

North Fork Kentucky River TMDL Fact Sheet

- Project Name:** North Fork Kentucky River Fecal Coliform TMDL
- Location:** Southeastern Kentucky draining the counties of Letcher, Perry, Breathitt, and Lee
- Scope/Size:** TMDL covers all 162.6 miles of the North Fork Kentucky River and its tributaries
- TMDL Issues:** PS/NPS
- Data Sources:** Ambient monitoring, Intensive surveys, municipal facilities' monitoring, and compliance sampling surveys
- Monitoring Plan:** Monthly sampling of the upper North Fork Kentucky River main stem during PCR season and random compliance sampling inspections at wastewater plants
- Control Measures:** NPDES Permits and Enforcement. Local communities will receive educational, technical, and limited financial assistance regarding fecal contamination from non-point sources.
- TMDL Development:** In 1987, ambient monitoring indicated excessive levels of fecal coliform (FC) caused violations of the FC standard for the North Fork Kentucky River. Several intensive surveys and follow-up monitoring indicated that the majority of the pollution was coming from wastewater plants. All point sources are required to meet the FC standard (400/100 ml) prior to discharge. Strict enforcement of the NPDES permits resulted in improvement of the river, however due to numerous raw discharges from households the standard was still being violated. Education and other forms of assistance will be provided to local residents in order to reduce the fecal contamination from the direct pipe sources.
- Implementation Controls:** Fines, compliance inspections and monitoring have reduced the level of fecal contamination from wastewater plants. Strict enforcement of NPDES permits will continue. Communities will receive educational, technical and financial assistance regarding non-point sources of fecal contamination.

Removing Fecal Pollution from the North Fork Kentucky River Basin



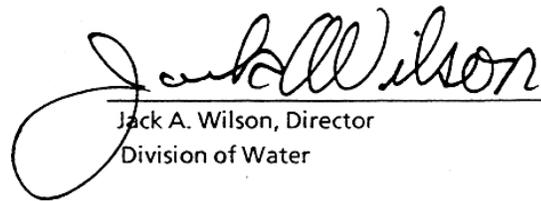
Kentucky Natural Resources and Environmental Protection Cabinet
Department for Environmental Protection
Division of Water
September 1994

REMOVING FECAL POLLUTION FROM THE NORTH FORK KENTUCKY RIVER
DRAINAGE

KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER
ECOLOGICAL SUPPORT SECTION

Frankfort, Kentucky

This report has been approved for release:



Jack A. Wilson, Director
Division of Water



Date

Removing Fecal Pollution From The North Fork Kentucky River Drainage

Prepared by
Gary Beck, Microbiologist

Water Quality Branch
Division of Water

Mike Mills, Supervisor
Ecological Support Section

September, 1994

This report is printed on recycled paper with state funds

DISCLAIMER

The mention of brand names or commercial products in this report does not constitute endorsement or recommendation for use of the product.

Abstract

A water quality investigation was conducted in May of 1987 to identify the source(s) of fecal coliform (FC) bacteria in the North Fork Kentucky River at Jackson. The North Fork Kentucky River is a sixth order stream 162.6 miles long, with a drainage area of 1,100 sq mi (2,852 km²) at Jackson. Ambient monitoring data from there indicated unacceptable FC levels for primary contact recreation (PCR)(i.e. swimming). Thirty-six samples (including duplicates) from 17 stations on the North Fork Kentucky River, Panbowl Lake, Cane Creek, Quicksand Creek, South Fork Quicksand Creek, Troublesome Creek, and the Jackson wastewater treatment plant (WWTP) were analyzed. Of the 34 stream samples, 53 percent had FC levels above the maximum (400/100 ml) considered safe for primary contact recreation. Information obtained after the survey indicated two major sources of bacterial contamination. The city of Jackson had broken sewer lines and improperly operating lift stations that were bypassing untreated sewage to the North Fork Kentucky River. During the survey, the Jackson WWTP was found to be discharging sludge (concentrated sewage) to the North Fork Kentucky River. During Franklin County Circuit Court proceedings, the city of Jackson admitted to Judge Bill Graham that they had improperly operating lift stations and agreed to repair them.

However, ambient monitoring data from Jackson continued to indicate unacceptable fecal coliform levels during the PCR season (May 1 through October 31). In May 1990, a more extensive survey (37 stations) of the North Fork Kentucky River drainage was conducted from Beattyville to Whitesburg (approx. 154 miles). This survey found the cities of Jackson, Hazard, Hindman, and Whitesburg out of compliance for FC bacteria. None were in the process of upgrading their facilities. Numerous straight pipe discharges of raw sewage were also found, as well as a bypassing lift station at Jackson. Because of unacceptable instream and final effluent FC levels and the fact that untreated sewage or sludge was to be discharged periodically during facility upgrading, a swimming advisory was posted for the length of the North Fork Kentucky River.

In order to reduce FC contamination in a holistic watershed, a watershed monitoring effort was instigated. This was similar to a total maximum daily load approach, in that an instream goal of less than 400FC/100mL was established in order to lift the swimming ban. Ten mainstem stations and four municipal effluents were monitored throughout the primary contact recreation season while facility upgrading occurred. In 1992, permitted dischargers in the drainage were warned by letter that noncompliance with their Kentucky Pollutant Discharge Elimination System (KPDES) permit limit for FC bacteria would result in a \$1,000 fine. During the 1992 PCR season, each facility was sampled three times. As a result, noncompliance fell from 43 percent to 13 percent, and instream FC levels declined, allowing the swimming advisory to be removed from approximately one-half of the North Fork Kentucky River (80 miles). Fecal pollution levels continue to be unacceptable for swimming in the upper part of the drainage, from below Hazard to above Whitesburg. This is mostly due to the numerous illegal straight pipe discharges of untreated waste from private homes.

ACKNOWLEDGEMENT

I gratefully acknowledge the assistance of Sam Call, Lythia Metzmeier, Ron Houpp and Charles Roth for the field data and sample collection. Special thanks to Gene Blair and Chuck Donaldson for DOW file information and Dave Leist for computer modeling.

In the area of field laboratory operations, I would like to thank Charles Roth, Supervisor, Bioassay Section, for use of the mobile laboratory. Also, thanks to Lee Colten, Water Quality Branch, and Mike Gevedon, Enforcement Branch, for transport of the mobile laboratory and sample collection; Giles Miller, Water Quality Branch, for Hydrolab monitoring.

In the area of field operations, I would like to thank Sam Lester, Branch Manager, Field Operations, and Jim Sproles, Supervisor, London District Office, for providing fecal conform analysis in 1991. I would also like to thank Gene Blair, Supervisor, Hazard District Office, for his study plan and coordination of the following people: Jim Adkins, Myrna Allyn, Darvin Messer, Damon White, Robert Adams, Kevin Francis, and George Flora, who made the airlift of samples a success. Thanks to Jenő Balassa, Division of Administrative Services, for map production and Scott Richards for the cover.

Table of Contents

	Page
Disclaimer	ii
Abstract	iii
Acknowledgement	iv
List of Figures and Tables	vi
Executive Summary	1
Introduction	4
Basin Description	8
Materials and Methods	9
Intensive Survey Data	9
North Fork Kentucky River Monitoring Stations' Fecal Coliform Data	12
Municipal Facilities' Fecal Coliform Data	14
Compliance Sampling Survey Data	14
Summary	15
Appendix A : North Fork Kentucky River Intensive Surveys Summary of Field Data and Bacteriological Data	18
Appendix B: North Fork Kentucky River Mainstem Fecal Coliform Data	23
Appendix C: North Fork Kentucky River Drainage Municipal Facility Fecal Coliform Data	34
Appendix D: 1992 Compliance Sampling Inspections Fecal Coliform Data for Non-Municipal Facilities	37
Appendix E: North Fork Kentucky River Facility List	39
Appendix F: Literature Cited	42

List of Figures and Tables

Figures		Page
1.	Map of the North Fork Kentucky River depicting intensive Survey Station Locations	6
2.	Map of the North Fork Kentucky River depicting Mainstem Monitoring Stations	7
Tables		
1.	North Fork Kentucky River at Jackson Ambient Monitoring Fecal Coliform Data	5
2.	North Fork Kentucky River Geometric Mean Fecal Coliform Data, May - October of 1990, May of 1991, April - May of 1992, and May of 1993	13

EXECUTIVE SUMMARY

1987 INTENSIVE SURVEY

1. Thirty-six samples (including duplicates) were collected from 17 stations on May 4 and 19, 1987. The stations were located on the North Fork Kentucky River, Cane Creek, Quicksand Creek, South Fork Quicksand Creek, Troublesome Creek, Jackson water plant intake (WPI), Jackson WWTP and Panbowl Lake.
2. Of 34 stream samples, 18 (53 percent) had FC levels above the maximum level (400/100 ml) considered safe for PCR and eight (24 percent) were above the maximum level (2,000/100 ml) considered safe for secondary contact recreation.
3. The discharge of sludge by the city of Jackson WWTP to the North Fork Kentucky River was the most severe impact observed in the study area. This discharge degraded PCR for approximately 37 miles and SCR for approximately 27 miles downstream.
4. The level of FC bacteria in the final effluent represented a violation of Jackson's KPDES permit. Violations of Kentucky Surface Water Standard (KSWs) for FC bacteria, 401 KAR 5:03 1, Section 6 were found at stations 48-4 and 47-2 and were most likely caused by the discharge of the Jackson WWTP.
6. Improperly operating lift stations, bypassing of raw sewage to the North Fork Kentucky River, and broken sewer lines were the most likely causes for excessive FC levels at the Jackson ambient monitoring station, and at the WPI.
6. The maximum FC level considered safe for swimming (400/100 ml) during the PCR season (May - October) was exceeded at the ambient monitoring station located on the North Fork Kentucky River at Jackson in all but one month from 1984 - 1988.
7. One of two samples taken at the Jackson WPI was greater than the KSWs FC geometric mean (2,000 / 100 ml) for raw water sources.
8. Fecal conform levels in Panbowl Lake indicated the presence of fecal pollution, which was most likely caused by illegal discharges of untreated wastewater and by septic tanks.
9. Current stream uses throughout the study area include warmwater aquatic habitat, PCR, SCR, and domestic water supply.

1990 INTENSIVE SURVEY

10. One-hundred-thirteen samples were collected from 37 stations on May 1, 8 and 15, 1990 (20 mainstem, eight tributaries, four municipalities, two lake and one WPI). The stations were located on the North Fork Kentucky River, Cane Creek, Quicksand.Creek, South Fork Quicksand Creek, Troublesome Creek and Carr Fork. The Vicco WWTP (May 17) and a bypassing lift station (May 8) were also sampled. Additional samples were taken in May at the Hindman, Hazard, and Jackson WWTPs during bioassay compliance sampling inspections. The receiving streams above and below these facilities were also sampled.
11. Of 20 mainstem stations, 17 (85 percent) had unacceptable FC levels. Three of the seven (43 percent) tributaries (Cane Creek, Troublesome Creek, and Carr Fork) had unacceptable FC levels.

12. Panbowl Lake, which discharges into the North Fork Kentucky River, had acceptable FC levels on both sampling events (May 1 and 8, 1990).
13. The FC level at the Jackson water plant intake was acceptable as a domestic raw water supply.
14. Four of five (80 percent) municipal plant effluents did not meet their KPDES permit limit for FC bacteria on at least one occasion (Jackson, Whitesburg, Hindman, and Hazard). The Jackson, Hazard, and Whitesburg WWTP effluents violated their FC permit limit on more than one occasion.
15. On May 17, 1990, a pipe which empties into the mixing chamber at the Hazard WWTP prior to discharging to the North Fork Kentucky River was sampled for FC bacteria. The FC level was indicative of raw sewage.
16. With the exception of Panbowl Lake and the Quicksand Creek drainage, FC levels were not acceptable for PCR uses at all instream stations from a point below Jackson to a point above Whitesburg. North Fork Kentucky River water quality became acceptable for PCR uses below the confluence with the Middle Fork Kentucky River at Beattyville (mp 255.0).
17. Fecal coliform/fecal streptococci ratios indicated human fecal pollution.
18. Lift station No. 1 at Jackson was bypassing raw sewage on May 8, 1990.
19. In June 1990, a swimming advisory was issued for 162.6 miles of the North Fork Kentucky River from the headwaters (mp 422.0) to the confluence with the Middle Fork Kentucky River (mp 259.4). Issuing the advisory was based on the fact that the Jackson and Whitesburg WWTPs would be bypassing untreated sewage while they were upgrading, Hazard would be constructing a new chlorine contact basin, and results of DOW investigations since May indicated that FC values consistently exceeded water quality standards associated with PCR uses in the North Fork Kentucky River.
20. Numerous straight pipes from private homes were noted during the May 1990 intensive survey.

1991

21. In May 1991, five samples were collected within a 30-day period at the ten mainstem stations. Fecal coliform results indicated a swimming advisory should remain in effect. Of the municipal effluents, only the Jackson WWTP had acceptable FC levels.
22. Monthly FC results from July through October 1991 indicated acceptable water quality at the mouth of the North Fork Kentucky River (Beattyville). Unacceptable water quality was consistently found in the upper part of the drainage (below Hazard to above Whitesburg).
23. In October 1991, after reviewing the 1991 FC data during the PCR season, a decision was made by DOW to notify each permitted facility in cy 1992 of an impending compliance sampling of their effluent for FC bacteria. Should they fail to meet their permit limit, a fine of not less than \$1,000 and up to \$25,000 would be levied against them. This action caused the greatest reduction in FC levels in the North Fork Kentucky River since continuous monitoring throughout the drainage began in 1990.

