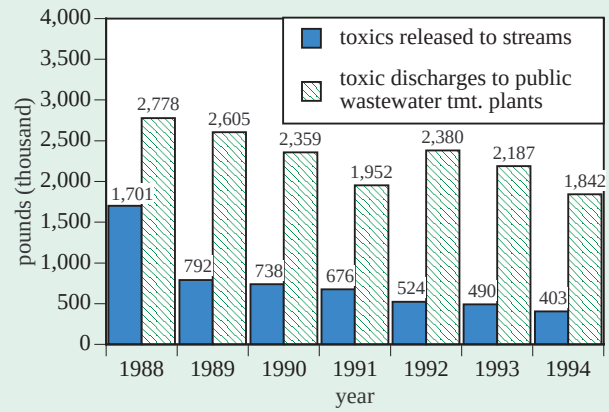
Elevated levels of dioxin in fish and sediment were also discovered in 1996 at Chickasaw Park Lake, an inner-city lake in Louisville. Dioxin levels found in the lake's sediment were 20% higher than the national average. Elevated dioxin levels were also detected in fish tissue. Dioxin can be produced as a by-product in the manufacture of pesticides, paper, and from waste incineration. Waste sites are also a source of dioxin. Exposure to dioxin at certain levels and durations can cause liver damage and reproductive risks.[19] The source of dioxin at the lake is unknown. A risk assessment conducted by the KY Department for Environmental Protection recommended that people eat no more than one crappie per year and that consumption of carp be banned at Chickasaw Lake. The fish were removed from the lake by the KY Department of Fish and Wildlife. The city of Louisville has also posted a fish consumption advisory at Chickasaw Lake and is studying the extent of contamination to determine if further action is needed.

Figure 27 Industrial Toxic Chemical Releases to Waterways in Kentucky (1994)



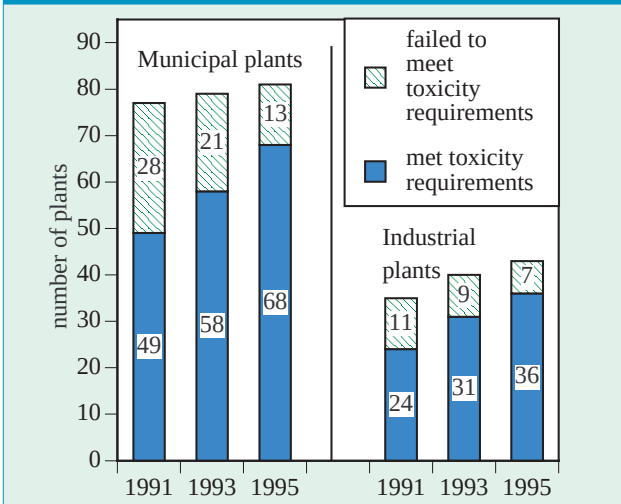
Source: 1994 KY Toxics Release Inventory Report

Figure 28 Industrial Toxic Water Releases and Transfers to Wastewater Treatment Plants in Kentucky



