

**EXPANSION OF AMBIENT BIOLOGICAL MONITORING PROGRAM**

**EAGLE CREEK**

**FINAL REPORT**

**(Revised)**

by

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**EPA Account Number: 12-34-590-BA00-E415**

**MOA Number: 19894**

**Agreement Period: 05/01/98 to 10/31/99**

**August 25, 2000**

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## EXECUTIVE SUMMARY

A total of eight sites within the Eagle Creek drainage system of the Kentucky River Basin were successfully sampled during the summer of 1998. These sites were sampled for fish and macroinvertebrates in order to make an assessment of the water quality of this system. The biological samples were returned to Eastern Kentucky University where they were sorted, identified, enumerated and analyzed according to KDOW QA/QC protocols. The data were entered into the biological database of KDOW, and have been reported within this document. The data analysis included taxa lists and taxa abundances for fish and macroinvertebrates. In addition, a number of metrics were calculated for both fish and macroinvertebrate samples. These included IBI values for fish, and for macroinvertebrates the Total Number of Taxa, Total Number of Individuals, Shannon Diversity, EPT Index, EPT/Chironomid Index, HBI, and percentage composition of each functional feeding group were included. It was learned that Eagle Creek is a warmwater stream with a typical warmwater fauna. It was also determined that some NPS pollution enters the stream. This may be due to agricultural practices within the drainage, which is the main landuse in the area. Three sites have been recommended as possible long term ambient sampling sites. These included Sites 04007002 (Map Number 2), 04010002 (Map Number 7), and 04010003 (Map Number 8). Site 04007004 (Map Number 4) was identified as probably the most impacted of the 8 sites in the drainage. It would benefit from further and more intensive monitoring. The final conclusions are that the Eagle Creek drainage within the Kentucky River Basin is moderately impacted by NPS pollution possibly due to agriculture. The bioassessments of both the fish and macroinvertebrate communities indicate an overall status of Fair/Good water quality for the drainage.

## **INTRODUCTION**

At present, the Kentucky Division of Water's (KDOW) long term Ambient Biological Monitoring Program (ABMP) consists of only 48 sites, 12 of which are sampled each year on a four-year rotation. Most of those sites are in larger (4th-5th order) streams with a variety of point and nonpoint source impacts. An expansion of the ABMP, by increasing the number of sampling stations, was necessary in order to effectively identify priority watersheds impacted by nonpoint source (NPS) pollution.

Sites were selected in watersheds with a high potential for NPS pollution. This will enable KDOW to more accurately assess and monitor the effects of siltation, nutrient enrichment, pesticides and other pollutants on aquatic communities. Agriculture, silviculture, and resource extraction are three major sources of NPS pollution in Kentucky, according to Kentucky's 305(b) Report to Congress on Water Quality (1996). Therefore, sites for this project were located in watersheds that were potentially impacted by these activities. Macroinvertebrates and fish communities were assessed based on methods standardized by the Division in "Methods for Assessing the Biological Integrity of Surface Waters" (KDOW 1993). Aquatic communities at the selected sites will be compared to Reference Reach Program sites in nearby (same ecoregion) watersheds to determine if they deviate from expected conditions.

The four objectives for this project were as follows: (1) assess the water quality and use attainability of 7-10 sites in targeted watersheds potentially impacted by NPS pollution, based on land use information; (2) identify biological indicators that are sensitive to, and/or specific for, NPS impacts such as siltation and nutrient enrichment; (3) establish sites that will be permanently included in the ambient biological monitoring program sampling rotation; and (4) identify sites that are the most severely impacted by NPS so that resources can be directed toward remediation of those impacts.

## **PLAN OF WORK**

The Kentucky Division of Water (KDOW), Water Quality Branch, Ecological Support Section (ESS) had responsibility for coordinating this program. Eight sites were established in the Eagle Creek drainage, Kentucky River basin, for sampling in 1998. The ESS selected sites that were possibly impacted by either agriculture, silviculture, resource extraction, or a combination of those activities. Land use information gathered from reports generated by other agencies (e.g., National Resources Conservation Service, Nature Preserves Commission, Division of Conservation, Department for Fish & Wildlife Resources) was used to select preliminary sites. Site selection criteria included: (1) known or suspected NPS inputs, (2) no major point sources in upstream watershed, (3) perennial stream (may be pooled in dry season), (4) presence of a nearby, same ecoregion, reference reach site, and (5) balanced geographical site distribution. The ESS strived for a balanced distribution of these sites by both geography and type of impact.

The ESS contracted Eastern Kentucky University to perform the sampling and taxonomic work. Sampling strictly followed protocols outlined in the Division's "Methods for Assessing Biological Integrity of Surface Waters" manual (KDOW 1993) and "Quality Assurance Guidelines" (KDOW 1986). The raw data has been provided to the ESS for Warmwater Aquatic Habitat (WAH) use assessment. Two of the three communities typically sampled by the ESS (fish and macroinvertebrates) were collected and identified to species level, where possible, using current taxonomic references. Biological indices defined in the "Methods Manual" were calculated by the contract biologists.

Data from this project will be made available through the Division's internet web page. In addition, any significant findings will be communicated through press releases in the local area newspapers. Data from this project will also be included in the next 305(b) Report to Congress on Water Quality. Assessment of NPS impacts on WAH use and recommendations of possible BMPs that may reduce or eliminate these impacts will be communicated to the Nonpoint Source Section of the Kentucky Division of Water at the completion of the project. This information will hopefully be used to target NPS impacted areas and help in prioritizing future requests for BMP implementation.

## **STATUS OF REQUIRED OUTPUTS**

Five distinct outputs were addressed in the MOA. These have all been fulfilled by the contractor. A summary of these accomplishments is as follows: Output 1, fish and macroinvertebrates have been collected from eight sites within the Eagle Creek drainage system; Output 2, IBI metrics have been calculated for all sites and are reported herein; Output 3, macroinvertebrate metrics have been calculated for all sites and are reported herein; Output 4, the data that has been collected and analyzed during the study has been entered into the Biological Database (ABIS) of the Kentucky Division of Water; Output 5, a review draft of a final report has been submitted to KDOW, and the current report represents the final edited report.

## **RESULTS AND DISCUSSION**

A total of eight sites (Table 1) were sampled in the Eagle Creek drainage (Figure 1). The raw fish and macroinvertebrate data generated by this project was transmitted to KDOW, and entered into the KDOW database. All of those data can be accessed from this database. Summary sheets that provide assessment information for both the macroinvertebrate and fish communities at each site can be found in the Appendix. Each sheet provides the location of that site, habitat assessment, an assessment of the macroinvertebrate community and an assessment of the fish community. The following is a discussion of each of the four pre-established objectives, and how each objective was met.

TABLE 1. Location of Eight Sampling Sites in the Eagle Creek Drainage.

Map Number	Site Number	LOCATION
1	04007001	Owen Co.; Eagle Creek, 1.5 mi NW Wheatley at Eagle Station Rd. near Eagle Valley recreation area
2	04007002	Owen/Gallatin Co.; Eagle Creek at SR 127 bridge at Glencoe
3	04008001	Grant Co.; Ten Mile Creek, at SR 467 near mouth
4	04007004	Grant Co.; Eagle Creek, at County Road 1132 bridge
5	04009001	Grant Co.; Clark's Creek, at Fords Mill Road
6	04010005	Owen Co.; 1.5 mi S Needmore at Fortner Ridge Rd.
7	04010002	Owen Co.; Eagle Creek, Natlee at SR 607
8	04010003	Scott Co.; Eagle Creek, at Pokeberry Rd.