1992

24. On May 6, 1992, the Hazard WWTP effluent had unacceptable fecal coliform levels and was grey to black in appearance. To a lesser extent, the Beattyville WWTP had an unacceptable discharge

On May 6 and 7, of 51 facilities, 22 (43 percent) had unacceptable FC levels in their effluent. On May 28, 1992, a total of \$ 21,300 in fines was assessed on both municipalities and the 212 package plants found to be in noncompliance.

25. On June 23, 1992, of 24 facilities tested, ten (42 percent) had unacceptable FC levels in their effluent. The Beattyville WWTP also failed to meet KPDES permit guidelines on this second inspection. On July 15, 1992, a total of \$9,150 in fines was assessed on ten noncompliant facilities.
26. On August 4, 1992, of 36 facilities tested, six (17 percent) failed to meet their KPDES permit limit for FC bacteria (Hindman WWTP included). The Hindman WWTP failed to meet KPDES permit guidelines for the first time on this second inspection. On August 15, 1992, a total of \$ 2,500 was assessed on one municipality and four package treatment plants, and a letter of warning was sent to one package plant.
27. On September 15 and 16, 1992 of 45 package treatment plants tested, only six (13 percent) had unacceptable FC levels in their effluents. This represents a 30-percent improvement from May 6 and 7. No municipal facility failed to meet KPDES permit requirements for FC bacteria. On September 28, 1992, a total of \$ 2,000 was assessed in fines.
28. In all, \$34,950 in civil penalties were assessed to all permitted dischargers found to be not in compliance. As of April 28, 1994, \$33,950 had been collected.
29. In October 1992, water quality for primary contact recreational uses (i.e. swimming) was acceptable at the lower five monitoring stations in the drainage, from a point above Haddix to Beattyville (approximately 60 miles).

1993

30. In May and June 1993, of five samples taken within a 30-day period, the lower six stations of the Drainage had acceptable FC levels for primary contact recreation (approximately 80 miles). The swimming advisory was removed from Chavies to Beattyville.
31. The FC standard of no greater than 400/100 ml was exceeded on two occasions at the ambient monitoring station at Jackson during the 1993 PCR season.
32. Fecal coliform levels continue to be unacceptable from below Hazard to above Whitesburg (approximately 83 miles). This is mostly due to numerous illegal straight pipe discharges of untreated waste from private homes.

1994

33. Division of Water, Hazard district office personnel are working with the Perry and Letcher County health departments, the Kentucky Division of Plumbing, and the Kentucky River Area Development District (KRADD) to inventory illegal discharges of untreated waste from private homes in the North Fork Kentucky River drainage wherever possible. Over 1,200 straight pipes were inventoried in Letcher County alone.
34. A multi-agency task force composed of the agencies listed in #33 above, as well as the Cabinet for Human Resources, are working as a task group to provide ways to eliminate straight pipe discharges and sewer the many small coal camps that have no treatment systems. A memorandum of agreement (MOA) to accomplish this through education, enforcement, and technical assistance has been drafted.
35. Monitoring during the PCR season will continue at five stations in the upper part of the drainage, as well as at Jackson, until the swimming advisory is removed

INTRODUCTION

The Kentucky Division of Water (DOW) uses fecal coliform (FC) data collected at ambient monitoring stations throughout Kentucky to assess water quality for recreational uses. Ambient monitoring FC data is compiled biennially for the 305b Report to Congress on Water Quality. From that FC data, a list is developed of streams with impairments to recreational uses. From that list, the North Fork Kentucky River drainage was selected for further investigation. Ambient monitoring FC data from the station at Jackson (Table 1) indicated bacterial levels unsafe for primary contact recreational (PCR) use (401 KAR 5:03 1, Section 6) in the North Fork Kentucky River drainage. The 1986 Kentucky Report to Congress on Water Quality (DOW, 86) indicated 100 percent of the monthly samples collected during the 1984 and 1985 PCR seasons (May 1 through October 31) exceeded 400 FC / 100 ml (Table 1), in fact, this level was exceeded in all but one month from 1984 to 1988.

For these reasons, the DOW conducted intensive survey investigations and FC monitoring in the North Fork Kentucky River drainage. The data that follow will show the extent of the FC pollution and why a swimming advisory was imposed. It will also show how FC compliance sampling inspections with the enforcement of \$1,000 fines for noncompliance on permitted dischargers led to the decrease in fecal pollution and the removal of the swimming advisory on approximately 80 of 163 miles of the North Fork Kentucky River drainage.

The data in this report are presented in four categories; the 1987 and 1990 intensive survey data summary (FC and field data in Appendix A), the 1991-1993 North Fork Kentucky River monitoring stations' FC data (Appendix B), the 1991-1993 municipal facilities' FC data (Appendix C) and the 1992 compliance sampling surveys' FC data for Non-Municipal Facilities (Appendix D).

The purposes of the 1987 and 1990 intensive surveys in the Jackson area drainage and the whole North Fork Kentucky River drainage, respectively, were to verify the ambient monitoring data; determine if the North Fork Kentucky River met uses in the Kentucky Surface Water Standards (KSWS) for PCR, secondary contact recreation (SCR), and as a domestic raw water supply; and identify the source(s) of FC bacteria in the North Fork Kentucky River drainage. The purpose subsequent to these surveys was to find ways to reduce the TMDL of fecal pollution in the North Fork Kentucky River drainage.

Initially in 1987, 17 collection sites were chosen in and around Jackson on the North Fork Kentucky River mainstem from milepoint (mp) 294.2 to 314.5 and minor tributaries between those points (Figure 1). The city of Jackson's point of withdrawal for the water treatment plant and the wastewater treatment plant (WWTP) final effluent were included, and a sample was taken from an additional location at the upper end of Panbowl Lake. Tributaries sampled in the survey were Cane Creek, Panbowl Lake, Quicksand Creek, South Fork Quicksand Creek, and Troublesome Creek. In all, a total of 36 samples were collected on two occasions (including duplicates).

In May 1990, 113 samples were collected from 37 stations (Figure 1) in the North Fork Kentucky River drainage, including all stations collected in 1987, with the exception of one of two stations on Panbowl Lake, which discharges to the North Fork Kentucky River, and the following tributaries: Cane Creek, Quicksand Creek, South Fork Quicksand Creek, Troublesome Creek, and Carr Fork. A bypassing lift station was also sampled. The final effluents of Hazard, Hindman, and Whitesburg WWTPs and their receiving streams above and below their discharge points were sampled on four occasions from May 15 through May 18, 1990, during toxicity compliance sampling inspections. The Vicco WWTP final effluent was sampled on May 17. Fecal coliform results are found in Appendix A. In all, approximately 148.6 miles of the North Fork Kentucky, from Beattyville (mp 255.0) to Whitesburg (mp 403.6) were monitored.

TABLE I
 NORTH FORK KENTUCKY RIVER AT JACKSON
 AMBIENT MONITORING FECAL COLIFORM DATA

MO.	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
JAN	ND	280	110	80	750	800	630	1,600	700	580
FEB	ND	700	1,200	290	450	540	630	200	310	20
MAR	ND	90	440	240	40	770	530	230	2,600	400
APR	1,600	40	250	660	ND	180	1,200	9,200	290	600
MAY	2,300	1,000	1,400	600	440	1,600	1,300	1,700	440	780
JUN	1,300	1,200	3,000	ND	50	4,200	1,000	500	800	180
JUL	5,400	1,400	780	5,600	460	600	1,500	10,000	1,000	380
AUG	4,400	600	860	1,800	2,500	300	620	650	2,700	750
SEP	10,000	1,900	1,800	>4,000	3,600	1,500	300	220	120	320
OCT	760	1,000	1,400	1,400	570	800	550	330	60	100
NOV	570	3,800	ND	2,000	32	200	210	600	60	80
DEC	700	320	560	1,300	8	250	140	630	230	360
PCRS	2,900	1,100	1,400	2,000	610	1,100	760	860	440	330
YR GM	1,900	590	770	900	240	640	580	830	400	260

PCRS - Primary Contact Recreation Season (May thru Oct)

GM Geometric Mean

YR Year

ND No Data



FIGURE 1
North Fork Kentucky River Intensive Survey Stations

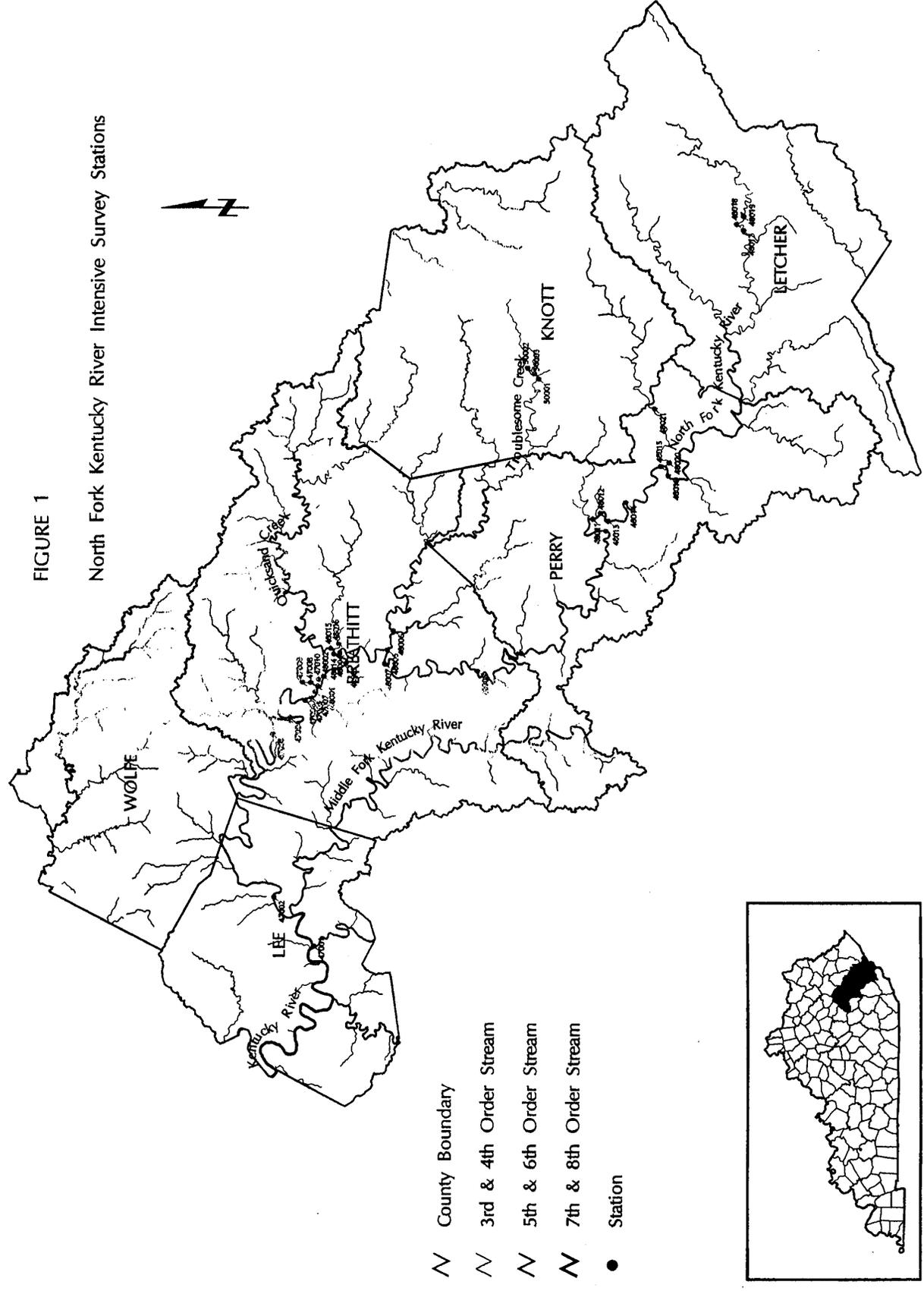
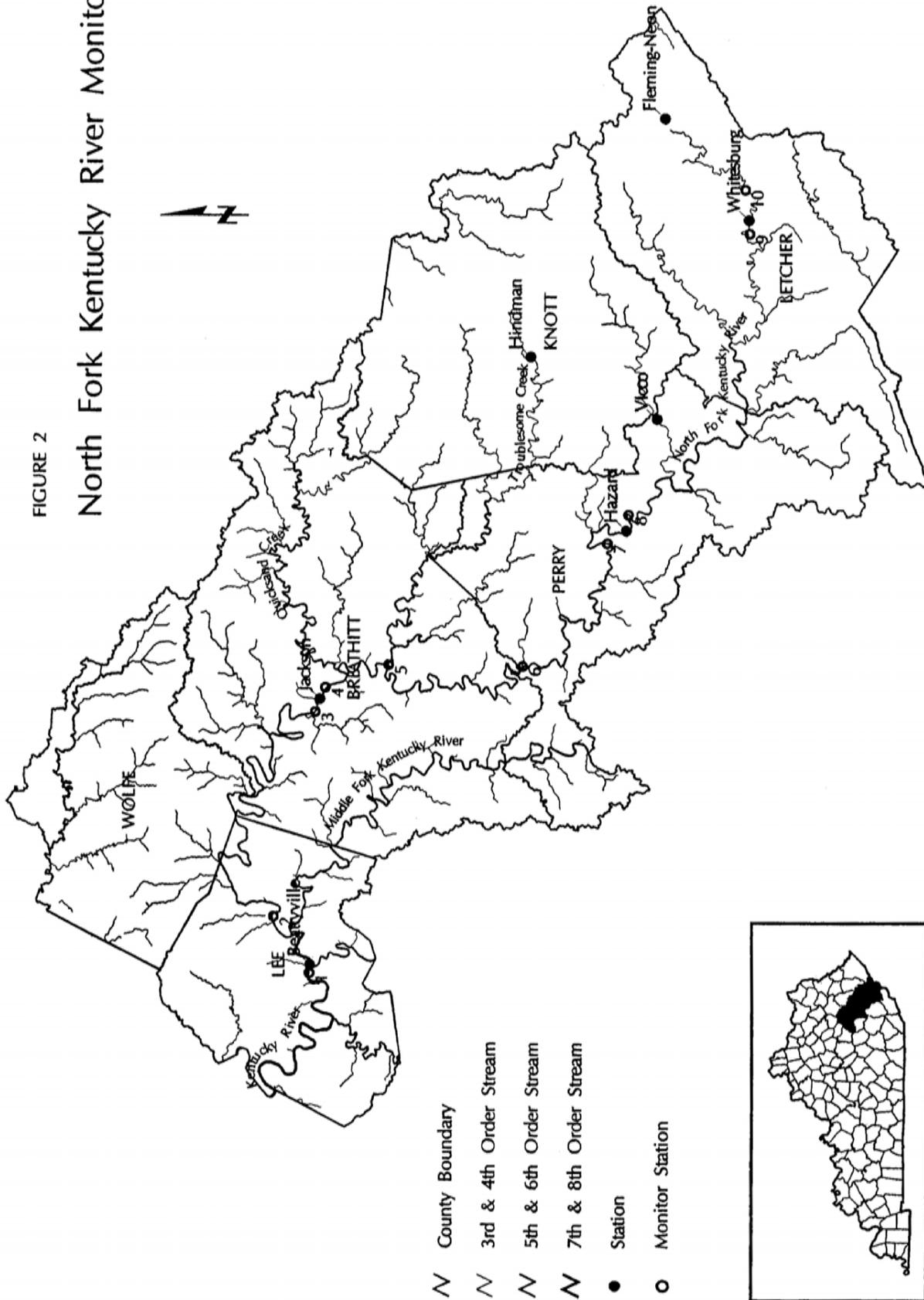


