1988
KENTUCKY
REPORT TO CONGRESS
ON
WATER QUALITY

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES and
ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

DIVISION OF WATER

APRIL 1, 1988

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ACKNOWLEDGEMENTS

Special recognition is given to the staff of the Water Quality Branch within the Division of Water for their significant contribution to the preparation of this report. Their dedication and persistence is to be commended. Also, appreciation is given to personnel in the Inventory and Data Management Section of the Permits Review Branch, Groundwater Branch, and Construction Grants Branch. Assistance from the Division of Conservation and the Department of Fish and Wildlife Resources is also greatly appreciated.

EXECUTIVE SUMMARY

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This report was prepared to fulfill requirements of Section 305(b) of the Federal Water Pollution Control Act of 1972 (P.L. 82-500) as amended by the Water Quality Act of 1987 (P.L. 100-4). Section 305(b) requires that states submit a report to the U.S. Environmental Protection Agency on a biennial basis which assesses current water quality conditions. New requirements call for the inclusion of specific data on 1) lake water quality, 2) waters affected by priority pollutants, and 3) waters affected by nonpoint sources of pollution. Other topics that are discussed in the report are groundwater quality, the status of the state water pollution control program, special water quality concerns and recommendations on additional actions necessary to achieve the objectives and goals of the Clean Water Act.

Water Quality Assessment

The water quality assessment of rivers and streams in Kentucky's 1988 report is based on those waters depicted on the 1974 U.S. Geological Survey Hydrologic Unit Map of the state. The map contains about 18,500 miles of streams. Approximately 9,400 miles (51%) of these were assessed, which is a 20 percent increase in coverage from the last report period.

The assessment is based on an analysis of the support of classified uses. Warmwater aquatic habitat and primary contact recreation uses were most commonly assessed. Full support of uses occurred in 6,175.2 miles (66%) of the assessed waters and uses were not supported in 1,722.6 miles (18%). Some degree of use impairment was found in 3,205.2 miles (34%) of the assessed waters. The major causes of use nonsupport were fecal coliform contamination, which affected primary contact recreation use, and siltation, which impaired warmwater aquatic habitat use. The major sources of the fecal coliform contamination were municipal wastewater treatment plant discharges. Surface mining and other unspecified nonpoint sources, were the major sources of siltation.

Pollution due to priority pollutants has occurred in some of the state's streams. Fish consumption warnings have been posted for the Mud River and Town Branch in Logan, Butler and Muhlenberg counties because of the presence of PCBs. A fish consumption advisory is also in effect for the West Fork of Drakes Creek in Simpson and Warren counties, because of PCBs. Another toxic pollutant which has emerged as a potential health threat is chlordane. Missouri issued a fish consumption advisory for the Mississippi River (which includes a reach bordering Kentucky) because of high chlordane levels in fish tissue. Subsequent investigations by Kentucky and the U.S. Environmental Protection Agency did not detect levels of chlordane that warranted an advisory on the Ohio and Mississippi River along Kentucky's border. Chlordane has been detected in fish tissue at a number of other stream sites in the state.

Section 304(l) of the 1987 amendments to the Clean Water Act requires states to focus attention on waters impaired by toxic pollutants. A preliminary list of affected waters and point source dischargers is required to be submitted as part of each state's 305(b) report. Three preliminary lists; a "short list" of waters affected by point source toxic pollutants, a "mini list" of waters affected by point and nonpoint sources of pollutants, and a "long list" of waters affected by all types of pollutants from all sources, are being submitted as part of the 1988 305(b) report. The short list contains 23 stream segments where individual control strategies for point source dischargers of toxic pollutants must be developed by February 1989. Many of the problems are already being resolved through normal permitting and enforcement programs.

Fifty-three fish kills totalling over 359,000 fish were reported in the past two years, affecting over 81 miles of streams and 247 acres of lakes. Fish kills were most commonly attributed to sewage discharges. Bacteriological surveys were conducted on three stream drainages and at 20 municipal facilities and their receiving streams in 1986-1987. Municipal sewage treatment plant discharges were found to be a major source of recreational use impairment.

The water quality assessment of lakes included more than 90 percent of the publicly owned lake acreage in Kentucky. Fifty of 92 lakes fully supported their uses. On an acreage basis, 84 percent (179,335 acres) of the 214,483 assessed acres fully supported uses.

High iron and manganese concentrations were the greatest cause of use nonsupport in lakes. This was largely because of impacts on domestic water supplies from hypolimnetic water released from large reservoirs which contained excessive levels of iron and manganese. Nutrients were the second greatest cause of use nonsupport and affected the largest number of lakes. Natural sources of nutrients nonsupport and affected the largest number of lakes. Natural sources of nutrients were responsible for the largest percentage of nonsupport (64%) followed by nonpoint sources (25%). Surface mining and unspecified nonpoint sources accounted for the greatest impacts from nonpoint sources.

An analysis of lake trophic status indicated that of the 92 lakes, 51 were eutrophic, 27 were mesotrophic and 14 were oligotrophic. Carr Fork Lake showed an improvement in water quality while Reformatory Lake, which had shown previous improvement, was categorized as not supporting warmwater aquatic habitat use. Cave Run Lake water quality is changing because of an increase in chloride concentration attributed to oil and gas activities in its watershed. Impacts on aquatic life are not yet apparent, but the threat from brine pollution is a cause of concern. An assessment of three lakes monitored specifically for acid deposition impacts revealed no discernible trend toward acidification.

The Nonpoint Source (NPS) Pollution Assessment Report consists of a list of surface waters, groundwaters, and wetlands in Kentucky impacted by nonpoint source pollution. In addition, the categories and subcategories of sources of NPS pollution for each of the listed waterbodies were identified. The information for the NPS pollution assessment was gathered from many different sources and with the coordination and cooperation of federal, state and local agencies. The Division of Water and cooperating agencies and organizations will prioritize the waters according to the severity of NPS pollution, which will be required for the development of a statewide NPS Management Program Plan. The NPS Management Program Plan will outline Kentucky's nonpoint pollution control program and will include education programs, demonstration projects and technical assistance to encourage the use of appropriate best management practices.

With some exceptions, the quality of Kentucky's groundwater is good. Special studies were conducted in 1987 on 199 wells in the Gateway Area Development District and the Calvert City area. Isolated occurrences of fecal coliform contamination were found and attributed to faulty well construction. No significant cases of organic contamination were found. While these studies point out the good quality of the groundwater in these areas, other statewide problems remain to be solved. Impacts from sanitary landfills, domestic on-site sewage treatment, inconsistencies in federal and state laws regarding groundwater, and improperly abandoned wells, are areas of concern relative to groundwater protection.

Special State Concerns

The discharge of brines to Kentucky waters remains a serious problem, particularly in portions of the Licking and Kentucky river drainages. Significant improvements in water quality in parts of the Blaine Creek drainage resulted from the application of newly promulgated federal chloride criteria to oil and gas permitting actions. Continuation of the permitting activities should significantly improve water quality in the other areas impacted by brine pollution.

The loss of wetland resources and adverse impacts to remaining wetland areas are of concern. It is estimated that half of Kentucky's original wetland acreage is gone. Nearly all of the remaining areas have been degraded by pesticides, acid mine drainage, siltation, oil brine, or domestic and industrial waste. A major threat to Kentucky wetlands is destruction by competing land use activities and poor land management practices.

The state, through the authority of the Clean Water Act, issues a Section 401 water quality certification for activities which require a federal permit or license. Issues of concern have to do with the appropriate and potential use of certification. Federal guidance on conditions that can be put on certifications, how to handle after-the-fact permits, and how to apply certification to activities which impact wetlands, is needed.

Water Pollution Control Programs

Kentucky's water pollution control programs have expanded to develop some new approaches to controlling pollution. Biomonitoring requirements are beginning to be incorporated into permits for major municipalities and industries. A state revolving fund program has been proposed to meet the needs of new wastewater treatment plant construction and, because needs far exceed available resources, innovative approaches are being developed to contain costs. These include streamlining or reducing requirements in funding projects, assisting small communities in their planning process and simplifying bidding, construction and change order activities.

Forty-five primary ambient monitoring stations, which characterized approximately 1,500 stream miles within the state were in operation during the reporting period. This was an expansion of six stations over the past two years. Biological monitoring was expanded from 22 stations to 33. In addition, eight lakes were sampled for eutrophication trends and three lakes for acid precipitation trends. Four intensive surveys were conducted on 267 miles of streams for the evaluation of industrial pollution, surface mining, and oil production activities on water quality and assessing use attainability.

WATER WATCH, a citizen education program, expanded its membership and more than doubled the number of waters "adopted" by local groups. A water quality monitoring project was initiated which produced data on stream water quality at 57 sites across the state. The program gained international recognition when it received the North American Environmental Education Association's 1987 award for outstanding service to environmental education.

An approach to developing a wetlands protection strategy for Kentucky was formulated over the past reporting period. The Kentucky Environmental Quality Commission assisted the Natural Resources and Environmental Protection Cabinet by acting as the lead agency in producing the strategy development mechanism for the Cabinet. A report was produced recommending a phased approach which included 1) legislative actions to establish a wetlands planning committee and provide for various funded activities, such as mapping and hiring of a coordinator, 2) establishment of a natural area and wetlands acquisition fund, and 3) through the wetlands planning committee, development and implementation of the protection strategy.

The groundwater program expanded during the last reporting period from a Section level to a Branch level unit with two sections. The Technical Services Section has responsibilities for wellhead protection, monitoring well and water well inspections, and implementing groundwater regulations. The Data Management and Support Section has responsibilities for coordinating the various groundwater programs in the state, and developing data management capabilities and groundwater regulations. A regulatory scheme for groundwater is being developed which will mirror the federal model.

BACKGROUND

BACKGROUND

This report was prepared to fulfill the requirements of Section 305(b) of the Federal Water Pollution Control Act of 1972 (P.L. 92-500) as amended by the Clean Water Act of 1987 (P.L. 100-4). Section 305(b) requires that states submit a report to the U.S. Environmental Protection Agency (EPA) every two years which addresses current water quality conditions. Items to be addressed in the report include an assessment of the degree to which nonpoint sources of pollutants affect water quality, an assessment of state groundwater quality, an assessment of the extent to which the state's waters meet their designated uses and the fishable/swimmable goals of the Act, and recommendations on additional actions necessary to achieve the water quality objectives of the Act. New requirements call for the inclusion of specific data on lake water quality, waters affected by nonpoint sources and waters affected by toxics. EPA uses the reports from the states to apprise Congress of the current water quality of the Nation's waters and recommends actions which are necessary to achieve improved water quality. States use the reports to provide information on water quality conditions to the general public and other interested parties.

This report follows the guidance document that EPA provided to the states for the 1988 report. The stream water quality in this report is based on those streams shown on the U.S. Geological Survey's Hydrologic Unit Map of Kentucky (scale 1:500,000). The assessments were based on this map's approximately 1,300 streams and rivers which contain about 18,500 stream miles. Kentucky is divided into 42 cataloging units, which compose the 12 river basins assessed in this report. These drainage basins from east to west are the Big Sandy, Little Sandy, Tygarts, Licking, Kentucky, Upper Cumberland, Salt, Green, Tradewater, Lower Cumberland, Tennessee and Mississippi. The Ohio River Valley Water Sanitation Commission (ORSANCO) compiles a report on the Ohio River which is used as a supplement to the 305(b) reports submitted by the member states of the Commission. The assessment of lake conditions is based largely on data collected by the Division of Water in 1981-1983 under the Federal Clean Lakes Program. More recent data were utilized, when available, to update that information base. The 92 lakes which were assessed have a total area of 214,483 acres. This includes the Kentucky portions of Barkley, Kentucky and Dale Hollow lakes which are border lakes with Tennessee. Total wetland acreage in Kentucky has not been accurately determined. The Division of Water, in collaboration with the Kentucky Department of Fish and Wildlife Resources, has contracted with the U.S. Fish and Wildlife Service to map wetlands in the Commonwealth.

Kentucky's population, according to the 1980 census, is 3,660,257. The state has an approximate area of 40,598 square miles. It is estimated that there are approximately 40,000 miles of streams within the borders of Kentucky, which ranks the state seventh in total length of streams within the contiguous United States. Kentucky has 849 miles of border rivers. The northern boundary of Kentucky is formed by the low water mark of the northern shore of the Ohio River and extends along the river from Catlettsburg in the east to the Ohio's confluence with the Mississippi River near Wickliffe in the west (a length of 664 miles). The southern boundary is formed by an extension of the Virginia-North Carolina 1780 Walker Line which extends due west to the Tennessee River. Following the acquisition of the Jackson Purchase in 1818, the 30°36' parallel was accepted as the southern boundary from the Tennessee River to the Mississippi River.

Kentucky's eastern boundary begins at the confluence of the Big Sandy River with the Ohio River at Catlettsburg and follows the main stem of the Big Sandy and Tug Fork southeasterly to Pine Mountain, for a combined length of 121 miles; then follows the ridge of the Pine and Cumberland mountains southwest to the Tennessee line. The western boundary follows the middle of the Mississippi River for a length of 64 miles and includes several of the islands in the Mississippi channel.

The climate of Kentucky is classified as continental temperate humid. Summers are warm and humid with an average temperature of 76°F, while winters are moderately cold with an average temperature of 34°F. Annual precipitation averages about 45 inches, but varies between 40 to 50 inches across the state. Maximum precipitation occurs during winter and spring with minimum precipitation occurring in late summer and fall.

Summary of Classified Uses

Kentucky lists waterbodies according to specific uses in its Water Quality Standards Regulations. These uses are: 1) Warmwater Aquatic Habitat, 2) Coldwater Aquatic Habitat, 3) Domestic Water Supply, 4) Primary Contact Recreation, 5) Secondary Contact Recreation and 6) Outstanding Resource Waters. Those waters not specifically listed are classified (by default) for use as warmwater aquatic habitat, primary and secondary contact recreation, and domestic water supply. The domestic water supply use is applicable at points of withdrawal. Lakes have not been listed in the regulations and are classified for the default uses. The Division of Water adds waterbodies to the classified lists as an ongoing process in its revision of water quality standards. Intensive survey data and data from other studies when applicable are used to determine appropriate uses. Currently, 1,683 stream miles are classified as warmwater aquatic habitat, 384.4 miles as coldwater aquatic habitat and 206.7 miles as outstanding resource waters. There are approximately 104 points where domestic water supply is withdrawn in streams, and there are 54 lakes which are used for domestic water supply purposes.

CHAPTER 1

WATER QUALITY ASSESSMENT OF RIVERS AND STREAMS

WATER QUALITY ASSESSMENT
RIVERS AND STREAMS

Status

Water quality conditions for rivers and streams in Kentucky are summarized by use support status in Table 1. The table indicates that of the 9,380.4 miles assessed, approximately 34 percent experienced some degree of use impairment, while 66 percent fully supported uses. River basin maps displaying use support information are presented in Figures 1 through 8. Approximately 50 percent of the river miles on the U.S.G.S. hydrologic unit maps were assessed. This is a 20 percent increase in map miles covered and is 40 percent more than the miles assessed in the 1986 305(b) report.

Table 1

Designated Use Support by River Basin

Basin	Total Miles	Miles Assessed	Miles Fully Supporting Use(s)	Miles Partially Supporting Use(s)	Miles Not Supporting Use(s)
Big Sandy	1,247.8	429.3	221.4	53.6	154.3
Little Sandy	360.2	122.9	41.2	31.1	50.6
Tygarts Creek	194.4	192.9	145.4	2.0	45.5
Licking	1,993.0	654.2	429.6	28.0	196.6
Kentucky	3,442.7	1,598.9	1,072.7	53.6	472.6
Upper Cumberland	2,089.2	952.7	715.8	152.2	84.7
Salt	1,528.7	889.8	529.1	144.0	216.7
Green	3,499.3	2,335.8	1,944.3	155.4	236.1
Tradewater	514.9	323.2	135.4	102.0	85.8
Lower Cumberland	672.9	404.1	329.1	68.0	7.0
Tennessee	368.6	142.5	101.5	21.5	19.5
Mississippi	440.1	214.1	96.5	95.8	21.8
Ohio (Minor tribs)	1,449.2	456.1	413.2	35.3	7.6
Ohio (Mainstem)*	663.9	663.9	0.0	540.1	123.8
STATE TOTAL	18,464.9	9,380.4	6,175.2	1,482.6	1,722.6

*Assessment provided in 1988 ORSANCO 305(b) Report.

Methods of Assessment

Water quality data collected by the Kentucky Division of Water, Kentucky Division of Waste Management, Ohio River Valley Sanitation Commission, U.S. Army Corps of Engineers, Virginia State Water Control Board, and the U.S. Geological Survey were used to determine stream use support status. Other sources of information used in this determination include biological studies at fixed stations,

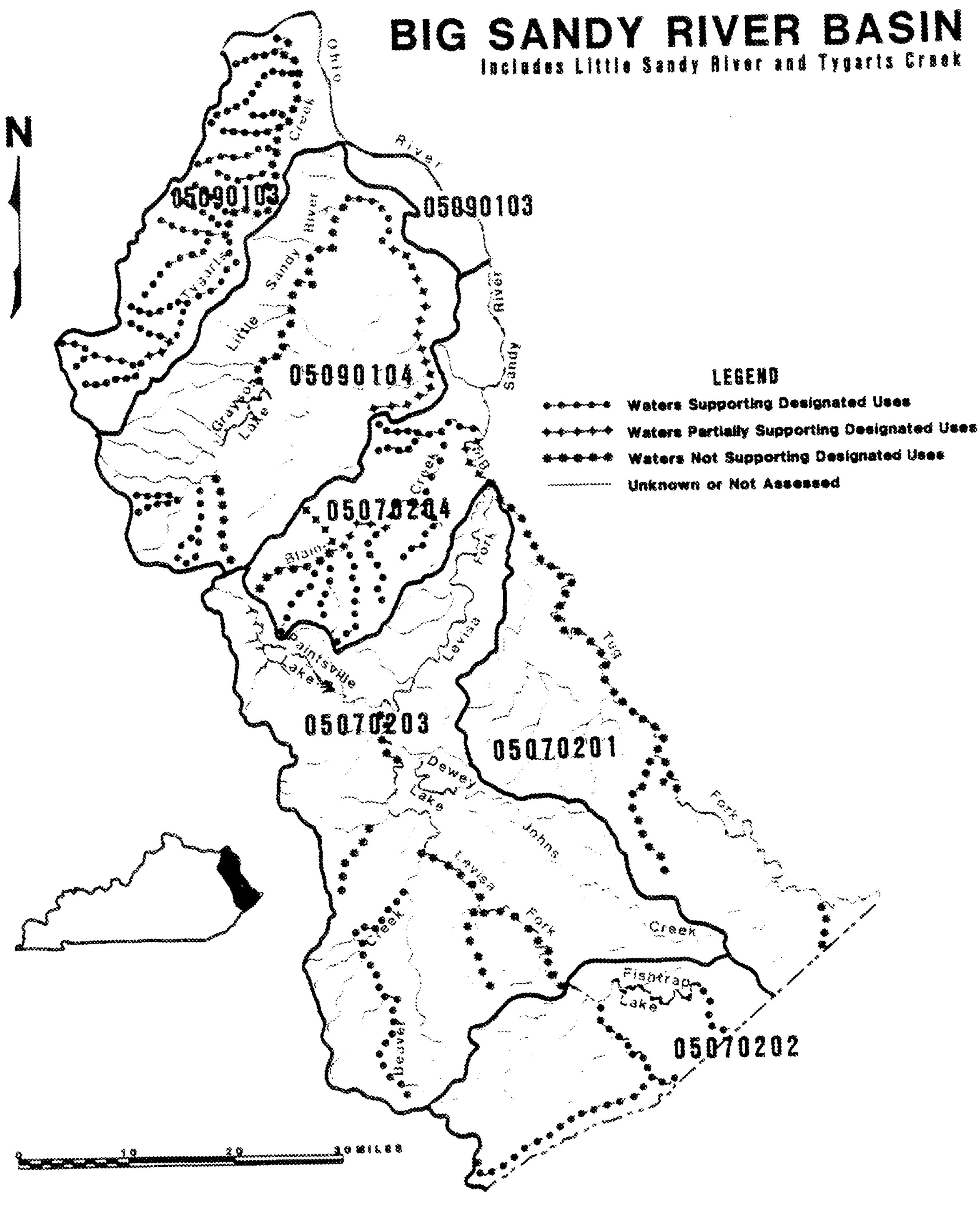
BIG SANDY RIVER BASIN
Includes Little Sandy River and Tygarts Creek
N
LEGEND
Waters Supporting Designated Uses
Waters Partially Supporting Designated Uses
Waters Not Supporting Designated Uses
Unknown or Not Assessed
05090103
05090103
05090104
05070204
05070203
05070201
05070202
Ohio River
Tygarts Creek
Little Sandy River
Grayson Lake
Big Sandy River
Paintsville Lake
Dewey Lake
Levisa Fork
Tug Fork
Johns Creek
Fishtrap Lake
Beaver Creek
10
20
30 MILES

Figure 1

LICKING RIVER BASIN

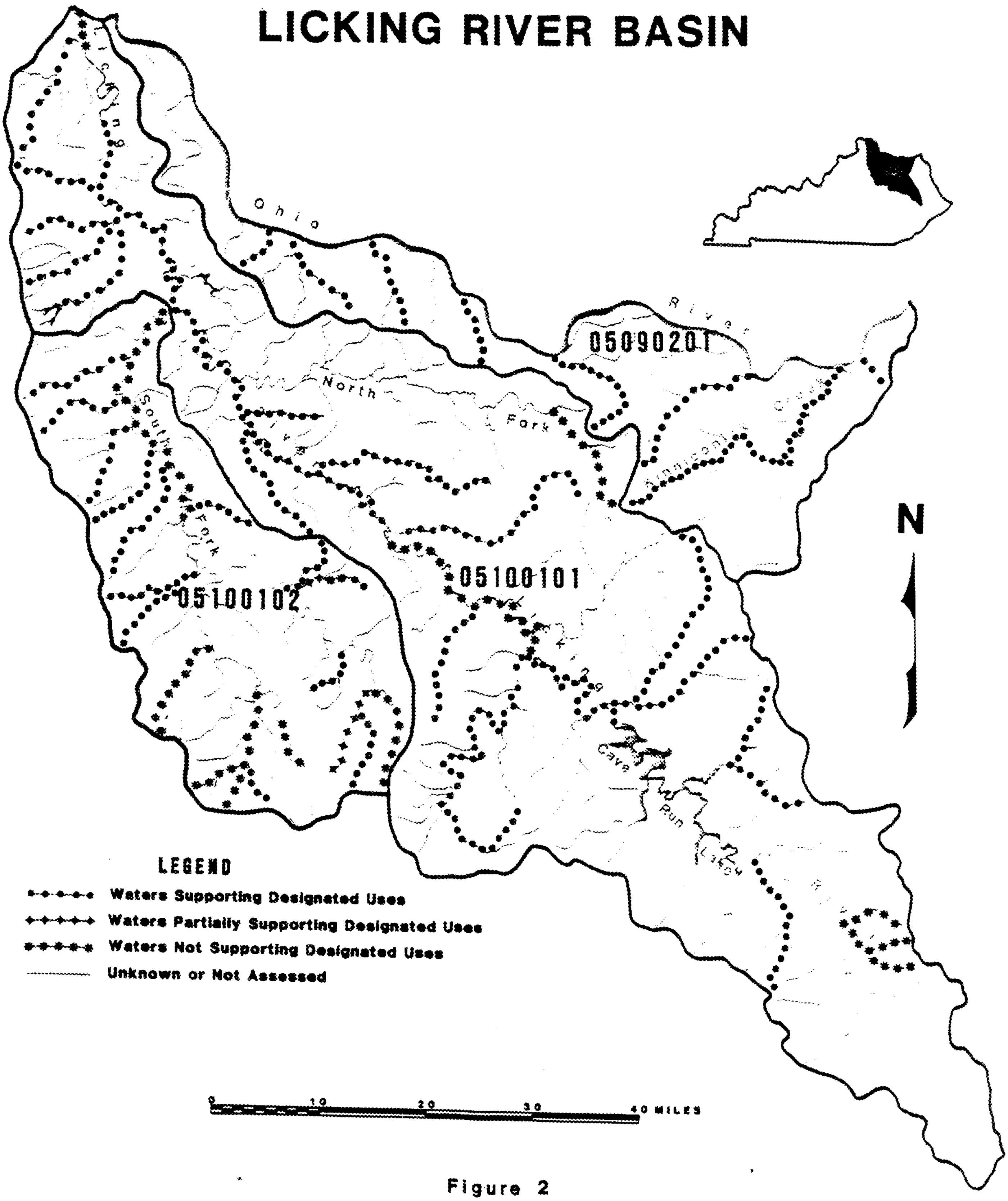

Figure 2

KENTUCKY RIVER BASIN

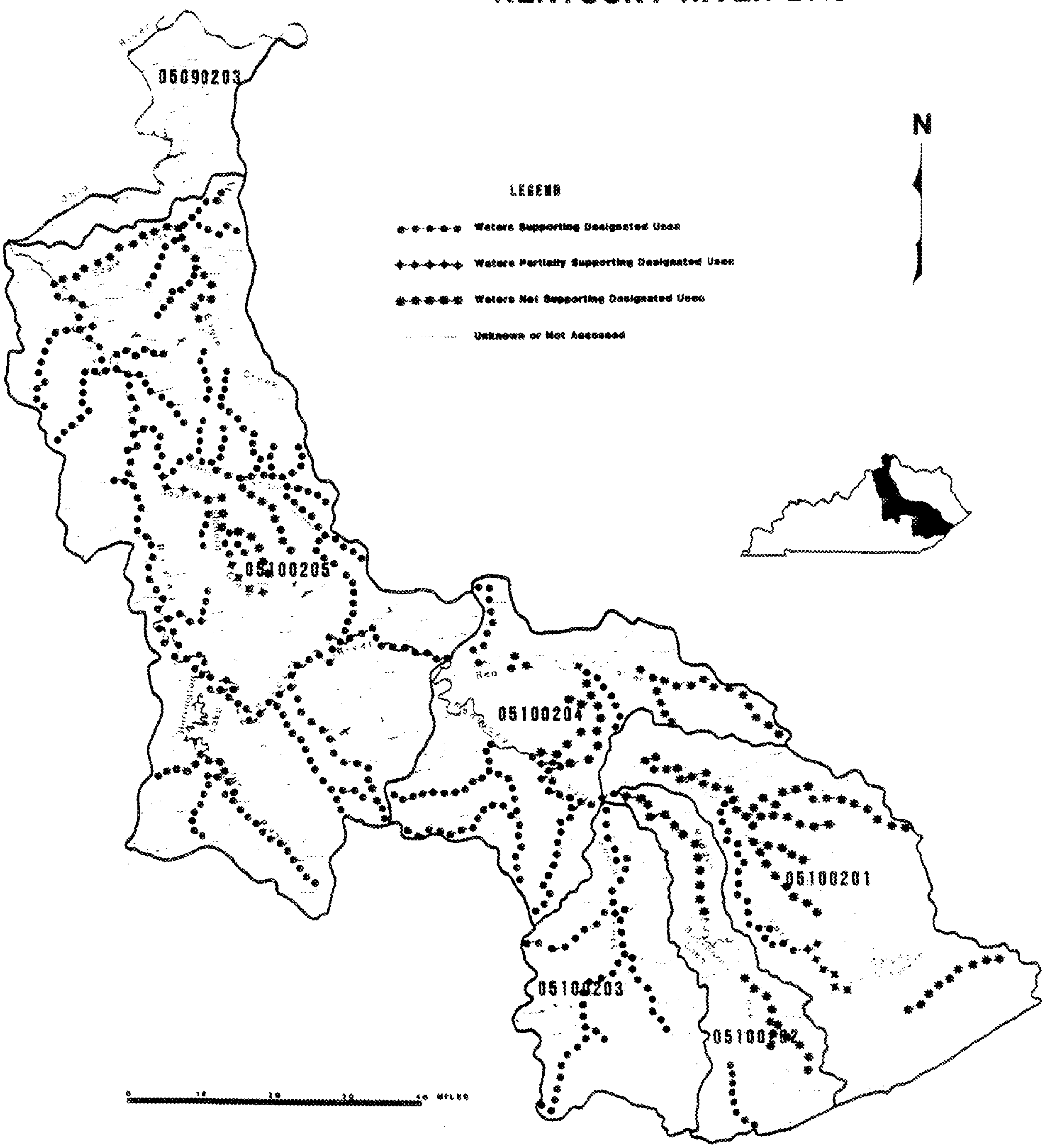

Figure 3

UPPER CUMBERLAND RIVER BASIN

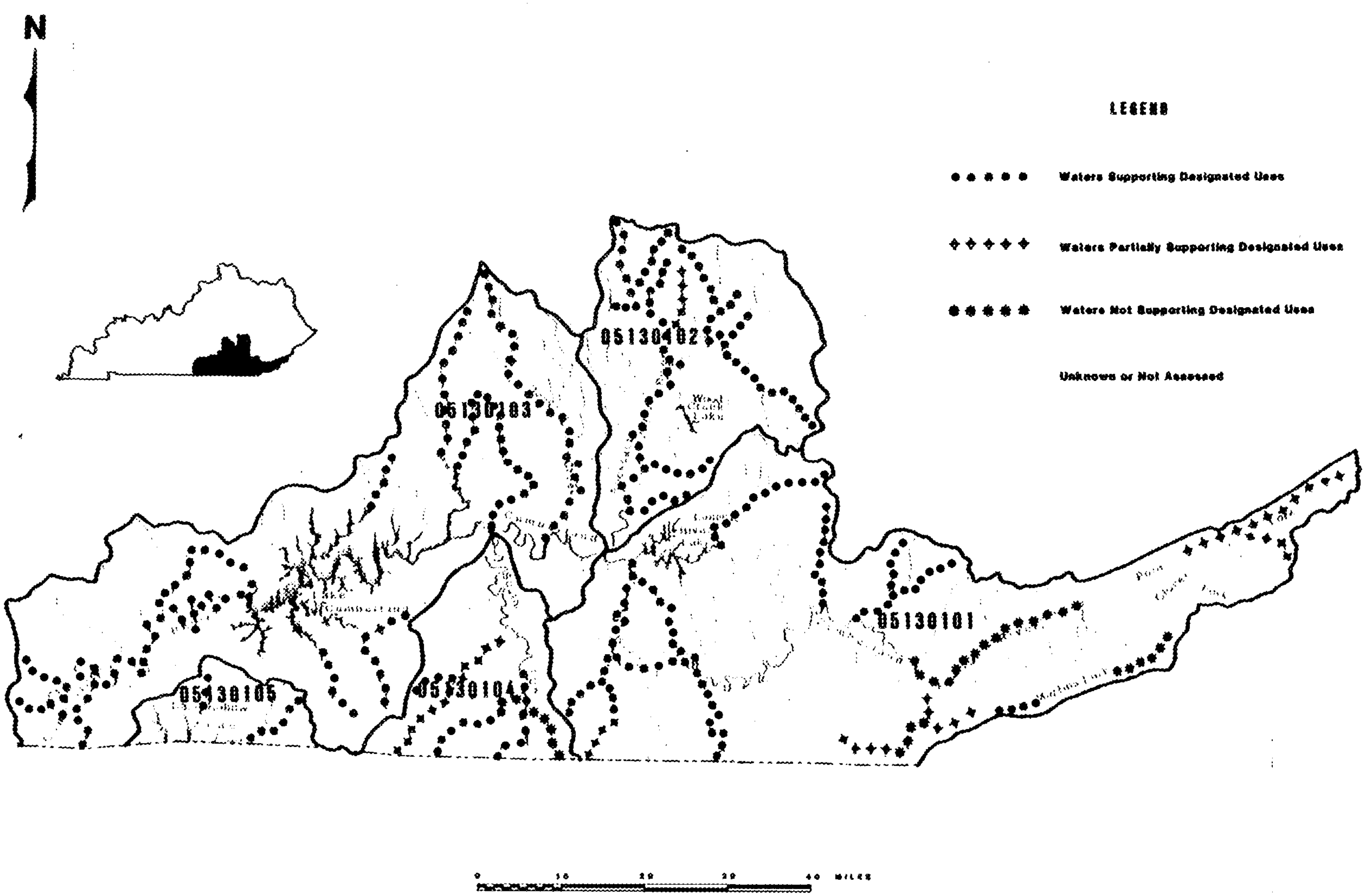

Figure 4

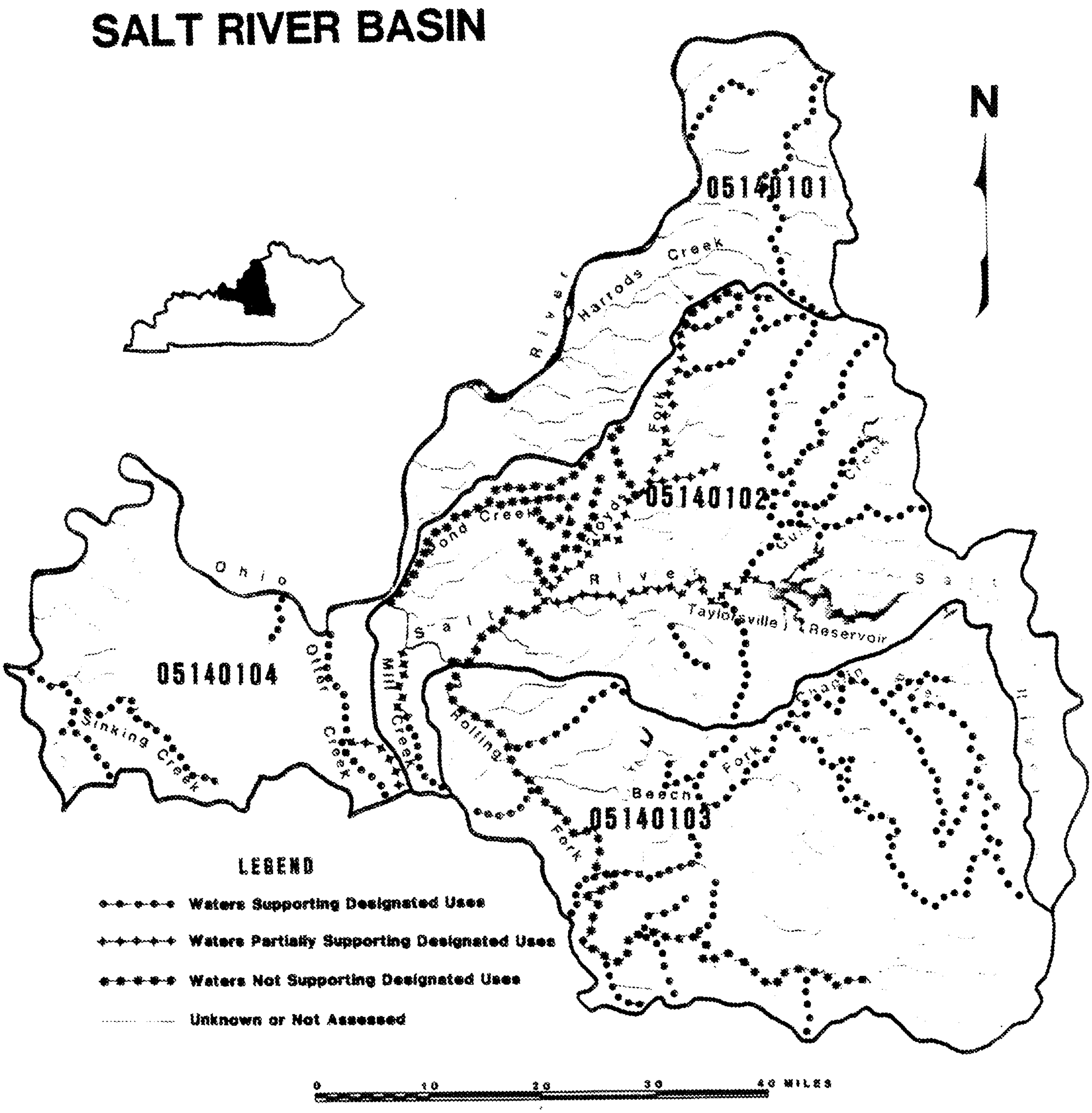
SALT RIVER BASIN
N
05140101
05140102
05140103
05140104
Harrods Creek
River
Ohio
Floyds Fork
Pond Creek
Salt River
Taylorsville Reservoir
Otter Creek
Mill Creek
Sinking Creek
Rolling Fork
Beech Fork
Chaplin River
LEGEND
Waters Supporting Designated Uses
Waters Partially Supporting Designated Uses
Waters Not Supporting Designated Uses
Unknown or Not Assessed
0 10 20 30 40 MILES

