File

WATER QUALITY DEMONSTRATION STUDY

BIG WILLS CREEK
FORT PAYNE, ALABAMA
1986 AND 1991

SPECIAL STUDIES SECTION
FIELD OPERATIONS DIVISION
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

WATER QUALITY DEMONSTRATION STUDY
BIG WILLS CREEK AT FORT PAYNE, ALABAMA

INTRODUCTION

The City of Fort Payne, Alabama utilizes Big Wills Creek as a receiving stream for the treated effluent from its municipal wastewater treatment facility (WWTP). During the period from September 1987 to August 1989, the City of Fort Payne underwent construction to upgrade the old disposal plant. Staff members of the Special Studies Section, Field Operations Division of the Alabama Department of Environmental Management (ADEM), at the request of the Municipal Branch of the Water Division of ADEM, conducted a water quality demonstration study to assess the effects of the new treatment facility on Big Wills Creek.

EPA CONSTRUCTION GRANTS PROGRAM

Since 1972, approximately $545 million dollars in EPA grant funds have been expended toward construction of municipal wastewater treatment works in Alabama. The City of Fort Payne, located in Dekalb county, recieved an EPA Construction Grant for the improvement of the Fort Payne WWTP and collection system.

The City of Fort Payne recieved an EPA Step III Grant in September of 1987 for the construction of an upgrade/expansion of its' WWTP from two million gallons per day (mgd) of secondary treatment capacity to four mgd of treatment capacity. The upgrade and expansion of the WWTP was completed in August 1989. The total construction cost was approximately $5,448,570 and consisted of three seperate contracts. Of this total, the EPA Grant funding was approximately $3,601,125.

The project engineer was Ladd Environmental Consultants, Inc. of Fort Payne, Alabama. The construction company for Contract I was Roland Pugh Construction Company, Inc. of Northport, Alabama; for Contract II was Garney Companies, Inc. of Kansas City, Missouri; and for Contract III was Cajun Contractor and Engineers, Inc. of Baton Rouge, Louisiana. New construction on the Fort Payne WWTP included the expansion/rehabilitation of the influent pumping station, bar screens and grit/grease removal, mechanical aerators/mixers, horizontal shaft rotary screen primary solids removal unit, super-rate roughing filters with synthetic media, two final clarifiers, sludge drying beds, chlorination/dechlorination facilities, and an effluent cascade with flow monitoring and sampling capabilities. New construction on the Fort Payne transport and collection system included elimination of the Beason Branch pump station and the installation of a twenty-four inch interceptor line, installation of the Airport pump station and force main, and the construction of the Vulcraft pump station and force main.

The upgrade of the Fort Payne WWTP was needed due to hydraulic and organic overloading, and augmented an existing extended aeration activated sludge treatment system originally designed to provide secondary treatment. In the modified and upgraded system,

wastewater first enters the bar screen and grease/grit removal system for preliminary treatment, is pumped to the rotary screens and then flows to the super-rate roughing filters (synthetic media). Next the wastewater flows through the extended aeration basin and then to the final clarifier. After the treated wastewater is chlorinated, it proceeds through a chlorine contact chamber and is then dosed with sulfur dioxide and discharged over a gravity step effluent aeration unit. The final discharge flows via the outfall line to Big Wills Creek.

NPDES permit limits for the 4.0 mgd WWTP are as follows:

Flow	4.0 mgd
BOD_5	20 mg/L
TSS	30 mg/L
NH_3-N	2 mg/L
D.O. (min)	6 mg/L

Average monthly performance by the treatment facility for the period from January 1991 to December 1991 is as follows:

Flow	2.034 mgd
BOD_5	6.0 mg/L
TSS	15.4 mg/L
NH_3-N	0.61 mg/L
D.O.	7.1 mg/L

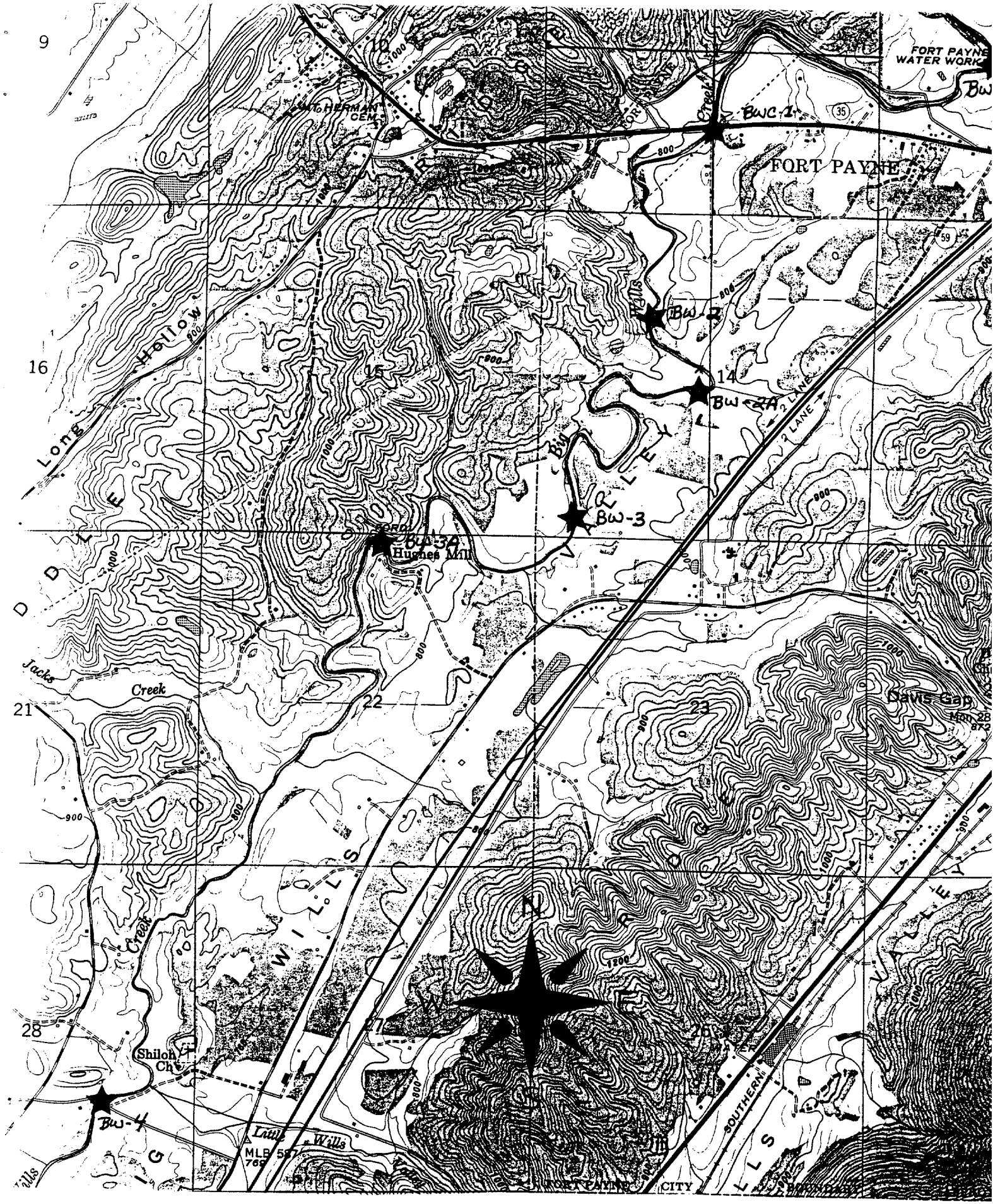
FIELD OPERATIONS

During the period of July 1986 to September 1986, staff members of the Special Studies Section collected data to establish conditions and provide a comparative base of information on Big Wills Creek prior to construction and implementation of the new treatment plant. During June to September 1991, data were collected to demonstrate the improvement, if any, of water quality in the receiving stream attributable to the new plant.

SAMPLING LOCATIONS AND METHODOLOGY

Sampling locations and chemical data acquired during the Big Wills Creek Wasteload Allocation were utilized as background material for this WQDS. The station names and locations were as follows:

STATION	LOCATION:
BW-1	Big Wills Creek at Ft. Payne Water Works.
(control)	T7S,R8E,S12,NW1/4,SE1/4
	Latitude: 34 26 42.0 Longitude: 085 45 03.0
BW-2	Big Wills Creek upstream of Ft. Payne STP.
(control)	T7S,R8E,S14,NE1/4,SW1/4
	Latitude: 34 25 23.0 Longitude: 085 46 11.0
BW-3	Big Wills Creek
	T7S,R8E,S14,SW1/4,SW1/4
	Latitude: 34 25 09.0 Longitude: 085 47 03.0
BW-4	Big Wills Creek at Shiloh Church



BIG WILLS CREEK
Sampling Locations

MAP 1

T7S,R8E,S28,SE1/4,SW1/4
Latitude: 34 23 38.0 Longitude: 085 47 52.0

In 1991, four sampling locations were selected and utilized for data collection during the water quality demonstration study. The station names and locations were as follows:

STATION	LOCATION:
BWC-1 (control)	Big Wills Creek at Alabama Highway 35 crossing. T7S,R8E,S11,SE1/4,NE1/4. Latitude: 34 26 17.0 Longitude: 085 46 01.0
BW-2A	Big Wills Creek approximately 100 yds downstream of WWTP. T7S,R8E,S14,NW1/4,SE1/4 Latitude: 34 25 52.1 Longitude: 085 45 47.5
BW-3A	Big Wills Creek at Hughes Mill T7S,R8E,S22,NE1/4,NW1/4 Latitude: 34 25 27.0 Longitude: 085 46 25.0
BW-4	Big Wills Creek at Shiloh Church T7S,R8E,S28,SE1/4,SW1/4 Latitude: 34 23 38.0 Longitude: 085 47 52.0

All physical data, chemical and biological sampling, sample handling techniques, and field parameter analyses utilized in the acquisition of data for this water quality demonstration study were as described in the Field Operations Standard Operating Procedures and Quality Control Assurance Manual (Field Operations Division, ADEM, Volumes 1 and 2), as amended. Chain- of-custody was maintained by locking the samples in a Departmental vehicle when not in sight of a Field Operations employee. The samples requiring laboratory analysis were transported to the ADEM Environmental Laboratory in Montgomery, Alabama. Analysis methodology were as specified in the Federal Register, 40 CFR Part 136, October 1984, as amended. Analysis of the samples yielded the data which are reported in Tables 2 and 3.

DISCUSSION AND RESULTS

A. PHYSICAL

Big Wills Creek is a fourth order stream over the length of the study reach. It drains agricultural, commercial, field/pasture, and forested lands (see Tables 1, 1A, 1B) and falls within the Interior Plateau Ecoregion. Big Wills Creek has canopy cover which varies from completely open to mostly shaded, has trees and shrubs as the dominant type of streamside vegetation and has moderately stable banks. Bottom structure is largely dominated by boulder, gravel, cobble, and sand substrates. Flows are usually greater than five cfs, even during low flow conditions. Big Wills Creek exhibits signs of erosion to varying degrees, but shows no channel alteration. Multiple habitats suitable for colonization by aquatic macroinvertebrates are abundant and, Habitat Assessments rated this stream as GOOD to EXCELLENT, depending on the location evaluated. It should be noted that shortly after the initiation of the after portion of this study, highway construction began at the Alabama

Highway 35 location. This may have contributed to a slight degradation of habitat and water quality conditions in the stream. Big Wills Creek lies within the Coosa River drainage basin.

B. CHEMICAL

The Water Use Classification for Big Wills Creek is Fish and Wildlife (F&W). F&W designates the waters to be suitable for fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water contact sports or as a source of water supply for drinking or food processing purposes.

