Qualitative Macroinvertebrate Assessment of Crouch Branch, June 1999

by

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Savannah River Site

Aiken, South Carolina 29808

DOE Contract No. **DE-AC09-96SR18500**

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QUALITATIVE MACROINVERTEBRATE ASSESSMENT OF CROUCH BRANCH, JUNE 1999

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Publication Date: October 1999

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Executive Summary

An assessment of the macroinvertebrate community of Crouch Branch was performed in June 1999 to determine if effluent from the H-02 outfall is impairing the quality of the stream. Concurrent samples were collected for metals analyses (copper and zinc). The results of the study indicate that the stream is most impaired just downstream from the H-02 outfall and that the quality of the stream biota improves with increasing distance from the outfall. Conversely, macroinvertebrate habitat quality is best just downstream from the H-02 outfall. The midreaches of the stream contain very poor habitat quality, and the lower reaches of the stream, contain habitat of intermediate quality. Although much of the stream has degraded habitat due to channel erosion and scouring, there is strong evidence to suggest that the impairment is due to elevated concentrations of copper and zinc that are present in the H-02 effluent. A comparison of macroinvertebrate data collected in 1997 to the data collected in this study indicates that the macroinvertebrate community of Crouch Branch has improved markedly in the last two years.

1.0 Introduction

In 1997-1998, fish and macroinvertebrate sampling was conducted in Crouch Branch, as part of a site-wide study to assess the effects of SRS NPDES discharges on receiving streams (Specht and Paller, 1998). The results of this study indicated that both the fish and macroinvertebrate communities of Crouch Branch were impaired. Subsequent to these findings, a visual walk-down of the stream was performed to look for habitat degradation of the stream and a toxicity test was performed at the H-02 outfall in January 1999 to determine if the H-02 effluent was toxic. During the walk-down, it was observed that surface runoff from the Burial Grounds, which are located to the west of Crouch Branch has resulted in severe channel erosion (the stream channel is 15 feet deep in some areas) to the portions of Crouch Branch. Therefore, evidence of moderate to severe habitat degradation was found. The results of the toxicity test showed that the H-02 effluent was toxic at the time of sampling (No Observed Effect Concentration of 50% effluent). Subsequent chemical testing indicated that potentially toxic concentrations of copper and possibly zinc were present in the effluent. The source of the metals is probably copper and galvanized piping and copper cooling water condenser coils.

In order to determine if degradation of Crouch Branch was due to physical habitat degradation or to effluent toxicity, qualitative macroinvertebrate sampling was performed at four locations in Crouch Branch on June 2, 1999. Water samples were also collected for copper and zinc analyses at these four locations when the macroinvertebrate samples were collected. If the degradation is due to habitat degradation, the macroinvertebrate community should be fairly similar at locations that have similar habitat quality. If the degradation is due to effluent toxicity, the quality of the macroinvertebrate community should improve with increasing distance from the H-02 outfall.

The parameters that are generally most useful in assessing the quality of a macroinvertebrate community are total number of taxa collected, number of EPT taxa (Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies)), percent dominant taxon, and presence/absence of pollution tolerant taxa. The EPT index is probably the best single indicator of the health of a macroinvertebrate

community, since these three groups of macroinvertebrates are relatively sensitive to organic enrichment, as well as chemical toxicants.

2.0 Description of Sampling Locations

Four locations were selected for macroinvertebrate sampling (Figure 1). Site 1 was located just downstream from Road 4, and approximately 100 m downstream from the H-02 outfall. Site 1 is the same location that was sampled in 1997. Site 2 was located approximately 700 m downstream from Site 1, just downstream from the confluence of the northern branch of Crouch Branch with the main stream channel. The northern branch appears to be an intermittent stream, and no flow was observed on the day that the macroinvertebrate sampling was conducted. Site 3 was located about mid-way between Site 2 and the creek mouth (about 500 m downstream from Site 2) and Site 4 was located just upstream from the creek mouth (about 600 m downstream from Site 3).