Figure 5

GREEN RIVER BASIN

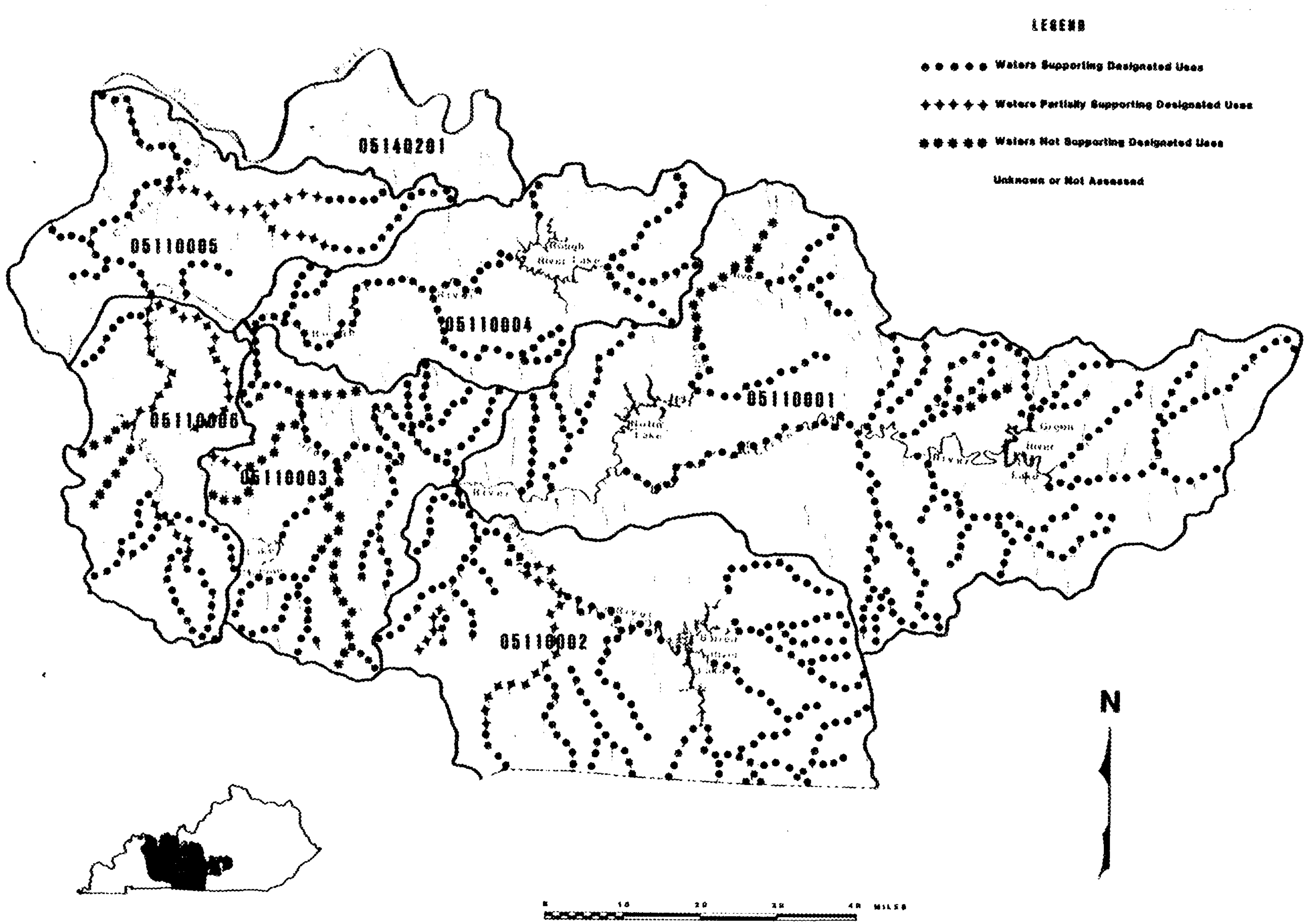

Figure 6

LOWER CUMBERLAND AND TRADEWATER RIVER BASINS

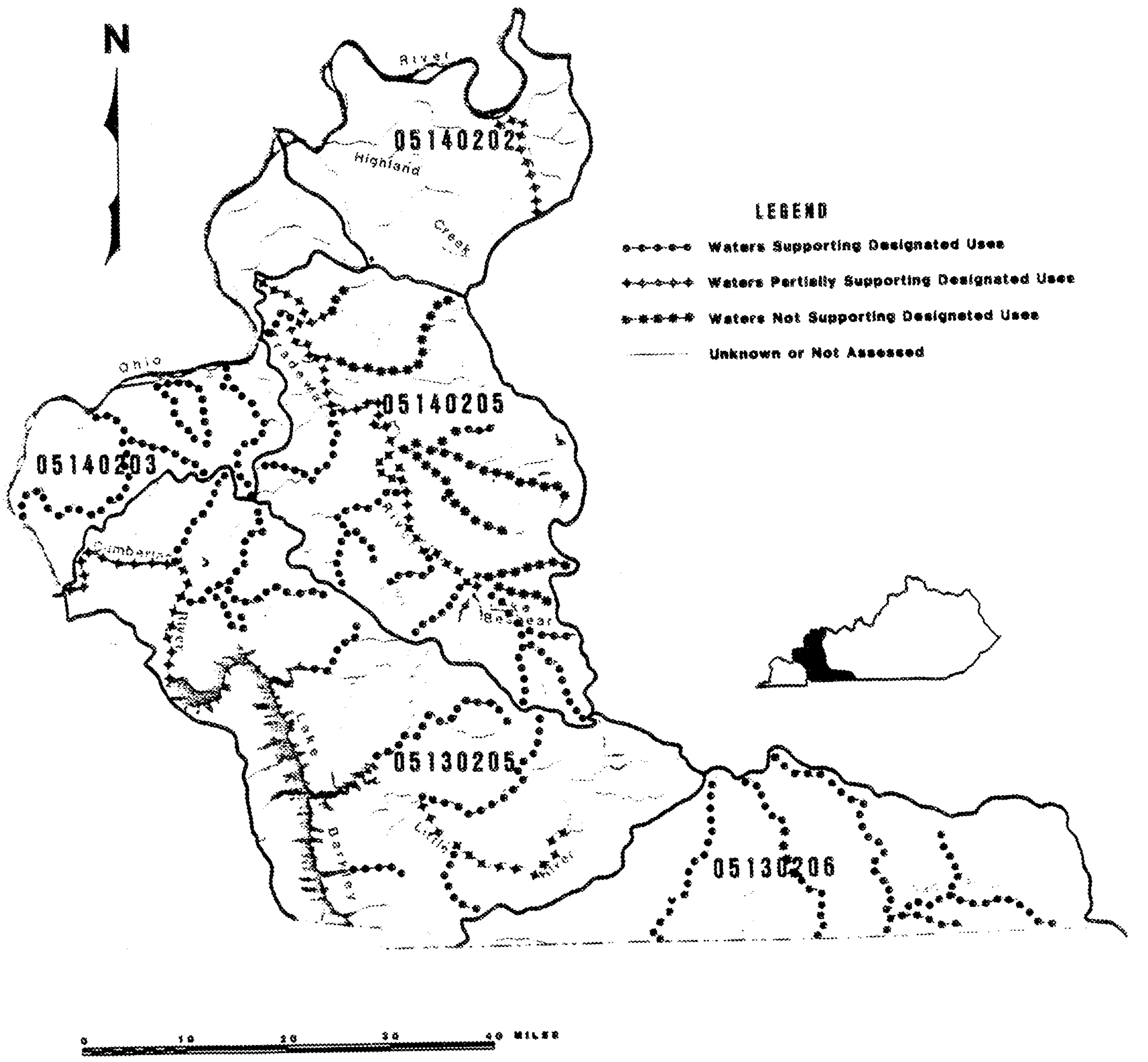

Figure 7

TENNESSEE AND MISSISSIPPI RIVER BASINS

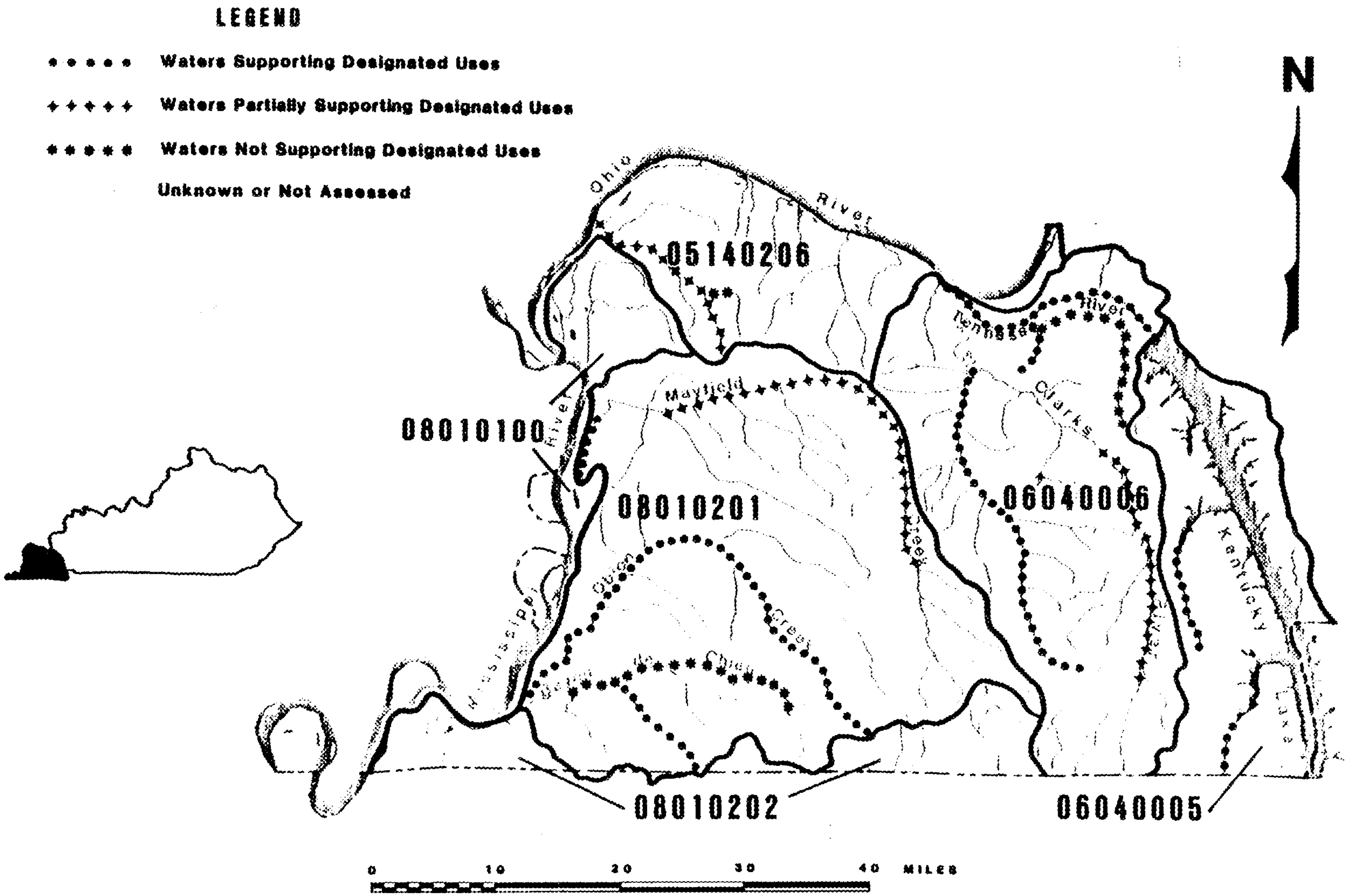

Figure 8

intensive surveys, and data supplied by the Kentucky Department of Fish and Wildlife Resources. The data were categorized as "monitored" or "evaluated." Monitored data were derived from site specific ambient surveys and were no more than five years old. Evaluated data were from other sources or from ambient surveys which were conducted more than five years ago. The criteria for assessing this data to determine use support follows.

Water Quality Data

Chemical data collected at fixed stations were evaluated according to U.S. EPA guidelines for the preparation of this report. Water quality data collected during the period from October 1985 through September 1987 were compared with state and EPA standards and applied to the status criteria. A list of the parameters and their corresponding criteria are noted in Table 2. All of the criteria in the table except fecal coliform were used to assess warmwater aquatic habitat (WAH) use support. If none of the criteria were exceeded in $\leq$ 10 percent of the measurements and their means were less than the criteria, the segment fully supported its use for WAH. Partial support was indicated if any one criterion was exceeded 11-25 percent of the time and the mean was less than the criterion, or if any criterion was exceeded $\leq$10 percent of the time and its mean was greater than the criterion. The segment was not supporting if any criterion was exceeded >25 percent of the time or the criterion was exceeded 11-15 percent of the time and the mean was greater than the criterion.

Fecal coliform data were used to indicate degree of support for primary and secondary contact recreation use. Primary contact support was indicated if the samples measured in May through October did not exceed 400 colonies/100 ml more than 20 percent of the time. If they did, the segment was judged not to support that use. Secondary contact recreation use was supported if (during the months of November through April) the samples measured in a segment did not exceed 2000 colonies/100 ml more than 20 percent of the time. If they did, the segment was judged to not support the use. Partial support was not assessed. Domestic water supply use was not assessed because the use is applicable at points of withdrawal only and could not be quantified in the format required by the guidelines. In areas where both chemical and biological data were available, the biological data were generally the determinate factor for establishing warmwater aquatic habitat use support status.

Fixed Station Biological Data

Biological data for 1984-1987 were collected from 33 fixed stations in ten drainage basins throughout the state. Algae, macroinvertebrates and fish were collected on an annual basis and used for making the biological assessments for those streams. The criteria used to evaluate each of those biological components varies according to habitat requirements, collection methods and stream characteristics. Once all data (algal, macroinvertebrate and fish) were compiled, a consensus was reached on use attainment. A reach was considered fully supporting the warmwater aquatic habitat use if all components showed full support. Partial or nonsupport was indicated if one or more of these components were not supporting the WAH use. A reach was classified as threatened when obvious habitat or water quality changes have occurred or have begun to occur because of increased sedimentation from upstream land disturbance or increased nutrient loading from nonpoint sources. These reaches may show use impairment in the future.

Because of the inherent variability in biological data caused by such factors as microhabitat differences at sites, habitat preferences of different species, seasonal distributional patterns and/or site-specific physical characteristics, there are no set criteria by which to judge community structure values at all sites. It is necessary to carefully weigh all the data when the objective is to determine extent of

Table 2

Parameters and Criteria Used to Determine Use Support Status

Parameter	Criterion	Source
Dissolved oxygen	4.0 mg/l	KWQS[1]
Temperature	30°C	KWQS
pH	6 to 9 units	KWQS
Un-ionized ammonia	0.05 mg/l	KWQS
Chloride	250 mg/l	KWQS
Arsenic	50 ug/l	KWQS
Cadmium	4 ug/l soft water 12 ug/l hardwater	KWQS (hardness <75 mg/l)
Chromium	100 ug/l	KWQS
Copper	Based on hardness[2]	EPA[3]
Lead	Based on hardness[4]	EPA
Mercury	0.2 ug/l	KWQS
Zinc	47 ug/l	KWQS
Fecal coliform	(May 1 thru Oct. 31) 400 colonies/100 ml (Nov. 1 thru April 30) 2000 colonies/100 ml	KWQS

1) Kentucky Water Quality Standards
2) Criterion = e (.8545 ln x - 1.465) x = hardness in mg/l as $CaCO_3$
3) U.S. Environmental Protection Agency
4) Criterion = e (1.273 ln x - 4.705) x = hardness in mg/l as $CaCO_3$

use support. In some instances, mean values of various indices can be calculated from all monitoring stations, and comparisons can be made against this mean. In addition, other reference sites known to have high water quality, or data from previous collections at a site, may be used for comparison. A discussion of the assessment criteria for each of the biological components follows.

Algae Algal samples were collected from each biological monitoring station using standarized collection procedures. Both plankton (algae suspended in the water column) and periphyton (attached algae) were collected. Plankton chlorophyll *a*, periphyton chlorophyll *a* and periphyton ash-free dry-weight were measured at each site, and diatoms were identified to species and enumerated. Diatom community structure indices (taxa richness, diversity and equitability) and relative abundance values were calculated.

Based on algal data, a reach supported the WAH use if the diatom taxa richness was high, community structure values were average or high, plankton and periphyton chlorophyll *a* and ash-free dry weight values were near average, and the diatom community was dominated by species typical for the particular physical characteristics and habitats present at the reach. A reach partially supported uses if diatom taxa richness was low, if community structure values were slightly lower than expected, or if the type of species present indicated a use impairment. Comparisons are based on other reference sites, average values for sites of similar physical and habitat characteristics, or values derived from the same site at a previous time. A reach did not support uses if toxic or organic enrichment was obvious based on the above-mentioned community structure criteria, or if the diatom community was dominated by pollution tolerant species. When chlorophyll *a* values were well above the mean, and taxa richness and diversity were low, organic pollution was indicated, while toxic impacts were suspected if taxa richness was extremely low compared to the mean value, but diversity and equitability values were average.

Macroinvertebrates For the macroinvertebrate evaluations, stream reaches were considered to fully support WAH use if information reflected no alterations in community structures or functional compositions for the available habitats, and if habitat conditions were relatively undisturbed. A reach was considered partially supporting uses when information revealed that community structures were slightly altered, that functional feeding components were noticeably influenced or if available habitats reflected some alterations and/or reductions. Reaches were considered not supporting uses if information reflected sustained alterations or deletions in community structures, taxa richness and functional feeding types, or if available habitats were often severely reduced or eliminated.

Fish Fish were collected for community structure evaluation at selected biological monitoring sites. The condition of the fish community was determined by analysis of relative abundance, species richness and species composition as well as use of an Index of Biotic Integrity (IBI). The IBI was used to assess biotic integrity directly by evaluation of twelve attributes, or community metrics, of fish communities in streams. These community metrics include measurement of species richness and composition, trophic structure, and fish abundance and condition. The IBI was used to assign one of the following categories to a fish community: excellent, good, fair, poor, very poor or no fish. Communities rated excellent or good indicated a reach as fully supporting, those rated fair indicated a reach as partially supporting, and those rated poor, very poor or no fish indicated a reach as not supporting the WAH use.

Intensive Survey Data

During 1986-1987, four intensive surveys were conducted to determine if streams were supporting their designated uses. In addition, data were evaluated from 32 surveys conducted during 1982-1985. About 50 percent of the total stream miles assessed by these surveys were considered as evaluated because the data were greater than five years old or not specific enough in quality to be used in the monitored category. The remaining miles were considered as monitored (those waterbodies for which the assessment is based on site specific ambient data less than five years old).

The streams were assessed by evaluating the biological, physicochemical, toxicological and habitat data and known watershed activities in concert with direct observation and professional judgment. The stream mileages were grouped as supporting, partially supporting, or nonsupporting uses. The streams were considered to support designated uses if no impacts or only minor impacts to the biotic integrity, physical habitat and water quality were observed. Streams were determined to be partially supporting when the data indicated stressed biotic communities, minor violations of water quality criteria or some physical impairment to aquatic habitats. Nonsupporting streams were those indicating severe stress, such as sustained species deletions, trophic imbalances in the biotic communities, chronic violations of water quality criteria and severely reduced or eliminated aquatic habitats.

Kentucky Department of Fish and Wildlife Resources Data

The Division of Water extended its analysis of stream use support by developing questionnaires on unmonitored streams and sending them to Conservation Officers of the Kentucky Department of Fish and Wildlife Resources (KDFWR). The questionnaire results were utilized in the evaluated category of assessed waters. Sixty-six of 120 questionnaires were returned, a response of slightly over 50 percent.

Each questionnaire was divided into two sections. A habitat evaluation section included questions on major land uses in the stream basin, flow, bottom type, sedimentation, and water quality. If water quality was stated to be less than good, the respondent was asked to indicate why a fair or poor evaluation was given.

Fisheries support was evaluated through questions regarding stream fishery characterization, reproduction (as indicated by presence or absence of both young-of-year (y-o-y) and adult sport fishes), fishery success, and trend of the fishery over the last 10 years. If the fishery was felt to be poor, the respondent was asked to indicate why.

In this evaluation of use support, only those questionnaire responses indicating definite support or nonsupport were used. Partial support was not assessed. A stream was considered to fully support WAH use if:

(1) the stream supported a good fishery,
(2) both y-o-y and adult sport fishes were present, or if only y-o-y were present, the stream was a tributary to a stream supporting the WAH use, and
(3) water quality was judged good.

A stream did not support the WAH use if:

(1) the stream supported a poor fishery,
(2) few or no fish were present in the stream, and
(3) water quality was judged poor and/or repeated fish kills were known to occur.

The questionnaires proved useful in evaluating the support or nonsupport of use in streams. The concept of utilizing sport fishery information was adopted from the Illinois 1986 305(b) report. While the questionnaire was somewhat rudimentary, it was useful and helped to increase the number of assessed streams in the state.

Another source of data for the evaluated category was a list of streams recommended by the KDFWR as candidates for State Outstanding Resource Waters. They were recommended because of their outstanding value as sport fishing streams. These streams were assessed as fully supporting warmwater aquatic habitat use if there was no data which conflicted with the assessment.

Use Support Summary

Table 3 shows the results of the evaluated and monitored assessments on a statewide basis. The threatened category is a subset of the miles fully supporting uses. It refers to stream miles which were judged to be in danger of use impairment from anticipated land use changes, development of trends indicating possible impairment, or other data such as fish tissue contaminants which indicated a future problem.

Table 1 has more total assessed miles and more miles in the partial support category because it included conclusions from ORSANCO's assessment of the mainstem of the Ohio River and Missouri's assessment of the Mississippi River. Both tables followed EPA guidelines which defined fully supporting as meaning that all uses which were assessed had to be fully supporting before a segment could be listed under that title. If a segment supported one use, but did not support another, it was listed as not supporting. For instance, if a segment supported a warmwater aquatic habitat use, but not a primary contact recreation use, it was listed as not supporting. A segment would be listed as partially supporting if any assessed use fell into that category even if another use was fully supported. Many streams were assessed for only one use because data were not available to assess other uses.

Table 3

Summary of Assessed* Use Support

Degree of Use Support	Assessment Basis: Evaluated	Assessment Basis: Monitored	Total Assessed
Miles Fully Supporting	4,521.7	1,653.5	6,175.2
Miles Threatened	399.0	320.4	
Miles Partially Supporting	493.1	385.4	878.5
Miles Not Supporting	446.9	1,151.9	1,598.8
TOTAL	**5,461.7**	**3,190.8**	**8,652.5**

*Excludes mainstems of Ohio and Mississippi rivers; refer to ORSANCO and Missouri 305(b) Reports for assessments.

Causes of Use Nonsupport

Table 4 indicates the relative causes of use nonsupport. Stream segment lengths which either did not support or partially supported uses were combined to indicate the miles that were affected. Fecal coliform bacteria were the greatest cause of use impairment and affected primary contact use in 969 miles of streams and rivers. Siltation was the second greatest cause of use impairment. It impaired warmwater aquatic habitat use in 723.7 miles of streams and rivers and moderately impacted a further 126.5 miles. Siltation affects the use by covering available habitat, preventing aquatic organisms which would normally live in the stream from inhabiting the area.

Sources of Use Nonsupport

Sources of use nonsupport were assessed under point and nonpoint categories and are listed in Table 5. Nonpoint sources as a whole affected about twice as many miles of streams as point sources. However, municipal point sources affected more miles of streams than any other source. Primary contact recreation was the major use impaired by municipal sources and was caused by fecal coliform pollution. Nonpoint sources, primarily surface mining and unspecified sources, impaired warmwater aquatic habitat use because of siltation.

Table 4

Relative Causes of Use Nonsupport in Rivers and Streams

Cause Category	Miles Affected: Major Impact	Miles Affected: Moderate/Minor Impact
Pathogens (fecal coliforms)	969.0	-
Siltation	723.7	126.5
Metals	369.9	124.8
Organic enrichment/D.O.	300.4	113.5
pH	184.7	-
Salinity (chlorides)	158.4	50.2
Priority organics	137.8	-
Unknown toxicity	118.0	10
Habitat modification	111.1	20.5
Nutrients	100.3	4.2
Oil and grease	37.3	-
Pesticides	27.5	-
Ammonia	-	2
Chlorine	-	2

- Not assessed

Attainment of Clean Water Act Goals

The Clean Water Act sets a national goal that, wherever attainable, water quality should provide for the protection and propagation of fish, shellfish and wildlife and provide for recreation in and on the nation's waters. These are often referred to as the fishable/swimmable goals of the Act. The data utilized to assess use support were evaluated in terms of the above goals. If warmwater aquatic habitat use was fully or partially supported, the fishable goal was assumed to be met. If a stream was not supporting the use, the fishable goal was not met. Similarly, if the primary contact recreation use was supported, then the swimmable goal was met. If the use was not supported, the goal was not met. Table 6 summarizes the attainment of the fishable/swimmable goals for Kentucky's rivers and streams. The fishable goal was met in more of the assessed waters than the swimmable goal. The swimmable goal was not met in about half of the assessed waters. As pointed out in the previous discussion, fecal coliform pollution is the major cause of this goal not being achieved. There is a difference in miles assessed for these goals because more biological data was available to assess the fishable goal than was bacteriological data to assess the swimmable goal.

Table 5

Relative Sources of Use Nonsupport in Rivers and Streams

Source Category	Miles Affected: Major Impact	Miles Affected: Moderate/Minor Impact
Point Sources		
Municipal	757.0	234.5
Industrial	234.2	11.2
CSO*	64.0	11.3
Storm sewers	27.2	
TOTAL	1,082.4	257.0
Nonpoint Sources		
Unspecified	614.2	208.4
Surface mining	600.3	156.5
Subsurface mining	249.5	78.9
Agriculture	173.8	253.1
Urban runoff	155.6	55.7
Petroleum activities	91.3	52.3
Habitat modification	86.3	68.3
Septic tanks	58.1	132.0
TOTAL	2,029.1	1,005.2
Unknown Sources	30.6	

*Combined sewer overflows

Table 6

Attainment of Clean Water Act Goals
in Rivers and Streams

Goal Attainment	Fishable Goal	Swimmable Goal
Miles meeting	7,840.7	1,307.6
Miles not meeting	792.4	1,097.8

Assessment of Pollution Caused by Toxics

The biomonitoring program focuses on the protection of aquatic life from toxic pollutants. However, one of the underlying themes of aquatic life protection is public health protection. During 1985, fish consumption advisories were issued for two streams because of the presence of PCBs in fish tissue in excess of the U.S. Food and Drug Administration (FDA) action level of 2.0 mg/kg. The advisories recommended that women of child-bearing age and pre-school children should not consume any fish from the streams, and that consumption by others should be infrequent. The streams involved were the Mud River in Logan, Butler and Muhlenberg counties and the West Fork of Drakes Creek in Simpson and Warren counties. In August 1986, the advisory on Mud River was upgraded to a warning that no one should consume fish. Information on these two streams is listed below.

List of Fishing Advisories and Bans

Stream: Mud River/Town Branch - Logan, Butler, Muhlenberg counties

Pollutant: PCBs

Type of Restriction: Warning - Signs are posted warning people not to eat fish from Mud River and Town Branch.

Area Affected: 64.7 miles

Date Established: Advisory, October 1985; Warning, August 1986

Source of Pollution: Unpermitted discharge from metal dye-cast plant

Comments: Cleanup in progress; monitoring continues, levels still elevated

Stream: West Fork Drakes Creek - Simpson, Warren counties

Pollutant: PCBs

Type of Restriction: Advisory - Consumption should be limited.

Area Affected: 46.8 miles

Date Established: April 1985

Source of Pollution: Spring draining an adhesive plant

Comments: Levels in fish appear to be declining, monitoring continues

The presence of PCBs in stream sediments and fish tissue may be an emerging problem in the state. Another toxic substance emerging as a public health concern is chlordane, which has been found in fish at levels exceeding the FDA action level at several locations throughout the state. (See following special studies discussion). Further study is needed to delineate the statewide extent of the problem.

The sediments of Mud River (Town Branch) and West Fork Drakes Creek are also contaminated by PCBs. The Mud River system is presently being studied by the University of Kentucky, under contract from the Division of Water, to determine the extent and magnitude of sediment contamination. Contamination in the West Fork Drakes Creek was limited to the area near the spring, approximately one mile.

Special Studies

The Division of Water has been involved in several studies which dealt with pollution from 307(a) priority pollutants. A summary of those studies follows.

Mississippi River/Lower Ohio River Early in 1987, the Kentucky Division of Water was notified by the State of Missouri Department of Conservation that a Fish Consumption Advisory had been issued for the Mississippi River, including the reach bordering Kentucky. The advisory was based on data showing chlordane levels exceeding FDA action levels in different species of fish taken from several locations. During a meeting among the Kentucky state agencies involved, i.e. Kentucky Department of Fish and Wildlife Resources (KDFWR), Cabinet for Human Resources (CHR) and Division of Water (DOW), it was decided that a study of fish contamination in the Mississippi and lower Ohio rivers would be undertaken. In late February, CHR collected samples of fish at several fish markets along the Mississippi River. These samples were analyzed by the CHR laboratory and split with the Department for Environmental Protection, Division of Environmental Services (DES) laboratory. The DOW coordinated a study with KDFWR to collect fish from three sites on the Mississippi and two sites on the lower Ohio. Fish were collected by KDFWR and transferred to DOW for processing and analysis. Sediment samples were also collected at all sites.

Fish samples from the Mississipi River were split with EPA Region IV and the State of Missouri. Fish samples from the lower Ohio River were split with EPA Region IV. Duplicate samples were also analyzed.

The chlordane values displayed a wide variation, with no distinct pattern related to location or type of fish, although channel catfish generally showed higher levels than others. According to DOW data, two out of nine samples had chlordane values above FDA action levels (one each from the Mississippi and Ohio rivers). The EPA Region IV split sample data indicated that only one out of ten samples were above the action level (an Ohio River sample). The results from Missouri on the split samples from the Mississippi River indicated that seven out of nine fillet samples were above the action level. Many of the values were either slightly above or below the action level. The Ohio River (below Paducah) fish samples had somewhat elevated chlordane values, which is not unusual near a large urban area (DOW historical data). No PCB or DDT values were above the action levels for those contaminants. None of the sediment samples had detectable levels of chlordane or PCBs.

Levisa Fork/Fishtrap Reservoir The Kentucky Division of Water was notified by the Virginia Water Control Board (VWCB) in July 1987 of a potential water quality problem in the Levisa Fork. Fish samples collected by VWCB in July 1986 showed levels of PCBs above the FDA action level. They conducted a more intensive study to delineate the extent and source of the problem during July 1987.

To determine if a PCB contamination problem existed in the Kentucky portion of Levisa Fork, a screening study was conducted the first week of August 1987. Two stations were sampled for fish tissue and sediment analysis. One station was in Fishtrap Reservoir, the other in the Levisa Fork above the reservoir.

No fish fillet sample contained PCB levels above the FDA action level; therefore, no action has been taken at present. The DOW will continue to monitor this area to assess the extent of the contamination problem.

Mud River/Green River During the reporting period, the DOW continued to monitor the PCB contamination of fish tissue and sediment in the Mud River system and in the Green River. As was reported in the last 305(b) report, the Mud River system has been extensively contaminated by an unpermitted discharge of PCBs. The Mud River (64.7 miles) is still under a fish consumption warning because of the continuing high levels of PCBs present in fish and sediment. An extensive collection of fish for tissue analysis was conducted in the Green River during 1987. The DOW has contracted with the University of Kentucky to study the extent and magnitude of water and sediment contamination in the Town Branch, Mud River and Green River. However, results are not yet available.

Drakes Creek Fish and sediments from Drakes Creek were sampled during 1986. Although PCB levels appear to be declining, a fish consumption advisory remains in effect for 46.8 miles of the West Fork and mainstem of Drakes Creek.

EPA National Bioaccumulation Study During 1987, the Division of Water participated in the National Bioaccumulation study. Fish were collected from three stations (Big Sandy-Cattletsburg, Mud River-Russellville and Ohio River-West Point) within the state. Samples were transferred to EPA for analysis. Results have not yet been received from EPA.

304(l) Report

Section 304(l) of the 1987 amendments to the Clean Water Act requires states to focus attention on waters impaired by point source discharges of toxic (priority or Section 307(a)) pollutants. A preliminary list of affected waters and point source dischargers is required to be submitted as part of each state's 305(b) report by April 1, 1988. Data will continue to be collected and refined throughout 1988, and a final list with control strategies is to be submitted by February 1989. In addition to the list of waters affected by point source discharges of toxic pollutants, Section 304(l) also requires that all waters impaired by conventional and nonconventional pollutants, and nonpoint (or unknown) sources of toxic pollutants be listed. These three lists, with their 304(l) subdivisions, are quoted below. They are commonly referred to as the "mini list," "long list," and "short list," respectively.

(A)(i): A list of waters for which the state does not expect to achieve numeric water quality standards for Section 307(a) toxic pollutants after technology-based requirements have been met, due to either point or nonpoint sources of pollution. This list is a subset of the (A)(ii) list described below and could be a very short list where a state has few or no numeric criteria for Section 307(a) toxics, even if water quality impairments due to toxicity are occurring in many of the state's waterbodies.

(A)(ii): A comprehensive list of waters impaired by point or nonpoint source discharges of toxic, conventional, and nonconventional pollutants. This list should reflect all waters needing additional control actions, whether the problem is toxicity or some other impairment.

(B): A list of waters the state does not expect to achieve "applicable standards" after technology-based requirements have been met, due entirely or substantially to point source discharges of Section 307(a) toxics. EPA interprets "applicable standards" to mean both numeric criteria for Section 307(a) toxic pollutants and narrative "free from toxicity" standards.

Individual control strategies for point source discharges of toxic pollutants contributing to water quality problems are to be developed by February 4, 1989. The purpose of this effort is to meet applicable water quality standards by June 4, 1992. The primary means of attaining this goal will be through the Kentucky Pollutant Discharge Elimination System (KPDES) permitting process administered by the Kentucky Division of Water (DOW). Where permits are not reissued by February 1989, a draft or interim permit with a compliance schedule must be issued to meet the 1992 deadline. This will require the reopening of permits known to have toxic discharge problems even though they are not due for reissuance under the normal 5-year KPDES permitting cycle. Any problems with conventional and nonconventional pollutants in those dischargers identified to have toxics problems must also be addressed when the permit is reissued or reopened. Furthermore, EPA (under language of Section 303(b)(1)c)) requires that water quality-based permit limits be developed for waters that are not achieving water quality standards due to any pollutant causing toxic effects, not just the Section 307(a) toxic pollutants.

Methods To aid the states in their efforts to draw up the three lists, EPA outlined 16 categories of information on which data should be collected.

1. Waters where fishing or shellfish bans and/or advisories are currently in effect or are anticipated.

2. Waters where there have been <u>repeated</u> fish kills or where abnormalities (cancers, lesions, tumors, etc.) have been observed in fish and other aquatic life during the last ten years.

3. Waters where there are restrictions on water sports or recreational contact.

4. Waters identified by the states in the 1982, 1984, 1986 or draft 1988 State Section 305(b) reports as either "partially achieving" or "not achieving" designated uses.

5. Waters identified by the states and reported to EPA in the third quarter of FY 87 as waters needing water quality-based controls for "toxics" and "non-toxics."

6. Waters identified by the states as priority waterbodies in FY 86 because of impaired or threatened uses.

7. Waters where ambient data indicate the presence of Section 307(a) toxic pollutants from primary industries.

8. Waters for which effluent toxicity test results indicate possible violations of state water quality standards, including narrative "free from" criteria or EPA criteria where state standards are not available.

9. Waters with primary industrial major dischargers where simple dilution analyses indicate violations of state water quality standards (or EPA criteria where state standards are not available) for Section 307(a) toxic pollutants, ammonia, or chlorine. These dilution analyses could be based upon estimates of best available technology economically achievable (BAT) levels from effluent guidelines development documents, National Pollutant Discharge Elimination System (NPDES) permit application data (e.g., Form 2C), discharge monitoring reports (DMRs), or other available information.

10. Waters with municipal major dischargers requiring pretreatment where simple dilution analyses indicate violations of state water quality standards (or EPA criteria where state standards are not available) for Section 307(a) toxic pollutants, ammonia or chlorine. These dilution analyses could be based upon data from NPDES permit applications (e.g., Form 2A), DMRs, or other available information.

11. Waters with known or suspected use impairments where dilution analyses indicate violations of state water quality standards (or EPA criteria where state standards are not available) for Section 307(a) toxic pollutants, ammonia, or chlorine. This category includes waters with facilities not included in the previous two categories such as municipal majors not required to have pretreatment, federal majors, and minors having water quality impacts. These dilution analyses could be based upon estimates of BAT levels from effluent guidelines, development documents, NPDES permit application data, DMRs or other available information.

12. Waters classified for uses that will not support the "fishable/swimmable" goal of the Clean Water Act.

13. Waters where ambient toxicity or adverse water quality conditions have been reported by local, state, EPA or other federal agencies, the private sector, public interest groups, or universities. The organizations and groups should be actively solicited for research they may be conducting or reporting. For example, state university researchers, the USDA Extension Service, and the U.S. Fish and Wildlife Service are good sources of current field research and activities.

14. Waters identified as having impaired or threatened designated uses in the Clean Lakes Assessments conducted under Section 314 of the Clean Water Act.

15. Waters identified as impaired by nonpoint sources in the 1985 Association of State and Interstate Water Quality Pollution Control Administrator's report America's Clean Water: State's Nonpoint Source Assessment and waters identified as impaired or threatened in the nonpoint source assessments under Section 319 of the Clean Water Act.

16. Surface waters impaired by pollutants from hazardous waste sites on the National Priority List prepared under Section 105(8)(A) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

EPA subcontracted the work to be done under Categories 7, 9, 10 and 11. Information on the other categories was collected by the state and provided to the subcontractor for coding into a computer-based format acceptable to EPA.

Categories 1-3 are self-explanatory. Fish kill data were provided by the Department of Fish and Wildlife Resources and Kentucky's 1986 305(b) report.

Category 4 comprises the initial 1988 305(b) report determinations and also includes information that falls under Category 13. All segments that are reported as not fully meeting designated uses in the 305(b) report are included on the "long list." Ambient data on toxics was one of many factors that was evaluated in the 305(b) reporting process. If biological data indicated no impacts, then the segment was listed as supporting designated uses whether or not some ambient data showed violation of water quality standards. Therefore, segments with ambient violations of water quality standards may or may not appear on the "mini list."

Categories 5 and 6 were not used because Kentucky did not report: 1) waters needing water quality based controls (nearly all permits in Kentucky are written with water quality-based limits); or 2) priority watersheds.

Category 7 was performed by EPA personnel by means of STORET data and other computer data bases identifying industry locations and types. This information was useful in identifying potential point source discharges of toxics that may be contributing to elevated ambient levels. However, there were several problems with the methodology. First, industries were assigned assumed pollutant discharges based on their standard industrial classification code, industrial Category, and BAT technology. This approach is not appropriate in Kentucky, where most permits are water-quality based. Second, industries located on small streams with no assigned reach number were not included. This methodology omits many significant dischargers on small creeks. Third, many industries now discharge to municipal facilities, which were not included in the analysis. Therefore, the industries and their pollutants actually discharging into a particular reach may be significantly different than the generalized Category 7 information. The information from category 7 should also appear in discharge monitoring reports (DMRs) submitted by industries because the toxics that are analyzed from ambient station samples are also monitored in wastewater discharges.

Data for Category 8 were collected by reviewing : 1) biomonitoring tests performed since 1984 by the Division of Water on 36 municipal and 17 industrial discharges; 2) Permits Compliance System (PCS) violations for Section 307(a) toxic pollutants, chlorine, and ammonia; and 3) pretreatment program data submitted by POTWs with industries that contained data on 307(a) toxics and other pollutants. This latter data is not in a computer data base and necessitated the examination of semi-annual reports submitted by POTWs that contain influent and effluent data on many toxic parameters. Only positive results from effluent-dominated streams (at 7Q10) were used as "other-toxics" data for the biomonitoring tests and ammonia or chlorine permit violations. Permit violations of Section 307(a) toxics resulted in segment listing where violations were of water quality-based limits. However, violations of technology-based limits on larger rivers did not necessarily result in instream problems because of available stream dilution. Technology-based limits should be met even where there is no discernable problem in the receiving stream. Although these dischargers exceeding technology-based limits may not appear on the "short list", they are targeted for enforcement action. KPDES permits were examined to identify discharges on water quality limited streams that have been issued technology-based limits. This was accomplished by means of a computer printout from PCS listing all permits with toxics and their permit limits.

The dilution analyses referenced in categories 9-11 were also performed primarily by a subcontractor, and methods will be detailed in their report (Research Triangle Institute, in print). Generally, the methods involved using computer data bases for: 1) lists of industries and municipalities; 2) industry averages for pollutant concentrations based on BAT; 3) stream locations and flows; and 4) pollutant standards. Again, as in Category 7, the generalized approach has several drawbacks. First and foremost, pollutant concentrations discharged are based on technology-based limits (BAT), while Kentucky issues water quality-based permits when appropriate. Thus, pollutant levels estimated in the streams will often be overestimated. Second, industries with no assigned industrial category or effluent guidelines, are not included in the analysis. Third, where an industry was located on a small stream not in the REACH system, flow from the nearest downstream segment in REACH was used. Thus, many industry discharges will be mixed with more stream flow than is actually there. Lastly, many industries on the list were no longer discharging, either because they have been inactivated or they now discharge to a municipality.

Stream segments that appear on the "short list" from the subcontractor dilution calculations were investigated in detail to determine the cause for listing and if the listing was reasonable. In many cases, a stream segment appears on the "short list" because of human health criteria. If that stream segment is not a source of domestic water supply, it was not included on the "short list" provided with this report. If a stream segment appeared on the "short list" because of stream flow estimates or discharge concentrations that are known to be unrealistic, then that segment was also not included in this report.

Category 12 is not applicable because Kentucky has no waters which are designated for uses below that necessary to maintain fishable/swimmable status.

Category 13 information was primarily included in the 305(b) report determination, and has been previously accounted for in Category 4. This data consisted largely of ecological studies conducted by DOW. Data collected included stream biota, sediments, fish tissue and water quality.

Category 14 was based on the DOW's ambient lakes monitoring program and previous Clean Lakes studies.

Further dilution calculations have been and will be made by DOW to determine is additive effects of dischargers are a problem, especially in areas where several facilities are in close proximity. The data used in these calculations usually comes from the permit limits.

Category 15 is included in the 305(b) report as the Section 319 nonpoint source reporting requirements. Stream segments affected by nonpoint sources are referenced to that portion of the 305(b) report. Because of the lack of hard data in this area, these segments would appear only on the "long list" in the final submittal of Section 304(l) requirements in February 1989.

Category 16 segments were identified by the Kentucky Division of Waste Management. Because Resource Conservation and Recovery Act (RCRA) and CERCLA sites have the potential to affect surface waters, they were included in this category. Only those surface waters known to be impaired by RCRA or CERCLA sites were included. There are many instances of known groundwater contamination not proven to be causing a surface water problem.

Results Results of the work are summarized in Tables 7, 8 and 9. The short list contains 23 stream segments with known or potential toxics problems from point sources. The mini list contains 45 stream segments which have toxics problems due to either point, nonpoint or unknown sources. The long lists contains 331 segments that are affected by toxic, conventional or nonconventional pollutants from any sources.

The 23 stream segments on the short list are affected by 15 industrial facilities, nine municipal sewage treatment plants (STPs or POTWs), and four RCRA or CERCLA waste sites (Table 7). Two of the waste sites, B.F. Goodrich in Calvert City and Mid-South Electric in Manchester, were listed because of problems from both permitted discharges and manifestation of groundwater contamination in surface waters. Several of the facilities on the short list are presently under enforcement action, and others will either cease to discharge or will discharge to a POTW.

The mini list (Table 8) comprises the segments on the short list and segments that contained toxics above water quality standards in ambient samples where the source(s) could not be determined, and use nonsupport was noted in the 305(b) report. Most of the segments falling into the latter category result from ambient metals levels at DOW primary water quality monitoring stations. Three segments (Cypress Creek in Calvert City, Mississippi River, and Nolin River) were listed because of chlordane or PCB levels in fish tissue. As was stated earlier in the methodology section, it should be realized that where other data (usually biological) indicated no use impairment, segments with some ambient data violations of water quality standards were not listed. There are numerous sites in the state where a few violations of metals criteria occurred that do not appear on the mini list. Ambient data are also scarce for the majority of the Section 307(a) organic pollutants.

The long list consists of 331 segments that are a compilation of all known water quality problems in the state (Table 9). Other than the segments listed because of their appearance on the "mini list," most of these segments are listed as a result of: 1) fecal coliform bacteria data from DOW primary stations or intensive bacteriological surveys; 2) ammonia, chlorine, or whole effluent toxicity from DMR and biomonitoring data; 3) siltation and acid drainage from coal mining activities; 4) salinity from oil and gas well operations; and 5) nutrient/organic enrichment from STPs and private sewer lines and septic fields. Those segments listed solely because of discharger information (i.e., permit violations, ammonia, chlorine or, whole effluent toxicity) were not included in the assessment of designated use support presented in Table 1.