### Objective 1: Assessment of Water Quality of Eagle Creek

A total of eight sites were sampled (as stipulated in the MOA) in the Eagle Creek drainage. Each site was assessed in terms of habitat, macroinvertebrate and fish communities.

### FISH COMMUNITY ASSESSMENTS

The fish community of seven sites was sampled by KDOW in 1990. IBI scores were calculated for these seven sites using metrics from KDOW (1993). In 1998, these seven sites were re-sampled along with one additional site (Site 04007004 (Map Number 4)). IBI scores were calculated for these eight sites using metrics from KDOW (1997). Species abundance is given for each site and for both collection periods in Table 2. In order to compare 1990 IBI scores to 1998 IBI scores, the 1990 scores were recalculated using the 1997 KDOW metrics (Table 3).

The following section provides a summary of the fish assemblages found at each site in 1990 and 1998. A total of 43 species were collected from Eagle Creek during the 1990 and 1998 projects.

#### Site 04007001 (Map Number 1)

1990. Seventeen species of fishes representing seven families were collected. Cyprinidae and Centrarchidae were the most diverse family with five species each, followed by Percidae with three. A relatively low number of darter species and intolerant species and a low percentage of insectivores lowered the IBI score for this site. Notable fishes in the



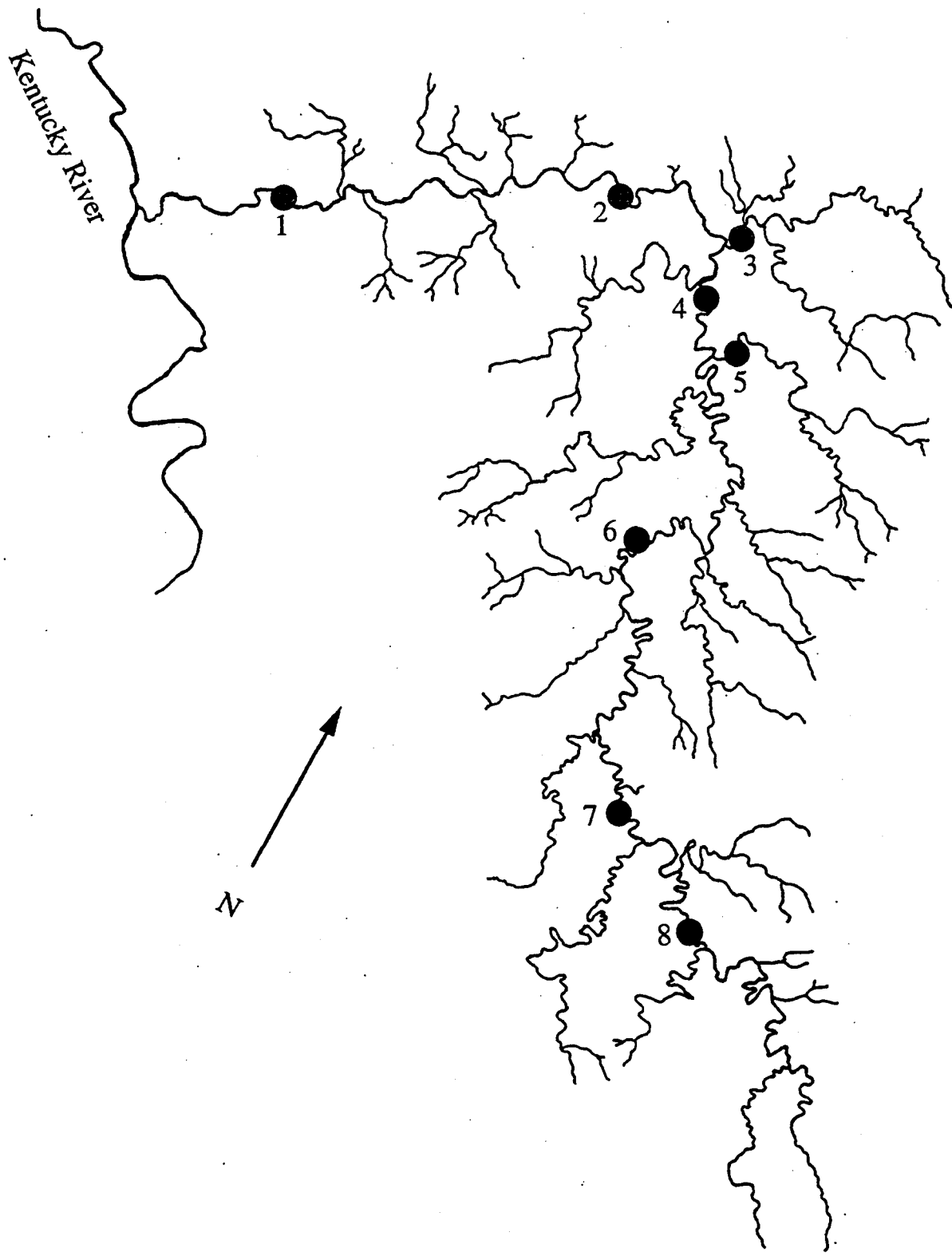


Figure 1. Map of the Eagle Creek system and localities sampled.

Table 2. Fish Species Abundance for each Site and for each Collection Period.

Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Site 8	
	1990	1998	1990	1998	1990	1998	-	1998	1990	1998	1990	1998	1990	1998	1990	1998
<i>Lepisosteus osseus</i>	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	1	-	-	-	-	-	-	1	-	3	-
<i>Campostoma anomalum</i>	10	9	10	4	2	13	-	11	3	2	8	7	1	19	3	31
<i>Cyprinella whipplei</i>	28	46	4	39	-	11	-	41	-	-	-	24	-	8	-	-
<i>Cyprinus carpio</i>	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
<i>Ericymba buccata</i>	-	1	-	-	14	-	-	1	2	-	-	-	-	-	-	-
<i>Luxilus chrysocephalus</i>	20	9	6	-	10	-	-	-	8	19	13	-	20	8	4	7
<i>Lythrurus fasciolaris</i>	-	-	1	-	25	13	-	8	19	53	4	35	80	146	124	308
<i>Notemigonus crysoleucas</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
<i>Notropis atherinoides</i>	15	53	1	41	1	68	-	13	-	-	1	15	13	5	-	17
<i>Notropis buchanani</i>	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-
<i>Notropis volucellus</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Pimephales notatus</i>	21	2	6	3	109	46	-	86	68	100	85	30	63	53	30	126
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
<i>Semotilus atromaculatus</i>	-	-	-	-	5	-	-	-	-	-	-	-	-	7	-	2
<i>Catostomus commersoni</i>	-	-	-	-	-	-	-	-	-	1	-	-	-	3	-	-
<i>Hypentelium nigricans</i>	-	-	-	1	1	1	-	-	1	-	-	-	-	-	-	-
<i>Moxostoma duquesnei</i>	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<i>Moxostoma erythrurum</i>	1	-	-	-	2	-	-	-	1	-	2	-	-	-	-	-

Table 2. Fish Species Abundance continued.

Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Site 8	
	1990	1998	1990	1998	1990	1998	-	1998	1990	1998	1990	1998	1990	1998	1990	1998
<i>Ictalurus natalis</i>	-	-	-	-	1	-	-	-	-	-	1	-	-	-	2	-
<i>Ictalurus punctatus</i>	2	1	-	-	8	-	-	-	-	-	-	-	-	-	-	-
<i>Noturus flavus</i>	-	5	-	-	-	-	-	2	-	-	-	-	-	-	-	-
<i>Noturus miurus</i>	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	1	-	1	4	-	-	5	1	2	1	-	4	3	2	23
<i>Labidesthes sicculus</i>	1	-	1	29	3	1	-	17	1	2	1	-	15	14	23	13
<i>Ambloplites rupestris</i>	2	-	2	-	3	3	-	4	2	1	11	-	5	2	1	1
<i>Lepomis cyanellus</i>	-	-	2	3	3	2	-	7	1	4	3	4	13	7	9	7
<i>Lepomis humilis</i>	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2
<i>Lepomis macrochirus</i>	9	-	1	2	8	-	-	3	4	-	11	1	9	1	14	2
<i>Lepomis megalotis</i>	2	1	1	4	10	15	-	28	3	15	8	5	5	8	5	13
<i>Micropterus dolomieu</i>	1	-	1	2	2	-	-	-	1	1	-	-	-	-	-	-
<i>Micropterus punctulatus</i>	3	2	3	-	7	3	-	3	3	1	7	-	19	1	12	7
<i>Micropterus salmoides</i>	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
<i>Etheostoma caeruleum</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
<i>Etheostoma blennioides</i>	8	8	7	15	8	14	-	44	-	2	22	11	12	16	1	23
<i>Etheostoma flabellare</i>	6	2	6	1	17	8	-	5	8	1	11	7	35	30	22	37

Table 2. Fish Species Abundance continued.

Species	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Site 8	
	1990	1998	1990	1998	1990	1998	-	1998	1990	1998	1990	1998	1990	1998	1990	1998
<i>Etheostoma nigrum</i>	-	-	1	-	8	1	-	2	3	-	3	-	5	2	7	2
<i>Etheostoma spectabile</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
<i>Percina caprodes</i>	-	2	-	1	1	-	-	-	-	1	2	-	-	1	-	1
<i>Percina maculata</i>	3	-	-	-	-	-	-	-	-	1	-	1	-	2	-	-
<i>Percina phoxocephala</i>	-	12	-	1	-	1	-	-	-	-	-	-	-	-	-	-

Table 3. Individual IBI Metric Scores for Each Site and for Each Collection Period.

Metrics	Site 1		Site 2		Site 3		Site 4		Site 5		Site 6		Site 7		Site 8	
	1990	1998	1990	1998	1990	1998	-	1998	1990	1998	1990	1998	1990	1998	1990	1998
Total # of Species	3	3	5	3	5	5	-	5	5	5	5	3	5	5	5	5
# of Darter Species	3	3	3	3	3	3	-	3	3	5	3	3	3	5	5	5
# of Sunfish Species	5	3	5	5	5	5	-	5	5	5	5	5	5	5	5	5
# of Sucker Species	5	1	3	3	5	3	-	1	5	3	3	1	1	3	1	1
# Intolerant Species	3	3	5	3	5	5	-	3	3	5	3	3	3	3	3	5
% Tolerant Species	5	5	5	5	5	5	-	5	5	1	5	5	5	5	5	5
% of Omnivores	3	5	5	5	1	3	-	3	1	1	1	5	3	3	5	3
% of Insectivores	3	5	1	5	1	5	-	5	1	3	1	5	3	5	5	5
# of Top Carnivores	5	3	5	3	5	5	-	5	5	5	5	1	5	5	5	5
# of Simple Lithophils	3	3	3	3	5	3	-	1	3	5	3	1	3	3	1	3
% DELT anomalies	5	5	5	5	5	5	-	3	1	5	5	5	5	5	5	5
# of Individuals	3	5	3	5	5	5	-	5	5	5	5	5	5	5	5	5
<b>Total IBI Score</b>	<b>46</b>	<b>44</b>	<b>48</b>	<b>48</b>	<b>50</b>	<b>52</b>	<b>-</b>	<b>44</b>	<b>42</b>	<b>48</b>	<b>44</b>	<b>42</b>	<b>46</b>	<b>52</b>	<b>50</b>	<b>52</b>

collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Moxostoma duquesnei*, *Ambloplites rupestris*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, and *Percina maculata*. This site had an IBI scored of 46, classifying it as Fair-Good.

1998. Sixteen species of fishes representing eight families were collected. Cyprinidae was the most diverse family with six species, followed by Percidae with four. A combination of a relatively lower number of sucker species, lower number of darter species, and lower number of top carnivore species were responsible for this site having a lower IBI score than recorded 1990. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lepisosteus osseus*, *Cyprinella whipplei*, *Noturus flavus*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina phoxocephala*. The IBI score was 44, classifying the site as Fair.

#### **Site 04007002 (Map Number 2)**

1990. Nineteen species of fishes representing six families were collected. Cyprinidae and Centrarchidae were the most diverse families with six species each. A combination of a relatively lower number of darter species, sucker species, simple lithophils, and a lower number of individuals impacted the IBI score for this site. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lepisosteus osseus*, *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Lepomis megalotis*, *Micropterus dolomieu*, *Ambloplites rupestris*, and *Etheostoma blennioides*. The IBI score for this site was 48, classifying it as Good.

1998. Fifteen species of fishes representing six families were collected. Cyprinidae, Centrarchidae, and Percidae each were represented by four species. The same IBI score was recorded for this site in both 1990 and 1998. In 1998, a lower number of total species, intolerant species, and top carnivore species were found. However, more individuals and a greater percentage of insectivores were recorded for 1998. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Hypentelium nigricans*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina phoxocephala*. The IBI score was 48, classifying this site as Good.

#### **Site 04008001 (Map Number 3)**

1990. Twenty-five species of fishes representing eight families were collected. Cyprinidae was the most diverse family with eight species, followed by Centrarchidae with six species and Percidae with four. A relatively high percentage of omnivores and low percentage of insectivores, and low number of darter species prevented this site from scoring in the Excellent category. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lepisosteus osseus*, *Lythrurus fasciolaris*, *Hypentelium nigricans*, *Ambloplites rupestris*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, and *Percina caprodes*. The IBI score was 50, classifying this site as Good.

1998. Seventeen species of fishes representing seven families were collected. Cyprinidae was the most diverse family with five species, followed by Centrarchidae and Percidae with four species each. An increase in the percent of insectivores, and a decrease of omnivores contributed to the higher IBI score for this site in 1998. A relatively lower number of sucker species and simple lithophils impacted the IBI score for this site. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Hypentelium nigricans*, *Noturus miurus*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina phoxocephala*. The IBI score was 52, classifying this site as Good.