FIGURE 2

North Fork Kentucky River Monitoring Sites



In June 1990, ten stations from Beattyville to above Whitesburg were chosen for routine monitoring (Figure 2). Monitoring in the North Fork Kentucky River drainage centered on bracketing the municipal effluents of Whitesburg, Hazard, and Jackson, with samples being taken from their effluents and above and below their discharges. To a lesser extent, the municipal effluent of Fleming-Neon on Boone Fork in the extreme North Fork Kentucky River headwaters was also sampled routinely.

Sampling at the ten mainstem monitoring stations was conducted mostly on a monthly basis throughout the PCR season, with the exception of 1991, when samples were taken weekly. Five samples were taken within a 30-day period before the swimming advisory was issued (June 1990) and at the start of each PCR season (1991, 1992, and 1993). Limited sampling below each municipal discharge of Jackson, Hazard, and Whitesburg was conducted November through April in 1991-1992.

Non-municipal permitted dischargers in the drainage were sampled three times the same year (1992) along with municipal facilities during compliance sampling inspections (Appendix D). Failure to meet KPDES permit requirements for FC bacteria resulted in a \$1,000 fine. On May 6 and 7, 1992, seven municipal facilities and 54 package treatment plants were sampled along with the ten mainstem stations. An effort was made to sample before the end of the school year in Lee, Perry, Breathitt, and Letcher county to account for the school wastewater treatment facilities' FC load on the North Fork Kentucky River. In June, facilities failing the compliance inspection in May were sampled again. Those facilities that met KPDES permit compliance in May were tested in August. All facilities were tested for compliance again in September. Not all facilities were discharging at the time of sampling, but are shown in Appendix E. All facilities discharge to the drainage, except Lee Adjustment Center and the Beattyville WWTP, which discharges just below the mouth of the North Fork Kentucky River. However, they are included in this report because they were part of the 1992 compliance sampling surveys.

BASIN DESCRIPTION

The North Fork Kentucky River is a sixth order stream. It originates in the mountains of southeastern Kentucky near Whitesburg and flows northwest, draining the counties of Letcher, Perry, Breathitt, and Lee (Sehlinger and Underwood, 1980). It flows in a westerly direction until joining the Middle Fork Kentucky River at mp 258.6 and the South Fork Kentucky River at mp 254.8, thus forming the Kentucky River. The stream is 162.6 miles in length and has a drainage basin of 1,100 mi² (2,852 km²) at Jackson and 1,320 mi² (3,416 km²) just above the confluence with the Middle Fork Kentucky River (Bower and Jackson 1981). The major tributaries to the North Fork Kentucky River are Middle Fork Kentucky River and South Fork Kentucky River.

According to McDowell et al. (1981), geology of the Jackson area is of the Middle Pennsylvanian age. Rock strata is of the lower part of the Breathitt Formation, which is comprised of numerous coal beds, siltstone, sand or sandstone, and carbonaceous shale.

The facility list in Appendix E gives present permitted dischargers to the North Fork Kentucky River drainage. In 1987, there were 58 permitted dischargers, consisting of 11 schools, three municipals, 19 industrials, one subdivision, 21 small sewage plants, and three public water supply withdrawals (Jackson, Hazard, and Hindman). There were 12 permitted dischargers in Breathitt County. The following cities are the major population areas in the drainage (1990 census):

CITY	CLASS OF CITY	POPULATION
Beattyville	5	1,131
Fleming - Neon	6	759
Hazard	3	5,416

CITY	CLASS OF CITY	POPULATION
Hindman	6	798
Jackson	4	2,466
Whitesburg	5	1,636

MATERIALS AND METHODS

Water samples were collected in sterile 250 ml Nalgene bottles, sterile 120 ml borosilicate glass bottles, or sterile disposable 120 ml plastic bottles (Corning 17-100). After collection, the samples were placed on wet ice and transported to the Division of Water mobile bioassay trailer or the microbiological laboratory in Frankfort for analyses. Samples were also analyzed by the DOW London regional office and McCoy & McCoy, Inc., Pikeville. Chain of custody procedures were maintained on all samples, as outlined in the Ecological Support Section's Quality Assurance Manual (DOW, 87). An attempt was made to collect and deliver all samples within six hrs.

In the laboratory, fecal coliform analysis by membrane filter technique was performed using the methods outlined in *Standard Methods For The Examination of Water And Wastewater*, 15th edition, and *Microbiological Methods For Monitoring the Environment*, USEPA60018-78-017. All samples were filtered and incubated within eight hours from the time of collection. Duplicate analyses were performed on every tenth sample for quality assurance, as well as beginning and ending quality control checks for carryover of FC bacteria. When weekly samples were taken to McCoy & McCoy, Inc., Pikeville, duplicate samples were split monthly with the DOW microbiological laboratory, Frankfort, for quality assurance.

In 1987 and 1990, field measurements were taken at each station along with the sample collected for fecal coliform analysis. Total residual chlorine was measured using either a Fisher series 17T2000 amperometric titrator or a Hach field kit. Dissolved oxygen, water temperature, pH and conductivity were measured with Yellow Springs Instruments or a Hydrolab model 4041. Turbidity was measured with a DRTIS turbidimeter.

Wet weather sampling and dry weather sampling were accomplished by use of data from the USGS gaging station at Jackson. When dry weather sampling was desired, a target flow of 500 cfs was chosen, which represents a flow equalled or exceeded 65 percent of the time at Jackson. Flow readings greater than 500 cfs were considered to indicate wet weather.

INTENSIVE SURVEY DATA

The first intensive survey investigation of the North Fork Kentucky River was conducted in the vicinity of Jackson on May 4 and 19, 1987. Field and FC data are shown in Appendix A. Field data did not indicate any violations of KSWs for tested parameters. Fecal coliform levels were higher in the May 4 samples and were most likely influenced by wet weather runoff, as reflected in the turbidity readings and flow. The following results combine both sampling events.

Fifteen of 26 (58percent) stream samples were above the maximum level (400FC/100ml) considered safe for PCR, and seven (27percent) were above the maximum level (2,000/100MI) considered safe for SCR. Troublesome Creek, South Fork Quicksand Creek, and Quicksand Creek samples each had FC levels unsafe for swimming in one of two samples. One of two samples taken at the Jackson WPI was greater than the FC geometric mean (2,000/100 ml) allowed by KSWs for raw water sources. The FC level in the final effluent of the Jackson WWTP most likely influenced KSWs violations at Station (Stn) 48-8 for PCR/SCR uses and for PCR uses at Stn 47-2. This appeared to be a direct result of

the discharge of sludge from the plant. At the time of violation, the facility did not have another way to dispose of the sludge (i.e. farmland application and landfill). The FC level in the final effluent samples of the Jackson WWTP were indicative of raw (untreated) sewage or sludge (concentrated sewage), with an average of over 1,000,000 FC/100 ml. Fecal coliform levels at the two stations (48-8 and 47-2) below the Jackson WWTP discharge were unacceptable for PCR, of which the closest station below the Jackson outfall (0.4 mi) had unacceptable FC levels for SCR, most likely due to the discharge of the Jackson WWTP. The discharge of sludge to the North Fork Kentucky River by the Jackson WWTP was the greatest contributor to the degradation of North Fork Kentucky River during the survey.

The QUAL-2E computer model was used to determine how far downstream the Jackson WWTP effluent would affect water quality and recreational uses during median river conditions. From this model, it was determined that approximately 37 miles of the North Fork Kentucky River were unacceptable for swimming and approximately 27 miles were unacceptable for secondary contact recreation.

Through personal communication with Chuck Donaldson of the DOW Frankfort District Office, Gene Blair of the DOW Hazard District Office, court action, and DOW central office files, it was learned that Jackson had six improperly operating lift stations during the survey period. Three of those lift stations (1,3, and 5) had bypasses (milepoints 304.7, 305.8, and 307.4) to the North Fork Kentucky River from Quicksand downstream to just above the USGS gaging station. The other lift stations (2,4, and 6) bypassed to the adjacent downstream lift station. All six lift stations are located upstream of the Jackson ambient monitoring station.

Division of Water files also contain reports of broken sewer lines and a wastewater tap-on ban to the Jackson WWTP. Above the ambient monitoring station, there were three broken sewer lines that discharged raw sewage to North Fork Kentucky River. These lift station bypasses and any broken sewer lines were most likely the major cause of high FC levels at the ambient monitoring station.

In a court of law, the city of Jackson admitted to bypassing lift stations, as well as being found discharging raw sludge into the North Fork during the 1987 intensive survey. However, it should be noted that the WWTP discharge is downstream of the ambient monitoring station, and if the lift stations were not bypassing, the sources of fecal coliforms would most likely be the Hazard WWTP and/or illegal discharges upstream of the collection site.

In May of 1990, a second intensive survey investigation, larger in scope than the first survey, was conducted on the North Fork Kentucky River drainage from Beattyville to Whitesburg (approximately 160 mi). Again, unacceptable water quality for recreational uses was found and to a greater extent in the drainage. One hundred thirteen samples were collected from 35 stations (20 mainstem of which one is a water plant intake, eight tributaries, five municipalities and two on Panbowl Lake). One bypassing lift station was also sampled.

Of 20 mainstem stations, 17 (85 percent) had unacceptable FC levels. Four of the seven (57 percent) tributary stations on Cane Creek, Troublesome Creek, and Carr Fork were unacceptable. Panbowl Lake, which discharges to the North Fork Kentucky River, had acceptable FC levels on both sampling events. While the FC level in the Jackson water plant intake was acceptable as a domestic raw water supply, it was an unacceptable level for primary contact recreational uses.

Four of the five (80 percent) municipal plant effluents did not meet their KPDES permit limit for FC bacteria on at least one occasion (Jackson, Whitesburg, Hindman, and Hazard). The Jackson, Hazard, and Whitesburg WWTP effluents violated their FC permit limit on more than one occasion. On May 17, an auxiliary pipe which empties into a mixing chamber at the Hazard WWTP prior to discharging to the North Fork Kentucky River was sampled for FC bacteria during toxicity testing. The FC level was

indicative of raw sewage. One bypassing lift station in Jackson was sampled on May 8 and found to be discharging raw sewage.