Of the four sampling locations, Site 1 showed the least evidence of habitat degradation. The stream channel was not eroded, and contained a sandy bottom, with numerous woody snags and other organic debris. Channel erosion begins just upstream from Site 2 and continues until below Site 3. Site 2 was located in a severely eroded ravine that was approximately 15 feet deep. The stream substrate consisted of hardpan clay, with sand deposits in some portions of the channel. Large trees were toppled into and across the ravine, but woody debris and other habitat structure in the stream channel was minimal. Of the four sampling locations, Site 2 was the most physically degraded. Although Site 3 was located in a ravine and Site 4 was located in a relatively flat area that is adjacent to the floodplain of Upper Three Runs, these two sites were very similar in terms of habitat. Both had a slight gradient and a sandy substrate, with moderate numbers of woody snags and leaf packs.

3.0 Sampling Methods

Macroinvertebrate sampling was performed by ETT Environmental, Greenville, SC, a laboratory that is certified by SCDHEC to perform macroinvertebrate studies (SCDHEC Certification # 23104). The macroinvertebrate communities of the four sampling locations were sampled by qualitative sampling of natural substrates. Sampling consisted of sampling the stream substrate with a D-frame dip net and/or sieve (#30 mesh), and visual inspection of woody debris, root mats and leaf packs. A similar sampling effort was expended at each sampling site, so the results are semi-quantitative and are comparable among sites. Although some macroinvertebrates were hand-collected from natural substrates, leaf packs and other organic debris was collected and returned to the laboratory for inspection under a dissecting microscope. In the laboratory, macroinvertebrates were sorted from debris and preserved in 70% ethanol. All macroinvertebrates were identified to the lowest practical taxon (usually genus or species).

Metrics reported include total number of taxa, total number of organisms collected, number of EPT taxa, North Carolina biotic index (Lenat, 1993), percent dominant taxon, percent composition of major taxonomic groups, and percent composition of functional feeding groups.

At the time that macroinvertebrate sampling was performed, water samples were collected at each of the four sampling sites for total and dissolved copper and zinc.

Figure 1. Crouch Branch Sampling Locations

4.0 Results

The macroinvertebrate data are summarized in Tables 1 through 4, and presented in entirety in the attached Appendix tables. The metals data are presented in Table 5.

As shown in Table 1, the total number of macroinvertebrate taxa collected in Crouch Branch ranged from 23 at Site 2 to 44 at Site 4. Slightly more taxa were collected at Site 1 (25) than at Site 2 (23). The total number of organisms collected ranged from 53 at Site 2 to 248 at Site 4. The number of EPT taxa ranged from 2 taxa at Site 1 to 11 taxa at Site 4. NC (North Carolina) biotic index values ranged from 6.32 at Site 4 to 8.32 at Site 1. NC biotic index values are inversely related to stream quality (lower values indicate higher quality), with values <5.24 generally indicating high quality coastal plain streams, 5.25 to 5.95 indicating good quality streams, 5.96 to 6.67 indicating good-fair streams, 6.68 to 7.70 indicating fair quality streams, and >7.71 indicating poor quality streams (Lenat, 1993). The biotic index values for Crouch Branch indicate poor quality at Site 1, fair quality at Sites 2 and 3, and good-fair quality at Site 4. With respect to overall habitat quality, Sites 3 and 4 were very similar. The decrease in biotic index values between Sites 3 and 4, and the increase in number of taxa and number of EPT taxa strongly suggest that habitat quality is not the limiting factor in Crouch Branch, because habitat quality at these two sites was very similar.