**Site 04007004 (Map Number 4)**

1990. This site was not sampled in 1990, and was added as a new site for 1998 sampling.

1998. Eighteen species of fishes representing six families were collected. Cyprinidae was the most diverse family with six species, followed by Centrarchidae with five. A combination of relatively lower number of darter, sucker, intolerant, and simple lithophil species, and a greater number of fishes with anomalies were responsible for this site having a relatively low IBI score. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Noturus flavus*, *Ambloplites rupestris*, *Lepomis megalotis*, and *Etheostoma blennioides*. The IBI score was 44, classifying this site as Fair.

**Site 04009001 (Map Number 5)**

1990. Sixteen species of fishes representing six families were collected. Centrarchidae was the most diverse family with six species, followed by Cyprinidae with five. Site 04009001 had the lowest IBI score of the sites sampled on Eagle Creek in 1990. This site had a combination of relatively lower number of darter, intolerant, and simple lithophil species, a higher percent of omnivores and lower percent of insectivores. A relatively higher number of fishes were recorded with anomalies. These factors were responsible for the low IBI score for this site. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Hypentelium nigricans*, *Ambloplites rupestris*, *Lepomis megalotis*, and *Micropterus dolomieu*. The IBI score was 42, classifying the site as Fair.

1998. Sixteen species of fishes representing six families were collected. Centrarchidae was the most diverse family with five species, followed by Cyprinidae and Percidae with four species each. In 1998 a greater number of darter, intolerant, and simple lithophil species, and an increase in the percent of insectivores was recorded. Along with a decrease in the percent of fishes with anomalies, these factors resulted in a higher IBI score for this site in 1998 compared to 1990. A relatively lower number of sucker species, and higher number of tolerant species prevented this site from scoring in the excellent range. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina maculata*. The IBI score was 48, classifying the site as Good.

**Site 04010005 (Map Number 6)**

1990. Nineteen species of fishes representing seven families were collected. Cyprinidae was the most diverse family with six species, followed by Centrarchidae and Percidae with four each. A combination of a relatively lower number of darter, intolerant, and simple lithophil species, and a high percentage of omnivore and low percentage of insectivore species were responsible for this site having a relatively low IBI score. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina caprodes*. The IBI score was 44, classifying the site as Fair.

1998. Thirteen species of fishes representing three families were collected. Cyprinidae was the most diverse family with six species, followed by Centrarchidae with four and Percidae with three. This site had the lowest IBI score of the 1998 Eagle Creek project. A decrease in the total number of species, sucker species, top carnivore species, and simple lithophils contributed to the low IBI score for this site. There was a decrease in the percentage of omnivores and an increase in the percentage of insectivores compared to the 1990 results. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina maculata*. The IBI score was 42, classifying the site as Fair.

**Site 04010002 (Map Number 7)**

1990. Seventeen species of fishes representing six families were collected. Cyprinidae and Centrarchidae were the most diverse families with six species each. A combination of a relatively lower number of darter, sucker, simple lithophil, and intolerant species was found for this site. Along with a decrease in the percent of insectivores and increase in the percent of omnivores, these factors were responsible for this site having a low score. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina caprodes*. The IBI score was 46, classifying the site as Fair-Good.

1998. Twenty species of fishes representing six families were collected. Cyprinidae was the most diverse family with seven species, followed by Centrarchidae and Percidae with five. A greater number of darter species and sucker species were responsible for the higher IBI score recorded in 1998 than 1990. A combination of a relatively lower number of intolerant and simple lithophil species, and an increase in the percentage of omnivores were responsible for this site not scoring in the Excellent range. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina maculata*. The IBI score was 52, classifying the site as Good.



#### Site 04010003 (Map Number 8)

1990. Eighteen species of fishes representing seven families were collected. Centrarchidae was the most diverse family with six species, followed by Cyprinidae and Percidae with four species each. A combination of a relatively lower number of sucker, intolerant, and simple lithophil species prevented this site from having an Excellent IBI score. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Labidesthes sicculus*, *Ambloplites rupestris*, *Lepomis megalotis*, and *Etheostoma blennioides*. The IBI score was 50, classifying the site as Good.

1998. Twenty-two species of fishes representing five families were collected. Cyprinidae was the most diverse family with ten species, followed by Centrarchidae with six and Percidae with five. This site had a higher IBI score in 1998 than 1990. This resulted from an increase in intolerant and simple lithophil species. A low number of sucker species and high percentage of omnivores impacted the IBI score for this site. Notable fishes in the collection were the following KDOW-classified intolerant species: *Lythrurus fasciolaris*, *Notropis volucellus*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina caprodes*. The IBI score was 52, classifying the site as Good.

### MACROINVERTEBRATE COMMUNITY ASSESSMENTS

A list of the Macroinvertebrates from eight sites in the Eagle Creek drainage including the abundance of each taxon at each site and the values for 13 metrics are provided in Table 4. A total of 89 taxa were collected and identified from these sites. Site 04010002 (Map Number 7) had the greatest number of taxa (40) while Site 04007001 (Map Number 1) had the greatest number of individuals (1255). The highest Shannon Diversity values were found at Sites 04008001 (Map Number 2), 04010005 (Map Number 6), and 04010002 (Map Number 7), and the highest EPT index values were found at Sites 04007002 (Map Number 2), 04010002 (Map Number 7), and 04010003 (Map Number 8). The HBI values for all eight sites were rather consistent (ranging from 4.74 - 5.85). All were within the Fair-Good water quality rating. These values indicated possible NPS organic enrichment throughout the drainage. Agriculture, the predominant landuse in the drainage is a suspected source for this NPS pollution. This is substantiated by the low EPT/Chironomid Index values (ranging from 0.06 - 0.46), and is also correlated to the high percentage of Collector/Filterers and Scrapers functional feeding groups at most sites. A total of 21 EPT taxa were collected from the eight sites. However, the EPT taxa that were collected tend to be the more tolerant taxa associated with the EPT (e.g., *Caenis*, *Isonychia*, *Stenacron*, *Acronuria*, *Cheumatopsyche*, and *Chimarra*). The macroinvertebrate fauna of Eagle Creek is a typical warmwater fauna, which indicated some NPS nutrient enrichment to the system possibly due to agricultural landuse in the drainage.

Table 4. Eagle Creek Macroinvertebrate List Including Abundances and Metric Values

TAXA	SITES							
	1	2	3	4	5	6	7	8
<b>Annelida</b>								
<i>Glossiphonidae</i> sp.	2	3						1
<b>Platyhelminthes</b>				1				
<i>Planaridae</i> sp.		1						
<b>Mollusca</b>								
<i>Corbicula fluminea</i>	6					2	15	
<i>Elimia</i> sp.	183	164		31	65	66	299	1
<i>Ferrissia rivularis</i>		1						
<i>Helisoma</i> sp.	1							
<i>Helisoma anceps</i>		2						
<i>Physella</i> sp.		1						
<i>Pleurocera</i> sp.	9	1			1			
<i>Sphaerium</i> sp.		2						
<b>Arthropoda</b>								
<b>Crustacea</b>								
<i>Hyaella azteca</i>		17					1	
<i>Lirceus fontinalis</i>	3	11	1		4	1	1	
<i>Orconectes rusticus</i>	19	9	11	6	1	20	38	22
<b>Insecta</b>								
<b>Ephemeroptera</b>								
<i>Baetis</i> sp.	50	135	23	168	95	45	139	61
<i>Caenis</i> sp.	1	3			4	1	1	6
<i>Hexagenia</i> sp.							1	
<i>Isonychia</i> sp.	54	2		7	12		42	2
<i>Labiobaetis</i> sp.			9					
<i>Leucrocuta</i> sp.			1		2			
<i>Parcloeodes minutus</i>								2
<i>Procloeon</i> sp.								1
<i>Stenonema</i> sp.		21	30		27	12	14	6
<i>Stenacron interpunctatum</i>	4		3	27	1	6	1	1
<b>Odonata</b>								
<i>Argia</i> sp.		9					23	
<i>Boyeria</i> sp.					1			
<i>Calopteryx</i> sp.			1		1		2	
<i>Cordulegaster</i> sp.	1							
<i>Dromogomphus</i> sp.								3
<i>Epitheca</i> sp.		1						
<i>Libellula</i> sp.							2	

Table 4. Continued.