As shown in Table 2, and Figure 1, data collected prior to the upgrade of the treatment plant indicated that the waters in Big Wills Creek below the Fort Payne WWTP were not meeting the dissolved oxygen standard for the F&W classification (5.0 mg/L). Very minor changes were noted in the pH data (Table 2, Figure 2) collected in the stream. Biochemical Oxygen Demand (BOD_5), Ammonia (NH_3), Total Kjeldahl Nitrogen (TKN), Total Organic Nitrogen (TON), and Phosphates (PO_4) were all shown to have increases as compared to the upstream stations (Table 2, Figures 3, 5, and 6).

Chemical data collected on Big Wills Creek after the upgrade indicated that, as compared to the before data, water quality was only slightly improved. Dissolved Oxygen concentrations (Table 3, Figure 1) exhibited a substantial increase. In addition, BOD_5, NH_3, TKN, and TON showed reductions in concentration (Table 3, Figures 3, 5, and 6). Sample analysis, however, also indicated that, when compared to the upstream station, Chlorides (Cl), Total Dissolved Solids (TDS), Nitrates (NO_3) and Phosphates (PO_4) all increased (Table 3, Figures 4, 5, and 6). Conductivity also increased dramatically downstream of the WWTP (Table 3, Figure 2).

Flow data collected (Tables 2 and 3, Figure 2) after the upgrade of the WWTP was observed to be three to four times greater than flow data collected before the upgrade. This may have contributed to the improvements noted in certain parameters, due to increased volumes of water. Non-point source effects from increased flow, as well as highway construction upstream of the WWTP, may have contributed to degradation noted in certain parameters.

Discharge Monitoring Report (DMR) data recieved from the Fort Payne WWTP (Table 9, Figure 11) confirms that while Biochemical Oxygen Demand and Ammonia concentrations have been reduced, Phosphates and Nitrogen have increased dramatically.

C. BIOLOGICAL

An assessment of Big Wills Creek water quality would be incomplete without considering impacts to the biological communities. The aquatic macroinvertebrate community was sampled using the RBP-Multihabitat method to substantiate the physical, and chemical data and to provide an aspect that reflects pollution response over time.

A complete listing of the taxa collected during this water quality demonstration study has been included behind the Tables section of this report. However, in order to provide results which accurately assess the sampling locations, biological metrics (Tables

4 to 7, Figures 7 to 10) were used to analyze only the raw macroinvertebrate data collected at similar habitats. Table 8 provides a simplified interpretation of these metrics and should be referred to in the following discussion.

As demonstrated in Tables 4, 5, and 6 and Figure 7, macroinvertebrates collected on Big Wills Creek immediately downstream of the WWTP discharge, showed a reduction in the overall number of taxa present, and in the generally pollution intolerant Ephemeroptera, Plecoptera and Trichoptera (EPT) families. At BW-3, however, the EPT families had recovered and taxa richness was recovering. Community structure (Figure 8) was observed to be well balanced with all major functional feeding groups present. Species Diversity, and Equitability (Figure 9) increased as compared to BWC-1, supporting the conclusion of improving water quality. Of the Similarity Indices, all metrics (Table 7) indicated that aquatic macroinvertebrate communities at all stations were similar.

In contrast, the Biotic Index, as compared to BCW-1, was higher indicating a slight deterioration in water quality. The EPT to EPT/Chironomidae ratio experienced a decrease, and the Shredders to Total ratio and the Scrapers to Scrapers/Collector-Filterers ratio show substantial changes as compared to background.

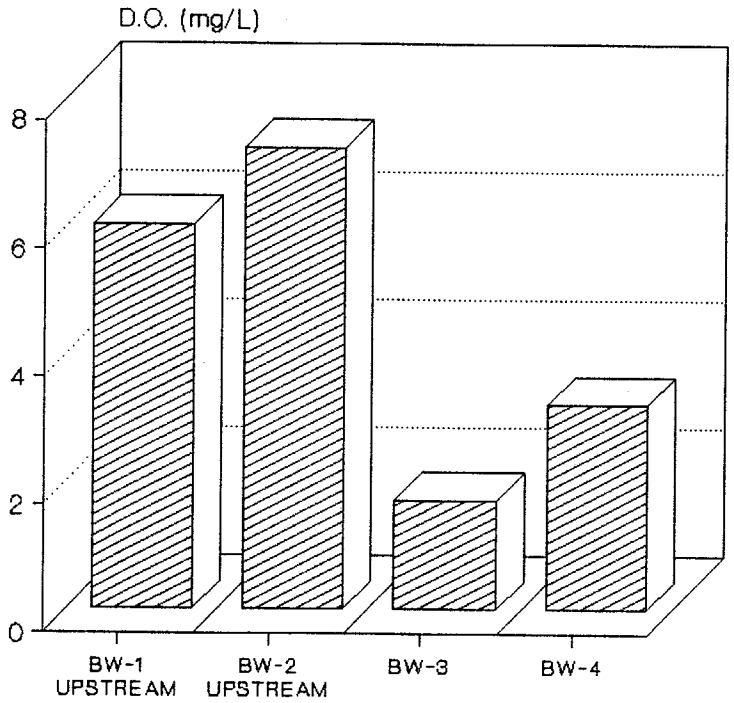
Biological data from the area of Big Wills Creek downstream of the WWTP discharge reflects slight negative affects from the effluent.

CONCLUSIONS

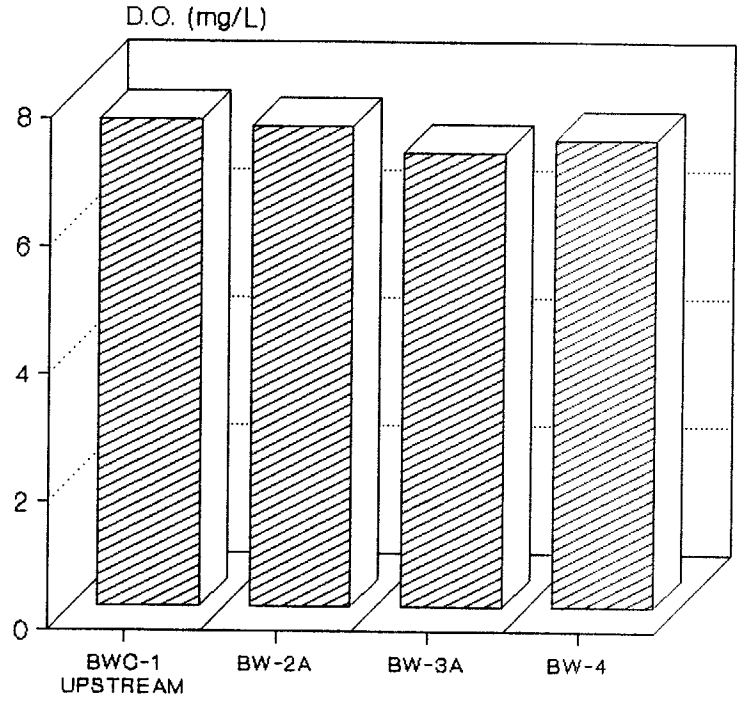
Physical, chemical, and biological data collected before and after the upgrade of the Big Wills Creek wastewater treatment plant indicate that Big Wills Creek, while meeting its' requirements for the Fish and Wildlife Water Use Classification, has experienced a slight deterioration in overall water quality below the treatment plant discharge. Increased flows attributable to multiple precipitation events, non-point source considerations, and increased nutrient loading by the Ft. Payne WWTP have adversely impacted the chemical and biological integrity of this stream.

FIGURE 1
BIG WILLS CREEK
DISSOLVED OXYGEN DATA

BEFORE WWTP UPGRADE

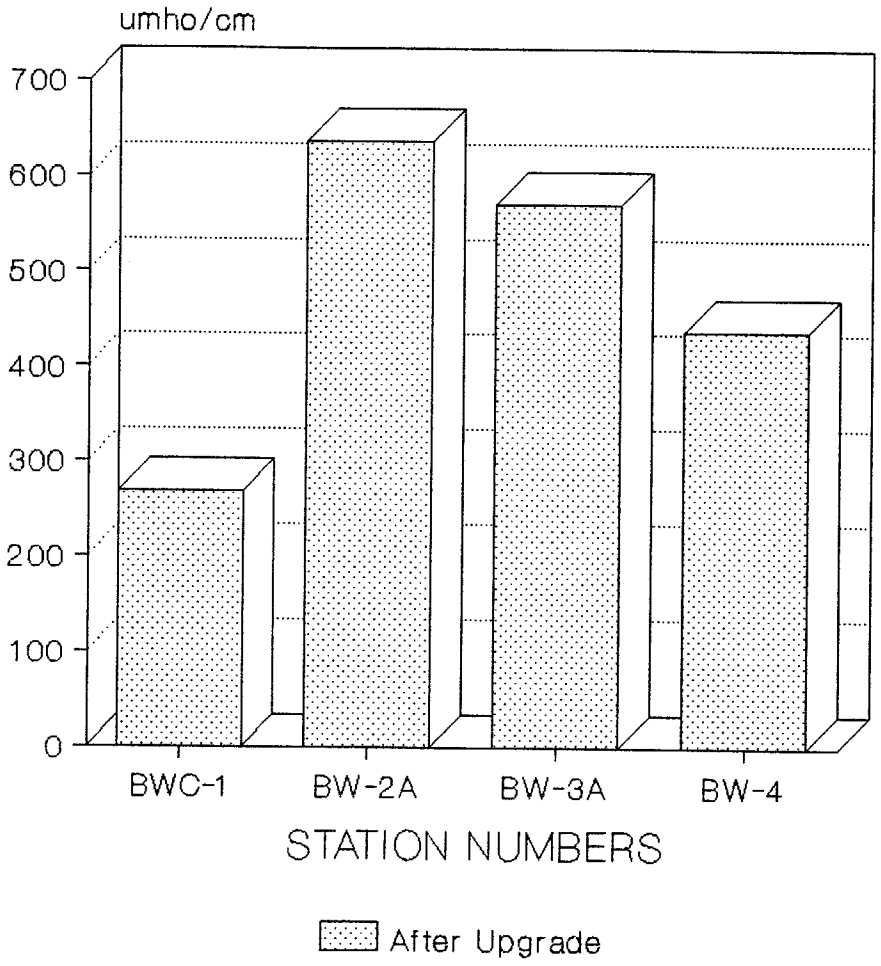


AFTER WWTP UPGRADE



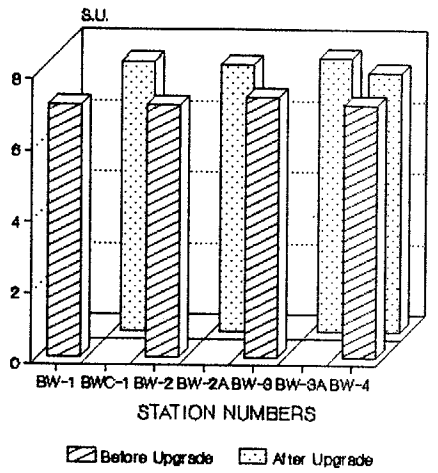
THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