The May 1990 surveys (Appendix A) were conducted mostly during wet weather and therefore represent FC levels indicative of surface runoff and stormwater influences. Fecal coliform levels were not acceptable for PCR at all instream stations, with the exception of Panbowl Lake and the Quicksand Creek drainage. Eight of 13 (62 percent) mainstem stations were unacceptable for SCR on May 1. All 14 mainstem stations (100 percent) on May 8 had unacceptable water quality for PCR. Of those stations, five (36 percent) had unacceptable water quality for SCR. On May 15, 14 of 19 mainstem stations (74 percent) were unacceptable for PCR. However, only two mainstem stations (ten percent) were unacceptable for SCR.

The Hazard and Jackson WWTPs were not disinfecting their final effluents, which was indicated by either excessive bacterial levels and/or lack of total residual chlorine. No bacteria were recovered from the Hindman WWTP final effluent on five of six occasions, indicating more chlorine than necessary was being used for disinfection.

Fecal coliform / fecal streptococci ratios, which indicate the source of fecal pollution, generally indicated human origin. Numerous illegal (straight pipe) discharge locations serving individual homes were seen in the drainage. Lift station # 1 in Jackson (mp 304.6) was found to be bypassing untreated human waste on May 8, just upstream of the ambient monitoring station.

The Hazard WWTP effluent was often extremely high in FC bacteria. Since FC counts were greater than 800,000/100 ml (Appendix A) and a pipe discharging raw sewage or sludge to the effluent was also found during a toxicity compliance sampling inspection, an arbitrary value of 1,000,000/100 ml was used for computer modeling. Using the QUAL - 2E computer model to calculate how far downstream water quality would not be acceptable for PCR uses if the Hazard WWTP effluent had a FC level of 1,000,000 /100 ml, that level would be reduced to 986/100 ml at the Jackson ambient monitoring station (PRI03 1). This indicates that if the city of Hazard is not adequately treating its wastewater, the effect would be unacceptable water quality for PCR uses from Stn #7 (below Hazard) to a point downstream of Stn #3 (below Jackson). This also indicates that once the sources of FC pollution are removed from the Jackson area, the ambient monitoring station there could be influenced by the Hazard WWTP effluent.

In June 1990, the DOW decided to conduct one more round of sampling when the Jackson USGS gaging station indicated normal flow conditions on the North Fork Kentucky River. A target flow of 500 cfs was chosen, which represents a flow equalled or exceeded 65 percent of the time at Jackson. Stream flow was approximately 505 cfs at Jackson on June 20, 1990. Fecal coliform levels were not acceptable for PCR uses at eight of ten (80 percent) stations. Only three of ten (30 percent) stations were unacceptable for SCR uses or as domestic raw water supplies. The Jackson and Whitesburg WWTPs may have been bypassing raw sewage because of facility upgrading at the time of sampling.

The DOW recommended that a swimming advisory be issued for 162.6 miles of the North Fork Kentucky River from the headwaters (mp 422.0) to the confluence with Middle Fork Kentucky River (mp 259.4) based on the following: (1) WWTP's of the cities of Jackson and Whitesburg would be bypassing untreated sewage while they were upgrading their facilities, (2) the Hazard WWTP had insufficient chlorine contact time (30 seconds) and would be constructing a new chlorine contact basin in the future (15-minute retention time), and (3) results of DOW investigations since May 1990 indicated FC values that consistently exceeded water quality standards associated with primary contact recreational uses in the North Fork Kentucky River.

In accordance with the developed protocol between DOW and the Cabinet For Human Resources (CHR), CHR was asked to post the North Fork Kentucky River before the 4th of July holiday and issue a press release, The swimming advisory would remain in effect until FC data were within the standard

limits for PCR uses. The DOW would continue to monitor bacteriological conditions in the North Fork Kentucky River.

NORTH FORK KENTUCKY RIVER MONITORING STATIONS' FECAL COLIFORM DATA

In May 1991, five samples were collected within a 30-day period at the ten instream monitoring stations. Their results indicated unacceptable FC levels at ten of ten (100 percent) stations from above Whitesburg (Stn #10) to Beattyville (Stn # 1). All raw data from 1991 - 1993 are found in Appendix B. Geometric mean data for 1990 - 1993 are found in Table 2.

Flow data (Appendix B) indicated all samples were collected during a period of wet weather. Therefore, the fecal coliform results were influenced by stormwater runoff. These results indicated a swimming advisory should remain in effect. Of the municipal effluents, only the Jackson WWTP had acceptable effluent FC levels. The Hazard WWTP had increased its chlorine contact retention time from approximately 30 seconds to approximately 15 minutes. However, the FC results were still unacceptable. A broken sewer line was still influencing results at collection sites above Jackson (Stn #4) and below Jackson (Stn #3).

These results still indicated a swimming advisory should remain in effect. However, the data also showed improvement in the quality of the municipal effluents, especially the Jackson WWTP. Although the number of FC present in the Hazard WWTP effluent had been greatly reduced, the number was still not within KPDES guidelines. The Whitesburg WWTP effluent had met KPDES guidelines for FC bacteria since the middle of the month of May by increasing chlorine use. An improperly operating lift station upstream of the sample collection site above Whitesburg could have been influencing FC results there.

Monthly FC results from July through October indicated acceptable water quality at the mouth of the North Fork Kentucky River (Stn #1, Beattyville, & Stn #2, Airdale Road). Unacceptable water quality was consistently found in the upper part of the drainage (Stn #7, below Hazard, to Stn #10, above Whitesburg).

In April and May 1992, five samples were collected within a 30-day period at the ten instream stations (Appendix B and Table 2). That data showed unacceptable FC levels from above Whitesburg (Stn #10) to below Jackson (Stn #3) or at eight of the ten (80percent) instream stations. Based on the ten mainstem stations' FC data, the North Fork Kentucky River indicated unacceptable water quality for swimming from above Whitesburg (Stn #10) to a point below Jackson (Stn #3) and acceptable water quality for swimming from a point below Jackson (Stn #3) to Beattyville (Stn #1). The North Fork Kentucky River had acceptable water quality for all recreational uses by the time it formed the Kentucky River. Samples were collected during periods of wet weather.

In September 1992, after compliance sampling inspections that resulted in fines that year, monthly sampling at the ten stations indicated acceptable FC levels for PCR uses from Haddix (Stn 5) to Beattyville (Stn #1) (approximately 60 miles).

In October 1992, monthly sampling showed the best results since 1990. Fecal coliform levels were acceptable at six of the ten stations (from Chavies to Beattyville). The municipal discharges of Fleming-Neon, Whitesburg, Hazard, and Jackson had acceptable FC levels. Since flow data indicated the samples to have been collected during a period of dry weather, the FC data did not reflect stormwater runoff or nonpoint contributions of fecal pollution. Therefore, the data still indicated other contributions of fecal pollution in the upper part of the drainage. A survey conducted by personnel from the Hazard regional office personnel and the Perry County Health Department revealed numerous straight pipe discharges of untreated waste. Over 1,200 straight pipes were

Table 2

NORTH FORK KENTUCKY RIVER GEOMETRIC MEAN FECAL COLIFORM DATA,
MAY - OCTOBER OF 1990, MAY OF 1991, APRIL - MAY OF 1992, AND MAY, 1993

<u>MILE- POINT</u>	<u>LOCATION</u>	<u>NO. OBS/ 1990 GM</u>	<u>NO. OBS/ 1991 GM</u>	<u>NO. OBS/ 1992 GM</u>	<u>NO. OBS/ 1993 GM</u>
408.9	ABOVE WHITESBURG	7 / 6,700	5 / 3,200	5 / 2,000	5 / 1,600
403.5	WHITESBURG WWTP	4 / 40,000	5 / 480	5 / <20	5 / <16
402.6	BELOW WHITESBURG	7 / 2,900	5 / 4,600	5 / >2,200	5 / 1,500
361.0	ABOVE HAZARD	7 / 590	5 / 3,100	5 / 1,400	5 / 1,400
357.78	HAZARD WWTP	6 / >560,000	5 / 3,200	5 / > 1,500	5 / <13
354.6	BELOW HAZARD	7 / 9,500	5 / 4,900	5 / 1,900	5 / 1,900
335.5	CHAVIES	7 / 410	5 / 2,000	5 / 440	5 / 290
313.6	HADDIX	7 / 550	5 / 1,900	5 / 320	5 / 150
304.5	ABOVE JACKSON	7 / 550	5 / 4,200	5 / 550	5 / <11 0
299.6	JACKSON WWTP	3 / 1,600	5 / 20	5 / <16	5 / <10
299.15	BELOW JACKSON	7 / 560	5 / 2,400	5 / 390	5 / 180
261.2	AIRDALE Rd.	7 / 94	5 / 650	5 / 46	5 / 41
255.0	BEATTYVILLE	7 / <75	5 / >220	5 / <57	5 / <47
USGS GAGING STATION AT JACKSON		7 / FLOW AVE 535 cfs	5 / FLOW AVE 985 cfs	5 / FLOW AVE 1,508 cfs	5 / FLOW AVE 633 cfs

GM = Geometric Mean
AVE = Average

Geometric Means measured in fecal coliforms per 100 ml
No. Obs Number of Observations

< = Less Than
> = Greater Than

inventoried in Letcher County alone. Straight pipes and failed septic tank discharges are now the primary source of fecal pollution in the North Fork Kentucky River drainage during dry weather.

In May and June 1993, five samples were collected within a 30-day period from the ten instream stations and the Fleming - Neon, Whitesburg, Hazard, and Jackson WWTPs (Table 2). The FC data was acceptable from Chavies (Stn #6) to Beattyville (Stn # 1). The four municipal discharges met their KPDES permit limit for FC bacteria (Appendix C). As a result, the swimming advisory was removed on approximately 80 miles of river from Chavies (Stn #6) to Beattyville (Stn #1).

Monthly FC data for the 1993 PCR season from the mainstem of the North Fork Kentucky River at the upper five stations and the Jackson ambient station (also known as Stn #4, above Jackson) indicated the mainstem was not within KSWs for FC bacteria.

MUNICIPAL FACILITIES' FECAL COLIFORM DATA

Fecal coliform results for the municipal facilities (Appendix C) indicated that they could be major sources of fecal pollution. Seven municipalities were monitored in the drainage. The Beattyville WWTP discharges to the Kentucky River, just below the mouth of the North Fork Kentucky River. However, it was also monitored during compliance sampling inspections in 1992 and is included in this report. Most facilities showed an improvement from initial monitoring in 1991.

The Hazard WWTP effluent had the most KPDES permitting violations of FC levels. In May 1990, the Hazard effluent was grey to black in appearance on three of the five sampling occasions. Faulty fecal coliform results provided by a private laboratory may have indicated acceptable FC levels in the Hazard WWTP final effluent when there were not. In 30 samples collected from May of 1991 until October of 1993, 12 (40 percent) had unacceptable FC levels. The Whitesburg WWTP had unacceptable effluent FC levels in six of 30 (20 percent) samples-

During 1992 compliance sampling inspections in May, of the seven municipal facilities tested, two (Hazard and Beattyville) failed to have acceptable FC levels in their effluent. The Hazard WWTP effluent was grey to black in appearance and was indicative of raw or untreated sewage. The city of Hazard was fined \$2,900. The Beattyville WWTP was out of compliance on two of three occasions in 1992 and was fined \$1,250. The Hindman WWTP was out of compliance on one of three occasions. Because the city was under an existing federal order for numerous violations, no fine was imposed.

COMPLIANCE SAMPLING SURVEY DATA

By the end of 1991, the FC data indicated the municipal effluents in the drainage to have acceptable FC levels. Though FC levels had been reduced in the North Fork Kentucky River, the levels were still unacceptable for PCR. Therefore, it was decided by the DOW to sample all permitted dischargers within the drainage, in combination with the ten instream stations, at the start of the 1992 PCR season. Prior to that sampling, a letter was sent to the owners/operators of each facility notifying them that at some time a compliance sample would be collected from the effluent of their facility. Should they fail to meet their permit limit, a fine of not less than \$1,000 and up to \$25,000 would be levied against them. Most facilities were fined \$1,000. In some cases a fine of \$500 was assessed or a letter of warning was sent, based on the fecal coliform level in the facility's effluent. It was also decided to send the samples by air to the DOW microbiological laboratory in Frankfort to meet the six-hour sample holding time for FC analysis. This action caused the greatest reduction in fecal coliform levels in the North Fork Kentucky River since continuous monitoring throughout the drainage began in 1990.

The 1992 compliance sampling inspections' FC data for non-municipal facilities (i.e., package treatment plants) are found in Appendix D. A facility list of 1994 permitted dischargers in the North Fork Kentucky River drainage is found in Appendix E.

Of the 54 package plants sampled, three did not have a discharge at the time of sampling. Of the 51 package plants tested, using a fecal coliform limit of 400 per 100 ml, 22 (43 percent) had unacceptable FC levels in their effluents. This data indicates that about half of the package plants were having an adverse effect on water quality in the North Fork Kentucky River on this occasion. Most of these facilities are located in the upper part of the drainage. This survey resulted in \$21,300 in fines being levied May 28 against two municipal WWTPs and 22 package treatment plants.