TAXA	SITES							
	1	2	3	4	5	6	7	8
<b>Plecoptera</b>								
<i>Acroneuria</i> sp.	11			1			9	
<i>Eccoptura xanthenes</i>		2						
<i>Neoperla</i> sp.	1	17	38	59	20	57		23
<b>Heteroptera</b>								
<i>Mesovelgia</i> sp.							3	
<i>Metrobates hesperius</i>	1						7	1
<b>Coleoptera</b>								
<i>Berosus</i> sp.								1
<i>Dineutus</i> sp.	48						2	
<i>Dubiraphia</i> sp.	5	12		1	16	2		1
<i>Ectopria</i> sp.			1					
<i>Haliplus triopsis</i>	2							
<i>Helichus</i> sp.	1							
<i>Helichus lithophilus</i>		1						
<i>Laccophilus</i> sp.					1			
<i>Macronychus glabratus</i>								1
<i>Microcylloepus pusillus</i>							1	
<i>Peltodytes</i> sp.						1		
<i>Psephenus herricki</i>	1	5	7	1	2	11	6	10
<i>Stenelmis</i> sp.	267	76	50	164	42	168	42	85
<i>Tropisternis</i> sp.								1
<b>Megaloptera</b>								
<i>Corydalus cornutus</i>	15	2		2	2		3	
<i>Sialis</i> sp.		7	3	1	6	2	5	3
<b>Trichoptera</b>								
<i>Cheumatopsche</i> sp.	432	36	134	284	192	104	239	41
<i>Chimarra</i> sp.	33	7						
<i>Mystacides</i> sp.		1						
<i>Oecetis</i> sp.		1	5					
<i>Paranyctiophylax</i> sp.			1				2	
<i>Polycentropus</i> sp.		2			5	1		3
<i>Protopila</i> sp.	18							
<i>Pycnopsyche</i> sp.		1				1	4	
<b>Diptera</b>								
<i>Ablablesmyia</i> sp.	3	2	2		2	2		
<i>Anopheles</i> sp.							4	
<i>Axarus</i> sp.	1							
<i>Brillia</i> sp.						2		
<i>Chironomus</i> sp.			2					1
<i>Cricotopus</i> sp.		13	4	7	17	47	5	48
<i>Cryptochironomus</i> sp.	2	1			5	2	3	

Table 4. Continued.

TAXA	SITES							
	1	2	3	4	5	6	7	8
<i>Culex</i> sp.							2	
<i>Dicrotendipes</i> sp.			1			3	16	2
<i>Endochironomus</i> sp.	1							
<i>Glyptotendipes</i> sp.			2				1	
<i>Hemerodromia</i> sp.		1						
<i>Hexatoma</i> sp.				3				
<i>Microtendipes</i> sp.		1	2		4	1	1	
<i>Nilotanypus</i> sp.					1			
<i>Paracricotopus</i> sp.								1
<i>Parakiefferiella</i> sp.								4
<i>Paratendipes</i> sp.						1		
<i>Phaenopsectra</i> sp.		1	1				13	
<i>Polypedilum</i> sp.	20	7	11	21	10	52	22	19
<i>Procladius</i> sp.							1	2
<i>Procladius sublettei</i>								2
<i>Rheocricotopus</i> sp.						1		
<i>Rheotanytarsus</i> sp.		1			4	3	1	2
<i>Simulium</i> sp.	55	20	11	91		3	54	12
<i>Stratiomys</i> sp.								1
<i>Tanytarsus</i> sp.	1		1					
<i>Thienemannimyia</i> gr.			1	1	8	16	1	3
<i>Tipula</i> sp.				1				
<i>Zavrelimyia</i> sp.	4				1			
Total Number of Taxa	33	36	27	21	30	30	40	34
Total Number of Individuals	1255	595	356	877	552	633	1043	373
Shannon Diversity	0.92	1.04	0.96	0.84	0.98	1.02	1.03	1.1
EPT Index	9	12	9	6	9	8	11	10
EPT/Chironomid Index	0.28	0.46	0.33	0.24	0.17	0.06	0.17	0.12
HBI	4.99	5.46	5.28	4.74	5.2	5.51	5.62	5.85
Percent Shredders	1.7	3.6	4.9	3.3	4.9	16.6	3.1	19.1
Percent Collector/Filterers	46.3	11.6	41.6	43.4	38.4	17.9	33.5	15.3
Percent Collector/Gatherers	6.1	29.4	14	23.2	19	12.3	18.5	27.3
Percent Scrapers	38.6	47.2	25.3	22.4	28.1	40.9	39.1	28.2
Percent Predators	6.9	7.7	14.3	7.6	9.6	12.6	5.9	10.7
Percent Piercer/Herbivores	0.2	0	0	0	0	0.2	0	0.3
Percent Piercer/Carnivores	0	0.5	0	0.1	0	0	0	0.3

## SUMMARY OF COMMUNITY ASSESSMENTS

A summary sheet for each site is provided in the Appendix. A summary of the habitat and biological assessments of each site is presented in Table 5. The habitat scores and assessments indicate that all sites are fully supporting of aquatic fauna. This is, therefore, an indication that habitat disturbance within the Eagle Creek drainage is somewhat minimal. The MBI scores indicate that based on the macroinvertebrate community present the Eagle Creek drainage has overall about Fair integrity, and IBI scores show slightly higher ranges indicating overall integrity of Fair to Good. Taking all three measures into account overall Eagle Creek appears to have Fair to Good Biotic Integrity. These results indicate that the habitats necessary to maintain fish and macroinvertebrate communities are sufficiently present in Eagle Creek, but that other perturbations are lowering assessment scores. Based on predominant land use in the drainage, these perturbations are probably the result of agricultural practices.

Table 5. Summary of Habitat and Biological Assessments Scores of all Eagle Creek Sites (FS = Full Supporting; F = Fair; F/G = Fair/Good, P/F = Poor/Fair).