Table 7

304(l) Short List

	Waterbody	Reach Number	Facility	KPDES Number	Source[a]	Toxics
1)	UT and Limestone Creek	05090201	Wald Manufacturing	0000477	1	Metals
2)	UT and Rock Lick Creek	05100101	Maxey Flats Nuclear Waste Disposal Facility	-[b]	3	Organics
3)	Stoner Creek	05100102	Paris STP	0021059	2	Metals
4)	South Fork Licking River	05100102	Cynthiana STP	0023370	2	Metals
5)	UT and Strodes Creek	05100102	Contech Construction	0073237	1	Metals
6)	Sexton and Bray creeks	05100203	Mid-South Electric	0026735	1,3	Metals
7)	UT, Cedar Brook, and Bailey Run	05100205	Universal Fasteners	001724	1,4	Metals
8)	Town Br. and S. Elkhorn Creek	05100205	Lexington (Town Br.) STP	0021491	2	Metals
9)	Knob Creek	05140102	Tri-City Industrial	-[b]	3	Tetra-chloroethene
10)	Fox Run	05140102	Eminence STP	0026883	2	Metals, cyanide
11)	Thrasher Creek	05140201	Commonwealth Aluminum	0002666	1	Zinc, cyanide
12)	Hidden River (underground to Green River)	05110001	Horse Cave STP/Ken-Dec, Inc.	0041092	2,6	Metals
13)	UT and Taylor Fork	05110001	Leitchfield STP	0022934	2	Metals

Table 7 (continued)

	Waterbody	Reach Number	Facility	KPDES Number	Source[a]	Toxics
14)	West Fork and Drakes Creek	05110002	Kendall Company	0074659	4,6	PCBs
15)	Town Br. and Mud River	0511003	Rockwell Int.	-[b]	4,6	PCBs
16)	Yellow Creek	05130101	Middlesboro STP	0027235	1,6	Metals
17)	Trib. and E. Fk. Lynn Camp Creek	05130101	National Standard	0003778	1	Metals
18)	North Fork Little River	05130205	Hopkinsville STPs	0023388 0066532	2	Metals
19)	Tennessee River	06040006	B.F. Goodrich	0003484	1,3	EDC
20)	Clark's Run	05100205	North American Phillips Lighting	0002607	5	Lead
21)	UT to South Fork Little River	05130205	Pop Fasteners Division	0003786	7	Zinc
22)	Northern Ditch (Pond Creek)	05140101	Cardinal Extrusion Co. Cardinal Aluminum Co.	0034835 0071978	5 5	Metals Metals
23)	Ash Run	05140101	Anamag LP	0002208	7	Copper

[a]Source:
1) PCS Permit Violations
2) Pretreatment Reports/STP Data from Division of Water
3) Division of Waste Management
4) Special Studies
5) Discharge at permit limits would exceed instream water quality standards
6) Enforcement Branch
7) Monitored - only data (i.e. data collected, but no permit limits)

[b]No permitted discharge

Table 8

304(l) Mini List

Waterbody		Reach Number	Toxics
1)	UT and Limestone Creek	05090201	Metals
2)	Licking River	05100101	Metals
3)	UT and Rock Lick Creek	05100101	Organics
4)	Stoner Creek	05100102	Metals
5)	South Fork Licking River	05100102	Metals
6)	UT and Strodes Creek	05100102	Metals
7)	North Fork Kentucky River	05100201	Zinc
8)	Red River	05100204	Metals
9)	Sexton and Bray creeks	05100203	Metals
10)	Cane Run	05100205	Unknown toxicity
11)	Clark's Run	05100205	Unknown toxicity, lead
12)	UT, Cedar Brook, and Bailey Run	05100205	Metals
13)	Town Br. and S. Elkhorn Creek	05100205	Metals
14)	Northern Ditch (Pond Creek)	05140101	Metals
15)	Ash Run	05140101	Copper
16)	Knob Creek	05140102	Tetra-chloroethene
17)	Fox Run	05140102	Metals, cyanide
18)	Thrasher Creek	05140201	Zinc, cyanide
19)	Hidden River (underground)	05110001	Metals
20)	Little Pitman Creek	05110001	Pesticides

Table 8 (continued)

Waterbody		Reach Number	Toxics
21)	Nolin River	05110001	Chlordane in fish
22)	UT and Taylor Fork	05110001	Metals
23)	West Fork and Drakes Creek	05110002	PCBs
24)	Barren River	05110002	Lead
25)	Town Br. and Mud River	05110003	PCBs
26)	Pond Creek	05110003	Metals
27)	Caney Creek	05110003	Metals
28)	Pond River	05110006	Metals
29)	Cypress Creek	05110006	Metals
30)	Harris Creek	05110006	Metals
31)	Yellow Creek	05130101	Metals
32)	Trib. and E. Fk. Lynn Camp Creek	05130101	Metals
33)	Cumberland River	05130101	Metals
34)	North Fork Little River	05130205	Metals
35)	UT to South Fork Little River	05130205	Zinc
36)	Little River	05130205	Metals
37)	Cumberland River	05130205	Metals
38)	Pond River	05140102	Metals
39)	Salt River	05140102	Metals
40)	Tradewater River	05140205	Metals
41)	Tennessee River	06040006	EDC

Table 8 (continued)

Waterbody		Reach Number	Toxics
42)	E. Fork Clarks River	06040006	Metals
43)	Cypress Creek	06040006	PCB in fish, Metals in sediment, Unknown toxicity
44)	Mayfield Creek	08010201	Metals
45)	Mississippi River	08010100	Chlordane in fish

TABLE 9. 304(1) LONG LIST

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS 0
05100205	CEDAR BROOK							*						*								
05100205	TRIB. TO CEDAR BROOK							*						*		*						
05100205	BAILEY RUN									*				*								
05070201010	TUG FORK				*										*			*				
05070201018	BIG CREEK				*													*				
05070201028	KNOX CREEK				*													*				
05070202016	ELKHORN CREEK							*								*						
05070203	DEWEY LAKE										*							*				
05070203	FISHTRAP LAKE										*							*				
05070203018	LEVISA FORK (PAINTSVILLE)				*										*			*				
05070203032	LEFT FORK BEAVER CREEK							*								*						
05070203035	MUD CREEK				*													*				
05070203038	MUD CREEK				*													*				
05070203039	MUD CREEK				*													*				
05070203042	LEVISA FORK (PIKESVILLE)				*										*			*				
05070204	CHADWICK CREEK							*						*								
05070204001	BIG SANDY RIVER							*						*								
05070204015	BLAINE CREEK				*										*							
05070204016	BLAINE CREEK				*										*							
05070204018	BLAINE CREEK				*										*							
05070204020	BLAINE CREEK				*										*							
05070204021	BLAINE CREEK				*										*							
05070204023	LEFT FORK MIDDLE CREEK				*													*				
05070204024	BLAINE CREEK				*										*							
05070204025	BLAINE CREEK				*										*							
05070204034	BIG SANDY RIVER				*										*		*	*				
05090103002	TYGART'S CREEK				*										*			*				
05090103004	TYGART'S CREEK				*										*			*				
05090103006	TYGART'S CREEK				*										*			*				
05090103008	TYGART'S CREEK				*										*			*				
05090103010	TYGART'S CREEK				*										*			*				
05090103012	TYGART'S CREEK				*										*			*				

KEY: T = Priority Pollutants, NT = Nontoxics, OT = Other toxics (Cl, NH3)
PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

TABLE 9.(Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS 0
05090103014	TYGART'S CREEK				*										*			*				
05090103016	TYGART'S CREEK				*										*			*				
05090103026	TYGARTS CREEK							*								*						
05090104004	LITTLE SANDY RIVER				*										*			*				
05090104005	LITTLE SANDY RIVER				*										*			*				
05090104009	LITTLE SANDY RIVER				*										*			*				
05090104011	LITTLE SANDY RIVER				*										*			*				
05090104013	LITTLE SANDY RIVER				*										*			*				
05090104014	LITTLE SANDY RIVER				*										*			*				
05090104016	LITTLE SANDY RIVER				*										*			*				
05090104018	LITTLE SANDY RIVER				*										*			*				
05090104019	LITTLE SANDY RIVER				*										*			*				
05090104020	LITTLE SANDY RIVER				*										*			*				
05090104032	NEWCOMBE CREEK				*										*							
05090104049	EAST FORK LITTLE SANDY R.				*													*				
05090104051	EAST FORK LITTLE SANDY R.				*													*				
05090104052	EAST FORK LITTLE SANDY R.				*													*				
05090104053	EAST FORK LITTLE SANDY R.				*													*				
05090104055	EAST FORK LITTLE SANDY R.				*													*				
05090104057	EAST FORK LITTLE SANDY R.				*													*				
05090201	TRIB. TO LIMESTONE CREEK							*								*						
05090201	TRIB. TO LAWRENCE CREEK							*								*						
05090201	TRIB. TO LIMESTONE CREEK									*				*								
05090203	TRIB. TO S FK GUNPOWDER C							*								*						
05090203	TRIB. TO S FK GUNPOWDER C							*								*						
05100101	A.J. JOLLY LAKE										*							*				
05100101	WILLIAMSTOWN LAKE										*							*				
05100101	ROCKHOUSE FORK				*										*							
05100101	RACCOON CREEK				*										*							
05100101	STATE ROAD FORK				*										*							
05100101	LICK CREEK				*										*							
05100101	TOWN BRANCH OF FLEMING CR							*								*						

KEY: T = Priority Pollutants, NT = Nontoxics, OT = Other toxics (Cl, NH3)
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TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS O
05100101	BRUSHY FORK OF GRASSY CR.							*								*						
05100101	BANKLICK CREEK		*																		*	
05100101001	LICKING RIVER				*															*		
05100101012	LICKING RIVER				*													*				
05100101023	CAVE RUN LAKE										*							*				
05100101030	CAVE RUN LAKE										*							*				
05100101031	BEAVER CREEK							*								*						
05100101032	CAVE RUN LAKE										*							*				
05100101033	CAVE RUN LAKE										*							*				
05100101034	CAVE RUN LAKE										*							*				
05100101036	CAVE RUN LAKE										*							*				
05100101037	CAVE RUN LAKE										*							*				
05100101039	CAVE RUN LAKE										*							*				
05100101046	LICKING RIVER				*										*			*				
05100101048	BURNING FORK				*										*							
05100101051	CAVE RUN LAKE										*							*				
05100101061	NORTH FORK LICKING RIVER				*													*				
05100101063	KINCAID (FALMOUTH) LAKE										*							*				
05100102	INDIAN CREEK				*										*							
05100102	BIG BRUSHY CREEK				*													*				
05100102	BRUSHY FORK				*										*			*				
05100102	TRIB. TO BRUSHY FORK				*										*							
05100102	TRIB. TO STRODES CREEK							*								*						
05100102	TRIB. TO BRUSHY FORK							*								*						
05100102	TRIB. TO STRODES CREEK									*				*	*							
05100102	TRIB. TO BRUSHY FORK									*				*	*							
05100102	BRUSHY FORK							*		*						*						
05100102001	SOUTH FORK LICKING RIVER				*										*							
05100102003	SOUTH FORK LICKING RIVER				*										*							
05100102005	SOUTH FORK LICKING RIVER				*										*							
05100102007	SOUTH FORK LICKING RIVER				*										*							

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PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

TABLE 9.(Continued)

Reach	Waterbody Name	1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS O
05100102009	SOUTH FORK LICKING RIVER				*			*		*				*	*	*		*		*		
05100102014	STONER CREEK							*						*		*						
05100102015	HOUSTON CREEK				*													*				
05100102020	HANCOCK CREEK				*													*				
05100102021	STRODES CREEK				*			*							*	*		*				
05100102022	STONER CREEK				*										*			*				
05100102026	HINKSTON CREEK				*			*							*	*		*				
05100201	CARR FORK LAKE										*							*				
05100201	SOUTH FORK QUICKSAND CR.				*													*				
05100201	LOST CREEK				*													*				
05100201003	NORTH FORK KENTUCKY RIVER				*													*				
05100201004	NORTH FORK KENTUCKY RIVER				*												*	*				
05100201012	ROCKHOUSE CREEK				*													*				
05100201015	TROUBLESOME CREEK				*													*				
05100201017	TROUBLESOME CREEK							*								*						
05100201020	QUICKSAND CREEK				*													*				
05100201023	SPRING FORK				*													*				
05100202002	BUCKHORN LAKE										*							*				
05100202013	CUTSHIN CREEK		*		*													*			*	
05100202015	CUTSHIN CREEK				*													*				
05100203	BRAY CREEK							*						*	*							
05100203003	SEXTON CREEK									*				*								
05100203008	GOOSE CREEK							*								*						
05100204	SAND LICK FORK				*										*							
05100204	JUDY CREEK							*		*						*						
05100204023	MILLERS CREEK				*										*							
05100204025	BIG SINKING CREEK				*										*							
05100204026	BILLY FORK				*										*							
05100204032	RED RIVER							*							*	*						
05100204035	SOUTH FORK RED RIVER				*										*							
05100204040	SWIFT CAMP CREEK				*			*		*					*	*						

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PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS O
05100204041	RED RIVER				*													*		*		
05100204043	RED RIVER				*													*				
05100205	WILGREEN LAKE										*							*				
05100205	STANFORD LAKE										*										*	
05100205	GENERAL BUTLER ST. PARK L										*							*				
05100205	LOGAN CREEK							*		*						*						
05100205	DREAMING CREEK							*		*						*						
05100205	BRUSHY CREEK							*		*						*						
05100205	WHITE OAK CREEK							*		*						*						
05100205	WALNUT MEADOW CREEK				*			*		*					*	*						
05100205	TOWN FORK							*		*						*						
05100205	TOWN BRANCH							*		*						*						
05100205	ROYAL SPRING							*		*						*						
05100205	STEAMMILL BRANCH							*								*						
05100205	SOUTH BENSON CREEK		*												*							
05100205001	KENTUCKY RIVER							*								*						
05100205004	TOWN CREEK							*								*						
05100205021	CLARKS RUN							*		*				*	*	*						
05100205025	DIX RIVER				*										*							
05100205026	DIX RIVER							*								*						
05100205036	SILVER CREEK				*										*							
05100205037	SILVER CREEK				*										*							
05100205038	SILVER CREEK				*										*							
05100205043	TATES CREEK							*		*						*						
05100205059	W. HICKMAN CREEK							*		*						*						
05100205061	GLENNS CREEK							*								*						

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TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS O
05100205064	LEE'S BRANCH				*			*		*					*	*						
05100205065	SOUTH ELKHORN CREEK				*					*				*	*	*						
05100205067	TOWN BR. (SOUTH ELKHORN)				*			*		*				*	*	*		*				
05100205069	CANE RUN				*										*			*				
05100205070	NORTH ELKHORN CREEK				*										*							
05100205074	EAGLE CREEK				*										*			*				
05100205075	EAGLE CREEK				*										*			*				
05100205076	EAGLE CREEK				*										*			*				
05110001	CAMPBELLSVILLE CITY LAKE										*							*				
05110001	SHANTY HOLLOW LAKE										*							*				
05110001	LIBERTY LAKE										*							*				
05110001	SALEM LAKE										*							*				
05110001	METCALFE COUNTY LAKE										*							*				
05110001	SULPHUR CREEK							*								*						
05110001	BUCKHORN CREEK							*		*						*						
05110001	HIDDEN RIVER(underground)							*						*		*						
05110001007	S. FK. LITTLE BARREN R.							*								*						
05110001026	GREEN RIVER							*								*						
05110001033	LITTLE PITMAN CREEK				*										*		*					
05110001042	NOLIN RIVER				*										*		*	*				
05110001046	NORTH FORK NOLIN RIVER							*								*						
05110001048	VALLEY CREEK							*								*						
05110002	BLACK LICK CREEK				*										*							
05110002	CURTIS BRANCH							*								*						
05110002005	BARREN RIVER				*												*					
05110002006	DRAKES CREEK	*								*				*								
05110002007	DRAKES CREEK	*								*				*								
05110002008	WEST FORK DRAKES CREEK	*						*		*				*								
05110002014	BARREN RIVER LAKE										*							*				
05110002021	BARREN RIVER LAKE										*							*				
05110002022	BARREN RIVER LAKE										*							*				
05110002023	BARREN RIVER LAKE										*							*				

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TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS OT
05110002025	BARREN RIVER LAKE										*							*				
05110002037	BARREN RIVER LAKE										*							*				
05110002039	BARREN RIVER LAKE										*							*				
05110002040	BARREN RIVER LAKE										*							*				
05110002042	BARREN RIVER LAKE										*							*				
05110003	BRIGGS LAKE										*							*				
05110003	POND CREEK				*												*	*				
05110003	CANEY CREEK				*												*	*				
05110003	TOWN BRANCH							*								*						
05110003	LEWISBURG LAKE										*							*				
05110003	TOWN BRANCH									*				*								
05110003	TOWN BRANCH	*												*								
05110003004	MUD RIVER	*												*								
05110003008	WOLF LICK CREEK							*								*						
05110003014	MUD RIVER				*			*		*				*	*	*				*		
05110004	CANEYVILLE LAKE										*							*				
05110004	WEST FORK ADAMS FORK							*								*						
05110004006	CANEY CREEK							*								*						
05110004008	ROUGH RIVER LAKE										*							*				
05110004014	ROUGH RIVER LAKE										*							*				
05110004015	ROUGH RIVER LAKE										*							*				
05110004017	ROUGH RIVER LAKE										*							*				
05110004021	ROUGH RIVER LAKE										*							*				
05110006	HARRIS CREEK				*												*	*				
05110006	TRIB. TO FLAT CREEK							*								*						
05110006004	POND RIVER				*												*					
05110006006	POND RIVER				*												*					
05110006012	POND RIVER				*												*					
05110006013	POND RIVER				*												*					
05110006017	CYPRESS CREEK				*			*								*		*		*		
05130101	CORBIN LAKE										*				*			*				

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TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS 0
05130101	LAUREL RIVER LAKE										*				*			*				
05130101	MARTINS FORK LAKE										*							*				
05130101	BENNETT'S FORK				*													*				
05130101	LAUREL CREEK LAKE										*										*	
05130101044	CUMBERLAND RIVER				*										*		*	*				
05130101046	STONEY FORK				*													*				
05130101047	CLEAR FORK				*													*				
05130101048	CUMBERLAND RIVER				*										*		*	*				
05130101050	CUMBERLAND RIVER				*										*		*	*				
05130101052	CUMBERLAND RIVER				*										*		*	*				
05130101062	POOR FORK CUMBERLAND R.				*													*				
05130101065	LOONEY CREEK				*													*				
05130101090	CUMBERLAND RIVER				*										*		*	*				
05130103	ELK CREEK				*										*							
05130102	TOWN BRANCH							*		*						*						
05130102020	CROOKED CREEK				*													*				
05130104006	LITTLE S FK CUMBERLAND R.				*													*				
05130104010	ROCK CREEK				*													*				
05130104051	ROARING PAUNCH CREEK				*													*				
05130205	LAKE MORRIS										*							*				
05130205	NORTH FORK LITTLE RIVER							*						*								
05130205	HEMATITE LAKE										*										*	
05130205001	CUMBERLAND RIVER				*															*		
05130205002	CUMBERLAND RIVER				*															*		
05130205003	CUMBERLAND RIVER				*															*		
05130205004	CUMBERLAND RIVER				*															*		
05130205046	LITTLE RIVER				*									*			*			*		
05130205048	LITTLE RIVER				*												*					
05130206	TRIB. TO MONTGOMERY CREEK				*			*								*						
05130206030	ELK FORK				*			*								*		*				
05140101	REFORMATORY LAKE										*							*				
05140101	PADDY'S RUN							*								*						

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PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	(
05140101	SOUTH FORK BEARGRASS CR.							*								*						
05140102	MCNEELY LAKE										*				*							
05140102	TAYLORSVILLE LAKE										*				*			*				
05140102	GUIST CREEK LAKE										*							*				
05140102	LAKE SHELBY										*							*				
05140102	FISHPOOL CREEK				*										*			*				
05140102	SOUTHERN DITCH				*										*			*				
05140102	BRIER CREEK				*										*			*				
05140102	LONG LICK CREEK				*										*							
05140102	PENNSYLVANIA RUN				*										*							
05140102	BLUE LICK CREEK				*										*							
05140102	BROOKS RUN				*										*							
05140102	CHENOWETH RUN				*										*							
05140102	CANE RUN				*										*							
05140102	LONG RUN				*										*							
05140102	CHENOWETH RUN							*								*						
05140102	TOWN BRANCH							*		*						*						
05140102	MILL CREEK							*								*						
05140102	FOX RUN							*						*		*						
05140102	EAST FORK SIMPSON CREEK							*								*						
05140102002	SALT RIVER		*												*			*				
05140102003	MILL CREEK				*										*							
05140102004	SALT RIVER		*															*				
05140102005	SALT RIVER				*													*				
05140102007	COXS CREEK		*															*				
05140103012	HARDINS CREEK				*			*								*						
05140102016	HAMMONDS CREEK							*		*						*						
05140102022	CLEAR CREEK				*			*								*						
05140102025	FLOYD'S FORK				*										*							
05140102026	FLOYD'S FORK				*										*							
05140102027	FLOYD'S FORK				*										*							

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TABLE 9. (Continued)

Reach	Waterbody Name	Categories												PS			NPS			UKS		
		1	2	3	4	5	6	8	12	13	14	15	16	T	NT	OT	T	NT	OT	T	NT	(
05140102028	CURRY FORK				*										*							
05140102030	NORTH FORK CURRY RUN				*										*							
05140102031	CEDAR CREEK				*										*							
05140102033	KNOB CREEK				*					*			*	*	*			*				
05140102034	NORTHERN DITCH				*			*						*	*		*	*				
05140103	SYMPSON LAKE										*							*				
05140103	MARION COUNTY LAKE										*							*				
05140103	WILLISBURG LAKE										*							*				
05140103	BEAVER LAKE										*							*				
05140103001	ROLLING FORK LEBANON				*													*				
05140103002	ROLLING FORK LEBANON				*													*				
05140103003	ROLLING FORK LEBANON				*													*				
05140103004	ROLLING FORK NEW HAVEN				*													*				
05140103005	ROLLING FORK NEW HAVEN				*													*				
05140103007	ROLLING FORK NEW HAVEN				*													*				
05140104004	HARDINS CREEK							*								*						
05140205011	TRADEWATER RIVER				*			*								*		*		*		
05140205013	TRADEWATER RIVER				*			*								*		*		*		
05140201	KINGFISHER LAKE										*							*				
05140201	CARPENTER LAKE										*							*				
05140202	SCENIC LAKE										*										*	
05140205	LOCH MARY LAKE										*							*				
05140205	SMITH DITCH				*													*				
05140205	BUFFALO CREEK				*													*				
05140205	WEIRS CREEK				*													*				
05140205	CANEY CREEK				*													*				
05140205	MOFFIT LAKE										*										*	
05140205	LAKE BESHEAR										*										*	

KEY: T = Priority Pollutants, NT = Nontoxics, OT = Other toxics (Cl, NH3)
PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

Table 9 (continued)

REACH	WATERBODY NAME	CATEGORIES 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS OT
05100202	Middle Fork KY River				*										*			*				
05100202	Raccon Creek				*													*				
05100204	Middle Fk. Red River				*													*				
05110001049	Taylor Fk. of Bear Ck.							*						*								
05110005	Panther Creek				*													*				
05110005	S. Fk. Panther Ck.				*													*				
05110005	N. Fk. Panther Ck.							*								*	*					
05110006	Drakes Ck.				*													*				
05130101046	Yellow Ck.				*			*						*		*		*				
05130101	Trib. to E. Fk. Lynn Camp							*														
05130101	Cranks Ck.				*													*				
05130101	Marsh Ck.				*													*				
05130205	S. Fk. Little River							*							*							
05140101	Beargrass Ck.		*																		*	
05140102	Bullskin Ck.							*								*						
05140102	Salt River				*										*			*				
05140103	Chaplin River				*			*								*						
05140103	Hardins Creek				*			*								*						
05140201	Yellow Creek							*						*								
05140202	Canoe Creek				*													*				
05140205	Trib. of Owens Ck.							*								*						
05140206	Little Bayou Ck.									*				*								
05140206	Trib. to E. Fk. Clarks R.															*						
05140101	Ohio River							*						*								

TABLE 9. (Continued)

Reach	Waterbody Name	Categories 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS OT
05140205023	CRABORCHARD CREEK				*													*				
05140205024	VAUGHN DITCH				*													*				
05140206	HUMPHREY BRANCH				*													*				
05140206	PERKINS CREEK							*								*						
06040006	TRIB. TO CYPRESS CREEK							*								*						
06040006	MARTIN'S CREEK							*								*						
06040006	BEAR CREEK							*								*						
06040006	ISLAND CREEK							*								*						
06040006	CYPRESS CREEK									*												
06040006	TRIB. TO CYPRESS CREEK							*		*						*				*		
06040006012	EAST FORK CLARKS RIVER				*													*		*		
06040006017	TENNESSEE RIVER							*		*				*								
08010100026	SHAWNEE CREEK							*								*						
08010100033	MISSISSIPPI RIVER									*				*								
08010201004	BAYOU DE CHIEN									*							*					
08010201006	BAYOU DE CHIEN				*													*				
08010201008	BAYOU DE CHIEN				*													*				
08010201020	MAYFIELD CREEK				*												*					
08010201021	WEST FORK MAYFIELD CREEK							*								*						
08010201022	MAYFIELD CREEK				*												*					
08010201024	MAYFIELD CREEK				*												*					
08010201026	MAYFIELD CREEK				*												*					
08010201028	MAYFIELD CREEK				*												*					

KEY: T = Priority Pollutants, NT = Nontoxics, OT = Other toxics (Cl, NH_3)
PS = Point Source, NPS = Nonpoint Source, UKS = Unknown Source

Table 9 (continued)

REACH	WATERBODY NAME	CATEGORIES 1	2	3	4	5	6	8	12	13	14	15	16	PS T	PS NT	PS OT	NPS T	NPS NT	NPS OT	UKS T	UKS NT	UKS OT
05100202	Middle Fork KY River				*										*			*				
05100202	Raccon Creek				*													*				
05100204	Middle Fk. Red River				*													*				
05110001049	Taylor Fk. of Bear Ck.							*						*								
05110005	Panther Creek				*													*				
05110005	S. Fk. Panther Ck.				*													*				
05110005	N. Fk. Panther Ck.							*								*	*					
05110006	Drakes Ck.				*													*				
05130101046	Yellow Ck.				*			*						*		*		*				
05130101	Trib. to E. Fk. Lynn Camp								*													
05130101	Cranks Ck.				*													*				
05130101	Marsh Ck.				*													*				
05130205	S. Fk. Little River							*							*							
05140101	Beargrass Ck.		*																		*	
05140102	Bullskin Ck.							*								*						
05140102	Salt River				*										*			*				
05140103	Chaplin River				*			*								*						
05140103	Hardins Creek				*			*								*						
05140201	Yellow Creek							*						*								
05140202	Canoe Creek				*													*				
05140205	Trib. of Owens Ck.							*								*						
05140206	Little Bayou Ck.									*				*								
05140206	Trib. to E. Fk. Clarks R.																*					
05140101	Ohio River							*						*								

Corrective Action. During the remainder of 1988, Kentucky will be finalizing the "short list" and individual control strategies for each facility appearing on that list. These will be submitted in February 1989 as required by Section 304(l). A number of facilities on the list are in the process of implementing appropriate control strategies. For the most part, control strategies will follow the standard operating procedures of DOW. These procedures include the incorporation of water quality-based permit limits into some older KPDES permits that do not have adequate limits. Permit requirements will also include biomonitoring and total residual chlorine limits on all major municipal and industrial discharges, and all municipals with pretreatment programs. Specific chemical testing for toxics will also be required where appropriate. For many of the facilities on the short list with permit violations where the permit is considered sufficient, enforcement action will be the primary control strategy. Other control strategies might include the relocation or cessation of discharge.

Assessment of Pollution Caused by Non-toxics

Non-toxics are conventional pollutants such as chlorine, un-ionized ammonia, oxygen demanding substances and pathogenic organisms such as bacteria and viruses. These pollutants are a cause of concern because they are often responsible for fish kills or, like bacteria and viruses, can pose a threat to human health. Reports on fish kills and bacteriological evaluations of streams are discussed below.

Pollution Caused Fish Kills

During the current reporting period (1986-1987), 53 fish kills were reported, affecting over 81 miles of streams and 247 acres of lakes. These incidences resulted in over 359,000 fish being killed. While the number of kills decreased from the last reporting period by 17 percent, and the number of miles affected decreased by 47 percent, the number of fish killed increased by 116 percent.

Twenty-five fish kills affecting 23.3 miles of streams and 47 acres of Lake Barkley were reported during 1986. Of the reports containing counts of dead fish, two were classified as light (less than 100), seven were moderate (100-1,000) and eight were major (more than 1,000). Seven kills (35%) were attributed to sewage discharges, three (13%) to petroleum, three (13%) to toxic materials and the remainder to other causes. The largest kill, over 100,000 fish in Lake Barkley, was apparently caused by a bacterial infection.

During 1987, 30 kills affected 58.3 miles of stream and 200 acres of Taylorsville Lake. Four of the kills were classified as light, ten as moderate and ten as major. Discharge of sewage (13%), animal waste (10%) and petroleum products (10%) were the leading causes. However, nine kills (30%) were of unknown origin.

Table 10 is a summary of kills by severity, causes and river basins. A more detailed list of kills can be found in Appendix A.

Bacteriological Evaluations of Recreation Uses

The Division of Water monitors water quality for primary and secondary contact recreation use by measuring pH and fecal coliform bacteria. Waters support these uses when criteria established for protecting the uses are met. The pH criterion is a range of 6.0-9.0. The fecal coliform (FC) criteria for primary contact recreation

(PCR) use is based on a geometric mean (no greater than 200 colonies/100 ml) and a percentage (no more than 20% of all samples taken > 400 FC per 100 ml) of those samples (not less than five) taken in a 30 day period. The pH and FC limits for permitting wastewater discharges are the same, but differ in frequency of collection.

Fecal coliform bacteria are indicator bacteria commonly found in the small intestine of warm-blooded animals, including humans. They are not necessarily a cause of illness. It is their presence in sufficient numbers that indicates the likelihood of disease causing bacteria being present. The most common illnesses experienced from swimming in fecally polluted water are gastroenteritis, ear infections and skin infections (commonly called swimmer's itch).

Table 10

Fish Kill Summary

		Number Reported		
		1986	**1987**	**Total**
Severity:	Light (<100)	2	4	6
	Moderate (100-1,000)	7	10	17
	Major (>1,000)	8	10	18
	Unknown	6	6	12
	Total	23	30	53
Cause:	Sewage	7	4	11
	Agricultural operation	2	4	6
	Mining or oil operation	2	3	5
	Oil or chemical spill	6	7	13
	Natural (low D.O., etc.)	2	1	3
	Misc. (sediment, heated water, etc.)	2	2	4
	Unknown	2	9	11
	Total	23	30	53
River Basin:	Big Sandy	2	3	5
	Licking	5	7	12
	Kentucky	7	7	14
	Salt	4	4	8
	Green	1	5	6
	Upper Cumberland	1	1	2
	Lower Cumberland	1	0	1
	Tennessee	0	1	1
	Ohio tributaries	2	2	4
	Total	23	30	53
Approximate number of stream miles		23.3	58.3	81.6
Approximate acres of lakes		47	200	247
Estimated number of fish killed		129,560	229,583	359,143

In general, the main sources of fecal pollution to surface waters are improperly operating or overloaded sewage treatment facilities, agricultural sources such as animal feedlots, septic tank infiltration, and illegal direct pipe discharges. Bacteriological surveys conducted in 1986 and 1987 indicated that the greatest threat to recreational uses were municipal sewage treatment plant facilities. The data also indicated that not all of the surveyed municipal sewage treatment plant facilities met their Kentucky Pollutant Discharge Elimination System (KPDES) fecal coliform(FC) permit limits.

Bacteriological Surveys During the 1986-1987 recreation seasons, bacteriological surveys were conducted on the Elkhorn Creek and South Fork of the Licking River drainages and on the North Fork of the Kentucky River at Jackson. These streams were indicated as not supporting PCR use in the previous 305(b) report. They were surveyed to determine if the surface waters in those drainages were meeting the FC criteria for PCR and to find the source of fecal pollution. The following is a brief summary of each survey. In some cases additional data from 1985 were used in the assessment of the results. The data were assessed by the following criteria: if the geometric mean of the fecal coliform counts was above 200 colonies/100 ml, or if the counts were above 400 colonies/100 ml more than 20 percent of the time, or if any count was above 400 colonies/100 ml, then primary contact recreation use was not supported.

Elkhorn Creek Drainage

One hundred and seventy-five samples were collected at 46 stations in the drainage from 1985 to 1987. Elkhorn Creek had a FC geometric mean of 110 colonies/100 ml in 31 samples. The data indicated acceptable water quality throughout the length of Elkhorn Creek. The only noted influence was near the Old Grand Dad Distillery, where high FC counts were attributed to ducks and geese which utilized the creek near a sampling site.

North Elkhorn Creek had a geometric mean of 60 colonies/100 ml in 41 samples. The data indicated acceptable water quality. However, the data also indicated that tributaries to North Elkhorn Creek were a major source of fecal pollution. This was most likely due to agricultural practices. Of the 18 tributary samples taken in 1986, seven (39%) exceeded 400 colonies/100 ml, and the geometric mean was 298 colonies/100 ml. This data indicated that the PCR use was not supported in some of the tributaries.

Royal Springs is the source of the City of Georgetown's raw water supply. The data collected in this area indicated acceptable FC levels for a raw water supply and an acceptable geometric mean (143 colonies/100 ml) for PCR.

The 1985-1987 overall geometric mean for the South Elkhorn Creek drainage was 440 colonies/100 ml based on 53 samples which indicated nonsupport of the recreation use. The major influence to the mean was Town Branch. Of 19 samples collected from Town Branch, 15 (79%) exceeded 400 colonies/100 ml. In 1986-1987, nine of ten samples (90%) exceeded 400 colonies/100 ml. The data also indicated that there was an unidentified major source of fecal pollution in Town Branch above the Lexington WWTP discharge point. An identified source approximately three miles downstream from the Lexington WWTP was agricultural runoff from muck piles (horse manure and straw). These muck piles have been moved to another location by order of the Fayette County Health Department so they cannot drain into Town Branch.

South Fork Licking River Drainage

One hundred and fifty-five samples were collected at 58 stations in the drainage during 1987. The FC geometric mean for the survey, including FC levels in the permitted discharges to the South Fork Licking River drainage, was 234 colonies/100 ml, which indicated that some recreational use impairment was occurring. An examination of the data taken near municipal WWTP's indicated that they were the primary source of fecal pollution. Agricultural practices such as allowing cattle in creeks and/or runoff from pasture land were another source of fecal pollution. In particular, the discharges from the Cynthiana WWTP impaired the South Fork of the Licking River, the Paris WWTP impaired Stoner Creek, the Carlisle WWTP impaired Brushy Fork, the Winchester WWTP impaired Strodes Creek and the North Middletown WWTP impaired Indian Creek.

North Fork Kentucky River

Of 35 samples collected at 16 locations in the Jackson area, 20 (57%) exceeded the criteria used to assess primary contact recreational use. The geometric mean for the survey was 875 colonies/100 ml, which was over three times as great as the criterion.

The Jackson WWTP was discharging concentrated sludge at the time of sampling. This impaired the North Fork of the Kentucky River for primary contact recreation use for a distance of approximately 33 miles downstream. Other sources of fecal pollution were lift station overflows which bypassed raw sewage into the river.

Compliance Sampling Inspections

In 1986, fecal coliform sampling was conducted on 13 municipal effluents and their respective receiving streams. Of those 13 facilities, five (38%) had counts above 400 colonies/100 ml, an indication that they might not be meeting their FC permit limits. Streams below three of the facilities had increased counts that were above criteria levels, indicating that they were the sources of recreational use impairments.

In 1987, stream samples from above and below seven municipal WWTPs, as well as final effluent samples, were collected on five occasions within a 30 day period. The data were used to assess compliance with FC permit requirements and to evaluate the achievement of the FC criteria for PCR in the receiving streams. Four facilities did not meet their FC permit limits. Two of three other municipal facilities which were sampled once had very high FC counts. This indicated that they might not be meeting their permit limits.

Of the seven streams sampled in 1987 where the PCR FC criteria were evaluated, five exceeded the criteria for PCR at the sampling location above the municipal effluent discharge point. At the downstream sampling sites, five of seven did not meet the criteria. It was determined that three of these downstream sites did not meet the criteria because of effluent discharges from municipal facilities. Upstream sources were responsible for the criteria being exceeded at the other two sites.

State Park Beaches Fecal coliform data collected at 12 state park swimming beaches in 1987 by the Kentucky Department of Parks showed water quality to be acceptable for PCR use. No illnesses or disease outbreaks related to PCR usage at these beaches were reported during 1986-1987. Water quality monitoring at these locations had increased during 1987 and should provide more data in the future. No incidences of waterborne diseases or illnesses were reported from other locations in the Commonwealth during 1986-1987.

CHAPTER 2

LAKE WATER QUALITY ASSESSMENT

LAKE WATER QUALITY ASSESSMENT

Section 314 of the Clean Water Act of 1987 requires that states submit a lake water quality assessment as part of their biennial 305(b) report. Six areas are to be included in the assessment. These are:

(1) An identification and classification according to eutrophic condition of all publicly owned lakes in a State.

(2) A general description of the State's procedures, processes and methods (including land use requirements) for controlling lake pollution.

(3) A general discussion of the State's plans to restore the quality of degraded lakes.

(4) Methods and procedures to mitigate the harmful effects of high acidity and remove or control toxics mobilized by high acidity.

(5) A list and description of publicly owned lakes for which uses are known to be impaired, including those lakes which are known not to meet water quality standards or which require implementation of control programs to maintain compliance with applicable standards, and those lakes in which water quality has deteriorated as a result of high acidity that may reasonably be due to acid deposition.

(6) An assessment of the status and trends of water quality in lakes including the nature and extent of pollution loading from point and nonpoint sources and the extent of impairment from these sources, particularly with regard to toxic pollution.

The U.S. Environmental Protection Agency (EPA) has developed a guidance document (Clean Lakes Program Guidance, December 1987) which includes a section on lake assessment reports. Kentucky's report generally complies with the guidelines suggested by the EPA. The short time frame for preparation of this report, to meet the April 1, 1988 deadline required by the Clean Water Act of 1987, necessitated relying on existing information which was readily available. A more comprehensive assessment will be made in the next 305(b) report.

