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**SECO WATERSHED BIOASSESSMENT STUDY**

# **TEXAS**

**SEPTEMBER 18, 1991 TO SEPTEMBER 1, 1993**

by

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September 29, 1993

**EDWARDS AQUIFER RESEARCH & DATA**

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## **ACKNOWLEDGMENTS**

The Seco Creek Bioassessment project was funded by Agreement No. 68-7442-2-147 between the Southwest Texas State University, Edwards Aquifer Research and Data Center and the Soil Conservation Service, United States Department of Agriculture. We would like to thank the various staff members of the Soil Conservation Service, landowners, staff of the Texas Agricultural Extension Service, Agricultural Stabilization and Conservation Service, Texas Parks and Wildlife Department, United States Environmental Protection Agency and others that provided assistance to the investigators. A special thanks goes to Victor Castillo, undergraduate research assistant on the project. Additional thanks go to the staff of the Edwards Aquifer Research and Data Center Laboratory for the special attention given to the analysis of samples from this project. We would also like to thank Mrs. Astin Hardcastle, intern, for assistance in producing the graphics in this report. We would also like to thank Calvin Phillips, a graduate research assistant that worked during the first year of the project.

## EXECUTIVE SUMMARY

The Seco Creek Water Quality Demonstration Project has been established in portions of Bandera, Medina and Uvalde Counties, Texas in order to demonstrate and transfer technology to agricultural producers that will protect the rapidly recharged and environmentally sensitive Edwards Aquifer from agrochemical, bacterial and sediment contaminants. EPA's Rapid Bioassessment Protocols (RBPs) II and V for Streams and Rivers were used to document effects of demonstrated best management practices and to monitor trends in water quality in the Seco Creek watershed.

RBP II (benthic macroinvertebrates) evaluates a series of seven metrics (community attributes) and is based on a family-level identification of the taxa comprising the invertebrate community. RBP V (fish) evaluates a series of twelve metrics and is based on a species-level identification of the taxa comprising the fish community.

Physical, chemical and bacteriological analyses and pesticide analyses of water samples were also performed. The physical, chemical and bacteriological analyses included the following parameters: fecal coliform, fecal streptococcus, fecal coliform: fecal streptococcus ratio, BOD<sub>5</sub>, total organic carbon, pH, temperature, conductivity, dissolved oxygen, nitrate, sulfate, ortho- and total phosphate, turbidity and total suspended solids. Pesticide analyses were carried out for Aldrin,  $\alpha$ -BHC,  $\beta$ -BHC,  $\gamma$ -BHC (Lindane),  $\delta$ -BHC,  $\alpha$ -chlordane,  $\delta$ -chlordane, Dieldrin, Endosulfan I, Endosulfan II, Endosulfan Sulfate, Endrin, Endrin Aldehyde, Heptachlor, Heptachlor Epoxide, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT.

Sampling began in September, 1991 and has been carried out through September, 1993. RBP II sampling and physical, chemical and bacteriological analyses were conducted twice each month on five sampling sites on Seco Creek. The sites were numbered 1-5, in order, from the northernmost (headwaters) site to the southernmost site. Sites 1-4 were located above the aquifer recharge zone, in an area predominantly influenced by ranching activities and Site 5 was located below the aquifer recharge zone, in an area heavily influenced by farming activities. RBP V sampling was carried out seasonally at each of the sites. Pesticide analyses were performed monthly on water samples collected below the recharge zone.

Physical, chemical and bacteriological data indicated that water quality parameters were consistently higher downstream throughout the course of the study, indicating lower water quality. Most of the water quality parameters remained within the good to excellent range at all sampling sites throughout the study. The sampling site below the recharge zone (Site 5) consistently showed high levels of fecal coliform and sulfate, and exhibited low dissolved oxygen levels on three sample dates. The lowermost site which was located above the recharge zone (Site 4) showed high levels of fecal coliform on ten sample dates. Site 3 showed high fecal coliform on seven sample dates. The headwaters site (Site 1) exhibited low dissolved oxygen levels on three sample dates. Physical, chemical and bacteriological data was inconclusive to judge overall water quality trends over time, as different parameters exhibited varying levels of increase and decrease at different sites during the course of the study. Pesticide levels were consistently low ( $< 0.08 \mu\text{g/l}$ ) throughout the course of the study.

RBP II results indicated a consistent biological condition score of Moderately impaired at the four sites located above the recharge zone and a consistent score of Non impaired at the site below the recharge zone. A habitat assessment comparison to reference site condition which was carried out at each of the sites indicated that Sites 1-4 were only partially supporting in their ability to sustain a non impaired biological community when compared to their reference site. Site 5 was judged to be fully

supporting in its ability to sustain a non impaired biological community, when compared to its reference site. Site 5 actually scored higher than its reference site in ability to support a non impaired community. When adjusted for habitat suitability, all sites consistently scored in the Non impaired category. Adjusted RBP II data indicates that the biological condition of Seco Creek increased downstream above the recharge zone, then decreased somewhat below the recharge zone. Sites 1, 2 and 5 showed slight improvement in biological condition during the course of the study. Site 3 exhibited a slight decline in biological condition. Site 4 showed periods of decline and recovery, with no overall trend in condition change being discernable.

RBP V results indicated a consistent Poor to Fair biological condition at each site. When adjusted for habitat suitability, all sites consistently scored in the Good or Excellent range, with the exception of Site 1, which scored in the high Fair category. The presence of a healthy population of salamanders (*Eurycea* sp.) which was noted at Site 1 would tend to indicate that Site 1 was also excellent from a biological standpoint. Adjusted RBP V data indicates that the biological condition of Seco Creek increased downstream above the recharge zone, with a slight decrease below the recharge zone. Site 2 exhibited a slight overall increase in biological condition throughout the course of the study. Site 5 exhibited a slight overall decline in biological condition. Sites 1, 3 and 4 exhibited no discernable change in biological condition during the course of the study.

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## INTRODUCTION

Under authority of the President's Water Quality Initiative, the U.S. Department of Agriculture and the State of Texas have cooperatively established the Seco Creek Water Quality Demonstration Project in portions of Bandera, Medina and Uvalde Counties. Leadership for this project is being provided by the U.S.D.A.-Soil Conservation Service, the Texas Agricultural Extension Service, the Texas State Soil and Water Conservation Board and the U.S.D.A.-Agricultural Stabilization and Conservation Service. The project is intended to demonstrate and transfer technology to producers that will protect the environmentally sensitive, rapidly recharged Edwards Aquifer from agrochemical, bacterial and sediment contaminants. The project will encourage voluntary adoption of demonstrated best management practices in order to reduce nonpoint source water pollution originating on rangeland and cropland. Another goal of the project is to demonstrate technology that has potential for enhancing aquifer recharge. The project has far reaching potential for adoption of best management practices on over 1 billion acres of rangeland and cropland across the United States. In order to document the effects of these best management practices on the water quality of Seco Creek, U.S. E.P.A.'s Rapid Bioassessment Protocols (RBP) II and V for Streams and Rivers were used (Plafkin, et al, 1989). These RBP's were specifically developed to obtain basic aquatic life data for use in planning and management, utilizing fundamental assessment techniques to generate basic information on ambient physical, chemical and biological conditions. Sampling was conducted at five locations on Seco Creek during the period of September 1991 through September 1993. Concurrent with the data collected by RBP's II and V, chemical and bacteriological analyses were conducted on Seco Creek water samples. The chemical and bacteriological analyses included the following parameters: fecal coliform, fecal streptococcus, fecal coliform: fecal streptococcus ratio, BOD<sub>5</sub>, TOC, pH, temperature, conductivity, dissolved oxygen, nitrate, sulfate, ortho- and total phosphate, turbidity, and total suspended solids. Additionally, pesticide scans were run on samples collected below the recharge zone. The primary objective of the study was to provide data to gauge effects of best management practices and to monitor trends in water quality in the Seco Creek Watershed.

## DESCRIPTION OF STUDY AREA

The Seco Creek watershed (Figure 1) comprises 170,670 acres in Bandera, Uvalde, Medina, and Frio Counties. The watershed includes 32,500 acres overlying the environmentally sensitive Edwards Aquifer Recharge Zone (Figure 2). The watershed is composed of predominately rangeland (>85%) with the remaining area consisting of irrigated and dryland cropland and pastureland. Predominate land uses are ranching with production of cattle, Angora goats, and native and exotic wildlife. Major crops produced within the watershed include corn, cotton, small grains and vegetable crops. Geographically, the portion of the watershed above the recharge zone is located within portions of the Edwards Plateau Major Land Resource Area of Texas. The portion of the watershed below the recharge zone is located within the Rio Grande Plains Major Land Resource Area. The southern limit of the aquifer recharge zone is the boundary of the two resource areas. The majority of the cropland in the watershed is located below the recharge zone.

Average annual rainfall throughout the region is 28-29 inches, with the majority (15-16 inches) falling during the months of April, May, June, September and October. The northern portion of the watershed receives slightly more rainfall than the southern portion, although rainfall is highly variable throughout the entire region. Average daily

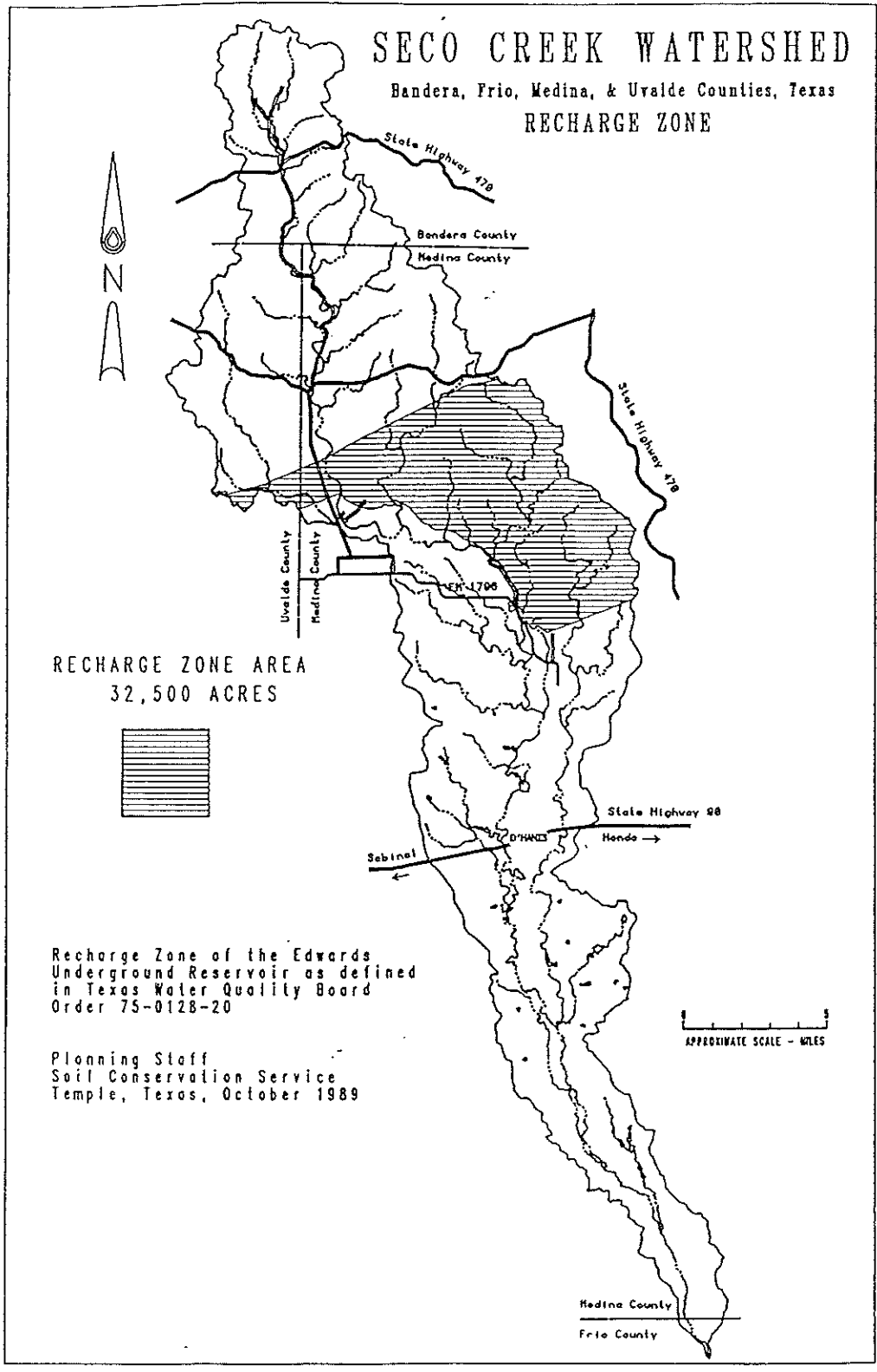
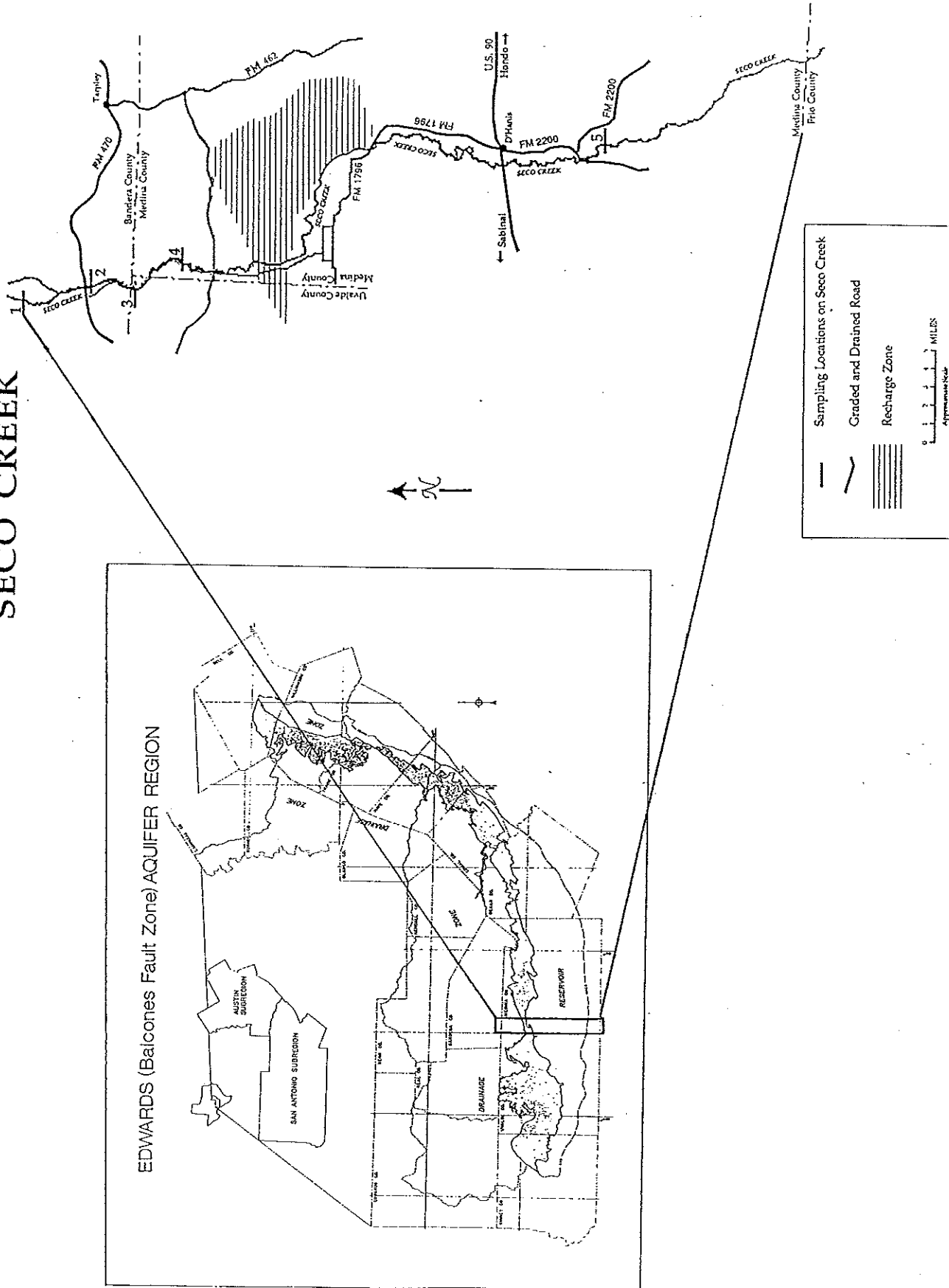


Figure 1. Seco Creek Watershed (Bandera, Uvalde, Medina, and Frio Counties).

# SECO CREEK



Edwards Aquifer Research and Data  
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Figure 2. Location of the Seco Creek watershed in relation to the Edwards Aquifer recharge zone.

maximum temperatures occur in August and are 94.7° F in the northern portion of the watershed and 98.4° F in the southern portion. Average daily minimum temperatures occur in January and are 32.3° F in the northern portion of the watershed and 38.6° F in the southern portion.

The headwaters of Seco Creek are in southwestern Bandera County. The creek originates from a number of springs which issue from canyons and hillsides. Seco Creek traverses the northeastern corner of Uvalde County before entering Medina County. As it crosses Medina County, the creek flows over the recharge zone of the Edwards Aquifer. The stream becomes ephemeral since all baseflow enters the aquifer at this point (Figure 3). This characteristic is reflected in the creek's name, "Seco" being a Spanish word meaning "dry." South of the recharge zone the creek emerges once again, continuing its journey through Medina County before emptying into Hondo Creek in northern Frio County. Above the recharge zone the creek is a perennial stream. Below the recharge zone it exists mainly as a series of more or less permanent riffles and pools, rather than as a continuously uninterrupted stream. Elevations along the creek range from 1800 feet in the northern portion of the watershed to 850 feet at the confluence with Hondo Creek.

Soils along the creek range from steep, very cobbly clayey and loamy, shallow to very shallow soils in the headwaters region, to exposed limestone bedrock and nearly level to gently sloping, undulating to steep, shallow to very shallow, gravelly and stony to clayey and loamy soils in the area of the recharge zone, to deep, nearly level to gently sloping, loamy and clayey soils below the recharge zone.



Figure 3. Seco Creek over the Edwards Aquifer recharge zone.

## Sampling Sites

Five sampling sites were established on Seco Creek as a part of the study (Figure 4). The sites were numbered 1-5, in order, from the northernmost to the southernmost site. Sites 1-4 were located above the recharge zone and Site 5 was located below the recharge zone.

Site 1 - This site was located in Bandera County, 5 miles north of F.M. 470, at the headwaters of West Seco Creek (29° 43' 20" N. latitude; 99° 26' 16" W. longitude). The site was situated at the head of a steep, rocky canyon, and was located approximately 10 yards below a developed spring. The site consisted of a shallow riffle with a gravel/cobble substrate and a deep pool, having a silty substrate, located below the riffle. The creek was not continuously-flowing much below the site. The site was partly shaded. Vegetation at the site consisted mainly of pecan, chinquapin oak, white oak, and grasses such as Texas wintergrass, bermudagrass and K.R. bluestem. The dominant soil at the site was a very cobbly clay consisting of about 65% limestone fragments (Figure 5).

Site 2 - This site was located in Bandera County, just south of F.M. 470 (29° 39' 58" N. latitude; 99° 25' 22" W. longitude). The site was situated about 30 yards downstream from the bridge at the road crossing. The site consisted of a deep pool with a silty substrate and a shallow riffle with a gravel/cobble and limestone bedrock substrate which was located below the pool. The site was open. Vegetation at the site consisted mainly of perennial threeawn grasses and sedges, with some live oak, sycamore and ashe juniper. The creek was not deeply embedded at this site. The dominant soil at the site was a calcareous silty clay overlying fractured limestone (Figure 6).

Site 3 - Site 3 was located in Uvalde County, 3.5 miles south of F.M. 470 (29° 37' 9" N. latitude; 99° 25' 20" W. longitude). The site consisted of a shallow riffle with a pocket of silt/gravel substrate overlying solid limestone bedrock, and stream runs located above and below the riffle, and with similar substrate. The site was open and was dominated by grasses such as K.R. bluestem, and perennial threeawn and sedges, with some ashe juniper and live oak also present. The creek was not deeply embedded at this site. The dominant soil at the site was a well-drained loam (Figure 7).

Site 4 - Site 4 was located in Medina County, 6.5 miles south of F.M. 470 (29° 35' 16" N. latitude; 99° 24' 5" W. longitude). The site was situated about 200 yards downstream from a county road crossing. The site consisted of several riffles having cobble substrates and a pool with a cobble substrate located below the riffle areas. The site was open. The creek banks at this site were extensively covered with cobbles and boulders. The dominant vegetation present consisted of perennial grasses such as K.R. bluestem and perennial threeawn, with scattered trees and shrubs such as sycamore, live oak, red oak, Texas persimmon, and willow baccharis also present. The stream was not deeply embedded at the site. The dominant soil present was a shallow clay overlying caliche and limestone (Figure 8).