SITE	MAP	HABITAT	MBI	IBI	OVERALL INTEGRITY
04007001	1	158 (FS)	3.2 (F/G)	44 (F)	FAIR/GOOD
04007002	2	158 (FS)	3.0 (F)	48 (G)	FAIR/GOOD
04008001	3	138 (FS)	3.0 (F)	52 (G)	FAIR/GOOD
04007004	4	118 (FS)	2.2 (P/F)	44 (F)	POOR/FAIR
04009001	5	141 (FS)	3.2 (F)	48 (G)	FAIR/GOOD
04010005	6	159 (FS)	2.8 (F)	42 (F)	FAIR
04010002	7	141 (FS)	3.2 (F/G)	52 (G)	FAIR/GOOD
04010003	8	140 (FS)	3.0 (F)	52 (G)	FAIR/GOOD

### **Objective 2: Biological Indicators Sensitive to or Specific for NPS Impacts in Eagle Creek Drainage.**

The fish fauna of Eagle Creek included a number species that KDOW has classified as intolerant. These include the following species: *Lepisosteus osseus*, *Cyprinella whipplei*, *Noturus flavus*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, *Percina phoxocephala*, *Percina maculata*, *Lythrurus fasciolaris*, *Micropterus dolomieu*, *Ambloplites rupestris*, and *Hypentelium nigricans*. The macroinvertebrate fauna includes numerous taxa (i.e.,

EPT taxa) that have been classified as generally intolerant to NPS. The fauna is for the most part a warm water fauna that by its nature consists of a variety of relatively tolerant taxa. A fair representation of the classic intolerant EPT groups were collected. However, even in these groups many of the taxa that were represented were somewhat tolerant (e.g., *Cheumatopsyche*, *Stenonema*).

### **Objective 3: Establish Sites That Will Be Permanently Included in the Ambient Biological Monitoring Program Sampling Rotation**

It is recommended that three sites could be used for permanent ambient biological monitoring. They are Sites 04007002 (Map Number 2), 04010002 (Map Number 7), and 04010003 (Map Number 8); Sites 04007002 (Map Number 2) and 04010002 (Map Number 7) are considered to be slightly better choices. This recommendation is based on both the fish and macroinvertebrate communities at these sites. Sites 04007002 (Map Number 2) and 04010002 (Map Number 7) scored well in a combination of fish species richness and IBI scores, Site 04010003 (Map Number 8) scored well in species richness, but did not score as well for the IBI; it scored in the Fair category for water quality. In macroinvertebrate metrics all three sites scored well in total number of taxa, Shannon Diversity, and the EPT Index. It is also thought that since Sites 04010002 (Map Number 7) and 04007002 (Map Number 2) represent, respectively, upstream and downstream sections of the drainage that they would be good sites for long term ambient sampling.

### **Objective 4: Identify Sites That Are the Most Severely Impacted by NPS So That Resources Can Be Directed Toward Remediation of Those Impacts.**

It should be noted that the results for fish and macroinvertebrate community assessments for all sites with the possible exception of Sites 04007002 (Map Number 2) and 04010002 (Map Number 7) were remarkably similar in several of the metrics (e.g., Total Number of Taxa, EPT Index, and HBI values) that it is very difficult to discern which sites are the most impacted. Based on macroinvertebrate metrics, Site 04007004 (Map Number 4) would appear to be the most impacted site that was sampled. It had the lowest species richness, Shannon Diversity and EPT Index values. In addition, Site 04007004 (Map Number 4) had one of the lowest IBI scores (44) and the lowest Habitat Score (118). Because Site 04007004 (Map Number 4) lies between Sites 04007002 (Map Number 2) and 04010002 (Map Number 7), the sites recommended for long term ambient sampling, it is recommended that Site Site 04007004 (Map Number 4) be used for remediation of NPS impacts.

## **SUMMARY AND CONCLUSIONS**

A total of eight sites within the Eagle Creek drainage system of the Kentucky River Basin were successfully sampled during the summer of 1998. These sites were sampled for fish and macroinvertebrates in order to make an assessment of the water quality of this system. The biological samples were returned to Eastern Kentucky University where they were sorted, identified, enumerated and analyzed according to KDOW QA/QC protocols. The data were entered into the biological database of KDOW, and have been reported within this document. The data analysis included taxa lists and taxa abundances for fish and macroinvertebrates. In addition, a number of metrics were calculated for both fish and macroinvertebrate samples. These included IBI values for fish, and for macroinvertebrates the Total Number of Taxa, Total Number of Individuals, Shannon Diversity, EPT Index, EPT/Chironomid Index, HBI, and percentage composition of each functional feeding group were included.

It was learned that Eagle Creek is a warmwater stream with a typical warmwater fauna. It was also determined that some NPS pollution enters the stream. This is in the form of organic enrichment due to agricultural practices within the drainage, which is the main landuse in the area. Three sites have been recommended as possible long term ambient sampling sites. These included Sites 04007002 (Map Number 2), 04010002 (Map Number 7) and 04010003 (Map Number 8). Site 04007004 (Map Number 4) was identified as probably the most impacted of the 8 sites in the drainage. It would benefit from further and more intensive monitoring.

The final conclusions are that the Eagle Creek drainage within the Kentucky River Basin is moderately impacted by NPS pollution which is possibly due to agriculture. The bioassessments of both the fish and macroinvertebrate communities indicate an overall status of Fair/Good water quality for the drainage.

## **APPENDIX**

**ASSESSMENT SHEETS FOR EACH SAMPLING SITE ON EAGLE CREEK**



## Eagle Creek Map Number One

Location:	Eagle Creek, near Eagle Valley recreation area				
County:	Owen			Date sampled:	8/28/98
Site Number:	04007001	Secondary No:		Mile point:	7.0
Stream Order:	6	Latitude:	38-37-53	Longitude:	84-59-52
Ecoregion:	Interior Low Plateau			Drainage area:	490
USGS topo:				GNIS:	
11-digit HUC				WQ sample date:	
Assessed reach:				Miles assessed:	

### Habitat Assessment

An assessment of the habitat at this site indicated an optimal degree of embeddedness, velocity/depth regime, sediment deposition, channel flow status, channel alteration, and frequency of riffles. A score of 158 was calculated using the Rapid Bioassessment Protocol habitat field data sheets. Bank stability of the left and right banks were suboptimal. Vegetative protection ranged from marginal on the left bank to suboptimal on the right bank. The riparian vegetative zone width was suboptimal on the left and right banks. Stream morphology consisted of 90% pools, 7% riffles, and 3% runs.

### Macroinvertebrate Assessment

A total of 1,255 individuals were collected. Thirty - three species of macroinvertebrates representing 11 orders were identified. Diptera was the most diverse order. The macroinvertebrates present were primarily comprised of collector/filterers. The MBI score was 3.2, which is ranked as Fair/Good. The high numbers of EPT individuals relative to the total number of individuals were responsible for this score. However, *Cheumatopsyche* sp. is a highly tolerant Trichoptera that was present in high numbers (432) and was responsible for raising the EPT individuals to total number of individuals ratio. This may indicate that this matrix is not a very accurate indicator of the health of this site. Other nutrient tolerant taxa were present in high numbers at this site, including *Dubiraphia* sp. (267 individuals), and *Elimia* sp. (183 individuals). One relatively intolerant organism that was notably present was *Neoperla* sp. (one individual).

### Fish Community Assessment

Sixteen species of fishes representing eight families were collected. Cyprinidae was the most diverse family with six species, followed by Percidae with four. A combination of a relatively lower number of sucker species, lower number of darter species, and lower number of top carnivore species were responsible for this site having a lower IBI score than recorded in 1990. Notable fishes in the collection were the following KDOW - classified intolerant species: *Lepisosteus osseus*, *Cyprinella whipplei*, *Noturus flavus*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina phoxocephala*. The IBI score was 44, classifying the site as Fair.