Table 1. Summary Statistics for Macroinvertebrate Sampling in Crouch Branch, June 2, 1999

Parameter	Site 1	Site 2	Site 3	Site 4
Total Number of Taxa	25	23	31	44
Total Number of Organisms	135	53	202	248
Number of EPT Taxa	2	4	4	11
NC Biotic Index	8.32	7.63	7.09	6.32
Percent Dominant Taxon	33%	23%	21%	21%

Table 2 lists the relative abundance (percent) of major groups of macroinvertebrate taxa collected at the four sites. Chironomid dipterans (midges) were the most abundant group of macroinvertebrates collected at all sites, ranging in abundance from 39.6% at Site 2 to 74.3% at Site 3. The most abundant midges included *Conchapelopia* *Meropelopia* at all sites, *Phaenopsectra* at Site 1, *Polypedilum illinoense* and *Parametriocnemus lunbecki* at Sites 3 and 4, and *Tvetenia paucuna* group at Site 3. Of these taxa, only *Parametriocnemus lunbecki* and *Tvetenia paucuna* have low biotic index values (Table 3), which are indicative of high quality streams. Heteroptera (bugs) were more abundant at Sites 1 and 2 (14.8% and 20.8%) than at Sites 3 and 4 (6.9% and 3.2%). Most of the Heteroptera were the water striders, *Rhagovelia* and *Microvelia*, which live on the surface film of the water, rather than in the water. Because the water striders have minimal contact with the water, they are less likely to be affected by toxicants that may be present in the water. Of particular note is the fact that no mayflies or stoneflies were collected at Sites 1, 2, and 3, while these groups were relatively abundant at Site 4, comprising 13.3% and 4.8% of the organisms collected. Most mayflies and stoneflies are very intolerant of poor water quality, and their absence at Sites 1, 2, and 3 strongly suggest a problem with water quality. Most of the mayflies collected at Site 4 were Baetidae, which are among the more tolerant mayflies. Caddisflies were collected at all four sites (1.5 to 11.3%), but were much more abundant at Site 2 (11.3%) than at the other sites (1.5 to 4.0%). Most of the caddisflies at Site 2

were *Hydropsyche betteni*, which are among the most tolerant of the caddisflies, with a biotic index value of 8.1 (Table 3).

Overall, the taxonomic composition of the macroinvertebrate community of Crouch Branch indicates a stream that is dominated by pollution tolerant species at Site 1, with gradual improvement to a stream of fair to good quality at Site 4.

Table 2. Percent of Major Taxonomic Groups of Macroinvertebrates Collected from Crouch Branch, June 2, 1999

Taxon	Site 1	Site 2	Site 3	Site 4
Annelida (worms)	0.0%	5.7%	0.0%	0.4%
Crustacea (crayfish, shrimp)	0.0%	0.0%	0.0%	0.8%
Ephemeroptera (mayflies)	0.0%	0.0%	0.0%	13.3%
Plecoptera (stoneflies)	0.0%	0.0%	0.0%	4.8%
Trichoptera (caddisflies)	1.5%	11.3%	2.0%	4.0%
Megaloptera	0.7%	0.0%	1.0%	2.8%
Odonata (dragon and damselflies)	7.4%	1.9%	3.0%	5.6%
Heteroptera (bugs)	14.8%	20.8%	6.9%	3.2%
Coleoptera (beetles)	0.0%	5.7%	0.5%	2.0%
Diptera (flies) excluding midges	9.6%	15.1%	12.4%	3.6%
Chironomid Diptera (midges)	65.9%	39.6%	74.3%	59.3%

Table 3. Dominant Taxa of Macroinvertebrates Collected From Crouch Branch, June 2, 1999