FIGURE 2
BIG WILLS CREEK
CONDUCTIVITY DATA



THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

pH DATA



FLOW DATA

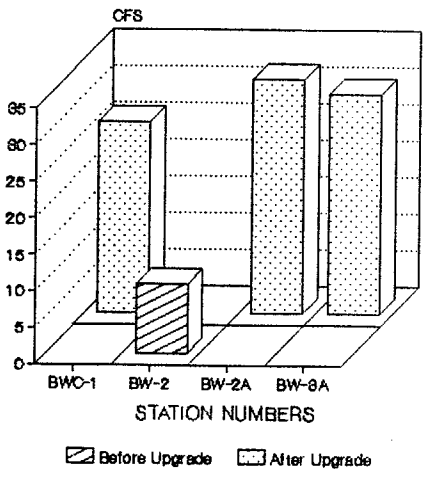
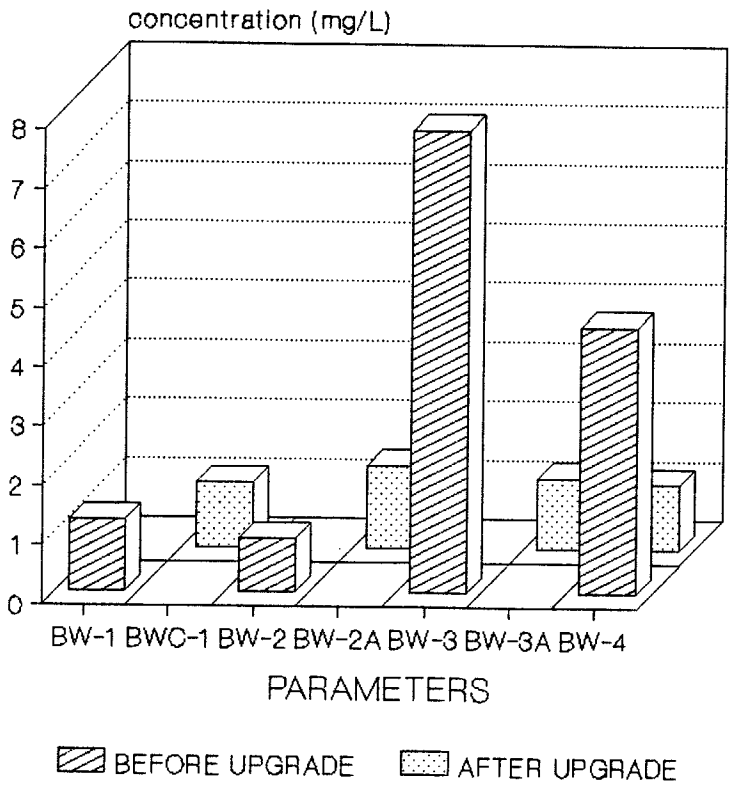
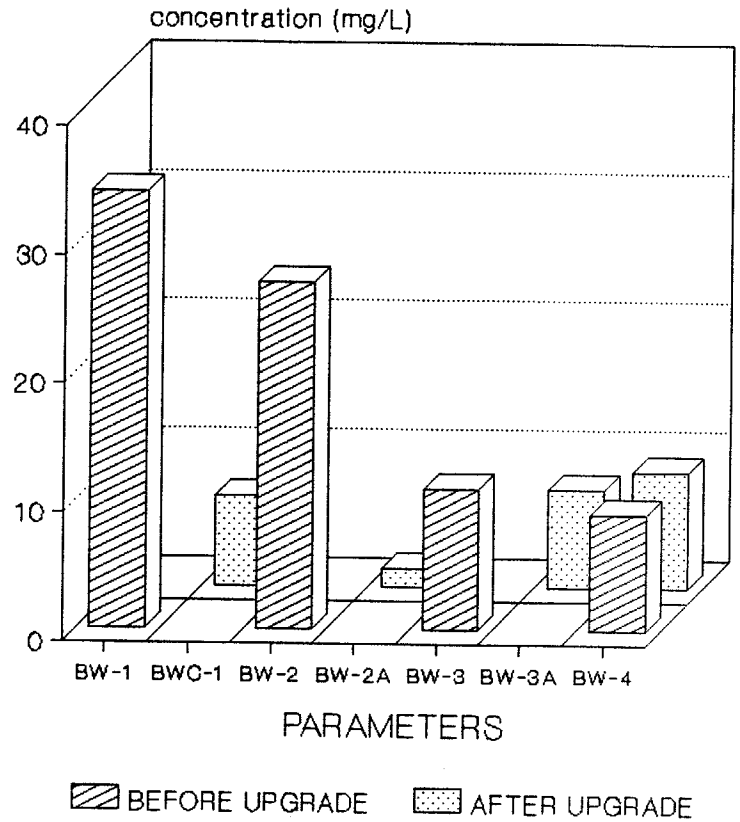


FIGURE 3
BIG WILLS CREEK
CHEMICAL ANALYSIS DATA

BIOCHEMICAL OXYGEN DEMAND (5 DAY)



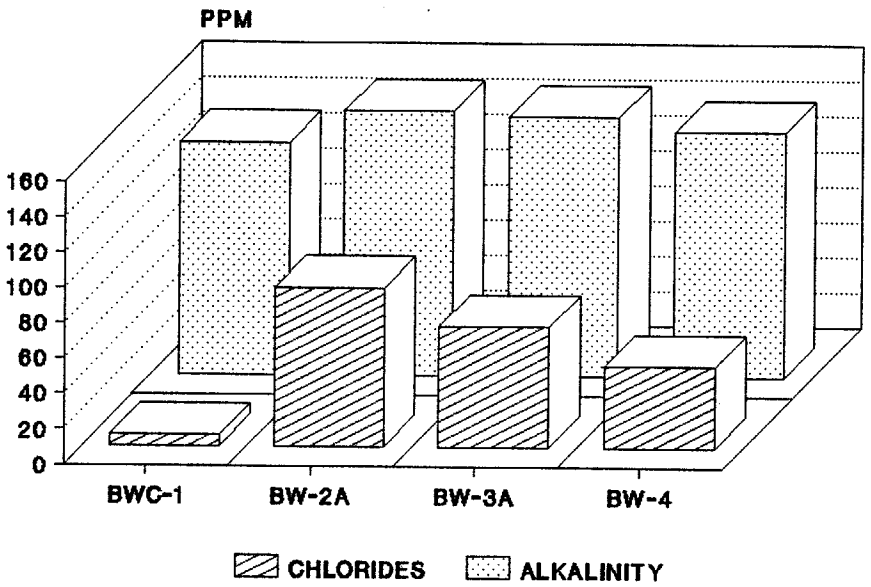
TOTAL SUSPENDED SOLIDS

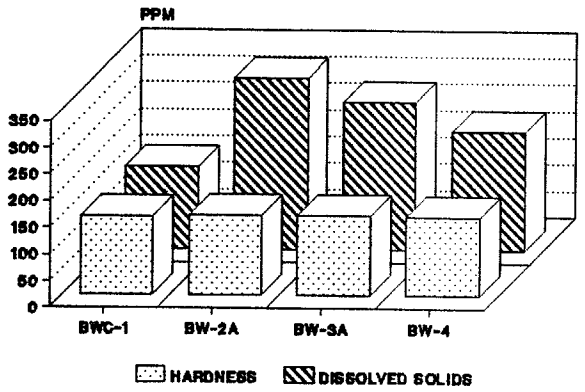


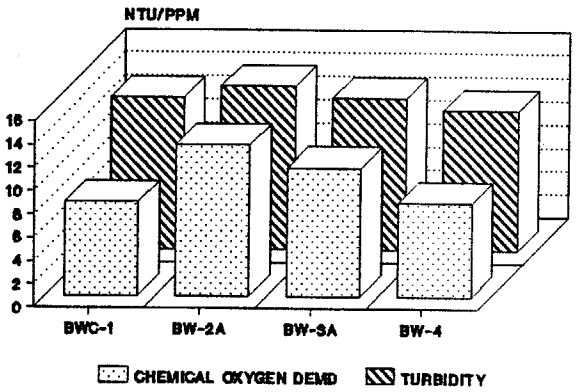
THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

FIGURE 4

BIG WILLS CREEK
CHEMICAL ANALYSIS DATA
AFTER UPGRADE







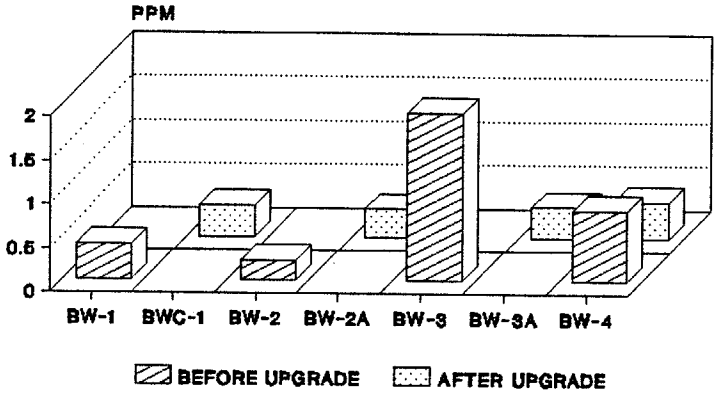
THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