Site 5 - This site was located in Medina County, 7.2 road miles south of the town of D'Hanis. It was located 1.7 road miles south of the point where Deer Creek Road branches off F.M. 2200, and 0.8 miles east of Deer Creek Road (29° 14' 53" N. latitude; 99° 16' 21" W. longitude). The site consisted of a shallow riffle with a gravel/cobble substrate, and a pool also having a gravel/cobble substrate downstream from the riffle. The site was partly shaded. Vegetation was dominated by trees and shrubs such as common buttonbush, elm, mesquite, and whitebrush, and by grasses such as bermudagrass. The creek was deeply embedded at this site, with banks 10-15 feet high. The dominant soil at the site consisted of a deep, frequently flooded clay loam (Figure 9).

# SECO CREEK

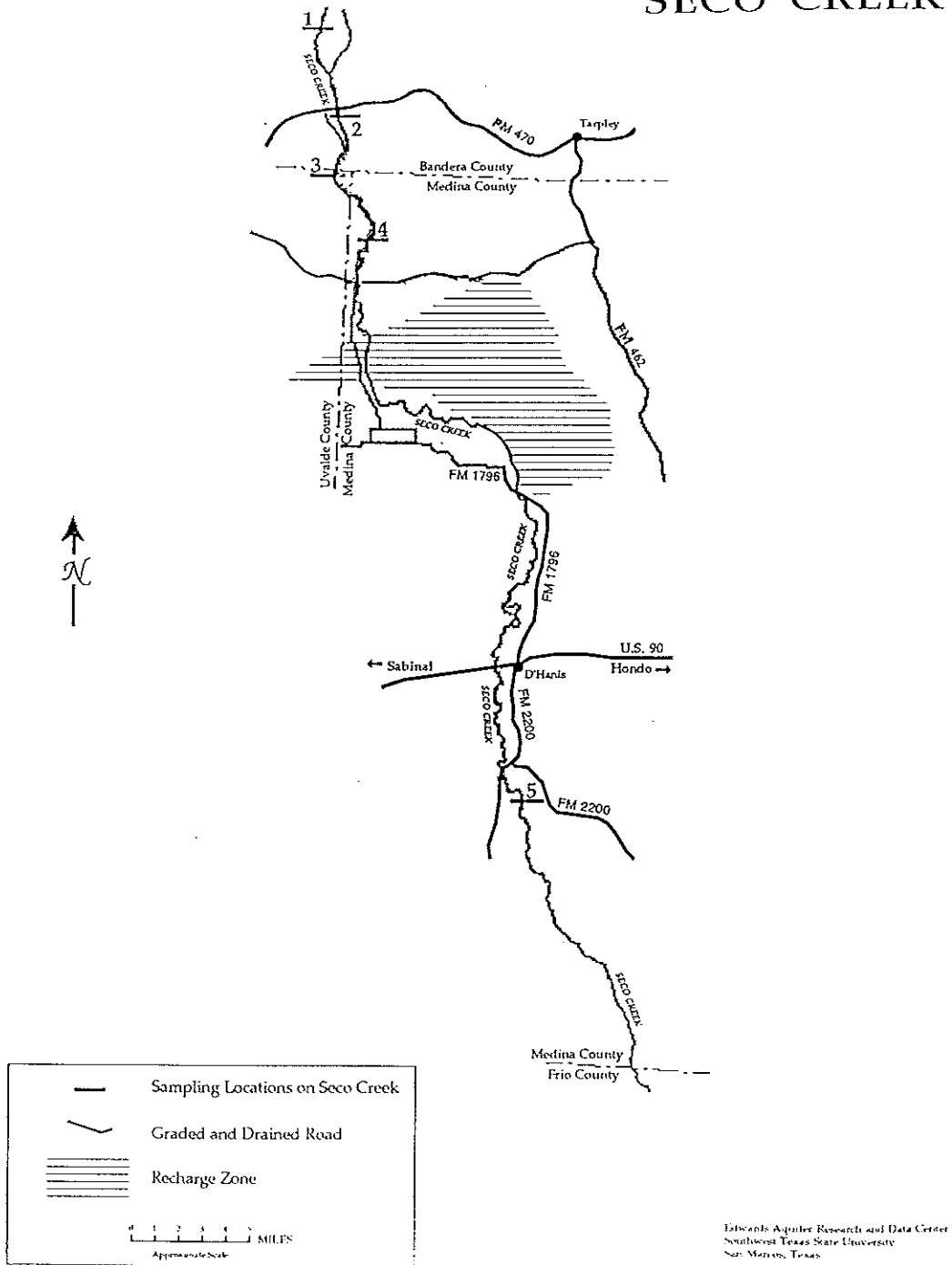


Figure 4. Sampling locations on Seco Creek.





Figure 5. Site 1 on Seco Creek.



Figure 6. Site 2 on Seco Creek.



Figure 7. Site 3 on Seco Creek.



Figure 8. Site 4 on Seco Creek.



Figure 9. Site 5 on Seco Creek.

## METHODS AND MATERIALS

### Physical, Chemical and Bacteriological Data

Physical, chemical and bacteriological samples were collected twice each month concurrent with RBP II sampling. Temperature, dissolved oxygen and pH data were taken in the field using a YSI® Model 58 Water Quality Instrument and a HANNA® pocket pH meter, respectively. The remainder of the parameters were analyzed in the water analysis lab at the Edwards Aquifer Research and Data Center from samples collected in the field.

Chemical and bacteriological samples were collected using one gallon plastic cubitainers, 120 ml sterile plastic containers and 50 ml amber, screw top bottles. Water samples were kept on ice during transportation and were refrigerated at 3<sup>o</sup> Celsius upon returning to the lab. The following methods (APHA, 1989) were used to test the water samples: 1. Fecal coliform - Membrane Filtration Technique (Method 9222 D); 2. Fecal streptococcus - Membrane Filtration Technique (Method 9230 C); 3. Biological Oxygen Demand - 5-Day BOD Test (Method 5210 B); 4. Total Organic Carbon - Combustion-Infrared (Method 5310 B); 5. Conductivity - Cole-Palmer® Conductivity Meter 1481-60; 6. Nitrate - Automated Cadmium Reduction (Method 4500-NO<sub>3</sub><sup>-</sup> F); 7. Sulfate - Turbidimetric (Method 4500-SO<sub>4</sub><sup>2-</sup> E); 8. Ortho-Phosphate - Ascorbic Acid (Method 4500-P); 9. Total-Phosphate - Ascorbic Acid (Method 4500-P); 10. Turbidity - HF Instruments® Turbidimeter Model DRT 100 B; and 11. Total Suspended Solids - Total Suspended Solids (Method 2540 D).

### Pesticide Analysis

Water samples for pesticide analysis were collected monthly at Site 5. Samples were collected in three, one-liter Hexane-washed glass bottles with plastic screw-on caps. The samples were kept on ice during transportation, and were refrigerated at 3<sup>o</sup> Celsius upon returning to the lab. Samples were analyzed for Aldrin;  $\alpha$ -BHC;  $\beta$ -BHC;  $\gamma$ -BHC (Lindane);  $\delta$ -BHC;  $\alpha$ -chlordane;  $\delta$ -chlordane; Dieldrin; Endosulfan I; Endosulfan II; Endosulfan Sulfate; Endrin; Endrin Aldehyde; Heptachlor; Heptachlor Epoxide; 4,4'-DDD; 4,4'-DDE; and 4,4'-DDT. Pesticide samples were run according to Gas Chromatographic Method 6630B (APHA, 1989).

### RBP II - Benthic Macroinvertebrates

#### Field methods

Benthic macroinvertebrates were sampled twice each month. The only exceptions being when sampling was prevented by high streamflow conditions following heavy rains. On each sampling date benthic macroinvertebrates were sampled using a four-foot X two-foot kick screen made of two five-foot wood garden hoe handles and 500 micron mesh netting. A one m<sup>2</sup> area of the substrate just upstream from the kick screen was disturbed by kicking and organisms which were dislodged from the substrate washed into the net, which was held by a second person in such a manner that not less than three feet of the screen was exposed to the water flow. Two 45 second kicks were made, one in a fast moving riffle and one in a slow moving riffle. These two samples were composited on the screen and returned to shore for sorting to order-level. Sorting was carried out for approximately 30 minutes, or until 100 organisms were collected from the screen. The

collected organisms were stored in 80% Ethanol in 15 dram plastic vials, and returned to the lab. In the lab, organisms were sorted to family-level, preserved in 80% Ethanol in 2 dram screw cap vials, and the number from each family was recorded.

### Data analysis

Families were given pollution tolerance values (Plafkin, et al, 1989) and functional feeding group assignments (Merritt and Cummins, 1984; Thorp and Covich, 1991; and Pennak, 1989). Several insect families are assigned multiple functional feeding group classifications by Merritt and Cummins. In order to clarify these classifications, organisms were further identified to genus, and where possible, to species. The community structure data thus recorded was used to score seven metrics for Rapid Bioassessment Protocol II (RBP II) (Plafkin, et al, 1989).

Metrics which were scored in the study were:

1. Taxa richness: total number of families collected
2. Family Biotic Index (modified):  $\sum (x_j t_j)/n$ , where  
 $x_j$  = number of individuals within a family  
 $t_j$  = tolerance value for the family  
 $n$  = total number of organisms in the sample
3. Ratio of scrapers/filtering collectors:  
number of scrapers/(number of scrapers + number of filtering collectors)
4. Ratio of EPT and Chironomid abundances:  
number of EPT individuals/(number of EPT individuals + number of Chironomids), EPT = Ephemeroptera, Plecoptera, and Trichoptera
5. Percent contribution of dominant Family: percent contribution of the dominant family to the total number of organisms
6. EPT Index: number of families belonging to the Orders Ephemeroptera, Plecoptera, and Trichoptera which were collected
7. Community Loss Index:  
(taxa richness at the reference site - taxa common to reference and sampling sites)/taxa richness at the sampling site

One metric which is included in the EPA Protocols, Ratio of Shredders/Total, was not evaluated due to the lack of abundance of coarse particulate organic matter (CPOM) at the study sites. CPOM is defined as organic matter > 1mm in diameter which is largely derived from terrestrial plant communities (Plafkin, et al, 1989). Each metric value obtained was given a Biological Condition Score of 0, 3, or 6, based on its percent comparison to the metric value obtained from reference station data. Organisms which had no pollution tolerance values assigned were discounted when calculating the Modified Family Biotic Index metric. Scoring criteria for the Percent Contribution of Dominant Family metric was expressed as the actual percent contribution, not percent comparability to the reference station. The Community Loss Index was scored as a range of values, and was not given a percent comparability to the reference station, because a comparison to the reference station is incorporated into the Index (Plafkin, et al, 1989). The metric scores for each sampling site were totalled, and were compared to the total metric score for the reference site to obtain the Percent Comparability to Reference Site value. The reference site for Sites 1-4 was given a total metric score of 42, and the reference site for Site 5 was given a total metric score of 36 for purposes of percent comparability. Each sampling site was classified as being Non impaired, Moderately impaired, or Severely impaired on each sample date, based on its percent comparability to the reference site value.

Reference sites were selected, based on the Ecoregion Concept, from a list of ecoregion reference sites obtained from the Texas Water Commission. Sites 1-4, which are

located in the Central Texas Plateau Ecoregion, were compared to the Upper Medina River at S.H. 16, west of Bandera, in Bandera County. Site 5, which is located within the Southern Texas Plains Ecoregion, was compared to Metate Creek at F.M.791, southwest of Campbellton, in Atascosa County. These reference sites were chosen, based on geographical proximity to, and similarity of basin size with, the Seco Creek watershed.

A habitat assessment matrix was completed for each reference site and each sampling site. The matrices were evaluated to determine percent comparability of habitat between the sampling sites and the reference sites. The percent comparability was used to judge the potential for each sampling site to support an acceptable level of biological health compared to its reference site.

## **RBP V - Fish**

### **Field methods**

Fish were sampled at each site on a seasonal basis (four times per year). Fish were collected using a backpack electroshocking unit. One person worked in pools and along the banks and under overhangs with the electroshocking unit. Fish which were shocked were collected by a second person, using a long handled net. Electroshocking was supplemented by the use of a ten foot minnow seine. Fish were preserved in the field in 5% Formalin and were returned to the lab for identification. In the lab, fish were identified to species and the number of each species was recorded. Fish species were assigned to origin, tolerance and trophic levels (Plafkin, et al, 1989; Hubbs, et al, 1991), and this information was used to score twelve RBP V metrics (Plafkin, et al, 1989).

### **Data analysis**

RBP V allows for some discretion in selecting individual metrics for analysis. The metrics which were evaluated in this study were:

1. Total number of species
2. Number of catfish species
3. Number of sunfish species
4. Number of minnow species
5. Number of intolerant species
6. Percent Green sunfish
7. Percent omnivores
8. Percent insectivores
9. Percent top carnivores
10. Total number of individuals
11. Percent hybrids
12. Percent of individuals with disease or anomalies

These metrics were chosen from a list of acceptable substitutes based on applicability to the two ecoregions represented in the watershed (Plafkin, et al, 1989). Metric 2 (Number of catfish species) is not listed in the EPA Protocols, but was included after consultation with Texas Parks and Wildlife personnel who advised that catfish represent benthic, long-lived species, and that the metric would be an acceptable substitute. Metrics 1-5 were scored based on species-waterbody size relationships developed from least-impaired stream data obtained from the Texas Water Commission, Texas Parks and Wildlife Department, and the Environmental Protection Agency. Metrics 6-9, 11 and 12 were scored directly as a percentage of individuals collected. Metric 10 was scored against the Upper Medina River and Metate Creek regional reference sites. Each metric value was expressed as a 1, 3, or 5, based on its percentage value. The twelve metric scores for each sampling site were totalled to obtain an Index of Biotic Integrity (IBI) score. Each sampling site was classified as being in Very Poor, Poor, Fair, Good, or Excellent condition on each sample date, based on its IBI score. Sites 1-4 were compared to Central Texas Plateau Ecoregion data, while Site 5 was compared to Southern Texas Plains Ecoregion data.



## RESULTS AND DISCUSSION

### Physical, Chemical and Bacteriological Data

The results of the physical, chemical and bacteriological analysis are shown in Appendix 1. The only indication of degraded water quality occurred during the periodic flooding which occurred throughout the sampling period. During flooding, water quality parameters such as fecal coliform, fecal coliform: fecal streptococcus ratio, and total suspended solids were higher, indicating lower water quality. As runoff ceased, these parameters returned to very low levels. Most other water quality parameters remained within the good to excellent range for water quality.

The State of Texas does not have stream quality standards established for Seco Creek. For purposes of comparison, the standards which have been established for the Medina River segment above Medina Lake (segment 1905 of the San Antonio River Basin) were used to evaluate the physical, chemical and bacteriological data obtained during the survey period. The results of the comparison are shown in Table 1. Site 5 consistently exceeded the standards for sulfate (> 100 mg/l on 39 sampling dates) and fecal coliform. Sites 3 and 4 showed high fecal coliform levels during periods of extremely high or low streamflow. Sites 1 and 5 had dissolved oxygen levels below 6.0 mg/l on three sampling dates. Site 2 had dissolved oxygen levels below 6.0 mg/l on one sampling date.

**Table 1. Comparison of stream quality standards established for the Medina River above Medina Lake with the physical, chemical and bacteriological data obtained on Seco Creek from 9/18/91 - 9/1/93.**

Medina River Criteria	Seco Creek Site 1	Seco Creek Site 2	Seco Creek Site 3	Seco Creek Site 4	Seco Creek Site 5
<sup>1</sup> Chloride - 50 mg/l	not measured	not measured	not measured	not measured	not measured
<sup>1</sup> Sulfate - 100 mg/l	9.52 mg/l	50.4 mg/l	42.5 mg/l	34.6 mg/l	400.2 mg/l
<sup>1</sup> Total Dissolved Solids - 400 mg/l	not measured	not measured	not measured	not measured	not measured
Dissolved Oxygen - 6.0 mg/l	5.5 - 9.5 mg/l	5.7 - 11.3 mg/l	6.3 - 13.2 mg/l	6.5 - 11.6 mg/l	5.0 - 12.9 mg/l
pH Range - 6.5 - 9.0	6.6 - 8.1	6.4 - 8.1	7.0 - 8.4	6.7 - 8.3	6.4 - 8.2
<sup>2</sup> Fecal Coliform - 200 colonies/100 ml	exceeded on 2 sample dates	exceeded on 3 sample dates	exceeded on 7 sample dates	exceeded on 10 sample dates	exceeded on 24 sample dates
<sup>3</sup> Temperature - 88° F (31.1° C)	73° F (23.0° C)	84° F (29.0° C)	85° F (29.5° C)	81° F (27.2° C)	82° F (27.9° C)

<sup>1</sup> Annual average not to exceed

<sup>2</sup> Thirty-day geometric mean not to exceed

<sup>3</sup> Not to exceed

The data indicates that while remaining mostly within the good to excellent range for water quality, most of the water quality parameters tended to be higher downstream, indicating lower water quality (Figures 10 - 17). Site 5 showed the highest average values for fecal coliform, fecal streptococcus, BOD<sub>5</sub>, TOC, conductivity, temperature, nitrate, sulfate, orthophosphate, total phosphate, turbidity, and total suspended solids, and the lowest average dissolved oxygen value. Site 1 had the lowest average values for fecal streptococcus, fecal coliform: fecal streptococcus ratio, temperature, and sulfate, but also had the lowest average pH value. Site 2 had the lowest average values for fecal coliform, nitrate, turbidity, and total suspended solids. Site 3 had the lowest average values for BOD<sub>5</sub>, and TOC, and the highest average dissolved oxygen and pH value. Site 4 had the lowest average values for conductivity and total phosphate. The lowest average orthophosphate value was shared between Site 1 and Site 3.