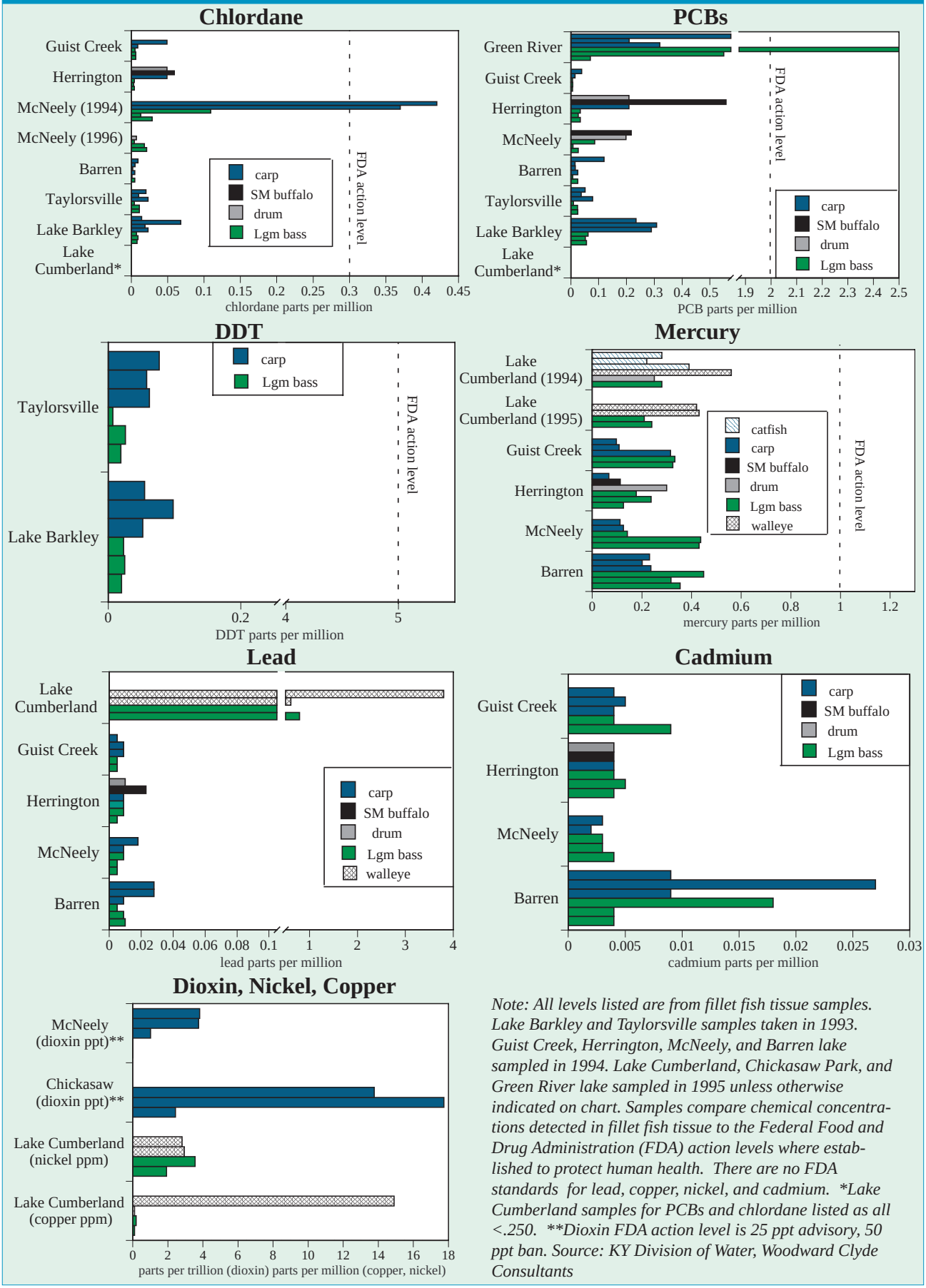
Source: Kentucky Toxic Release Inventory Reports

Figure 29 Toxicity Testing at Wastewater Treatment Plants in Kentucky



Note: Based on bioassay of whole effluent toxicity (WET).
Source: KY Reports to Congress on Water Quality

Figure 30 Contaminants Detected in Fish Tissue at Public Lakes in Kentucky



*Note: All levels listed are from fillet fish tissue samples. Lake Barkley and Taylorsville samples taken in 1993. Guist Creek, Herrington, McNeely, and Barren lake sampled in 1994. Lake Cumberland, Chickasaw Park, and Green River lake sampled in 1995 unless otherwise indicated on chart. Samples compare chemical concentrations detected in fillet fish tissue to the Federal Food and Drug Administration (FDA) action levels where established to protect human health. There are no FDA standards for lead, copper, nickel, and cadmium. *Lake Cumberland samples for PCBs and chlordane listed as all <.250. **Dioxin FDA action level is 25 ppt advisory, 50 ppt ban. Source: KY Division of Water, Woodward Clyde Consultants*

Because FDA has not established action levels for many chemicals, the Division of Water is considering the use of risk-based criteria to determine the need for fish consumption warnings at waterways with elevated levels of contaminants in fish tissue. The risk criteria will weigh chemical concentrations found in fish with health-based considerations when determining the need for fish consumption advisories.