FIGURE 5

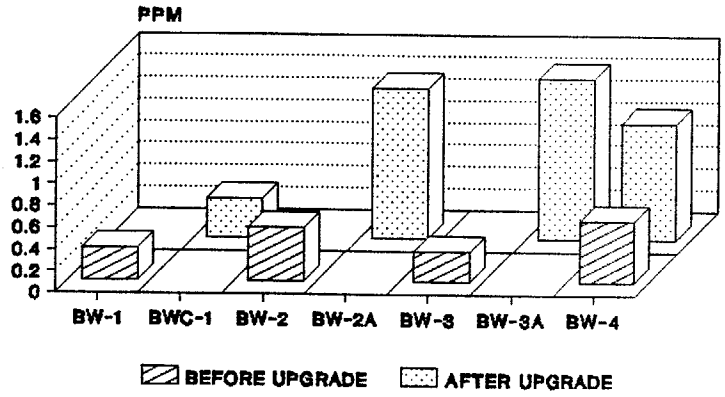
BIG WILLS CREEK

CHEMICAL ANALYSIS DATA

AMMONIA

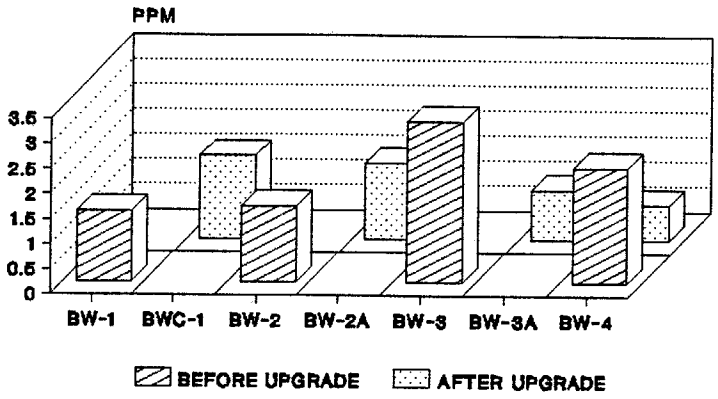


NITRATE



THESE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

TOTAL KJELDAHL NITROGEN



TOTAL ORGANIC NITROGEN

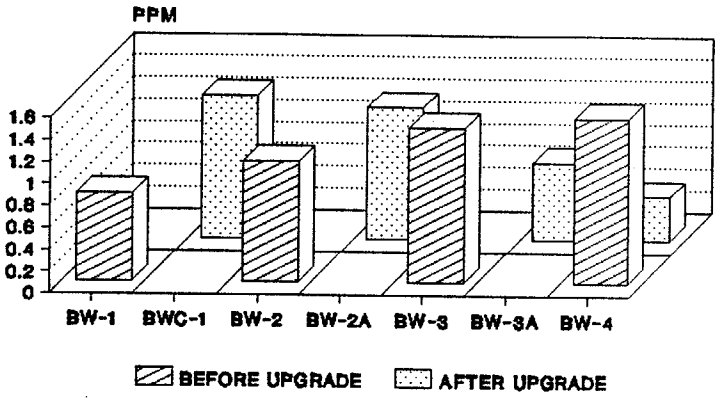
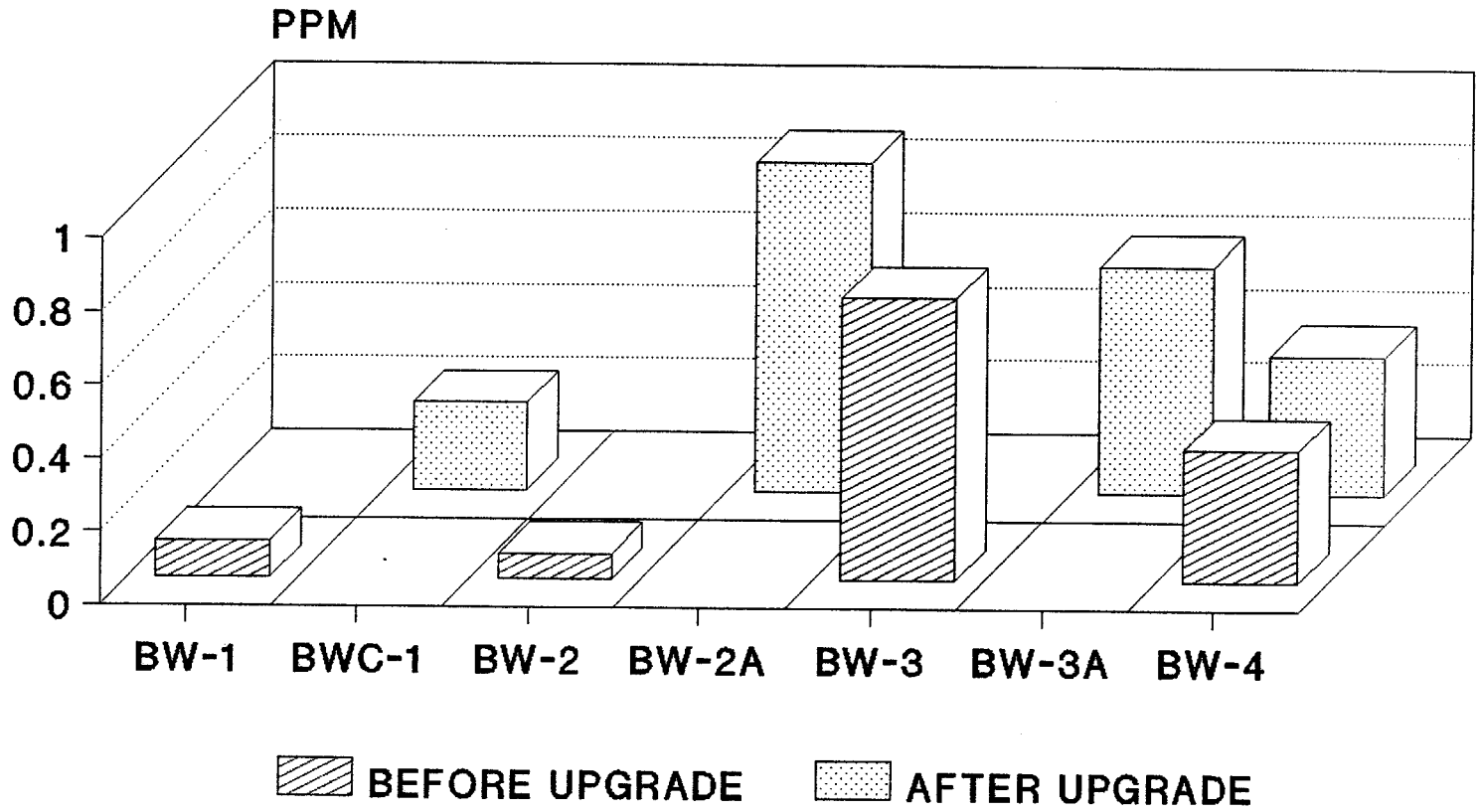
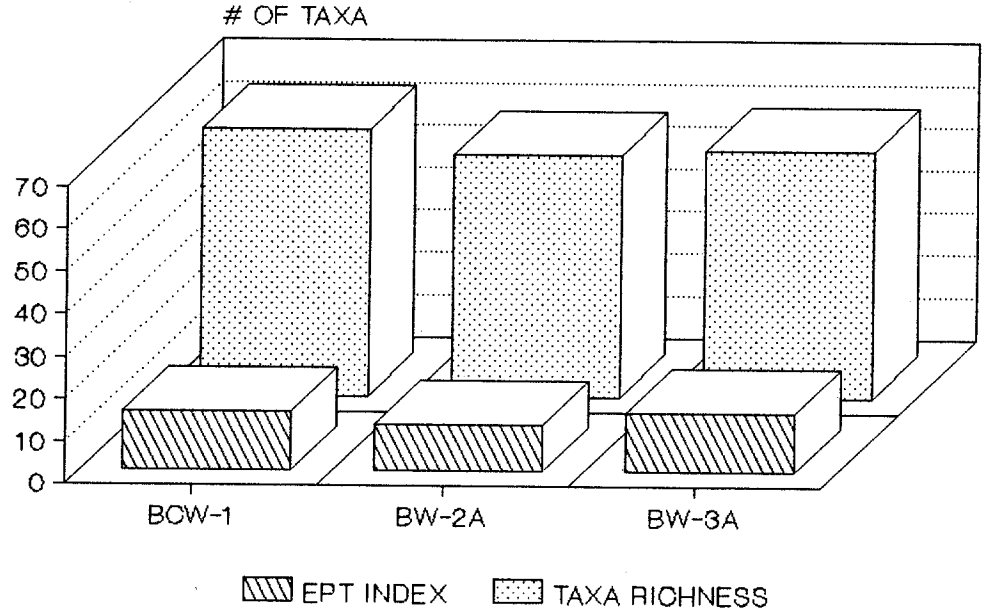


FIGURE 6
BIG WILLS CREEK
PHOSPHATES



THE ABOVE NUMBERS ARE AVERAGES
REPRESENTING MULTIPLE SAMPLING EVENTS

FIGURE 7
BIOMETRIC INDICES



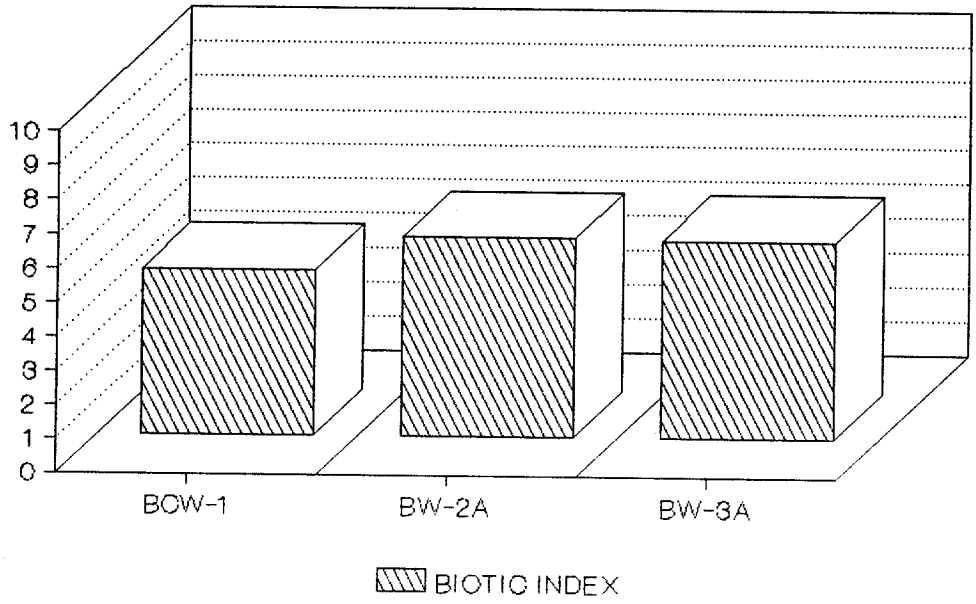
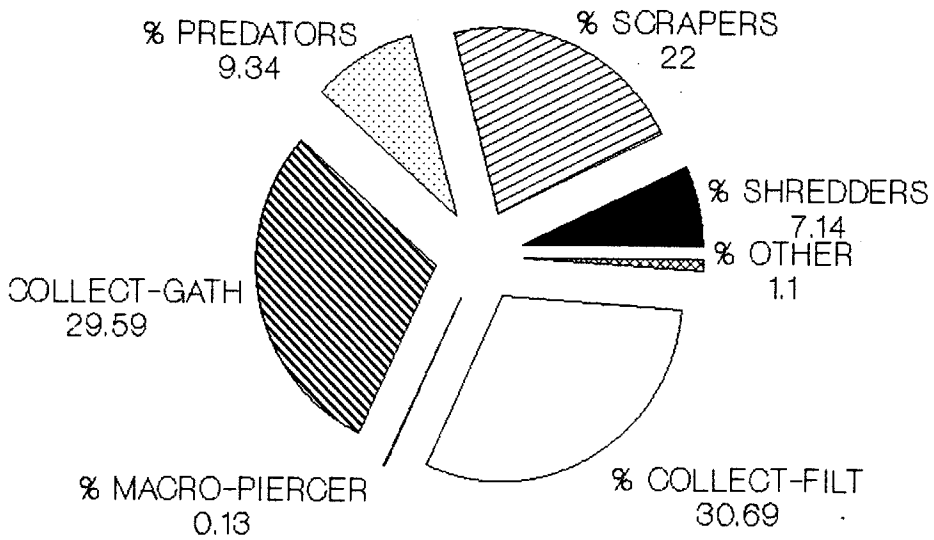


FIGURE 8

BIG WILLS CREEK
COMMUNITY STRUCTURE

AFTER UPGRADE

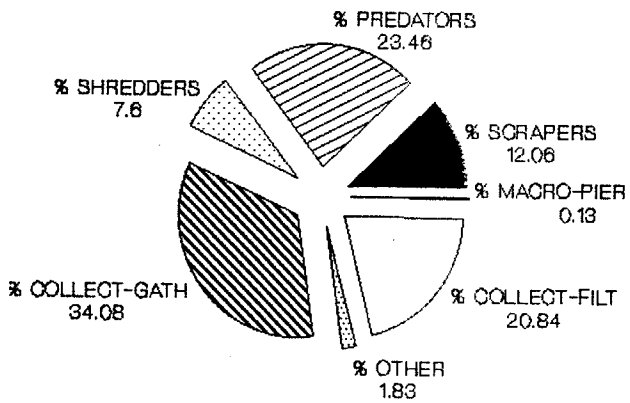
BWC-1



% OTHER ARE THE ORGANISMS WITHOUT FUNCTIONAL

FEEDING GROUP DESIGNATION.