On June 23, 1992, the 24 permitted facilities failing to meet their FC limit in May and fined were tested again. Ten (42 percent) failed to meet their KPDES permit limit for FC bacteria. The data also indicates 15 (52 percent) might have been overchlorinating their effluent, which could be harmful to aquatic life in the receiving streams. This survey resulted in \$9,150 in fines being assessed on July 15 for ten noncompliant facilities.

On August 4, 1992, 36 facilities that had met the KPDES permit limit for FC bacteria in their effluents on May 6 and 7 were sampled a second time. Of the 36 wastewater treatment facilities tested, six (17 percent) failed to meet their daily / weekly KPDES permit limit for FC bacteria. As a result of this survey, \$2,500 in fines was assessed on August 15 against five package treatment plants and a warning was given to one municipality.

On September 15 and 16, 1992, all permitted dischargers (i.e. municipal and package treatment plants) were reinspected to monitor compliance with the KPDES permit limit for FC bacteria and to assess the contributions of fecal pollution to the North Fork Kentucky River by the permitted dischargers before the end of the PCR season (October 31). This was the third inspection in 1992 for each facility. The results of September 15 and 16, 1992, indicated FC levels were acceptable in the effluents of all seven municipal wastewater treatment plants in the North Fork Kentucky River drainage. Of 45 package plants tested, only six (13 percent) had unacceptable FC levels in their effluents. A total of \$2,000 in fines was assessed on this final round of sampling.

In September 1992, 88 percent of all facilities with a discharge in the North Fork Kentucky River drainage had acceptable FC levels in their effluents. Excluding the Beattyville WWTP and Lee Adjustment Center, the percent of unacceptable FC levels in permitted effluents to the North Fork Kentucky River drainage had been reduced from 41 percent in the first round of inspections to 12 percent during this round of inspections. This represents a 29-percent improvement. In all, \$34,300 in civil penalties were assessed to all permitted dischargers found to be in noncompliance.

SUMMARY

The purposes of the intensive surveys were achieved. The 1987 intensive survey investigation of the North Fork Kentucky River drainage in the vicinity of Jackson confirmed the ambient monitoring FC data, which indicated unacceptable FC levels for PCR. The 1990 intensive survey, larger in scope, showed fecal pollution to be present throughout the drainage. It again verified the ambient FC data at Jackson as representative of the drainage. It also found municipal facilities to be out of compliance for FC levels in their effluents and presented them as major contributors of fecal pollution. In July 1990, when five samples were collected within a 30-day period at the ten monitoring stations within the drainage, that data supported the intensive survey's data, and a swimming advisory was issued for the entire North Fork Kentucky River drainage (approximately 163 miles).

The reduction of fecal pollution in the North Fork Kentucky River was accomplished by first proving the problem existed through FC monitoring and then enforcing compliance with KPDES permitting

Through fines. The primary sources of fecal pollution in the North Fork Kentucky River drainage were improperly operating municipal WWTPs (i.e., Jackson, Hazard, Hindman, and Whitesburg), package treatment plants, broken sewer lines, bypassing lift stations discharging raw sewage to the drainage, and illegal (straight pipe) discharges of untreated waste from private homes throughout the drainage. While the Whitesburg WWTP was upgraded, raw sewage was discharged to the drainage.

Based on past FC data of the permitted dischargers, the Hazard WWTP remained the single greatest threat to PCR/SCR uses in the North Fork Kentucky River drainage. Until this facility is upgraded, water quality in the North Fork Kentucky River below the discharge point will remain at risk for recreational uses. However, improvement of this facility will not guarantee attainment of PCR/SCR uses, but it will expose the degree of other sources of fecal pollution in the drainage. When the level of fecal pollution was reduced significantly from permitted facilities in 1992, the fecal coliform standard for PCR was not attained, most likely due to illegal discharges of untreated waste from private homes throughout the drainage.

The following actions by DOW specifically reduced fecal pollution in the North Fork Kentucky River: imposing \$1,000 fines on all permitted effluents found not in compliance with KPDES permitting for FC bacteria; bringing municipal effluents within compliance with KPDES permitting for FC bacteria through improved maintenance or facility upgrading; bringing other permitted effluents (i.e. package plants) into compliance with KPDES permitting for FC bacteria; removing bypasses of raw sewage by enforcing repair of broken lift stations and broken sewer lines.

By 1993, 400 FC/ 100ml was exceeded on only two occasions during the PCR season at the Jackson ambient monitoring station. Compared with the fact that this level was exceeded in all but one month from 1984 to 1988, the 1993 data indicated significant reduction in fecal pollution in the North Fork Kentucky River drainage. In June 1993, after sampling five times within a 30-day period at the ten instream stations, the data indicated that FC levels were within DOW standards for PCR uses from Chavies (Stn #6) to Beattyville (Stn # 1). The swimming advisory was removed from Chavies to Beattyville (approximately 80 miles). However, removal of fecal pollution from the upper 83 miles of the drainage may be more difficult due to the number of illegal straight pipe discharges serving individual homes.

As of April 28, 1994, \$33,950 has been collected of the \$34,950 levied in civil penalties. A new Hazard WWTP is scheduled for completion by November 30, 1996. Perry County Sanitation District # 1, which pumps wastewater to the Hazard WWTP for treatment, will be upgrading its system in 1995. The DOW Municipal Compliance Section reports that six of eleven lift stations in that system routinely bypass untreated sewage to the North Fork Kentucky River below Hazard before the wastewater arrives at the Hazard WWTP for treatment.

A multi-agency task force composed of the Kentucky River Area Development District (KRADD), the DOW, the Cabinet for Human Resources, the Kentucky River District Health Department, the Division of Plumbing, and various local officials, is studying ways to eliminate the straight pipe discharges and sewer the many small coal camps that have no treatment systems. This will be accomplished through education, enforcement, and technical assistance. A memorandum of agreement has been drafted between DOW and KRADD to: provide financial assistance for one or more low-income communities (not yet selected) to comply with wastewater requirements; demonstrate the application of one or more low-cost wastewater technologies that may subsequently be adopted by other similar communities or clusters of homes in the region; and employ monitoring to assess any measurable improvement in water quality with the application of the technology (ies) to be demonstrated. Both agencies will assist in the development of news releases and brochures, participate in joint enforcement actions with district health departments, conduct monitoring and analysis of best management practices before and after construction. They will develop and disseminate two brochures, conduct public meetings, provide programs for primary and secondary education, and develop and issue six news releases and radio announcements. This will be done to explain the

problems associated with improper wastewater disposal, indicate treatment options available, and direct residents to the proper agency for further assistance.

At present, a monthly sampling program on the upper North Fork Kentucky River mainstem will continue at five stations from above Whitesburg to Chavies during the PCR season, as well as at Jackson. The municipal discharges and non-municipal facilities continue to have random compliance sampling inspections which could result in fines for noncompliance. Sampling will continue until acceptable FC levels are indicated and the swimming advisory is lifted. These next steps necessary for removing the swimming advisory by reducing fecal pollution in the North Fork Kentucky River drainage may be the most difficult to achieve.

Appendix A. NORTH FORK KENTUCKY RIVER INTENSIVE SURVEY DATA SUMMARY

BACTERIOLOGICAL DATA						FIELD PARAMETERS						
Station	Source / Receiving Stream	Mile-point	Dates	Fecal Coliform per 100 ml	Fecal Strep per 100 ml	FC/FS Ratio	TRC, ppm	D. O., ppm	Water Temp, oC	pH, SU	Conductivity, umhos@25 oC	Turbidity, NTU
04047001	North Fork Kentucky River	255.0	15 May 90	160								
04047002	North Fork Kentucky River	261.2	8 May 90	1,900 / 2,000	300 / 420	6.3 / 4.8						
04047003	North Fork Kentucky River	288.85	15 May 90	300								
04047003	North Fork Kentucky River	288.85	1 May 90	3,500	2,100	1.7		9.2	17.7	6.8	418	
04047003	North Fork Kentucky River	288.85	8 May 90	2,100	300	7.0						
04047004	North Fork Kentucky River	294.2	4 May 87	3,000			0.6	9.0	16.0	7.8	370	280
04047004	North Fork Kentucky River	294.2	19 May 87	1,000			0.0	9.2	23.0	7.6	550	6
04047004	North Fork Kentucky River	294.2	1 May 90	1,600	420	1.7		9.0	18.1	6.7	413	80
04047004	North Fork Kentucky River	294.2	8 May 90	1,400	220	6.4						
04047004	North Fork Kentucky River	294.2	15 May 90	500								
04047006	Cane Creek	0.1 (298.7)	4 May 87	680			0.4	10.5	13.0	7.7	85	8
04047006	Cane Creek	0.1 (298.7)	19 May 87	140			<1	8.1	22.5	7.2	325	5
04047006	Cane Creek	0.1 (298.7)	1 May 90	3,000	1,100	2.7		9.0/8.7	17.8/17.6	6.8/7.3	168/158	28
04047006	Cane Creek	0.1 (298.7)	8 May 90	490	170	2.9						
04047006	Cane Creek	0.1 (298.7)	15 May 90	340								
04047005	North Fork Kentucky River	299.15	4 May 87	4,000/2,200			0.0/0.6	8.4/9.2	17.8/15.5	7.8/7.6	478/370	320/180
04047005	North Fork Kentucky River	299.15	19 May 87	2,400/1,900			0.1/0.0	8.1/8.9	24.0/23.0	8.9/7.8	1,240/550	8.5/6.0
04047005	North Fork Kentucky River	299.15	1 May 90	2,300	540	4.3		8.3	18.1	6.5	412	168
04047005	North Fork Kentucky River	299.15	8 May 90	1,500 / 1,200	270	4.4/ 5.4						
04047005	North Fork Kentucky River	299.15	15 May 90	2,000								
04047007	Jackson WWTP	299.7	4 May 87	1,000,000			0.0	9.2	16.7	7.6	496	310
04047007	Jackson WWTP	299.7	19 May 87	1,200,000			0.0	7.0	23.8	8.4	1,260	42
04047007	Jackson WWTP	299.7	1 May 90	400,000/ 600,000	80,000/ 74,000	5.0/ 8.1		0.7	16.7	6.8	731	
04047007	Jackson WWTP	299.7	8 May 90	320,000	90,000	3.6						
04047007	Jackson WWTP	299.7	15 May 90	20								
04047008	Panbowl Lake	300.0	4 May 87	230			0.2	9.0	12.5	7.3	130	10.6
04047009	Panbowl Lake	300.2	4 May 87	<8			0.6	8.8	17.5	7.4	125	240
04047009	Panbowl Lake	300.2	19 May 87	280			0.0	7.9	23.5	6.8	270	34
04047009	Panbowl Lake	300.2	1 May 90	<10	80	NA		8.8	20.5	6.6	171	6.0

Appendix A. NORTH FORK KENTUCKY RIVER INTENSIVE SURVEY DATA SUMMARY

BACTERIOLOGICAL DATA							FIELD PARAMETERS						
Station	Source / Receiving Stream	Mile-point	Dates	Fecal Coliform per 100 ml	Fecal Strep per 100 ml	FC/FS Ratio	TRC, ppm	D. O., ppm	Water Temp, oC	pH, S U	Conductivity, umhos @ 25 oC	Turbidity, NTU	
04047010	Panbowl Lake	303.0	8 May 90 4 May 87 1 May 90 8 May 90	40 30 10 30	70	NA NA NA	0.6	8.8 8.9	17.5 20.9	7.4 6.5	125 165	240 6.7	
04048001	North Fork Kentucky River	304.5	4 May 87 19 May 87 1 May 90 8 May 90 15 May 90	2,700 360 1,200 1,500 640	1,000 180	1.2 8.3	0.0 0.0	7.8 7.2 8.5	16.2 23.5 17.7	8.0 8.9 7.7	478 1,280 400	240 7.2	
04048002	Lift Station #1 Jackson WTP	304.6 306.0	8 May 90 4 May 87 19 May 87 1 May 90 15 May 90	34,000 2,700 360 1,800 480	1,600 400	21.0 4.5	0.0 0.0	7.8 7.2	16.2 23.5	8.0 8.9	478 1,280	240 7.2	
04048003	North Fork Kentucky River	306.9	4 May 87 19 May 87 8 May 90 15 May 90	2,200 250 1,900 160	200	9.5	0.0 0.0	8.0 7.1	16.2 23.3	7.9 8.8	452 1,240	320 5.9	
04048014	Quicksand Creek	0.1 (307.78)	4 May 87 19 May 87 1 May 90 8 May 90 15 May 90	1,500 40 310 390 410	240 110	1.3 3.5	0.3 0.0	9.8 8.6	13.0 21.5	7.4 7.7	200 340	40 5.0	
04048015	Quicksand Creek	0.4	4 May 87 19 May 87 1 May 90 8 May 90	1,500 100 220 250	120 170	1.8 1.5	0.2 0.1	10.0 8.4 8.9	14.0 21.5 17.0	7.6 7.4 7.4	170 240 188	240 7.0 38	
04048016	S. Fork Quicksand Creek	1.1	4 May 87 19 May 87	1,100 180			0.1 0.1	10.4 8.4	12.0 21.0	8.0 7.8	330 740	40 9.0	