Location	Taxon	Percent	NC Biotic Index Value ¹
Site 1	<i>Conchapelopia/Meropelopia</i>	32.6%	8.7
	<i>Phaenopsectra</i>	13.3%	7
	<i>Rhagovelia obesa</i>	12.6%	-
	<i>Limonia</i> sp.	5.9%	10
Site 2	<i>Conchapelopia/Meropelopia</i>	22.6%	8.7
	<i>Rhagovelia obesa</i>	20.8%	-
	<i>Hydropsyche betteni</i>	5.7%	8.1
Site 3	<i>Polypedilum illinoense</i>	20.8%	9.2
	<i>Conchapelopia/Meropelopia</i>	18.8%	8.7
	<i>Tvetenia paucuna</i> group	16.8%	5
	<i>Microvelia</i> sp.	5.4%	-
	<i>Parametriocnemus lunbecki</i>	5.0%	3.7
Site 4	<i>Polypedilum illinoense</i>	20.6%	9.2
	<i>Parametriocnemus lunbecki</i>	8.9%	3.7
	<i>Baetis</i> nr. <i>pluto</i>	7.7%	4.8
	<i>Conchapelopia/Meropelopia</i>	6.4%	8.7

¹Biotic index values are from Lenat (1993). Values range from 0 (most sensitive) to 10 (most tolerant).

Table 4 lists the relative abundance (percent composition) of functional feeding groups of macroinvertebrates at the four sites that were sampled. In most unperturbed streams in the southeast, collector-gatherers are the dominant functional feeding group. High numbers of collector-filterers generally indicates organic enrichment, while high numbers of predators generally indicates some form of imbalance in the stream community. As shown in Table 4, predators are the most abundant functional feeding group at Sites 1 and 2 (70.4% and 57.5%), but decrease to 23.4% of the organisms collected at Site 4. These data further substantiate that the upper reaches of Crouch Branch are perturbed and that stream quality improves with increasing distance from the H-02 outfall.

Table 4. Percent Composition of Functional Feeding Groups of Macroinvertebrates Collected in Crouch Branch, June 2, 1999.

Trophic Group	Site 1	Site 2	Site 3	Site 4
Collector-gatherers	10.4%	15.1%	36.9%	38.3%
Collector-filterers	1.5%	9.4%	9.9%	11.7%
Scrapers	0.0%	0.0%	0.0%	7.5%
Predators	70.4%	57.5%	35.4%	23.4%
Shredders	17.8%	17.9%	17.8%	19.2%

Table 5 presents total and dissolved copper and zinc data for Sites 1 through 4. These samples were collected on the same date that the macroinvertebrate sampling was performed. EPA ambient water quality criteria for copper and zinc at a hardness of 10 mg/l CaCO₃ are 1.65 and 15.07 µg/l, respectively. As can be seen in Table 5, total copper at Site 1 was 123 µg/l. Copper concentrations rapidly declined with increasing distance from the H-02 outfall to 20 µg/l at Site 2 and <10 µg/l at Site 4. Total zinc was 93 µg/l at Site 1 and decreased to 16 to 20 µg/l at Sites 3 and 4.

Table 5. Total and Dissolved Copper and Zinc in Crouch Branch, June 2, 1999

Location	Total Copper	Dissolved Copper	Total Zinc	Dissolved Zinc
Site 1	123 µg/l	100 µg/l	93 µg/l	76 µg/l
Site 2	20 µg/l	20 µg/l	24 µg/l	20 µg/l
Site 3	18 µg/l	15 µg/l	16 µg/l	15 µg/l
Site 4	<10 µg/l	<10 µg/l	20 µg/l	6 µg/l

Figures 2 through 4 compare longitudinal trends of the total number of taxa collected, number of EPT taxa, and NC biotic index values to total copper and zinc concentrations. As the figures indicate, there is a strong inverse relationship between metal concentrations and both the total number of taxa and number of EPT taxa collected. There is also a strong direct relationship between biotic index values and metal concentrations. Because higher biotic index values indicate more impaired communities, this relationship also indicates that increased metals are related to increased impairment of the macroinvertebrate community.

5.0 Comparison with 1997 Data

Table 6 compares summary statistics for the qualitative macroinvertebrate samples that was collected in 1997 from Crouch Branch just downstream from Road 4 (Site 6, as reported in Specht and Paller, 1998), and data collected from the same location (Site 1)

in 1999. Both sets of data were collected by the same certified laboratory (ETT Environmental) using the same sampling methods and the same level of effort. The only difference was the season in which the sampling was done. In 1997, samples were collected in November, while in 1999, samples were collected in June. Typically, fewer species are collected in late spring and early summer, just after emergence, while the largest number of species are usually collected during the fall and winter months.