## Eagle Creek Map Number Two

Location:	Eagle Creek, at ST 127 bridge at Glencoe				
County:	Owen/Gallatin	Date sampled:	8-28-98		
Site Number:	04007002	Secondary No:	Mile point:	21.50	
Stream Order:	6	Latitude:	38-42-22	Longitude:	084-49-32
Ecoregion:	Interior Low Plateau		Drainage area:	437.0	
USGS topo:			GNIS:		
11-digit HUC			WQ sample date:		
Assessed reach:			Miles assessed:		

### Habitat Assessment

An assessment of the habitat at this site indicated an optimal degree of epifaunal substrate/available cover, embeddedness, velocity/depth regime, channel flow status, and channel alteration. Vegetative protection and riparian zone width was considered optimal on the left bank, and marginal on the right bank. A score of 158 was calculated using the Rapid Bioassessment Protocol habitat field data sheets, which ranked this site as Full Supporting. The stream morphology consisted of 40% pools and runs, and 20% riffles.

### Macroinvertebrate Assessment

A total of 595 individuals were collected. Thirty-six taxa of macroinvertebrates representing nine orders were identified. Diptera was the most diverse order. The macroinvertebrates were comprised primarily of scrapers. The MBI score was 3.0, which is ranked as Fair. The high percentage of the top five taxa were responsible for this low score. Notable taxa were *Elimia* sp., *Baetis* sp., and *Stenelmis* sp., which occurred in high numbers, and are all tolerant to nutrient enrichment.

### Fish Community Assessment

Fifteen species of fishes representing six families were collected. Cyprinidae, Centrarchidae, and Percidae each were represented by four species. The same IBI score was recorded for this site in both 1990 and 1998. In 1998, a lower number of total species, intolerant species, and top carnivore species were found. However, more individuals and a greater percentage of insectivores were recorded for 1998. Notable fishes in the collection were the following KDOW-classified intolerant species: *Cyprinella whipplei*, *Hypentelium nigricans*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina phoxocephala*. The IBI score was 48, classifying this site as Good.

## Ten Mile Creek Map Number Three

Location:	Ten Mile Creek, at SR 467 near mouth		
County:	Grant	Date sampled:	7-10-98
Site Number:	04008001	Secondary No:	Mile point: 0.25
Stream Order:	5	Latitude:	38-42-53
Longitude:	84-44-58		Drainage area: 67.0
Ecoregion:	Interior Plateau		GNIS: 485704
USGS topo:			WQ sample date:
11-digit HUC:			Miles assessed:
Assessed reach:			

### Habitat Assessment

An assessment of the habitat at this site indicated an optimal degree embeddedness and channel alteration. Frequency of riffles, and bank stability were considered marginal. A score of 138 was calculated using the Rapid Bioassessment Protocol habitat assessment field data sheets, which ranked this site as Fully Supporting. The stream morphology consisted of 33% riffles, runs, and pools.

### Macroinvertebrate Assessment

A total of 356 individuals were collected. Twenty - seven taxa representing seven orders were identified. Diptera was the most diverse order. The macroinvertebrates present primarily consisted of collector/filterers. The MBI score was 3.0 which is ranked as fair. This score is a result of all criteria being near the Fair range. This community was dominated by taxa that are tolerant to nutrient high streams including *Cheumatopsyche* sp., *Stenelmis* sp., and *Stenonema* sp. A notable exception was *Neoperla* sp., a less tolerant organism that was present in high numbers.

### Fish Community Assessment

Seventeen species of fishes representing seven families were collected. Cyprinidae was the most diverse family with five species, followed by Centrarchidae and Percidae with four species each. An increase in the percent of insectivores, and a decrease of omnivores contributed to the higher IBI score for this site in 1998. A relatively lower number of sucker species and simple lithophils impacted the IBI score for this site. Notable fishes in the collection were the following KDOW - classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Hypentelium nigricans*, *Noturus miurus*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina phoxocephala*. The IBI score was 52, classifying the site as Good.

## Eagle Creek Map Number Four

Location:	Eagle Creek, at SR 1132 bridge				
County:	Grant	Date sampled:	08-28-98		
Site Number:	04007004	Secondary No:			
Stream Order:	5	Latitude:	38-41-08	Longitude:	84-45-12
Ecoregion:	Interior Low Plateau		Drainage area:	319.6	
USGS topo:			GNIS:	491407	
II-digit HUC			WQ sample date:		
Assessed reach:			Miles assessed:		

### Habitat Assessment

An assessment of the habitat at this site yielded no optimal habitat conditions for any habitat parameter on the Rapid Bioassessment Protocol habitat assessment field data sheet. A score of 118 indicated that the site is Fully Supporting. Embeddedness, sediment deposition, channel alteration, frequency of riffles, bank stability, and vegetative protection were considered suboptimal. The stream morphology consisted of 50% runs, and 25% riffles and pools.

### Macroinvertebrate Assessment

A total of 877 individuals were collected. Twenty - one taxa of macroinvertebrates were identified representing 10 orders. Diptera was the most diverse order. The macroinvertebrates present were primarily comprised of collector/filterers. The MBI score was 2.2 which ranked this site as Poor/Fair. The low taxa richness and high percentage of five dominant taxa contributed to the low score. This site was dominated by nutrient tolerant organisms such as *Cheumatopsyche* sp. and *Baetis* sp. A notable exception was *Neoperla* sp., a less tolerant organism which was present in the top five percent.

### Fish Community Assessment

Eighteen species of fishes representing six families were collected. Cyprinidae was the most diverse family with six species, followed by Centrarchidae with five. A combination of a low number of darter, sucker, intolerant, and simple lithophil species, and a greater number of fishes with anomalies were responsible for this site having a relatively low IBI score. Notable fishes in the collection were the following KDOW - classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Noturus flavus*, *Ambloplites rupestris*, *Lepomis megalotis*, and *Etheostoma blennioides*. The IBI score was 44, classifying the site as Fair.

## Clark's Creek Map Number Five

Location:	Clark's Creek, at Fords Mill Road				
County:	Owen			Date sampled:	7-9-98
Site Number:	04009001	Secondary No:		Mile point:	0.85
Stream Order:	4	Latitude:	38-39-52	Longitude:	84-42-53
Ecoregion:	Interior Low Plateau			Drainage area:	
USGS topo:				GNIS:	
11-digit HUC				WQ sample date:	
Assessed reach:				Miles assessed:	

### Habitat Assessment

Habitat assessment indicated an optimal degree of epifaunal substrate/available cover, embeddedness, sediment deposition, and channel flow status. A score of 141 was calculated using the Rapid Bioassessment Protocol habitat field data sheets, which ranked the site as Fully Supportive. The riparian zone width of the left and right banks and channel alteration scores were marginal. There was a gravel removal operation in place at this site, and erosion was ranked as moderate. The stream morphology was 33% riffles, runs, and pools.

### Macroinvertebrate Assessment

A total of 552 individuals were collected. Thirty taxa of macroinvertebrates representing 10 orders were identified. Diptera was the most diverse order. The macroinvertebrates present were primarily comprised of collector/filterers. The MBI score was 3.2 which ranked this site as Fair. The score was a result of a high percentage of the top five taxa which lowered the score and high percentage of EPT taxa, which helped to raise the score. This site was dominated by nutrient tolerant organisms such as *Cheumatopsyche* sp. and *Baetis* sp. A notable exception was high numbers of *Neoperla* sp., a less tolerant organism.