Lake Identification

Table 11 lists publicly owned lakes for which data were available to assess trophic status. Much of this information came from lake classification surveys conducted by the Division of Water in 1981-1983 as part of an EPA cooperative agreement funded under Section 314 of the Clean Water Act. Not all of the significant publicly owned lakes in Kentucky are included in the table because data has not been collected from all such lakes. For purposes of this report, publicly owned lakes are those lakes which are owned or managed by a public entity such as a city, county, state or federal agency where the public has free access for use. A nominal fee for boat launching charged by concessionaires may occur on some of these lakes. Lakes which are publicly owned, but restrict public access because they are used solely as a source of domestic water supply, are not included. These lakes do not qualify for federal restoration funds under the Clean Lakes Program and were not monitored in the lake classification survey. EPA guidance suggests that all significant lakes be included in state surveys. The term "significant" is to be defined by the state so that

Table 11

Location of Classified Publicly Owned Lakes

River Basin	Lake	Hydrologic Unit	County
Mississippi	Flat	08010100	Ballard
Tennessee	Kentucky	06040003	Calloway, Marshall, Lyon, Trigg
Lower Ohio	Turner	05140206	Ballard
	George	05140203	Crittenden
	Mauzy	05140202	Union
	Scenic	05140202	Henderson
	Carpenter	05140201	Daviess
	Kingfisher	05140201	Daviess
Lower Cumberland	Barkley	05130205	Lyon, Trigg
	Energy	05130205	Trigg
	Hematite	05130205	Trigg
	Honker	04130205	Trigg
	Morris	05130205	Christian
	Blythe	05130205	Christian
Tradewater	Pennyrile	05140205	Christian
	Beshear	05140205	Caldwell, Christian
	Loch Mary	05140205	Hopkins
	Peewee	05140205	Hopkins
	Providence City	05140205	Webster
	Moffit	05140205	Union
Green	Campbellsville	05110001	Taylor
	Freeman	05110001	Hardin
	Green River	05110001	Taylor, Adair
	Liberty	05110001	Casey
	Metcalfe County	05110001	Metcalfe
	Nolin	05110001	Edmonson, Grayson, Hart
	Salem	05110001	Larue
	Shanty Hollow	05110001	Warren
	Spurlington	05110001	Taylor
	Barren River	05110002	Allen, Barren
	Mill Creek	05110002	Monroe
	Briggs	05110003	Logan
	Lewisburg	05110003	Logan

Table 11 (continued)

River Basin	Lake	Hydrologic Unit	County
Green (Cont'd.)	Luzerne	05110003	Muhlenberg
	Malone	05110003	Muhlenberg, Todd, Logan
	Spa	05110003	Logan
	Caneyville	05110004	Grayson
	Rough River	05110004	Breckinridge, Grayson
	Washburn	05110004	Ohio
	Grapevine	05110006	Hopkins
Salt	Guist Creek	05140102	Shelby
	Long Run	05140102	Jefferson, Shelby
	McNeely	05140102	Jefferson
	Shelby	05140102	Shelby
	Taylorsville	05140102	Spencer, Anderson
	Beaver	05140103	Anderson
	Marion County	05140103	Marion
	Sympson	05140103	Nelson
	Willisburg	05140103	Washington
Middle Ohio	Jericho	05140101	Henry
	Reformatory	05140101	Oldham
Upper Cumberland	Cannon Creek	05130101	Bell
	Chenoa	05130101	Bell
	Corbin	05130101	Laurel
	Cranks Creek	05130101	Harlan
	Laurel Creek	05130101	McCreary
	Laurel River	05130101	Laurel
	Martins Fork	05130101	Harlan
	Linville	05130102	Rockcastle
	Tyner	05130102	Jackson
	Wood Creek	05130102	Laurel
	Cumberland	05130103	Clinton, Pulaski, Russell, Wayne
	Dale Hollow	05130105	Clinton, Cumberland
Kentucky	Carr Fork	05100201	Knott
	Fishpond	05100201	Letcher
	Pan Bowl	05100201	Jackson
	Buckhorn	05100202	Perry, Leslie
	Bert Combs	05100203	Clay
	Campton	05100204	Wolfe
	Mill Creek	05100204	Powell
	Boltz	05100205	Grant
	Bullock Pen	05100205	Grant
	Corinth	05100205	Grant
	Elmer Davis	05100205	Owen

Table 11 (continued)

River Basin	Lake	Hydrologic Unit	County
Kentucky (Cont'd.)	General Butler	05100205	Carroll
	Herrington	05100205	Boyle, Garrard, Mercer
	Stanford	05100205	Lincoln
	Wilgreen	05100205	Madison
Licking	A.J. Jolly	05100101	Campbell
	Cave Run	05100101	Bath, Menifee, Morgan, Rowan, Grant
	Doe Run	05100101	Kenton
	Greenbriar	05100101	Montgomery
	Kincaid	05100101	Pendleton
	Sand Lick Creek	05100101	Fleming
	Williamstown	05100101	Grant
	Carnico	05100102	Nicholas
Big Sandy	Fishtrap	05070202	Pike
	Dewey	05070203	Floyd
	Paintsville	05070203	Johnson
Little Sandy	Grayson	05090104	Carter, Elliott
	Greenbo	05090104	Greenup
Tygarts Creek	Smokey Valley	05090103	Carter
	Lakes Proposed to be Classified		
Lower Ohio	**Swan**	**08010100**	**Ballard**
	Fish	**08010100**	**Ballard**
	Buck	**08010100**	**Ballard**
	Twin	**08010100**	**Ballard**
	Burnt Slough	**08010100**	**Ballard**
	Long Pond	**08010100**	**Ballard**
	Arrowhead	**08010100**	**Ballard**
	Metropolis	**08010100**	**McCracken**
Lower Cumberland	**Barkley**	**05130205**	
	Little River*		**Trigg**
	Muddy Fork*		**Trigg**
Tennessee	**Kentucky**	**06040005**	
	Blood River*		**Calloway**
	Jonathan Creek*		**Marshall**
	Bear Creek*		**Marshall**

*Embayments

all lakes which have substantial public interest and use would be included. For this purpose, Kentucky considers all of the publicly owned lakes it has surveyed and listed in Table 11 and also those which have not yet been surveyed, but qualify as a publicly owned lake, as significant. All of these lakes have substantial local or regional public interest and use.

The Division of Water submitted a grant proposal to the EPA in late 1987. The proposed plan was to resurvey the lakes that were classified in 1981-1983 and to survey additional lakes in order to update the assessment of lake water quality. Funding was not appropriated by the U.S. Congress and the proposal was withdrawn for 1988. Kentucky hopes to resubmit the proposal whenever funding is appropriated. It contains a strategy and time table for assessing the additional lakes and for updating the previous classifications. The additional lakes are listed at the end of Table 11 in boldface type.

Trophic Status

Chlorophyll *a* concentrations were converted to Carlson trophic state index (TSI) values to determine the trophic state of Kentucky lakes. Data from the growing season (April through October) were utilized and averaged to obtain a seasonal value for each lake. If lakes exhibited trophic gradients or embayment differences, those areas were analyzed separately.

Chlorophyll *a* concentration data from the ambient monitoring program and the most current chlorophyll *a* data collected during the spring through fall seasons by the U.S. Army Corps of Engineers (COE) on several reservoirs which they manage, were used to update the trophic classifications for this report. Other data were obtained from a draft report on a study of Lake Barkley conducted by Dr. Joe M. King of Murray State University and from studies of McNeely Lake conducted by Dr. G.C. Holdren of the University of Louisville. Data averaged from water column depths of up to 20 feet were used in calculating TSI values. Table 12 contains the trophic state rankings of lakes of 5,000 acres or more in size and Table 13 lists and ranks the trophic state of lakes less than 5,000 acres in size. Lakes which have updated classifications are in bold face type.

A summarization of Tables 12 and 13 indicates that of the 92 lakes classified, 51 (55%) were eutrophic, 27 (29%) were mesotrophic and 14 (15%) were oligotrophic. This is based on the status of the major areas of lakes and does not account for the trophic gradient that exists in some reservoirs nor the trophic status of the embayments of others. The dynamic nature of these reservoirs makes it more difficult to assign them a single trophic state because their water residence times, the nature of major inflows, and their morphology can result in different trophic states in separate areas. The tables indicate that trophic gradients exist in Barren River and Laurel River lakes and that certain embayments of Lake Cumberland are eutrophic, while the main lake area has a different status.

The 92 assessed lakes have a total area of 214,483 acres. There is a substantial reduction in the number of acres assessed in this report compared to the 1986 305(b) report, because only those portions of lakes Barkley, Kentucky and Dale Hollow lying within Kentucky were included. Tennessee reports on those portions within their border. Of the total, the greatest percentage of these surface waters were eutrophic, 54 percent (115,158 acres), while 30 percent (64,068 acres) were oligotrophic and 16 percent (35,257 acres) were mesotrophic.

Table 12

Trophic State Rankings for Lakes
5,000 Acres or Greater in Area
(by Carlson TSI(Chl a) Values)

Lake	TSI (Chl a)*	Acres
	Eutrophic	
Barkley	**61**	**45,600**
Nolin	**55**	**5,790**
Kentucky	**52**	**48,100**
	Mesotrophic	
Rough River	**48**	**5,100**
Green River	**44**	**8,210**
Cave Run	**44**	**8,270**
Barren River	**44**	**7,205**
Beaver Creek Arm	**57 (Eutrophic)**	**1,565**
Skaggs Creek Arm	**57 (Eutrophic)**	**1,230**
	Oligotrophic	
Cumberland	38	49,364
Lily Creek Embayment	**52 (Eutrophic)**	**144**
Beaver Creek Embayment	**50 (Mesotrophic)**	**742**
Laurel River	34	4,990
Midlake-Laurel Arm	47 (Mesotrophic)	754
Headwaters-Laurel Arm	58 (Eutrophic)	316
Dale Hollow	33	4,300

*Scale: 0-40 Oligotrophic (nutrient poor, low algal biomass)
41-50 Mesotrophic (slightly nutrient rich, moderate amount of algal biomass)
51-69 Eutrophic (nutrient rich, high algal biomass)
70-100 Hypereutrophic (very high nutrient concentrations and algal biomass)

Bold Type = Updated Classifications

Table 13

Trophic State Rankings for Lakes Less Than 5,000 Acres in Area (by Carlson TSI(Chl *a*) Values)

Lake	TSI (Chl *a*)	Acres
	Eutrophic	
McNeely	**69**	**51**
Wilgreen	68	169
Briggs	67	18
Carpenter	66	64
Marion County	65	21
Kingfisher	65	30
Bullock Pen	64	134
Kincaid	64	183
Guist Creek	64	317
Flat	64	38
Willisburg	62	126
Washburn	62	26
Honker	61	190
Boltz	61	92
Mauzy	61	84
Elmer Davis	60	149
Energy	60	370
Turner	60	61
Shanty Hollow	59	135
Greenbriar	59	66
Reformatory	**59**	**54**
Scenic	59	18
Sand Lick Creek	59	74
A.J. Jolly	58	204
Beaver	58	158
Grapevine	58	50
Taylorsville	**58**	**3,050**
Corinth	57	96
Chenoa	57	37
Spurlington	57	36
Jericho	57	137
Spa	56	240
Hematite	56	90
Herrington	56	2,940
Corbin	55	139
Morris	55	170
Liberty	55	79

Table 13 (continued)

Lake	TSI (Chl a)	Acres
Malone	54	826
Moffit	54	49
General Butler	54	29
Carr Fork	**53**	**710**
Shelby	53	17
Carnico	53	114
Williamstown	52	300
Linville	52	273
Long Run	52	27
Campbellsville City	51	63
Mill Creek (Monroe County)	51	109
	Mesotrophic	
Luzerne	50	55
Salem	50	99
Pennyrile	50	47
Peewee	49	360
Paintsville	49	1,139
Caneyville	49	75
Beshear	48	760
Fishpond	48	32
Freeman	48	160
Doe Run	48	51
Loch Mary	47	135
George	47	53
Blythe	47	89
Metcalfe County	47	22
Mill Creek (Powell County)	46	41
Bert Combs	46	36
Smokey Valley	45	36
Laurel Creek	45	42
Buckhorn	**44**	**1,230**
Sympson	44	184
Pan Bowl	43	98
Greenbo	41	181
Lewisburg	41	51
	Oligotrophic	
Tyner	40	87
Campton	40	26
Stanford Reservoir	40	43
Grayson	37	1,512
Martins Fork	37	334

Table 13 (continued)

Lake	TSI (Chl *a*)	Acres
Cranks Creek	38	219
Wood Creek	35	672
Providence City	35	35
Dewey	34	1,100
Cannon Creek	33	243
Fishtrap	32	1,143

*Scale:			
0-40	Oligotrophic	51-69	Eutrophic
41-50	Mesotrophic	70-100	Hypereutrophic

Bold Type = Updated Classifications

Lake Pollution Control Procedures

Kentucky utilizes several approaches to control pollution in its publicly owned lakes. The approach chosen is dependent upon the pollutant source and the characteristics of each lake. Point sources of potential pollution are more controllable than nonpoint sources. The following procedures are routinely used to control point sources of pollution.

Permitting Program

A lake discharge guidance procedure is in effect and is applied to any new construction permit for a facility which proposes to discharge into a lake, or for any application for a lake discharge permit under the Kentucky Pollutant Discharge Elimination System (KPDES). An applicant is required to evaluate all other feasible means of routing the discharge or to explore alternate treatment methods which would result in no discharge to a lake. As a last resort, a lake discharge may be permitted. Permits for domestic wastes require secondary treatment and a discharge into the hypolimnion in the main body of the lake. More stringent treatment may be required depending upon lake characteristics. Surface discharges are not allowed. A permit may also be denied to a prospective discharger if the discharge point is within five miles of a domestic water supply intake.

Water Quality Standards Regulations

Kentucky has not adopted specific criteria to protect lake uses. Warmwater aquatic habitat, domestic water supply (if the lake is used for this purpose), and primary and secondary contact recreation criteria are generally applicable to lakes. In specific cases a provision in the water quality standards regulation can be utilized to designate a waterbody as nutrient limited if eutrophication is a problem. Point source dischargers to the lake and its tributaries can then have nutrient limits included in their permits.

Lakes which support trout are further protected by another provision which requires dissolved oxygen in waters below the epilimnion to be kept consistent with natural water quality.

Kentucky is not planning to adopt statewide criteria specifically for lakes. A site-specific approach to lake pollution control is more realistic and feasible.

Specific Lake Legislation and Local Initiatives

The Kentucky General Assembly has the prerogative to pass legislation to protect lakes. This has been done for Taylorsville Lake. House Joint Resolution No. 4 prohibits issuing any discharge permits which allow effluents to be directly discharged into the lake. It also prohibits issuing any permits which allow inadequately treated effluents to be discharged into contributing tributaries that drain the immediate watershed of the lake. In addition, wastewater permit applications in the basin above the lake must be evaluated to ensure that discharges will not adversely affect the lake or its uses. Other provisions provide for stringent on-site wastewater treatment requirements, promotion of nonpoint source controls and proper management of sanitary landfills in the watershed.

Lake protection associations are not formally organized in Kentucky. This is one mechanism which has proven to be successful in preventing lake pollution in other states. Local ordinances can be passed which restrict land use activities and on-site treatment systems and lead to pollution abatement. Local grass roots opposition to activities which may degrade lakes can lead to state agency action. An example is the petition process in the state's surface mining regulations which can lead to lands being declared unsuitable for mining. Such a petition has been made to protect the water quality of Cannon Creek Lake in Bell County. The lake is used as a water supply for the City of Pineville and is also used for fishing and recreation.

Lake Monitoring

Monitoring water quality in lakes is a part of Kentucky's ambient monitoring program and is described in Chapter 6. The objectives of the monitoring program are flexible so that lakes can be monitored for several purposes. These include:

- trend detection in trophic status
- impacts of permit decisions
- ambient water quality characterization
- nonpoint source impacts
- long-term acid precipitation impacts
- pollution incidences such as fish kills and nuisance algal blooms
- new initiatives such as fish tissue analysis for toxics and fecal coliform surveys in swimming areas.

Lake Restoration Plan

Kentucky has not developed a formal state Clean Lakes Program. Several states have adopted a program modelled after the federal Clean Lakes Program and have had state funds appropriated to aid in lake restoration projects. The impetus for developing these programs has been the historical importance of lakes as recreational and aesthetic resources in these states. Pollution or the potential for pollution has prompted support for state development of these programs. Pollution of lakes in Kentucky has not reached a point where there is a recognized need to develop a state program of this nature.

The Division of Water does participate in the federal Clean Lakes Program. The Natural Resources and Environmental Protection Cabinet is the state agency designated by the Governor to receive federal assistance under this program. Kentucky has received two assistance awards. One helped to fund a project which classified lakes in the state according to trophic status and assessed their need for restoration. The other award helped to fund a diagnostic/feasibility study of McNeely Lake in Jefferson County.

The Division of Water cooperated with local and federal agencies in both of these projects and prepared a grant for implementation of the restoration plan for McNeely Lake. The grant was not awarded because it was technically not eligible for assistance under federal guidelines. However, Jefferson County passed a bond issue to finance the implementation of the plan. It is scheduled to be completed in the spring of 1988. The Division will monitor the lake as part of its ambient program to document water quality improvements.

The Division of Water is ready to cooperate with local agencies and other interested groups to participate in the federal Clean Lakes Program. The preparation of this assessment report is a requirement for future participation in that program.

Toxic Substance Control/Acid Mitigation Activities

Kentucky does not have publicly owned lakes which have high acidity that is caused by acid precipitation, consequently this requirement does not apply and will not be addressed.

Identification of Impaired and Threatened Lakes

Table 14 summarizes information on use support for Kentucky lakes. This information was gathered from published annual reports produced by the COE on reservoirs which they manage, from research reports by other investigators, and from Division of Water data bases. The total acres assessed are equal to the acres monitored. The analysis is based on chemical data relating to iron, manganese and dissolved oxygen problems, and biological data relating to algal biomass (blooms), algae causing taste and odor problems, macrophyte infestations and fish kill reports. Kentucky has not developed water quality standards specifically for lakes. Consequently, criteria were developed based on other indicators of lake use impairment (see Table 15).

Table 14
Summary of Lake Use Support

Degree of Use Support	Assessment Basis (Monitored)	Total Assessed
Acres Fully Supporting	179,335	179,335
Acres Threatened	152,544	
Acres Partially Supporting	31,471	31,471
Acres Not Supporting	3,677	3,677

Acres Assessed - 214,483
Total Kentucky Lake Acreage - 228,385

There are no known published data on the total lake acreage in Kentucky. The total reported in Table 14 is based on the Division of Water's Dam Inventory Files and the acres inventoried in the lake classification program. The assessed acres represent over 90 percent of the publicly-owned lake acreage in the state. Lakes have not specifically been classified by use in Kentucky. Waters not specifically listed by use in water quality regulations are generally classified for the uses of warmwater aquatic habitat, primary and secondary contact recreation and domestic water supply at points of withdrawal. Lake use support is based on these uses. Primary contact recreation was not assessed because the primary indicator of use support (fecal coliform bacteria) was not measured as part of agency monitoring programs.

Table 15
Criteria for Lake Use Support Classification

	Uses		
	Warmwater Aquatic Habitat	**Secondary Contact Water Recreation**	**Domestic Water Supply**
Not Supporting:	At least two of the following:		
	1. Fish kills caused by water quality	1. Widespread excessive macrophyte/ macroscopic algal development	1. Chronic taste and odor complaints caused by algae
	2. Severe hypolimnetic oxygen depletion	2. Chronic nuisance algal blooms	2. Chronic treatment problems caused by water quality
	3. Dissolved oxygen less than 5 mg/l in epilimnion		
Partially Supporting:	1. Dissolved oxygen less than 5 mg/l in the epilimnion	1. Localized excessive macrophyte/macroscopic algal development	1. Occasional taste and odor complaints caused by algae
	2. Severe hypolimnetic oxygen depletion	2. Occasional nuisance algal blooms	2. Occasional treatment problems caused by water quality
		3. High suspended sediment concentrations during the recreation season	
Fully Supporting:	1. None of the above	1. None of the above	1. None of the above

Detailed information on the assessed lakes can be found in the report on the lake classification program entitled Trophic State and Restoration Assessments of Kentucky Lakes, which was published in 1984 by the Division of Water. Detailed information on Taylorsville and Paintsville lakes has not been compiled.

Table 16 and Table 17 list lakes according to whether their uses are not supported or are partially supported. The tables indicate which criteria from Table 15 were used to determine nonsupport or partial support and the probable causes and sources for the support not being achieved. Table 18 lists those lakes which fully support their uses.

Eighty-four percent of the total acres assessed supported uses while 16 percent did not fully support uses. Six of the ten lakes over 5,000 acres in size fully supported uses. Similarly, more than half of the small lakes fully supported their designated uses (44 of 82).

None of the lakes listed in this report as not supporting particular uses or as partially supporting uses are degraded to the extent that fishing and swimming are precluded. Hazards to human health through consumption of fish or swimming in waters contaminated by bacteria were not reported as problems in any of the listed lakes. In this sense, all of the assessed 214,483 acres supported a fishable/swimmable use.

EPA guidance asks for a list of threatened lakes. These are defined as lakes which fully support uses now, but may not in the future because of anticipated sources or adverse trends of pollution. Table 14 indicates the total acres classified as threatened. Table 19 lists the lakes and indicates what uses are threatened and the causes and sources of the threat.

Table 20 indicates the causes responsible for nonsupport of lake uses. Metals cause the greatest percentage of nonsupport. This is primarily because of the release of hypolimnetic water from large reservoirs which contains excessive concentrations of iron and manganese. Downstream cities using this water for domestic consumption have resultant taste, odor and treatment problems. Nutrients are the second largest contributor to nonsupport of uses and affect the largest number of lakes. Major and minor impacts from these causes were not differentiated. The criteria used in the assessments would categorize these causes as major impacts. Priority pollutants (toxics) did not cause any of the lake use impairments.

Table 21 indicates the sources responsible for nonsupport of lake uses. Natural sources are responsible for the largest percentage of the use non-support (64%). This is largely because of iron and manganese impacts on domestic water supply uses. These metals are solubilized from lake sediments under anoxic conditions and cause water treatment problems. Undisturbed watersheds with high nutrient runoff are another natural source of use nonsupport. Nonpoint sources account for the second highest percentage of lake uses not being supported (25%). Municipal point sources caused nine percent of the use nonsupport. A further discussion of nonpoint source impacts on lakes follows.

Nonpoint Source Pollution in Lakes

Table 22 lists lakes which are not fully supporting uses because of nonpoint sources of pollution and indicates the categories of nonpoint sources that produce the pollution. Nutrients from unspecified sources are the greatest contributor to lake uses not being supported. Nutrients can stimulate a proliferation of algae, which may cause taste and odor problems in lakes used for domestic water supplies. Dissolved oxygen can also be lowered in surface waters by very productive algal populations which stimulate microbial respiration. This may result in fish kills or decrease oxygen to levels that are not conducive to supporting healthy populations of fish.

Table 16
Lakes Not Supporting Uses

Lake	Use Not Supported*	Criteria	Cause	Source
McNeely	WAH	1,2,3	Nutrients	Municipal point sources (package treatment plants)
	SCR	2	Nutrients	Same as above
Carpenter	SCR	1	Shallow lake basin	Natural
Corbin	DWS	1	Nutrients	Municipal point sources and unspecified nonpoint sources
	SCR	2	Nutrients	Same as above
Loch Mary	DWS	2	Metals (Mn) and other inorganics (noncarbonate hardness)	Surface mining (abandoned lands)
Sympson	DWS	1	Nutrients	Agriculture nonpoint sources
Taylorsville	WAH	1,2,3	Nutrients	Municipal point sources and unspecified nonpoint sources
	DWS	1	Nutrients	Same as above
Reformatory	WAH	2,3	Nutrients	Animal holding/management areas

*WAH - Warmwater Aquatic Habitat, SCR - Secondary Contact Recreation, DWS - Domestic Water Supply

Table 17

Lakes Partially Supporting Uses

Lake	Use*	Criteria	Cause	Source
Rough River	DWS	1	Metals (Mn)	Natural
Barren River	DWS	1	Metals (Mn and Fe)	Natural
Cave Run	DWS	1	Metals (Mn and Fe)	Natural
Laurel River (Headwaters)	SCR	2	Nutrients	Municipal point sources and unspecified nonpoint sources
Martins Fork	SCR	3	Suspended solids	Surface mining
Carr Fork	SCR	3	Suspended Solids	Surface mining
Buckhorn	SCR	3	Suspended Solids	Surface mining
Dewey	SCR	3	Suspended Solids	Surface mining
Fishtrap	SCR	3	Suspended Solids	Surface mining
Wilgreen	WAH	2	Nutrients	Septic tanks
	SCR	2	Nutrients	Septic tanks
Briggs	WAH	1	Nutrients	Lake fertilization
	SCR	2	Nutrients	Lake fertilization
Marion County	SCR	2	Nutrients	Lake fertilization
Kingfisher	SCR	2	Nutrients	Lake fertilization
Kincaid	WAH	1	Nutrients	Lake fertilization
Guist Creek	DWS	1	Nutrients	Unspecified nonpoint sources
Willisburg	WAH	1	Nutrients	Unspecified nonpoint sources
Shanty Hollow	WAH	1	Nutrients	Lake fertilization
Scenic	WAH	1	Nutrients	Natural
Beaver	WAH	1	Nutrients	Lake fertilization
	SCR	1	Shallow lake basin	Natural
Hematite	WAH	1	Nutrients	Natural

Table 17 (continued)

Lake	Use*	Criteria	Cause	Source
Morris	DWS	1	Nutrients	Unspecified nonpoint sources
Liberty	DWS	2,3	Metals (Fe and Mn)	Natural
Moffit	WAH	1	Nutrients	Natural
General Butler	SCR	1	Shallow lake basin	Natural
A.J. Jolly	WAH	1	Nutrients	Unspecified nonpoint sources
Shelby	WAH	1	Nutrients	Unspecified nonpoint sources
Williamstown	WAH	1	Nutrients	Unspecified nonpoint sources
Campbellsville	WAH	1	Nutrients	Unspecified nonpoint sources
Salem	SCR	1	Shallow lake basin	Natural
Caneyville	DWS	1	Nutrients	Natural
Beshear	WAH	1	Nutrients	Natural
Metcalfe County	SCR	1	Shallow lake basin	Natural
Laurel Creek	DWS	1	Nutrients	Natural
Lewisburg	SCR	1	Shallow lake basin	Natural
Stanford	DWS	1	Nutrients	Natural

*WAH - Warmwater aquatic habitat, SCR - Secondary contact recreation, DWS - Domestic water supply

Table 18
Lakes Fully Supporting Uses

Size		
5000 Acres or Larger	**Less than 5000 Acres**	
Barkley	Bert Combs	Honker
Cumberland	Blythe	Jericho
Dale Hollow	Boltz	Linville
Green	Bullock Pen	Long Run
Kentucky	Campton	Luzerne
Laurel River (except for headwaters)	Cannon Creek	Malone
Nolin	Carnico	Mauzy
	Chenoa	Mill Creek (Monroe Co.)
	Corinth	Mill Creek (Powell Co.)
	Cranks Creek	Paintsville
	Doe Run	Pan Bowl
	Elmer Davis	Peewee
	Energy	Pennyrile
	Fish Pond	Providence City
	Flat	Sand Lick Creek
	Freeman	Smokey Valley
	George	Spa
	Grapevine	Spurlington
	Grayson	Tyner
	Greenbo	Washburn
	Greenbriar	Wood Creek
	Herrington	

Table 19

Threatened Lakes

Lake	Use* Threatened	Cause	Source
Kentucky	SCR	Macrophyte infestations	Natural or introduced exotic species
	WAH	Low dissolved oxygen	Unspecified nonpoint sources
Paintsville	WAH	Salinity/brine	Petroleum activities
Grayson	WAH	Salinity/brine	Petroleum activities
Cannon Creek	DWS	Metals/pH Suspended solids	Subsurface Mining
Barkley	SCR	Suspended solids	Unspecified nonpoint sources
Dale Hollow	WAH	Salinity/brine	Petroleum activities

*SCR - Secondary Contact Recreation, WAH - Warmwater Aquatic Habitat, DWS -Domestic Water Supply

Table 20

Causes of Use Nonsupport* In Lakes

Cause	Number of Lakes Affected	Acres	% Contribution (by Acres)
Nutrients	27	6,707	19
Metals (Fe/Mn)	5	23,584	67
Other (Shallow lake basin)	6	423	1
Other inorganics (noncarbonate hardness)	1	135	< 1
Suspended solids	5	4,517	13

*Nonsupport is a collective term for lakes either not supporting or partially supporting uses

Table 21

Sources of Use Nonsupport* in Lakes

Source	Major Impact (Acres)	Moderate/Minor Impact (Acres)
Point Sources		
Municipal	3,101	455
Nonpoint Sources		
Unspecified	4,777	
Agriculture	184	
Surface mining	4,651	
Septic tanks	169	
Animal holding/ management areas	54	
Other		
Lake fertilization	545	
Natural	24,874	

*Nonsupport is a collective term for lakes either not supporting or partially supporting uses

More detailed studies in watersheds of the lakes in the unspecified category are necessary before contributing sources of nonpoint pollution can be distinguished. Surface mining for coal (resource extraction) is the next greatest contributor to lake uses not being fully supported. Most lake uses are impaired because waters become turbid after receiving runoff water laden with sediment from lands disturbed by surface mining activities. This reduces the incentive for secondary contact uses.

Water Quality Trend Assessment

Trophic Trends

One of the objectives of the ambient monitoring program is to assess eutrophication of Kentucky lakes. The monitoring strategy is to obtain at least two years of data during the growing season on each lake. After the data is assessed, a decision is made either to continue monitoring or to assess another lake.

A review of current lake data from the ambient monitoring program, data retrieved through STORET on COE managed lakes, and other reports resulted in an assessment of trophic trends at several lakes. A discussion of each lake follows.

Table 22

Extent of Nonpoint Source Pollution in Lakes

Source	Pollutant	Acres Not Fully Supporting Uses	% Contribution (by Acres)	Lakes Affected
Surface mining	a. Suspended solids	4,451	46	a. Martins Fork, Carr Fork, Buckhorn, Dewey, Fishtrap
	b. Mn and noncarbonate hardness	135	1	b. Loch Mary
Agriculture	Nutrients	184	2	Sympson
Unspecified nonpoint activities	Nutrients	4,777	48	Willisburg, Corbin, A. J. Jolly, Shelby, Williamstown, Taylorsville, Campbellsville, Guist Cr., Laurel R. Morris, Caneyville
Land disposal (septic tanks)	Nutrients	169	2	Wilgreen
Animal holding/ management areas	Nutrients	54	< 1	Reformatory
TOTALS		**9,835**	**100**	

Green River Lake COE data from 1981 indicated that this lake might be changing from a mesotrophic to a eutrophic state. The lake was monitored in 1985 by the Division of Water and those data, plus 1982 data from COE stations, showed the lake was still mesotrophic except for the headwater area where it has historically been eutrophic. Data collected in 1986 indicated that the lake was even less productive and tended to be oligotrophic. Based on the present data, it appears that the main lake area is not becoming eutrophic.

Barren River Lake COE data from 1981 at the station nearest the dam, indicated a eutrophic condition, while the period of record (1975-80) data indicated the lake in this area was mesotrophic. The Division of Water monitored the lake in 1985, 1986 and 1987. Analysis of this data and COE data from 1982 showed that the lake was mesotrophic near the dam. No trend toward eutrophy was indicated. The Skaggs

Creek and Beaver Creek arms of the lake have historically been eutrophic, but show no signs of accelerating eutrophy.

Rough River COE data from 1981 indicated that the lake might be changing from a mesotrophic to a eutrophic state. Data from 1982 did not support this as the lake was mesotrophic, as it had been since 1975. The Division of Water monitored the lake in 1985 and 1986. Analysis of the 1985 data showed that the lake was borderline eutrophic. The 1986 data indicated that the lake was mesotrophic. A trend toward eutrophy was not established.

Nolin River The Division of Water classified this lake as mesotrophic in its lake classification report, based on COE data collected from 1975 through 1981. Data collected in 1982 indicated that the lake was still mesotrophic. However, in June of 1983 and July of 1984, the lake was eutrophic. TSI values at those times were higher than the historic range and in the eutrophic category. The Division of Water monitored the lake in 1987 to establish its present trophic state. Analysis of the 1987 data resulted in the lake being classified as eutrophic. The lake will be monitored in 1988 to better define its trophic state.

Carr Fork This lake has historically been oligotrophic. However, a lake fertilization program conducted by the Kentucky Department of Fish and Wildlife Resources to increase fishery potential has caused the lake to become eutrophic since 1981. Fertilization dosages have decreased recently and data from 1986 indicated that the lake was shifting back to a more mesotrophic state.

Cave Run This lake has historically been oligotrophic. However, data from 1983 and 1984 indicated that the major portion of the lake was mesotrophic and that the headwater area had changed from a mesotrophic to a eutrophic state. A review of COE data from 1985 and 1986 indicates that this was not a trend. The major portion of the lake had shifted back to an oligotrophic state and by 1986 the upper portion was mesotrophic again.

Lake Cumberland The Division of Water began collecting data on this lake as part of the ambient monitoring program in 1985. The objective was to determine the trophic state of two embayments that are fed by streams receiving effluents from municipal sewage treatment plants. The embayments have been studied for a three-year period. The data indicate that both embayments are eutrophic toward the areas receiving tributary runoff and that the areas near their juncture with the main lake are trophically similar to the main lake (oligotrophic). The Lily Creek embayment is slightly more eutrophic than the Beaver Creek embayment. Ratios of TN/TP indicate that the Lily Creek embayment is nitrogen limited and that the Beaver Creek embayment is phosphorous limited.

Buckhorn Lake Studies on this lake were initiated as part of the ambient monitoring program to determine if nuisance algal conditions developed in the headwater area. This condition had reportedly been linked to the discharge from a municipal wastewater treatment facility into a tributary stream. The 1985 and 1986 data indicated that the upper lake was mesotrophic and that nuisance algal blooms did not occur.

Reformatory Lake The Division of Water classified this lake as hypereutrophic in the 1984 305(b) report. At that time, it was the most eutrophic lake in the lake classification program data base. Its use as a recreational fishing resource was impaired because of severe hypolimnetic oxygen depletion and low dissolved oxygen in the epilimnion. Nutrients from livestock operations in the watershed were suspected of being the major cause of the lake's trophic state.

In order to alleviate what had become a potentially serious eutrophication problem, Division of Water staff met with the managers of the livestock operations and, with assistance from staff of the University of Kentucky's Agriculture Extension Service, suggested that better waste handling practices be instituted. The managers were cooperative, and steps were taken to handle the livestock waste in several of the suggested ways.

The Division began monitoring the lake in 1985 to determine if lake water quality had improved after the implementation of these better management practices. Preliminary data from 1985 indicated that the measures taken by the farm managers had dramatically improved lake water quality. Average spring through fall data showed that in the surface waters, there was 77 percent less chlorophyll *a* in 1985 than in 1981. This resulted in greater water clarity (the Secchi depth doubled) and a doubling of the depth of the euphotic zone. There was 78 percent less total phosphorus and a 59 percent decrease in total nitrogen. Dissolved oxygen remained above 5 mg/l in the upper water column in 1985 in contrast to 1981 when the concentration in the surface water declined to 2.4 mg/l. Hypolimnetic oxygen depletion occurred at a lower rate in 1985, and concentrations did not decline below 1.0 mg/l as they had in 1981. The lake was no longer considered hypereutrophic, based on an average TSI value decline of 15 points from 72 to 57.

The lake was monitored in 1986 and 1987 to verify that the improvements were sustained. It appears that this has not occurred. The 1987 data shows that chlorophyll *a* has increased to near 1981 concentrations, water clarity has declined and euphotic zone depths are back to 1981 values. Dissolved oxygen was again below 5 mg/l in the epilimnion and there was severe hypolimnetic oxygen depletion. The lake was hypereutrophic in the summer and fall. It was placed on the list of lakes that do not support their uses in this report. Monitoring of the lake will continue and the causes of increased eutrophication will be investigated.

McNeely Lake This lake no longer has problems from excessive duckweed growth because grass carp introduction has effectively eliminated the duckweed. The lake is, however, still highly eutrophic and a grass carp kill occurred in the summer of 1985 because of oxygen depletion in the surface waters. It is still considered as not supporting its uses. The discharges from package treatment plants in its watershed are scheduled to be piped to the stream below the lake outlet structure in the spring of 1988. This should cause a noticeable improvement in water quality and restore the warmwater aquatic habitat and secondary contact recreation uses.

Other Trends in Water Quality

Cave Run Lake This lake is threatened by brine pollution from petroleum activities (oil well operations) in its watershed. Chloride levels monitored by the COE indicate a steady increase in concentration beginning before 1981. Data averaged from the water column at the dam for the years 1974-1976 showed a mean chloride concentration of 4 mg/l. In 1981 the mean was 10 mg/l, in 1983 it was 13 mg/l and by 1986 it was 22 mg/l. This is a four and one-half fold increase. Chloride data from the Licking River, the main inflow to the lake, shows a similar trend but with much higher concentrations. The average chloride concentration from 1972 to 1976 was 9 mg/l. In 1981 it was 23 mg/l and in 1983 it was 57 mg/l. The concentration peaked in 1985 with an average of 200 mg/l. The 1986 average concentration declined slightly to 158 mg/l. The 1985 average was a 21 fold increase from 1971 - 1976 levels. Lake chloride concentrations are not now at levels which exceed water quality criteria for protection of aquatic life. However, the threat from brine pollution is a cause of concern. It is not known at what levels chloride and other constituents in brine may cause adverse changes in the aquatic community of the lake.

Loch Mary Loch Mary was monitored to assess the improvements in water quality brought about by abandoned mine reclamation efforts in its watershed. Monitoring was begun in April of 1981 and ended in June 1983, which covered the reclamation activity period. A report prepared by the Division of Water in 1984, entitled Water Quality Aspects of the Loch Mary Reclamation Project, Hopkins County, Kentucky, indicated that the lake had shown no improvements in terms of the water treatment problems brought about by high noncarbonate hardness, sulfate, and manganese concentrations. The report showed that toxic metals relating to public health were not a concern. The 1987 raw water concentrations for the problem parameters were recently reviewed and showed no improvements. Macrophytes (water lotus) have added to the drinking water problems at this lake. They have increased in areal coverage and seasonal die-off has caused taste and odor problems in the finished water supply. The City of Earlington has been exploring ways to manage the macrophytes. The water treatment problems caused by acid mine drainage from abandoned mined lands remain to be resolved.

Lake Acidification Most lakes in Kentucky have enough buffering capacity to protect them from the effects of acidic deposition. Lakes with an acid neutralizing capacity (ANC) of 200 uequiv/l or less can be classified as being susceptible to acidic deposition. Three lakes with the lowest ANC's in the Division of Water's data base have been monitored yearly since 1985. These lakes, (Tyner, ANC average of 359 uequiv/l; Bert Combs, ANC average of 198 uequiv/l; and Cannon Creek, ANC average of 141 uequiv/l) have shown no detectable acidification trends.

Kentucky Lake Water quality problems became apparent in this reservoir in 1986. Numerous reports of diseased fish, mussel mortalities, increases in aquatic plant infestations and low dissolved oxygen were made by commerical fishermen, musselers and resource management agencies. These problems coincided with the most severe drought in the history of the region which had caused extremely low flows and increased the residence time of water in the reservoir. Concerns about the deteriorating water quality led to the formation of a task force composed of state and federal resource agency personnel and members of the public who represented commerical and environmental interests. A series of studies were approved which addressed defining the extent of the above problems and developing plans for their control. So far, the studies have indicated that fish disease (which centered on catfish) was not a wide spread phenomenon. The reports of "fish disease" were largely due to fish flesh discoloration caused by the electrical methods used to kill catfish at commerical processing facilities. Mussel mortalities have been confirmed and were extensive at certain areas in the Tennessee part of the reservoir. The cause of the mortalities is under study. The major problem in the Kentucky portion of the reservoir is the spread of aquatic macrophytes. Limited spraying to destroy the plants where they cause interference at marinas, camps and lake shore residences has been conducted. About 670 acres were sprayed in 1987. The macrophyte spread is being monitored and control plans are reassessed each year. The task force is continuing to study, evaluate and implement plans to solve the water quality problems of Kentucky Lake. The lake is considered to fully support its uses, but is listed as threatened due to these recent problems.

CHAPTER 3

NONPOINT SOURCE POLLUTION ASSESSMENT REPORT

NONPOINT SOURCE POLLUTION ASSESSMENT REPORT

Section 319 of the Water Quality Act of 1987 requires all states to complete, and submit to the U.S. Environmental Protection Agency (EPA) by August 4, 1988, a statewide Nonpoint Source (NPS) Pollution Assessment Report and Management Program Plan. Additionally, Kentucky is required to submit the first two assessment items (items 1 and 2 below) of the NPS Pollution Assessment Report as part of their 1988 305(b) Report to Congress.

The NPS Pollution Assessment Report consists of four (4) requirements briefly summarized as follows:

1. Identify navigable waters which cannot attain or maintain applicable water quality standards or goals and requirements of the Water Quality Act of 1987, without additional action to control NPS pollution;

2. Identify categories and subcategories of NPS pollution that affect waters identified in item 1;

3. Describe the process for identifying Best Management Practices (BMPs) and other measures to control NPS and to reduce such pollution to the "maximum extent practicable"; and

4. Identify and describe state and local programs for NPS control.

Information for Kentucky's assessment was gathered from many different sources. The primary source of information was the NPS survey conducted by the Division of Conservation (DOC). The survey requested information from 121 conservation districts with technical assistance provided by field representatives of the Soil Conservation Service (SCS) and the Kentucky Division of Conservation. Details concerning this survey are discussed later in this chapter. Additional information was obtained from a NPS survey, conducted by the Division of Water, of private citizens and groups with a known interest in water quality. There were 85 responses to this survey including those from various groups and organizations such as County Health Departments and Kentucky Chapters of the National Audubon Society and the Sierra Club. Other sources of information were previous 305(b) reports, ambient water quality data, intensive surveys, data from the U.S. Army Corps of Engineers and the U.S. Geological Survey, and other publications.