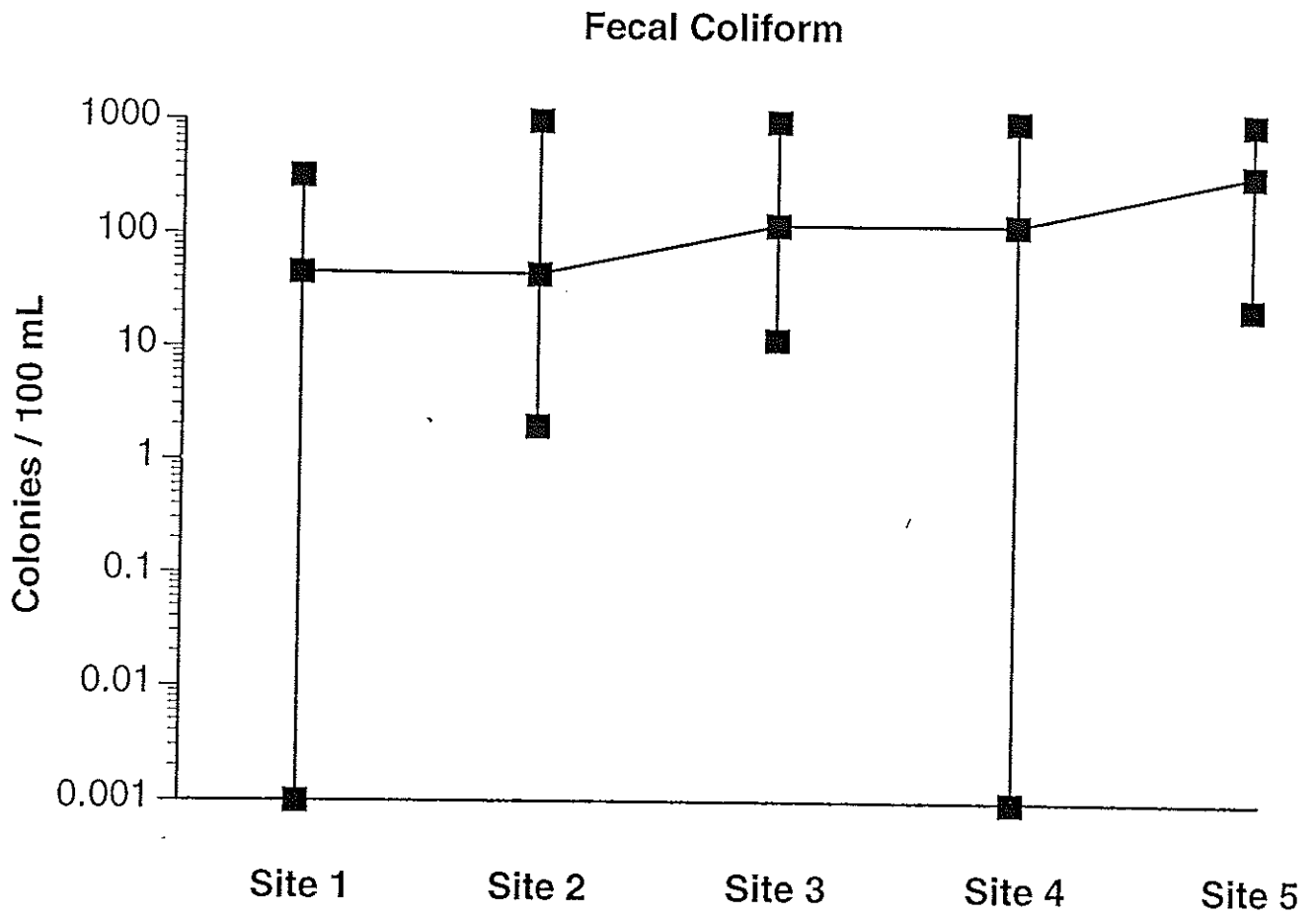


Figure 10. Maximum, minimum and average fecal coliform levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

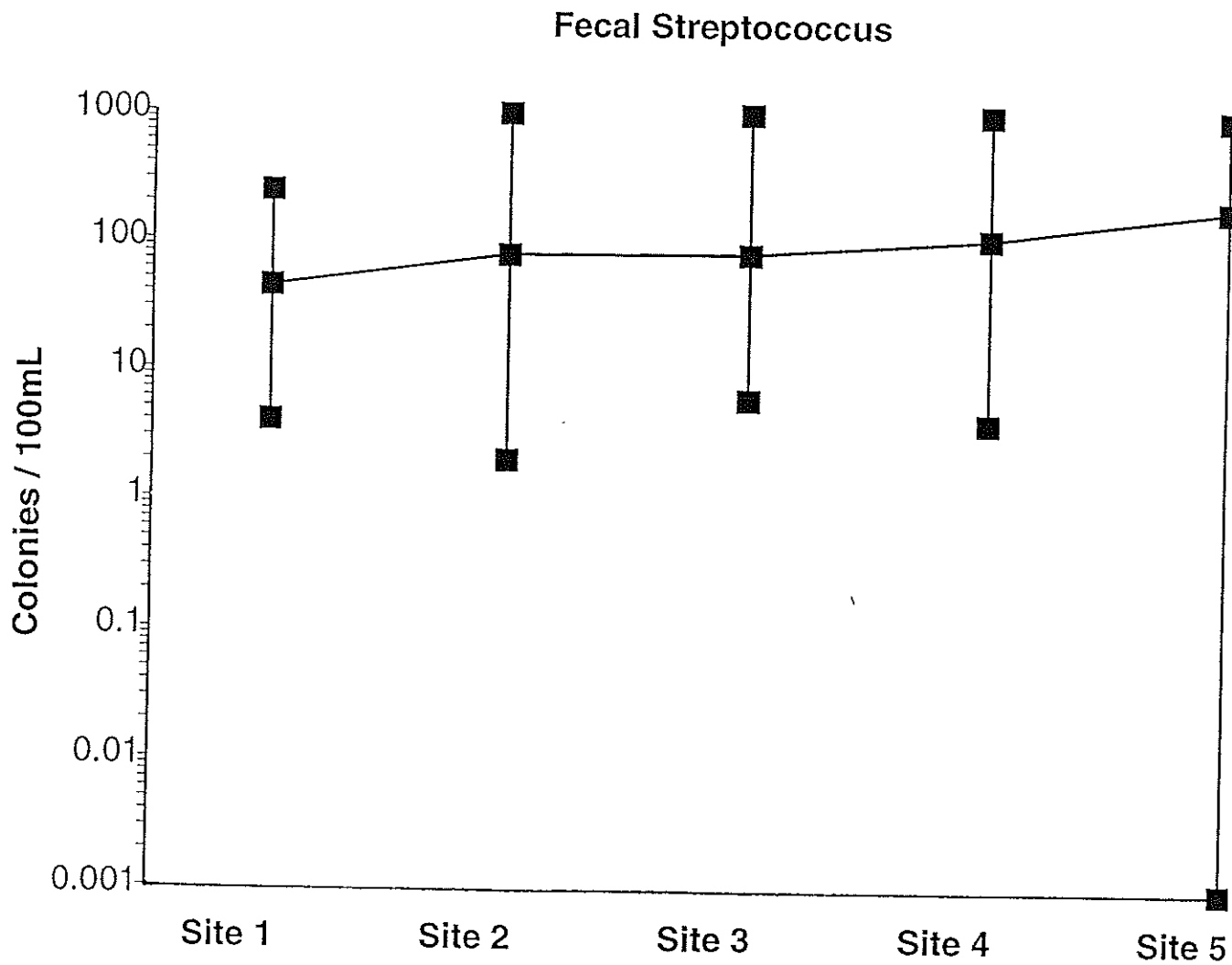


Figure 11. Maximum, minimum and average fecal streptococcus levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

### Total Organic Carbon

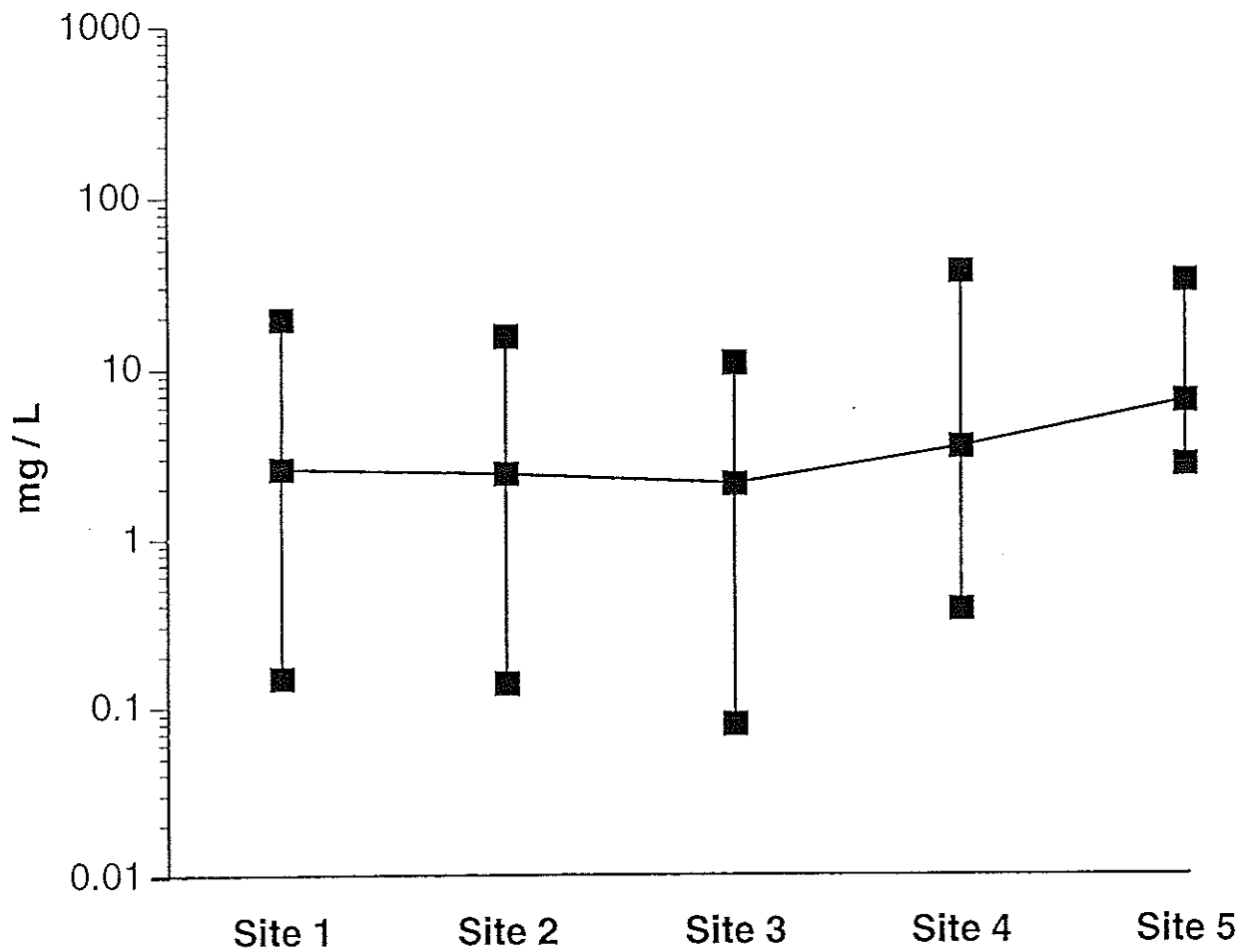


Figure 12. Maximum, minimum and average total organic carbon levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

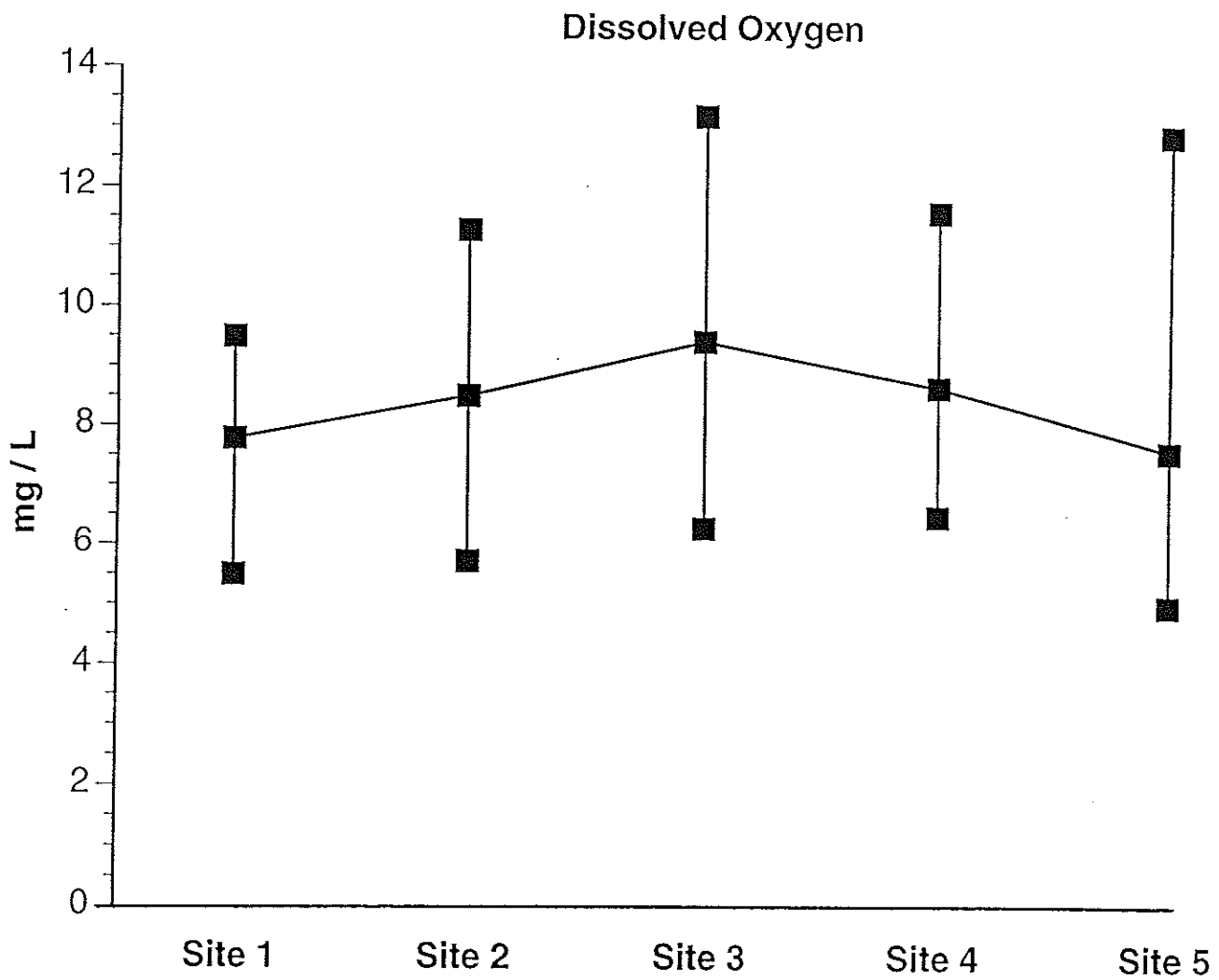


Figure 13. Maximum, minimum and average dissolved oxygen levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

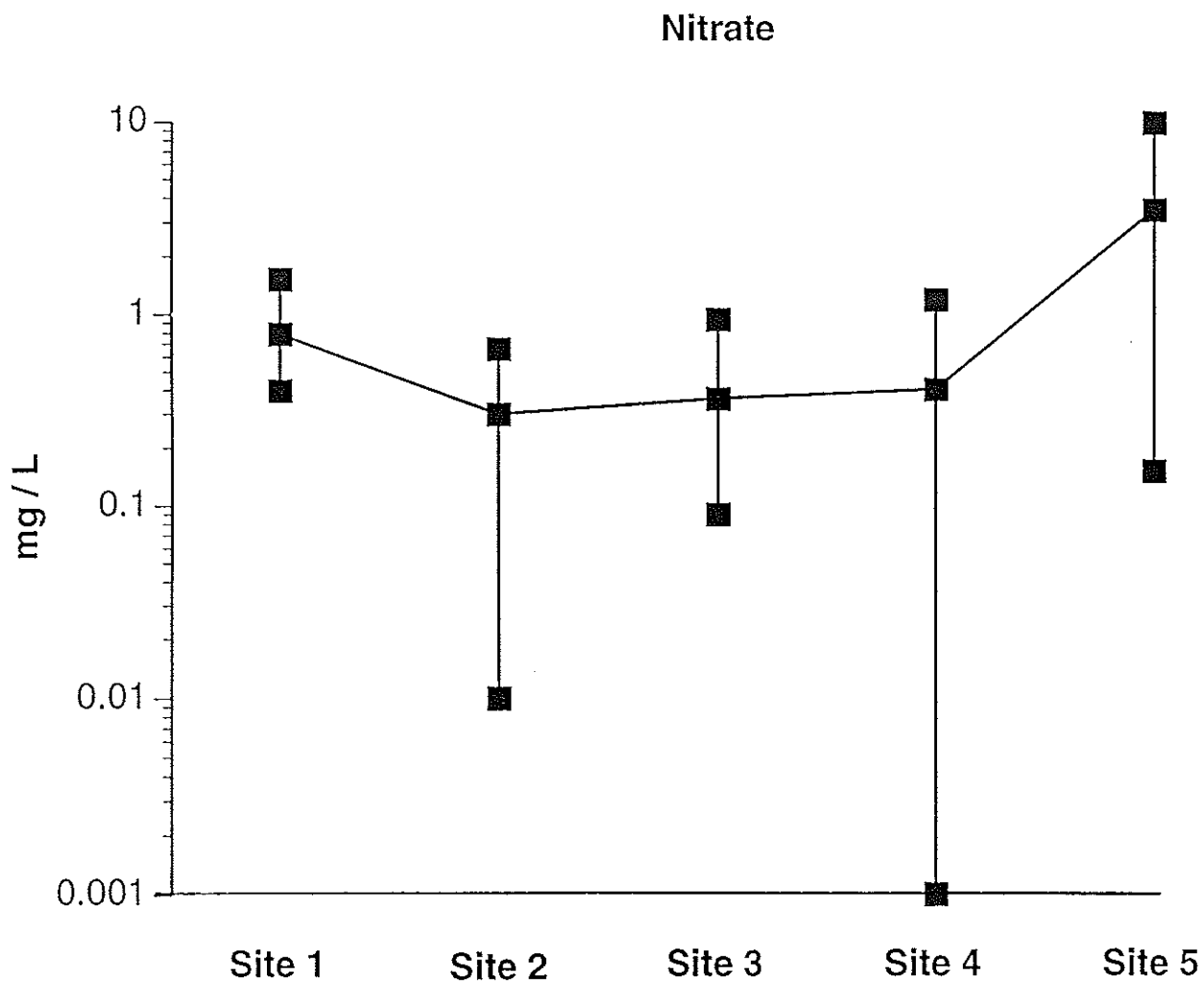


Figure 14. Maximum, minimum and average nitrate levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

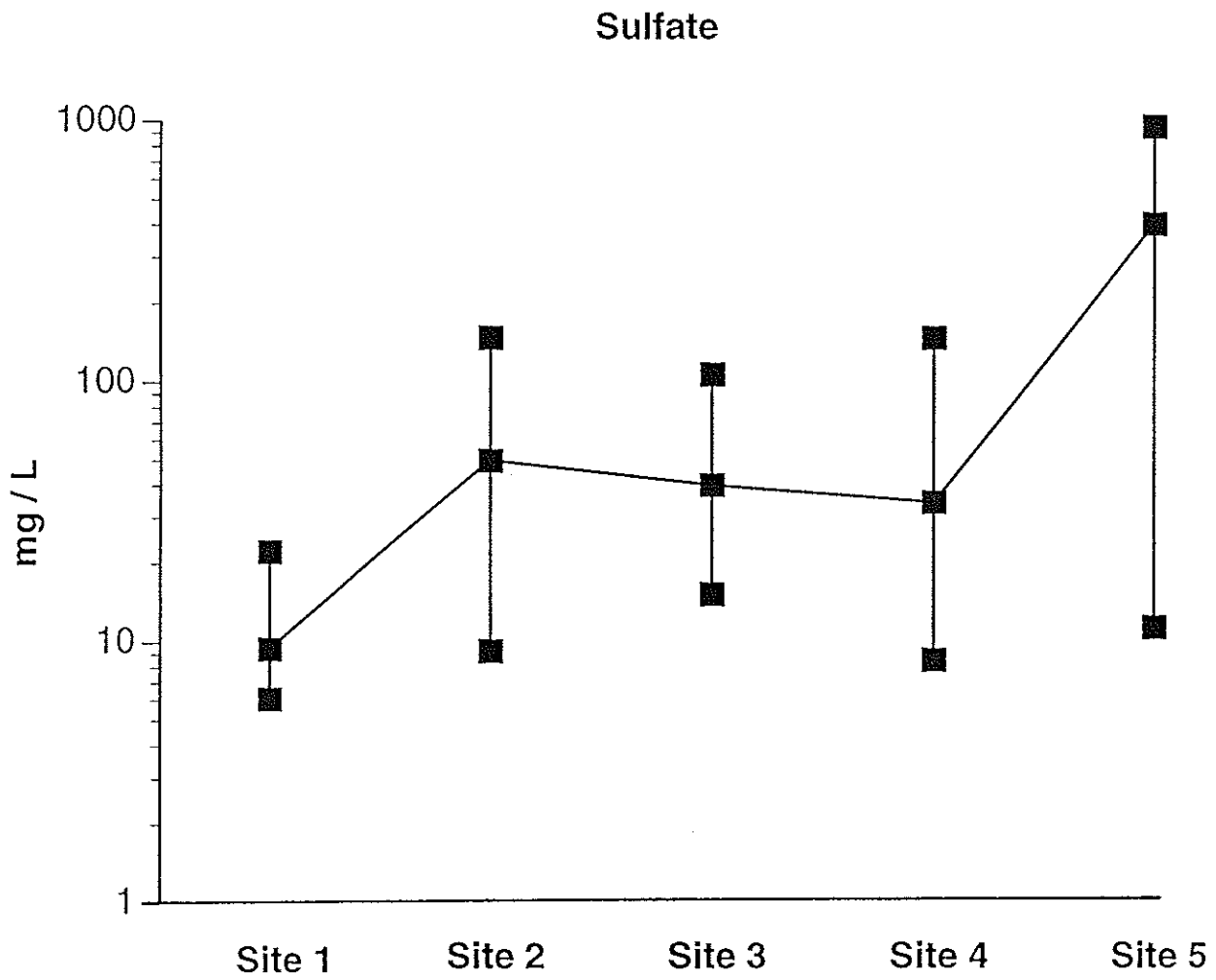


Figure 15. Maximum, minimum and average sulfate levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.