BW-2A



BW-3A

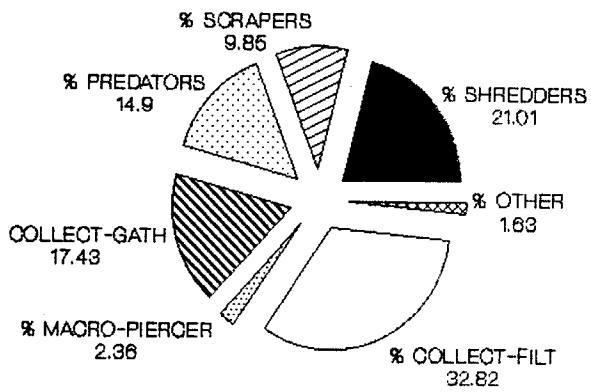
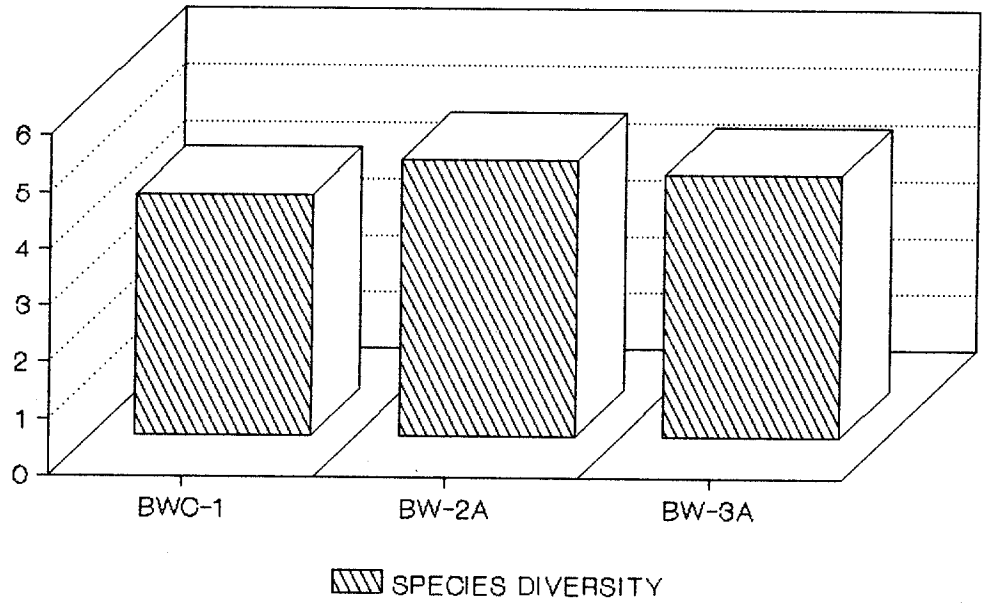


FIGURE 9
BIOMETRIC INDICES



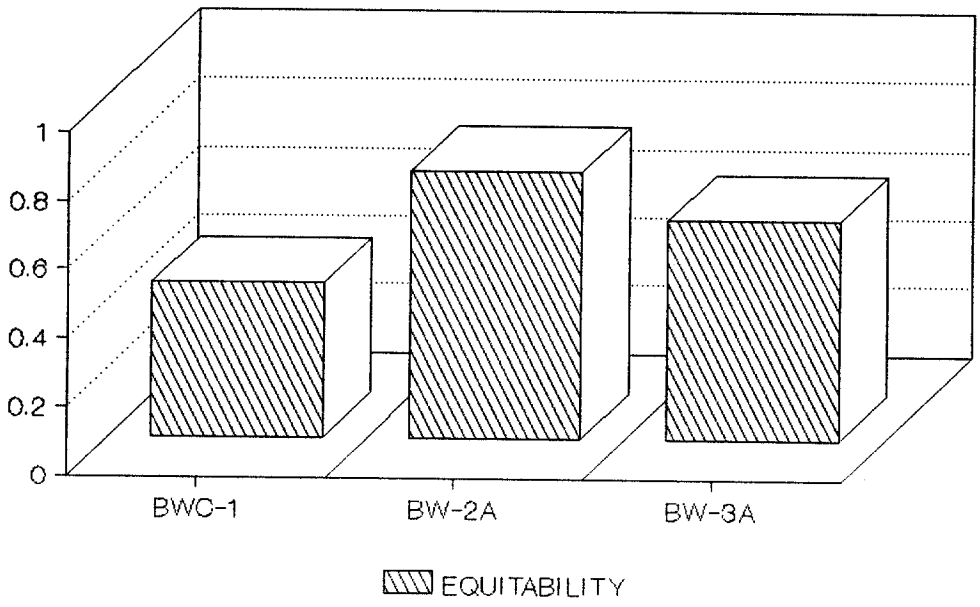
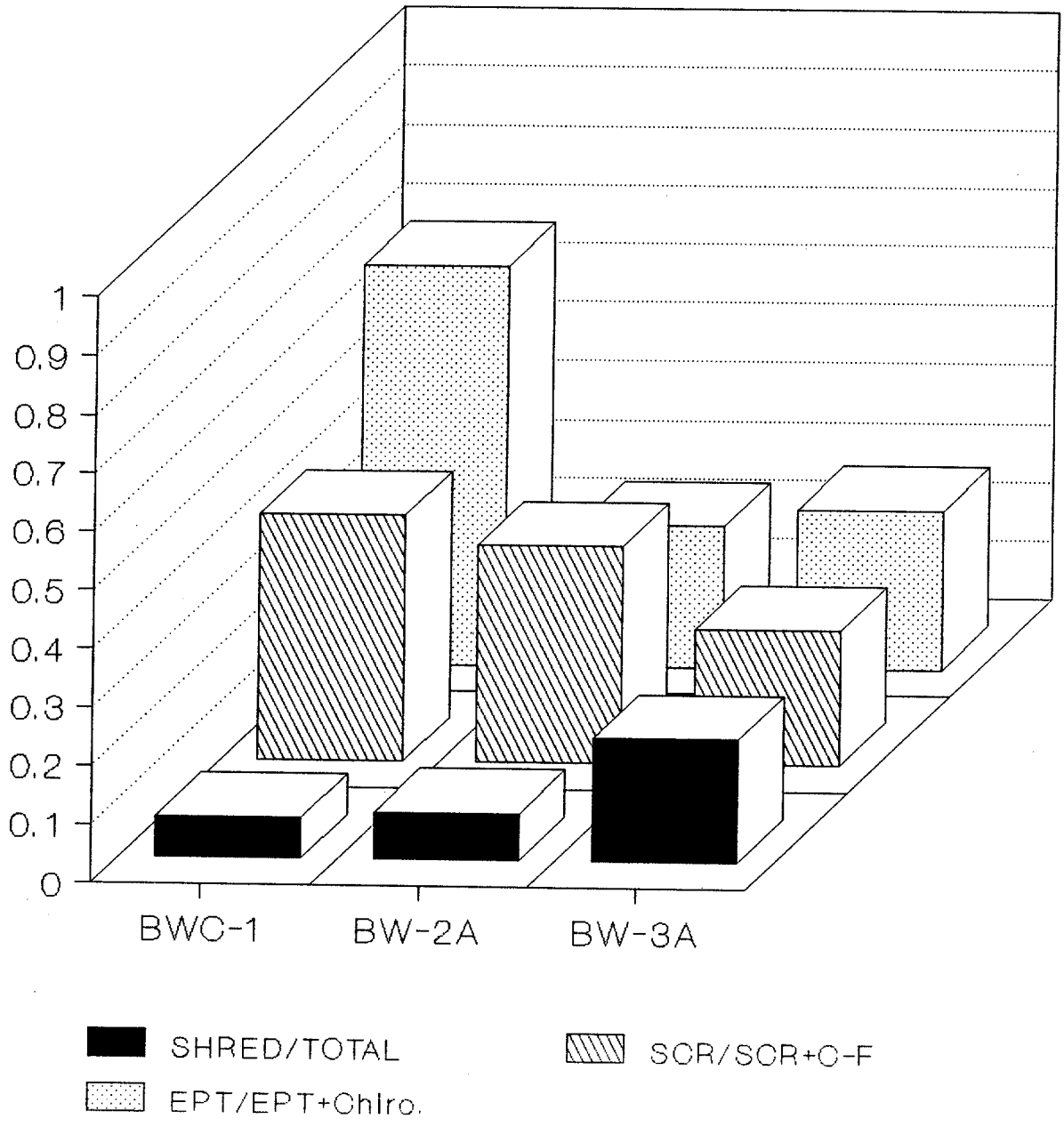
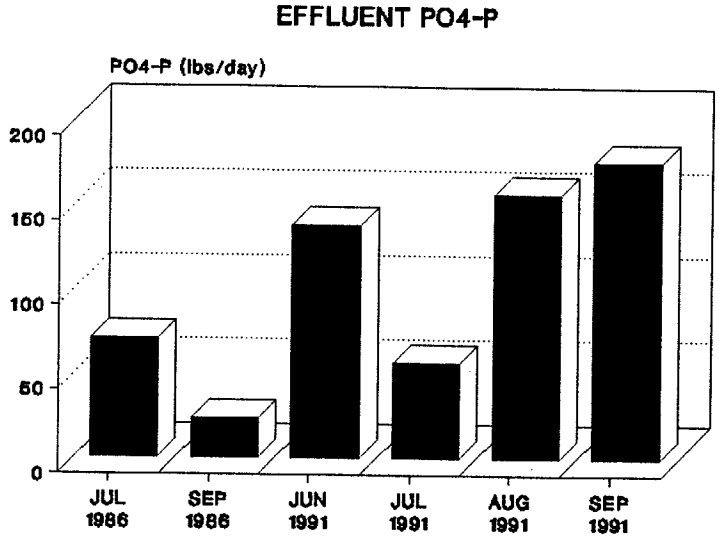


FIGURE 10
BIOMETRIC INDICES





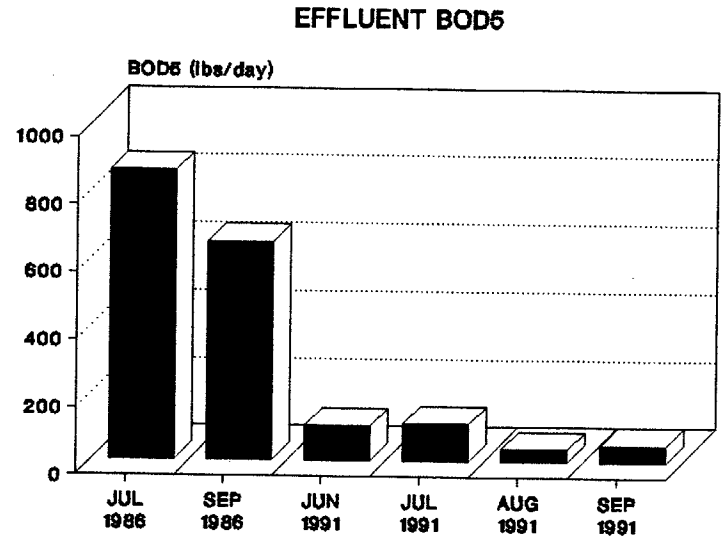
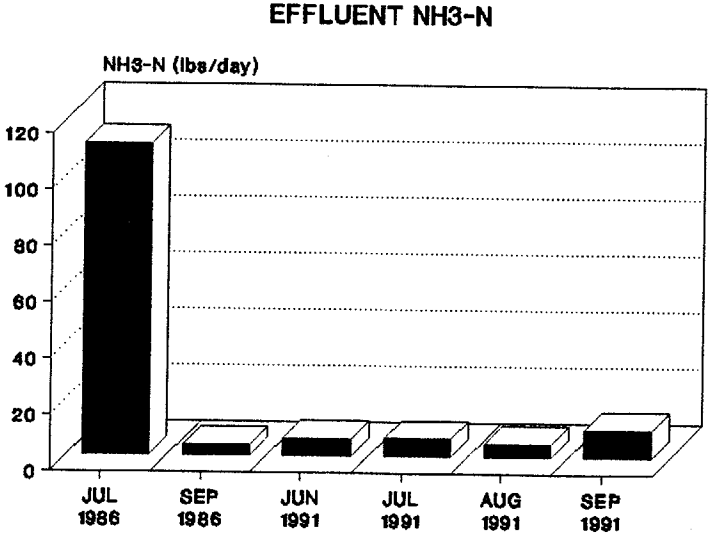