Figure 31 Fish Consumption Advisories in Effect in Kentucky

Stream (county)	pollutant	year listed	miles	source	fish
Town Br./Mud River (Logan/Butler/Muhlenburg)	PCBs	1985	71.5	Dye-cast plant	all species
West Fork Drakes Creek (Simpson, Warren)	PCBs	1985	46.9	adhesive plant	all species
Little Bayou Creek (McCracken)	PCBs	1985	6.5	gas. diff. plant	all species
Ohio River (entire length of KY border)	PCBs chlordane	1989	663.9	industry urban runoff	carp, paddle catfish, bass
W. KY Wildlife Area (McCracken Co.)	mercury	1993	5 ponds	unknown	bass
Green River Lake (Taylor, Adair)	PCBs	1994	entire lake	gas compression station	catfish, carp

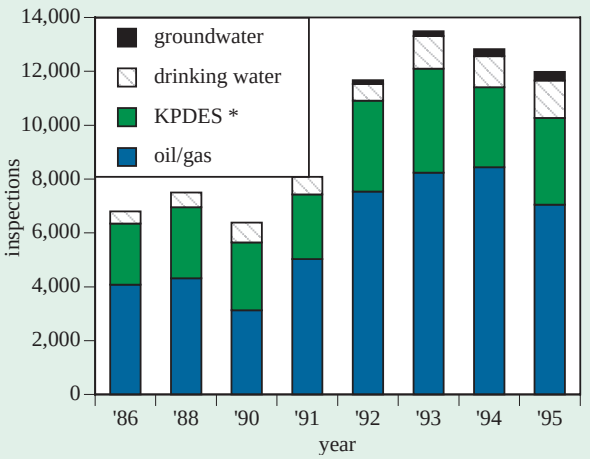
Source: 1996 KY Report to Congress on Water Quality

Water Inspections, Violations, Penalties Decline

Many water quality improvements are due to state enforcement of federal and state clean water rules. **Figure 32** reveals that water inspections hit an all time high in 1993, totaling 13,490. The number of inspections dropped to 11,978 in 1995. Violations cited by inspectors also declined **(Figure 33)**. The drop in inspections and violations are attributed to a reduction in field inspectors (from 67 in 1992 to 60 in 1995), fewer oil wells (oil production in Kentucky fell from 4.6 million barrels in 1993 to 3.4 million barrels in 1996), and a move toward technical assistance as part of the Cabinet's Customer Service Initiative.

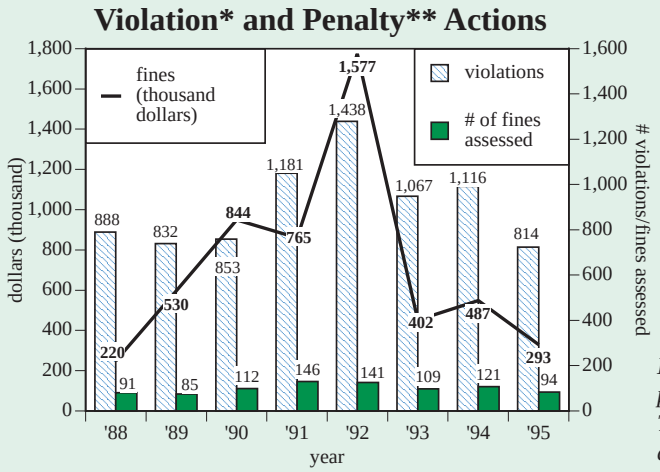
Most of the violations cited are resolved through agreed orders and other means, but some of the more serious infractions result in fines. Penalties assessed against water polluters have varied over the years (**Figure 33**). In 1995, $293,995 in fines were assessed against 94 entities, most

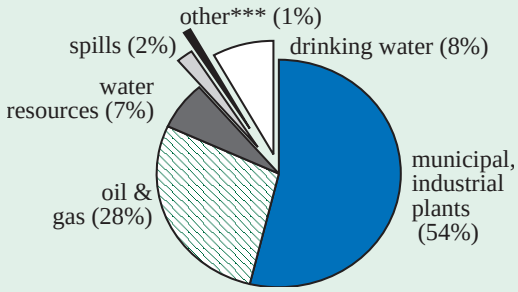
Figure 32 Water Quality Inspection Trends



**Facilities with KY Pollutant Discharge Elimination System permits. Does not include inspections at KPDES permitted coal mines which are conducted by the KY Dept. of Surface Mining. This information will appear in the EQC Resource Extraction Trends report. Source: KY Division of Water*

Figure 33 Water Quality Violation and Penalty Trends





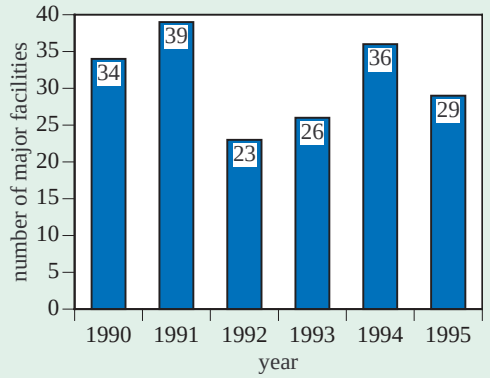
*Note: Does not include coal mine water inspections and penalties. This will be reported in the EQC Resource Extraction Trends report. *Violations cited by field inspectors. **Penalties assessed by the Division of Water Enforcement Branch (does not include drinking water or federal government penalty assessments). Drinking water penalty assessments appear in the EQC Safe Drinking Water Trends Report. ***Includes groundwater, wild river, and agriculture violations.*
Source: KY Division of Water