### Fish Community Assessment

Sixteen species of fishes representing six families were collected. Centrarchidae was the most diverse family with five species, followed by Cyprinidae and Percidae with four species each. In 1998 a greater number of darter, intolerant, and simple lithophil species, and an increase in the percent of insectivores was recorded. Along with a decrease in the percent of fishes with anomalies, these factors resulted in a higher IBI score for this site in 1998 compared to 1990. A relatively lower number of sucker species, and higher number of tolerant species were responsible for this site having a low IBI score. Notable fishes in the collection were the following KDOW - classified intolerant species: *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Micropterus dolomieu*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina maculata*. The IBI score was 48, classifying the site as Good.

## Eagle Creek Map Number Six

Location:	Eagle Creek, 1.1 mi SE of Needmore, KY at Fortner Ridge Road				
County:	Owen			Date sampled:	
Site Number:	04010005	Secondary No:		Mile point:	53.45
Stream Order:	4	Latitude:	38-33-50	Longitude:	84-43-32
Ecoregion:	Interior Low Plateau			Drainage area:	
USGS topo:				GNIS:	
11-digit HUC				WQ sample date:	
Assessed reach:				Miles assessed:	

### Habitat Assessment

An assessment of the habitat at this site indicated that all four velocity/depth regimes were present, and sediment deposition, and channel alteration were at optimal levels. The bank stability of the left and right banks were considered suboptimal. Overall erosion was ranked as moderate. A score of 159 was calculated using the Rapid Bioassessment Protocol habitat assessment field data sheets, which ranked this site as Fully Supporting. The stream morphology consisted of 40% riffles and pools, and 20% runs.

### Macroinvertebrate Assessment

A total of 633 individuals were collected. Thirty taxa of macroinvertebrates representing nine orders were identified. Diptera was the most diverse order. The macroinvertebrates were primarily comprised of scrapers. The MBI score was 2.8 which ranked this site as Fair. The score was a result of few EPT taxa and a high percentage of tolerant taxa. The site was dominated by taxa tolerant to nutrient enrichment such as *Stenelmis* sp. and *Cheumatopsyche* sp. A notable exception was *Neoperla* sp., which was a less tolerant organism present in high numbers.

### Fish Community Assessment

Thirteen species of fishes representing three families were collected. Cyprinidae was the most diverse family with six species, followed by Centrarchidae with four and Percidae with three. This site had the lowest IBI score of the 1998 Eagle Creek survey. A decrease in the total number of species, sucker species, top carnivore species, and simple lithophils contributed to the low IBI score. There was a decrease in the percentage of omnivores and an increase in the percentage of insectivores compared to the 1990 results. Notable fishes in the collection were the following KDOW - classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Lepomis megalotis*, *Etheostoma blennioides*, and *Percina maculata*. The IBI score was 42, classifying the as Fair; this site had the lowest IBI score within the study.

## Eagle Creek Map Number Seven

Location:	Eagle Creek, Natlee at SR 607		
County:	Owen	Date sampled:	7-9-98
Site Number:	04010002	Secondary No:	Mile point: 70.40
Stream Order:	3	Latitude:	38-26-47 Longitude: 84-39-49
Ecoregion:	Interior Low Plateau		Drainage area: 124
USGS topo:			GNIS:
11-digit HUC			WQ sample date:
Assessed reach:			Miles assessed:

### Habitat Assessment

Habitat assessment indicated an optimal degree of channel alteration and optimal channel flow. Sediment deposition and frequency of riffles were ranked as marginal. A score of 141 was calculated using the Rapid Bioassessment Protocol habitat field data sheets, which ranked the site as Fully Supportive. Erosion at the sight was considered slight. The stream morphology was 80% pools, 15% runs, and 5% riffles.

### Macroinvertebrate Assessment

A total of 1,043 individuals were collected. Forty taxa of macroinvertebrates representing 13 orders were identified. The macroinvertebrates present were primarily comprised of scrapers. Diptera was the most diverse order present. The MBI score was 3.2 which ranked this site as Fair/Good. The score was brought down by a high percentage of only a few dominant taxa. The high numbers of EPT individuals relative to the total number of individuals were responsible for this score. However, *Cheumatopsyche* sp. is a highly tolerant Trichopteran that was present in high numbers (239) and was responsible for raising the EPT individuals to total number of individuals ratio. This may indicate this metric is not a very accurate indicator of the health of this site. Other nutrient tolerant taxa were present in high numbers at this site, including *Cheumatopsyche* sp., *Elimia* sp., and *Baetis* sp.

### Fish Community Assessment

Twenty species of fishes representing six families were collected. Cyprinidae was the most diverse family with seven species, followed by Centrarchidae and Percidae with five. A greater number of darter species and sucker species were responsible for the higher IBI score recorded in 1998 than 1990. A combination of a lower number of intolerant and simple lithophil species, and an increase in the percentage of omnivores were responsible for not scoring excellent on the IBI. Notable fishes in the collection were the following KDOW - classified intolerant species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina maculata*. The IBI score was 52, classifying the site as Good.

## Eagle Creek Map Number Eight

Location:	Eagle Creek, at Pokeberry Rd		
County:	Scott	Date sampled:	7-09-98
Site Number:	04010003	Secondary No:	Mile point: 79.8
Stream Order:	3	Latitude:	38-24-25 Longitude: 84-35-41
Ecoregion:	Interior Low Plateau		Drainage area: 66.0
USGS topo:		GNIS:	
11-digit HUC		WQ sample date:	
Assessed reach:		Miles assessed:	

### Habitat Assessment

An assessment of the habitat at this site indicated optimal epifaunal substrate/available cover, embeddedness, velocity/depth regime, channel alteration, and frequency of riffles. Left and right bank stability was ranked as poor. Vegetative protection of the left and right banks was considered marginal. A score of 140 was calculated using the Rapid Bioassessment Protocol habitat assessment field data sheets, which ranked this site as Fully Supporting. The stream morphology of this site consisted of 50% pools, 30% riffles, and 20% runs.

### Macroinvertebrate Assessment

A total of 373 individuals were collected. Thirty-four taxa of macroinvertebrates representing eight orders were identified. Diptera was the most diverse order. The macroinvertebrates present were primarily comprised of scrapers. The MBI score was 3.0 which ranked this site as Fair. This site was dominated by nutrient tolerant organisms including *Cheumatopsyche* sp., *Stenelmis* sp., and *Cricotopus* sp. A notable exception was *Neoperla* sp., a less tolerant organism which was present in the top 5 percent.

### Fish Community Assessment

Twenty-two species of fishes representing five families were collected. Cyprinidae was the most diverse family with ten species, followed by Centrarchidae with six and Percidae with five. This site had a higher IBI score in 1998 than 1990. This resulted from an increase in intolerant and simple lithophil species: *Cyprinella whipplei*, *Lythrurus fasciolaris*, *Ambloplites rupestris*, *Lepomis megalotis*, *Etheostoma blennioides*, *Percina caprodes*, and *Percina maculata*. The IBI score was 52, classifying the site as Good.



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