### Turbidity

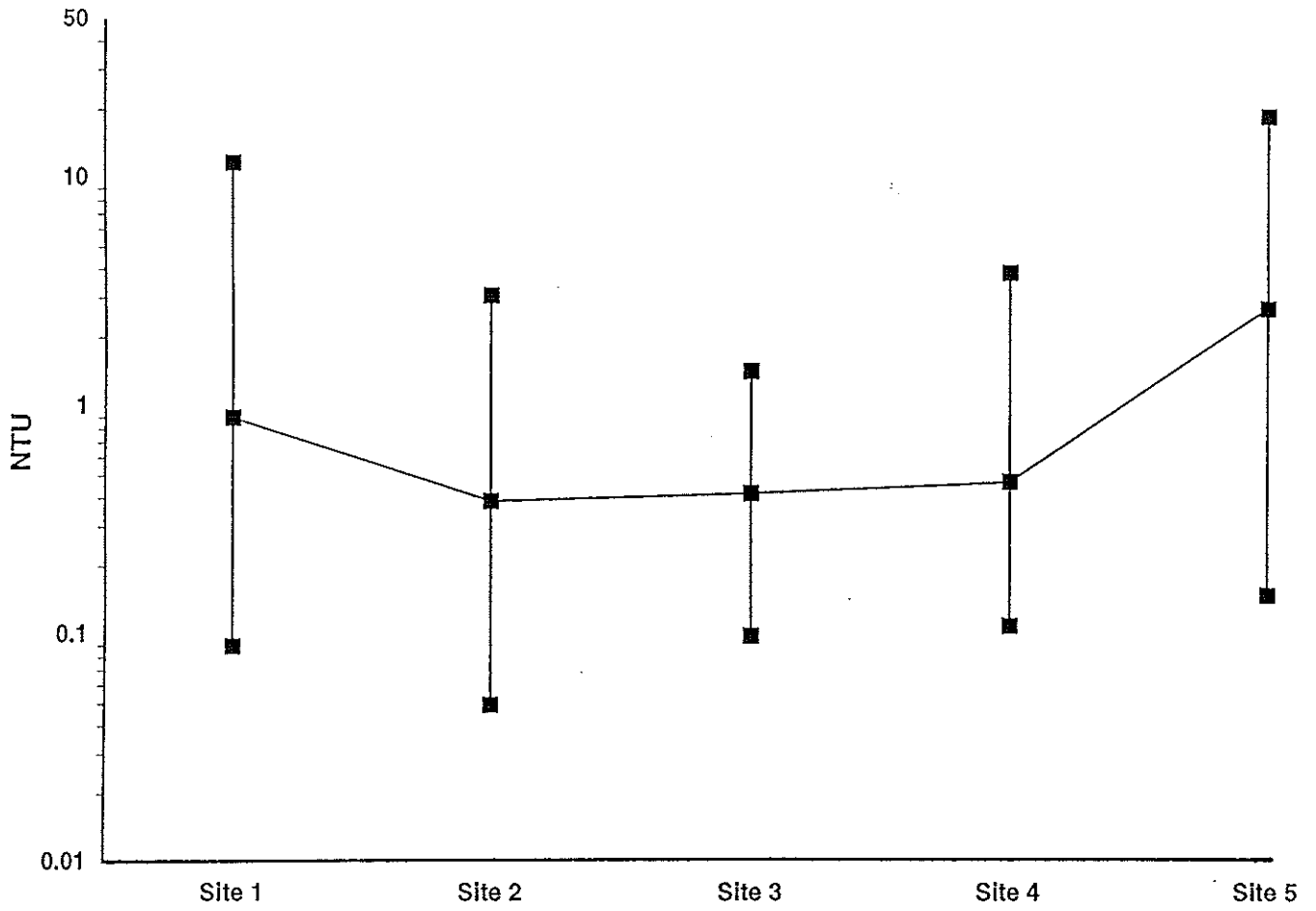


Figure 16. Maximum, minimum and average turbidity levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

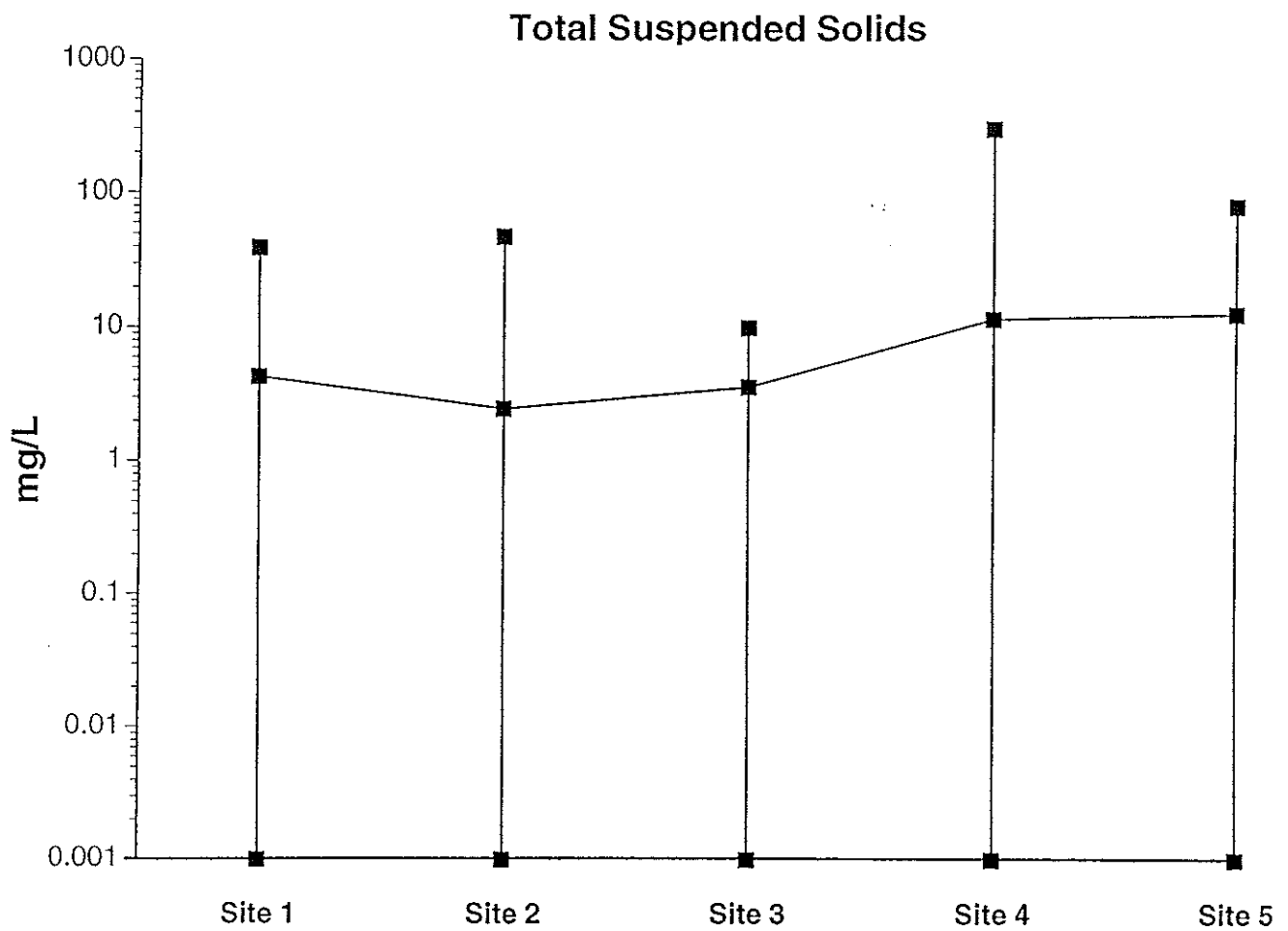


Figure 17. Maximum, minimum and average total suspended solids levels measured at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

Results such as these are not surprising given the nature of the stream and the climate of the area. Due to the presence of the aquifer recharge zone and the nature of the soils in the watershed, the creek does not appreciably increase in size downstream past the recharge zone. The creek is actually smaller in many places below the recharge zone than in many places above the recharge zone. At most times during the year, stream base flow is governed by springflow rather than rainfall. Most of the springs in the watershed are located above the recharge zone. Because the majority of cultivated land in the watershed is located below the recharge zone, the portion of the watershed which could be expected to be exposed to the most significant agricultural runoff is more or less isolated downstream from a significant portion of stream base flow.

Physical/chemical data trends for each individual site during the course of the study are summarized below:

Site 1 - Fecal coliform and nitrate levels decreased during the course of the study. Sulfate levels increased slightly. The remainder of the water quality parameters exhibited no trend towards increase or decrease.

Site 2 - Fecal coliform and sulfate levels increased during the course of the study. Nitrate and total suspended solids levels decreased. The remainder of the water quality parameters showed no trend to increase or decrease.

Site 3 - Fecal coliform levels increased during the period from September 1991 through December 1992, then decreased. Fecal streptococcus and total suspended solids levels exhibited a downward trend. Sulfate levels increased. The remainder of the water quality parameters exhibited no trend to increase or decrease.

Site 4 - Fecal coliform and total suspended solids levels exhibited a downward trend. Sulfate levels exhibited an upward trend. The remainder of the water quality parameters exhibited no trend to increase or decrease.

Site 5 - Fecal coliform, fecal streptococcus, and total suspended solids levels all decreased through the study period. Nitrate and sulfate levels increased. The remainder of the water quality parameters showed no trend to increase or decrease.

### **Pesticide Analysis**

Pesticide analysis results are shown in Appendix 2. Pesticide residues were very low throughout the course of the study.

### **RBP II - Benthic Macroinvertebrates**

The macroinvertebrates which were collected during the course of the study are listed by taxonomic group in Appendix 3. Invertebrate distribution by site, functional feeding group classifications and pollution tolerance values are listed in Appendix 4. The data indicates that the aquatic insect community of Seco Creek is, for the most part, evenly distributed along the course of the creek. Most of the taxa which are not well-distributed were collected in small numbers during the course of the study, and do not appear to make up a significant part of the invertebrate community. This was true for taxa such as Gyrinidae, Haliplidae, Helicopsychidae, Hydroptilidae, Belostomatidae, Corixidae, Sialidae, Dixidae, Leuctridae, and Perlidae. Hemipterans and plecopterans, in particular, were collected in low numbers during the course of the study. Other taxa, such as Psephenidae, Calamoceratidae, and Ephemeridae were collected in greater numbers, but seem to be restricted in their distribution due to habitat requirements. Calamoceratidae were restricted to Site 1 due to availability of materials for the construction of leaf cases being restricted to this site. Psephenidae were collected in great numbers at Site 1, but were only incidentally collected at two other sites. This is presumably due to the fact that Psephenidae

prefer habitats with both lotic and lentic characteristics. Ephemeridae were restricted to Sites 5 and 3, probably because the substrates at these sites were siltier and the current less swift, which was more favorable to the organisms' burrowing habits. Shredder organisms, in particular, were restricted mainly to Site 1 and Site 5. These sites were the only ones which contained significant numbers of trees in the riparian areas to furnish a food supply for these organisms.

Organisms other than aquatic insects were collected in low numbers during the study. These organisms are generally heavier than insects and are more difficult to collect with a kick screen. The only exception to this occurred with oligochaetes, which were frequently collected, especially at Site 5.

Overall lack of taxa richness is probably due to the nature of the creek itself. The small size of the creek, the presence of extensive areas of limestone bedrock substrate, and the lack of allochthonous energy sources in the form of trees and brush in the upper reaches of the stream contribute to an overall lack of habitat.

Results of the RBP II Impairment Assessment are shown in Appendix 5. The results indicate that Sites 1-4 exhibited a consistent level of moderate impairment and that Site 5 was consistently non-impaired throughout the period of the study (Figure 18). Sites 1-4 consistently scored low in the Number of Taxa and EPT Index metric categories. Both of these metrics require a high level of comparability with the reference site to score high according to the biological condition scoring criteria. Sites 1-4 also scored moderately low in the Percent Contribution of Dominant Family and Community Loss Index metrics. Sites 1-4 consistently scored high in the Family Biotic Index, Scraper/Filtering Collector, and EPT/Chironomid metric categories. Site 5 consistently scored high in all metric categories except for the Percent Contribution of Dominant Family and Community Loss Index metrics.

RBP II  
18 Sept 1991 - 1 Sept 1993

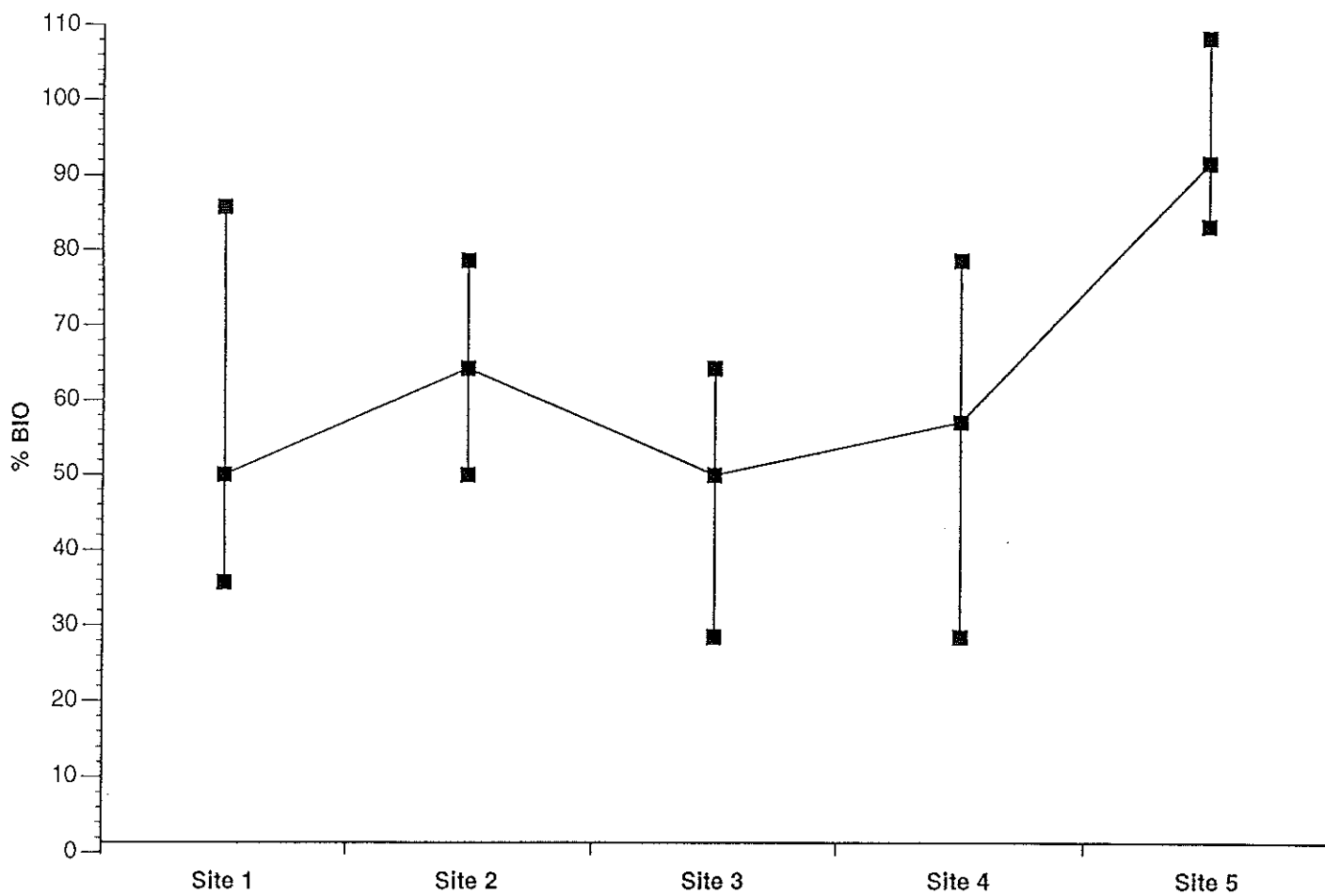


Figure 18. Maximum, minimum and average biological condition scores for Rapid Bioassessment Protocol II (benthic macroinvertebrates) determined from samples taken at five sites on Seco Creek from 18 September 1991 - 1 September 1993.

Appendix 6 shows the physical characterization and water quality assessment which was done for each sampling site. Appendix 7 shows the habitat assessment comparison which was made between the sampling sites and the reference sites. The habitat assessment comparison indicates that the habitats at Sites 1-4 are only partially supporting of a comparable biological community when compared to the reference site at the Upper Medina River. Site 5 actually scored higher than the Metate Creek reference site in its ability to support a biological community. The habitat assessment supports the impairment assessment results which were obtained with RBP II. A habitat that is only partially supporting when compared to the reference site will, at best, only be able to support a biological community that is 79% comparable to the reference site (Plafkin, et al, 1989). Therefore, an impairment assessment score of Moderately Impaired is the best that can be expected under these circumstances. **When adjusted for habitat percent comparability to reference site**, the average biological condition scores for Sites 1-4 were 75%, 88%, 96%, and 81%, respectively and the average score for Site 5 was 86%. **This would put all sites in the Non-impaired category**, or on the borderline between Non-impaired and Moderately Impaired, **according to RBP II guidelines.**

The adjusted RBP II data indicates that the water quality of Seco Creek increases downstream above the recharge zone, and then decreases somewhat below the recharge zone. These results are consistent with the physical, chemical and bacteriological data. Each individual site varies somewhat in its trends over time. Site 1 shows a general decrease in biological condition from December 1991 through May 1992, followed by improvement through December 1992, and another decline through May 1993, then a slight increase through August 1993. The overall trend in biological condition at this site appears to be a slight improvement. Site 2 also shows a slight overall improvement in biological condition, although it exhibits several periods of decline and recovery. Site 3 appears to exhibit a slight overall decline in biological condition. The extensive solid rock substrate at this site may have helped to mask the effects of seasonal flooding. Site 4 exhibits periods of decline and recovery. No overall trend in biological condition is discernable. Site 4 appeared to be more affected by seasonal flooding and by anthropogenic factors than the other sites, which may explain the lack of an overall trend. Site 5 exhibits a steady improvement in biological condition over the course of the study.

### **RBP V - Fish**

The fish which were collected during the study are listed in Appendix 8. The species distribution by site and by trophic level, pollution tolerance and origin is listed in Appendix 9. Additionally, twenty-six salamander (*Eurycea* sp.) individuals were collected at Site 1 on various sampling dates during the course of the study. These individuals were collected incidentally to both the fish and invertebrate sampling. Dates collected, numbers collected, and disposition of the individuals collected is shown in Table 2. The fish community was not as evenly distributed as the insect community of Seco Creek. Five species (*Lepomis gulosus*, *Lepomis microlophus*, *Cyprinella venusta*, *Pimephales promelus*, and *Ameiurus natalis*) were limited in their distribution to one site. Five more species (*Lepomis cyanellus*, *Cichlasoma cyanoguttatum*, *Notropis amabilis*, *Ictalurus punctatus*, and *Noturus nocturnus*) were limited to two sites.

**Table 2. Collection dates, numbers of individuals collected, and disposition of salamanders (*Eurycea* sp.) collected from Seco Creek (Site 1) during the period 9/18/91 - 9/1/93.**

Collection Date	Numbers Collected	Disposition of Specimens
1/22/92	4	preserved
4/22/92	2	released
10/11/92	2	released
10/25/92	2	released
12/13/92	1	preserved
3/18/93	3	released
3/28/93	2	released
4/25/93	5	released
5/26/93	1	released
6/27/93	1	released
7/7/93	2	released
8/1/93	1	released

Site 1 had the least diverse fish community. This site provided very limited habitat and was isolated from the rest of the sites on the creek. The fish community increased in diversity downstream, with Site 4 having the most diverse community. Species richness at Site 5 was comparable to that at Site 4. Site 5 did not have a fast riffle habitat. This could explain the absence of Campostoma anomalum (central stoneroller) from the site. Campostoma anomalum is a species which is generally restricted to fast riffles.

RBP V results are listed in Appendix 10. Appendix 10 indicates that the water quality of Seco Creek ranged from Poor to Fair at Sites 2-5, and that Site 1 was consistently Poor. All sites scored consistently low in metrics 1-5 and metric 9. Metrics 1-5 are species richness and composition metrics which are scored against species-waterbody size relationships. Each of these metrics requires a high degree of correlation (>67%) with the reference data in order to score highly. Metric 9 is a measurement of the percentage of top carnivores in the sample. Few top carnivores were collected during the course of the study, although numerous individuals were observed. Only two individuals exhibiting disease or anomalies were collected. A Rio Grande cichlid (Cichlasoma cyanoguttatum), with a fungus growth, was collected at Site 4. Fungus growths are not uncommon for this species. A bluegill sunfish (Lepomis macrochirus), with a parasitic growth on the gill operculum, was collected at Site 5. Both of these individuals were collected during the winter (February/March) during 1993. Overall lack of species richness can probably be attributed to the small size of the stream, lack of instream cover, and the solid limestone substrate that exists over much of the creek.