Figure 34 Major KPDES Facilities in Significant Noncompliance (Feb. 1997)

Facility	County
AK Steel	Boyd
Murray STP	Calloway
North Am. Stainless	Carroll
Greenup Co. Environmental	Greenup
London STP	Laurel
BTR Precision Dye Casting	Logan
Russellville STP	Logan
Lebanon STP	Marion
B.F. Goodrich	Marshall
Hazard STP	Perry
Morganfield STP	Union
Big Rivers Electric	Webster

Note: STP - sewage treatment plant. Significant noncompliance is defined as those major facilities with two to four exceedances of permit limits in a six month period based on type of pollutant. Major facilities currently include 67 major municipal wastewater treatment plants that treat 1 million gallons or more per day and 34 industrial and 4 federal facilities based on chemical and conventional pollutants, flow, and potential to impact health and water quality.
Source: KY Div. of Water

Figure 35 Major KPDES Facilities in Significant Noncompliance with Permits

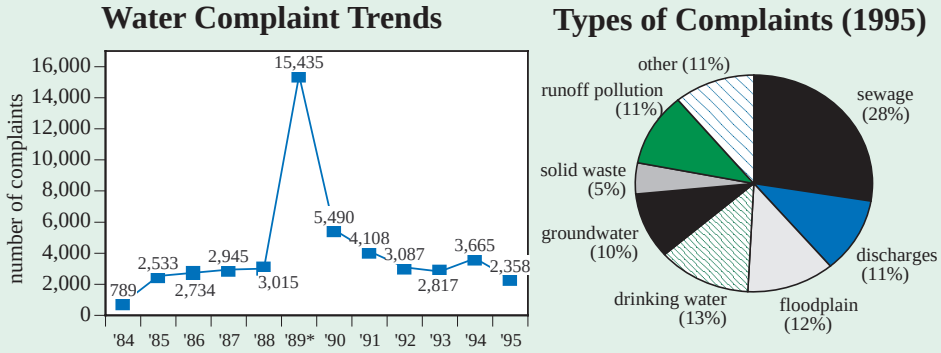


Source: KY Division of Water

of which, 74, were at permitted facilities. As of Feb. 1997, 12, or 11% of the 105 major facilites were in significant noncompliance with their KPDES permits **(Figure 34 and Figure 35)**.[20]

In 1995, citizen water complaints dropped to their lowest recorded since 1984 **(Figure 36)**. Complaints included wastewater treatment plants (320), septic tanks (330), public drinking water (448), floodplains (457), groundwater wells (335), odors (332), landfarming (214), illegal discharges (164), stormwater runoff (149), and open dumping (129).

Figure 36 Citizen Water Complaints in Kentucky



*Note: Complaints received by the Div. of Water. *Increase in complaints attributed to Russell County sewage treatment plant pipeline to Lake Cumberland. Source: KY Division of Water*

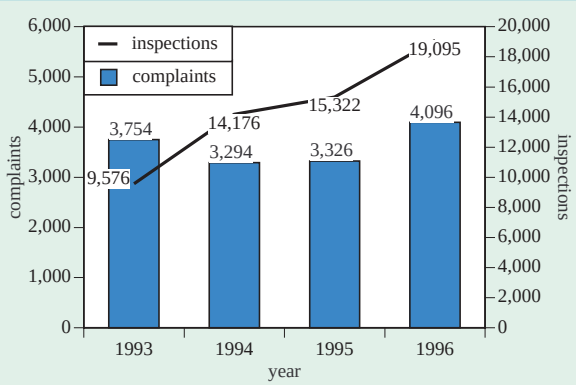
On-Site Sewage Inspections Double in Four Years

Since 1982, the KY Department for Health Services has had authority for ensuring that on-site sewage systems, such as septic tanks, are properly sited and installed. Local health departments issue thousands of on-site sewage permits each year, conduct inspections of systems, and respond to complaints.