FIGURE 11
FORT PAYNE WWTP DMR DATA



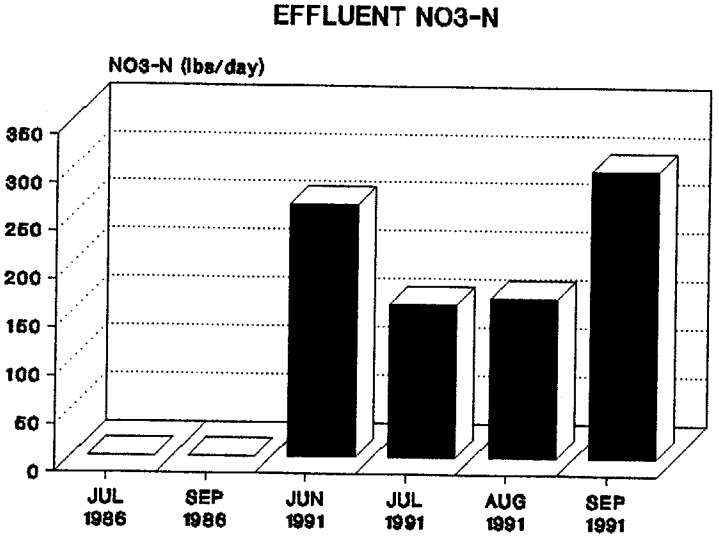


TABLE 1
PHYSICAL CHARACTERIZATION DATA

Name Of Waterbody: Big Wills Creek @ AL Hwy 35 Station #: BWC-1
Date: July 10, 1991 Investigator(s): Diggs, Leslie

Riparian Zone / Instream Features

Surrounding Land Use:	Agricultural, Field/Pasture, Commercial
Local Watershed Erosion:	Moderate
Local Watershed NPS Pollution:	Some Potential Sources
Estimated Stream Width:	60 feet
Estimated Stream Depth:	Riffle: N/A
	Run: 12-24 in.
	Pool: 30 in.
High Water Mark:	7 feet
Dams Present?:	None
Channelized?:	No
Canopy Cover:	Open

Sediment / Substrate

Sediment Odors:	Normal	
Sediment Oils:	None	
Substrate Deposits:	Sand	
Anaerobic Conditions:	No	
Estimated Substrate Composition:	Cobble (2.5-10 in.)	2%
	Gravel (0.1-2.5 in.)	33%
	Sand	50%
	Silt	7%
	Detritus	8%

Water Quality

Water Odors:	Normal
Water Surface Oils:	None

Biological Indicators

Aquatic Communities:	Periphyton, Macrophytes, Fish, Macroinvertebrates

TABLE 1A
PHYSICAL CHARACTERIZATION DATA

Name Of Waterbody: Big Wills Creek @ Ft. Payne STP Station #: BW-2A
Date: July 10, 1991 Investigator(s): Diggs, Leslie

Riparian Zone / Instream Features

Surrounding Land Use:	Agricultural, Field/Pasture
Local Watershed Erosion:	Moderate
Local Watershed NPS Pollution:	Some Potential Sources
Estimated Stream Width:	50 feet
Estimated Stream Depth:	Riffle: N/A in. Run: 6-18 in. Pool: 24 in. and greater
High Water Mark:	4-5 feet
Dams Present?:	None
Channelized?:	No
Canopy Cover:	Partly Open

Sediment / Substrate

Sediment Odors:	Normal
Sediment Oils:	None
Substrate Deposits:	Sand
Anaerobic Conditions:	No
Estimated Substrate Composition:	

Bedrock	58%
Boulder (10 in.)	10%
Cobble (2.5-10 in.)	10%
Gravel (0.1-2.5 in.)	2%
Sand	5%
Silt	5%
Detritus	10%

Water Quality

Water Odors:	Sewage
Water Surface Oils:	None

Biological Indicators

Aquatic Communities:	Periphyton, Fish, Macroinvertebrates

TABLE 1B
PHYSICAL CHARACTERIZATION DATA

Name Of Waterbody: Big Wills Creek @ Hughes Mill Station #: BW-3A
Date: July 10, 1991 Investigator(s): Diggs, Leslie

Riparian Zone / Instream Features

Surrounding Land Use:	Agricultural, Field/Pasture, Forest
Local Watershed Erosion:	None
Local Watershed NPS Pollution:	No Evidence
Estimated Stream Width:	50 feet
Estimated Stream Depth:	Riffle: 2-18 in. Run: >24 in. Pool: 6 in. or less
High Water Mark:	14 feet
Dams Present?:	None
Channelized?:	No
Canopy Cover:	Partly Shaded

Sediment / Substrate

Sediment Odors:	Normal
Sediment Oils:	None
Substrate Deposits:	Sand
Anaerobic Conditions:	No
Estimated Substrate Composition:	

Bedrock	74%
Boulder (10 in.)	5%
Cobble (2.5-10 in.)	5%
Gravel (0.1-2.5 in.)	10%
Sand	2%
Silt	2%
Detritus	2%

Water Quality

Water Odors:	Normal
Water Surface Oils:	None

Biological Indicators

Aquatic Communities:	Periphyton, Macrophytes, Fish, Macroinvertebrates

TABLE 2
WATER QUALITY DEMONSTRATION STUDY
BIG WILLS CREEK AT FORT PAYNE, ALABAMA
DATA COLLECTED PRIOR TO UPGRADE OF WWTP

DATE	LOCATION	TIME	WATER TEMP	D.O.	pH	BOD5	TSS	NO2+NO3	NH3-N	TKN	TON	PO4-P	FLOW
07/09/86	BW-1	06:05	24	5.4	7.7	0.9	24	0.06	<0.2	1.6		0.3	
	(upstrm	14:00	27	6.7	6.5	1.2	9		0.4			0.08	
07/10/86	of STP @	17:57	24	5.2	7.2	0.2	25		0.5	2.4	1.9	0.07	
09/17/86	Ft. Payne	06:30	20.5	5.8		2	58	0.64	0.1	1.2	1.1	0.05	
	Water	13:30	21.5	6.7		1.9	22	0.49	0.1	1.2	1.1	0.03	
09/18/86	Works)	06:25	19			1.2	66	0.6	1	1.9	0.9	0.05	
AVERAGE			22.7	6.0	5.4	1.2	34	0.30	----	1.4	0.8	0.10	-----
07/09/86	BW-2	06:34	22	6.7	7.2	0.9	20	0.3	<0.2	1.2		0.19	
	(upstrm	14:30	25	7.7	7.3	0.6	10	0.34	0.4	1.8	1.4	0.08	8.35
07/10/86	of STP)	06:10	22	6.7	6.9	0.4	30	0.32	0.5	2.2	1.7	0.08	10.1
09/17/86		06:45	19	7.2		0.8	43	0.66	0.1	1	0.9	0.02	9.36
		13:45	20	7.5		0.9	20	0.65	0	0.8	0.8	0.02	10.0
09/18/86		06:40	18.5	7.5		1.7	41	0.66	0.1	1.8	1.7	0.02	
AVERAGE			21.1	7.2	5.4	0.9	27	0.49	----	1.5	1.1	0.07	9.48
07/09/86	BW-3	06:50	24	1.2	7	7	14	0.04	3.1	4.6	1.5	0.92	
		14:10	26	2.5	7.7	5	7	0.14	2.6	4.2	1.6	0.7	
07/10/86		06:30	23	1.2	7.1	7.2	5	0.04	3.5	5.8	2.3	1.8	
09/17/86		07:05	20	1.6		9.6	17	0.48	0.7	1.2	0.5	0.44	
		14:00	20.5	2.2		8.8	11	0.52	0.6	1.4	0.8	0.35	
09/18/86		06:55	19	1.6		9.2	9	0.38	0.6	2	1.4	0.38	
AVERAGE			22.1	1.7	7.3	7.8	11	0.27	1.9	3.2	1.4	0.77	-----
07/09/86	BW-4	07:20	24	2.4	7.2	2.1	3.5	0.3	1.7	3.2	1.5	0.46	
	(@ bridge	15:45	25	5.4	7.1	4.9	2	0.59	1.5	2.8	1.3	0.41	
07/10/86	just	07:20	23	2.1	7.1	2.4	6	0.24				0.46	
09/17/86	dwnstrm	07:25	20	3		5.4	12	0.8	0.3	1.4	1.1	0.28	
	of Little	14:40	20			2.3	18	0.76	0.3	1.6	1.3	0.28	
09/18/86	Wills Br)	07:20	19	3.1		9.6	11	0.68	0.3	2.6	2.3	0.29	
AVERAGE			21.8	3.2	7.1	4.5	9	0.56	0.8	2.3	1.5	0.36	-----
			C	mg/L	SU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	cfs

TABLE 3
WATER QUALITY DEMONSTRATION STUDY
BIG WILLS CREEK AT FORT PAYNE, ALABAMA
DATA COLLECTED AFTER UPGRADE OF WWTP

DATE	LOCATION	TIME	AIR TEMP	H2O TEMP	D.O.	pH	TURB	COND	ALK	BOD5	Cl	HARD	TDS	TSS	COD	NH3-N	NO3-N	TKN	TON	PO4-P	FLOW	BACT
06/11/91	BWC-1	1535	27	21	8.3	7.8	13	265	129	1	4	146	77	8	<2	<0.2	0.45	0.9	0.9	0.58	47.11	
06/12/91	(@ AL HWY	0715	23	20	7.4	8.3	11.5	265	131	0.5	6	148	99	7	4	<0.2	0.42	3	3	0.81		167.5
07/10/91	35)	1546	33	25	7.8	7.7	13	280	133	1.1	5.5	143	299	10	8	<0.2	0.36	6.61	6.4	<0.02	27.89	
07/11/91		0545	21	22	6.5	7.8	12	276	134	1.3	6.5	143	167	10	8	<0.2	0.4	<0.4	0.2	0.38		163
08/21/91		1540	23.5	21	9	8	8	260	132	2.2	6	151	170	3	12	0.71	0.32	0.6	0	0.02	17.64	
08/22/91		0625	18	19	6.8	7.5	23	226	132	1.4	6	155	161	4	10	0.42	0.35	<0.4	0	<0.02		83
09/17/91		1430	33	24	8.3	7.9	10	296	130	0.8	7.5	150	132	13	10	0.44	0.25	0.48	0	0.03	12.2	
09/18/91		0617	19	20	6.4	8	13	287	131	0.6	8	150	138	4	10	0.5	0.3	0.6	0	0.04		200
AVERAGE			24.7	21.5	7.6	7.9	13	269	132	1.1	6.2	148	155	7	---	---	0.36	---	1.3	---	26.21	153
06/11/91	BW-2A	1415	24	21	8.5	7.8	11.5	476	140	1.3	61	145	190	8	7	<0.2	1.34	0.9	0.9	1.03	53.3	
06/12/91	(BELOW	0740	21	20	7.4	7.4	14	431	140	0.9	48	144	189	10	4	<0.2	1.08	4.1	4.1	0.4		137.5
07/10/91	WWTP)	1420	32	25	7.5	8.1	12	600	144	1.6	66	150	298	10	18	<0.2	1.2	4.05	3.8	0.33	34.08	
07/11/91		0603	21	22	6.7	7.6	14	297	130	1.3	18	152	203	11	2	<0.2	<0.04	<0.4	0.2	<0.02		140
08/21/91		1430	24	21	8.5	7.9	7.5	866	167	2.2	127	156	424	3	22	0.48	1.55	0.66	0.1	1.22	24.2	
08/22/91		0645	19	20	7	7.7	18	608	154	1.6	112	162	379	4	14	0.35	1	0.51	0.1	0.85		83
09/17/91		1310	32	24	7.6	8	13	1019	165	1.2	165	153	478	8	18	0.47	3.57	0.7	0.2	2.01	16.47	
09/18/91		0635	19	22	6.5	7.7	23	796	162	1.1	120	152	406	10	18	0.42	1.2	0.74	0.3	1.37		500
AVERAGE			24.0	21.9	7.5	7.8	14	637	150	1.4	90	152	321	8	13	---	---	---	1.2	---	32.01	215
06/11/91	BW-3A	1330	24	20	8.5	8	11.5	398	137	0.8	30	149	120	9	<2	<0.2	1	<0.4	0	0.24	55.02	
06/12/91	(@ HUGHES	0805	24	20	7.5	7.4	12	376	137	0.6	27	147	143	11	4	<0.2	0.81	1.7	1.7	0.19		590
07/10/91	MILL)	1213	29.5	24	7.5	8	14	382	138	1.3	29	147	227	10	10	<0.2	0.81	1.92	1.7	0.11	28.5	
07/11/91		0625	21	24	6.3	7.3	16	561	140	1.1	67	145	309	14	8	<0.2	1.2	1.5	1.3	0.32		
08/21/91		1650	23	21	8.4	8.1	14	433	147	1.8	43	154	236	9	14	0.76	0.62	<0.4	0	0.4	22.87	
08/22/91		0715	19	20	6.5	7.5	11	719	159	1.4	103	151	383	4	14	<0.2	1.2	0.42	0.1	0.88		103
09/17/91		1243	30	24	6.8	7.8	10.5	816	150	1.2	103	153	356	<1	16	0.55	3.18	1.12	0.5	1.24	14.18	
09/18/91		0700	20	23	5.5	7.6	15	884	166	1.4	143	159	451	3	18	0.55	2.94	0.54	0	1.58		193
AVERAGE			23.8	22.0	7.1	7.7	13	571	147	1.2	68	151	278	---	---	---	1.47	---	0.7	0.62	30.15	295
06/11/91	BW-4	1218	28	21	8.6	7.8	11	325	132	0.8	18	148	110	7	<2	<0.2	0.85	<0.4	0	0.17		
06/12/91	(@ BRIDGE	0825	25	19.5	7.5	7.4	11	374	135	0.7	26	148	138	9	<2	<0.2	0.83	1.7	1.7	0.19		137.5
07/10/91	JUST	1152	32	23	7.3	8.3	14	385	137	1.1	31	146	226	9	8	<0.2	0.94	0.5	0.3	0.1		
07/11/91	DWNSTRM	0645	22	22	6.5	7.1	17	435	137	1	43	142	254	14	8	<0.2	0.93	0.64	0.4	0.21		63
08/21/91	OF LITTLE	1715	23.5	21	8	8.1	8.7	487	145	1.8	60	150	268	4	12	0.97	0.9	<0.4	0	0.51		
08/22/91	WILLS BR)	0730	19	19.5	6.7	7.5	10	514	149	1.4	70	153	291	8	12	0.24	0.9	0.42	0.1	0.57		140
09/17/91		1135	32	22	7.2	7.9	13	499	134	0.9	60	149	256	10	12	0.39	1.82	0.83	0.4	0.63		
09/18/91		0720	19	21	6.2	7.5	13	487	142	0.7	57	156	250	10	10	0.93	1.3	0.7	0	0.64		120
AVERAGE			25.1	21.1	7.3	7.7	12	438	139	1.1	46	149	224	9	---	---	1.06	---	0.4	0.38		115
			C	C	ppm	S.U.	NTU	umho @25C	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	cfs	org/ 100mL