Appendix A. NORTH FORK KENTUCKY RIVER INTENSIVE SURVEY DATA SUMMARY

BACTERIOLOGICAL DATA					FIELD PARAMETERS							
Station	Source / Receiving Stream	Mile-point	Dates	Fecal Coliform per 100 ml	Fecal Strep per 100 ml	FC/FS Ratio	TRC, ppm	D. O., ppm	Water Temp, oC	pH, S U	Conductivity, umhos @ 25 oC	Turbidity, N TU
			1 May 90 8 May 90	320 210	360 90	0.9 NA		9.5	17.3	7.9	505	24
04048004	North Fork Kentucky River	307.85	4 May 87 19 May 87 1 May 90 8 May 90 15 May 90	1,700 120 1,400 1,600 210	1,100 280	1.3 5.7	0.0 0.0	8.3 7.1 8.6	16.2 23.8 17.9	7.9 8.6 7.5	1,360 498 439	280 6.2
04048005	North Fork Kentucky River	313.6	4 May 87 19 May 87 1 May 90 8 May 90 15 May 90	3,000 200 / 180 2,200 2,100 720			0.0 <1	8.4 8.3 8.4	16.5 23.8 17.8	7.8 8.6 7.4	1,320 484 440	120 6.5 184
04048006	Troublesome Creek	0.1 (313.7)	4 May 87 19 May 87 1 May 90 8 May 90 15 May 90	800 300 1,100 1,100 / 1,000 430	2,000 260 1,300 230 / 180	1.1 8.1	0.2 0.2 / 0.1	10.0 7.9 8.6	13.5 21.5 17.5	7.8 7.6 7.4	260 720 407	120 8.0 165
04050001	Troublesome Creek	42.0	1 May 90 8 May 90 15 May 90 16 May 90 17 May 90 18 May 90	> 16,000 6,000 10,000 13,000 28,000 5,400	6,000 800	3.7 7.5		12.9	11.8	7.8	216	9
04050002	Hindman WWTP	42.1	1 May 90 8 May 90 15 May 90 16 May 90 17 May 90 18 May 90	< 10 > 800,000 < 100 < 10 < 10 < 10	10 210,000	NA 4.8	> 2.3 11.6 0.15 22.6 0.25	7.8	15.9	6.3	350	4

Appendix A. NORTH FORK KENTUCKY RIVER INTENSIVE SURVEY DATA SUMMARY

BACTERIOLOGICAL DATA						FIELD PARAMETERS								
Station	Source / Receiving Stream	Mile-point	Dates	Fecal Coliform per 100 ml	Fecal Strep per 100 ml	FC / FS Ratio	TRC, ppm	D. O., ppm	Water Temp, oC	pH, S U	Conductivity, umhos @ 25 oC	Turbidity, NTU		
04050003	Troublesome Creek	42.2	1 May 90	> 16,000	6,000	3.3		10.4	17.9	8.1	164	11		
			8 May 90	6,800	700	9.7								
			15 May 90	6,000										
			16 May 90	14,000										
			17 May 90	23,000										
			18 May 90	7,600										
04048007	North Fork Kentucky River	314.5	4 May 87	1,200 / 1,000			0.0	9.4	14.8	8.1	477	60		
			19 May 87	360			0.0	6.2	23.7	7.0	1,680	6		
			1 May 90	2,700	1,500	1.8		8.3	18.0	7.6	455	127		
			8 May 90	2,900	200	14.0								
15 May 90	450													
04048008	North Fork Kentucky River	326.9	8 May 90	3,200	340	9.4		8.4	17.8	7.6	369	282		
			15 May 90	800										
04048009	North Fork Kentucky River	335.5	1 May 90	10,000	9,200	1.1								
			8 May 90	2,700	330	8.2								
			15 May 90	1,800										
04048010	North Fork Kentucky River	353.5	1 May 90	16,000	6,400	2.5		8.8	17.9	7.6	385	146		
			8 May 90	4,000	500	8.0								
			15 May 90	> 16,000										
04048011	North Fork Kentucky River	357.7	15 May 90	6,000										
			16 May 90	> 16,000										
			17 May 90	> 16,000										
			18 May 90	> 16,000										
04048012	Hazard WWTP	357.78	1 May 90	> 800,000	300,000	2.7	< 0.1	2.8	13.9	7.2	505	170		
			8 May 90	380,000	80,000	4.7	0.0							
			15 May 90	> 800,000			0.0							
			16 May 90	> 800,000			0.0							
			17 May 90	> 240,000			0.0							
			18 May 90	640,000			0.0							

Appendix A. NORTH FORK KENTUCKY RIVER INTENSIVE SURVEY DATA SUMMARY

BACTERIOLOGICAL DATA					FIELD PARAMETERS								
Station	Source / Receiving Stream	Mile-point	Dates	Fecal Coliform per 100 ml	Fecal Strep per 100 ml	FC/FS Ratio	TRC, ppm	D. O., ppm	Water Temp, oC	pH, S U	Conductivity, umhos @ 25 oC	Turbidity, NTU	
04048013	North Fork Kentucky River	357.8	15 May 90	1,500									
			16 May 90	3,200									
			17 May 90	2,300									
			18 May 90	2,600									
04048014	North Fork Kentucky River	361.0	1 May 90	1,700	1,500	1.1		8.1	14.6	7.9	334	46	
			8 May 90	1,400	110	12.7							
			15 May 90	6,000									
04048015	North Fork Kentucky River	367.7	1 May 90	4,000	4,000	1.0		12.1	16.9	7.7	324	120	
			8 May 90	1,100	300	3.7							
			15 May 90	320									
04048020	Carr Fork	0.3	1 May 90	7,400	5,600	1.3/1.9		9.2	16.8	7.1	348	132	
			8 May 90	8,400	4,400	NA							
			15 May 90	1,000	90								
04048021	Vicco WWTP	6.2	17 May 90	680									
04048016	North Fork Kentucky River	367.8	1 May 90	<100									
			8 May 90	4,200	4,000	1.1		8.5	17.6	7.1	301	140	
			15 May 90	1,300	280	4.6							
04048017	North Fork Kentucky River	403.4	15 May 90	300									
			16 May 90	6,200									
			17 May 90	7,000									
			18 May 90	13,000									
04048018	Whitesburg WWTP	403.5	15 May 90	7,200									
			16 May 90	40,000				0.0					
			17 May 90	62,000				0.0					
			18 May 90	63,000				0.0					
04048019	North Fork Kentucky River	403.6	15 May 90	> 16,000									
			16 May 90	5,600									
			17 May 90	11,000									
			18 May 90	12,000									
			18 May 90	8,800									

Appendix B

NORTH FORK KENTUCKY RIVER MAINSTEM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
1. Beattyville	255.0	20 Jun 90			170/120
		11 Jul 90		<10/<10	
		18 Jul 90		280	300
		26 Jul 90			10
		1 Aug 90			10
		8 Aug 90			50
		15 Aug 90		72	20
		22 Aug 90			> 600
		29 Aug 90			40
		5 Sep 90		20	<10
		12 Sep 90			10
		19 Sep 90			<10
		26 Sep 90			70
		3 Oct 90			> 600
		10 Oct 90			40
		17 Oct 90		120	560
		10Apr 91		1,200	> 600
		1 May 91			100
		8 May 91			100
		15 May 91		150	260
		22 May 91			> 600
		29 May 91			300
		17 Jul 91			260*
		15 Aug91			300*
		10 Sep 91			80*
		26 Sep 91			10*
		17 Oct 91			< 200*
		15 Apr 92			20
		22 Apr 92			140
		29 Apr 92			120
		6 May 92			<10
		13 May 92			180
		10Jun92			250
15 Jul 92			400		
12 Aug 92			540		
15 Sep 92			40 / 50		
14 Oct 92			10		
5 May 93			120		
12 May 93			170		
19 May 93			110		
26 May 93			<10		
2 Jun 93			<10		
2. Airdale Rd	261.2	20 Jun 90		240	
		11 Jul 90		20 / 10	
		18 Jul 90		1,300	700
		26 Jul 90			10 / 30

Appendix B (Continued)

LOCATION	MILEPOINT	DATE	FECAL COLIFORM FLOW	DATA DOW	McCOY
		1 Aug 90			10
		8 Aug 90		130	
		15 Aug 90		28	<10
		22 Aug 90			140
		29 Aug 90			180
		5 Sep 90			30
		20			
		12 Sep 90			90
		19 Sep 90			<10
		26 Sep 90			90/ < 10
		3 Oct 90			40
		10 Oct 90			50
		17 Oct 90		40	50
		10 Apr 91		400	> 600
		1 May 91			450
		8 May 91			150
		15 May 91		190	510
		22 May 91			6,000
		29 May 91			550
		17 Jul 91		380*	
		15 Aug 91		240*	
		10 Sep 91		200*	
		26 Sep 91		40*	
		17 Oct 91		< 200*	
		15 Apr 92		10	
		22 Apr 92		170	
		29 Apr 92		70	
		6 May 92		20	
		13 May 92		90	
		10 Jun 92		280	
		15 Jul 92		70	
		12 Aug 92		2,000	
		15 Sep 92		70	
		14 Oct 92		10	
		5 May 93		20	
		12 May 93		220	
		19 May 93		130	
		26 May 93		10	
		2 Jun 93		20	
3. below Jackson	299.15	20 Jun 90		730	
		11 Jul 90		700	
		18 Jul 90		1,800	840
		26 Jul 90			170
		1 Aug 90			490
		8 Aug 90			190
		15 Aug 90		800	560
		22 Aug 90			230

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		29 Aug 90			>600
		5 Sep 90		60	>600
		12 Sep 90			>600/ >600
		19 Sep 90			>12,000
		26 Sep 90			7,000
		3 Oct 90			390
		10 Oct 90			510
		17 Oct 90		200	590
		10 Apr 91		4,800	>600
		1 May 91			2,000
		8 May 91			1,400
		15 May 91		620	2,900
		22 May 91			4,200
		29 May 91			2,200
		17 Jul 91		200*	
		1 5 Aug 91		1, 100*	
		10 Sep 91		360*	
		26 Sep 91		590*	
		17 Oct 91		440*	
		15 Apr 92		260	
		22 Apr 92		3,600	
		29 Apr 92		80	
		6 May 92		170	
		13 May 92		310	
		10 Jun 92		660	
		15 Jul 92		1,700	
		12 Aug 92		1,200	
		15 Sep 92		100	
		14 Oct 92		40	
		5 May 93		100 / 90	
		12 May 93		1,400	
		19 May 93		550 / 610	
		26 May 93		20 / 20	
		2 Jun 93		120	
4. USGSGagingStation	304.5	20 Jun 90	505 cfs	1,000	
		20 Jun 90		650	
		11 Jul 90	11 5 cfs	200	
		18 Jul 90	735 cfs	1,400/1,500	1,400
		26 Jul 90	249 cfs		310
		1 Aug 90	164 cfs		10 / 140 8
		Aug 90	182 cfs		250
		15 Aug 90	164 cfs	620/620	580
		22 Aug 90	1,066 cfs		<10
		29 Aug 90	203 cfs		>600
		5 Sep 90	355 cfs	300	150
		12 Sep 90	11 8 cfs		160

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		19 Sep 90	329 cfs		>600
		26 Sep 90	329 cfs		530
		3 Oct 90	122 cfs		210
		10 Oct 90	600 cfs		340
		17 Oct 90	280 cfs	550	310
		20 Nov 90	241 cfs		2,100/11,800
		28 Dec 90	11,950 cfs		>600
		23 Jan 91	1,411 cfs		590
		26 Feb 91	2,451 cfs		>600
		26 Mar 91	3,577 cfs		1,400
		10 Apr 91	2,327 cfs	9,200	>600
		1 May 91	784 cfs		2,000
		8 May 91	545 cfs		2,800 / 4,200
		15 May 91	800 cfs	1,700	1,900
		22 May 91	2,025 cfs		8,000
		29 May 91	773 cfs		>12,000
		17 Jul 91	2,327 cfs	420*	
		15 Aug 91	298 cfs	1,300*	
		10 Sep 91	164 cfs	240*	
		26 Sep 91	253 cfs	950*	
		17 Oct 91	391 cfs	200*	
		15 Apr 92	1,860 cfs	260	
		22 Apr 92	3,170 cfs	3,900	
		29 Apr 92	999 cfs	440 / 440	
		6 May 92	638 cfs	240	
		13 May 92	875 cfs	440/410	
		10 Jun 92	1,335 cfs	640 / 800	
		15 Jul 92	368 cfs	1,400/ 2,800	
		12 Aug 92	580 cfs	1,200 / 1,300	
		15 Sep 92	257 cfs	60/ 40	
		14 Oct 92	269 cfs	60	
		5 May 93	980 cfs	120	
		12 May 93	1,083 cfs	510	
		19 May 93	585 cfs	500	
		26 May 93	360 cfs	<10	
		2 Jun 93	457 cfs	60	
		13 Jul 93	299 cfs	380	
		11 Aug 93	181 cfs	750	
		8 Sep 93	194 cfs	320	
		6 Oct 93	125 cfs	100	
		8 Nov 93		80	
5. Haddix	313.6	20 Jun 90		600	
		11 Jul 90		400	
		18 Jul 90		1,200	640
		26 Jul 90			230