The data indicate that although Site 1 still showed evidence of perturbation in 1999, the macroinvertebrate community at this location has improved markedly in the past two years. The number of taxa collected increased from 3 to 25; the total number of organisms increased from 5 to 135, and the number of EPT taxa increased from 0 to 2. The value for the North Carolina Biotic Index was higher (worse) in 1999 than in 1997. However, since only three species were collected in 1997, any interpretation of the Biotic Index data should be made cautiously. It is likely that if both sets of samples had been collected in the same season, Site 1 would have shown even more improvement.

The improvement at Site 1 suggests either that the quality of the effluent has improved during the past two years, or that there may be temporal variability in metal concentrations in the effluent, which periodically eliminate all but the most tolerant species, followed by periods of partial recovery.

Table 6. Comparison of Macroinvertebrate Data Collected During Qualitative Sampling of Natural Substrates in 1997 and 1999

Parameter	Site 1 (1997)	Site 1 (1999)
Total Number of Taxa	3	25
Total Number of Organisms	5	135
Number of EPT Taxa	0	2
NC Biotic Index	7.60	8.32
Percent Dominant Taxon	60%	33%
Taxon		
Annelida (worms)	0%	0.0%
Crustacea (crayfish)	60%	0.0%
Ephemeroptera (mayflies)	0%	0.0%
Plecoptera (stoneflies)	0%	0.0%
Trichoptera (caddisflies)	0%	1.5%
Megaloptera	0%	0.7%
Odonata (dragon and damselflies)	0%	7.4%
Heteroptera (bugs)	0%	14.8%
Coleoptera (beetles)	0%	0.0%
Diptera (flies) excluding midges	20%	9.6%
Chironomid Diptera (midges)	20%	65.9%

6.0 Conclusions

The results of the macroinvertebrate survey indicate that the macroinvertebrate community of Crouch Branch is severely impaired just downstream from the H-02 outfall and that the quality of the macroinvertebrate community improves with increasing distance from the outfall. Potentially toxic concentrations of copper and zinc from the H-02 outfall are most likely responsible for the degraded macroinvertebrate community at Site 1, since this site shows no evidence of habitat degradation. Site 2 suffers from severe channel erosion and scouring, and it is not possible to separate this physical degradation from possible toxic effects attributable to the H-02 effluent. Sites 3 and 4 are fairly similar with respect to habitat, but Site 4 supports a richer macroinvertebrate community. The quality of the macroinvertebrate community at Site 1 has shown substantial improvement since sampling was conducted in November 1997.

7.0 References

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APPENDIX 1

TABLE I. Species List. Qualitative Macroinvertebrate Assessment

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

ORDER EPHEMEROPTERA (mayflies)	stage	Site / # of Organisms			
		Site 1	Site 2	Site 3	Site 4
<i>Baetis intercalaris</i>	N	0	0	0	2
<i>Baetis nr. pluto</i>	N	0	0	0	19
Leptophlebiidae	N	0	0	0	1
<i>Stenonema modestum/smithae</i>	N	0	0	0	11

ORDER PLECOPTERA (stoneflies)	stage	Site / # of Organisms			
		Site 1	Site 2	Site 3	Site 4
<i>Acroneuria</i>	N	0	0	0	6
<i>Leuctra sp.</i>	N	0	0	0	5
<i>Paragnetina fumosa</i>	N	0	0	0	1

ORDER TRICHOPTERA (caddisflies)	stage	Site / # of Organisms			
		Site 1	Site 2	Site 3	Site 4
<i>Cheumatopsyche</i>	L	1	1	0	4
<i>Diplectrona modesta</i>	L	0	0	1	3
<i>Hydropsyche betteni</i>	L	1	3	1	0
<i>Hydropsyche elissoma</i>	L	0	0	0	2
<i>Lepidostoma sp.</i>	L	0	1	1	1
<i>Ceratonina sp.</i>	L	0	1	1	0