List of Waters Impacted By NPS and Sources of Pollution

The first two NPS Assessment Report requirements are the listing of waters impacted by NPS and the identification of NPS categories contributing to the problem. A list of impacted surface waters, groundwaters and wetlands are presented in Tables 23-26. The waters have not been prioritized according to the severity of NPS pollution, as will be necessary for the NPS Management Program Plan. This NPS Assessment Report is an attempt to identify all waters impacted by NPS. The prioritization process will eliminate some waters from this list. However, as more

Table 23
Nonpoint Source Impacted Lakes

HYDROLOGIC CODE	LAKES WATERBODY NAMES	COUNTY	N.P.S.- CATEGORIES 1	2	3	4	5	6	7	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/ EVALUATED	USES NOT FULLY SUPPORTED.
05070203-120	DEWEY LAKE	FLOYD	51	88	65	31	32a			SEDIMENT, BACTERIA	NPS SURVEY, 1987; 305(b), 1988	MONITORED	SCR
05100201-070	CARR FORK LAKE	KNOTT	51	80	65	32a	32b			SEDIMENT, BACTERIA	NPS SURVEY, 1987; 305(b), 1988	MONITORED	SCR
05100202-030	BUCKHORN LAKE	LESLIE, PERRY	51	88	21	52	55	23	32a	SEDIMENT	NPS SURVEY, 1987; 305(b), 1988	MONITORED	SCR
05130101-530	LAUREL RIVER LAKE	LAUREL	22	32a						SEDIMENT, NUTRIENTS	NPS SURVEY, 1987; 305(b), 1988	MONITORED	SCR
05140102-040	TAYLORSVILLE LAKE	ANDERSON, SPENCER, NELSON	14	11	18	32a	65			SED, NUTR, BACTERIA	NPS SURVEY, 1987;DOW;COE	MONITORED	WAH & DWS
05140205-090	LOCH MARY RES.	HOPKINS	50							pH, SO4, Mn	305(b), 1988	MONITORED	DWS
05140103-180	SYMPSON LAKE	NELSON	11	14	18	63	65	76	87	NUTRIENT	305(b), 1988	MONITORED	DWS
05130101-030	MARTINS FORK LAKE	HARLAN	52	51	88	89				SEDIMENT	NPS SURVEY, 1987, 305(b), 1988	MONITORED	SCR
05070202-120	FISHTRAP LAKE	PIKE	50							SEDIMENT	305(b), 1988	MONITORED	SCR
05100205-090	WILGREEN LAKE	MADISON	65							NUTRIENTS	305(b), 1988	MONITORED	WAH, SCR
05140103-140	WILLISBURG LAKE	WASHINGTON	10							NUTRIENTS	305(b), 1988	MONITORED	WAH
05100101-260	A. J. JOLLY LAKE	CAMPBELL	10							NUTRIENTS	305(b), 1988	MONITORED	WAH
05140102-100	SHELBY LAKE	SHELBY	10							NUTRIENTS	305(b), 1988	MONITORED	WAH
05100101-250	WILLIAMSTOWN LAKE	GRANT	10							NUTRIENTS	305(b), 1988	MONITORED	WAH
05110001-090	CAMBELLSVILLE RES.	TAYLOR	10							NUTRIENTS	305(b), 1988	MONITORED	WAH
05130205-340	BARKLEY LAKE	CALDWELL, LYON, TRIGG	11	14	16	21	24	18	74	SEDIMENT, NUTRIENTS	NPS SURVEY, 1987	EVALUATED	
05140101-260	REFORMATORY LAKE	OLDHAM	16	18						NUTR, DO	305(b), 1988	MONITORED	WAH
05130101-520	CORBIN RES.	WHITLEY	90							NUTRIENTS	305(b), 1988	MONITORED	DWS, SCR
05130205-190	MORRIS LAKE	CHRISTIAN	90							NUTRIENTS	305(b), 1988	MONITORED	DWS
05140102-080	GUIST CREEK LAKE	SHELBY	90							NUTRIENTS	305(b), 1986	MONITORED	DWS

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
050702	*BIG SANDY RIVER BASIN*									
05070201-090	TUG FORK	51	52	55	42	21	SED, BACT, SO4	DOW; NPS SURVEY, 1987	MONITORED	WAH, PCR
05070201-091	EMILY CREEK	51	65	21	52	32a	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-092	TURKEY CREEK	51	62	32a	14	87	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-110	KNOX CREEK	51	52	65	88	32	SED, BACT, SO4	AMBIENT; NPS SURVEY, 1987	MONITORED	PCR
05070201-120	PETER CREEK	51	52	65	88	32	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-130	BLACKBERRY CREEK	51	52	65	88	32	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-160	POND CREEK	51	52	65	88	32	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-170	BIG CREEK	51	52	65	88	32	SED, BACT, SO4	DOW; NPS SURVEY, 1987	MONITORED	WAH
05070201-190	WOLF CREEK	51	21	52	32a	65	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070201-210	ROCKCASTLE CREEK	51	52	55	32a	87	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070202-080	ELKHORN CREEK	88	51	52	21	65	SED, BACT, SO4	NPS SURVEY, 1987	EVALUATED	
05070202-090	LEVISA FORK	51	52	42	65	88	SED, BACT, SO4, MET	DOW; NPS SURVEY, 1987	MONITORED	WAH, PCR
05070202-120	GRAPEVINE CREEK	52	65	88	32	83	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070202-130	FEDS CREEK	51	52	65	88	32	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070202-141	SHELBY CREEK	51	52	65	88	32	SO4, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-001	PRATER CREEK	51	88	65	32a		SO4, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-002	LITTLE PAINT	88	65	32a			SO4, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-010	ISLAND CREEK	51	52	65	88	61	SO4, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-020	MUD CREEK	51	65	88	32a	32b	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-030	BULL CREEK	51	57	88	65	32a	SED, BACT, SO4, MET	NPS SURVEY, 1987	MONITORED	WAH
05070203-031	COW CREEK	88	65	32a	51		SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05070203-040	BEAVER CREEK	51	65	41	88	32a	pH, Fe, SO4, SP. COND.	NPS SURVEY, 1987	EVALUATED	
05070203-050	LF. FORK BEAVER CREEK	42	41	65	88	32a	NUTR, BACT, SED	NPS SURVEY, USGS 1980	EVALUATED	
05070203-060	CANEY FORK	51	31	88	65	32a	SED, SO4, MET, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-070	LF. FORK MIDDLE CREEK	51	65	88	32a	32b	SED, SO4, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05070203-071	RT. FORK MIDDLE CREEK	88	65	32a	32b		SED, BACT	NPS SURVEY, 1987	MONITORED	WAH, PCR
05070203-080	ABBOTT CREEK	88	65	32a			SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-090	MILLER CREEK	63	51	52	65	62	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-100	JOHN'S CREEK	51	88	65	32a	52	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-101	BRUSHY CREEK	51	52	65	88	32	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-102	RACCOON CREEK	51	52	65	88	61	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-110	BUFFALO CREEK	51	88	65	32a	83	SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-130	DANIEL CREEK	83	51	75	71	52	BACT, SED	NPS SURVEY, 1987	EVALUATED	
05070203-141	JENNY'S CREEK	51	55	83	87	32a	SED, Cl, BACT, SO4, MET	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05070203-142	MUDLICK CREEK	51	52	83	87	31	SED, Cl, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070203-143	BARNETTS CREEK	32a	83	65	24	87	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-150	GREASY CREEK	51	21	83	65	24	SED, BACT, SO4, MET, NUTR	NPS SURVEY, 1987	EVALUATED	
05070203-160	TOM'S CREEK	51	52	61	65	62	SED, BACT, SO4, MET, NUTR	NPS SURVEY, 1987	EVALUATED	
05070203-170	LEVISA FORK	83	51	55	75	71	SED, BACT, SO4, MET, NUTR	NPS SURVEY, 1987	EVALUATED	
05070203-171	GRIFFITH CREEK	51	32a	65	87	83	MET, SED, SO4, BACT	NPS SURVEY, 1987	EVALUATED	
05070203-180	GEORGE'S CREEK	51	83	32	65	21	MET, SED, SO4, BACT	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
05070203-181	WILEY BRANCH	51	21	65	87		SED, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05070204-010	FIVE FORKS CREEK	51	84	52	31	73	SED, BACT, SO4, MET	NPS SURVEY, 1987; DOW	MONITORED	WAH, PCR
05070204-020	BLAINE CREEK	55	51	31	32	21	SED, BACT, SO4, MET, Cl	EPA; COE; NPS SURVEY, 1987	MONITORED	WAH, SCR
05070204-021	UPPER LAUREL CREEK	55	51	61	83	14	SED, BACT, SO4, MET	NPS SURVEY, 1987	MONITORED	
05070204-022	LOWER LAUREL CREEK	55	51	61	83	14	SED, BACT, SO4, MET	NPS SURVEY, 1987	MONITORED	
05070204-023	HOOD CREEK	55	51	11	83	87	SED, BACT, SO4, MET	NPS SURVEY, 1987	MONITORED	
05070204-024	FRANKS CREEK	55	51	61	87	83	SED, BACT, SO4, MET	NPS SURVEY, 1987	MONITORED	
05090103	*TYGARTS CREEK BASIN*									
05090103-040	CLIFFESIDE & CHINNS BRANCH	87	41	43	75		SED, MET, NUTR	NPS SURVEY, 1987	EVALUATED	
05090103-100	UPPER TYGARTS & FLAT CREEK	88	65	21	18	89	SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05090103-110	TYGARTS & SMOKEY CREEKS	14	24	65			SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090103-120	BUFFALO & GRASSY CREEKS	14	24	65			SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090103-130	THREE PRONG BRANCH	65	11	18	87		BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05090103-150	LEATHERWOOD BRANCH	65	11	18	87		SED	NPS SURVEY, 1987	EVALUATED	
05090103-160	WHITEOAK CREEK	65	11	18	87		SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090103-170	BEECHY CREEK	65	11	18	87		SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090103-180	SCHULTZ & WHITE OAK CREEKS	65	11	18	87		SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090103-200	OHIO RIVER DRAINAGE	41	42	43	11	16	MET, SED, NUTR, BACT, Cl	NPS SURVEY, 1987	EVALUATED	
05090104	*LITTLE SANDY RIVER BASIN*									
05090104-010	LITTLE SANDY RIVER	51	55	88	65	87	SED, BACT, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05090104-020	RT. & MIDDLE FORKS, LITTLE SANDY	51	65	87	21		SED, BACT, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05090104-031	BIG GIMLET CREEK	11	88	65	21		SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090104-040	NEWCOMBE CREEK	55	51	88	65	87	Cl, SED, BACT, SO4, MET	DOW, 1988; NPS SURVEY, 1987	MONITORED	WAH
05090104-050	CANEY CREEK	55	11	65	21		Cl, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090104-060	SINKING CREEK	88	65	24	14	51	SED, pH, Fe, Mn	NPS SURVEY, 1987, DOW,1981	EVALUATED	
05090104-070	LITTLE FORK	51	88	65	21	90	SED, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05090104-080	STINSON CREEK	65	89	90	88	51	BACT, SED	NPS SURVEY, 1987	EVALUATED	
05090104-090	BARRETT'S CREEK	65	18	88			BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-100	LITTLE SANDY RIVER	65	11	18	87		SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-101	LOST CREEK	88	21	90	65	11	SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-110	OLDTOWN CREEK	65	11	18	87		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-120	CANE CREEK	65	11	18	87		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-130	RACCOON & ALLCORN CREEK	65	11	18	87		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05090104-140	E. FORK LITTLE SANDY	87	65	11	89	18	SED, NUTR, BACT, SO4, MET, Cl	NPS SURVEY, 1987	EVALUATED	
050902	*OHIO RIVER MINOR TRIBUTARIES*									
05090201-060	KINNICONNICK	23	21	88	65	18	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-070	SALT LICK CREEK	23	21	89	65	11	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-080	SAND BRANCH	74					SED	NPS SURVEY, 1987	EVALUATED	
05090201-090	QUICK RUN	14	21				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05090201-120	E. FORK CABIN CREEK	11	65	13	16	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-130	CABIN CREEK	65	24	89	18	11	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-170	STONE LICK BRANCH	11	13	14	16	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/EVALUATED	USES NOT FULLY SUPPORTED
05090201-171	BULL FORK CREEK	65	55	11	14	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-190	LAWRENCE CREEK	11	13	14	16	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-220	BEASLEY CREEK	11	12	13	14	16	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-230	LEE CREEK	11	12	13	14	16	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-280	INDIAN CREEK	11	14	13	12	15	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-290	BRACKEN CREEK	11	14	15	21	22	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-320	TURTLE CREEK	11	14	15	21	22	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-330	LOCUST CREEK	11	14	15	21	22	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-380	SNAG CREEK	11	14	15	21	22	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-390	TWELVE MILE CREEK	10	30	60			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090201-440	FOUR MILE CREEK	60	10	30	40		SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05090203-140	WOOLPER CREEK	40	30	10	80	20	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090203-190	GUNPOWDER CREEK	40	30	10	80	20	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090203-200	MUD LICK CREEK	40	30	10	60	80	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090203-210	OHIO RIVER DRAINAGE	88	19	65			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05090203-250	STEPHEN'S CREEK	11	18	32b	43		MET, SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05090203-260	AGNIELS & BLACKROCK CREEK	11	18	32b	43		MET, SED	NPS SURVEY, 1987	EVALUATED	
05090203-290	McCOOLS CREEK	11	18	32b	43		MET, SED	NPS SURVEY, 1987	EVALUATED	
051001	"LICKING RIVER BASIN"									
05100101-010	LICKING RIVER	51	55	88	87	11	Cl, SP COND, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100101-020	LF. & RT. FORKS MIDDLE CREEK	51	88	21	87	32a	SED	NPS SURVEY, 1987	EVALUATED	
05100101-030	COW CREEK	88	87				SED	NPS SURVEY, 1987	EVALUATED	
05100101-041	LICKING RIVER	55	65	88	51		BACT, MET, SED, OIL-GREASE	NPS SURVEY, 1987, DOW	EVAL. & M	
05100101-042	LICK CREEK	87	89	32a	11		SED	NPS SURVEY, 1987	EVALUATED	
05100101-043	NORTH FORK LICKING RIVER	88	65	51			SED, MET, BACT	NPS SURVEY, 1987, DOW	MONITORED	PCR
05100101-050	WHITE OAK CREEK	51	87	88	32a	11	SED, MET, SO4, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-060	ELK FORK	88	65	21	51		SED, MET, SO4, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-061	WILLIAMS BRANCH	88	51	65	21		SED, MET, SO4, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-070	CANEY CREEK	88	65				BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-080	GREASY CREEK	88	65	11	87		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-090	BLACK WATER CREEK	11	88	87	65		SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100101-100	CRANEY CREEK	88	55	11	65	21	NUTR, SED, Cl	NPS SURVEY, 1987	EVALUATED	
05100101-110	BEAVER CREEK	11	88	42	21		NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100101-120	LICKING RIVER	87	88	21	11	65	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100101-130	N. FORK TRIPLETT	65	88	89	14		BACT	NPS SURVEY, 1987	EVALUATED	
05100101-131	TRIPLETT CREEK	10	65	88	43	51	PEST, BACT, SED	NPS SURVEY, 1987; 305(b), 1988	MONITORED	
05100101-140	SALT LICK CREEK	11	88	21	87		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100101-150	SLATE CREEK	16	11	18	14	65	SED	NPS SURVEY, 1987	EVALUATED	
05100101-160	FOX CREEK	21	88	11	73	66	SED	NPS SURVEY, 1987	EVALUATED	
05100101-170	HILLSBORO BRANCH	11	16				BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-180	LICKING RIVER	11	14	16	87	88	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-190	FLAT CREEK	11	88	18	14	65	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/EVALUATED	USES NOT FULLY SUPPORTED
05100101-200	FLEMING CREEK	43	16	11	87	88	BACT, SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
05100101-210	JOHNSON CREEK	11	16	13	14	24	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-230	LICKING RIVER	11	87	88	14	24	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-240	KINCAID CREEK	11	65	24	14	15	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100101-250	GRASSY CREEK	11	19	65	24	63	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100101-251	SOUTH FORK GRASSY CREEK	10	18				NUTR, BACT	305(b), 1988	MONITORED	
05100101-260	PHILLIPS CREEK	60	30	10	40		NUTR, MET, SED, BACT	NPS SURVEY, 1987, 305(b), 1988	MONITORED	
05100101-270	DECOURSEY CREEK	40	30	60	10		NUTR, MET, SED	NPS SURVEY, 1987	EVALUATED	
05100101-280	BOWMAN CREEK	10	30	60			NUTR, MET, SED	NPS SURVEY, 1987	EVALUATED	
05100101-281	CRUISES CREEK	10	60	30			NUTR, MET, SED	NPS SURVEY, 1987	EVALUATED	
05100101-290	BANKLICK CREEK	30	40	10	60		NUTR, MET, SED	NPS SURVEY, 1987	EVALUATED	
05100102-010	HINKSTON CREEK	87	11	12	87	43	BACT, NUTR, SED, MET	NPS SURVEY, 1987; DOW	MONITORED	PCR
05100102-011	SOMERSET CREEK	11	88	18	43	14	BACT, NUTR, SED, MET	NPS SURVEY, 1987	EVALUATED	
05100102-020	S. FORK LICKING RIVER	11	12	16	18	19	NUTR, PEST, SED, MET, BACT	NPS SURVEY, 1987	EVALUATED	
05100102-030	BIG BRUSHY CREEK	11	62	87	32a	65	NUTR, SED, BACT	NPS SURVEY, 1987, 305(b), 1988	MONITORED	WAH
05100102-040	KENNEDY & CABIN CREEKS	11	16	14	51	18	MET, NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100102-041	STONER CREEK	11	16	14	51	18	MET, NUTR, SED, BACT	NPS SURVEY, 1987, 305(b), 1988	MONITORED	PCR
05100102-042	STRODES CREEK	11	14	16	41	60	SED, PEST, BACT	NPS SURVEY, 1987; DOW	MONITORED	PCR
05100102-050	TOWNSEND CREEK	11	16	18	77	65	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100102-060	MILL CREEK	11	14	24	32a	87	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100102-070	TWIN CREEK	11	14	24	32a	16	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100102-080	RAVEN CREEK	11	14	16	24	32a	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100102-090	COPPERSTOWN CREEK	88	19	65			NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
051002	"KENTUCKY RIVER BASIN"									
05100201-010	MILLSTONE CREEK	51	88	63	21		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05100201-020	ROCKHOUSE CREEK	51	57	88	21		SED, MET, SO4	NPS SURVEY, 1987	MONITORED	
05100201-030	NORTH FORK KENTUCKY RIVER	51	88	11	52	32a	SED, AS, MET, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR
05100201-040	TURKEY CREEK	51	88	21	55		SO4, SED, MET, Cl	NPS SURVEY, 1987	EVALUATED	
05100201-050	LEATHERWOOD CREEK	51	52	88	57	55	SO4, SED, MET, Cl	NPS SURVEY, 1987	EVALUATED	
05100201-060	MACES CREEK	51	52	55	23	88	SO4, SED, MET, Cl	NPS SURVEY, 1987	EVALUATED	
05100201-071	CARR FORK CREEK	51	52	88	57		SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100201-080	LOTTS CREEK	51	52	65	88	32a	SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100201-090	BIG CREEK	51	52	55	32a	23	SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100201-100	NORTH FORK KENTUCKY RIVER	51	52	88	55	21	SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100201-110	GRAPEVINE CREEK	51	52	88	32a	32b	SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100201-120	TROUBLESOME CREEK	42	51	52	55	88	SO4, MET, SED, BACT	NPS SURVEY, 1987; DOW	MONITORED	PCR
05100201-121	BUCKHORN CREEK	51	65				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100201-122	LOST CREEK	88					SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100201-123	BALLS FORK	65	88	51	32a		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100201-130	SOUTH FORK QUICKSAND CREEK	51	88				SED	NPS SURVEY, 1987; 305(b), 1988	MONITORED	PCR
05100201-140	QUICKSAND CREEK	51	55	65	88	32a	NUTR, SO4, SED, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	PCR
05100201-150	NORTH FORK KENTUCKY RIVER	88	51	55	20		SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/ EVALUATED	USES NOT FULLY SUPPORTED
05100201-160	CANE CREEK	88					SED	NPS SURVEY, 1987	EVALUATED	
05100201-170	FROZEN CREEK	88	11				SED	NPS SURVEY, 1987	EVALUATED	
05100201-180	BOONE FORK FROZEN CREEK	88	11				SED	NPS SURVEY, 1987	EVALUATED	
05100201-210	DEVIL CREEK	50	51	55	20		SED, MET, SO4, Cl, pH, Fe	NPS SURVEY, 1987; DOW, 1981	EVALUATED	
05100201-220	WALKER'S CREEK	55	21	23			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05100201-230	MIDDLE FORK KENTUCKY RIVER	88	51	21			SED, MET	NPS SURVEY, 1987	EVALUATED	
05100202-001	HALLS FORKS	51	52	88	55		SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100202-002	HALANDS FORK	51	52	88	55	23	SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100202-010	MIDDLE FORK KENTUCKY RIVER	51	57	52	21	88	SED, MET, SO4, Cl, BACT	NPS SURVEY, 1987; 305(b), 1988	EVALUATED	PCR
05100202-011	ROCKHOUSE CREEK	32a	88	21	55	51	SED, MET, SO4, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05100202-012	BEECH FORK	51	52	88	55	32a	SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100202-013	GREASY CREEK	51	52	88	14	32a	SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100202-020	CUTSHIN CREEK	51	88	55	52		SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100202-040	MIDDLE FORK KENTUCKY RIVER	51	11	52	88	55	SED, MET, SO4, Cl, BACT	NPS SURVEY, 1987; 305(b), 1988	EVALUATED	PCR
05100202-041	TURKEY CREEK	11					SED, Cl, MET	NPS SURVEY, 1987	EVALUATED	
05100202-050	LONG CREEK	51	52	88	23	21	SED	NPS SURVEY, 1987	EVALUATED	
05100203-010	REDBIRD RIVER	20	51	14	11	62	SO4, SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100203-020	SOUTH FORK KENTUCKY RIVER	20	51	88	11	55	SED, BACT, Cl	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100203-021	COW CREEK	51	11				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05100203-022	INDIAN CREEK	51	11				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05100203-023	UPPER BUFFALO CREEK	51					SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05100203-024	ISLAND CREEK	51	11				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05100203-030	BULLSKIN CREEK	20	51	52	88	55	SED, MET, SO4, Cl, NUTR	NPS SURVEY, 1987	EVALUATED	
05100203-040	GOOSE CREEK	51	20	14	11	77	SED, MET, SO4, Cl, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100203-050	SEXTON CREEK	57	51	85	11	20	SED, MET, SO4, Cl, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100203-060	SOUTH FORK KENTUCKY RIVER	88	51	11			SED	NPS SURVEY, 1987	EVALUATED	
05100203-061	BUCK CREEK	88	51	11			SED	NPS SURVEY, 1987	EVALUATED	
05100203-062	JONES FORK	88	65	51	32a	32b	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100203-063	RIGHT FORK OF BEAVER CREEK	51	65	88	32a	32b	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100203-070	MEADOW CREEK	88	32a				SED	NPS SURVEY, 1987	EVALUATED	
05100204-001	CALLOWAY'S CREEK	55	87				SED, Cl	NPS SURVEY, 1987	EVALUATED	
05100204-002	SWEET LICK CREEK	77					SED	NPS SURVEY, 1987	EVALUATED	
05100204-010	KENTUCKY RIVER	51	88				SED	NPS SURVEY, 1987	EVALUATED	
05100204-020	STURGEON CREEK	57	85	87	88	51	SED, MET, NUTR, SO4	NPS SURVEY, 1987	EVALUATED	
05100204-030	KENTUCKY RIVER	11	22	55	87	51	SED, MET, NUTR, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05100204-040	MILLER'S CREEK	55	22	11	87	51	Cl, SED, MET, NUTR, SO4	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05100204-050	SOUTH FORK STATION CAMP CREEK	55	18	85	87	22	Cl, SED, MET, NUTR, SO4	NPS SURVEY, 1987	EVALUATED	
05100204-060	COW CREEK	55	87				Cl, SED	NPS SURVEY, 1987	EVALUATED	
05100204-070	RED LICK CREEK	11	65	22	55	87	Cl, SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100204-080	KENTUCKY RIVER	11	22	55	87	51	Cl, SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100204-090	CAMPBELL CREEK	22	55	87			SED, Cl	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100204-100	DROWNING CREEK	11	65	32a	14	22	SED, NUTR	NPS SURVEY, 1987	EVALUATED	

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05100204-110	RED RIVER	10	60	65	20	50	BACT, SED, Fe, Mn	NPS SURVEY, 1987, 305(b), 1988	MONITORED	WAH, PCR
05100204-111	LACY CREEK	10	20	51			SED	NPS SURVEY, 1987	EVALUATED	
05100204-112	GILMORE CREEK	10	20	51	41		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100204-120	RED RIVER	21	88	87			SED	NPS SURVEY, 1987	EVALUATED	
05100204-130	STILLWATER CREEK	10	60	65	20		SED, BACT	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100204-150	CANE CREEK	11	21	87			SED	NPS SURVEY, 1987	EVALUATED	
05100204-160	RED RIVER	55	65	20	11		C1, SED, NUTR, BACT	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, SCR
05100204-170	RED RIVER	55	22	11	87	51	C1, SED, NUTR, SO4, BACT	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, SCR
05100204-171	HARDWICK CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05100204-180	LULBEGRUD CREEK	11	14	21	23	31	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-010	UPPER HOWARD CREEK	88	10				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100205-020	MUDDY CREEK	32a	32b	65	66	63	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-030	FOUR MILE CREEK	88					SED	NPS SURVEY, 1987	EVALUATED	
05100205-040	OTTER CREEK	32a	32b	65	41	11	PEST, SED, NUTR	NPS SURVEY, 1987; 305(b),1988	MONITORED	
05100205-050	LOWER HOWARD CREEK	87					SED	NPS SURVEY, 1987	EVALUATED	
05100205-060	KENTUCKY RIVER	41	43	32a	32b	65	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-070	BOONE CREEK	87	14	11	32a		SED	NPS SURVEY, 1987	EVALUATED	
05100205-080	TATE CREEK	32a	32b	65	41	11	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100205-090	SILVER CREEK	32a	32b	65	11	41	PEST, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05100205-100	PAINT LICK CREEK	11	16	18	32a	32b	SED, BACT	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100205-110	SUGAR CREEK	11	18	22			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-120	HICKMAN CREEK	32a	32b	41	43	64	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05100205-130	JESSAMINE CREEK	41	43	32a	32b	65	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05100205-140	KENTUCKY RIVER	11	14	32a	32b	65	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-141	CANOE CREEK	11	18	22			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-150	DIX RIVER	11	87	18	65	61	SED, NUTR, BACT, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05100205-160	LOGAN CREEK	11	18	87	32a	32b	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-170	DIX RIVER	11	16	65	32a	32b	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-171	WALKER BRANCH	10	18				BACT, NUTR	305(b), 1988	MONITORED	
05100205-180	HARRIS CREEK	11	12	14	13		SED	NPS SURVEY, 1987	EVALUATED	
05100205-181	HANGING FORK	11	87	18	65		SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100205-190	CLARK'S RUN	62	65	32a	14		SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100205-200	PREAR'S CREEK	14	32a				SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05100205-210	SHAKER CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-220	CLEAR CREEK	11	87	14	24		SED	NPS SURVEY, 1987	EVALUATED	
05100205-230	CRAIG CREEK	11	87	14	24		SED	NPS SURVEY, 1987	EVALUATED	
05100205-240	GLENN'S CREEK	11	42	87	14		SED, MET	NPS SURVEY, 1987	EVALUATED	
05100205-250	STONEY CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-260	NORTH & SOUTH BENSON CREEKS	11	12	14	65		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-270	SOUTH ELKHORN CREEK	11	87	32a	32b	43	LINDANE, SED, MET, C1, DDT	NPS SURVEY, 1987, 305(b), 1988	MONITORED	WAH, SCR
05100205-280	NORTH ELKHORN CREEK	11	12	13	14	32a	MET, SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-281	CANE RUN CREEK	11	12	14	32a	32b	MET, SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	

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Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
05100205-290	ELKHORN CREEK	41	42	43			MET, SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-300	FLAT CREEK	11	14				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100205-310	SANDRIDGE CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-311	CEDAR CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-320	SEVERN CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05100205-330	SIX MILE CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-340	SULPHUR CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-341	DRENNON CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-342	CANES RUN	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05100205-350	MILL CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-351	TWIN CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-360	EAGLE CREEK	11	12	14	22	24	AS, SED, OIL-GREASE, BACT, MET	NPS SURVEY, 1987, 305(b), 1988	MONITORED	PCR
05100205-370	EAGLE CREEK	88	65	10c			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-371	GRASSY RUN	88	19	65			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-380	CLARK'S CREEK	88	19	65			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-390	TEN MILE CREEK	88	19	65			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-400	BRUSH CREEK	88	65	19	10c		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05100205-410	EAGLE CREEK	88	65	19	10c	11	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05100205-420	KENTUCKY RIVER	11	18	32b	43		SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
05100205-421	WHITES RUN CREEK	11	18	32b	43		SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
05100205-430	MILL CREEK	11	18	14	32b	43	SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
051100	*GREEN RIVER BASIN*									
05110001-010	GREEN RIVER	11	13	18	14	21	SED, NUTR, MET, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-030	CASEY CREEK	11	13	87	16		SED	NPS SURVEY, 1987	EVALUATED	
05110001-040	ROBINSON TALLOW CREEK	11	18	14			SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-050	GREEN RIVER	11	14	16	18	87	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-060	MEADOW CREEK	11	18	16	14	65	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05110001-070	RUSSELL CREEK	11	14	16	18	13	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-071	CANEY FORK	14	16	18	65	76	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05110001-080	LITTLE RUSSELL	11	14	16	18	65	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05110001-090	PITMAN CREEK	62	11	64	65	18	BACT, SED	NPS SURVEY, 1987	MONITORED	
05110001-091	LITTLE PITMAN CREEK	62	11	64	65	18	BACT, SED	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05110001-100	BRUSH CREEK	11	14	16	18	21	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-110	LITTLE BARREN RIVER	11	21	18	32a	14	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-111	TRAMMEL CREEK	11	14	16	18	65	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-112	GREASY CREEK	11	14	16	18	21	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-120	LYNN CAMP CREEK	11	18	16	14	21	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-130	GREEN RIVER	11	18	32a	32b	42	Cl, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-140	GREEN RIVER	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05110001-150	BACON CREEK	11	18				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-160	WALTERS CREEK	11	99				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110001-170	McDOUGAL CREEK	11	99				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
05110001-180	NOLIN RIVER	11	18	32	21	16	NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-190	MIDDLE CREEK	11	15	18	32	99	NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-200	VALLEY CREEK	11	15	18	32		NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05110001-220	NOLIN RIVER	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05110001-230	BEAVER DAM CREEK	11	14				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110001-240	ALEXANDER CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05110001-250	LITTLE BEAVER DAM CREEK	11	14				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110001-260	BEAR CREEK	11	16	14	51	13	SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05110001-270	LOST CREEK	10					SED	NPS SURVEY, 1987	EVALUATED	
05110001-280	BIG REEDY CREEK	11	16	14	51	77	MET, SO4, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-290	BIG BULL CREEK	51	11	14	22	24	MET, SO4, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-291	LITTLE BULL CREEK	51	11	14	22	24	MET, SO4, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-292	LITTLE REEDY CREEK	51	70	11	14	22	MET, SO4, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110001-300	CLAY LICK CREEK	10					SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110002-031	BARREN RIVER	11	14	22	24		SED	NPS SURVEY, 1987	EVALUATED	
05110002-040	E. FORK BARREN RIVER	11	16				SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110002-050	MILL CREEK	14	23	32a	11		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110002-110	PUNCHEON CREEK	10	87				SED	NPS SURVEY, 1987, A.S.C.S.	EVALUATED	
05110002-130	PETER CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05110002-131	HUNGRY CREEK	10	87				SED	NPS,1987, 305(b),1986 A.S.C.S.	EVALUATED	
05110002-160	PETER'S CREEK	11	18				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110002-170	BEAVER CREEK	11	18	32a	32b	42	Cl, SED, MET	NPS SURVEY, 1987	EVALUATED	
05110002-180	SKAGG'S CREEK	11	14	16	18	55	Cl, SED, MET	NPS SURVEY, 1987	EVALUATED	
05110002-190	BARREN RIVER	11	18	14			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05110002-200	BAYS FORK	11	56				pH, SED	NPS SURVEY, 1987	EVALUATED	
05110002-230	W. FORK DRAKE'S CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05110002-240	LICK CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05110002-260	SULPHUR FORK	11	14	87			SED, PEST	NPS SURVEY, 1987, A.S.C.S.	EVALUATED	
05110002-280	MIDDLE FORK DRAKE'S CREEK	11	62	55	14		SED, BACT	NPS, 1987, DOW, A.S.C.S., HTH. DEPT.	MONITORED	
05110002-300	TRAMMELL FORK	11					SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110002-320	TRAMMELL FORK	11	14	62	55	87	SED, BACT, Cl, PEST	NPS, 1987, A.S.C.S., HTH DEPT	E & M	
05110002-340	TRAMMEL FORK	11					SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110002-350	GASPER RIVER	11	14	22	24	16	SED, SOLID WASTE, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05110002-360	LITTLE MUDDY CREEK	11	70	14	22	24	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110003-010	WELCHS CREEK	51	11	70	14	22	SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110003-020	INDIAN CAMP CREEK	70	11	51	14	22	SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110003-030	GREEN RIVER	11	51	14	22	24	SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110003-040	MUDDY CREEK	11	70	14	51	22	SED, pH, SO4, Fe	NPS SURVEY, 1987, DOW, 1981	EVALUATED	
05110003-041	CANEY CREEK	51	52	22	24	11	SED	NPS SURVEY, 1987; DOW	MONITORED	
05110003-050	PANTHER CREEK	51	11	14	22	24	SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05110003-060	MUD RIVER	11	14	51	18	66	SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05110003-070	GREEN RIVER	51	11	87			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	

Table 24
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HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/EVALUATED	USES NOT FULLY SUPPORTED
05110003-080	POND CREEK	51	57	52	11	42	SED, pH, SO4, Fe	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR, SCR
05110003-090	LEWIS CREEK	51	10				SED, MET, pH, SO4, Fe	NPS SURVEY, 1987; DOW, 1981	EVALUATED	
05110003-100	GREEN RIVER	51	11	87			SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05110004-010	MEETING CREEK	11	16	15	18	21	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-020	ROUGH CREEK	11	15	21	55		SP COND, SED, pH, Cl	NPS SURVEY, 1987	EVALUATED	
05110004-030	CLIFTY CREEK	11	16				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-050	LITTLE CLIFTY CREEK	11	16				SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-060	MUDDY PRONG	11	14	16	21		SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-070	FIDDLER'S CREEK	11	14	16	21		SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-080	ROUGH RIVER	11	14	16	21		SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-090	ROCK LICK CREEK	11	14	16	21		SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-100	SHORT CREEK	11	16	71			BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110004-110	ROUGH RIVER	11	14	16	21		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110004-120	CANEY CREEK	11	16	71			BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05110004-130	ROUGH RIVER	11	51				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05110004-140	ADAM'S FORK	11	14	22			SED	NPS SURVEY, 1987	EVALUATED	
05110004-141	ROCK LICK CREEK	11	14	22			SED	NPS SURVEY, 1987	EVALUATED	
05110004-150	HALL'S CREEK	11					SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-160	MUDDY CREEK	11	14	51			SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110004-170	BARNETT CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05110005-010	BUCK CREEK	11	13	14	16	51	PEST, SED, BACT	NPS SURVEY, 1987, HTH DEPT, A.S.C.S.	MONITORED	
05110005-040	LONG FALLS CREEK	11	13	14	16	87	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05110005-050	GREEN RIVER	55	87	11	81		SED, NUTR, Cl	NPS SURVEY, 1987	EVALUATED	
05110005-060	DEER CREEK	11	87	55	16	88	SED, NUTR, Cl	NPS SURVEY, 1987	EVALUATED	
05110005-070	GREEN RIVER	11	13	14	16	51	SED, NUTR, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05110005-080	W. FORK KNOBLICK CREEK	11	51	14			SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-090	CASH CREEK	51	11				SED, SO4, MET	NPS SURVEY, 1987	EVALUATED	
05110005-100	PANTHER CREEK	11	87	14			SED	NPS SURVEY, 1987	EVALUATED	
05110005-110	N. FORK PANTHER CREEK	11	87	14	16	21	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-120	S. FORK PANTHER CREEK	11	87	14			SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-130	TWO MILE CREEK	11	14	87			SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-140	RHODES CREEK	11	87				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-150	W. FORK KNOBLICK CREEK	11	51	14			SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05110005-160	GREEN RIVER	55	11				SED, Cl	NPS SURVEY, 1987	EVALUATED	
05110005-170	RICHMOND SLOUGH	55	11	14			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05110005-180	LICK CREEK	51	11				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05110006-010	E. FORK POND RIVER	11	21	87	83	55	SED, Cl	NPS SURVEY, 1987	EVALUATED	
05110006-020	W. FORK POND RIVER	11	87	88	51		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05110006-030	POND RIVER	51	13	14	16	11	SED, pH, SO4, Fe	NPS SURVEY, 1987, DOW, 1981	EVALUATED	
05110006-040	DRAKE'S CREEK	11	51	87	88		SED, pH, SO4, Fe	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05110006-050	FLAT CREEK	51	57	11			SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1988	MONITORED	WAH
05110006-060	POND RIVER	51	11				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	

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HYDROLOGIC CODE	STREAM NAME	N.P.S.-CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED EVALUATED	USES NOT FULLY SUPPORTED
05110006-070	ELK CREEK	87	88	11			SED	NPS SURVEY, 1987	EVALUATED	
05110006-080	OTTER CREEK	87	88	11			SED	NPS SURVEY, 1987	EVALUATED	
05110006-090	CYPRESS CREEK	51	13	14	16	11	SED, NUTR, SO4, BACT, MET	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
051301	*UPPER CUMBERLAND RIVER BASIN*									
05130101-010	POOR FORK CREEK	52	51	88	21	55	SED, MET, NUTR, SO4, BACT, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05130101-020	CLOVER FORK	52	51	88	21		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-030	MARTINS FORK	52	51	88	89		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-031	CRANK'S CREEK	51	52	88			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-040	SLATER'S FORK	57	51	52			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-050	CATRON'S CREEK	52	51	88	21		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-060	WALLINS CREEK	52	51	88			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-070	PUCKETT CREEK	88	51	52	87		SED, MET, SO4, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130101-080	BROWNIES CREEK	51	21	89	65	87	SED, MET, SO4, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130101-090	CLEAR FORK	51	87				SED	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05130101-110	YELLOW CREEK	51	23	31	41	42	SED, MET, SO4, NUTR, BACT	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05130101-130	STONE FORK	51	21				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-140	L. CLEAR CREEK	51	87				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-150	STRAIGHT CREEK	21	51	65	87	51	NUTR, BACT, SED	NPS SURVEY, 1987	EVALUATED	
05130101-160	GREASY CREEK	87					SED	NPS SURVEY, 1987	EVALUATED	
05130101-170	GREASY CREEK	51	21	87			SED	NPS SURVEY, 1987	EVALUATED	
05130101-180	CUMBERLAND RIVER	51	87	88	43		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-190	STINKING CREEK	51	87	21			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-200	BRUSH CREEK	51	87	88	21		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-210	RICHLAND CREEK	51	87				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-220	INDIAN CREEK	51	87				SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-230	L. POPLAR CREEK	51	52	21			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-240	MEADOW CREEK	11	13	14	16	51	SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05130101-250	CANE CREEK	52	57				SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-270	POPLAR CREEK	51	52	57			SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-280	PATTERSON CREEK	51	52	57			SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-290	LAUREL CREEK	51	57	87			SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-320	LAUREL FORK	51	52	57	87	65	SO4, SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130101-420	WATTS CREEK	11	13	14	16	18	SO4, SED, MET, NUTR, BACT, Cl	NPS SURVEY, 1987	EVALUATED	
05130101-440	BUNCHES CREEK	51	52	57	22		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-461	JELLICO BRANCH	51	52	57			SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130101-470	MARSH CREEK	51	55				SED, MET, SO4, Cl	NPS SURVEY, 1987	EVALUATED	
05130101-480	LAUREL CREEK	30	40				SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-490	INDIAN CREEK	30	40				SED, MET	NPS SURVEY, 1987	EVALUATED	
05130101-500	SPRUCE CREEK	51	57	55			SO4, SED, MET, Cl	NPS SURVEY, 1987	EVALUATED	
05130101-520	LYNN CAMP CREEK	62	63	43	42	41	SED, MET, SO4, NUTR	NPS SURVEY, 1987	EVALUATED	
05130102-010	SOUTH FORK ROCKCASTLE RIVER	51	20	14	11	13	BACT, NUTR, SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130102-011	MOORES CREEK	18	85	87	22		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	