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA					
LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		1 Aug 90			10
		8Aug90			200
		15 Aug 90		310	270
		22 Aug 90			<10
		29 Aug 90			50
		5 Sep 90		3,400	30
		12 Sep 90			140
		19 Sep 90			190
		26Sep90			480
		3 Oct 90			200
		10 Oct 90			220
		17 Oct 90		220 / 230	210/230
		10 Apr 91		2,800	>600
		1 May 91			2,000
		8 May 91			600
		15 May 91		400	630
		22 May 91			6,200
		29 May 91			5,200 / 6,200
		17Jul 91		400*	
		15 Aug 91		1,000*	
		10 Sep 91		210*	
		26 Sep 91		1,900*	
		17 Oct 91		200*	
		15 Apr 92		190	
		22 Apr 92		2,000	
		29 Apr 92		420	
		6 May 92		80	
		13 May 92		260	
		10 Jun 92		2,500	
		15 Jul 92		800	
		12 Aug 92		730	
		15 Sep 92		240	
		14 Oct 92		80	
		5 May 93		160	
		12 May 93		220	
		19 May 93		210	
		26 May 93		50	
		2 Jun 93		200	
6. Chavies	335.5	20 Jun 90		1,800	
		11Jul 90		350	
		18 Jul 90		1,500	790
		26 Jul 90			270
		1 Aug 90			130
		8Aug90			450
		15 Aug 90		560	340
		22 Aug 90			150

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		29 Aug 90			330
		5 Sep 90		10	> 600
		12 Sep 90			350
		19 Sep 90			90
		26 Sep 90			> 600
		3 Oct 90			120
		10 Oct 90			320
		17 Oct 90		220	120
		10 Apr 91		6,600	>600
		1 May 91			1,100 / 450
		8 May 91			2,400
		15 May 91		140	420
		22 May 91			> 16,000
		29 May 91			2,400
		17 Jul 91		320*	
		15 Aug 91		1,400*	
		10 Sep 91		60*	
		26 Sep 91		440*	
		17 Oct 91		> 600*	
		15 Apr 92		60	
		22 Apr 92		6,400	
		29 Apr 92		1,100	
		6 May 92		90	
		13 May 92		440	
		10 Jun 92		2,000	
		15 Jul 92		140	
		12 Aug 92		680	
		15 Sep 92		600	
		14 Oct 92		130	
		5 May 93		200	
		12 May 93		280	
		19 May 93		420	
		26 May 93		150	
		2 Jun 93		560	
		14 Jul 93		70	
		11 Aug 93		4,800	
		8 Sep 93		100	
		6 Oct 93		70	
7. below Hazard	354.6	20 Jun 90		4,000	
		11 Jul 90		16,000	
		18 Jul 90		10,000	4,800
		26 Jul 90			1,400
		1 Aug 90			3,600
		8 Aug 90			9,800 / 3,800
		15 Aug 90	13,000 / 13,000		8,000 / 10,000
		22 Aug 90			60

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOIN	DATE	FLOW	DOW	McCOY
		29 Aug 90			6,200
		5 Sep 90		11,000	7,600
		12 Sep 90			910
		19 Sep 90			3,400
		26 Sep 90			6,600
		3 Oct 90			1,500
		10 Oct 90			6,200
		17 Oct 90		13,000	> 12,000
		20 Nov 90			7,200
		28 Dec 90			3,400
		23 Jan 91			3,000/ 2,500
		26 Feb 91			1,400
		26 Mar 91			1,400
		10 Apr 91		3,400	1,400 / 2,800
		1 May 91			14,000
		8 May 91			1,300
		15 May 91		1,400	4,800
		22 May 91			> 12,000
		29 May 91			2,800
		17 Jul 91		3,800*	
		15 Aug 91		4,600*	
		10 Sep 91		5,600*	
		26 Sep 91		5,400*	
		17 Oct 91		1,800*	
		15 Apr 92		2,000	
		22 Apr 92		2,500	
		29 Apr 92		1,400	
		6 May 92		1,300	
		13 May 92		2,700	
		10 Jun 92		5,000	
		15 Jul 92		2,000	
		12 Aug 92		4,600	
		15 Sep 92		350	
		14 Oct 92		6,600	
		5 May 93		600	
		12 May 93		1,500	
		19 May 93		2,800	
		26 May 93		3,800	
		2 Jun 93		2,600	
		14 Jul 93		8,000	
		11 Aug 93		> 16,000	
		8 Sep 93		1,400	
		6 Oct 93		10,000	
8. USGS Gaging Station	361.0	20 Jun 90		370	
		11 Jul 90		3,000	
		18 Jul 90		360	720

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		26 Jul 90			380
		1 Aug 90			620
		8 Aug 90			2,300
		15 Aug 90		610	800
		22 Aug 90			> 600
		29 Aug 90			370
		5 Sep 90		240	310
		12 Sep 90			240
		19 Sep 90			420
		26 Sep 90			470
		3 Oct 90			160 / 240
		10 Oct 90			360
		17 Oct 90		280	310
		10 Apr 91		1,300	>600
		1 May 91			3,400
		8 May 91			7,600
		15 May 91		1,200	2,100
		22 May 91			4,000
		29 May 91			1,300
		17 Jul 91		4,000*	
		15 Aug 91		1,800*	
		10 Sep 91		1,400*	
		26 Sep 91		1,600*	
		17 Oct 91		1,800*	
		15 Apr 92		800	
		22 Apr 92		2,200	
		29 Apr 92		1,600	
		6 May 92		1,200	
		13 May 92		1,800	
		10 Jun 92		4,600	
		15 Jul 92		2,500	
		12 Aug 92		4,000	
		15 Sep 92	3,000 /	2,100	
		14 Oct 92		5,200	
		5 May 93		400	
		12 May 93		1,300	
		19 May 93		2,700	
		26 May 93		1,400	
		2 Jun 93		3,200	
		14 Jul 93		4,000	
		11 Aug 93		2,700	
		8 Sep 93		2,500	
		6 Oct 93		6,600	
9. below whitesburg	402.6	20 Jun 90		3,300	
		11 Jul 90		3,600	
		18 Jul 90		2,300	2,200

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		26 Jul 90			3,800
		1 Aug 90			>3,000
		8 Aug 90			8,800
		15 Aug 90		2,600	2,900
		22 Aug 90			> 600
		29 Aug 90			2,900 / 5,000
		5 Sep 90		1,000	560/ 550
		12 Sep 90			7,200 / 7,400
		19 Sep 90			4,400
		26 Sep 90			8,000
		3 Oct 90			950
		10 Oct 90			2,600
		17 Oct 90		3,700	4,200
		20 Nov 90			1,600
		28 Dec 90			2,800 / 3,200
		23 Jan 91			230
		26 Feb 91			2,200
		26 Mar 91			400 / 2,100
		10 Apr 91		3,200	> 600
		1 May 91			4,100
		8 May 91			7,000
		15 May 91		700	440
		22 May 91			< 10
		29 May 91			100
		17 Jul 91		6,000*	
		15 Aug 91		1,000*	
		10 Sep 91		1,500*	
		26 Sep 91		2,400*	
		17 Oct 91		< 3,000*	
		15 Apr 2		1,300	
		22 Apr 92		6,600	
		29 Apr 92		4,400	
		6 May 92		>800 / >800	
		13 May 92		1,800	
		10 Jun 92		7,600	
		15 Jul 92		2,600	
		12 Aug 92		10,000	
		15 Sep 92		4,600	
		14 Oct 92		1,600	
		5 May 93		2,700	
		12 May 93		2,000	
		19 May 93		5,600	
		26 May 93		1,000	
		2 Jun 9		220	
		14 Jul 93		260	
		11 Aug 93		510	
		8 Sep 93		500	

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		6 Oct 93		770	
10. above Whitesburg	408.9	20 Jun 90		9,000	
		11 Jul 90		7,200	
		18 Jul 90		2,800	2,600
		26 Jul 90			3,000
		1 Aug 90			4,200
		8 Aug 90			5,200
		15 Aug 90		13,000	8,800
		22 Aug 90			>600
		29 Aug 90			810
		5 Sep 90	1,400 / 1,600		570
		12 Sep 90			ND
		19 Sep 90			5,000
		26 Sep 90			8,800
		3 Oct 90			> 600
		10 Oct 90		2,400	4,400
		17 Oct 90	4,000 / 4,200		5,600
		10 Apr 91	2,200 / 2,200		>600
		1 May 91			6,200
		8 May 91			2,600
		15 May 91	1,800 / 1,600	2,300 / 2,100	
		22 May 91			6,000
		29 May 91			1,700
		17 Jul 91		2,700*	
		15 Aug 91		4,700*	
		10 Sep 91		1,000*	
		26 Sep 91		5,000*	
		17 Oct 91		2,700*	
		15 Apr 92		1,600	
		22 Apr 92		3,000	
		29 Apr 92		1,800	
		6 May 92		1,200	
		13 May 92		2,800	
		10 Jun 92		4,000	
		15 Jul 92		3,400	
		12 Aug 92		11,000	
		15 Sep 92		2,600	
		14 Oct 92		2,200	
		12 May 93		1,900	
		19 May 93		3,800	
		26 May 93		1,300	
		2 Jun 93		530	
		14 Jul 93		700	
		11 Aug 93		2,800	
		8 Sep 93		700	

Appendix B (Continued)

NORTH FORK KENTUCKY RIVER INSTREAM FECAL COLIFORM DATA

LOCATION	MILEPOINT	DATE	FLOW	DOW	McCOY
		6 Oct 93		600	

Results measured in fecal coliforms per 100 ml

ND = Not Determined

DOW = Fecal coliform results provided by Kentucky Division of Water, Frankfort

* = Fecal coliform results provided by Kentucky Division of Water, London

McCoy = Analytical results provided by McCoy & McCoy Laboratories, Inc., Pikeville

Appendix C

1991-1993 NORTH FORK KENTUCKY RIVER DRAINAGE MUNICIPAL FACILITY FECAL COLIFORM DATA

<u>MILEPOINT</u>	<u>LOCATION</u>	<u>DATE</u>	<u>FECAL COLIFORMS / 100 ml</u>
3.4 Boone Fork (416.6)	FLEMING - NEON WWTP	6 May 92	<10
		10 Jun92	110
		15 Jul 92	<10
		4 Aug 92	110
		12 Aug 92	<10
		15 Sep92	<10
		14 Oct 92	<10
		5 May 93	<10
		12 May 93	<10
		19 May 93	<10
		26 May 93	<10
		2 Jun 93	<10
		14 Jul 93	<10
		11 Aug 93	<10
		8 Sep 93	<10
		6 Oct 93	<10
		403.5	WHITESBURG WWTP
8 May 91	7,000		
15 May 91	440		
22 May 91	<10		
29 May 91	100		
24 Jul 91	100		
15 Aug 91	13,000		
10 Sep 91	> 12,000		
26 Sep 91	> 12,000		
17 Oct 91	< 200		
15 Apr 92	10		
22 Apr 92	60		
29 Apr 92	60		
6 May 92	<10		
13 May 92	<10		
10 Jun 92	<10		
15 Jul 92	20		
4 Aug 92	60		
12 Aug 92	40		
15 Sep.92	160		
4 Oct 92	80		
5 May 93	< 10		
12 May 93	< 10		
19 May 93	120		
26 May 93	10		
2 Jun 93	10		
14 Jul 93	<10		
11 Aug 93	10		

Appendix C (continued)

NORTH FORK KENTUCKY RIVER DRAINAGE MUNICIPAL FACILITY FECAL COLIFORM DATA

<u>MILEPOINT</u>	<u>LOCATION</u>	<u>DATE</u>	<u>FECAL COLIFORMS / 100 ml</u>
		8 Sep 93	<10
		6 Oct 93	<10
6.2	VICCO WWTP	6 May 92	<10
Carr Fork		4 Aug 92	<10/<10
(367.8)		15 Sep 92	<10
357.78	HAZARD WWTP	1 May 91	4,800
		8 May 91	10,000
		15 May 91	3,000
		22 May 91	1,500
		29 May 91	1,500
		24 Jul 91	<10/<10
		15 Aug 91	3,800
		10 Sep 91	10
		26 Sep 91	50
		17 Oct 91	< 200
		15 Apr 92	<10
		22 Apr 92	9,200
		29 Apr 92	>80,000
		6 May 92	100,000
		13 May 92	<10
		10 Jun 92	<10
		23 Jun 92	<10
		15 Jul 92	20
		12 Aug 92	220
		15 Sep 92	<10
		14 Oct 92	90
		5 May 93	40
		12 May 93	<10
		19 May 93	10
		26 May 93	<10
		2 Jun 93	<10
		14 Jul 93	80
		11 Aug 93	>80,000
		8 Sep 93	>80,000
		6 Oct 93	>80,000 (250,000)
42.1	HINDMAN WWTP	6 May 92	<10
Troublesome Cr		4 Aug 92	70,000
(313.7)		15 Sep 92	<10
299.6	JACKSON WWTP	1 May 91	<10
		8 May 91	20
		15 May 91	<10
		22 May 91	20

Appendix C (Continued)