ORDER ODONATA (dragonflies)	stage	Site / # of Organisms			
		Site 1	Site 2	Site 3	Site 4
<i>Argia sedula</i>	N	6	0	0	0
<i>Boyeria vinosa</i>	N	2	0	2	7
<i>Calopteryx dimidiata</i>	N	0	1	4	5
<i>Cordulegaster sp.</i>	N	0	0	0	2
<i>Ischnura sp.</i>	N	2	0	0	0

ORDER HETEROPTERA (true bugs)	stage	Site / # of Organisms			
		Site 1	Site 2	Site 3	Site 4
<i>Hydrometra sp.</i>	A	0	0	0	1
<i>Microvelia sp.</i>	A	0	0	11	0
<i>Neogerris hesione</i>	A	3	0	0	0
<i>Rhagovelia obesa</i>	A	17	11	3	7

TABLE I. Species List. Qualitative Macroinvertebrate Assessment

Client: WSRC
Stream: Crouch Branch
County: Aiken, SC
Collection Date: 2 June 1999

	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
O. MEGALOPTERA (hellgrammites)					
<i>Nigronia serricornis</i>	L	1	0	2	7

	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
ORDER COLEOPTERA (beetles)					
<i>Helochaers sp.</i>	A	0	1	0	0
<i>Macronychus glabratus</i>	L, A	0	0	0	3
Staphylinidae	A	0	2	1	0
<i>Stenelmis sinuata</i>	L	0	0	0	2

	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
ORDER DIPTERA - other than midges					
<i>Culex</i>	L	1	0	0	0
<i>Chelifera</i>	L	0	0	3	0
<i>Clinocera sp.</i>	L	0	1	1	0
Ephydriidae	P	0	1	0	0
<i>Hemerodromia</i>	L,P	1	2	5	0
<i>Limonia (Geranomyia)</i>	L	8	0	0	0
Dolichopodidae	L	0	1	0	0
<i>Pilaria</i>	L	1	0	0	0
<i>Palpomyia sp.</i>	L	1	0	0	0
<i>Psychoptera sp.</i>	L	0	0	1	0
<i>Pseudolimnophila sp.</i>	L	1	0	0	0
<i>Simulium nr. decorum</i>	L	0	1	5	0
<i>Simulium nr. tuberosum</i>	L	0	0	4	7
<i>Dixa sp.</i>	L	0	0	1	1
<i>Tipula (immature)</i>	L	0	2	5	1

TABLE I. Species List. Qualitative Macroinvertebrate Assessment

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

ORDER DIPTERA - (Tanypodinae)	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
<i>Ablabesmyia mallochi</i>	L	11	0	0	0
<i>Apsectrocladius johnsoni</i>	L	1	0	0	0
<i>Conchapelopia/Meropelopia</i>	L	44	12	38	16
<i>Paramerina</i>	L	1	1	0	2
<i>Zavrelimyia</i>	L	2	0	0	1

ORDER DIPTERA - (Orthoclaadiinae)	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
<i>Brillia flavifrons</i>	L	0	0	3	10
<i>Corynoneura nr. taris</i>	L	0	2	0	1
<i>Cricotopus bicinctus</i>	L	3	1	0	0
<i>Eukiefferiella sp.</i>	L	0	0	4	3
<i>Parametriocnemus lundbecki</i>	L	0	1	10	22
<i>Rheocricotopus robacki</i>	L	0	0	2	8
<i>Smittia sp.</i>	L	1	0	0	0
<i>Thienemanniella xena gp.</i>	L	0	1	2	3
<i>Tvetenia paucunca gp.</i>	P	0	1	34	8