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05130102-011	RACCOON CREEK	14	51	63	77	22	SED, BACT, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130102-020	WOOD CREEK	32a	32b	14	51	18	SED, BACT, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130102-030	POND CREEK	18	85	87	22		SED, NUTR	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05130102-040	MIDDLE FORK ROCKCASTLE RIVER	85	87	18	22		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130102-050	HORSE LICK CREEK	57	85	87	18	22	BACT, SED, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130102-060	ROUNDSTONE CREEK	11	51	65	88		BACT, SED, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130102-070	ROCKCASTLE RIVER	11	65	88	51	52	MET, BACT, SED	NPS SURVEY, 1987, DOW	E & M	
05130102-080	SKEGG'S CREEK	51	88	65	11		MET, BACT, SED	NPS SURVEY, 1987	EVALUATED	
05130102-090	SINKING CREEK	51	22				MET, BACT, SED	NPS SURVEY, 1987	EVALUATED	
05130102-100	CANE CREEK	22					SED	NPS SURVEY, 1987	EVALUATED	
05130103-010	PITMAN CREEK (LOWER)	32	43	42	83	51	SED, MET, SO4, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130103-011	PITMAN CREEK (UPPER)	11	43	32	42	18	SED, MET, SO4, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130103-030	CANEY CREEK	11	87	83	18	88	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-040	BUCK CREEK	11	87	88	18	65	SED, BACT, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05130103-060	FISHING CREEK	11	13	87	65	16	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-070	ROCK LICK CREEK	11	13	87	16		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-080	COLD WEATHER CREEK	11	87	32	18		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-090	BIG CLIFTY CREEK	11	83	18			NUTR, SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05130103-100	MEADOW CREEK	11	51	65	85		NUTR, SED	NPS SURVEY, 1987	EVALUATED	
05130103-110	SPUTTER BRANCH	11	87	18	83		NUTR, SED	NPS SURVEY, 1987	EVALUATED	
05130103-130	WOLF CREEK	18	11	14	21	24	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-140	BEAVER CREEK	41	42	43	65	32a	SED, NUTR, MET, BACT	NPS SURVEY, 1987	EVALUATED	
05130103-150	OTTER CREEK	11	18	65	85	55	SED, Cl, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-170	CUMBERLAND RIVER	74	77	11	14	21	PEST, SED, BACT, SOLID WASTE	NPS SURVEY, 1987	EVALUATED	
05130103-180	CROCUS CREEK	11	14	13	18	21	PEST, SED, BACT, SOLID WASTE	NPS SURVEY, 1987	EVALUATED	
05130103-190	BIG RENOX CREEK	11	14	21	55		PEST, SED, BACT, SOLID WASTE, Cl	NPS SURVEY, 1987	EVALUATED	
05130103-200	CUMBERLAND RIVER	11	55	14	21	40	PEST, SED, BACT, SOLID WASTE, Cl	NPS SURVEY, 1987	EVALUATED	
05130103-220	BEAR CREEK	55	11				SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130103-230	MARROWBONE CREEK	11	21	14	18	87	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130103-240	MUDCAMP CREEK	55	21	14			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130103-250	MESHACK CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05130103-260	SULPHER CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05130103-280	McFARLAND CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05130103-290	KETTLE CREEK	11	21	55			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130104-250	BIG SOUTH FORK OF CUMBERLAND RIVER	51	52	57	83		SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130104-251	WOLF CREEK	51	52	57			SO4, SED, MET	NPS SURVEY, 1987	EVALUATED	
05130104-270	ROARING PAUNCH CREEK	51	52	57			SO4, SED, MET, pH	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05130104-290	ROCK CREEK	51	52	57			SO4, SED, MET	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR, SCR
05130104-310	LITTLE SOUTH FORK	11	23	51	55	65	NUTR, BACT, SED, Cl	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH
05130104-320	SINKING CREEK	11	23	51	55	65	NUTR, BACT, SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130104-330	CEDAR SINKING CREEK	11	23	51	55	65	NUTR, BACT, SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130105-180	SPRING CREEK	14	11	18	13	12	NUTR, BACT, SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	

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05130105-210	SMITH CREEK	14	11	12	13	18	NUTR, BACT, SED, Cl	NPS SURVEY, 1987	EVALUATED	
05130105-220	ILLWILL CREEK	55	21	14	11	13	NUTR, BACT, SED, Cl	NPS SURVEY, 1987	EVALUATED	
051302	*LOWER CUMBERLAND RIVER BASIN*									
05130205-100	CUMBERLAND RIVER	87					SED	NPS SURVEY, 1987	EVALUATED	
05130205-160	SALINE CREEK	11	14	16	21	24	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130205-170	DONALDSON CREEK	11	14	16	21	24	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130205-180	S. FORK LITTLE RIVER	11	31	32a	87	14	SED	NPS SURVEY, 1987	EVALUATED	
05130205-190	N. FORK LITTLE RIVER	11	31	32a	87		SED	NPS SURVEY, 1987	EVALUATED	
05130205-200	LITTLE RIVER	11	14	16	21	24	SED, NUTR, BACT, MET	NPS SURVEY, 1987; 305(b), 1988	MONITORED	HAH
05130205-210	SINKING FORK	11	14	16	21	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130205-220	MUDDY CREEK	11	14	16	21	24	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130205-230	DRY FORK CREEK	11	16	18	14	21	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05130205-240	RICHLAND CREEK	14	11				SED	NPS SURVEY, 1987	EVALUATED	
05130205-250	LIVINGSTON CREEK	11	14	16	21	24	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130205-260	CLAY LICK CREEK	11	14	57	30		BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130205-270	SUGAR CREEK	51	11	14			SED, pH, SO4, Fe	NPS SURVEY, 1987; DOW 1981	EVALUATED	
05130205-280	SANDY CREEK	14	11	30			SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05130205-290	HICKORY CREEK	11	14	21			SED	NPS SURVEY, 1987	EVALUATED	
05130206-050	RED RIVER	11	18				BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-060	SULPHER SPRING CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05130206-070	RED RIVER	11	16				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-080	PLEASANT RUN	11	16				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-090	SOUTH FORK RED RIVER	11	16				SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-150	WHIPPOORWILL CREEK	11	16	21	87		SED, NUTR	NPS SURVEY, 1987	MONITORED	
05130206-180	ELK FORK	11	43	65			MET, BACT, SED, NUTR	NPS SURVEY, 1987	MONITORED	
05130206-190	ELK FORK	11	14	87	18	21	MET, BACT, SED, NUTR	NPS SURVEY, 1987; 305(b), 1988	MONITORED	
05130206-230	MONTGOMERY CREEK	11	31	32a	87	21	MET, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-250	SPRING CREEK	11	87	18	21		MET, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-280	CASEY CREEK	11	14	16	21	24	MET, BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05130206-300	CASEY CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140	*OHIO RIVER MINOR TRIBUTARIES*									
05140101-010	LITTLE KENTUCKY RIVER	11	14	18	32b	43	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140101-011	WHITE SULPHUR FORK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140101-020	LOCUST CREEK	11	18	32b	43	14	NUTR, SED, MET	NPS SURVEY, 1987	EVALUATED	
05140101-021	CAMP CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140101-040	GILMORE CREEK	11	18	32b	43		SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05140101-041	SPRING CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140101-100	PRYOR BRANCH	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140101-101	CORN CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140101-120	BARE BONE CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140101-130	PATTONS CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140101-131	MIDDLE CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Streams

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05140101-150	EIGHTEEN MILE CREEK	10					SED	NPS SURVEY, 1987	EVALUATED	
05140101-170	POND, TAYLOR & BULL CREEKS	10					SED	NPS SURVEY, 1987	EVALUATED	
05140101-200	HARRODS CREEK	11	14	30			SED	NPS SURVEY, 1987	EVALUATED	
05140101-220	GOOSE CREEK	40	60	30			SED, MET	NPS SURVEY, 1987	EVALUATED	
05140101-250	BEARGRASS CREEK	40	60				SED, MET	NPS SURVEY, 1987	EVALUATED	
05140101-320	BIG RUN CREEK	10	30				SED	NPS SURVEY, 1987	EVALUATED	
05140101-330	MILL CREEK	30	60	10			SED	NPS SURVEY, 1987	EVALUATED	
051401	*SALT RIVER BASIN*									
05140102-010	SALT RIVER	11	14	32a	32b	12	SED, MET	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR
05140102-020	HAMMOND'S CREEK	11	14	32a	32b		SED	NPS SURVEY, 1987	EVALUATED	
05140102-030	TIMBER CREEK	14	11	18			SED, BACT, NUTR	NPS SURVEY, 1987; 305(b), 1988	MONITORED	
05140102-050	E. PRONG CREEK	11	18	32a	14		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-060	BEECH CREEK	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-070	JACK'S CREEK	11	18	32a	14	65	SED, NUTR, BACT, MET	NPS SURVEY, 1987	EVALUATED	
05140102-080	BRASHEARS CREEK	11	18	23	32a		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-081	BUCK CREEK	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-082	GUIST CREEK	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-090	FOX RUN	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-091	BULLSKIN CREEK	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-100	CLEAR CREEK	11	18	32a	32b	42	SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-110	SALT RIVER	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-111	DUTCHMAN CREEK	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-112	GOOSE CREEK	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-120	ELK CREEK	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-130	EAST FORK SIMPSON CREEK	11	14	18	43		MET, NUTR, SED, BACT	NPS SURVEY, 1987; 305(b), 1988	MONITORED	
05140102-140	PLUM CREEK	11	18	32a			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-150	KIMBLY RUN	11	14	18			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-151	EAST FORK OF COX'S CREEK	11	14	18	65		SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-152	WEST FORK OF COX'S CREEK	11	14	18			SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140102-170	SALT RIVER	32a					SED	NPS SURVEY, 1987	EVALUATED	
05140102-180	FLOYD'S FORK	10	65	32	18	14	MET, SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05140102-190	FLOYD'S FORK	10	40	60	32a		SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
05140102-200	LONG LICK CREEK	21	32a				SED	NPS SURVEY, 1987	EVALUATED	
05140102-230	POND CREEK	40	60	30			AS, MET, Cl, SED	NPS SURVEY, 1987, DOW	EVAL. & M	
05140103-010	ROLLING FORK RIVER	87	76	11	12	14	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-020	CLEAR CREEK	11	14	18	62	87	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-030	PRATHER CREEK	11	14	22	24	87	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-040	SALT LICK CREEK	11	99	22	24	87	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-050	OTTER CREEK	11	99				SED	NPS SURVEY, 1987	EVALUATED	
05140103-060	POTTINGER CREEK	11	14	18			SED, BACT, NUTR	NPS SURVEY, 1987; 305(b), 1988	MONITORED	
05140103-070	THOMPSON'S CREEK	11	99				SED	NPS SURVEY, 1987	EVALUATED	
05140103-080	ROLLING BEECH FORK	11	99	14	18	32a	SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	

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05140103-100	BEECH RIVER	11	14	18	20		SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-110	DRY FORK OF CHAPLIN RIVER	11	14	12			SED	NPS SURVEY, 1987	EVALUATED	
05140103-120	GLENN'S CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05140103-130	BEAVER CREEK	14	32a	14	20		SED	NPS SURVEY, 1987	EVALUATED	
05140103-140	LONG LICK CREEK	10	20				SED	NPS SURVEY, 1987	EVALUATED	
05140103-150	BEECH FORK	11	14	18	65	20	SED, BACT	NPS SURVEY, 1987	EVALUATED	
05140103-151	COXS CREEK	10	18				BACT, NUTR	305(b), 1988	MONITORED	
05140103-160	CARTWRIGHT CREEK	11	14	16	22	24	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-180	BEECH FORK	11	14	18	32a	32b	SED, MET	NPS SURVEY, 1987	EVALUATED	
05140103-190	LICK CREEK	11	12	18	14	65	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140103-200	ROLLING BEECH FORK	11	32	14	18	41	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140	*OHIO RIVER MINOR TRIBUTARIES*									
05140104-020	TIOGA CREEK	11	14	16	31	32a	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140104-030	OTTER CREEK	11	14	16	31	32a	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140104-050	DOE RUN	11	14	16	31	32a	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140104-060	FRENCH CREEK	11	14	16	31	32a	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140104-160	WOLF CREEK	11	14	16	31	32a	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140104-190	SPRING CREEK	11	14	16	21	31	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140104-220	YELLOW BANK CREEK	11	14	16	31	32a	SED	NPS SURVEY, 1987	EVALUATED	
05140104-240	LICK RUN	11	14	16	21		SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140104-250	SINKING CREEK	11	14	16	21		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-010	TOWN CREEK	11	14	16	21		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-030	CLOVER CREEK	11	14	22	16	21	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-040	INDIAN CREEK	11	14	22	16	21	SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-060	LEAD CREEK	11	14	22			SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-070	YELLOW CREEK	51	11	14	22		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-120	PANTHER CREEK	11	14	22			SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140201-140	LEWISPORT CREEK	32a	32b	31	71	11	SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-160	BLACKFORD CREEK	51	11	14	22	16	SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-170	BLACKFORD CREEK	51	11	14	22		SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-190	MACEO BOTTOMS CREEK	11	87				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-210	PUP CREEK	11	51	14			SED, MET, SO4	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-220	YELLOW CREEK	42	11	65			SED, BACT	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140201-240	FULKERSON & HORSMAN DITCH	11	42	32b	87		SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140202-050	PITTMAN CREEK	11	87	55			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-080	CANOE CREEK	41	11	55			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-110	GRASSY POND & LITTLE CYPRESS SLOUGH	77	72	55	87		SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-150	HIGHLAND CREEK	11	55	16	14	87	SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-160	HIGHLAND CREEK	11	16	55	14		SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-170	LOST CREEK	11	14	55			SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140202-190	SIBLEY CREEK	77	55				SED, Cl	NPS SURVEY, 1987	EVALUATED	
05140203-020	MUDDY POND	77	55				SED, Cl	NPS SURVEY, 1987	EVALUATED	

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05140203-030	GOOSE POND DITCH	11	14	72			SED	NPS SURVEY, 1987	EVALUATED	
05140203-040	EAGLE CREEK	11	14	16			NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
05140203-060	CAMP CREEK	10	30				SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
05140203-070	CROOKED CREEK	10	30	40	63		SED, MET	NPS SURVEY, 1987	EVALUATED	
05140203-080	HURRICANE CREEK	10	30				SED, pH, Fe, SO4	NPS SURVEY, 1987; DOW, 1981	EVALUATED	
05140203-090	CANEY FORK	10	30				SED, pH, Fe, SO4	NPS SURVEY, 1987; 305(b), 1986	EVALUATED	
05140203-110	DEER CREEK	11	14	57	30		SED, MET, SO4	NPS SURVEY, 1987	EVALUATED	
05140203-120	BUCK CREEK	14	11				SED	NPS SURVEY, 1987	EVALUATED	
05140203-130	LONG BRANCH	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140203-160	SUGARCAMP CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140203-190	CANY CREEK	11	14				SED	NPS SURVEY, 1987	EVALUATED	
05140205	*TRADEWATER RIVER BASIN*									
05140205-010	SANDLICK CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
05140205-020	BUFFALO CREEK	51	87	88	11		pH, SO4, SP COND	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR, SCR
05140205-030	CANY CREEK	51	87	88	11		pH, SO4, SP COND	NPS, 1987; 305(b),1986; DOW 1981	MONITORED	WAH, PCR, SCR
05140205-050	TRADEWATER RIVER	11	74	21	30	51	SED, MET, SO4	NPS SURVEY, 1987; STORET	MONITORED	
05140205-060	MONTGOMERY CREEK	11	21				SED	NPS SURVEY, 1987	MONITORED	
05140205-070	WARD CREEK	11	21				SED	NPS SURVEY, 1987	EVALUATED	
05140205-080	DONALDSON CREEK	11	21				SED	NPS SURVEY, 1987	EVALUATED	
05140205-090	CLEAR CREEK	51	11	55	21	77	pH, SO4, SP COND	NPS SURVEY, 1987; 305(b), 1988	MONITORED	PCR, WAH
05140205-100	BUTLER CREEK	10	30				SED	NPS SURVEY, 1987	EVALUATED	
05140205-110	CRAB ORCHARD CREEK	11	51	52	14	87	MET, SO4, SED, pH	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR, SCR
05140205-120	TRADEWATER RIVER	11	30	51	14		pH, SO4, SP COND	NPS SURVEY, 1987; DOW, 1981	EVALUATED	
05140205-130	SMITH DITCH	11	14	51	16		NUTR, MET, SED, SO4, pH	NPS SURVEY, 1987; 305(b), 1988	MONITORED	WAH, PCR, SCR
05140	*OHIO RIVER MINOR TRIBUTARIES*									
05140206-020	TENNESSEE RIVER	31	32a	32b	42	64	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-040	PERKINS CREEK	11	14	31	32a	32b	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-050	MASSAC CREEK	11	14	16	32a	43	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-060	L. BAYOU CREEK	11	14	32a	32b	43	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-070	BAYOU CREEK	11	14	32a	32b	41	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-110	REDSTONE CREEK	11	14	16	24	31	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
05140206-120	NEWTOWN CREEK	11	14	16	87		SED, NUTR	NPS SURVEY, 1987	EVALUATED	
05140206-130	CLAYTON CREEK	11	14	16	24	32b	SED, BACT, NUTR, MET, SO4	NPS SURVEY, 1987	EVALUATED	
060400	*TENNESSEE RIVER BASIN*									
06040005-290	WILDCAT CREEK	11	14	16	18	21	SED, BACT, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
06040005-310	CLEAR CREEK	11	14	16	18	21	SED, BACT, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
06040006-010	TENNESSEE RIVER	11	14	87	81	32a	MET, SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
06040006-020	JOHN'S CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
06040006-040	E. FORK CLARK'S RIVER	11	14	16	18	21	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
06040006-050	W. FORK CLARK'S RIVER	11	14	16	18	21	SED, MET, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
06040006-060	ISLAND CREEK	11	14	31	32a	32b	SED, MET, NUTR, BACT	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
08010	*MISSISSIPPI RIVER BASIN*									

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08010100-010	HAZEL CREEK	11	14	16	87		SED	NPS SURVEY, 1987	EVALUATED	
08010100-020	SHAWNEE CREEK	11	14	16	24	43	BACT, SED, NUTR	NPS SURVEY, 1987	EVALUATED	
08010100-030	BACK SLOUGH CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
08010201-010	MAYFIELD CREEK	11	14	16	18	24	SED, BACT, MET	NPS SURVEY, 1987	EVALUATED	
08010201-020	W. FORK MAYFIELD CREEK	11	51	18			SED, NUTR, MET	NPS SURVEY, 1987	EVALUATED	
08010201-030	TRUMAN CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
08010201-040	OBION CREEK	11	30	18			SED, NUTR	NPS SURVEY, 1987	EVALUATED	
08010201-050	MUD CREEK	11	87	71	72	74	SED, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
08010201-051	LITTLE MUD CREEK	11	87	71	72	74	SED	NPS SURVEY, 1987	EVALUATED	
08010201-060	BAYOU DE CHEIN	10					SED	NPS SURVEY, 1987, 305(b), 1986	EVALUATED	
08010201-061	CANE CREEK	11	18	87	30		NUTR, SED, BACT	NPS SURVEY, 1987	EVALUATED	
08010201-062	LITTLE BAYOU DE CHEIN	11	87				SED	NPS SURVEY, 1987	EVALUATED	
08010201-063	RUSH CREEK	11					SED	NPS SURVEY, 1987	EVALUATED	
08010201-064	HARRIS FORK CREEK	11	43	41	87		SED, MET	NPS SURVEY, 1987	EVALUATED	
08010202-020	TERRAPIN CREEK	11	14	16	18	21	SED, MET, BACT, NUTR	NPS SURVEY, 1987	EVALUATED	
08010202-070	KNOBB CREEK	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
08010202-090	BRUSH CREEK	11	18				SED, NUTR, BACT	NPS SURVEY, 1987	EVALUATED	
08010202-350	OWENS SLOUGH	11	14	22			SED	NPS SURVEY, 1987	EVALUATED	

Table 24
Nonpoint Source Impacted Wetlands

WETLANDS WATERBODY NAME	COUNTY	N.P.S.- CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/ EVALUATED
PROVIDENCE-TRADEWATER RIVER	WEBSTER, CRITTENDEN, HOPKINS	51	52	57			SEDIMENT, Mn, SO4, Al, SPECIFIC CONDUCTANCE	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
BROOKS CREEK-TRADEWATER RIVER	CALDWELL, HOPKINS, CRITTENDEN, WEBSTER	51	52	57			SO4, SPECIFIC CONDUCTANCE, SEDIMENT	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
LICK CREEK-TRADEWATER RIVER	CALDWELL, HOPKINS, CRITTENDEN, WEBSTER	51	52	57			pH, SO4, Fe	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
OLNEY- TRADEWATER RIVER	CALDWELL, HOPKINS	51	52	57			SEDIMENT, pH, METALS	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
WEIRS CREEK-TRADEWATER RIVER	HOPKINS	51	52	57			SEDIMENT, SO4, SPECIFIC CONDUCTANCE	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
MONTGOMERY CREEK-TRADEWATER RIVER	HOPKINS, CALDWELL, CHRISTIAN	65					SEDIMENT	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
UNNAMED-HURRICANE CREEK-TRADEWATER	HOPKINS, CALDWELL, CHRISTIAN	51					pH, DO, Fe	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
CANY CREEK-TRADEWATER & GREEN RIVERS	HOPKINS	51	52	57			ACIDITY, SO4, METALS	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
FLAT CREEK-POND R.-GREEN RIVER	HOPKINS	51	52	57			SO4, SPECIFIC CONDUCTANCE	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
DRAKES CREEK-POND R.-GREEN RIVER	CHRISTIAN	51	52	57			pH, Fe, SO4	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
LONG POND-POND R.-GREEN RIVER	CHRISTIAN	51	52	57			SPECIFIC CONDUCTANCE, METALS	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
THOMPSON CREEK-POND R.-GREEN RIVER	MUHLENBERG	51	57				SPECIFIC CONDUCTANCE,	MITSCH, TALYOR, BENSON	MONITORED

Table 25
Nonpoint Source Impacted Wetlands

WETLANDS WATERBODY NAME	COUNTY	N.P.S. - CATEGORIES 1	2	3	4	5	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED/ EVALUATED
							SO_4	HILL, 1983	
WEST FORK POND RIVER-GREEN RIVER	CHRISTIAN	51	57				SPECIFIC CONDUCTANCE, SO_4, ALKALINITY	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
LITTLE CYPRESS CREEK	OHIO	51	52	57			SPECIFIC CONDUCTANCE, SO_4, Fe, Mn	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
POND CREEK-GREEN RIVER	OHIO, MUHLENBERG	51					SPECIFIC CONDUCTANCE, SO_4, METALS	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
LEWIS CREEK-GREEN RIVER	OHIO, MUHLENBERG	51					pH, SPEC CONDUCTANCE, SO_4, SUSPENDED SOLIDS, METALS	MITSCH, TALYOR, BENSON HILL, 1983	MONITORED
CYPRESS CREEK-GREEN RIVER	McLEAN, MUHLENBERG	51					SUSPENDED SOLIDS, SO_4, SPECIFIC CONDUCTANCE	MITSCH, BOSSERMAN, HILL & TAYLOR, 1982	MONITORED
CLEAR CREEK SWAMP	HOPKINS	51	21				SEDIMENT, pH, SO_4, Fe, SPECIFIC CONDUCTANCE	MITSCH, BOSSERMAN, HILL & TAYLOR, 1982	MONITORED
HENDERSON SLOUGHS	HENDERSON	11					SEDIMENT	MITSCH, BOSSERMAN, HILL & TAYLOR, 1982	MONITORED

Table 26
Nonpoint Source Impacted Groundwater

GROUNDWATER WATERBODY NAME	N.P.S. CATEGORIES RANKING 1	2	3	4	5	6	7	8	9	10	11	12	13	14	PARAMETERS OF CONCERN	DATA SOURCES	MONITORED OR EVALUATED
AQUIFERS BENEATH THE BIG SINKING OIL FIELD-ESTILL, POWELL, LEE & WOLF CO.	55														pH, SPEC. COND., TDS, TOC, Cl, Br, SO4, Na, Ca	STRIPPER WELLS OF E.C. KY SMC MARTIN, 1983	MONITORED
ALLUVIAL AQUIFER BETWEEN CALVERT CITY AND TENNESSEE RIVER	11	62	63	64	65	66									METALS, VOC, PESTICIDES	DOW, CALVERT CITY, 1988	MONITORED
GATEWAY ADD	11	65													BACTERIA	DOW, GATEWAY ADD, 1988	MONITORED
AQUIFER BENEATH ROCKWELL SITE AT RUSSELLVILLE - LOGAN CO.	64	66	61												PCB's, METALS	ROCKWELL, 1986	MONITORED
LOST RIVER	32	41	42	43	61	62	83	64	65	66	86	83			ORGANICS	CRAWFORD, WKU & EPA, 1986	MONITORED
LOST RIVER	82														ORGANICS	CRAWFORD, 1982	EVALUATED
LOUISVILLE AQUIFER	65														BACTERIA	EPA 904/9-81-079	MONITORED
ROYAL SPRING	11	14	16	18	61										BACTERIA	UK WRI RR#113, 1978	EVALUATED
SLOANS VALLEY KARSTIC AQUIFER	61	63	51												METALS	WRIGHT STATE THESIS, 1986	MONITORED
AQUIFER IN LIVINGSTON, MARSHALL AND McCRACKEN COUNTIES	10	65													BACTERIA, NITRATES	DOW, 1988(TO BE PUBLISHED)	MONITORED
AQUIFER IN DOUBLE SPRINGS DRAINAGE BASIN-WARREN CO.	65														BACTERIA	SCHINDEL MS THEISS, 1984	MONITORED
INNER BLUEGRASS KARST AQUIFERS	10	40													BACTERIA, NITRATES	SCANLON DISSERTATION, 1985	MONITORED
KARST AQUIFERS OF WARREN, HARDIN, HART, PULASKI & EDMONSON COUNTIES	40														ORGANICS	CRAWFORD, 1984	MONITORED
OHIO VALLEY ALLUVIAL AQUIFER NEAR HAWESVILLE IN HANCOCK COUNTY	60														FLUORIDES, CYANIDE	ENVIR. RESOURCES MGT., INC., 1980	EVALUATED
KARSTIC AQUIFER KENDALL PLANT AT DRAKES CREEK IN SIMPSON COUNTY	60														PCB	CRAWFORD, 1985	MONITORED

data is collected, other waters may also be added. Information contained in the tables include the hydrologic unit/waterbody name, NPS categories ranking, parameters of concern, data sources, whether the waterbody was monitored or evaluated and designated uses not supported.

Hydrologic Unit/Waterbody Name

The identification of waters impacted by NPS pollution consists of the name of the stream, lake, wetland, or groundwater site. The hydrologic unit number and the P.L. 566 watershed number further delineate the waterbody.

NPS Category

The categories and subcategories or sources of NPS pollution for each of the listed waters were assigned by the codes established in U.S. EPA's Guidelines for the Preparation of the 1988 State Water Quality Assessment (305(b) Report), April 1, 1987. Refer to Table 27 for an explanation of the codes.

Additionally, the NPS categories were prioritized based on the severity of the NPS impact. The number ranking, one through twenty-one, indicates the level of NPS impact for the specific waterbody, with 1 being the highest and 5 the lowest.

Parameters of Concern

This information indicates the parameters which appear to be the causes of the NPS impacts. These parameters include sediment, nutrients, bacteria, chemicals, pesticides, metals, etc. See Table 28 for a list of the parameters and their abbreviations as used in the tables.

Data Sources

Because the NPS Assessment Report is based on information from many different sources, it was necessary to identify them. For complete references, refer to the Final NPS Assessment Report to be published in June, 1988. The information on wetlands and groundwater contamination is very limited. Much of the groundwater information was obtained from the Groundwater Branch of the Kentucky Division of Water. The Groundwater Branch will be expanding its monitoring and data assessment activities and will provide more information on NPS groundwater contamination in the near future. The wetland information was based on reports completed by universities in Kentucky. There is very little agency information on wetlands at this time.

Monitored or Evaluated

Two levels of assessment were used to determine the impact of NPS pollution: monitored or evaluated. "Monitored" waters are those that have been assessed based on current site specific ambient water quality data. Waters were labelled as being "evaluated" if, based on field observations, citizens complaints, fish

Table 27

Nonpoint Source Category Codes

10 Agriculture
- 11 Non-irrigated crop production
- 12 Irrigated crop production
- 13 Specialty crop production (e.g., truck farming and orchards)
- 14 Pasture land
- 15 Range land
- 16 Feedlot - all types
- 17 Aquaculture
- 18 Animal holding - management areas

20 Silviculture
- 21 Harvesting, reforestation, residue management
- 22 Forest management
- 23 Road construction - maintenance
- 24 Woodland Grazing

30 Construction
- 31 Highway - road - bridge
- 32 Land development
  - 32a Residential sites
  - 32b Commercial sites

40 Urban Runoff
- 41 Storm sewers (source control)
- 42 Combined sewers (source control)
- 43 Surface runoff

50 Resource Extraction-Exploration-Development
- 51 Surface mining
- 52 Subsurface mining
- 53 Placer mining
- 54 Dredge mining
- 55 Petroleum activities
- 56 Mill tailings
- 57 Mine tailings

60 Land Disposal (Runoff-Leachate From Permitted Areas)
- 61 Sludge
- 62 Wastewater
- 63 Landfills
- 64 Industrial land treatment
- 65 On-site wastewater systems (septic tanks, etc.)
- 66 Hazardous waste

70 Hydrologic - Habitat Modification
- 71 Channelization
- 72 Dredging
- 73 Dam construction
- 74 Flow regulation/modification
- 75 Bridge construction
- 76 Removal of riparian vegetation
- 77 Streambank modification - destabilization

80 Other
- 81 Atmospheric deposition
- 82 Waste storage - storage tank leaks
- 83 Highway maintenance and runoff
- 84 Spills
- 85 In-place contaminants
- 86 Natural
- 87 Streambank erosion
- 88 ____________
- 89 ____________
- 90 ____________
- 91 ____________

90 Source unknown

Table 28

Parameter Abbreviations

Parameters	Abbreviation or Notation
Agriculture	
Suspended Solids	SUSPENDED SOLIDS
Sediment	SED, SEDIMENT
Pesticides	PEST
Lindane	LINDANE
Dichloro-diphenyl-trichloro-ethane	DDT
Nutrients (ammonia, phosphorus)	NUTR
Bacteria	BACT
Dissolved oxygen	DO
Nitrates	NITRATES
Mining	
Acidity	ACID
Manganese	Mn
Sulfates	SO_4
Aluminum	Al
Metals	MET
Iron	IRON, Fe
pH	pH
Alkalinity	ALKALINITY
Petroleum	
Chlorides	CL
Total organic carbon	TOC
Urban	
Oil-grease	OIL-GREASE
Arsenic	As
Solid waste	SOLID WASTE
Poly/chlorinated-biphenyl	PCB
Total dissolved solids	TDS
Bromide	Br
Sodium	Na
Calcium	Ca
Volatile organic compounds	VOC
Organics	ORGANICS
Fluorides	FLUORIDES
Cyanide	CYANIDE

kill reports, land use data, etc., the waters were judged to be impacted by NPS pollution. Additionally, specific ambient water quality data that is greater than 5 years old is labelled as evaluated. Many of the waters identified in the Assessment are evaluated waters. However, the NPS Assessment Report is a dynamic document, which will be updated as new data is obtained.

Uses Not Fully Supported

All surface waters in Kentucky have been assigned an aquatic life use for warmwater or coldwater aquatic habitat (WAH, CAH), and a recreational use of primary or secondary contact recreation, (PCR, SCR). For a more thorough explanation of designated uses of surface water, see the Summary of Classified Uses in the Background section of the 1988, 305(b) report.

Tables 23-26 have identified those waters that are not fully supporting their designated use because of NPS impacts.

Identification of Best Management Practices

The purpose of this section is to describe the process Kentucky will use to identify Best Management Practices (BMPs) to control and reduce NPS pollution to the "maximum extent practicable." BMPs are defined as "methods, measures or practices to prevent or reduce water pollution, including but not limited to structural and nonstructural controls and operation and maintenance procedures."

A process of data collection from eight sources will aid in the identification of BMPs for the control of NPS. The data will be evaluated and recommendations as to the selection of appropriate BMPs will be made. The eight sources from which data will be collected are listed below. An explanation follows.

1. NPS survey of conservation districts, conducted by the Kentucky Division of Conservation in December, 1987.

2. Public meetings scheduled for 1988.

3. Federal, state, and local agencies identified as having a role in the control of NPS.

4. Low altitude photography of a specific watershed and interpretation of the data.

5. Field assessments, such as intensive survey studies, to be conducted by the Division of Water.

6. Conservation districts' annual and long range plans.

7. Existing conservation plans, including those developed for landowners, as required by the 1985 Food Security Act.

8. Individual landowners in the affected areas.

Nonpoint Pollution Survey

The NPS survey requested the conservation district boards in each county to identify surface waters impacted by NPS, categories or subcategories of NPS, land uses, conservation practices, etc. This survey, which had a 100 percent response, provided detailed watershed information for the Assessment Report. Important information generated by the survey included the BMPs presently in use and the percentage of areas using BMPs. More importantly, the survey requested the identification of BMPs needed to control NPS pollution in identified impacted waters.

The NPS survey provided information based on the conservation districts' best professional judgement and the technical expertise of field representatives from the Soil Conservation Service and the Kentucky Division of Conservation. This is evaluated information and is not based on data gathered through actual ambient monitoring efforts. This information is considered valuable, however, because of the proximity of those providing the data to the actual NPS problems.

Public Meetings

Another important data source to be used in selecting the most appropriate BMPs will be public meetings. These meetings will be open to the citizens of Kentucky, including environmental groups such as the Sierra Club, Audubon Society, and Water Watch groups. As with the NPS survey, the data provided by these public meetings will be based on evaluations by individuals or groups living in areas impacted by NPS. It will be a broad base of information that will need to be refined, but is still very valuable.

Agencies

A number of agencies have been identified as having a role in the control of NPS pollution. Late in 1987, letters were sent from the Division of Water to other federal, state and local agencies requesting input to aid in the development of the NPS program. Contact persons to work with NPS staff at the Division of Water were selected from the various agencies and organizations by their directors. It is this agency coordination that will play a vital role in selecting BMPs for areas identified as being impacted by NPS pollution. Agencies with expertise in a specific area (i.e. forestry, mining or agriculture) will help the Division of Water select BMPs for a given watershed. Cooperating agencies' input will further refine data received from the NPS survey and public meetings. The agencies having a role in NPS pollution control are listed below.

Federal Agencies

U.S. Soil Conservation Service
U.S. Agriculture Stabilization and Conservation Service
U.S. Forest Service
U.S. Geological Survey
U.S. Army Corps of Engineers
Tennessee Valley Authority

State Agencies

Division of Water
Division of Conservation

Division of Abandoned Lands
Division of Forestry
Division of Pesticides
Department for Surface Mining Reclamation and Enforcement
Kentucky Geological Survey
Nature Preserves Commission

Universities

Water Resources Laboratory, University of Louisville
Water Resources Research Institute, University of Kentucky
College of Agriculture, University of Kentucky

Low Altitude Photography

Low Altitude Photography (LAP) is an excellent tool for obtaining information on land use in a watershed. The identification of land uses will help locate sources of NPS pollution. Once the sources of NPS pollution are identified, the ability to select the appropriate BMPs will be enhanced. LAP will only be used in priority watersheds targeted as demonstration projects.

LAP has been completed in the Little River Watershed of the Lower Cumberland River basin in Western Kentucky. The Tennessee Valley Authority provided the data interpretation. Maps were developed identifying many important features such as land uses, animal waste sites, sink holes, etc. LAP will be one of the eight data sources Kentucky will use to identify BMPs for NPS control in the watershed and will provide another level of information to aid in the process of identifying BMPs.

Field Assessment

Two on-site planning teams will conduct field assessments in watersheds identified as a priority, based on NPS pollution impacts. The on-site planning teams will consist of a team leader from the Kentucky Division of Water and a soil specialist from the Kentucky Division of Conservation. The combined expertise of the planning teams will aid in the identification of "on the land activities" with water quality impacts. Field assessments will consist of water monitoring activities and "land activities" surveys. The data from the field assessment will provide specific information to enable NPS personnel to select the appropriate BMPs to minimize or control NPS pollution.

Intensive surveys of a specific watershed may also be conducted by the Ecological Support Section of the Division of Water. This activity, however, will be very limited because of resource constraints. These surveys will be conducted in identified demonstration watersheds where LAP has been completed. The intensive surveys will be used to verify the use of LAP. The information provided by intensive surveys will also aid in the identification of BMPs.

Conservation District Annual and Long Range Plans

The conservation districts' annual and long range plans provide an additional source of data. All conservation districts are charged with the legal responsibility of developing plans to conserve and develop all renewable natural resources within their counties. The plans identify land use, prime farmland and conservation needs on cropland and pasture. Consequently, these plans will provide more specific information for each county and actually describe control measures or BMPs that will be needed. Because the conservation district plans are for counties instead of watersheds, the information must be adjusted.

Conservation Plan

Individual landowner's conservation plans may either be existing conservation plans or those being required by the 1985 Food Security Act. In order to remain eligible for federal subsidies, all farmers must have conservation plans in place by 1990. These plans will be an excellent source of information because they will specify control measures or BMPs for the individual farm. However, the individual conservation plans only apply to farmland. Mining areas, construction sites, forestry areas and other sites contributing to NPS pollution do not have specific conservation plans. It will be up to the cooperating agencies to develop plans using previously identified information sources, where appropriate.

Landowner

The final source of data, and the most critical, is the landowner. Whether it is the farmer, contractor, mine owner, etc., they will ultimately determine what type of control measure or BMP will be applied to an area impacted by NPS pollution. The cooperation of individual landowners is crucial to the success of the NPS Pollution Control Program. All the information Kentucky will gather through the previously described data sources, and the resulting BMPs that will be selected for use, will depend on the ultimate cooperation of the individual landowners. The landowners will refine the information to meet their needs and ultimately decide which BMPs will best correct problems. Soliciting the cooperation of all landowners in identifying BMPs may be the deciding factor in many cases.

Kentucky will solicit input from many different organizations, government agencies, citizens, and environmental groups in determining and identifying BMPs for NPS control. The process will be flexible enough to allow modifications for use in various types of watersheds (i.e., agricultural, mining, silviculture and urban).

Once the data has been collected from as many of the identified sources as possible, a selection process will be used to target sites for BMP application. A cooperative effort with the appropriate agency or agencies will be established and criteria developed to select BMPs for a priority watershed. The BMP selection process will be described in the NPS Management Program Plan.

State and Local NPS Control Programs

The Kentucky Division of Water was designated by the Governor as the lead oversight agency for NPS Pollution Control. In response, the Division of Water developed and implemented an NPS Pollution Control Program. A work plan has been developed to prioritize objectives and establish target dates for activities to address the diverse sources of NPS pollution. Demonstration projects, educational programs and technical assistance will be used to encourage the use of BMPs for all priority areas. Technical assistance to local governments to aid in developing NPS control mechanisms for urban and construction sources will also be part of the program.

The NPS Pollution Control Program consists of six functions designed for the long-term reduction of nonpoint source pollution in Kentucky: planning, education, agency coordination, problem assessment, implementation and tracking, and evaluation. Actions in each of the functions can occur simultaneously or independently.

In an effort to fully implement the NPS Program, a new NPS Section was developed within the Division of Water with staffing and budget necessary to meet the requirements of section 319 of the Water Quality Act of 1987. The implementation strategy includes the following elements:

- o Increase and formalize overall coordination and cooperation of the NPS program with all agencies involved in NPS control, including the Division of Conservation and the Soil Conservation Service. The Division of Conservation is the designated implementation agency for agriculture and construction-related NPS control. There will be added emphasis on implementing the prioritization process through a multi-agency federal-state-local effort.

- o Establish a multi-agency technical group consisting of representatives from the U.S. Soil Conservation Service, Kentucky Divisions of Conservation and Pesticides and other federal, state, and local agencies to prioritize watersheds within each major river basin. This process will rank watersheds that are most heavily impacted by nonpoint sources of pollution to determine which watersheds will be selected for demonstration projects.

- o Establish two field teams, each comprised of one employee from the Division of Water and the Division of Conservation, to assess land and water impacts within the watersheds.

- o Coordinate watershed projects to demonstrate NPS control through the use of BMPs, and track the progress of their implementation.

- o Contract for low-altitude photography, if it has proven to be a viable process, in the demonstration watersheds to identify areas with high potential for nonpoint source pollution. Land use and land cover surveys will be conducted to target specific areas that contribute to NPS pollution.

- o Increase the level of nonpoint pollutant sample analysis capabilities. Sampling will be required in both assessment and tracking phases of the program.

- o Participate with the Tennessee Valley Authority's Land and Water 201 program, the Soil Conservation Service, and the Kentucky Division of Conservation, to establish a demonstration project in the Little River watershed in Western Kentucky.

- o Develop an NPS Assessment Report and an NPS Pollution Control Management Program as required by Section 319 of the 1987 Clean Water Act Amendments. These two documents must be approved by EPA before the state will be eligible for Section 319 implementation funds.

- o Coordinate the surface water NPS program elements with the groundwater program in important or sensitive groundwater recharge areas.

The Kentucky Division of Conservation (DOC), through a Memorandum of Agreement (MOA) with the Kentucky Division of Water, is responsibile for implementing the NPS Control Program for agriculture and construction. The MOA, which was signed in 1987, outlines specific tasks that DOC is required to complete. Additionally, a person has been designated as the NPS coordinator for DOC.