The number of on-site sewage disposal inspections conducted by local health departments have doubled in the past four years **(Figure 37)**. This is due to a number of factors, including stepped up enforcement of on-site sewage disposal rules, the adoption of ordinances and agreements in 21 counties requiring verification of approved on-site sewage systems prior to the hookup of electrical service in new dwellings, and greater public awareness of permit requirements. However, the Department for Health Services admits that much more needs to be done to address the problem of illegal straight sewage discharge pipes and older failing septic systems.

The department notes that the state's on-site sewage law does not provide for penalties, nor does it allow the agency to take action against a violator unless there is a written complaint and then only if there is an imminent health hazard. In addition, more support and actions are needed at the state and local level including passage of state laws or local ordi-

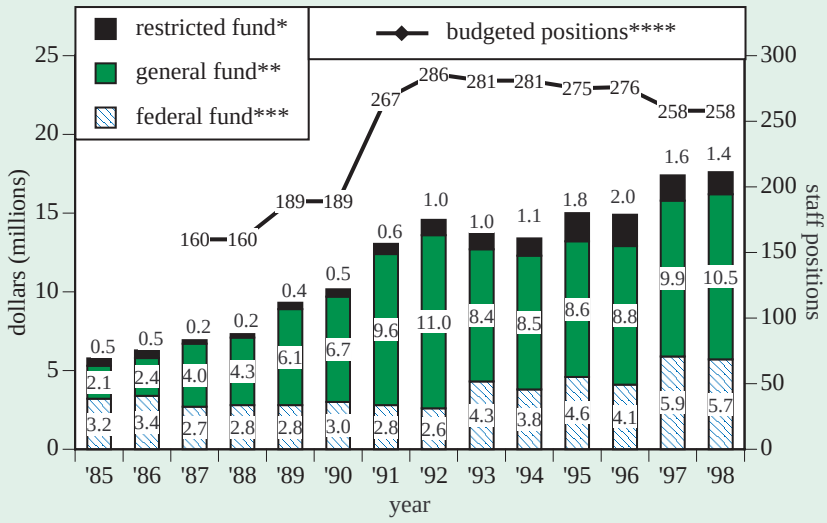
Figure 37 On-Site Sewage Disposal Inspections and Complaints in KY



Source: KY Department for Health Services

nances to promote proper on-site sewage disposal. The Department for Health Services also indicates that there is little interest by local courts to prosecute violators of on-site sewage laws. State and local programs are also needed to educate the public about proper sewage disposal and maintenance of septic systems. Woodford County is the first county to consider an ordinance to require the proper operation and maintenance of septic systems. And the department believes funding is needed to help finance regional and other on-site sewage systems for economically disadvantaged areas.

Figure 38 Kentucky Division of Water Budget Trends

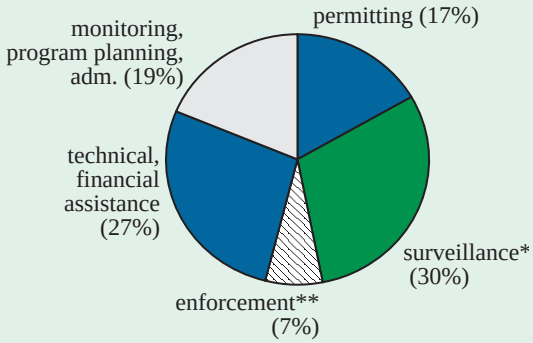


*Note: Based on fiscal year. *Grants, permit fees, and other sources of funds not included in general funds. **General funds appropriated from the state budget. ***Federal grants received to support NREPC water programs. ****Budgeted staff does not necessarily mean that all staff positions have been filled. Source: KY Cabinet for Natural Resources and Environmental Protection, Budget Office*

Water Program Expenditures Amount to $2.66 Per Kentuckian

Carrying out water pollution laws requires financial resources and personnel to protect public health and restore water quality. **Figure 38** reveals a steady increase in funding for KY Division of Water programs between 1985 and 1992. However, in 1993, budget shortfalls in Kentucky resulted in a $3 million reduction in state general fund appropriations for water programs. Since then, the total number of budgeted positions has steadily declined **(Figure 38)**. Consequently, the Division of Water has been forced to cut back on some programs, such as wastewater operator training, drought response, dam inspections, and water monitoring, in order to carry out its core activities of KPDES permitting and enforcement **(Figure 39)**. But the cuts have also impacted permitting and enforcement programs. For example, six field inspector positions have been cut since 1992. The Division of Water currently employs 60 inspectors to monitor thousands of permits and respond to complaints.