BIG WILLS CREEK BWC-1 METRICS TABLE
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
TAXA RICHNESS	43	30	31	63
# ORGANISMS	1025	208	308	1541
EPT TAXA RICHNESS	11	7	7	14
BIOTIC INDEX	4.19	5.51	6.60	4.85
# CHIRONOMIDAE TAXA / TOTAL TAXA	.19	.33	.35	.27
# EPT / # EPT + # CHIRONOMIDAE	.96	.28	.32	.68
# SCRAPERS / # FILTERING COLLECTORS + # SCRAPERS	.37	.70	.54	.42
# SHREDDERS / TOTAL # ORGANISMS	.01	.23	.18	.07
PERCENT SCRAPERS	24.10	23.56	13.96	22.00
PERCENT SHREDDERS	.68	22.60	18.18	7.14
PERCENT FILTERING COLLECTORS	40.59	10.10	11.69	30.69
PERCENT COLLECTOR GATHERERS	27.32	33.17	34.74	29.59
PERCENT PREDATORS	6	9	19	9.34
PERCENT MACROPHYTE PIERCERS	.00	.96	.00	.13
PERCENT OTHERS	1.07	.48	1.62	1.10
# HYDROPTILIDAE / # TRICHOPTERA	.0000	.1818	.0000	.0144
SHANNON WEAVER DIVERSITY INDEX	3.35	4.17	4.02	4.27
EQUITABILITY	.34	.88	.76	.45

BIG WILLS CREEK BWC-1 METRICS TABLE
MACROINVERTEBRATE DATA

DOMINANT TAXON AND PERCENT CONTRIBUTION

ROOT BANK	ROCK LOG	CPOM	TOTAL
Isonychia	Cricotopus	Dubiraphia	Isonychia
27.80	22.60	21.43	18.69

BIG WILLS CREEK BWC-1 METRICS TABLE
MACROINVERTEBRATE DATA

FIVE DOMINANT TAXA IN TOTAL COLUMN AND PERCENT CONTRIBUTION

Isonychia
18.69

Dubiraphia
17.39

Stenelmis
16.09

Cheumatopsyche
5.06

Cricotopus
3.63

BIG WILLS CREEK BW-2A METRICS TABLE
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
TAXA RICHNESS	42	26	30	57
# ORGANISMS	198	408	157	763
EPT TAXA RICHNESS	6	6	7	11
BIOTIC INDEX	5.49	5.89	5.99	5.81
# CHIRONOMIDAE TAXA / TOTAL TAXA	.26	.35	.40	.26
# EPT / # EPT + # CHIRONOMIDAE	.63	.14	.32	.24
# SCRAPERS / # FILTERING COLLECTORS + # SCRAPERS	.76	.23	.43	.37
# SHREDDERS / TOTAL # ORGANISMS	.02	.10	.08	.08
PERCENT SCRAPERS	17.17	8.58	14.65	12.06
PERCENT SHREDDERS	2.02	10.29	7.64	7.60
PERCENT FILTERING COLLECTORS	5.56	28.92	19.11	20.84
PERCENT COLLECTOR GATHERERS	35.86	32.60	35.67	34.08
PERCENT PREDATORS	32	19	22	23.46
PERCENT MACROPHYTE PIERCERS	.51	.00	.00	.13
PERCENT OTHERS	6.06	.25	.64	1.83
# HYDROPTILIDAE / # TRICHOPTERA	.0000	.0000	.0000	.0000
SHANNON WEAVER DIVERSITY INDEX	4.33	3.96	4.47	4.89
EQUITABILITY	.70	.88	1.09	.78

BIG WILLS CREEK BW-2A METRICS TABLE
MACROINVERTEBRATE DATA

DOMINANT TAXON AND PERCENT CONTRIBUTION

ROOT BANK	ROCK LOG	CPOM	TOTAL
Dubiraphia	Rheotanytarsus	Dubiraphia	Rheotanytarsus
17.17	15.44	11.46	10.22

BIG WILLS CREEK BW-2A METRICS TABLE
MACROINVERTEBRATE DATA

FIVE DOMINANT TAXA IN TOTAL COLUMN AND PERCENT CONTRIBUTION

Rheotanytarsus	10.22
Dubiraphia	7.21
Tanytarsus	7.08
Stenochironomus	6.82
Orthocladius	6.68

BIG WILLS CREEK BW3A-910710 METRICS
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
TAXA RICHNESS	37	36	23	58
# ORGANISMS	554	355	319	1228
EPT TAXA RICHNESS	7	9	7	14
BIOTIC INDEX	5.15	5.53	7.01	5.75
# CHIRONOMIDAE TAXA / TOTAL TAXA	.22	.28	.39	.24
# EPT / # EPT + # CHIRONOMIDAE	.55	.32	.10	.27
# SCRAPERS / # FILTERING COLLECTORS + # SCRAPERS	.22	.44	.10	.23
# SHREDDERS / TOTAL # ORGANISMS	.00	.31	.46	.21
PERCENT SCRAPERS	12.64	10.99	3.76	9.85
PERCENT SHREDDERS	.18	31.27	45.77	21.01
PERCENT FILTERING COLLECTORS	44.22	14.08	33.86	32.82
PERCENT COLLECTOR GATHERERS	17.33	23.94	10.34	17.43
PERCENT PREDATORS	22	11	5	14.90
PERCENT MACROPHYTE PIERCERS	.00	7.61	.63	2.36
PERCENT OTHERS	3.25	.56	.00	1.63
# HYDROPTILIDAE / # TRICHOPTERA	.0000	.6429	.1429	.2761
SHANNON WEAVER DIVERSITY INDEX	3.40	4.07	3.22	4.64
EQUITABILITY	.41	.68	.58	.64

BIG WILLS CREEK BW3A-910710 METRICS
MACROINVERTEBRATE DATA

DOMINANT TAXON AND PERCENT CONTRIBUTION

ROOT BANK	ROCK LOG	CPOM	TOTAL
Lirceus	Cricotopus	Endochironomus	Lirceus
37.36	29.58	35.74	16.86

BIG WILLS CREEK BW3A-910710 METRICS
MACROINVERTEBRATE DATA

FIVE DOMINANT TAXA IN TOTAL COLUMN AND PERCENT CONTRIBUTION

Lirceus
16.86

Cricotopus
10.34

Endochironomus
9.28

Simulium
5.94

Dubiraphia
5.94

TABLE 7

BIG WILLS CREEK
MACROINVERTEBRATE DATA

	BWC1-910710 VERSUS BW2A-910710	BWC1-910710 VERSUS BW3A-910710
DOMINANTS IN COMMON	Dubiraphia	Dubiraphia Cricotopus
# DOMINANTS IN COMMON	1	2
INDICATOR ASSEMBLAGE INDEX	0.40	0.42
SORENSON'S COMMUNITY SIMILARITY INDEX	0.73	0.76
COMMUNITY LOSS INDEX	0.33	0.29
JACCARD COEFFICIENT OF COMMUNITY	0.57	0.61
QUANTITATIVE SIMILARITY INDEX-TAXA	41.70	43.11
QUANTITATIVE SIMILARITY INDEX-FUNCTIONAL FEEDING GROUP	80.20	75.68

TABLE 8

BIOMETRIC INTERPRETATION

METRIC	RANGE	INTERPRETATION
HABITAT ASSESSMENT	104-135	EXCELLENT
	71-106	GOOD
	35-70	FAIR
	0-34	POOR
TAXA RICHNESS EPT INDEX SHANNON WEAVER DIVERSITY INDEX EQUITABILITY		GENERALLY INCREASES WITH INCREASING WATER QUALITY
BIOTIC INDEX % DOMINANT TAXON TOLERANCE VALUE OF DOM. TAXON		GENERALLY INCREASES WITH DECREASING WATER QUALITY
% SHREDDERS % SCRAPERS % PREDATORS % COLLECTOR GATHERERS % COLLECTOR FILTERERS % MACROPHYTE PIERCERS % OTHERS		PERCENTAGES AND COMPOSITION SHOULD BE SIMILAR TO BACKGROUND STATION FOR SIMILAR STREAM SIZES AND HABITAT COMPOSITION
SCRAPERS / SCRAPERS + COL. FIL. SHREDDERS / TOTAL HYDROPTILIDAE / TRICHOPTERA		NO SIGNIFICANT CHANGE AS COMPARED TO BACKGROUND
EPT / EPT + CHIRONOMIDAE		GENERALLY INCREASING WATER QUALITY AS APPROACHES 1.0