ORDER DIPTERA - (Chironomini)	Site / # of Organisms				
	stage	Site 1	Site 2	Site 3	Site 4
<i>Chironomus</i>	L	5	0	0	0
<i>Cryptochironomus fulvus gp.</i>	L	2	0	2	1
<i>Paralauterborniella nigrohalteralis</i>	L	0	0	0	1
<i>Phaenopsectra flavipes</i>	L	18	0	2	0
<i>Polypedilum aviceps</i>	L	0	0	0	1
<i>Polypedilum laetum</i>	L	0	0	0	1
<i>Polypedilum fallax</i>	L	0	0	3	2
<i>Polypedilum illinoense</i>	L	0	2	42	51
<i>Robackia claviger</i>	L	0	0	0	2
<i>Stenochironomus hilaris</i>	L	1	0	0	0

TABLE I. Species List. Qualitative Macroinvertebrate Assessment

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

Site / # of Organisms					
ORDER DIPTERA - (Tanytarsini)	stage	Site 1	Site 2	Site 3	Site 4
<i>Rheotanytarsus distinctissimus gp.</i>	L	0	0	2	6
<i>Tanytarsus</i>	L	0	0	6	5
<i>Zavrelia/Stempellinella</i>	L	0	0	0	3
PHYLUM ANNELIDA (worms, leeches)		Site 1	Site 2	Site 3	Site 4
Cambarincola		0	0	0	1
Lumbricidae		0	3	0	0
CLASS CRUSTACEA (crayfish, shrimp)	stage	Site 1	Site 2	Site 3	Site 4
Cambarus latimanus	J	0	0	0	2

APPENDIX 2

TABLE II. Percent Composition by Major Taxonomic Group

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

Taxon	Site1	Site2	Site3	Site4
Annelida (worms)	0.0%	5.7%	0.0%	0.4%
Mollusca (clams, snails)	0.0%	0.0%	0.0%	0.0%
Crustacea (crayfish, shrimp)	0.0%	0.0%	0.0%	0.8%
Ephemeroptera	0.0%	0.0%	0.0%	13.3%
Plecoptera	0.0%	0.0%	0.0%	4.8%
Trichoptera	1.5%	11.3%	2.0%	4.0%
Megaloptera	0.7%	0.0%	1.0%	2.8%
Odonata	7.4%	1.9%	3.0%	5.6%
Heteroptera	14.8%	20.8%	6.9%	3.2%
Coleoptera	0.0%	5.7%	0.5%	2.0%
Diptera (excl. midges)	9.6%	15.1%	12.4%	3.6%
Diptera (midges)	65.9%	39.6%	74.3%	59.3%

APPENDIX 3

TABLE III. Biological Parameter Results and Water Quality Ratings

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

BIOLOGICAL PARAMETER RESULTS	Site 1	Site 2	Site 3	Site 4
1. Taxa Richness	25	23	31	44
(Total Number of Organisms / Site)	135	53	202	248
2. EPT Index	2.0	4.0	4.0	11.0
3. EPT / Chironomid Ratio	0.02	0.29	0.03	0.37
4. Scraper / Filterer Ratio	0.00	0.00	0.00	0.64
5. Biotic Index	8.32	7.63	7.09	6.32
6. % Dominant Taxon	33%	23%	21%	21%
7. Shredder / Total # of Organisms Ratio	0.18	0.18	0.18	0.19
8. Community Loss Index	N/A	0.78	0.55	0.39

APPENDIX 4

TABLE IV. Functional Feeding Group Analysis

Client: WSRC

Stream: Crouch Branch

County: Aiken, SC

Collection Date: 2 June 1999

Trophic Groups	Site 1	Site 2	Site 3	Site 4
Collector - Gatherers	10.4%	15.1%	36.9%	38.3%
Collector - Filterers	1.5%	9.4%	9.9%	11.7%
Scrapers	0.0%	0.0%	0.0%	7.5%
Predators	70.4%	57.5%	35.4%	23.4%
Shredders	17.8%	17.9%	17.8%	19.2%