This MOA between the Divisions of Conservation and Water consists of the following four tasks that the Division of Conservation agrees to develop and implement in exchange for financial assistance from the Division of Water:

1. Coordinate activities of the agencies (U.S. Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS)) cooperating with the implementation of Water Quality Management Plans for agriculture and construction;

2. Evaluate existing MOUs, MOAs and Cooperative Agreements between assisting agencies to determine their effectiveness in meeting goals, objectives and implementation tasks of the Water Quality Management Plans;

3. Organize an education and information delivery program network involving agriculture agencies, environmental groups, and builder and developer organizations. Additionally, DOC will implement and coordinate an education program on a statewide basis to create water quality problem awareness and its relationship to soil erosion. This program will be initiated through a pilot project to determine the best approach and funds needed for full implementation.

4. Develop, with the Division of Water, a monitoring and evaluation system to track the success of the voluntary program. This task also requires the establishment of a bench mark, using the 1982 Soil and Water Conservation Commissions' Long Range Report. A tracking system on a watershed basis will be developed through a pilot program.

Conservation districts within each county in Kenucky will also participate in the NPS Control Program. Conservation districts are authorized to undertake, sponsor or participate in projects, activities and programs which promote the conservation, development, maintenance and use of the land, water, trees and other renewable natural resources within each district. Kentucky's conservation districts are subdivisions of state government, and district boundaries generally coincide with county lines (except for Logan County, which is divided into two districts) resulting in a total of 121 conservation districts.

Each conservation district is governed by a seven-member board of supervisors elected by the registered voters within the district. Conservation districts have been organized under Kentucky law for the specific purpose of assisting landowners and land users in solving soil and water resource problems, setting priorities for conservation work to be accomplished, and coordinating the federal, state, and local resources necessary to carry out these programs. Conservation districts provide leadership at the local level and a means for interested local citizens to work together in solving conservation and natural resource problems.

Conservation districts in Kentucky, under their statutory authorization, can assume any responsibility relating to nonpoint source water pollution control, from initial assessement of the problems to the final BMP implementation on the land for improved water quality. Districts stand ready to meet their responsibilities of developing and implementing an effective NPS pollution program for agriculture and construction in Kentucky. Districts will provide leadership in the identification of water quality problems, establishing priorities and goals, contacting and informing landowners about pollution, making technical assistance available to landowners through the district, assisting in the coordination of other agencies' efforts within the county, and seeking additional federal, state, and local resources to provide adequate funding to implement NPS programs.

The success of Kentucky's voluntary nonpoint source program for agriculture and construction will depend on Kentucky's 121 conservation districts' efforts to inform landowners of the problems relating to NPS pollution and their ability to assist them in addressing these problems.

CHAPTER 4

GROUNDWATER ASSESSMENT

GROUNDWATER ASSESSMENT

In November of 1987, Kentucky refocused its attention on groundwater quality with the release of the Kentucky Groundwater Protection Strategy. A salient document for groundwater protection, the Strategy is a working document which, for Kentucky, announces major new groundwater initiatives. Central to the Strategy is the groundwater protection goal: to maintain and protect the resource for its highest and best use, and to minimize or prevent waste and degradation. Program elements announced in the Strategy include: a proposed classification system equivalent to that proposed by the U. S. EPA; the evaluation of the KPDES system for regulating all discharges to groundwater; a proposed program to certify well pump installers and all non-water well drillers in Kentucky; a proposal to reform oil and gas laws; and various funding proposals to protect aquifers, clean-up non-federal abandoned hazardous waste sites, and for groundwater research and data management.

Sources and Contaminants in Groundwater

Table 29 presents the major sources of groundwater contamination in the state and ranks the top five sources (number one being the most serious). Table 30 lists those substances contaminating groundwater in the Commonwealth from the sources listed in Table 29.

Special Studies

In 1987, Kentucky undertook studies of water well quality in both the Gateway area Development District (Gateway ADD) and the Calvert City area. The purpose of the studies was to evaluate the quality of domestic well water consumed in all or parts of Marshall, Livingston and McCracken counties (Calvert City study) and Bath, Menifee, Rowan, Morgan, and Montgomery counties (Gateway ADD study). Well water was analyzed for 81 constituents including bacteria, pesticides, Safe Drinking Water Act (SDWA) primary and secondary contaminants, and priority pollutants. Well construction data was also gathered. While these studies indicated that the quality of groundwater as a whole was good, isolated incidents of contamination were discovered. Specifically, high fecal coliform bacteria levels were found in some wells where well construction failed to meet modern criteria.

Of the 109 wells surveyed in the Gateway ADD study, the most commonly detected contamination was bacteriological (57 cases). A self-help manual for the domestic well owners has been sent to the well user where this type of contamination was found, so that a proper remedy (simple chlorination or a well recompletion/renovation) could be applied to the supply. Three wells equaled or exceeded recommended levels for the SDWA primary contaminants. No cases of significant contamination were found for the 50 organic compounds analyzed in the survey. While organics were intially detected in 13 samples, sampling or laboratory contamination probably was responsible for three of the well results. Four wells retested negative for organics.

Ninety wells and springs were inspected in the Calvert City area well study. Sixty-four domestic wells or springs, four industrial wells, and composite samples from four public water systems using wells were analyzed for a wide variety of chemical parameters. Of the 64 domestic wells or springs surveyed, the most

Table 29
Major Sources of Groundwater Contamination

Source		Relative Priority
Septic tanks	X*	2
Municipal landfills	X	
On-site industrial landfills (excluding pits, lagoons, surface impoundments)	X	5
Other landfills		
Surface impoundments (excluding oil and gas brine pits)	X	
Oil and gas brine pits	X	4
Underground storage tanks	X	3
Injection wells (incl. Class V)	X	5
Abandoned hazardous waste sites	X	5
Regulated hazardous waste sites		
Salt water intrusion		
Land application/treatment	X	
Agricultural activities	X	
Road salting		
Mining	X	4
Improperly constructed and abandoned (decommissioned) wells	X	4
Spills and poor materials handling or storage	X	
Salt storage	X	
Poor water well construction	X	1

X* = Major Source in Kentucky

Table 30
Substances Contaminating Groundwater

Organic chemicals:		Metals	X
Volatile	X*	Radioactive material	X
Synthetic	X	Pesticides	X
Inorganic chemicals:			
Nitrates	X	Other agricultural chemicals	X
Fluorides		Petroleum products	X
Arsenic	X	Others	Bacteria Cyanide
Brine/salinity	X		
Other			

X* - Substances present

commonly detected contamination was bacteriological (22 cases). A self-help manual for domestic well owners has been sent to the well user where this type of contamination was found so that a proper remedy (simple chlorination and/or a well recompletion/renovation) could be applied to the supply. Nine wells exceeded or equaled recommended levels for the SDWA primary contaminants. Five wells equaled or exceed standards for nitrate, two wells equaled or exceeded standards for lead, one well equaled standards for selenium, and one well equaled standards for lead and exceeded standards for selenium. These wells are currently being resampled and additional tests are being conducted in an effort to determine the source of contamination. Municipal raw and finished water samples met SWDA primary contaminant recommended levels. One industrial well, which is not used for drinking water, contained vinyl chloride at a concentration of 1 ppb above the SWDA recommended primary contaminant level. No cases of significant contamination were found for the 50 organic compounds analyzed. While organics were detected in four domestic well samples, three were most likely the result of lab contamination. The four wells are being resampled to confirm the results. All organics found in drinking water wells were below SWDA recommended contaminant levels.

Groundwater Problem Areas

The groundwater surveys indicated that a high quality resource may be available to the consumer. However, significant problem areas remain, both in terms of groundwater protection policy and for actual cases of groundwater contamination.

Federal Policy Responsibilities

The federal government has failed to formulate a meaningful national groundwater protection policy. The United States Environmental Protection Agency

(EPA) stated in it's Groundwater Protection Strategy that the principal challenge to EPA in developing a groundwater strategy was to harmonize the implementation of its various groundwater programs and increase protection of this critical resource by enhancing its partnership with the states. EPA believes that the most effective and broadly acceptable way to increase national institutional capability to protect groundwater is to strengthen state programs. However, because of interstate program differences, a harmful practice of interstate transfer of hazardous and solid waste is beginning. This endangers Kentucky's groundwater.

Sanitary landfills involve a risk to groundwater. When refuse is deposited on land, some of the organic and inorganic chemical consitutents are subject to leaching by percolating water. These chemicals can reach aquifers, surface streams and impoundments. Leachate may seriously impair water quality and endanger public health and welfare. Pollutant entering the groundwater zone usually follow paths similar to the uncontaminated groundwater.

Many substances that go to landfills are extensively regulated by either state or federal law. However, while there are more than 2,400 substances listed in the Federal Code of Regulation as hazardous commodities, many of the 70,000 chemical products on the market today have not been reviewed for inclusion in the list. Many of the products reach landfills directly in industrial waste and also from residential waste.

To protect their underground water supplies, communities in the Northeast have had little alternative to interstate shipment of solid waste. The history of the Sayville Solid Waste Disposal Site in Islip (Long Island) New York show the damages from leachate in a poorly designed landfill. The site received residential waste and incinerator residue. The leachate plume extends more than 5,000 feet down gradient of the site, 170 feet in depth and up to 1,300 feet in width. About 1 billion gallons of groundwater have been contaminated and wells in the area have been abandoned. The New York Legislature has ordered Long Island's landfills, which are situated atop the Island's only source of water, to close by 1990. Philadelphia, New York, New Jersey and Massachusetts are also areas that have reached their landfill capacity. Laws and local opposition to new landfills are leading to interstate trash hauling. Long Island alone spends 150 million dollars annually to haul garbage to the Midwest. By 1989, enough garbage will be leaving Long Island to fill one tractor trailer every 6.5 minutes with 40,000 pounds of trash.

In some instances, state laws contribute to the interstate hauling problem. For instance, the 1983 Florida Water Quality Assurance Act prohibits land disposal of hazardous waste and it forbids the Florida Department of Environmental Regulation (DER) from permitting new underground injection wells that inject hazardous waste. A serious problem is that a good portion of the hazardous waste that is not allowed to be disposed of through the land disposal methods in the state is transported to Alabama, South Carolina and other states. The quality of data on materials in interstate transport is extremely poor. Data are needed to show state-to-state and regional transportation patterns.

Under the current state/federal arrangement, individual states are not controlling waste sources within the state and have no inducement to do so. It appears that the easiest way for industries and communities to deal with waste is not to modify systems or contain and reduce waste generation within, but to transport the wastes out of the state. This reflects the basic economic fact that companies and public entities seek the least costly method of achieving pollution abatement.

The unwillingness of the intensively urbanized areas of the Eastern Seaboard to come to grips with their waste generation and the failure of Florida's approach to control waste production can eventually create a problem in Kentucky and other states. Current waste disposal charges remain artifically low because environmental costs of disposal have not been considered. Landfill fees in Kentucky are usually less than $15 per ton while $100 a ton or more is charged on the East Coast. Waste, then, because of economics and because of groundwater protection efforts in other states, is moving from areas where landfill space is at a premium to more rural areas like Kentucky. Because this material moves in interstate commerce, Kentucky's ability to tax and regulate it is diminished. For Kentucky and similarly situated states to have unwanted interstate wastes placed in them serves to subsidize groundwater quality of net waste-exporting states at the expense of the net waste-importing states. Most importantly, no net environmental improvement occurs nationally.

These concerns touch on the topic of risk equity, the appropriate distribution of risks among different members of society. What level of risk do Kentuckians find acceptable for their groundwater? To continue the status quo forces Kentuckians to assume involuntary risks with regard to the placement of out-of-state waste.

Rather than continuing to ignore the problem, EPA should adopt one of the recommendations of the National Academy of Sciences: a policy for encouragement of safe hazardous waste treatment and disposal within the state or local jurisdiction. Solid waste, too, should be contained within state boundaries.

Congress also needs to act. Some form of polluter-pays legislation is needed. This type of regulation or tax should impose the real environmental costs on waste products that enter interstate commerce. The burdens of such a system would be on the pollutant generator, so that polluting industries and communities of other states do not reap economic windfalls for their unwillingness to improve their own waste production practices. The levy set on the trash should be greater than or equivalent to what the cost would have been to retain, treat, and landfill the material in the generating locality or state. Receipts should be used to create an Office of Resource Recovery and Recycling within the EPA where programs to aid local governments to ease their waste problems could be started. The EPA approach of allowing individual states to develop their own groundwater protection plan certainly has some merit. However, the systemic problem with interstate waste transport outlined above is a direct outgrowth of the scheme. States and localities are left with little alternative than to appeal to the federal government to solve the problem.

Domestic On-Site Sewage Treatment

The Cabinet for Human Resources (CHR) has estimated that 60 to 70 percent of Kentucky homesites are not sewered. In 1985, new regulations requiring more comprehensive siting criteria were adopted by CHR and this regulatory effort is changing the way on-site sewage treatment systems have traditionally been installed. Many counties in the past have allowed "seepage pits" in new constructions (these systems are little more than raw sewage injection wells). These counties have now been notified by state officials to stop allowing seepage pits. The ban on new seepage pits is a positive step. Existing seepage pits remain a problem; for instance, it is estimated that 50,000 seepage pits exist in Jefferson County alone. CHR's new system establishes environmental priorities in site selection; before the regulation, environmental considerations were usually an afterthought to development.

City of Irvington

The City of Irvington has depended on a system of public water supply wells for many years. The main well was drilled into a cave conduit and produced a great amount of water. In the summer of 1987, a drought, combined with a pollution incident, closed the supply for several days. Petroleum products were detected in the well water and the water available in the well was diminished. At some point in the past, a petroleum spill or a leaking underground tank contaminated the upper aquifer. The pollution event, however, went unnoticed until the diminished water in the cave conduit allowed the floating contaminant to enter the water supply. This water supply, like many others in Kentucky, withdraws from a karst aquifer. The problems of these aquifers have been documented in prior 305(b) reports and this most recent event in Irvington underscores the vulnerability of this significant resource.

The Irvington water supply problem has apparently been solved with the drilling of several smaller yielding wells in a deeper aquifer. Adequate planning, however, may have avoided the problem altogether. A wellhead protection program is needed for all public water supplies that depend on groundwater in the Commonwealth.

Proliferation of Improperly Abandoned (Decommissioned) Wells

With the thousands of coal mines and the associated drilling of exploration and monitoring wells, and with the construction of various other mineral exploration and engineering wells, Kentucky could rank as the most intensively drilled state in the nation. The individuals in the drilling trade are not taught in a structured way and this results in inadequate subsurface data, failed well construction, and improper abandonments because of a lack of understanding on the part of some of the drillers. State statutes and regulations exist to regulate certain well construction practices; however, state resources often are insufficient to fully regulate the volume of drilling activity. Problems have been recognized in both water well and oil and gas drilling industries.

New water lines have been installed in many parts of the Commonwealth and water wells that formerly were the water source often were not properly plugged. Federal funds used in the construction of the water lines failed to include monies earmarked for proper plugging of the old water supply wells. This failure to properly plug wells, while representing an obvious hazard to children (as the recent event in Texas and a similar event in Kentucky have demonstrated), also allows a direct path for sources of contamination to reach the aquifer. Additionally, little incentive exists to properly plug these wells and as time passes, the wells deteriorate because of inattention from the well owner. A state regulation is needed which encourages plugging old water wells when new water lines are laid.

Thousands of unplugged oil wells, including a great number drilled in the 19th century, can be found in Appalachian oilfields, which includes areas in eastern Kentucky. Thousands of others, salvaged for their steel or iron casing and wellhead equipment, are more difficult or impossible to locate. Four thousand wells were plugged in the seven Appalachian states in 1985; in 1986 the number fell to 3,100. Through November of 1987, 2,100 pluggings had taken place. Economics has lead to the plugging and abandonment of most of these oil facilities. Surface discharge requirements and injection well requirements to protect the environment have had an influence also.

Injection systems which use freshwater as an injection fluid have caused widespread contamination problems in the region and are associated with voluminous surface water discharge of contaminated water. Malfunctioning injection, production, and abandoned wells are also a part of the problem and can contribute to environmental degradation. Large surface water discharges contaminate alluvial aquifers and malfunctioning injection, production, and abandoned wells directly conduct produced fluid into aquifer systems. The U.S. EPA has begun to exercise its authority in addressing the freshwater-waterflood problem.

In 1987, the U.S. EPA entered a consent decree which will affect groundwater in large portions of Johnson and Lawrence counties in Kentucky. The Martha Field was recently closed for violations of the SDWA's Underground Injection Control Program. The plugging of 1,380 oil production and water injection wells are a part of the consent decree as is a provision for developing new water supplies in the affected area. Groundwater will be monitored for ten years in the primary aquifers in the region.

CHAPTER 5

SPECIAL STATE CONCERNS

OIL BRINE IMPACTS

Oil brine pollution problems in Kentucky streams were documented in the 1986 Report to Congress. During this biennium, the discharge of brines to Kentucky waters has remained a serious problem, particularly in portions of the Licking and Kentucky River drainages (see Table 31). The brines have degraded water quality, impacted aquatic life and created problems with public drinking water supplies. The City of Salyersville has experienced problems with treating its drinking water supply because portions of the Licking River are periodically laden with oil brines. A monitoring station in Cave Run Lake, a Licking River impoundment located approximately 55 miles downstream of Salyersville, indicates that the chloride concentration in this reservoir has been steadily increasing during the past few years. To date, the concentrations are not considered toxic to aquatic life; however, if chloride concentrations continue to rise, chronic toxicity problems may develop for sensitive species.

The Kentucky American Water Company, which serves the City of Lexington and portions of several adjacent counties, has observed excessive concentrations of bromide in the Kentucky River at their water withdrawal point. The highest concentrations typically occur in the fall during rain events which follow drought periods. The bromides are known to be instrumental in the formation of trihalomethanes, which are known to be carcinogenic. High concentrations of bromide in the raw water supply have occasionally resulted in the formation of trihalomethanes in the Lexington public water supply. Detected amounts have occasionally exceeded the maximum contaminant level listed in Kentucky's Drinking Water Regulations.

It is estimated that there are between 10,000 and 12,000 oil and gas facilities that discharge varying amounts of produced water into the waters of the Commonwealth. Very few of these are covered by discharge permits. The Division of Water (DOW) promulgated numeric chloride criteria for the protection of aquatic life as a part of revisions to state water quality standards in April 1985. This resulted in a lawsuit by Kentucky oil and gas producers. The suit was settled out of court through an agreement allowing an economic exemption if the producers met certain criteria regarding the economic benefits of their facilities and minimal environmental impact to the receiving streams.

Consequently, DOW attempted to issue permits with exemptions to criteria, where appropriate, to satisfy the agreement between Kentucky and the oil and gas industry. EPA then objected to the permits, citing numerous technical and regulatory deficiencies with the exemption process. Recognizing that DOW was still constrained by the settlement agreement, EPA promulgated a federal water quality criterion for the state of Kentucky. Given the federal criterion's applicability under state law, DOW discontinued the exemption process that was part of the settlement and began drafting permits using the federal criterion of a 600 mg/l chloride value, and modified the earlier KPDES drafts to conform to the 600 mg/l value. At the end of 1987, a total of 63 permits covering 250 oil and gas leases had been issued. In addition to permitting operations, DOW has been involved in 660 legal cases between January 1985 and November 1987. A total of 460 cases have been resolved, of which 259 have resulted in agreed orders.

Adherence to the chloride criterion has significantly improved water quality in parts of the Blaine Creek drainage. As more oil and gas facilities are brought into compliance with the chloride criterion, oil brine-associated water quality problems will be significantly mitigated.

Table 31

Use Nonsupport in Kentucky
Streams Attributable to Brine Discharges

River Basin	USGS Hydrologic Unit	Total Stream Miles Assessed	Miles Fully Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses
Licking					
Licking River	05100101	7	0	7	0
Burning Fork	05100101	10	0	0	10
State Road Fork	05100101	5	0	0	5
Lick Creek	05100101	9	0	0	9
Kentucky					
Millers Creek	05100204	26	0	0	26
South Fork Red River	05100204	17	0	0	17
*Cow Creek	05100204	6	3	0	3
*Walkers Branch	05100204	8	0	0	8
*Lower Devils Creek	05100204	6	0	0	6
Big Sandy					
Blaine Creek	05070204	162	128	20	14
Little Sandy					
Little Sandy River (Headwaters)	05090104	38	7	3	28
Green					
*Greasy Creek	05110005	7	7	0	0
*Slovers Creek	05110004	3	3	0	0
Buck Creek	05110002	5	5	0	0
Beaver Creek	05110002	35	35	0	0
Upper Cumberland					
Illwill Creek	05130105	5	5	0	0
Roaring Paunch Creek	05130104	16	0	0	16
Little South Fork of Cumberland River	05130104	53	9	44	0
TOTAL		418	202	74	142

*Streams not included on the United States Geological Survey's Hydrologic Unit Map - 1974, State of Kentucky

WETLAND LOSS

Wetlands are defined as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The importance of these lands is just being fully understood. Their value lies in several aspects which, when taken either partially or as a whole, often exceed the apparent economic value of the land itself. Wetlands are among the most productive of all ecosystems. They are vital for the existence of many species of fish, wildlife, and plants. A summary of primary values includes: (1) natural moderation of floods, (2) erosion control, (3) water quality enhancement, (4) groundwater recharge, (5) fish and wildlife habitat, (6) recreation, (7) education and scientific research, (8) aesthetic and open space, and (9) food and fiber productivity.

According to the most recent (1979) U. S. Fish and Wildlife Service classification system, the majority of Kentucky's wetlands fall into the Palustrine System. Areas lying shoreward of rivers and lakes, including floodplains, oxbows, ponds, marshes, and swamps, are members of this category. The broad alluvial floodplains of the Ohio and Mississippi rivers and their tributaries in western Kentucky comprise the vast majority of Kentucky wetlands. Small ponds are common throughout the state and their area is difficult to assess. They are, however, very important and have value as ecological epicenters. The Riverine System includes all wetlands and deepwater habitats contained within a channel that experiences continuous or periodic moving water or connects two bodies of standing water. While wetlands of this type are not extensive, they provide a unique habitat for many rare or endangered species and are ecologically important. Lacustrine systems in Kentucky are limited to man-made lakes, their shorelines, and spillways. The Lacustrine systems are the least ecologically significant type of Kentucky wetland.

The loss of valuable wetland resources, and adverse impacts to remaining areas, are of special concern to Kentucky. Over half of the original wetland acreage has been destroyed. Nearly all of the areas that remain have been degraded by pesticides, acid mine drainage, siltation, brine water, or domestic and industrial sewage. In addition, Kentucky still does not have a wetlands monitoring program (a problem identified in the 1984 and 1986 305(b) reports) and there continues to be a poor understanding of what once occurred, what is left, and current impacts and rates of loss.

In 1985 the Division of Water provided funding to the Kentucky Nature Preserves Commission (KNPC), under a Memorandum of Agreement in order to determine the status of Kentucky's wetlands and recommend methods for protection of remaining areas. Their report, "Wetland Protection Strategies for Kentucky," was released in 1986. Among their findings was an estimate that as of 1978, fifty-eight percent or 929,000 of the original 1,566,000 acres of wet soils in Kentucky had been drained. Further, it was estimated that only 20 percent of Kentucky's wet soils remain forested, which reflects a dramatic decline in bottomland hardwood wetlands. The Kentucky Department of Fish and Wildlife Resources estimates Kentucky's annual rate of wetland loss at 3,600 acres.

The major threat to Kentucky wetlands is their destruction from competing land use activities and poor land management practices. Both coal mining and agricultural practices are depleting this unique habitat. Strip mining operations in the western Kentucky coalfield are either totally destroying (by actually stripping coal from wetland areas), or drastically altering (by siltation and acid mine drainage), many of Kentucky's wetlands. In 1983, a U.S. Fish and Wildlife Service study in the Western Kentucky Coalfield, determined that 515 stream miles were affected by acid mine drainage. Problem parameters degrading water quality included manganese, sulfate, aluminum, conductivity, turbidity, dissolved oxygen, pH, and iron. It was concluded that nearly all of the wetlands in the coalfield have been adversely impacted by coal mining practices.

Logging and agricultural practices, such as channelizing, tile draining, burning, and otherwise altering the water regime to render the land tillable, are rapidly depleting wetland ecosystems. Other agricultural practices which cause erosion, and chemical fertilizer and pesticide runoff, are also having adverse effects on the natural system. To a lesser extent and generally in localized situations, domestic and industrial sewage discharge, oil brine discharge, and urbanization are having detrimental effects on Kentucky wetlands.

There is a general lack of specific information on the extent, rate of loss, and quality (chemical and biological) of Kentucky wetlands. Other needs for Kentucky wetlands include an increased public awareness of the value of these ecosystems, acquisition and protection of strategic wetlands, a definition of regulated wetlands, and regulations specifically addressing wetlands.

SECTION 401 WATER QUALITY CERTIFICATION

Section 401 of the Clean Water Act (CWA) provides that "any applicant for a Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall provide the licensing or permitting agency a certification from the State in which the discharge originates or will originate, that any such discharge will comply with the applicable provisions . . . of this Act." Section 401 further provides that "any certification provided under this section shall assure that any applicant for a Federal license or permit will comply with any applicable effluent limitations and other limitations, . . . standard of performance, . . . or prohibition, effluent standard, or pretreatment standard under . . . this Act, and with any other appropriate requirements of State law set forth in such certification, and shall become a condition on any Federal license or permit subject to the provisions of this section." Chapter 224 of the Kentucky Revised Statutes and Title 401, Chapter 5, Kentucky Administrative Regulations, provide that the Natural Resources and Environmental Protection Cabinet has the authority to regulate the discharge of pollutants (including "dredged spoil, solid waste, incinerator residue, sewage, sewage sludge, garbage, chemical, biological or radioactive materials, heat, wrecked or discarded equipment, rock, sand, soil, industrial, municipal or agricultural waste, and any substance resulting from the development, processing or recovery of any natural resource which may be discharged into water") into any of the waters of the Commonwealth, including wetlands, and is the Section 401 (CWA) "certifying agency." Title 40, Code of Federal Regulations, Part 121 provides that the certifying agency may place "any conditions which are deemed necessary or desirable with respect to the discharge or the activity."

Although Section 401 has been in existence since 1970, confusion still exists concerning the appropriate and potential use of this section of the Clean Water Act. While attempting to protect Kentucky's aquatic resources through application of Section 401, many problems have been encountered. Federal guidance detailing the use and application of Section 401 water quality certification (WQC) is needed in order to solve such problems.

Specific areas of concern are:

(a) Currently, the U.S. Army Corps of Engineers (COE) does not request WQC for Section 10 activities, regardless of the potential impact to water quality and aquatic life. This appears in conflict with the provisions of Section 401.

(b) Section 401(d) provides the certifying agency with the authority to "condition" WQC, but does not provide any guidance. Does Section 401 allow the use of conditions that require mitigation or restoration?

(c) Is the review process, under Section 401, limited to the construction phase of the activity or should it include post construction impacts, i.e., the operation of a marina or a coal and sand dredging operation?

(d) Section 401 offers no guidance for after-the-fact permits. Because of the inability to evaluate the effects on water quality by such activities after-the-fact, WQC is generally waived. Should restoration and/or mitigation be considered under Section 401?

(e) Wetlands are defined in federal/state regulations as waters of the United States/Commonwealth. However, because of their unique characteristics, typical water quality standards often don't apply. Guidance for specific wetland standards is needed.

(f) Should the state utilize the Section 404(b)(1) guidelines (40 CFR 230) to interpret the significance of degradation by an activity under the state antidegradation policy for WQC?

Kentucky has experienced difficulty with the consistent implementation of Section 401 provisions within the framework of the state's water pollution control program. These problems are exaggerated by the lack of guidance at the federal level (i.e., EPA and the COE). Section 401 has the potential to play a significant role in carrying out the intentions of the CWA, i.e., "to restore and maintain the chemical, physical, and biological integrity of the Nations waters." However, without additional federal guidance and funding assistance, this potential will not be realized.

CHAPTER 6

WATER POLLUTION CONTROL PROGRAMS

POINT SOURCE CONTROL PROGRAM

Wastewater Treatment Facility Permitting

Point source pollution refers to any discharge from municipal or industrial facilities that can be identified as emanating from a discrete source such as a conduit or ditch. Kentucky has a total of 5,946 facilities covered by the Kentucky Pollutant Discharge Elimination System (KPDES) program. The program has 2,676 facilities covered under individual permits and 3,179 facilities covered under two general permits. The individually permitted facilities include 56 major municipals and 220 major industrials. In addition, new federal mandates require expansion of the point source program to include stormwater runoff.

Wastewater permit limits in Kentucky have been water quality-based since National Pollutant Discharge Elimination System (NPDES) program delegation on September 30, 1983. Generally, there are two approaches for establishing water quality-based limits for toxic pollutants: (1) chemical-specific limits, meaning the use of individual chemical criteria (which are derived for the protection of aquatic life) for determining discharge limits for all known toxic or suspected toxic pollutants in an effluent; or (2) whole effluent toxicity testing, which sets limits on an effluent's total toxicity, as measured by acute and/or chronic bioassays on appropriate aquatic organisms. Both approaches have advantages and drawbacks, but when both are integrated into a toxics control strategy, they provide a flexible and effective control for the discharge of toxic pollutants.

Toxicity data are available for only a limited number of compounds. Single parameter protection criteria, therefore, often do not provide adequate protection of aquatic life where the toxicity of the components in the effluent is unknown, where there are synergistic (greater than predicted) or antagonistic (less than predicted) effects between toxic substances in complex effluents; and/or where a complete chemical characterization of the effluent has not been carried out. Since it is not economically feasible to determine the toxicity of each of the thousands of potentially toxic substances in complex effluents or to conduct exhaustive chemical analyses of effluents, the most direct and cost-effective approach to measuring the toxicity of effluents is to conduct effluent toxicity tests with aquatic organisms. By the end of 1987, Kentucky had incorporated biomonitoring requirements into the permits of six major municipalities and seven major industries. It is anticipated that appropriate biomonitoring requirements will be included in most major permits and in many selected minor facility permits.

Kentucky's water quality continues to face a threat from improperly treated industrial waste which is discharged into municipal sanitary sewage systems. Such waste often contains pollutants that are not removed by the municipal treatment process or, if removed, result in the generation of contaminated sludge. Kentucky has approved 57 pretreatment programs and has screened other facilities to assess the need for pretreatment programs. The facilities needing programs are on schedule for obtaining approval. Each approved program submits semi-annual status reports to the Division of Water for review and incorporation into the Permit Compliance System (PCS) and Pretreatment Permits and Enforcement Tracking System (PPETS).

Municipal Facilities

The Construction Grants Program has resulted in the construction of $85.8 million in wastewater projects which came on line during 1986-1987 as indicated in Table 32. Twenty-one municipal wastewater projects were completed during this two year period. An additional 16 projects are in various stages of construction.

Significant improvements in water quality have been realized through the construction of new wastewater treatment facilities. A review was made of facilities completed during 1986-1987 which had discharges to surface waters. The discharge monitoring reports indicated significant reductions in pollutants.

Table 32

Construction Grants Funded Projects Which Came On Line During Calendar Years 1986 and 1987

Project	Date on Line	Design Flow (MGD)	Treatment* Cost	Other Cost
Augusta	Feb. 86	0.170	$ 416,333	$ 214,475
Berea	Oct. 87	2.100	$6,178,465	$2,668,514
Boyd/Greenup	Oct. 87	Sewers	$ -0-	$ 486,432
Carrollton	Feb. 86	0.700	$3,406,874	$ -0-
Centertown	Mar. 87	0.045	$ 578,000	$1,178,000
Fleming-Neon	Mar. 87	0.485	$1,699,000	$5,330,000
Flemingsburg	Dec. 86	0.656	$2,950,122	$ 247,081
Florence	Oct. 86	Sewers	$ -0-	$8,862,885
Fountain Run	Nov. 86	0.028	$1,793,000	**
Franklin	Jan. 86	3.200	$3,992,000	$1,669,000
Lexington M/S	Apr. 86	Sewers	$ -0-	$2,660,000
Lexington S/E	Mar. 87	Sewers	$ -0-	$5,075,552
Livermore	Nov. 86	Sewers	$ -0-	$ 165,000
London	Jan. 86	4.000	$6,155,000	$1,281,000
Middlesboro	Jan. 87	2.800	$9,492,000	$2,903,000
Midway	Feb. 86	0.253	$1,648,053	$ 275,690
Milton	Dec. 87	0.160	$ 535,476	$1,439,942
Monticello	Mar. 87	0.700	$3,186,000	$1,541,000
Sadieville	Feb. 86	0.033	$ 935,149	$ 599,634
Stanford	Jan. 87	0.800	$2,297,000	$ 263,000
Sturgis	Dec. 87	0.500	$2,554,000	$ 186,000
Totals			$47,816,472	$37,046,205

*Cost includes local share
**Subsurface wastewater disposal system

Although significant improvements in water quality have been realized through the construction of new wastewater treatment facilities, there are numerous needs that remain to be addressed. The 1986 Needs Survey, conducted by the Division of Water as part of its planning process, indicated that municipal dischargers continue to impair water quality and pose potential human health problems. State and federal minimum treatment requirements are not being met in every instance. The 1986 Needs Survey identified a capital investment need of $1.14 billion to construct and rehabilitate wastewater treatment facilities and components for Kentucky, based on the 1986 population. Backlog needs of $1.14 billion, coupled with long-range needs for publicly-owned treatment facilities, reveal a projected total need of over $1.52 billion through the year 2008. A detailed breakdown of investment needs is presented in Table 33.

Table 33

Investment Needs for Wastewater Treatment Facilities in Kentucky 1986-2008 (In January 1986 millions of dollars)

Facility	For Current 1986 Population	Projected Needs 2008 Population
Secondary treatment	$ 193	$ 286
Advanced secondary treatment	$ 53	$ 78
Infiltration/Inflow	$ 76	$ 76
Major rehabilitation of sewers	$ 8	$ 8
New collector sewers	$ 536	$ 646
New interceptor sewers	$ 252	$ 401
Correction of combined sewer overflows	$ 22	$ 22
Total	$1,140	$1,517

The 1986 305(b) Report to Congress described Kentucky's Water Infrastructure Report and concluded that a revolving loan fund concept was the most feasible option for Kentucky in meeting its water infrastructure needs. Because the federal law was not in place at that time, Kentucky was unable to pass appropriate legislation during the 1986 Kentucky General Assembly.

When the 100th Congress of the United States passed HR 1, this initiated the final steps toward establishment of state revolving funds. States were given the option of using a portion of the allotment for grants through FY 90. Kentucky made the decision to place all federal dollars in the revolving fund to the extent possible beginning in FY 88. A few large segmented grant projects require continuation of grant funding through FY 89. An early transition from grants to loans will assure more available dollars in the revolving loan fund over the long term.

Kentucky state legislation was drafted and has been revised through the committee process. At this time, the legislation is awaiting approval by the Senate and will become law upon signature by the Governor. Kentucky expects to receive a capitalization grant from EPA during the latter part of FY 88. Provisions have been made in the state biennial budget for the 20 percent match, and if passed by the 1988 General Assembly, the first projects will be funded during FY 89. It is estimated that approximately $70 million will be available in federal and state funding for the 1989-1990 state biennium. This should be a first step toward funding the $441 million of requests contained in the state's priority list, plus other wastewater needs which have not yet been placed on the priority list.

Because these needs far exceed available funding through grants and loans, the Division of Water has been pursuing other approaches. Three such areas are: 1) streamlining or reducing requirements, 2) community outreach and technical assistance, 3) enhanced construction management. These are described below:

- <u>Streamlined Requirements</u>

  A major benefit of the state revolving fund approach to financing such facilities is the opportunity to reduce or eliminate the burden of requirements of the past grant program. By simplifying this paperwork load, more money can be directly used to achieve water quality standards. Areas which are targeted include applications, planning, environmental reviews and documents, procurement, contract amendments, and change orders. The majority of projects increasingly involve smaller communities, which means an overall increase in the number of annually fundable projects. Efforts to streamline requirements would save time and money at both the state and local levels.

- <u>Community Outreach and Technical Assistance</u>

  Since projects will tend to be smaller over time, and since small communities have less management expertise than their bigger, more urban counterparts, they will need increasingly active assistance. The state will need to be aggressive in this area to assure success of the loan program and its effectiveness in meeting clean water goals. A strong partnership will be formed which will make available the state's expertise in planning, design, construction and financial management. In providing planning assistance, the state will focus on capital as well as operation and maintenance cost validation throughout the planning process. Enhanced design assistance will result from an increased, streamlined Value Improvement Program and value engineering efforts. Cost containment and value enhancement are priority objectives.

- <u>Construction Management</u>

  Greatly streamlined biddability and constructability and change order activites should directly benefit the construction phase of projects. Change order management is to be emphasized under the loan program. A number of the administrative burdens are slated for curtailment, which should expedite projects and reduce costs.

SURFACE WATER MONITORING PROGRAM

An effective water monitoring program is essential for making sound pollution control decisions and for tracking water quality improvements. Specifically, Kentucky's ambient monitoring program provides monitoring data to identify priority waterbodies upon which to concentrate agency activities, to revise state water quality standards, to aid in the development of wasteload allocations, and to determine water quality trends in Kentucky surface waters. As outlined in Kentucky's current Water Quality Management Continuing Planning Process, the major objectives associated with the Ambient Monitoring Program are:

1. To operate a fixed-station monitoring network meeting chemical, physical, and biological data requirements of the state program and EPA's Basic Water Monitoring Program (BWMP);

2. To conduct intensive surveys on priority waterbodies in support of stream use designations, wasteload allocation model calibration/verification, and other agency needs;

3. To store data in EPA's STORET system, a computerized water quality data base; and

4. To coordinate ambient monitoring activities with other agencies (EPA, Ohio River Valley Water Sanitation Commission, U.S. Geological Survey, U.S. Army Corps of Engineers, etc.).

Following is a discussion on components of the monitoring program (fixed-station monitoring, biological monitoring, intensive surveys). A citizen education program called WATER WATCH, which includes a monitoring element, is also discussed.

Fixed-Station Monitoring Network

Fixed-station stream water quality monitoring sites active during 1986-1987 are listed in Table 34. Locations of these sites are depicted in Figure 9. Excluding the mainstem of the Ohio River, data generated by this monitoring network were used to characterize approximately 1,500 stream miles within the state.

For the reporting period (1986-1987), the Division of Water's physicochemical network consisted of 45 stream stations located in ten river basins. Water samples collected monthly at each station were analyzed for the parameters shown in Table 35. In addition, the Division supports and uses data collected by the Ohio River Valley Water Sanitation Commission (ORSANCO) at five major tributary stations. The Division also uses data from eight major tributary stations maintained as part of the U.S. Geological Survey's National Stream Quality Accounting Network (NASQAN).