SIMILARITY INDICES

INDICATOR ASSEMBLAGE INDEX (IAI) JACCARD COEFFICIENT OF COMMUNITY SORENSON'S COMMUNITY SIMILARITY INDEX	INCREASING SIMILARITY AS APPROACHES 1.0
DOMINANTS IN COMMON QUANTITATIVE SIMILARITY INDEX (QSI-FFG) QUANTITATIVE SIMILARITY INDEX (QSI-TAXA)	GENERALLY INCREASES WITH INCREASING SIMILARITY
COMMUNITY LOSS INDEX	GENERALLY INCREASES WITH INCREASING DISSIMILARITY

TABLE 9

FORT PAYNE WWTP
EFFLUENT LOADS TO BIG WILLS CREEK

LOADING BEFORE UPGRADE					LOADING AFTER UPGRADE				
DATE	BOD5	PO4-P	NO3-N	NH3-N	DATE	BOD5	PO4-P	NO3-N	NH3-N
07/08/86	807.5	36.1	0.6	112.9	06/11/91	102.1	138.5	262.9	6.4
07/09/86	903.1	106.3	0.6	108.9	07/10/91	109.3	57.3	160	6.5
09/16/86	643.1	23.5	1.1	3.2	08/21/91	36.7	156.9	165.8	4.8
09/17/86	699.8	24	1.2	4.6	09/17/91	48.6	176.3	298.9	9.9
09/18/86	592.5		0.9	4.6					
	lbs/ day	lbs/ day	lbs/ day	lbs/ day		lbs/ day	lbs/ day	lbs/ day	lbs/ day

BIG WILLS CREEK BWC-1 TAXA LIST
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	TOTAL
ANNELIDA						
OLIGOCHAETA				1	1	2
ARTHROPODA						
MALACOSTRACA						
AMPHIPODA						
Talitridae						
Hyalella		8				8
DECAPODA		10		1		11
ISOPODA						
Asellidae						
Lirceus		12		6		18
INSECTA						
COLEOPTERA						
Elmidae						
Ancyronyx		9		5		14
Dubiraphia		195	7	66		268
Macronychus		8	11	1		20
Optioservus			2			2
Promoresia		11				11
Stenelmis	15	223	10	15		263
Gyrinidae						
Dineutus		3				3
Gyrinus			1			1
Hydrophilidae						
Helochares	4					4
DIPTERA						
Athericidae						
Atherix		4	2			6
Ceratopogonidae						
Bezzia			1			1
CHIRONOMIDAE						
Chironominae						
Chironomini						
Cryptochironomus				4		4

BIG WILLS CREEK BWC-1 TAXA LIST
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	TOTAL
EPHEMEROPTERA						
Baetidae						
Baetis	30	31	8			69
Caenidae						
Caenis		1		6		7
Ephemerellidae						
Ephemerella			1			1
Heptageniidae						
Stenacron				5		5
Stenonema	8	12	19	3		42
Oligoneuridae						
Isonychia	4	285	3			292
Tricorythidae						
Tricorythodes		15		23		38
HEMIPTERA						
Veliidae						
Rhagovelia		5				5
MEGALOPTERA						
Corydalidae						
Corydalus	8	9	2			19
Nigronia		5				5
Sialidae						
Sialis			1			1
ODONATA						
Aeshnidae						
Boyeria		20		1	1	22
Calopterygidae						
Calopteryx		4		1		5
Coenagrionidae						
Argia		3				3
Gomphidae						
Gomphidae UNID				1		1
Libellulidae						

BIG WILLS CREEK BWC-1 TAXA LIST
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	TOTAL
Libellulidae UNID				1		1
Macromiidae						
Macromia		3				3
TRICHOPTERA						
Hydropsychidae						
Ceratopsyche	38	17				55
Cheumatopsyche	4	76		2		82
Hydroptilidae						
Hydroptila	4		2			6
Leptoceridae						
Ceraclea		2				2
Mystacides		4	1	1		6
Philopotamidae						
Chimarra		1				1
Polycentropodidae						
Polycentropus		1	8	23		32
MOLLUSCA						
GASTROPODA						
LIMNOPHILA						
Ancylidae						
Ferrissia			16	3	1	20
Physidae						
Physella				1		1
Planorbidae						
Planorbella		1				1
MESOGASTROPODA						
Hydrobiidae						
Somatogyrus		6				6
Pleuroceridae						
Elimia	23	5	2	2	4	36
PELECYPODA						
HETERODONTA						
Corbiculidae						
Corbicula	8	2		5	5	20

BIG WILLS CREEK BWC-1 TAXA LIST
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	TOTAL
MISCELLANEOUS						
Planaria			1			1

BIG WILLS CREEK BW-2A
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
ANNELIDA				
OLIGOCHAETA	2	1		3
ARTHROPODA				
MALACOSTRACA				
AMPHIPODA				
Talitridae				
Hyalella			2	2
DECAPODA	5			5
ISOPODA				
Asellidae				
Lirceus	3		5	8
INSECTA				
COLEOPTERA				
Dytiscidae				
Hydroporus	1			1
Elmidae				
Ancyronyx	9		2	11
Dubiraphia	34	3	18	55
Macronychus	1	3		4
Microcylloepus	2			2
Promoresia	7		3	10
Stenelmis	30	1	1	32
Gyrinidae				
Gyrinus	1			1
Hydrophilidae				
Berosus	1			1
DIPTERA				
Athericidae				
Atherix		7	5	12
Ceratopogonidae				
Ceratopogonidae UNID dif	5			5
CHIRONOMIDAE				
Chironominae				
Chironomini				
Chironomus	1		8	9

BIG WILLS CREEK BW-2A
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
Dicrotendipes	2	21		23
Phaenopsectra			5	5
Polypedilum	3		5	8
Stenochironomus	2	42	8	52
Tanytarsini				
Rheotanytarsus	5	63	10	78
Tanytarsus	2	42	10	54
Orthocladinae				
Brillia			2	2
Cricotopus	1	42	5	48
Orthocladius	1	42	8	51
Rheocricotopus			3	3
Tanypodinae				
Ablabesmyia	2	10	3	15
Labrundinia		10		10
Procladius	5			5
Thienemannimyia Grp	1	31	5	37
Tanypodinae UNID			1	1
CHIRONOMIDAE UNID			1	1
Culicidae				
Culicidae UNID dif	1			1
Simulidae				
Simulium		5		5
Tipulidae				
Antocha		16		16
EPHEMEROPTERA				
Baetidae				
Baetis	1	6	5	12
Caenidae				

BIG WILLS CREEK BW-2A
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
Caenis			1	1
Heptageniidae				
Stenacron		3	1	4
Stenonema	2	16	6	24
Tricorythidae				
Tricorythodes	2			2
HEMIPTERA				
Gerridae				
Trepobates	1			1
Veliidae				
Rhagovelia	1			1
MEGALOPTERA				
Corydalidae				
Corydalus		3		3
Sialidae				
Sialis	3		1	4
ODONATA				
Aeshnidae				
Boyeria	6			6
Calopterygidae				
Calopteryx	1		1	2
Coenagrionidae				
Argia	9			9
Coenagrionidae UNID dif	4			4
Gomphidae				
Gomphus	1			1
Macromiidae				
Macromia	1			1
TRICHOPTERA				
Hydropsychidae				
Ceratopsyche			3	3
Cheumatopsyche		8		8

BIG WILLS CREEK BW-2A
MACROINVERTEBRATE DATA

	ROOT/ BANK	ROCK LOG	CPOM	TOTAL
Leptoceridae				
Mystacides	9			9
Oecetis	1		2	3
Polycentropodidae				
Cyrnellus		16	17	33
Polycentropus	27	2		29
MOLLUSCA				
GASTROPODA				
LIMNOPHILA				
Ancylidae				
Ferrissia	1	11	9	21
Physidae				
Physella	1	1		2
MESOGASTROPODA				
Pleuroceridae				
Elimia		3	1	4

BIG WILLS CREEK BW-3A
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	MACROPHYTE SWEEP	TOTAL
ANNELIDA							
HIRUDINEA							
Rhynchobdellida							
Glossosiphonidae							
Placobdella		2					2
OLIGOCHAETA		8	1			9	18
ARTHROPODA							
MALACOSTRACA							
AMPHIPODA							
Talitridae							
Hyalella		27					27
DECAPODA		2					2
ISOPODA							
Asellidae							
Lirceus		207					207
INSECTA							
COLEOPTERA							
Elmidae							
Ancyronyx		2	1			1	4
Dubiraphia	84	70	3			6	163
Macronychus			2	1		3	6
Microcylloepus		1	1			1	3
Promoresia		3	1				4
Stenelmis	96	62	7	3	2	28	198
Hydrophilidae							
Berosus						2	2
DIPTERA							
Athericidae							
Atherix	12		14	1		22	49
Ceratopogonidae							
Atrichopogon						14	14
Ceratopogonidae UNID dif		8					8
CHIRONOMIDAE							
Chironominae							
Chironomini							

BIG WILLS CREEK BW-3A
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	MACROPHYTE SWEEP	TOTAL
Dicrotendipes		2	13				15
Endochironomus				114			114
Polypedilum	132		6	7		18	163
Stenochironomus			6				6
Stictochironomus					1		1
Tanytarsini							
Rheotanytarsus	252	2	19	14		119	406
Tanytarsus		4	6	22	3		35
Orthocladinae							
Cricotopus	264		105	22	5	9	405
Eukiefferiella	60			7			67
Nanocladius		1	6				7
Orthocladius	60	1	6	7	2		76
Parametriocnemus						27	27
Rheocricotopus	240		6	7		64	317
Tanypodinae							
Ablabesmyia		21		14	1		36
Procladius		1					1
Thienemannimyia Grp	72	12	6				90
Zavrelimyia	12						12
Simulidae							
Simulium	300		9	64		116	489
Tabanidae							
Tabanus						7	7
Tipulidae							
Antocha			23	6		1	30
Tipula		1				1	2

BIG WILLS CREEK BW-3A
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	MACROPHYTE SWEEP	TOTAL
EPHEMEROPTERA							
Baetidae							
Baetis	60	2	17	5		56	140
Caenidae							
Caenis		1				1	2
Heptageniidae							
Stenacron			3				3
Stenonema			17	3	1	3	24
Oligoneuridae							
Isonychia	48		5	1		338	392
Tricorythidae							
Tricorythodes		1			1	1	3
HEMIPTERA							
Gerridae							
Trepobates			1				1
Mesoveliidae							
Mesovelia						1	1
MEGALOPTERA							
Corydalidae							
Corydalus	60		12	1		43	116
Nigronia		7					7
Sialidae							
Sialis		7					7
ODONATA							
Aeshnidae							
Basiaeschna		1					1
Boyeria		5	2				7
Coenagrionidae							
Argia		29	1				30
Enallagma		1					1
Corduliidae							
Corduliidae UNID dif			1				1

BIG WILLS CREEK BW-3A
MACROINVERTEBRATE DATA

	RIFFLE	ROOT/ BANK	ROCK LOG	CPOM	SAND	MACROPHYTE SWEEP	TOTAL
Macromiidae							
Macromia		1					1
TRICHOPTERA							
Hydropsychidae							
Ceratopsyche	372		9	7		142	530
Cheumatopsyche	84		1				85
Hydroptilidae							
Hydroptila	24		27	2		5	58
Leptoceridae							
Mystacides		12					12
Nectopsyche				3			3
Oecetis		2	2	2		7	13
Polycentropodidae							
Cyrnellus		1	3				4
Polycentropus		34				2	36
MOLLUSCA							
GASTROPODA							
LIMNOPHILA							
Ancylidae							
Ferrissia			12	6	7		25
Planorbidae							
Planorbella		7					7
MESOGASTROPODA							
Pleuroceridae							
Elimia		1			3		4
PELECYPODA							
HETERODONTA							
Corbiculidae							
Corbicula		5	1		3	3	12