Since five of the RBP V metrics are scored against species-waterbody size relationships and six of the remaining seven metrics are scored directly as percentages of individuals collected, it is difficult to compare a habitat assessment against a specific reference site, as was done with RBP II. However a comparison of the habitat assessment scores for the study sites (Appendix 7) with an ideal site having a score of 135, produces corrected average metric scores of 41, 50, 60, 50, and 49 for Sites 1-5, respectively. These corrected scores are all within the Excellent or Good condition categories according to the scoring criteria for RBP V, with the exception of Site 1, which falls within the high Fair category. The presence of the healthy amphibian population at Site 1 indicates that the water quality at the site is excellent from a biological standpoint.

The RBP V data indicates that the water quality of Seco Creek increases downstream above the recharge zone, with a very slight decrease below the recharge zone. This data is consistent with RBP II data and with the physical, chemical and bacteriological data. As with the RBP II data, each site varied in its trend over time. Site 1 exhibited no overall change in biological condition throughout the study (Figure 19). Site 2 showed a very slight overall increase in biological condition (Figure 20). Site 3 exhibited periods of improvement and decline seasonally, but no overall change in biological condition during the course of the study (Figure 21). Site 4 exhibited a gradual increase, then decline in biological condition, with no net overall change (Figure 22). From the standpoint of the fish community, Sites 3 and 4 appeared to be more affected by seasonal flooding than the other sites, which may help to explain the lack of an overall trend in biological condition at these sites. Site 5 exhibited an overall decline in biological condition over the course of the study (Figure 23).



Rapid Bioassessment Protocol V Metrics  
Site 1

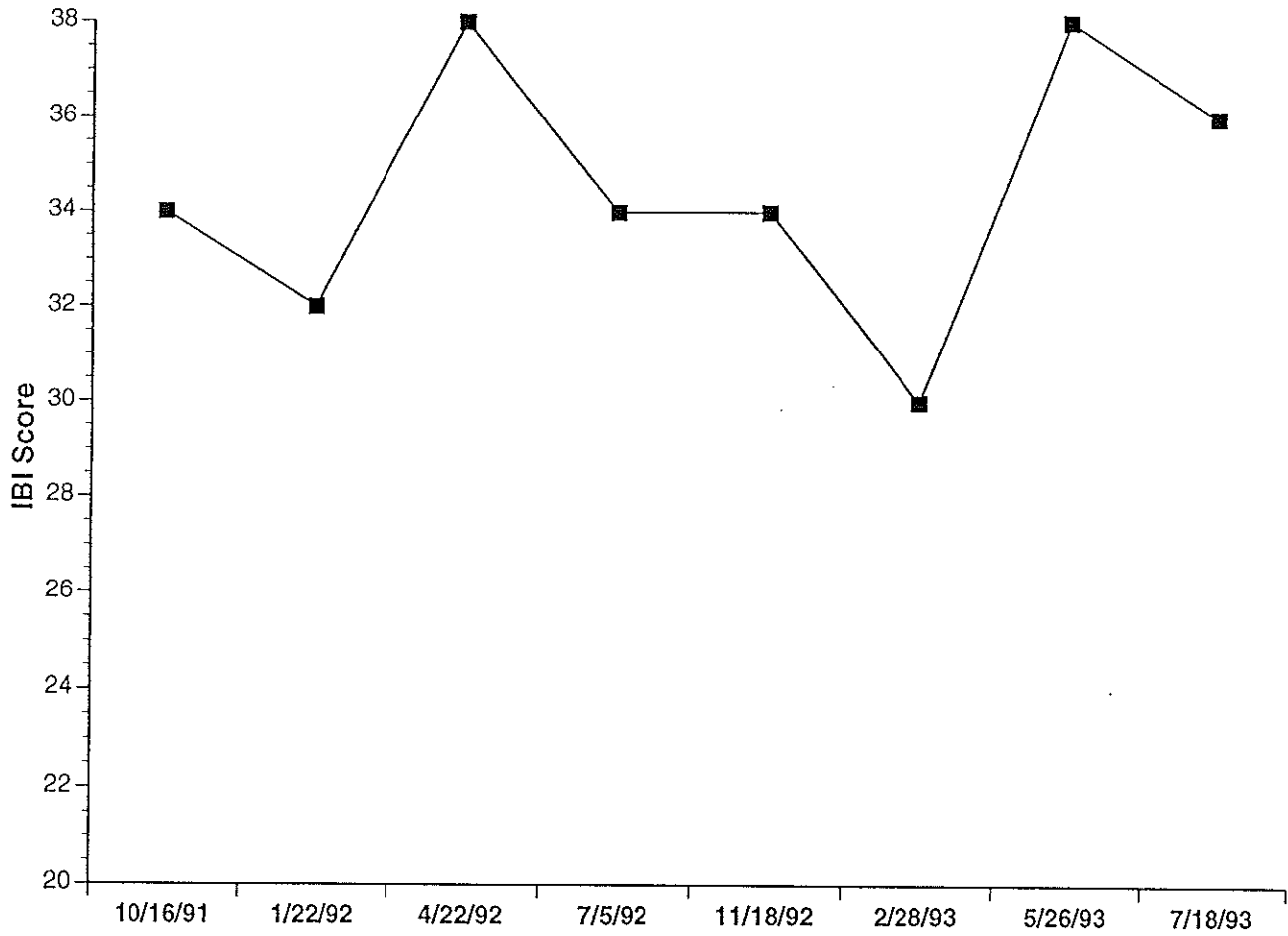


Figure 19. Index of Biological Integrity scores for Rapid Bioassessment Protocol V (fish) determined from samples taken at Site 1 on Seco Creek from 16 October 1991 - 18 July 1993.

Rapid Bioassessment Protocol V Metrics  
Site 2

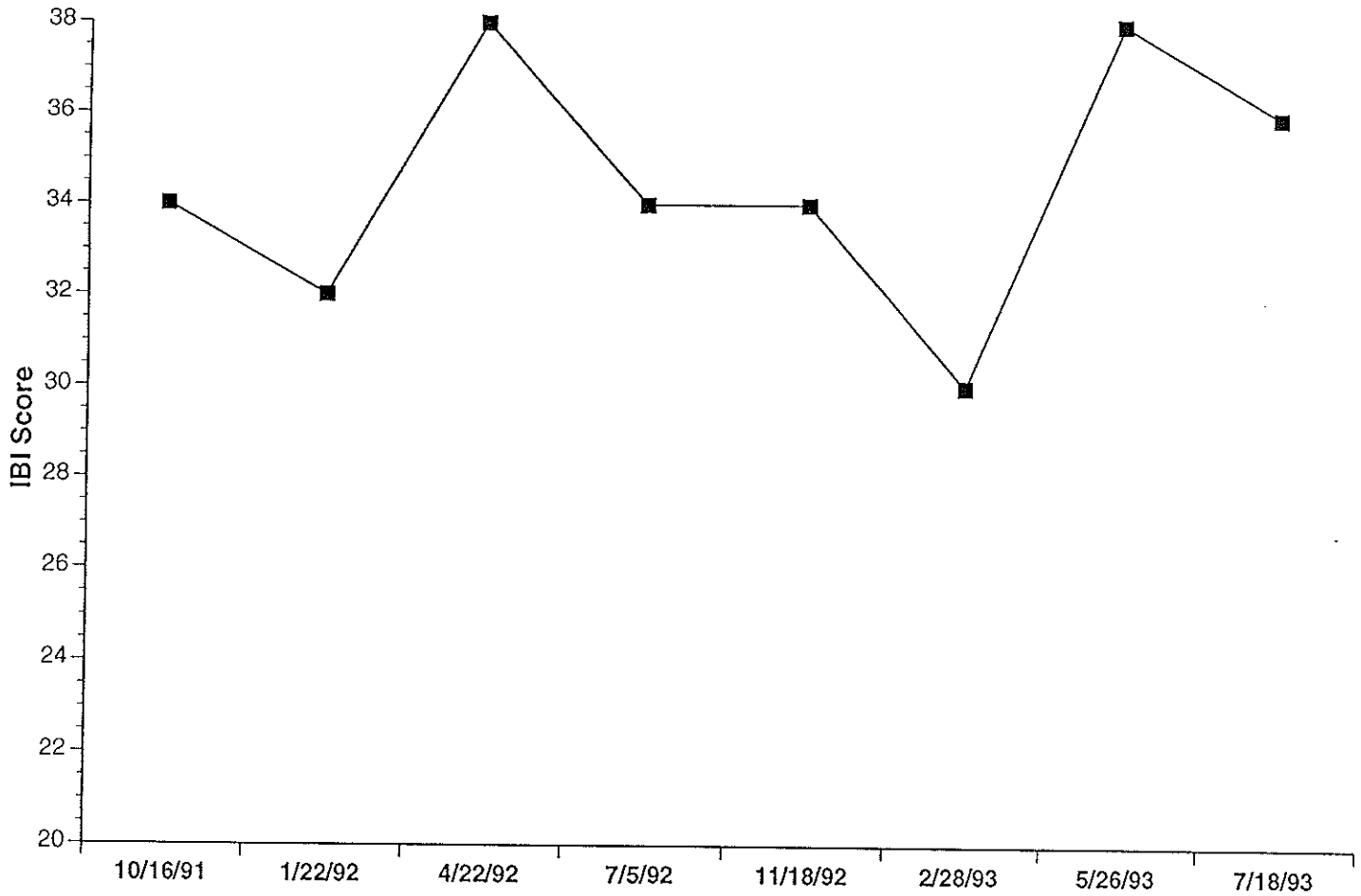


Figure 20. Index of Biological Integrity scores for Rapid Bioassessment Protocol V (fish) determined from samples taken at Site 2 on Seco Creek from 16 October 1991 - 18 July 1993.

Rapid Bioassessment Protocol V Metrics  
Site 3

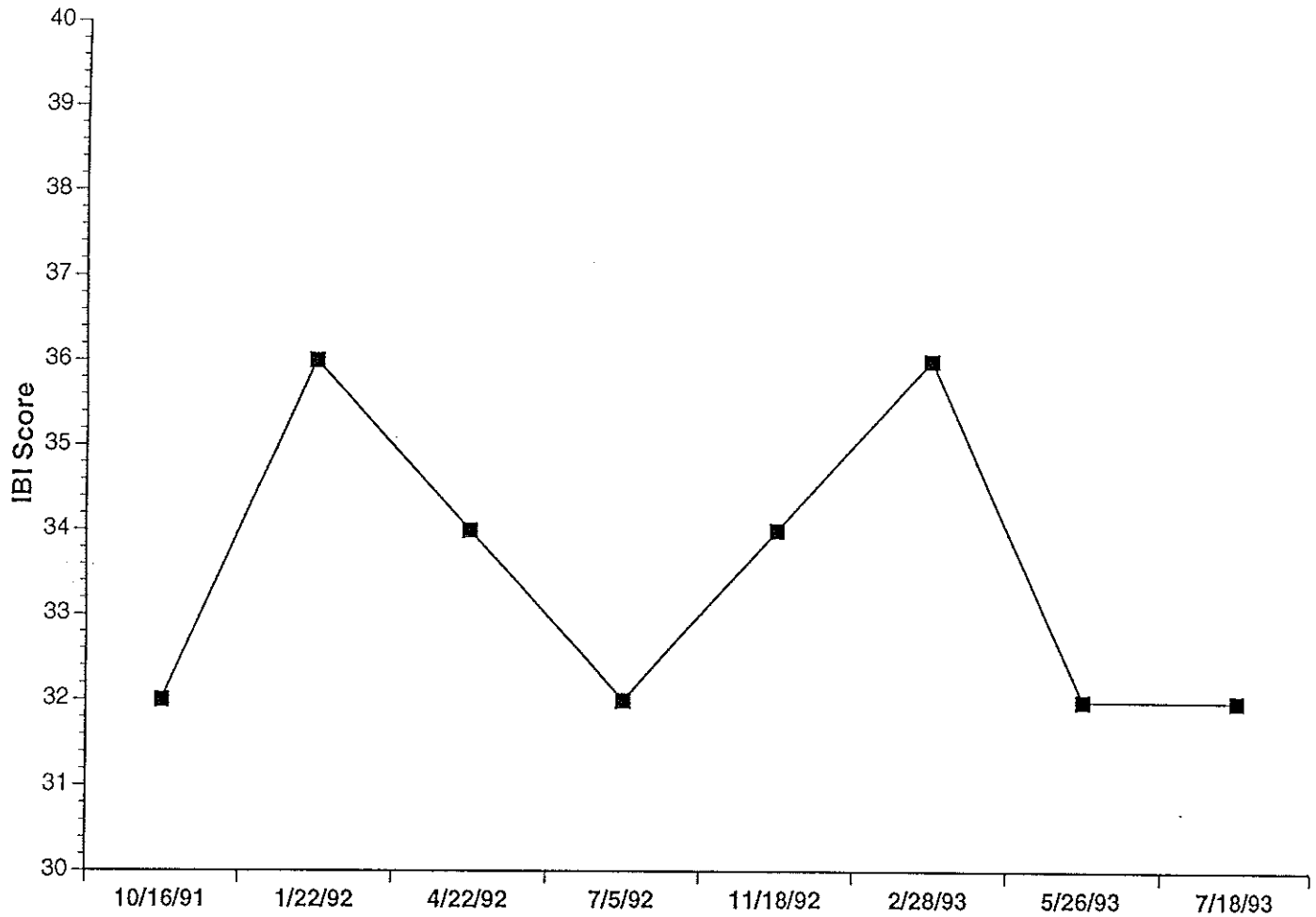


Figure 21. Index of Biological Integrity scores for Rapid Bioassessment Protocol V (fish) determined from samples taken at Site 3 on Seco Creek from 16 October 1991 - 18 July 1993.

Rapid Bioassessment Protocol V Metrics  
Site 4

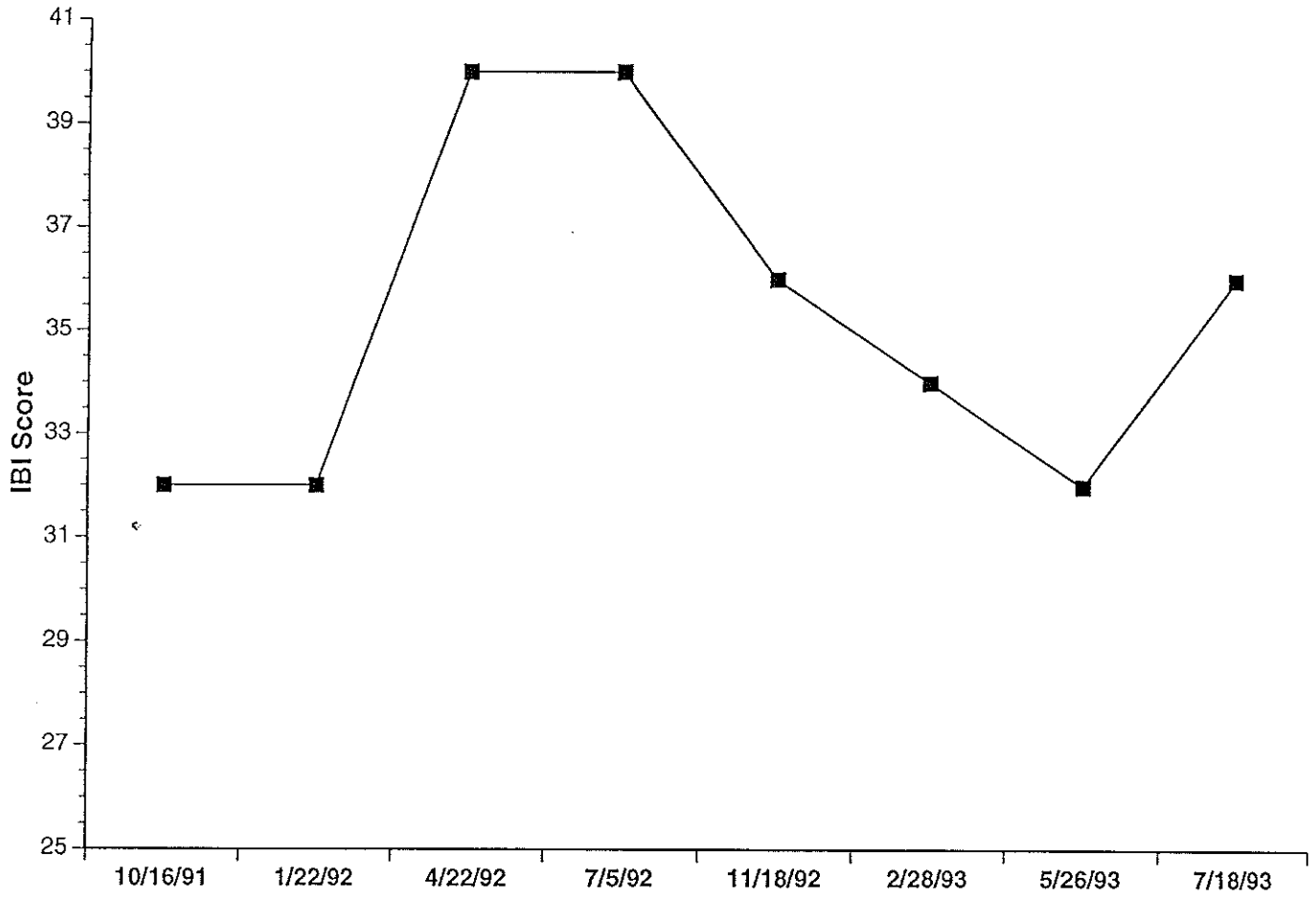


Figure 22. Index of Biological Integrity scores for Rapid Bioassessment Protocol V (fish) determined from samples taken at Site 4 on Seco Creek from 16 October 1991 - 18 July 1993.

Rapid Bioassessment Protocol V Metrics  
Site 5

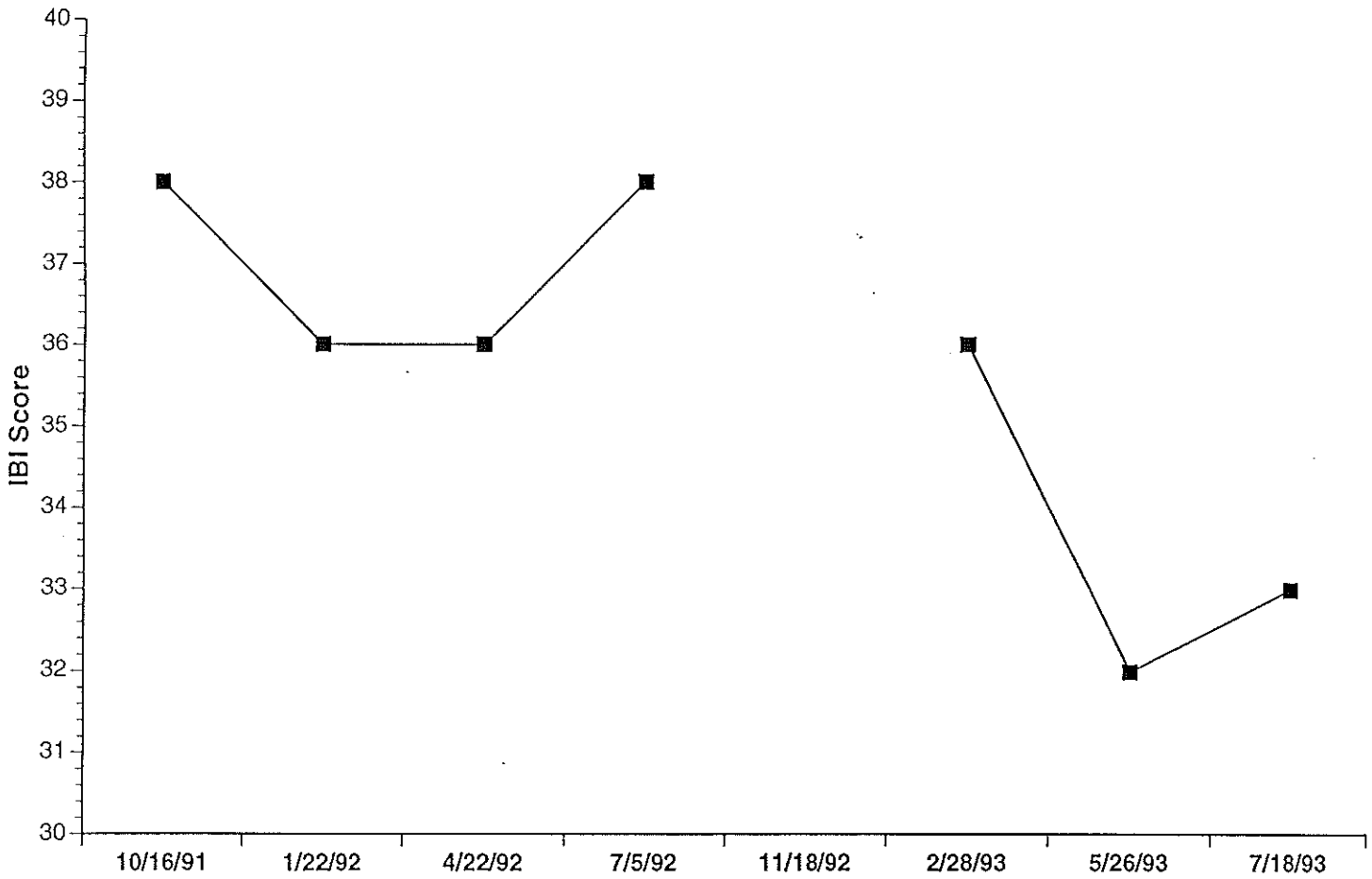


Figure 23. Index of Biological Integrity scores for Rapid Bioassessment Protocol V (fish) determined from samples taken at Site 5 on Seco Creek from 16 October 1991 - 18 July 1993. (No data available for November, 1992 sample.)