Table 34

Fixed- Station Stream Monitoring Network

Map No.	Station Name	RMI	Location
1	Tug Fork-Kermit	35.1	KY 40
2	Levisa Fork-Paintsville	69.4	US 23
3	Levisa Fork-Pikeville	117.3	KY 1426
4	Little Sandy River-Argillite	13.2	KY 1
5	Tygarts Creek-Load	28.1	KY 7
6	Licking River-Sherburne	126.7	KY 11
7	North Fork Licking River-Lewisburg	50.4	KY 419
8	South Fork Licking River-Cynthiana	49.1	KY 36/356
9	Licking River - Salyersville	266.9	KY 30
10	Eagle Creek-Glencoe	21.5	US 127
11	Kentucky River-Frankfort	66.4	St. Clair St. Bridge
12	South Elkhorn Creek-Midway	25.3	US 62/421
13	Dix River-Danville	34.6	KY 52
14	Kentucky River-Camp Nelson	135.1	Old US 27
15	Red River-Clay City	21.6	KY 15
16	Red River-Hazel Green	68.5	KY 746
17	Kentucky River-Heidelberg	249.0	KY 399
18	North Fork Kentucky River-Jackson	304.5	Old KY 30
19	Middle Fork Kentucky River-Tallega	8.3	KY 708
20	South Fork Kentucky River-Booneville	12.1	KY 28
21	Salt River-Shepherdsville	22.9	KY 61
22	Pond Creek-Louisville	15.4	Manslick Rd. Bridge
23	Rolling Fork-New Haven	38.8	US 31E
24	Beech Fork-Maud	48.1	KY 55
25	Green River-Munfordsville	225.9	Upstream US 31W
26	Nolin River-White Mills	80.9	White Mill Bridge
27	Bacon Creek-Priceville	7.3	C. Avery Rd. Bridge
28	Barren River-Bowling Green	37.5	College St. Bridge
29	Green River-Cromwell	130.6	Ohio Co. Water Dist. Intake
30	Mud River-Lewisburg	44.5	KY 106
31	Pond River-Apex	62.8	KY 189
32	Pond River-Sacramento	12.4	KY 85
33	Rough River-Dundee	62.5	Davidson Rd. Bridge
34	Tradewater River-Olney	72.6	KY 1220
35	Cumberland River-Pineville	654.4	Pine St. Bridge
36	Cumberland River-Cumberland Falls	562.3	KY 90
37	Rockcastle River Billows	24.4	Old KY 80
38	Horse Lick Creek-Lamero	7.5	Daugherty Road
39	Buck Creek-Eubank	45.0	KY 70
40	Big South Fork Cumberland River-Yamacraw	40.3	KY 92
41	Cumberland River-Burkesville	427.0	Allen St. Boat Dock
42	Little River-Cadiz	24.4	KY 272
43	Clarks River-Almo	53.5	Almo-Shiloh Rd. Bridge
44	Mayfield Creek-Magee Springs	10.8	KY 121
45	Bayou de Chien-Clinton	15.1	US 51

Fixed - Station Monitoring Network
Stream Station Locations

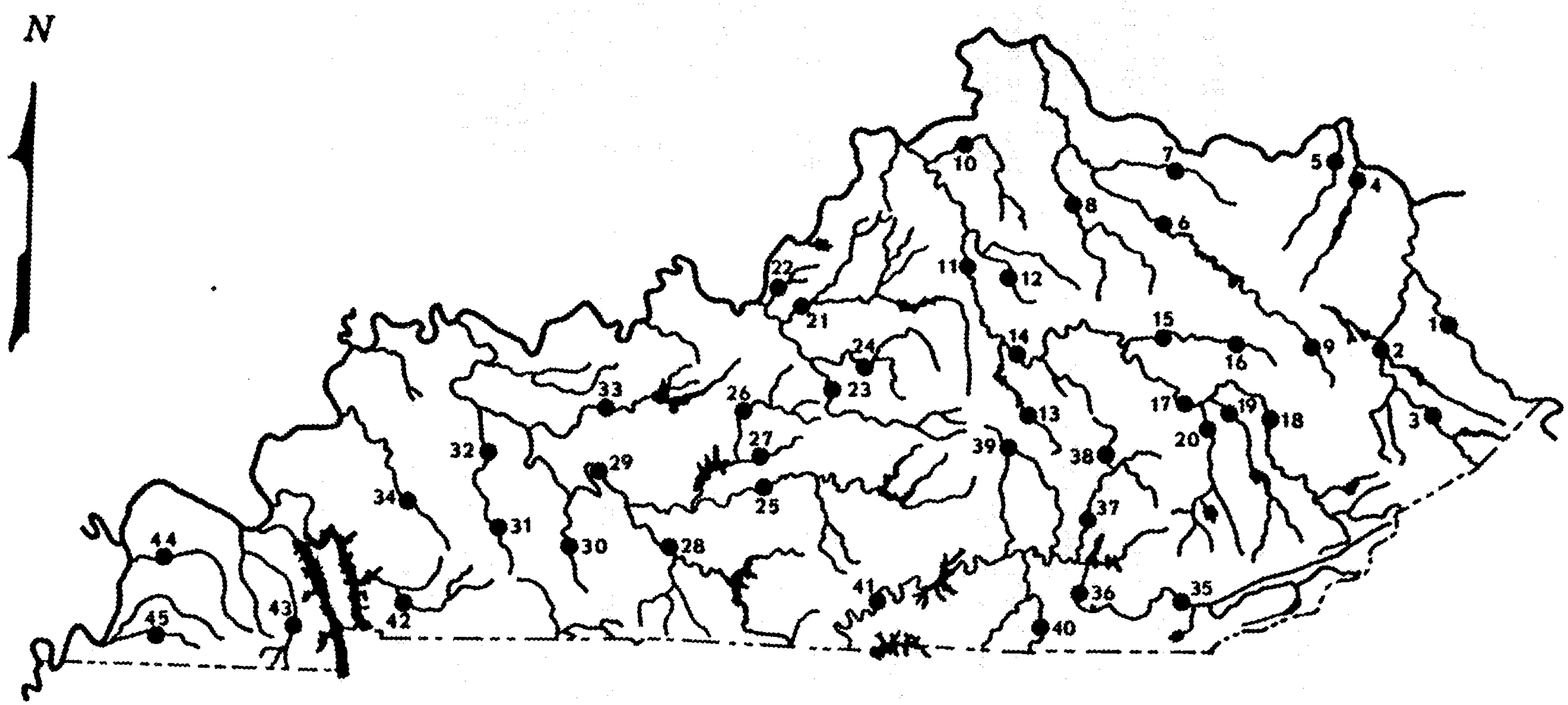

Figure 9

Table 35

Stream Fixed-Station Parameter Coverage
( ) STORET Parameter Code

Parameters	Parameters
Field Data	**Laboratory Data**
Weather code (47501)	Acidity, mg/l (00435)
Air temp, °C (00020)	Alkalinity, mg/l (00410)
Water temp, °C (00010)	BOD, 5-day, mg/l (00310)
Specific conductance uS/cm @ 25C (00094)	Chloride, mg/l (00940)
D.O., mg/l (00299)	Sulfate, dissolved mg/l (00946)
pH, S.U. (00400)	Suspended solids mg/l (00530)
Turbidity, N.T.U. (82078)	TOC, mg/l (00680)
Flow, cfs (00060)	
Minerals, Total*	
Calcium, mg/l (00916)	
Magnesium, mg/l (00927)	**Metals, Total***
Potassium, mg/l (00937)	
Sodium, mg/l (00929)	Aluminum, ug/l (01105)
Hardness, mg/l (00900)	Arsenic, ug/l (01002)
	Barium, ug/l (01007)
Bacteria	Cadmium, ug/l (01027)
	Chromium, ug/l (01034)
Fecal coliform, colonies per 100 ml (31616)	Copper, ug/l (01042)
	Iron, ug/l (01045)
Nutrients	Lead, ug/l (01051)
	Manganese, ug/l (01055)
NH_3-N, mg/l (00610)	Mercury, ug/l (071900)
NO_2 + NO_3-N, mg/l (00630)	Zinc, ug/l (01092)
TKN, mg/l (00625)	
Total phosphorus, mg/l (00665)	

*Total as Total Recoverable

Lake monitoring was continued in 1986-1987 to address needs of two objectives. First, several lakes were sampled to evaluate problems of accelerated eutrophication. Second, three lakes were sampled to evaluate trends relating to potential acid precipitation impacts. Lakes in the ambient monitoring program are listed in Table 36, and the parameters measured are in Table 37.

Table 36

Lake Ambient Monitoring Network

Lake	Station Location
Eutrophication Trend Lakes	
Reformatory	Dam
Barren River	Dam
	Beaver Creek Arm
	Skaggs Creek Arm
Green River (1986 only)	Dam
	Corbin Bend Area
	KY 551 Bridge
Rough River (1986 only)	Dam
	KY 259 Bridge
	Walkers Creek Area
Cumberland	Big Lily Creek Embayment
	Beaver Creek Embayment
Buckhorn (1986 only)	Dam
	Midlake Area
	Upperlake Area
Nolin River (1987 only)	Dam
	Long Falls Creek Area
	Sportsman Paradise Area
	KY 88 Bridge Area
	Bacon Creek Area
Dale Hollow (1987 only)	Sulphur Creek Area
	Williams Creek Area
	Fanny's Branch Area
	Illwill Creek Area
	Little Sulphur Creek Area
	Spring Creek Area
Acid Precipitation Trend Lakes	
Tyner	Dam
Cannon Creek	Dam
Bert Combs	Dam

Table 37

Lake Ambient Monitoring Parameters

Parameters	EUT[1]	ACP
Dissolved oxygen	X	
Temperature	X	
pH	X	X
Specific conductance	X	X
Depth of euphotic zone	X	
Acidity		X
Acid neutralizing capacity (Alkalinity)	X	X
T.[2] aluminum		X
Extractable aluminum		X
D.[3] Calcium		X
D. chloride		X
T. fluoride		X
D. fluoride		X
D. inorganic carbon		X
D. organic carbon		X
D. iron		X
D. magnesium		X
D. potassium		X
D. silica		X
D. sodium		X
D. sulfate		X
T. phosphorus	X	
T. soluble phosphorus	X	
Orthophosphate	X	
Ammonia-N	X	X
Nitrite & nitrate-N	X	
T. Kjeldahl-N	X	
Chlorophyll *a*	X	
Color		X

[1] EUT - lake eutrophication evaluation
ACP - lake acid precipitation evaluation

[2] Total

[3] Dissolved

Biological Monitoring

Kentucky's biological monitoring program currently consists of a network of 33 stations in 11 river basins. Data collected from these stations are used to ensure that existing water quality is maintained, provide background values against which future water quality conditions can be compared, and recognize emerging problems in the areas of toxic residue, bacteriological contamination and nuisance biological growth. Program emphasis is directed at evaluating warmwater aquatic habitat (WAH) use support instream, determining presence and concentration of toxic residues in fish tissue and sediments, and evaluating municipal and industrial effluents for toxic conditions. The information from these monitoring efforts supports EPA's Basic Water Monitoring Program, provides information to state programs, and is used in developing the 305(b) report. For this report, biological data from 33 sites sampled from 1984-1987 were used to assess 948.2 miles of streams for the WAH use. Biological monitoring station locations and parameter coverage are outlined in Table 38.

Intensive Surveys

Kentucky uses the intensive survey to evaluate site-specific water quality problems. Information developed from intensive surveys are essential in providing a technical basis to:

- Document the attainment/impairment of designated water uses,
- Verify and justify construction grants decisions,
- Address issues raised in petitions for water quality standard variances, or use redesignations, and
- Document water quality improvements and progress resulting from water pollution control efforts.

In 1986-1987, four intensive surveys were conducted on 267 miles of streams. The locations, purposes, and conclusions of these surveys are summarized in Table 39. During the 1988/1989 fiscal year, at least six intensive surveys are planned. Table 40 lists the locations and the objectives of each survey.

Aquatic Life/Human Health Toxicity Testing

The Commonwealth of Kentucky has enacted several regulations for the protection of aquatic life in receiving waters. These regulations, for the most part, are based on setting effluent limitations for individual chemicals. However, toxicity data are available for only a limited number of compounds. Single parameter protection criteria, therefore, does not provide adequate or correct protection of aquatic life in certain situations: where the toxicity of the components in the effluent or surface waters is not known; where there are synergistic (greater than predicted) or antagonistic (less than predicted) effects between toxic substances in the tested media; or where a complete chemical characterization of the water has not been carried out. Since it is not economically feasible to determine the toxicity of each of the thousands of potentially toxic substances in surface waters or point-source effluents, the most direct and cost-effective approach is whole-effluent or surface water analysis of toxicity in a standard bioassay.

Assessment of the extent, presence and control of toxic conditions in the Commonwealth has relied on chemical specific and whole-effluent monitoring for

Table 38
Biological Monitoring Station Locations and Sampling Coverage (1986-1987)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Big Sandy River Basin						
Tug Fork	05070201	X	X			X
Levisa Fork	05070203	X	X		X	X
Little Sandy River Basin						
Little Sandy River	05090104					X
Ohio River Basin						
Kinniconick Creek	05090201	X	X			X
Tygarts Creek	05090103					X
Licking River Basin						
North Fork Licking River	05100101	X	X			X
Licking River-Sherburne	05100101	X	X			X
Licking River-Salyersville	05100101	X	X	X	X	X
South Fork Licking River	05100102	X	X			X
Kentucky River Basin						
North Fork Kentucky River	05100201	X	X			X
Middle Fork Kentucky River	05100202	X	X			X
South Fork Kentucky River	05100203	X	X			X
Kentucky River, Lock 14	05100204	X	X			X
Red River	05100204	X	X	X	X	X
Kentucky River, Camp Nelson	05100205	X	X			X
Kentucky R. below Frankfort	05100205	X	X		X	X
South Elkhorn Creek	05100205	X	X			X
Eagle Creek	05100205	X	X			X

Table 38 (continued)

Station	U.S.G.S Hydrologic Unit No.	Algae	Macro-invertebrates	Fish	Fish Tissue	Sediments
Upper Cumberland River Basin						
Rockcastle River	05130102	X	X	X	X	X
Horse Lick Creek	05130102	X	X			X
Green River Basin						
Nolin River	05110001	X	X	X	X	X
Bacon Creek	05110001	X	X			X
Green River - Munfordville	05110001	X	X			X
Green River - Morgantown	05110003				X	
Barren River	05110002					X
Mud River	05110003	X	X		X	X
Salt River Basin						
Salt River	05140102	X	X			X
Pond Creek	05140102	X	X			X
Beech Fork	05140103	X	X	X	X	X
Rolling Fork	05140103	X	X			X
Tradewater River Basin						
Tradewater River	05140205	X	X			X
Tennessee River Basin						
Clarks River	06040006	X	X		X	X
Mississippi River Basin						
Bayou de Chien	08010201	X	X			X

X - indicates monitored parameters

Table 39
List of Intensive Surveys
Conducted During FY 86 and FY 87

Hydrologic Unit Number/Stream	Purposes of Survey	Total Miles Assessed	Miles Supporting Uses	Miles Partially Supporting Uses	Miles Not Supporting Uses	Conclusions
05100205 Elkhorn/North Elkhorn Cr. System	To establish background water quality and biological data prior to major industrial development.	156.6	154.6	2	0	At present this stream system supports diverse aquatic life and has good water quality.
*Cedar Brook/ Bailey Run	To assess the impact of an industrial discharge and to determine if PCBs were entering the stream system from an abandoned dump site.	7	3	1.5	2.5	The industrial discharge has severely degraded aquatic life and water quality. No PCBs were found in the stream system
05130104 Little South Fork Cumberland River	To determine the impact of surface coal mining and oil well drilling on the aquatic life and water quality.	53.4	0	53.4	0	Both surface mine and oil well operations have degraded the water quality and negatively impacted the stream's aquatic li
06040006 Tennessee River/ Cypress Creek	To determine the impact of the Calvert City industrial complex on the water quality and aquatic biota of the Tennessee River and Cypress Creek system.	50.4	30.9	0	19.5	Some toxicity was occurring nea industrial discharges in the Tennessee River. Aquatic life and water quality were degraded in the lower ten miles of Cypres Creek. Channelizing the creek has resulted in the loss of many forms of aquatic life due to habitat elimination.
	TOTAL	267.4	188.5	56.9	22	

*This stream does not appear on the U.S.G.S. Hydrologic Unit Map.

Table 40
Proposed Intensive Surveys for FY 88 and FY 89

Hydrologic Unit Number/Stream	Objective	Type of Study
05070201 - 05070204 Big Sandy River Basin	1986 305(b) report indicated levels of fecal coliform bacteria were in excess of water quality criteria for recreational use. Survey to determine recreational potential and problem areas in Big Sandy Basin.	Bacteriological and Water Quality Survey
05100202 Cutshin Creek, Kentucky River Basin	To attempt to locate the source of periodic fish kills (study recommended in the 1986 305(b) report).	Full Intensive Survey
05100205 Eagle Creek, Kentucky River Basin	To acquire baseline water quality and biological data prior to future industrial and urban development.	Full Intensive Survey
05130101 Yellow Creek, Cumberland River Basin	To determine if the newly completed Middlesboro WWTP is adequately treating the municipal waste. This is a follow-up survey of a study done in 1982.	Full Intensive Survey
05130104 Rock Creek, Cumberland River Basin	To determine the effect of clear cutting activities in the headwaters and acid mine pollution in the lower portion of the drainage.	Full Intensive Survey
05130206 Little River, Lower Cumberland River Basin	To establish baseline water quality and biotic conditions in support of a nonpoint source pollution evaluation study and to validate low altitude photography as an assessment technique for targeting priority management areas.	Full Intensive Survey

municipal and industrial discharges under the Kentucky Pollution Discharge Elimination System (KPDES) permit process, compliance biomonitoring on those point-source dischargers, quarterly toxicity analysis (bioassays) of surface waters from the 45 primary network stations, and toxicity testing of sediments and surface waters associated with intensive surveys. Under the KPDES permitting program, most major industrial and municipal facilities, and a number of minor facilities discharging priority pollutants, will be required to conduct toxicity testing (acute or chronic) on their final effluent(s).

During 1986-87, acute and chronic toxicity tests were conducted by the Division of Water on 46 point source discharges and on instream locations above and below those sources. In addition, 45 primary network stations and 56 locations associated with intensive surveys received toxicity testing. Stream miles impacted by point and nonpoint source pollutants totalled 1,084 miles. Impacts assessed by river basin are listed in Table 41.

The chemical-specific approach has been used to control toxics for the protection of human health. Generally, levels of protection for public water supplies rely on the 10^{-6} risk level (one additional cancer death in one million people). Fish consumption advisories have relied on the presence in fish fillets of concentrations that are greater than U.S. Food and Drug Administration action levels for poisonous or deleterious substances in human food.

Sediments

Toxicity assessments of sediments were made at 66 sites with 96-hour fathead minnow sediment-elutriate and/or 9-day embryo-larval solid-phase sediment toxicity tests. Since sediments act as "sinks" for many pollutants, toxicity demonstrated in such testing may be reflective of years of low-level substance buildup or brief highly toxic discharges.

Toxicity was determined at 53 (80%) of the sites assessed. A toxic response was observed at ten sites that did not show similar water column toxicity. However, at no site that was nontoxic in sediment tests was water-column toxicity seen. Further analyses of this data, such as correlations with benthic community structure at sample sites, need to be conducted to relate the results to impacts on stream use support.

Citizens Water Watch Program

The Kentucky WATER WATCH program is administered by the Natural Resources and Environmental Protection Cabinet's Division of Water. Launched in 1985, WATER WATCH promotes individual responsibility for a common resource, educates Kentuckians about the wise use and protection of local water resources, provides a recreational opportunity through group activities, and gives citizens more access to their government. Objectives include: promoting individual responsibility for a common resource by fostering a public role in drawing attention to specific problem situations; enhancing citizen understanding and support through a strong program of public education; and communicating the value of environmental quality in attracting industry and tourism to the state. The Division of Water promotes the program by encouraging citizens to form groups which "adopt" waterbodies of local interest.

After a group is formed, members identify the stream, lake or wetland they want to adopt and submit an "adoption" form for approval to the Division of Water. After the adoption is approved, the WATER WATCH group then promotes community awareness and protection of their adopted water resource through stream monitoring, school based programs and stream rehabilitation projects.

Table 41
Stream Miles Impacted by Toxic Discharges
Based on the Results of Toxicity Tests

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Green River			
	Town Branch	4.0	PCBs
	Mud River	64.7	PCBs
	*Barren River	6.5	Nonpoint
	*Green River	31.1	Pb, nonpoint
	*Rough River	59.0	Fe, nonpoint
	*Pond River	52.4	pH, Mn, Fe, nonpoint
	Total	217.7	
Kentucky River			
	Town Branch	12.0	Chlorine, nonpoint, ammonia, BOD
	South Elkhorn Creek	24.5	Chlorine, ammonia, BOD, nonpoint
	Royal Springs	1.0	Chlorine
	North Elkhorn Creek	5.0	Chlorine
	Cedar Brook	3.5	Metals, cyanide
	Bailey Run	1.5	Metals, cyanide
	*North Fork Kentucky River	8.6	Pb, nonpoint
	*Kentucky River	88.6	Ammonia,chlorine,Fe,Pb, nonpoint
	Jessamine Creek	5.0	Chlorine, ammonia
	Town Branch (Wilmore)	2.0	BOD, nonpoint
	Lee's Branch (Midway)	1.0	Chlorine
	Town Branch (Mt. Vernon)	2.0	Chlorine, ammonia, BOD
	Brushy Fork (Berea)	2.0	Chlorine, ammonia, BOD
	Walnut Meadows Creek	2.0	Chlorine, ammonia, BOD
	White Oak Creek	2.0	Chlorine, ammonia, BOD
	Logan Creek	2.0	Chlorine, ammonia, BOD
	Judy Creek	2.0	Chlorine, ammonia, BOD
	Swift Creek	2.0	Chlorine, ammonia, BOD
	*Red River	41.0	Nonpoint, Fe, chloride
	*Dix River	44.6	Nonpoint, Pb
	*Eagle Creek	27.2	Fe, nonpoint
	Clarks Run	2.0	Chlorine, BOD, ammonia
	Total	281.5	

Table 41 (continued)

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Licking River			
	Brushy Fork	2.5	Chloride, chlorine
	*Licking River	37.2	Nonpoint
	*Licking River (Salyersville)	76.4	Mn, nonpoint, chloride
	Strodes Creek	5.0	Metals, chlorine, BOD, ammonia, nonpoint
	Total	121.1	
Big Sandy River			
	*Tug Fork	56.0	Fe, pH, nonpoint
	*Levisa Fork	60.0	Fe, nonpoint
	Total	116.0	
Cumberland River			
	*Cumberland River	75.0	Fe, nonpoint
	*Buck Creek	30.0	Nonpoint
	*Horse Lick Creek	21.0	Nonpoint
	Total	126.0	
Tradewater River			
	*Tradewater River	29.9	Mn, Cd, nonpoint
	Total	29.9	
Tennessee River			
	Cypress Creek	8.0	Chlorine, nonpoint, organics
	Tennessee River	2.0	(B.F. Goodrich barge slip) Multiple industrial
	Total	10.0	

Table 41 (continued)

Basin	Stream(s) Affected	Miles Impacted	Probable Cause
Salt River			
	*Pond Creek	21.8	Nonpoint, multiple industrial, chlordane
	*Beech Fork	13.6	Nonpoint
	Town Creek (Harrodsburg)	2.0	Chlorine, ammonia, BOD
	Total	37.4	
Mississippi River			
	*Mayfield Creek	30.2	Fe, nonpoint
	Total	30.2	
Ohio Basin			
	*Little Sandy River	39.3	Zn, Mn, nonpoint
	*Tygarts Creek	75.0	Nonpoint
	Total	114.3	
	State Total	1,084.1	

*Locations in which the specific toxic component is unknown or can be attributed to nonpoint sources is indicated by asterisk.

Each group receives training from the division's program coordinator, along with educational resources which includes a WATER WATCH Program Manual and two field guides (A Field Guide to Kentucky's Lakes and Wetlands and A Field Guide to Kentucky's Rivers and Streams).

Since its beginning, over 150 groups have been established with more than 800 members statewide, and over 22,000 people have received an overview presentation telling them about the program. One hundred and twenty-four streams, seventeen lakes, eight wetlands and seven karst or underground systems have been adopted. Over 70 basic training workshops have been held in conjunction with the program statewide. Advanced training workshops for volunteers are also offered from time to time.

The Kentucky Division of Water has received inquiries from Texas, Wisconsin, Pennsylvania, New Jersey, New York, Tennessee, Colorado, Mississippi, Alabama, Arkansas, Washington, West Virginia, and South Carolina about establishing similar volunteer programs in their state. The program gained international recognition when it received the North American Environmental Education Association's 1987 award for outstanding service to environmental education.

Volunteer Stream Monitoring Project

To assist local groups in developing information concerning the quality of water resources close to them, and to gather information about stream segments not covered by the existing Kentucky Ambient Water Quality Monitoring Network, the WATER WATCH Program has recruited over 60 volunteer teams to conduct regular water quality tests on streams in their communities. Although the information obtained cannot be used in enforcement action, citizen monitoring can and has provided useful "flagging" of water quality problems.

The teams are equipped with commercial water testing kits for measuring dissolved oxygen, pH, temperature, nitrate-nitrogen, ortho-phosphate, sulfate, iron and chloride. Volunteers are trained in testing and reporting procedures and how to interpret results. Training also involves discussing ways the information can be shared through various organizations and media outlets.

Recruited groups have agreed to perform monthly tests on at least two designated sites in their community for one year. The volunteers submit the results to the division, usually within one week after the tests are performed. The results are tabulated, summarized and reported back to the groups.

The project is producing site data from 57 stations on Kentucky streams. The program is administered on a continuing basis by the WATER WATCH Program Coordinator at the Division of Water as a part of the overall WATER WATCH Program. New sites are being added continuously. Often, local groups, civic organizations, schools, and businesses contribute to the project.

WETLANDS PROTECTION PROGRAM

In 1985, the Division of Water provided funding to the Kentucky Nature Preserves Commission (KNPC), under a Memorandum of Agreement, to determine the status of Kentucky's wetlands and recommend methods for protection of remaining areas. Their report, Wetland Protection Strategies for Kentucky, was released in 1986. The report was widely distributed by the Division of Water, and public input was requested. It was soon apparent that wetland protection in Kentucky was and is highly controversial.

It was felt that the best approach to obtain a consensus (for an acceptable and workable wetland protection strategy) among affected and interested parties was through the Kentucky Environmental Quality Commission (EQC). EQC is composed of industry, environmental and citizen representatives. They serve as an objective public forum for the exchange of views, concerns and information relating to the quality of Kentucky's environment.

In order to define the components of a wetland strategy, EQC held a series of four public meetings between October 1986 and February 1987. The "public dialogues" focused on a number of key wetland issues. How should wetlands be defined? What regulatory and nonregulatory options are needed to curtail wetland loss? What are the impacts if a wetland program is or is not implemented? The meetings were well attended and provided EQC with a broad perspective on wetland issues and concerns in Kentucky.

Based on a review of the comments received from the public meetings and discussions with interested parties, EQC formed a nine-member Wetlands Advisory Subcommittee. The Subcommittee was charged with developing a consensus on what a state wetland strategy should include. Members of the subcommittee included representatives from mining, agriculture and silviculture industries, an environmental organization, a university and the EQC chairperson.

After six meetings, the Wetlands Advisory Subcommittee presented to EQC a set of recommendations as agreed upon by all members and their respective organizations and interests. It was recommended that the Natural Resources and Environmental Protection Cabinet protect wetlands by adopting and pursuing a phased approach for the development of a comprehensive wetland strategy for Kentucky. A discussion of this approach follows.

PHASE ONE: A State Wetland Legislative Policy

A state wetland legislative policy, to be introduced in the 1988 General Assembly, should contain the following provisions:

1. Statement of Wetland Values and General State Policy - An important conclusion of the EQC Wetlands Advisory Subcommittee was that wetlands are vital to the state and its quality of life. A state wetland policy statement is needed to acknowledge the economic and environmental importance of wetlands in Kentucky and ensure appropriate protection.

2. A State Wetland Definition - Currently there exists no state wetland definition. It is recommended that the state adopt the wetland

definition under the Emergency Wetlands Resources Act and the Food Security Act.

3. A Comprehensive Statewide Wetland Inventory - There is limited information on wetlands in Kentucky. A comprehensive wetland inventory is basic to the development of a wetland protection strategy. The inventory should be based on:

   a. Wetland mapping by the U.S. Fish and Wildlife Service under the National Wetlands Inventory (NWI). Note: The NWI is in progress for the western third of Kentucky.

   b. An accelerated mapping process, as a top state priority, funded at both federal and state levels as needed.

   c. Notification to landowners who own properties identified on draft and final maps, to allow for public input and comments.

   d. Digitization of final NWI maps and their availability to the public upon request at a cost determined by the state.

   e. State recognition that the NWI maps may be used as a planning tool but shall not be used as final wetland determinations.

4. Wetland Status and Trends Analysis - A wetland status and trends analysis is needed to assist the state in developing a comprehensive wetland protection strategy. The analysis should review the extent of wetland loss in Kentucky, determining how wetlands have been impacted or destroyed over the past ten years; however, emphasis should be on identifying future threats to wetlands given existing federal and state initiatives.

5. A State Wetland Planning Committee - Because of the many agencies and public and private interests involved in wetland management and protection, it is recommended that a State Wetland Planning Committee be established to develop a comprehensive wetland strategy for Kentucky and to continue an effective dialogue for the protection of wetlands. The strategy should be completed one year after the formation of the committee.

6. Establishment of a Wetlands Coordinator - A state wetlands coordinator position should be established and funded to monitor and coordinate various wetland programs and actions, make information available on wetlands, and staff the Wetlands Planning Committee.

PHASE TWO: A Statewide Natural Areas and Wetlands Acquisition Fund

There is an immediate need to protect Kentucky's most important wetlands for future generations. The enactment of a state acquisition program to purchase wetlands from willing sellers is a critical component to effectively manage and protect those wetlands with significant public values.

An acquisition program, to be introduced in the 1988 legislative session should include:

1. A funding mechanism to include a real estate transfer fee or proceeds from a bond issue or a combination of both.

2. The establishment of a board to manage and supervise the fund.

3. A provision that wetlands only be purchased from willing sellers.

4. A definition of the purposes for which funds are collected.

5. A provision for reimbursement to counties for lost property tax.

PHASE THREE: Development of a State Comprehensive Wetland Strategy

Upon legislative and executive enactment of the wetland legislative policy statement and appointment of the state Wetlands Planning Committee, it is recommended that the Committee consider the following in the development of a wetland strategy:

1. <u>Review and Monitor Current and Proposed Federal Wetland Programs</u> - Where appropriate, the committee should identify issues and needed changes in order to ensure federal programs are carried out effectively in Kentucky.

2. <u>Review State Programs That Impact Wetlands</u> - Based on the review of state programs, the wetland status and trends analysis, federal programs and economic, ecological, social and public interest factors, the committee should outline where wetland protection and management is deficient and propose programs and regulatory improvements.

3. <u>Review State Tax Incentives, Disincentives</u> - A review of state tax incentives as well as disincentives should be conducted and changes proposed to protect wetlands.

4. <u>Review Public Funding Policies</u> - Changes should be proposed to avoid wetland destruction and alteration in publicly funded development projects if feasible alternatives are available.

5. <u>Investigate the Need for a Conservation Easement Law</u> - The Committee should propose administrative and/or legislative changes to the current state conservation easement law to upgrade its effectiveness similar to those enacted in 43 other states.

6. Review Opportunities for Federal and State Cooperation and Communication - Areas for improved communication among various state agencies as well as between state and federal agencies should be outlined. Opportunities may include training, joint wetland investigations, and enhancement of technical assistance.

7. Develop an Education Program - An education program for the public and private sector should be developed.

8. Implementation Strategy - The committee should outline how the wetland strategy will be implemented, defining priorities, timeframes, responsible agencies, program costs and program review procedures.

9. Wetland Strategy Review and Update - Upon completion of the wetland strategy, the planning committee should meet at least once a year, or more if needed, to continue a wetland dialogue and continually review the strategy and update it as needed.

10. Timeframes - The wetland strategy should be completed one year after the formation of the Wetland Planning Committee and be presented to the Governor and Legislature at that time for review.

The Commission submitted these recommendations to the Cabinet on October 4, 1987 in a report entitled, A Wetland Protection Strategy for Kentucky. The Cabinet is currently reviewing the recommendations.

GROUNDWATER PROGRAM

The Groundwater Branch was created on October 1, 1987 by executive order of the Governor as a part of the overall reorganization of the Division of Water. To reflect the growing importance and national and state emphasis on groundwater protection, the Groundwater Section was elevated to Branch status. The new Groundwater Branch consists of two sections as follows:

Technical Services Section - provides field verification and direct technical assistance to groundwater users throughout the state in such areas as wellhead protection, monitoring well and water well inspections, and implementation of groundwater regulations.

Other activities include detection, investigation, modeling, mapping, technical assistance, and remedial actions in response to groundwater contamination and in support of groundwater protection programs. This section will also plan and implement the Wellhead Protection Program.

Data Management and Support Section - the Commonwealth's groundwater programs will be monitored and coordinated by this section. Efforts will be directed toward data management, administration, program planning and development, regulation development and education in support of the Water Well Drillers Certification Program, the Wellhead Protection Program, the Cabinet for Human Resources' Water Well Testing Program, and the Division's technical support activities. This section will develop a quality assurance/quality control program and oversee implementation of the Kentucky Groundwater Protection Strategy by developing regulations, maps and files, and conducting necessary research.

The Division of Water has announced that Kentucky's regulatory scheme for groundwater will mirror the federal model. A classification system has been proposed in the Kentucky Groundwater Protection Strategy which is intended to be equivalent to the recently issued (December 1986) draft U.S. EPA classification guidelines.

The federal model was chosen for Kentucky for several reasons. The federal system is "ready-made"; therefore, less time and resources will be needed at the state level to produce a viable and acceptable program. The federal system will produce an objective and enforceable standard. The federal emphasis on maintaining groundwater quality for potable uses has a strong human health-related basis. While to some reviewers this "drinking water" standard may seem a minimalistic standard, because of data considerations and the state's compelling interest to protect its people, such a standard will likely supply a rallying point for most Kentuckians. A non-degradation standard, while theoretically attractive, is not practical. Although a substantial number of states have adopted a non-degradation policy for groundwater management, not one state is enforcing it. One of the many reasons is lack of background data.

Adoption of the federal system will provide a consistent and less confusing regulatory array to the people. Other states will face problems of public acceptance of a separate state standard which may be debated over its consistency with the federal standard or weakness or strength relative to sister states. With Kentucky adopting the federal standard, only one standard will exist for Kentucky and this standard will have essential equality with other states.

Certain aspects of the federal methodology for classification offer interesting opportunities for groundwater protection. The DRASTIC mapping system for evaluating groundwater vulnerability is now being evaluated for the state. The term DRASTIC is an acronym for significant hydrogeologic phenomenon that can help indicate the likelihood of pollutants reaching a groundwater resource if a pollution event, such as a spill, were to occur. Most directly, DRASTIC is applied in classification decisions in protecting the most valuable and vulnerable water supplies. DRASTIC mapping can be of benefit in prioritizing cleanups of non-superfund, yet significant, uncontrolled waste sites. Emergency response planning can be aided with determination of groundwater vulnerability in the area of concern. As a tool for planning, vulnerability mapping can help developers, the public, state agencies and local government.

State protection of groundwater resources through permitting, classification, and DRASTIC mapping will not develop a complete system, however. Local government efforts are and will continue to be very important. By taking local needs and groundwater resources into account, localities can assure a sufficient and clean source of drinking water by initiating a wellhead protection program for their area. Wellhead protection would entail planning measures tailored to each local groundwater protection situation, geared to reducing the likelihood of contaminating a groundwater resource.

Wellhead protection planning will be aided by resources available to the Groundwater Branch. While federal funding is still awaited, long term efforts at the DOW have already begun to aid in the wellhead protection work. Water well records are being collected. Inventories of existing wells and their construction characteristics are going forward statewide. Six hundred public water supplies in Kentucky that rely on potable groundwater are likely to be served by the program in upcoming years.

CHAPTER 7

RECOMMENDATIONS

RECOMMENDATIONS

The actions listed below are recommended in order to achieve further progress in meeting the goals and objectives of the Clean Water Act.

- o Continue implementation of the state's Toxics Control Strategy through incorporation of appropriate chemical-specific and biomonitoring requirements in KPDES permits and, development of individual control strategies for those facilities impacting waters identified under Section 304(l)(1)(B) of the 1987 Water Quality Act amendments.

- o Develop a reference stream reach data base to determine baseline levels of water quality, aquatic community composition, and habitat conditions in aquatic ecoregions of the state to help assess use support attainment.

- o Continue to implement studies to determine the extent and sources of fecal coliform pollution in state waters and develop strategies for source controls.

- o Encourage EPA and the Corps of Engineers to develop consistent and specific guidance for implementation of Section 401 provisions in the Section 404 permitting process, and clarify state water quality agency roles in reviewing Section 10 permits.

- o Continue studies on the extent of fish tissue contamination by toxic pollutants.

- o Place emphasis on the following activities in the Construction Grants Program.

    1) Pursue streamlining necessary procedures, reviews and requirements, while eliminating those whose purpose is no longer relevant.

    2) Establish an effective community outreach program, making use of available grant funding from EPA, which emphasizes working with localities in the field through the planning, design, and construction stage of projects.

    3) Accelerate the transition from the Corps of Engineers' participation in the program to that of full state delegation of all construction-related activities focusing on adherence to project schedule, change order management and other cost-saving measures.

- o Incorporate the management of sludge into KPDES permits, and transfer certain responsibility from the state Division of Waste Management to the Division of Water. This would keep the state in step with EPA's implementation of the Water Quality Act of 1987.

- Develop a program, based on provisions of the Clean Water Act, that will meet all legislative requirements for controlling stormwater runoff. Program elements will include the development of appropriate regulations, issuance of industrial and large municipal source permits, and development of a procedure for issuing general permits for smaller cities.

- Continue implementation of the pretreatment program and periodically evaluate program effectiveness and needs.

- Encourage the U.S. Congress to appropriate the necessary funding to reactivate the federal Clean Lakes Program.

APPENDIX A

1986-1987
FISH KILL SUMMARY

Appendix A
1986-1987
Fish Kill Summary

1986

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
Anderson	Salt River	June 9	2.0	Unknown	500
Barren	Fallen Timber Creek	May 21	-	Nonpriority organics (natural gas)	4,280
Bullitt	Salt River	Sept. 5	1.0	Organic enrichment/DO	-
Campbell	Phillips Creek	May 3	1.2	Ammonia nitrogen	3,677
Campbell	Pond Creek	May 19	1.0	Unknown	1,056
Campbell	Licking River	July 30	0.5	Organic enrichment (sewage)	200
Clay	Goose Creek	July 30	0.5	Organic enrichment (sewage)	160
Floyd	Branham Creek	May 6	0.7	Unknown toxicity	-
Franklin	UT to South Benson Creek	July 14	0.01	Organic enrichment (sewage)	200
Jefferson	Beargrass Creek	June 29	0.5	Organic enrichment/DO	-
Jefferson	Beargrass Creek	Nov. 2	1.0	Chlorine	4,478
Kenton	Banklick Creek	July 19	1.0	Organic enrichment (sewage)	1,000
Laurel	Little Laurel River	July 30	0.5	Organic enrichment (sewage)	40

Appendix A
1986-1987
Fish Kill Summary (Cont'd.)

<u>1986</u>

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
Leslie	Raccoon and Cutshin creeks	Feb. 5	-	Petroleum	-
Lincoln	St. Asaph Creek	July 21	0.5	Organic enrichment (sewage)	500
Lyon	Lake Barkley	March 31	47 acres	Pathogens (bacterial infection)	100,000
Madison	Otter Creek	April 4	-	Pesticide	-
Madison	Otter Creek	Aug. 19	8.6	Pesticide	5,000
Nelson	Cox's Creek	Aug. 5	0.1	Organic enrichment (animal waste)	200
Pendleton	South Fork Grassy Creek	April 27	1.3	Organic enrichment (animal waste)	3,445
Perry	North Fork Kentucky River	Aug. 1	0.5	Organic enrichment (sewage)	100
Pike	Feds Creek	Dec. 22	1.0	Petroleum (diesel fuel)	-
Shelby	Little Bullskin Creek	June 20	1.52	Organic enrichment (sewage)	4,724
Total			23.34 miles 47 acres		129,560

Appendix A
1986-1987
Fish Kill Summary

1987

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
Anderson	Taylorsville Lake	June 15	200 acres	Organic enrichment/DO	500
Bath	Slate Creek	June 18	1.44	Nutrients (liquid nitrogen)	26,087
Bourbon	Stoner Creek	Sept. 17	1.5	Organic enrichment (sewage)	-
Campbell	Phillips Creek	May 6	1.36	Organic enrichment (sewage)	1,384
Clark	Hancock Creek	June 21	3.0	Organic enrichment/DO (soybean meal)	500
Clay	Redbird River	July 23	0.75	Sediment (concrete washing)	-
Estill	Station Camp Creek	Aug 9	1.0	Unknown	100
Estill	Station Camp Creek	Nov. 28	0.5	Unknown	25
Floyd	Left Fork Beaver Creek	Aug. 6	2.0	Unknown	1,000
Garrard	Walker Branch	June 23	3.0	Organic enrichment (animal waste)	150
Hardin	Valley Creek	Nov. 6	2.4	Organic enrichment (sewage) and unknown toxicity (industrial waste)	30,433
Jefferson	Beargrass Creek	May 22	1.5	pH (carmel food coloring)	2,000

Appendix A
1986-1987
Fish Kill Summary

1987

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
Kenton	Banklick Creek	May 29	2.0	Unknown	500
Leslie	Cane Branch, Wooton Creek, Cutshin Creek	Feb. 4	0.8	Chlorine	1,000
Leslie	Mudlick Branch and Cutshin Creek	July 23	5.0	Petroleum (sludge) and sediment	-
Marshall	Tennessee River	July 30	6.0	Unknown	500
Mason	Limestone Creek	Jan. 30	0.5	Petroleum	1,000
Menifee	Beaver Creek	Nov. 17	1.6	Emulsified asphalt	10,000
Metcalfe	Claylick Creek	July 28	0.25	Unknown	15,350
Monroe	Salt Lick Creek	July 27	0.25	Unknown	674
Muhlenberg	Green River	Dec. 3	0.1	Thermal modification (cooling water)	56,259
Melson	East Fork Simpson Creek	March 18	1.0	Nutrients (liquid nitrogen)	100
Nelson	Pottinger Creek	June 1	1.0	Organic enrichment (animal waste)	10,000
Nelson	Timber Creek	June 18	0.12	Organic enrichment (animal waste)	547

Appendix A
1986-1987
Fish Kill Summary

1987

County	Stream	Date	Miles Affected	Cause	Number of Fish Killed
Perry	North Fork Kentucky River	June 25	1.0	Petroleum (crude oil)	-
Pike	John's Creek	March 7	1.0	Unknown	-
Pike	Turkey Creek	March 12	2.0	Unknown	-
Rowan	Triplett Creek	Jan. 10	6.25	Pesticide (Permatox)	5,000
Taylor	Little Pitman Creek	May 22	7.97	Organic enrichment (sewage)	66,424
Whitley	Wolf Creek	Dec. 7	3.0	Petroleum (diesel fuel)	50
Total			58.29 miles 200 acres		229,583