NORTH FORK KENTUCKY RIVER DRAINAGE MUNICIPAL FACILITY FECAL COLIFORM DATA

		29 May 91	90
		24 Jul 91	<10
		15 Aug 91	<10. <10
		10 Sep 91	<1
		26 Sep 91	<10
		17 Oct 91	< 200
		15 Apr 92	30 / 20
		22 Apr 92	40
		29 Apr 92	10
		6 May 92	<10
		13 May 92	<10
		10 Jun92	<10
		15 Jul 92	<10
		4 Aug	<10
		12 Aug 92	<10
		15 Sep 92	<10
		14 Oct 92	<10
		5 May 93	10
		12 May 93	<10
		19 May 93	<10
		26 May 93	<10
		2 Jun 93	<10
253.9	BEATTYVILLE WWTP	6 May 92	>800
(Kentucky River)		23 Jun 92	800
		15 Sep92	<10

> m Greater Than
 Geometric Means measured in fecal coliforms per 100 ml
 No. Obs = Number of Observations
 GM Geometric Mean

Appendix D

1992 NORTH FORK KEKENTUCKY RIVER DRAINAGE COMPLIANCE SAMPLING INSPECTIONS' FECAL COLIFORM DATA FOR NONMUNICIPAL FACILITIES

Lee County (One Facility)

<u>FACILITY</u>	<u>MAY 6th & 7th</u>	<u>JUN 23rd</u>	<u>AUG 4th</u>	<u>SEP 15th 16th</u>
Lee Adjustment Center	700	<10		20

Breathitt County (Four Facilities)

<u>FACILITY</u>	<u>MAY 6th & 7th</u>	<u>JUN 23rd</u>	<u>AUG 4th</u>	<u>SEP 15th 16th</u>
Rousseau Elementary	10		<10	<10
Mount Carmel Elementary	76,000	<10		90
Jackson Village Mail	> 80,000	> 16,000		N D
Marie Roberts Elementary	N D		700	<10

Perry County (24 Facilities)

<u>FACILITY</u>	<u>MAY 6th & 7th</u>	<u>JUN 23rd</u>	<u>AUG 4th</u>	<u>SEP 15th 16th</u>
Leatherwood Elementary	<10			<10
Leatherwood Blackey Clinic	<10		<10	<10/<10
Viper Elementary	> 80,000	<10		30
Campbells Dairy Bar	<10		ND	ND
Willard Elementary School	30		<10	<10
Big Creek Elementar	<10		<10 / <10	<10
Couch's Apartments	ND		<10	ND
Concepts "N" Motion	<10		<10	<10
Robinson Elementary School	<10		<10	< 1 0 / < 1 0
Lost Creek Elementary	<10		<10	< 1 0
Grapevine Place Apartments	<10		<10	<10
AAA Mine Service	29,000	<10/<10		<10
Fugates Water Par	<10		<10	30
Middle Ridge Subdivision	600	8,400		>80,000(90,000)
Feltners & Neace's MHP	18,000	<10		< 1 0
Chavies Elementary	<10		<10	<10
Chavies Center	<10		20	<10
Rons Mobile Home Park	240 / 240		> 80,000	10
V. G. Combs MHP	> 80,000	> 16,000		<10
R. W. Combs Elementary	<10		<10	ND
Ky West Va Gas	> 80,000	<10		< 1 0 / < 1 0
Dilce Combs High School	48,000	<10		<10
B. B. S. & D. Building	< 1 0		<10	< 1 0
Adams Apartments	ND		<10	30

Appendix D (Continued)

1992 NORTH FORK KENTUCKY RIVER DRAINAGE COMPLIANCE SAMPLING INSPECTIONS' FECAL COLIFORM DATA

Knott County (8 facilities)

<u>FACILITY</u>	<u>MAY 6th & 7th</u>	<u>JUN 23rd</u>	<u>AUG 4th</u>	<u>SEP 15th 16th</u>
Beckham Combs Elementary	500	>16,000/>16,000		4,000
Highway 80 Motel	<10		1,000	90
Jamestown Village MHP	>80,000	>16,000		700
Emmalena Elementary	50,000	<10		> 80,000
Holly Hills Shopping Center	740	<10		< 10
AKP Coal Company Office	2,000	<10		<10
Carr Creek Elementary	>80,000	>16,000		100
U. S. Corps of Engineers	<10			

Letcher County (19 Facilities)

<u>FACILITY</u>	<u>MAY 6th & 7th</u>	<u>JUN 23rd</u>	<u>AUG 4th</u>	<u>SEP 15th 16th</u>
Blackey Headstart	> 80,000	<10		ND
Campbell Branch Elementary	<10		ND	ND
Kingdom Come Elementary	< 10		<10	ND
Parkway Motel	> 80,000	>16,000		80
Dry Fork Market	<10		<10/<10	ND
Taylor Body Shop	ND			ND
Banks Restaurant & Apartments	300		130	1,200
Beckham Bates Elementary	<10		30	210
Southeast Coal Company	<10		440	ND
Golden Oak Mining Office	> 80,000	>16,000		ND
Letcher Consolidated School	50		<10	<10
Hemphill Elementary	20		<10	<10 / <10
Martha Jane Potter Elementary	<10		30 / <10	<10
Mayking Mail	10		<10	78,000
Energy Express	>80,000	>16,000		<10
Standard Labs	>80,000	<10		<10
Elkhorn Hazard Coal	<10		ND	ND
Cowan Elementary	>80,000	<10		<10
Breedings Apartments	ND		600	<10

bold face values are above KPDES fecal coliform daily permit limit of 400 per 100 ml.

all values measured in fecal coliforms per 100 ml

ND = no discharge

- = no discharge to the North Fork Kentucky River drainage

Appendix E

1994 NORTH FORK KENTUCKY RIVER DRAINAGE FACILITIES

<u>FACILITY NAME</u>	<u>COUNTY</u>	<u>DESIGN FLOW, mgd</u>	<u>MAP No.</u>
Schools			
Mt Carmal High School	Breathitt	.004	9-53
Rousseau Elementary	Breathitt	.003	9-55
Marie Roberts Elementary	Breathitt	.009	8-54
Lost Creek Elementary	Perry	.004	7-55
Chavies Elementary	Perry	.01	7-54
Willard Elementary	Perry	.005	7-54
Big Creek Elementary	Perry	.008	6-54
Robinson Elementary	Perry	.008	7-55
Leatherwood Elementary	Perry	.008	5-55
Viper Elementary	Perry	.008	6-55
R. W. Combs Elementary	Perry	.008	6-56
Dilce Combs High School	Perry	.006	6-56
Campbell Branch Elementary	Letcher	.005	5-56
Beckham Bates Elementary	Letcher	.0075	5-57
Letcher Consolidated School	Letcher	.012	6-58
Hemphill Elementary	Letcher	.004	6-57
Martha Jane Potter Elementary	Letcher	.007	6-59
Cowan Creek Elementary	Letcher	.006	5-58
Beckham Combs Elementary	Knott	.005	7-56
Carr Creek Elementary	Knott	.01	6-57
Mount Carmal Elementary	Breathitt	.004	9-53
Municipals			
Beattyville, City of	Lee	.135	9-51
Jackson, City of	Breathitt	.75	9-53
Hazard, City of	Perry	1.5	7-55
Vicco, City of	Perry	.1	6-56
Fleming - Neon, City of	Letcher	.52	6-59
Whitesburg, City of	Letcher	.5	5-58
Hindman, City of	Knott	.125	7-55
Industrials			
L&N RR-Hazard Yards	Perry	.0432	7-55
Subdivisions			
Blackey Headstart	Letcher	.0015	6-55
Middle Ridge	Perry	.01	7-55
Lost Mountain Mining Corp	Perry	.0045	7-55

Appendix E (Continued)

1994 NORTH FORK KENTUCKY RIVER DRAINAGE FACILITIES

<u>FACILITY NAME</u>	<u>COUNTY</u>	<u>DESIGN FLOW, mgd</u>	<u>MAP NO.</u>
Water Plants			
Jackson, City of	Breathitt	0	9-54
Hazard, City of	Perry	.01	7-55
Hindman, City of	Knott	0	7-57
Whitesburg, City of	Letcher	.54	5-58
Small Sewage			
Chavies Center	Perry	.005	7-54
Jackson Village Mail	Breathitt	.02	9-54
Alpine Restaurant	Breathitt	.0025	9-54
Ron's Mobile Home Park	Perry	.004	7-54
Combs, VG Mobile Home Park	Perry	.0025	7-54
Feltner's Dairy Bar	Perry	.0005	7-54
Falcon Coal Co-Office *	Perry	.0016	7-55
Mountain View Estates Apts	Perry	.009	7-55
Ace Coal Co. Office **	Perry	.0025	7-55
Couch's Apartments	Perry	.0011	7-55
Grapevine Apartments	Perry	.0036	7-55
Leatherwood Blakey Health Center	Perry	.0025	5-56
Campbells Dairy Bar	Perry	.0005	
Concepts "N" Motion	Perry	UNK	
AAA Mine Service	Perry	.005	7-55
Adams Apartments	Pike	.0017	6-55
Fugates Water Park	Perry	.0077	7-55
Feltners Trailer Court	Perry	.0025	7-55
Ky, West Va Gas	Perry	.001	6-56
B. B. S. & D. Building	Perry	.0012	6-55
Aceco Inc. Office	Perry	.0025	7-55
Golden Oak Mining Office	Letcher	.003	6-57
Holly Hills Plaza Shopping Center	Knott	.03	7-55
Highway 80 Motel	Knott	.005	7-56
Hindman Funeral Home	Knott	.001	5-57
Jamestown Village MHP	Knott	.03	7-56
Parkway Motel	Letcher	.009	6-58
Dry Fork Market	Letcher	.0005	6-58
Taylor Body Shop	Letcher	.0005	6-57
Banks Restaurant & Apartments	Letcher	.005	6-57

Appendix E (Continued)

1994 NORTH FORK KENTUCKY RIVER DRAINAGE FACILITIES

<u>FACILITY NAME</u>	<u>COUNTY</u>	<u>DESIGN FLOW, mgd</u>	<u>MAP No</u>
Small Sewage			
Mayking Mall	Letcher	.001	6-58
Energy Express*	Letcher	.005	6-59
Standard Labs	Letcher	.002	6-58
BreedingsApartments	Letcher	.0075	6-57
U.S. COE, Irishman	Knott	.045	6-56
U.S. COE, Carr Fork Campground	Knott	.03	6-57
U.S. COE, Carr Fork Dam	Knott	.0025	6-56
Lee Adjustment Center	Lee	.044	9-51
Falcon Coal-Prep Plant	Perry	.0045	7-55
AKP Coal Company Office	Knott	.0016	7-57
Total: 79 Facilities		4.8013	

UNK = unknown or out of service

* = no discharge, not sampled

** = not permitted in 1992

*** = no discharge, not sampled and not permitted in 1992

Appendix F

LITERATURE CITED

- (APHA) American Public Health Association. 1981. Standard methods for the examination of water and wastewater, 15th Edition. Am. Publ. Heal. Assoc., Am. Water Works Assoc., Water Poll. Contr. Fed., Washington, D.C.
- Bordner, R., J. Winter, and P. Scarpino, editors. 1978. Microbiological methods for monitoring the environment, water and wastes. Environ. Monit. Supp. Lab., U.S. EPA., Cincinnati, OH EPA - 600/8-78-017.
- Bower, D.E. and W. H. Jackson. 1981. Drainage areas of streams at selected locations in Kentucky. U.,S. Dept. Int., Geol. Surv., Louisville, Ky. Open File Rept. 81 -61.
- (DES) Division of Environmental Services. 1983. Stream Use Designation Methodology. Dept. Environ. Prot., Nat. Res. Environ. Prot, Cabinet, Frankfort, Ky.
- (DOW) Division of Water. 1986. Kentucky Report to Congress on Water Quality. Dept. Environ. Prot., Nat. Res. Environ. Prot Cabinet, Frankfort, Ky.
- (DOW) Division of Water. 1987. Quality Assurance Manual. Dept. Environ. Prot., Nat. Res. Environ. Prot Cabinet, Frankfort, Ky.
- Kentucky Dept. of Business Development. 1988. Kentucky Economic Statistics. Frankfort, Ky.
- McDowell, R. C., G. J. Grabowski, Jr., and S. L. Moore. 1981. Geologic map of Kentucky. U. S. Geol. Surv. and The Eleventh Ky. Geol. Serv. 4 sheets, Univ. of Kentucky. Lexington, Ky.
- Proctor-Davis-Ray. 1976. The River Basin Water Quality Management Plan for Kentucky, Kentucky River. Ky. Department for Natural Resources and Environmental Protection. Frankfort, Ky.
- Sehlinger, B. and W. Underwood. 1980. A Fishing Guide to the Streams of Kentucky. Thomas Press. Ann Arbor, Mich.
- STORET, 1979-1988. United States Environmental Protection Agency water quality file. U.S. EPA, Office of Reg. and Stds., Washington, D.C.
- (USGS) United States Geological Survey. 1984. Water resources data for Kentucky, Water year 1984. U- S. Dept. Int., Geol. Surv. Water-Data Rept. KY-84-1.



The Natural Resources and Environmental Protection Cabinet does not discriminate on the basis of race, color, national origin, sex, age, religion, or disability and provides, on request, reasonable accommodations including auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all services, programs, and activities.