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Appendix I. Continued.

Site Five																
DATE	TIME	FECAL COLIFORM	FECAL STREP	FC/FS RATIO	BOD mg/L	TOC mg/L	pH	TEMP. C	CONDUCTIVITY µmhos/cm	DO mg/L	NITRATE mg/L	SULFATE mg/L	O-PHOS mg/L	T-PHOS mg/L	TURBIDITY NTU	TSS mg/L
18-Sep-91	8:05 AM	-	1140	-	<2.00	10.26	7.7	26	470.13	7.96	-	54.7	0.088	0.03	7.41	80.61
2-Oct-91	9:00 AM	-	366	-	<2.00	6.13	8	20.4	538	6.4	0.53	55.69	<0.01	<0.01	2.17	8.31
16-Oct-91	7:55 AM	42	92	0.46	2.46	6.38	8.2	18.8	711.1	6.6	0.149	126.59	0.015	0.025	5.76	5.96
6-Nov-91	7:45 AM	88	94	0.94	5.09	5.83	8	11.1	1514.48	8.6	0.879	455.09	<0.01	<0.01	0.57	16.76
20-Nov-91	7:45 AM	82	56	1.46	2.89	4.66	7.5	15.2	2061.38	6	1.924	535.42	<0.01	0.014	0.65	0.91
4-Dec-91	7:30 AM	152	172	0.88	<2.00	5.31	7.6	8	43.67	9.3	3.37	756.77	<0.01	0.049	0.93	0.47
17-Dec-91	8:00 AM	170	294	0.58	<2.00	5.38	7.8	11.8	42.85	8.4	2.91	855.15	0.01	0.067	2.11	17.44
8-Jan-92	9:00 AM	230	390	0.59	<2.00	4.6	7.7	13.6	1306	9.4	2.607	219.34	<0.01	<0.01	0.41	3.29
22-Jan-92	8:05 AM	24	120	0.20	<2.00	2.91	7.7	8.9	1666	12.7	4.73	335.72	<0.01	0.014	0.21	36.45
12-Feb-92	7:45 AM	254	408	0.62	<2.00	6.4	7.7	14.6	899	8.9	1.63	183.36	0.01	0.028	1.9	4.38
26-Feb-92	7:55 AM	TNTC	46	-	<2.00	24.8	7.7	13.3	1506	8.1	3.84	280.8	<0.01	25	0.68	11.44
11-Mar-92	7:50 AM	176	252	0.70	<2.00	5.89	7.5	15.7	909	7.3	1.37	196.08	<0.01	0.04	8.9	7.93
25-Mar-92	8:05 AM	554	148	3.74	<2.00	4.56	7.9	17.5	1573	7.9	3.47	300.48	<0.01	0.03	0.15	3.08
8-Apr-92	7:30 AM	290	142	2.04	<2.00	32.31	7.5	18.8	1153	7.3	2.05	223.24	<0.01	0.042	1.32	16.24
22-Apr-92	8:15 AM	260	210	1.24	<2.00	4.97	7.5	20.4	1903	7	3.88	333.8	<0.01	0.037	0.24	11.89
13-May-92	7:45 AM	-	468	-	<2.00	6.57	7.6	24.6	1752	7.5	2.954	314.4	<0.01	0.027	0.3	13.94
27-May-92	7:50 AM	TNTC	TNTC	-	-	11.33	7.4	24	1478	6.9	3.1	280.68	<0.01	0.018	0.2	12.27
14-Jun-92	7:30 AM	842	352	2.39	<2.00	5.38	7.4	26.7	726	6.1	0.85	181.08	0.013	0.037	1.53	15.08
5-Jul-92	7:45 AM	104	154	0.68	<2.00	3.33	-	27.7	1690	6	3.59	339.44	0.01	0.019	0.22	10.36
19-Jul-92	8:10 AM	466	202	2.31	2.38	5.27	7.6	27.3	1395	6.3	4.02	-	0.03	0.048	0.61	20.88
2-Aug-92	8:00 AM	4540	108	42.04	1.99	5.02	7.4	27.7	1819	6.3	4	11.52	0.32	0.056	0.34	1.4
16-Aug-92	7:55 AM	310	108	2.87	<2.00	5.99	7.6	26	1665	6.5	4.2	381	0.017	0.012	1.09	-
30-Aug-92	7:55 AM	954	306	3.12	2.24	3.84	7.7	24.8	2050	7.11	4.64	464.4	0.02	0.027	3.48	3.68
12-Sep-92	7:50 AM	82	398	0.21	<2.00	5.48	7.4	25.7	1894	7.46	4.1	460.8	0.055	0.033	1.41	9.35
27-Sep-92	8:00 AM	450	210	2.14	2.75	3.11	7.3	23.3	1827	7.11	3.61	460.64	0.023	0.039	7.84	9.48
11-Oct-92	8:10 AM	194	130	1.49	3.12	4.66	7.4	19.8	1974	-	3.67	494.72	0.014	0.015	0.87	10.29
25-Oct-92	7:45 AM	448	262	1.71	<2.00	4.76	7.7	-	1808	8.4	4.64	396.4	0.012	0.012	0.21	7.04
18-Nov-92	-	-	-	-	-	4.92	-	-	-	-	-	-	-	-	-	-
29-Nov-92	8:00 AM	106	96	1.10	<2.00	-	7.7	7.2	1572	12.9	4.88	911.2	0.015	0.018	0.68	10.64
13-Dec-92	8:50 AM	156	428	0.36	-	3.51	7.5	13.5	1769	9	8.21	384.88	<0.01	0.013	0.33	6.43
28-Dec-92	-	-	-	-	-	2.74	-	-	-	-	-	-	-	-	-	-
10-Jan-93	8:50 AM	88	224	0.39	<2.00	-	6.8	13.2	1838	10.8	6.03	422.8	<0.01	0.018	0.85	2.85
24-Jan-93	8:10 AM	218	186	1.17	-	4.6	7.4	11.6	1855	6.6	6.06	358.36	<0.01	0.01	15.68	12.89
14-Feb-93	7:20 AM	264	76	3.47	<2.00	2.89	7.5	14.1	1520	7.1	7.38	404.84	<0.01	0.01	4.53	11.91
28-Feb-93	8:15 AM	298	70	4.26	<2.00	9.61	7.3	13.3	1609	9.77	6.9	359.88	0.008	0.02	2.11	0
18-Mar-93	8:00 AM	392	46	8.52	<2.00	3.25	7.4	16.2	1641	9.09	1.53	355.8	0.023	0.11	0.26	10.91
28-Mar-93	8:15 AM	-	94	-	<2.00	3.94	7.5	19.5	1723	7.49	4.056	416.6	0.01	0.018	0.67	4.26
11-Apr-93	9:00 AM	52	10	5.20	<2.00	3.65	7.7	18.9	1240	9.23	5.12	369.7	<0.01	0.02	0.54	1.46
25-Apr-93	7:50 AM	TNTC	156	-	<2.00	4.36	7	21.4	2040	6.5	3.73	471.6	<0.01	0.02	1.3	41.58
13-May-93	8:45 AM	204	108	1.89	<2.00	9.63	6.7	19.8	841	6.07	1.4	453.3	0.02	0.04	0.46	21.57
26-May-93	7:55 AM	TNTC	-	-	<2.00	8.87	6.9	23.2	882	7.62	9.6	476.2	0.02	0.04	0.17	16.92
6-Jun-93	7:20 AM	176	0	-	2.54	7.34	7.2	27	1087	6.39	2.58	312.92	<0.01	0.04	0.67	18.1
27-Jun-93	9:00 AM	TNTC	22	-	<2.00	4.08	7.1	26.7	1522	6.13	2.46	316.96	0.01	0.03	1.29	5.22
7-Jul-93	7:50 AM	68	50	1.36	<2.00	4.23	6.7	27.9	1615	6.92	2.49	470.26	<0.01	0.03	3.44	5.98
18-Jul-93	7:50 AM	104	56	1.86	<2.00	5	6.8	24.5	1453	6.84	1.62	633.81	0.01	0.03	6.07	15.98
1-Aug-93	9:00 AM	94	54	1.74	<2.00	5.94	6.4	27	1828	5.77	1	336.78	<0.01	0.04	3.65	8.335
17-Aug-93	8:40 AM	86	48	1.79	<2.00	6.53	7.3	27.9	1932	5.87	0.99	944.8	<0.01	0.05	18.4	29.3
1-Sep-93	7:55 AM	68	112	0.61	<2.67	9.74	7.7	25.3	1823	5.03	0.15	910.16	<0.01	0.03	9.62	11.9
MINIMUM		24	0	0.20	1.99	2.74	6.4	7.2	42.85	5.03	0.149	11.52	0.008	<0.01	0.15	0
MAXIMUM		TNTC	TNTC	42.04	5.09	32.31	8.2	27.9	2061.38	12.9	9.6	944.8	0.32	25	18.4	80.61
AVERAGE		353.68	192.36	2.95	2.83	6.52	7.45	19.78	1438.36	7.61	3.40	400.18	0.03	0.61	2.66	12.78

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TNTC = too numerous to count

Appendix 2. Seco Creek Pesticide study results (All samples taken from Site 5 below the Recharge Zone).

Date	Time	Aldrin	α-BHC	β-BHC	γ-BHC	δ-BHC	α-chlordane	δ-chlordane	Dieldrin	Endosulfan	Endosulfan	Endosulfan	Endrin	Endrin	Heptachlor	Heptachlor	4,4'-DDD	4,4'-DDE	4,4'-DDT
		(µg/L)	(µg/L)	(µg/L)	(Lindane) (µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	I (µg/L)	II (µg/L)	Sulfate (µg/L)	(µg/L)	Aldehyde (µg/L)	Epoxide (µg/L)	(µg/L)	(µg/L)	(µg/L)
10/2/91	9:00 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
11/6/91	7:45 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
12/4/91	7:50 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
1/8/92	9:00 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
2/12/92	7:45 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
3/11/92	7:50 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
4/8/92	7:30 AM	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.08	<0.04	<0.08	-	<0.08	<0.08	<0.04	<0.04	<0.08	<0.08	<0.08
6/14/92	7:30 AM	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.02	<0.02
7/5/92	7:45 AM	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	<0.02	<0.02	<0.02	<0.02	<0.01	<0.01	<0.02	<0.02	<0.02
8/2/92	8:00 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
8/30/92	7:35 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
9/27/92	8:00 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
10/25/92	7:45 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
11/18/92	7:55 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
12/13/92	8:50 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
1/24/93	8:10 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
2/14/93	7:20 AM	<0.008	<0.005	<0.012	<0.005	<0.012	<0.007	<0.008	<0.004	<0.016	<0.008	<0.010	<0.008	<0.014	<0.006	<0.008	<0.004	<0.008	<0.003
3/18/93	8:00 AM	<0.007	<0.008	<0.011	<0.008	<0.007	<0.007	<0.008	<0.008	<0.010	<0.008	<0.009	<0.009	<0.012	<0.007	<0.007	<0.011	<0.011	<0.008
4/25/93	7:50 AM	<0.007	<0.008	<0.011	<0.008	<0.007	<0.007	<0.008	<0.008	<0.010	<0.008	<0.009	<0.009	<0.012	<0.007	<0.007	<0.011	<0.011	<0.008
5/26/93	7:55 AM	<0.013	<0.017	<0.018	<0.008	<0.007	<0.007	<0.002	<0.009	<0.011	<0.008	<0.024	<0.009	<0.012	<0.008	<0.011	<0.011	<0.012	<0.008
6/27/93	9:00 AM	<0.008	<0.018	<0.012	<0.010	<0.007	<0.007	<0.008	<0.008	<0.010	<0.008	<0.023	<0.011	<0.012	<0.007	<0.013	<0.011	<0.026	<0.008
7/18/93	7:50 AM	<0.008	<0.018	<0.012	<0.010	<0.007	<0.007	<0.008	<0.008	<0.010	<0.008	<0.024	<0.008	<0.012	<0.008	<0.008	<0.011	<0.026	<0.008
8/17/93	8:40 AM	<0.004	<0.015	<0.012	<0.009	<0.016	<0.007	<0.002	<0.008	<0.002	<0.008	0.402	<0.062	<0.012	<0.007	<0.004	<0.011	<0.026	<0.008
9/01/93	7:55 AM	<0.020	<0.002	<0.007	<0.005	<0.006	<0.007	<0.008	<0.008	<0.002	<0.008	<0.053	<0.008	<0.012	<0.020	<0.004	<0.011	<0.026	<0.008
Texas surface water quality standards		0.0312	0.645	2.26	4	not listed	0.0210	not listed	0.0012	not listed	not listed	not listed	0.2	not listed	0.0177	1.08	0.297	0.0544	0.0527

### Appendix 3. The Invertebrate Taxa of Seco Creek.

<u>Scientific Name</u>	<u>Common Name</u>
PHYLUM ARTHROPODA	ARTHROPODS
CLASS INSECTA	INSECTS
EPHEMEROPTERA	MAYFLIES
CAENIDAE	None
<i>Caenis</i> sp.	
<i>Brachycercus lacustris</i>	None
TRICORYTHIDAE	None
<i>Tricorythodes</i> sp.	
<i>Leptohyphes</i> sp.	
HEPTAGENIIDAE	None
<i>Stenonema femoratum tripunctatum</i>	
<i>Stenonema ares</i>	
LEPTOPHLEBIIDAE	None
<i>Choroterpes mexicanus</i>	
<i>Thraulodes gonzalesi</i>	
<i>Traverella presidiana</i>	
OLIGONEURIIDAE	None
<i>Isonychia sicca manca</i>	
BAETIDAE	None
<i>Baetis</i> sp.	
<i>Dactylobaetis mexicanus</i>	
<i>Cloeon</i> sp.	
<i>Paracloeodes</i> sp.	
EPHEMERIDAE	Burrowing mayflies
<i>Hexagenia limbata venusta</i>	
PLECOPTERA	STONEFLIES
LEUCTRIDAE	None
<i>Zealeuctra</i> sp.	
PERLIDAE	None
<i>Attaneuria</i> sp.	
TRICHOPTERA	CADDISFLIES
HYDROPSYCHIDAE	None
<i>Cheumatopsyche</i> sp.	
<i>Hydropsyche</i> sp.	
CALAMOCERATIDAE	Leaf-case makers
<i>Phylloicus ornatus</i>	
LEPTOCERIDAE	None
<i>Oecetis</i> sp.	
PHILOPOTAMIDAE	None
<i>Chimarra</i> sp.	
ODONTOCERIDAE	None
<i>Marilia</i> sp.	
HYDROPTILIDAE	None
<i>Oxyethira</i> sp.	
HELICOPSYCHIDAE	Snail-case makers
<i>Helicopsyche</i> sp.	

Appendix 3. continued.

Scientific Name	Common Name
TRICHOPTERA (Cont.)	
POLYCENTROPODIDAE	None
<i>Polycentropus sensu lato</i> complex	
<i>Polyplectropus</i> sp.	
MEGALOPTERA	DOBSONFLIES AND ALDERFLIES
CORYDALIDAE	Dobsonflies
<i>Corydalis cornutus</i>	
SIALIDAE	Alderflies
<i>Sialis</i> sp.	
ODONATA	DRAGONFLIES AND DAMSELFLIES
ANISOPTERA	Dragonflies
GOMPHIDAE	None
<i>Erpetogomphus</i> sp.	
LIBELLULIDAE	None
<i>Brechmorhoga mendax</i>	
ZYGOPTERA	Damselflies
COENAGRIONIDAE	None
<i>Argia</i> sp.	
CALOPTERYGIDAE	None
<i>Hetaerina</i> sp.	
COLEOPTERA	WATER BEETLES
HYDROPHILIDAE	Water scavenger beetles
<i>Berosus</i> sp.	
<i>Enochrus</i> sp.	
<i>Tropisternus</i> sp.	
DYTISCIDAE	Predaceous diving beetles
<i>Uvarus</i> sp.	
PSEPHENIDAE	Water pennies
<i>Psephenus</i> sp.	
ELMIDAE	Riffle beetles
<i>Stenelmis</i> sp.	
<i>Dubiraphia</i> sp.	
<i>Narpus</i> sp.	
<i>Microcyloopus</i> sp.	
LUTROCHIDAE	Minute marsh-loving beetles
<i>Lutrochus luteus</i>	
GYRINIDAE	Whirligig beetles
<i>Dineutus</i> sp.	
HALIPLIDAE	Crawling water beetles
<i>Peltodytes</i> sp.	
DRYOPIDAE	Long-toed water beetles
<i>Helichus</i> sp.	

Appendix 3. continued.

<u>Scientific Name</u>	<u>Common Name</u>
LEPIDOPTERA	AQUATIC CATERPILLARS
PYRALIDAE	Aquatic pyralid moths
<i>Petrophila</i> sp.	
DIPTERA	MIDGES and FLIES
CHIRONOMIDAE	Midges
unidentified taxa	
ATHERICIDAE	Watersnipe flies
<i>Atherix</i> sp.	
TABANIDAE	Horse and Deer flies
<i>Tabanus</i> sp.	
SIMULIIDAE	Black flies
<i>Simulium</i> sp.	
STRATIOMYIDAE	Aquatic soldier flies
<i>Euparyphus</i> sp.	
<i>Caloparyphus</i> sp.	
TIPULIDAE	Crane flies
<i>Hexatoma</i> sp.	
DIXIDAE	Dixid midges
<i>Dixella</i> sp.	
CERATOPOGONIDAE	Biting midges
unidentified taxa	
HEMIPTERA	TRUE BUGS
NAUCORIDAE	Creeping water bugs
<i>Ambrysus</i> sp.	
<i>Cryphocricos</i> sp.	
GERRIDAE	Water striders
<i>Gerris</i> sp.	
VELIIDAE	Short-legged striders
<i>Rhagovelia</i> sp.	
<i>Microvelia</i> sp.	
CORIXIDAE	Water boatmen
unidentified taxa	
CLASS ENTOGNATHA	
COLLEMBOLA	SPRINGTAILS
ISOTOMIDAE	
unidentified taxa	
CLASS ARACHNIDA	
HYDRACARINA	WATER MITES
unidentified taxa	



Appendix 3. continued.

<u>Scientific Name</u>	<u>Common Name</u>
<b>SUBPHYLUM CRUSTACEA</b>	<b>CRUSTACEANS</b>
<b>CLASS MALACOSTRACA</b>	
AMPHIPODA	SCUDS AND SIDESWIMMERS
HYALELLIDAE	
<i>Hyaella</i> sp.	
DECAPODA	SHRIMP AND CRAYFISH
CAMBARIDAE	Crayfish
<i>Procambarus</i> sp.	
<b>PHYLUM PLATYHELMINTHES</b>	<b>FLATWORMS</b>
<b>CLASS TURBELLARIA</b>	
TRICLADIDA	
PLANARIIDAE	Planarians
<i>Dugesia</i> sp.	
<b>PHYLUM NEMATOMORPHA</b>	<b>HORSEHAIR WORMS</b>
GORDIIDAE	Gordian worms
<i>Gordius</i> sp.	
<b>PHYLUM ANNELIDA</b>	<b>SEGMENTED WORMS</b>
<b>CLASS OLIGOCHAETA</b>	<b>AQUATIC EARTHWORMS</b>
HAPLOTAXIDA	
TUBIFICIDAE	Tubificid worms
<i>Branchiura sowerbyi</i>	
unidentified taxa	
<b>CLASS HIRUDINEA</b>	<b>LEECHES</b>
RHYNCHOBDELLIDA	PARASITIC LEECHES
PISCICOLIDAE	Fish leeches
<i>Myzobdella lugubris</i>	
<b>PHYLUM MOLLUSCA</b>	<b>MOLLUSCS</b>
<b>CLASS GASTROPODA</b>	<b>GASTROPODS</b>
HYDROBIIDAE	Freshwater snails
<i>Cochliopina riograndensis</i>	
PHYSIDAE	Freshwater snails
unidentified taxa	
ANCYLIDAE	Limpets
unidentified taxa	
<b>CLASS BIVALVIA</b>	<b>CLAMS AND MUSSELS</b>
CORBICULIDAE	Freshwater clams
<i>Corbicula fluminea</i>	Freshwater Asiatic clam

Appendix 4. Macroinvertebrate Families Collected from Seco Creek by Site, Functional Feeding Group Assignments, and Pollution Tolerance Values.