Figure 39 KY Division of Water Budget, By Program Area (FY 1997)



*Note: Based on $17,435,200 FY 1997 budget. *Inspections, responding to complaints. **Addressing violations of water rules through agreed orders, fines, other. Source: KY Division of Water*

Federal funds to support state water programs have not kept up with new mandates, according to Division of Water officials. The division reports that the federal funding increases in 1997 and 1998 reflect pass-through grants slated for local runoff pollution demonstration projects. The fiscal year 1997 and 1998 state general-fund appropriation for water programs restores funding back to 1991 levels at about $10 million a year. In 1998, state appropriations of $10.5 million to finance water programs will amount to an expenditure of $2.66 per Kentuckian to protect water quality.[21]

The Division has employed some cost-saving measures to assist the agency in meetings its statutory mandate to protect the waters of the Commonwealth. One measure under consideration is to switch from monthly to bimonthly monitoring at most of the 44 stream stations. This will allow the Division to expand its statewide monitoring network and assist with the watershed-based initiative as discussed on page five of this report. The Division has also been working to streamline water permit requirements and the review process to make it more efficient.

Kentucky Division of Water Budget

Program	1997 Budget
groundwater	$1,401,500
nonpoint	$3,075,500
surface water	$8,069,000
drinking water	$3,003,500
water resources*	$1,885,700
Total	**$17,435,200**

**Dam safety, water quantity, floodplain management programs.*
Source: KY Div. of Water

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20. Significant noncompliance defined as those major KPDES permitted facilities with exceedance of permit limits by 40% for oxygen demand, solids, nutrients, detergents/oil, minerals, and some metals and 20% for the parameters of heavy metals and inorganic chemicals twice in a six-month period. In addition, a facility is in significant noncompliance if it exceeds the permit limit of any parameter four times in a six-month period.
21. $2.66 per capita expenditure based on KY General Fund FY 1998 appropriation of $10.5 million to the Division of Water and the 1997 KY population of 3,941,376 as estimated (high-growth series) by KY State Data Center, Univ. of Louisville.

Acknowledgments

Prepared by Leslie Cole, Executive Director, Scott Richards, Assistant Director, and Erik Siegel, Research Assistant with the Environmental Quality Commission (EQC). EQC would like to thank Jack Wilson, Bob Ware, Terry Anderson, Tom VanArsdall, Scott Hankla, Giles Miller, Mike Mills, Karen Samples, John Gowins, Sam Lester, Patty Long, Donna Drury, Peter Goodmann, Billy Yarnell, Beverly Oliver, Jim Webb, Gary O'Dell, Vicki Prather, Bruce Scott, Brad Stone, Cliff Schnieder, Gary Beck, and other Division of Water staff for their assistance in providing information for this report. EQC also extends its appreciation for data used in the report to George Gilbert, Bob Padgett, Mike Welch, Doyle Mills, Brian Baker, and Tim Hubbard, Division of Waste Management; Jason Heath, ORSANCO; Dave Nichols and Sam Burnette, KY Dept. for Health Services; Steve Coleman, Division of Conservation; Ruth Rowles, Melanie Bailey, NREPC; Pat Nicher, U.S. Corps of Engineers; Fred Shroud, U.S. EPA; and Jim Axon, Charles Browning, KY Department of Fish and Wildlife Resources.

EQC also wishes to thank those who reviewed and commented on the report including Bill Caylor, KY Coal Assn.; Hank Graddy, Sierra Club; Allen Vicory, ORSANCO; Russ Barnett, KIESD, Univ. of Louisville; John Brazel, KY Chamber of Commerce; Charles McCollum, KY Water and Wastewater Assn.; Frank Elsen, KY Waterways Alliance; Gordon Garner and Sara Lynn Cunningham, Louisville Jefferson County MSD; and Lyle Sendlein, KY Water Research Institute. EQC would like to thank Maleva Chamberlain for her assistance with editing the report.

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Kentucky Environmental Quality Commission
14 Reilly Rd.
Frankfort, KY 40601
Telephone: 502-564-2150
Fax: 502-564-4245 n E-mail: EQC@mail.nr.state.ky.us
EQC web site: http://www.state.ky.us/agencies/eqc/eqc.html

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Printed on recycled paper with state funds. Partial funding was also provided by the State Environmental Goals and Indicator Project, a cooperative agreement between the U.S. EPA and the Florida Center for Public Management to encourage the development and use of environmental indicators.