Taxa	SITE					Functional Feeding Group	Pollution Tolerance
	1	2	3	4	5		
<b>Ephemeroptera (Mayflies)</b>							
Baetidae	X	X	X	X	X	scrapers	4
Caenidae	X		X	X	X	scrapers	7
Ephemeridae			X	X		gatherers	4
Heptageniidae	X	X	X	X	X	scrapers	4
Leptophlebiidae	X	X	X	X	X	scrapers	2
Oligoneuridae		X	X	X	X	filterer	2
Tricothyridae	X	X	X	X	X	gatherers	4
<b>Odonata (Dragonflies &amp; Damselflies)</b>							
Calopterygidae		X		X	X	predators	5
Coenagrionidae	X	X	X	X	X	predators	9
Gomphidae	X	X	X	X	X	predators	1
Libellulidae	X	X	X	X	X	predators	9
<b>Coleoptera (Beetles)</b>							
Dryopidae	X	X	X			scrapers	5
Dytiscidae	X	X	X		X	predators	*
Elmidae	X	X	X	X	X	scrapers	4
Gyrinidae					X	predators	*
Haliplidae					X	shredders	*
Hydrophilidae	X	X	X	X	X	predators	*
Lutrochidae		X	X	X	X	gatherers	*
Psephenidae	X	X			X	scrapers	4
<b>Trichoptera (Caddisflies)</b>							
Calamoceratidae	X					shredders	*
Helicopsychidae		X		X		scrapers	3
Hydropsychidae	X	X	X	X	X	filterers	4
Hydroptilidae	X					placers	4
Lepoceridae	X	X			X	shredders	4
Odontoceridae	X	X		X		shredders	0
Phlebotamidae	X	X	X	X	X	filterers	3
Polycentropodidae	X	X		X	X	filterers	6
<b>Hemiptera (Water Scuders)</b>							
Belostomatidae				X		predators	*
Corixidae					X	predators	*
Gerridae	X				X	predators	*
Naucoridae		X		X	X	predators	*
Velidae	X	X		X	X	predators	*
<b>Diptera (Midges)</b>							
Athericidae	X	X	X	X		predators	2
Ceratopogonidae	X	X	X	X	X	predators	6
Chironomidae (Chironomina)	X	X	X	X	X	gatherers	8
Chironomidae (Other Chironomids)	X	X	X	X	X	gatherers	6
Diidae	X	X				gatherers	*
Simuliidae	X	X	X	X	X	filterers	6
Stratiomyidae	X	X	X	X	X	gatherers	*
Tabanidae	X	X	X	X	X	predators	6
Tipulidae	X	X	X			shredders	3
<b>Megaloptera (Dobsonflies &amp; Alderflies)</b>							
Corydalidae	X	X	X	X		predators	0
Stalidae	X				X	predators	4
<b>Plecoptera (Stoneflies)</b>							
Leuctridae	X	X				shredder	0
Perlidae		X		X		predators	1
<b>Lepidoptera (Aquatic Moths)</b>							
Pyralidae	X	X	X	X		scrapers	5
<b>Collembola (Springtails)</b>							
Isotomidae	X					gatherers	*
<b>Gastropoda (Snails)</b>							
Ancylidae	X				X	scrapers	6
Hydrobiidae				X		scrapers	8
Physidae	X					scrapers	8
<b>Bivalvia (Clams &amp; Mussels)</b>							
Corbiculidae					X	filterers	8
Hydracarina (Water Mites)	X	X				predators	*
<b>Amphipoda (Scuds &amp; Side-swimmers)</b>							
Hyalellidae		X		X	X	omnivores	*
<b>Decapoda (Shrimp &amp; Crayfish)</b>							
Cambaridae	X				X	omnivores	*
<b>Tricladida (Flatworms)</b>							
Planariidae	X	X	X			predators	4
<b>Haplofaxidae (Aquatic Earthworms)</b>							
Tubificidae	X	X	X	X	X	generalists	10
<b>Rhynchobdellida (Leeches)</b>							
Piscolidae				X		predators	10
<b>Nematomorpha (Horsehair Worms)</b>							
Gordidae	X					parasites	*

\* Pollution tolerance values not assigned in EPA 444/4-89-001.

## Appendix 5. Rapid Bioassessment Protocol II Metrics, Biological Condition Scores and Impairment Assessment.

### Site 1: Data from 18 Sep 91 - 31 Aug 92

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio. %	Impairment
18-Sep-91	27	5	3.59	0.41	1.00	48.1	2	5.40	50.0%	Moderately impaired
2-Oct-91	81	9	3.99	0.90	1.00	54.3	4	2.80	50.0%	Moderately impaired
16-Oct-91	99	6	4.17	0.59	1.00	34.3	2	4.30	50.0%	Moderately impaired
6-Nov-91	65	9	3.44	0.76	1.00	26.2	6	2.80	64.3%	Moderately impaired
20-Nov-91	114	13	3.67	0.59	1.00	27.2	6	1.80	71.4%	Moderately impaired
4-Dec-91	89	13	3.77	0.63	1.00	32.6	6	1.80	64.3%	Moderately impaired
17-Dec-91	105	11	3.72	0.69	1.00	42.9	6	2.10	57.1%	Moderately impaired
8-Jan-92	30	9	4.72	0.39	0.81	23.3	2	2.70	64.3%	Moderately impaired
22-Jan-92	97	9	4.54	0.04	1.00	27.8	5	3.00	50.0%	Moderately impaired
12-Feb-92	100	14	5.35	0.50	0.99	36.0	7	1.50	64.3%	Moderately impaired
26-Feb-92	88	10	4.70	0.51	0.96	38.6	5	2.30	57.1%	Moderately impaired
11-Mar-92	78	13	4.54	0.73	1.00	24.4	5	1.80	71.4%	Moderately impaired
25-Mar-92	117	9	5.01	0.80	1.00	38.5	4	2.70	57.1%	Moderately impaired
9-Apr-92	61	13	4.84	0.42	0.91	27.9	5	1.80	71.4%	Moderately impaired
22-Apr-92	116	6	5.52	0.57	1.00	35.3	2	4.30	42.9%	Moderately impaired
13-May-92	81	9	4.97	0.14	0.98	50.6	4	2.60	35.7%	Moderately impaired
27-May-92	-	-	-	-	-	-	-	-	-	-
14-Jun-92	-	-	-	-	-	-	-	-	-	-
5-Jul-92	123	10	5.05	0.21	1.00	55.0	5	2.30	42.9%	Moderately impaired
19-Jul-92	117	9	6.11	0.01	1.00	85.0	3	2.70	28.6%	Moderately impaired
2-Aug-92	112	8	7.29	0.73	1.00	55.4	4	2.90	42.9%	Moderately impaired
16-Aug-92	84	8	6.59	0.18	1.00	46.4	3	3.00	42.9%	Moderately impaired
30-Aug-92	107	8	5.23	0.84	1.00	56.1	4	3.00	42.9%	Moderately impaired
<b>MINIMUM</b>	<b>27</b>	<b>5</b>	<b>3.44</b>	<b>0.01</b>	<b>0.91</b>	<b>23.3</b>	<b>2</b>	<b>1.50</b>	<b>35.7%</b>	
<b>MAXIMUM</b>	<b>117</b>	<b>14</b>	<b>7.29</b>	<b>0.90</b>	<b>1.00</b>	<b>85.0</b>	<b>7</b>	<b>5.40</b>	<b>71.4%</b>	
<b>AVERAGE</b>	<b>90</b>	<b>10</b>	<b>4.80</b>	<b>0.51</b>	<b>0.98</b>	<b>41.2</b>	<b>4</b>	<b>2.74</b>	<b>57.1%</b>	<b>Moderately impaired</b>

# Taxa = Number of families represented in the sample

FBI = Modified Family Biotic Index

SCR/FILT = Ratio of scrapers to filtering collectors

EPT/CHIR = Ratio of EPT individuals to chironomids

% CDF = Percent contribution of dominant family

EPT Index = Number of families collected from Ephemeroptera, Plecoptera, and Trichoptera

CLI = Community Loss Index

Bio % = Percent comparison to reference score

**Appendix 5. Continued.**

**Site 1: Data from 01 Sep 92 - 01 Sep 93**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio. %	Impairment
13-Sep-92	36	7	6.10	0.94	1.00	36.1	3	3.60	50.0%	Moderately impaired
27-Sep-92	103	7	6.31	0.75	1.00	41.7	4	3.60	50.0%	Moderately impaired
11-Oct-92	116	8	5.93	0.91	0.78	47.4	2	3.00	50.0%	Moderately impaired
25-Oct-92	112	9	5.45	0.84	0.86	40.2	3	2.70	50.0%	Moderately impaired
18-Nov-92	-	-	-	-	-	-	-	-	-	-
29-Nov-92	84	13	4.97	0.61	0.86	27.4	5	1.70	71.4%	Moderately impaired
13-Dec-92	125	16	5.44	0.94	0.97	41.1	8	1.40	64.3%	Moderately impaired
28-Dec-92	143	19	4.22	0.87	0.76	24.8	10	1.00	85.7%	Non-impaired
10-Jan-93	32	7	4.86	0.85	1.00	35.5	2	3.60	57.1%	Moderately impaired
24-Jan-93	121	15	5.05	0.94	0.97	44.2	7	1.50	71.4%	Moderately impaired
20-Feb-93	120	17	5.18	0.94	0.94	34.5	8	1.20	71.4%	Moderately impaired
28-Feb-93	92	10	5.16	0.95	1.00	30.4	4	2.30	57.1%	Moderately impaired
18-Mar-93	57	8	7.22	0.25	1.00	50.9	3	2.87	35.7%	Moderately impaired
28-Mar-93	126	11	6.64	0.85	1.00	52.4	4	2.18	42.9%	Moderately impaired
11-Apr-93	65	10	6.48	0.43	1.00	52.3	4	2.40	42.9%	Moderately impaired
25-Apr-93	110	13	5.55	0.88	1.00	40.0	4	1.77	57.1%	Moderately impaired
13-May-93	116	9	6.14	0.96	1.00	36.2	2	2.67	50.0%	Moderately impaired
26-May-93	111	12	6.57	0.88	0.91	41.4	5	1.83	57.1%	Moderately impaired
6-Jun-93	101	12	6.63	0.77	0.94	34.7	3	2.00	57.1%	Moderately impaired
27-Jun-93	51	12	5.55	0.93	1.00	37.3	3	1.92	57.1%	Moderately impaired
7-Jul-93	30	11	4.77	0.50	1.00	36.7	3	2.18	57.1%	Moderately impaired
18-Jul-93	36	10	3.17	1.00	0.90	25.0	1	2.50	64.3%	Moderately impaired
1-Aug-93	36	9	5.67	0.75	1.00	38.9	2	2.67	50.0%	Moderately impaired
17-Aug-93	51	12	5.16	0.75	0.70	25.5	3	1.92	71.4%	Moderately impaired
1-Sep-93	19	5	4.80	1.00	1.00	47.4	1	5.40	50.0%	Moderately impaired
<b>MINIMUM</b>	<b>19</b>	<b>5</b>	<b>4.22</b>	<b>0.33</b>	<b>0.70</b>	<b>24.8</b>	<b>1</b>	<b>1.00</b>	<b>35.7%</b>	
<b>MAXIMUM</b>	<b>143</b>	<b>19</b>	<b>7.26</b>	<b>1.00</b>	<b>1.00</b>	<b>52.4</b>	<b>10</b>	<b>5.40</b>	<b>85.7%</b>	
<b>AVERAGE</b>	<b>83</b>	<b>11</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>38</b>	<b>4</b>	<b>2</b>	<b>50.0%</b>	<b>Moderately impaired</b>

**Appendix 5. Continued.**

**Site 2: Data from 18 Sep 91 - 31 Aug 92**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
18-Sep-91	38	10	5.86	0.44	1.00	28.9	5	2.30	57.1%	Moderately impaired
2-Oct-91	10	6	1.89	0.67	1.00	40.0	2	3.80	57.1%	Moderately impaired
16-Oct-91	37	10	5.38	0.61	1.00	18.9	5	2.00	57.1%	Moderately impaired
6-Nov-91	55	11	4.77	0.89	1.00	23.6	5	2.00	64.3%	Moderately impaired
20-Nov-91	104	11	3.63	0.44	1.00	28.8	5	1.90	64.3%	Moderately impaired
4-Dec-91	71	7	5.28	0.00	1.00	49.3	1	3.30	35.7%	Moderately impaired
17-Dec-91	114	10	4.82	0.02	0.98	48.2	3	2.10	42.9%	Moderately impaired
8-Jan-92	76	10	5.71	0.38	1.00	28.9	4	2.10	57.1%	Moderately impaired
22-Jan-92	95	13	5.41	0.17	0.97	17.9	4	1.50	57.1%	Moderately impaired
12-Feb-92	96	12	5.76	0.25	1.00	32.3	5	1.80	50.0%	Moderately impaired
26-Feb-92	109	18	5.65	0.36	0.96	20.2	8	0.90	71.4%	Moderately impaired
11-Mar-92	53	10	6.30	0.41	1.00	22.6	3	2.00	57.1%	Moderately impaired
25-Mar-92	88	12	6.32	0.60	1.00	26.1	5	1.60	64.3%	Moderately impaired
9-Apr-92	73	6	3.80	1.00	1.00	79.5	3	4.00	50.0%	Moderately impaired
22-Apr-92	44	9	5.00	0.37	1.00	23.0	4	2.40	64.3%	Moderately impaired
13-May-92	75	12	5.00	0.26	0.97	22.7	4	1.60	64.3%	Moderately impaired
27-May-92	-	-	-	-	-	-	-	-	-	-
14-Jun-92	83	9	4.19	0.36	0.98	33.7	5	2.20	57.1%	Moderately impaired
5-Jul-92	129	8	3.99	0.07	0.99	45.0	3	2.60	42.9%	Moderately impaired
19-Jul-92	85	8	3.20	0.07	1.00	51.7	4	2.60	35.7%	Moderately impaired
2-Aug-92	103	10	5.03	0.29	1.00	34.0	4	2.20	50.0%	Moderately impaired
16-Aug-92	52	7	3.33	0.44	1.00	26.9	3	3.40	64.3%	Moderately impaired
30-Aug-92	103	9	3.25	0.28	1.00	38.8	3	2.40	50.0%	Moderately impaired
<b>MINIMUM</b>	<b>10</b>	<b>6</b>	<b>1.89</b>	<b>0.00</b>	<b>0.96</b>	<b>17.9</b>	<b>1</b>	<b>1.50</b>	<b>35.7%</b>	
<b>MAXIMUM</b>	<b>129</b>	<b>18</b>	<b>6.32</b>	<b>1.00</b>	<b>1.00</b>	<b>79.5</b>	<b>8</b>	<b>4.00</b>	<b>71.4%</b>	
<b>AVERAGE</b>	<b>77</b>	<b>10</b>	<b>4.71</b>	<b>0.38</b>	<b>0.99</b>	<b>33.7</b>	<b>4</b>	<b>2.30</b>	<b>57.1%</b>	<b>Moderately impaired</b>

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**Appendix 5. Continued.**

**Site 2: Data from 01 Sep 92 - 01 Sep 93**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
13-Sep-92	54	9	2.44	0.76	1.00	46.3	6	2.30	57.1%	Moderately impaired
27-Sep-92	82	12	2.98	0.74	1.00	39.0	4	1.70	64.3%	Moderately impaired
11-Oct-92	97	14	3.97	0.61	0.98	22.7	7	1.20	78.6%	Non-impaired
25-Oct-92	103	14	3.31	0.86	0.98	34.0	7	1.10	71.4%	Moderately impaired
18-Nov-92	83	14	4.02	0.53	0.94	20.5	7	1.21	78.6%	Non-impaired
29-Nov-92	100	13	3.90	0.83	0.99	51.0	6	1.50	57.1%	Moderately impaired
13-Dec-92	91	14	3.84	0.69	0.91	26.4	6	1.20	71.4%	Moderately impaired
28-Dec-92	127	14	3.81	0.83	0.97	36.2	6	1.30	64.3%	Moderately impaired
10-Jan-93	30	5	1.66	0.50	1.00	46.7	2	5.20	50.0%	Moderately impaired
24-Jan-93	109	13	3.89	0.91	0.92	40.6	5	1.40	64.3%	Moderately impaired
20-Feb-93	116	17	3.93	0.89	0.93	32.2	7	1.00	71.4%	Moderately impaired
28-Feb-93	127	14	3.64	0.94	0.94	33.9	5	1.36	64.3%	Moderately impaired
18-Mar-93	114	16	3.81	0.82	0.89	39.5	7	1.12	71.4%	Moderately impaired
28-Mar-93	82	17	3.85	0.90	0.91	35.4	6	1.06	64.3%	Moderately impaired
11-Apr-93	87	16	3.28	0.82	0.93	36.8	6	0.88	64.3%	Moderately impaired
25-Apr-93	65	13	4.19	0.88	0.88	41.5	5	1.31	64.3%	Moderately impaired
13-May-93	78	11	3.60	0.92	0.95	57.7	5	2.00	50.0%	Moderately impaired
26-May-93	70	11	4.14	0.49	0.98	30.0	5	1.91	57.1%	Moderately impaired
6-Jun-93	75	13	3.60	0.45	0.98	32.0	4	1.54	64.3%	Moderately impaired
27-Jun-93	49	9	3.57	0.79	1.00	61.2	4	2.33	50.0%	Moderately impaired
7-Jul-93	104	12	4.05	0.83	0.97	55.8	4	1.75	57.1%	Moderately impaired
18-Jul-93	107	13	3.72	0.73	0.99	45.8	5	1.38	64.3%	Moderately impaired
1-Aug-93	18	6	3.22	1.00	1.00	44.4	2	4.00	57.1%	Moderately impaired
17-Aug-93	28	9	3.37	0.86	0.84	57.1	4	2.44	50.0%	Moderately impaired
1-Sep-93	18	7	4.76	0.46	1.00	27.8	4	3.43	64.3%	Moderately impaired
<b>MINIMUM</b>	<b>18</b>	<b>5</b>	<b>1.66</b>	<b>0.45</b>	<b>0.84</b>	<b>22.7</b>	<b>2</b>	<b>0.88</b>	<b>50.0%</b>	
<b>MAXIMUM</b>	<b>127</b>	<b>17</b>	<b>4.76</b>	<b>0.92</b>	<b>1.00</b>	<b>61.2</b>	<b>7</b>	<b>5.20</b>	<b>78.6%</b>	
<b>AVERAGE</b>	<b>81</b>	<b>12</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>40</b>	<b>5</b>	<b>2</b>	<b>64.3%</b>	<b>Moderately impaired</b>

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## Appendix 5. Continued.

Site 3: Data from 18 Sep 91 - 31 Aug 92

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
18-Sep-91	28	7	4.61	1.00	1.00	25.0	3	3.60	64.3%	Moderately impaired
2-Oct-91	30	7	5.43	1.00	1.00	26.7	3	3.60	57.1%	Moderately impaired
16-Oct-91	53	10	3.37	0.71	1.00	22.6	4	2.20	64.3%	Moderately impaired
6-Nov-91	72	8	4.81	0.21	1.00	37.5	4	2.90	50.0%	Moderately impaired
20-Nov-91	100	9	4.07	0.45	1.00	20.0	4	2.30	64.3%	Moderately impaired
4-Dec-91	84	5	3.32	0.14	1.00	59.5	3	4.80	28.6%	Moderately impaired
17-Dec-91	45	9	4.18	0.80	0.95	55.5	4	2.40	50.0%	Moderately impaired
8-Jan-92	47	11	4.40	0.59	0.95	53.2	6	1.90	50.0%	Moderately impaired
22-Jan-92	89	10	5.44	0.96	0.98	60.7	3	2.40	42.9%	Moderately impaired
12-Feb-92	98	8	3.80	1.00	1.00	51.0	3	3.00	50.0%	Moderately impaired
26-Feb-92	101	12	4.06	0.95	1.00	31.7	6	1.70	64.3%	Moderately impaired
11-Mar-92	102	7	3.84	1.00	1.00	76.5	4	3.40	50.0%	Moderately impaired
25-Mar-92	126	5	4.37	0.00	0.97	85.7	2	5.20	28.6%	Moderately impaired
9-Apr-92	22	3	3.33	0.25	1.00	86.4	1	8.70	35.7%	Moderately impaired
22-Apr-92	26	8	3.73	0.40	0.94	50.0	3	2.90	57.1%	Moderately impaired
13-May-92	33	8	5.70	0.12	0.69	39.0	5	2.80	35.7%	Moderately impaired
27-May-92	-	-	-	-	-	-	-	-	-	-
14-Jun-92	-	-	-	-	-	-	-	-	-	-
5-Jul-92	17	7	2.60	0.91	1.00	23.5	4	3.10	64.3%	Moderately impaired
19-Jul-92	14	4	4.90	1.00	1.00	42.8	2	6.20	50.0%	Moderately impaired
2-Aug-92	23	8	5.74	0.70	1.00	34.8	2	2.70	50.0%	Moderately impaired
16-Aug-92	11	6	5.18	0.67	0.83	27.3	2	4.00	64.3%	Moderately impaired
30-Aug-92	29	5	4.34	1.00	0.96	72.4	1	5.40	42.9%	Moderately impaired
<b>MINIMUM</b>	<b>11</b>	<b>3</b>	<b>2.60</b>	<b>0.00</b>	<b>0.69</b>	<b>20.0</b>	<b>1</b>	<b>1.70</b>	<b>28.8%</b>	
<b>MAXIMUM</b>	<b>126</b>	<b>12</b>	<b>5.74</b>	<b>1.00</b>	<b>1.00</b>	<b>84.6</b>	<b>6</b>	<b>8.70</b>	<b>64.3%</b>	
<b>AVERAGE</b>	<b>55</b>	<b>7</b>	<b>4.34</b>	<b>0.66</b>	<b>0.97</b>	<b>46.8</b>	<b>3</b>	<b>3.58</b>	<b>57.1%</b>	<b>Moderately impaired</b>

**Appendix 5. Continued.**

**Site 3: Data from 01 Sep 92 - 01 Sep 93**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
13-Sep-92	5	4	4.80	0.75	1.00	40.0	3	6.50	50.0%	Moderately impaired
27-Sep-92	56	9	2.94	1.00	1.00	51.8	4	2.70	50.0%	Moderately impaired
11-Oct-92	38	8	4.29	1.00	0.59	26.3	4	2.90	57.1%	Moderately impaired
25-Oct-92	27	7	5.19	1.00	0.69	33.3	2	3.40	57.1%	Moderately impaired
18-Nov-92	58	8	5.81	0.00	0.17	50.0	2	1.70	21.4%	Moderately impaired
29-Nov-92	41	5	4.02	1.00	1.00	56.1	2	5.20	42.9%	Moderately impaired
13-Dec-92	35	8	4.87	0.83	0.80	28.6	5	3.00	64.3%	Moderately impaired
28-Dec-92	41	8	4.76	0.86	0.39	26.8	3	3.00	57.1%	Moderately impaired
10-Jan-93	20	9	3.85	1.00	0.78	30.0	4	2.40	57.1%	Moderately impaired
24-Jan-93	127	10	4.92	0.96	0.55	39.4	5	2.40	50.0%	Moderately impaired
20-Feb-93	166	13	5.04	0.95	0.34	48.8	5	1.60	57.1%	Moderately impaired
28-Feb-93	101	8	5.41	1.00	0.48	46.5	4	3.00	42.9%	Moderately impaired
18-Mar-93	86	10	5.52	1.00	0.28	67.4	5	2.40	35.7%	Moderately impaired
28-Mar-93	91	12	5.46	1.00	0.35	51.6	4	1.67	42.9%	Moderately impaired
11-Apr-93	47	11	4.02	0.91	0.56	27.7	6	2.09	57.1%	Moderately impaired
25-Apr-93	107	9	5.99	1.00	0.97	38.3	4	2.67	50.0%	Moderately impaired
13-May-93	66	8	6.44	0.98	0.98	80.3	5	3.00	42.9%	Moderately impaired
26-May-93	50	8	4.56	1.00	0.97	30.0	5	3.00	57.1%	Moderately impaired
6-Jun-93	28	10	4.54	1.00	0.86	32.1	5	2.40	57.1%	Moderately impaired
27-Jun-93	8	5	5.87	1.00	0.67	25.0	3	5.00	50.0%	Moderately impaired
7-Jul-93	3	1	4.00	0.00	1.00	100.0	1	28.00	28.6%	Moderately impaired
18-Jul-93	14	8	6.21	0.44	0.89	28.6	3	2.87	57.1%	Moderately impaired
1-Aug-93	17	5	5.76	1.00	1.00	52.9	3	5.20	35.7%	Moderately impaired
17-Aug-93	2	2	4.00	1.00	0.50	50.0	1	13.50	42.9%	Moderately impaired
1-Sep-93	11	5	4.10	0.83	1.00	36.4	2	4.80	50.0%	Moderately impaired
<b>MINIMUM</b>	<b>2</b>	<b>1</b>	<b>2.94</b>	<b>0.00</b>	<b>0.17</b>	<b>25.0</b>	<b>1</b>	<b>1.60</b>	<b>28.6%</b>	
<b>MAXIMUM</b>	<b>166</b>	<b>13</b>	<b>6.44</b>	<b>1.00</b>	<b>1.00</b>	<b>100.0</b>	<b>6</b>	<b>28.00</b>	<b>64.3%</b>	
<b>AVERAGE</b>	<b>50</b>	<b>8</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>44</b>	<b>4</b>	<b>5</b>	<b>50.0%</b>	<b>Moderately impaired</b>

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**Appendix 5. Continued.**

**Site 4: Data from 18 Sep 91 - 31 Aug 92**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
18-Sep-91	49	5	4.63	0.98	1.00	79.6	3	5.00	42.9%	Moderately impaired
2-Oct-91	69	7	3.77	0.93	1.00	62.3	4	3.30	50.0%	Moderately impaired
16-Oct-91	64	10	3.87	0.63	1.00	37.5	5	2.30	57.1%	Moderately impaired
6-Nov-91	104	7	2.94	0.80	1.00	58.7	2	3.10	50.0%	Moderately impaired
20-Nov-91	105	8	3.10	0.42	1.00	39.0	3	2.60	57.1%	Moderately impaired
4-Dec-91	114	8	2.90	0.51	1.00	47.4	4	2.60	57.1%	Moderately impaired
17-Dec-91	129	8	3.17	0.35	1.00	38.8	3	2.80	57.1%	Moderately impaired
8-Jan-92	52	11	3.77	0.67	1.00	17.3	5	1.70	64.3%	Moderately impaired
22-Jan-92	72	6	4.74	0.13	0.97	51.4	3	3.80	35.7%	Moderately impaired
12-Feb-92	25	5	5.04	0.46	1.00	40.0	5	5.20	50.0%	Moderately impaired
26-Feb-92	77	8	4.03	0.94	0.99	64.9	3	2.80	50.0%	Moderately impaired
11-Mar-92	13	4	2.54	0.58	1.00	38.0	3	6.30	50.0%	Moderately impaired
25-Mar-92	8	4	5.50	0.67	0.00	37.5	0	6.30	28.6%	Moderately impaired
9-Apr-92	55	10	7.36	0.00	1.00	41.8	2	2.30	35.7%	Moderately impaired
22-Apr-92	33	6	3.42	0.12	0.94	70.0	4	3.80	35.7%	Moderately impaired
13-May-92	98	8	3.49	0.29	0.17	41.8	4	2.60	35.7%	Moderately impaired
27-May-92	-	-	-	-	-	-	-	-	-	-
14-Jun-92	37	7	3.51	0.48	1.00	29.7	5	3.10	64.3%	Moderately impaired
5-Jul-92	89	6	3.76	0.60	1.00	48.3	3	4.00	57.1%	Moderately impaired
19-Jul-92	87	8	3.21	0.15	1.00	93.6	4	2.60	35.7%	Moderately impaired
2-Aug-92	134	8	3.44	0.20	1.00	45.5	3	2.60	50.0%	Moderately impaired
16-Aug-92	140	7	4.88	0.47	1.00	34.3	2	3.30	57.1%	Moderately impaired
30-Aug-92	159	8	3.60	0.52	1.00	38.4	4	2.60	57.1%	Moderately impaired
<b>MINIMUM</b>	<b>8</b>	<b>4</b>	<b>2.54</b>	<b>0.00</b>	<b>0.17</b>	<b>17.3</b>	<b>0</b>	<b>1.70</b>	<b>28.6%</b>	
<b>MAXIMUM</b>	<b>159</b>	<b>11</b>	<b>7.36</b>	<b>0.98</b>	<b>1.00</b>	<b>79.6</b>	<b>5</b>	<b>6.30</b>	<b>64.3%</b>	
<b>AVERAGE</b>	<b>78</b>	<b>7</b>	<b>3.94</b>	<b>0.50</b>	<b>0.91</b>	<b>48.0</b>	<b>3</b>	<b>3.40</b>	<b>57.1%</b>	<b>Moderately impaired</b>

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**Appendix 5. Continued.**

**Site 4: Data from 01 Sep 92 - 01 Sep 93**

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio %	Impairment
13-Sep-92	92	10	3.59	0.88	1.00	61.9	4	2.20	50.0%	Moderately impaired
27-Sep-92	88	7	3.60	0.77	1.00	55.7	3	3.10	50.0%	Moderately impaired
11-Oct-92	122	7	3.10	0.77	1.00	56.6	3	3.30	50.0%	Moderately impaired
25-Oct-92	87	5	4.10	1.00	0.98	63.2	1	4.80	42.9%	Moderately impaired
18-Nov-92	116	11	3.34	0.72	0.99	51.7	4	1.70	50.0%	Moderately impaired
29-Nov-92	114	15	3.23	0.88	0.99	45.6	5	1.10	64.3%	Moderately impaired
13-Dec-92	101	15	3.20	0.82	0.97	52.6	6	1.10	57.1%	Moderately impaired
28-Dec-92	140	16	3.26	0.78	0.96	47.4	6	1.10	64.3%	Moderately impaired
10-Jan-93	68	9	2.94	0.96	0.98	73.5	3	2.60	50.0%	Moderately impaired
24-Jan-93	96	14	3.27	0.54	1.00	20.0	6	1.30	71.4%	Moderately impaired
20-Feb-93	94	12	3.77	0.81	0.96	23.4	8	1.70	78.6%	Non-impaired
28-Feb-93	88	13	3.20	0.75	0.99	23.9	6	1.46	71.4%	Moderately impaired
18-Mar-93	99	12	4.11	0.98	0.92	45.5	6	1.75	64.3%	Moderately impaired
28-Mar-93	142	14	4.49	0.93	1.00	43.0	7	1.29	71.4%	Moderately impaired
11-Apr-93	85	13	4.11	0.82	1.00	38.8	5	1.54	64.3%	Moderately impaired
25-Apr-93	108	12	4.02	0.20	1.00	49.1	5	1.58	57.1%	Moderately impaired
13-May-93	2	2	6.50	0.00	1.00	50.0	1	13.50	28.6%	Moderately impaired
26-May-93	46	11	4.57	0.95	0.84	34.8	5	1.91	57.1%	Moderately impaired
6-Jun-93	39	7	4.45	0.77	0.58	43.6	3	3.29	50.0%	Moderately impaired
27-Jun-93	135	11	4.99	0.30	1.00	41.5	5	1.82	50.0%	Moderately impaired
7-Jul-93	110	8	4.94	0.06	1.00	48.2	4	2.75	42.9%	Moderately impaired
18-Jul-93	141	12	4.50	0.32	0.99	32.6	5	1.50	64.3%	Moderately impaired
1-Aug-93	74	11	3.97	0.80	1.00	50.0	3	1.82	57.1%	Moderately impaired
17-Aug-93	90	7	3.39	0.38	1.00	32.2	3	3.29	57.1%	Moderately impaired
1-Sep-93	79	11	4.47	0.18	1.00	38.0	5	1.82	50.0%	Moderately impaired
<b>MINIMUM</b>	<b>2</b>	<b>2</b>	<b>3.10</b>	<b>0.00</b>	<b>0.58</b>	<b>20.0</b>	<b>1</b>	<b>1.50</b>	<b>28.6%</b>	
<b>MAXIMUM</b>	<b>142</b>	<b>16</b>	<b>6.50</b>	<b>1.00</b>	<b>1.00</b>	<b>73.5</b>	<b>7</b>	<b>13.50</b>	<b>78.6%</b>	
<b>AVERAGE</b>	<b>94</b>	<b>11</b>	<b>4</b>	<b>1</b>	<b>1</b>	<b>45</b>	<b>4</b>	<b>3</b>	<b>57.1%</b>	<b>Moderately impaired</b>

## Appendix 5. Continued.

### Site 5: Data from 18 Sep 91 - 31 Aug 92

DATE	# individual	#Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio. %	Impairment
18-Sep-91	60	5	6.72	0.98	0.97	90.0	2	2.20	75.0%	Non-impaired
2-Oct-91	56	3	6.84	1.00	1.00	96.4	1	4.00	75.0%	Non-impaired
16-Oct-91	70	7	6.21	0.90	0.90	62.9	2	1.30	83.3%	Non-impaired
6-Nov-91	32	6	6.03	0.68	0.65	28.1	2	1.50	100.0%	Non-impaired
20-Nov-91	151	8	4.01	0.82	0.83	40.4	4	1.10	91.7%	Non-impaired
4-Dec-91	61	8	4.57	0.95	0.95	52.5	3	1.10	83.3%	Non-impaired
17-Dec-91	24	6	4.67	1.00	1.00	50.0	3	1.70	91.7%	Non-impaired
8-Jan-92	124	9	6.77	0.80	0.83	73.4	5	1.10	83.3%	Non-impaired
22-Jan-92	108	7	6.71	0.92	0.97	85.2	4	1.60	83.3%	Non-impaired
12-Feb-92	144	5	6.92	0.94	0.99	91.0	2	2.00	75.0%	Non-impaired
26-Feb-92	104	7	6.78	0.87	0.97	83.7	2	3.70	83.3%	Non-impaired
11-Mar-92	115	8	6.32	0.73	0.98	59.1	3	1.30	83.3%	Non-impaired
25-Mar-92	122	8	6.62	0.87	0.95	59.0	4	1.30	83.3%	Non-impaired
9-Apr-92	84	10	5.25	0.89	0.92	46.4	5	1.00	91.7%	Non-impaired
22-Apr-92	45	8	4.33	0.80	0.79	36.0	5	1.40	91.7%	Non-impaired
13-May-92	174	13	4.37	0.98	0.98	60.9	5	0.80	91.7%	Non-impaired
27-May-92	-	-	-	-	-	-	-	-	-	-
14-Jun-92	184	7	4.11	0.44	1.00	50.0	5	1.70	91.7%	Non-impaired
5-Jul-92	137	8	6.18	1.00	1.00	22.6	4	1.50	100.0%	Non-impaired
19-Jul-92	122	8	4.20	1.00	1.00	54.0	3	1.50	83.3%	Non-impaired
2-Aug-92	92	8	6.14	1.00	0.97	32.9	3	1.30	91.7%	Non-impaired
16-Aug-92	186	10	4.23	0.05	1.00	43.5	4	1.20	75.0%	Non-impaired
30-Aug-92	36	5	5.06	1.00	1.00	55.6	2	2.40	75.0%	Non-impaired
<b>MINIMUM</b>	<b>24</b>	<b>3</b>	<b>4.01</b>	<b>0.05</b>	<b>0.65</b>	<b>22.6</b>	<b>1</b>	<b>0.80</b>	<b>75.0%</b>	
<b>MAXIMUM</b>	<b>186</b>	<b>13</b>	<b>6.92</b>	<b>1.00</b>	<b>1.00</b>	<b>96.4</b>	<b>5</b>	<b>4.00</b>	<b>100.0%</b>	
<b>AVERAGE</b>	<b>101</b>	<b>7</b>	<b>5.59</b>	<b>0.85</b>	<b>0.94</b>	<b>57.9</b>	<b>3</b>	<b>1.67</b>	<b>83.3%</b>	<b>Non-impaired</b>

## Appendix 5. Continued.

### Site 5: Data from 01 Sep 92 - 01 Sep 93

DATE	# individual	# Taxa	FBI	SCR/FILT	EPT/CHIR	%CDF	EPT index	CLI	Bio. %	Impairment
13-Sep-92	55	9	4.53	0.21	1.00	23.6	5	1.20	91.7%	Non-impaired
27-Sep-92	69	7	3.81	1.00	0.98	52.2	3	1.40	83.3%	Non-impaired
11-Oct-92	56	8	4.49	1.00	0.89	41.1	4	1.20	91.7%	Non-impaired
25-Oct-92	35	8	4.18	1.00	0.90	28.6	2	1.40	100.0%	Non-impaired
18-Nov-92	-	-	-	-	-	-	-	-	-	-
29-Nov-92	68	11	4.58	0.98	0.70	41.2	4	0.80	100.0%	Non-impaired
13-Dec-92	61	10	4.43	1.00	0.62	36.7	3	1.00	91.7%	Non-impaired
28-Dec-92	-	-	-	-	-	-	-	-	-	-
10-Jan-93	75	10	3.99	0.96	0.94	54.2	4	0.90	83.3%	Non-impaired
24-Jan-93	71	12	5.44	0.92	0.75	27.7	5	0.70	108.3%	Non-impaired
20-Feb-93	76	11	4.23	0.98	0.84	33.3	5	0.91	100.0%	Non-impaired
28-Feb-93	97	13	4.84	0.90	0.98	44.3	5	0.77	100.0%	Non-impaired
18-Mar-93	85	12	5.06	0.90	0.90	28.2	4	0.75	108.3%	Non-impaired
28-Mar-93	113	13	6.31	0.87	0.82	34.5	7	0.69	100.0%	Non-impaired
11-Apr-93	121	13	3.81	0.29	1.00	25.6	6	0.85	108.3%	Non-impaired
25-Apr-93	69	13	4.91	0.93	0.81	23.2	5	0.69	108.3%	Non-impaired
13-May-93	92	12	5.40	0.98	0.92	29.3	4	0.75	108.3%	Non-impaired
26-May-93	32	9	5.47	1.00	0.86	34.4	4	1.11	91.7%	Non-impaired
6-Jun-93	32	9	5.06	1.00	0.88	37.5	5	1.11	91.7%	Non-impaired
27-Jun-93	49	9	5.92	1.00	0.97	34.7	4	1.00	91.7%	Non-impaired
7-Jul-93	54	9	5.41	1.00	0.66	25.9	4	1.00	100.0%	Non-impaired
18-Jul-93	17	5	7.35	1.00	0.55	29.4	2	1.80	91.7%	Non-impaired
1-Aug-93	20	8	4.95	1.00	0.88	30.0	5	0.07	100.0%	Non-impaired
17-Aug-93	26	7	5.58	1.00	0.67	30.8	3	1.43	91.7%	Non-impaired
1-Sep-93	74	10	5.64	1.00	0.91	48.6	5	1.00	91.7%	Non-impaired
<b>MINIMUM</b>	<b>17</b>	<b>5</b>	<b>3.81</b>	<b>0.21</b>	<b>0.55</b>	<b>23.2</b>	<b>2</b>	<b>0.07</b>	<b>83.3%</b>	
<b>MAXIMUM</b>	<b>121</b>	<b>13</b>	<b>7.35</b>	<b>1.00</b>	<b>1.00</b>	<b>54.2</b>	<b>7</b>	<b>1.80</b>	<b>108.3%</b>	
<b>AVERAGE</b>	<b>63</b>	<b>10</b>	<b>5</b>	<b>1</b>	<b>1</b>	<b>35</b>	<b>4</b>	<b>1</b>	<b>91.7%</b>	<b>Non-impaired</b>

**Appendix 6. Seco Creek Physical Characterization/Water Quality Data.**

<b>PARAMETERS</b>	<b>SITE 1</b>	<b>SITE 2</b>	<b>SITE 3</b>	<b>SITE 4</b>	<b>SITE 5</b>
<b>PHYSICAL CHARACTERIZATION</b>					
<b>Riparian Zone/Instream Features</b>					
Predominant Surrounding Land Use	Field/Pasture	Field/Pasture	Field/Pasture	Field/Pasture	Field/Pasture
Local Watershed Erosion	None	Moderate	Moderate	Moderate	Moderate
Local Watershed NPS Pollution	No evidence	No evidence	No evidence	No evidence	Some Potential Sources
Estimated Stream Width (Ft.)	2	25	50	40	20
Estimated Stream Depth (Ft.)	0.1	0.4	1	1.5	0.7
High Water Mark (Ft.)	N/A	N/A	N/A	N/A	15
Velocity (Ft. per sec.)	3.3	2.5	2	3.3	1.5
Dam Present	No	No	No	No	No
Channelized	No	No	No	No	No
Canopy Cover	Partly Open	Open	Open	Open	Partly Shaded
<b>Sediment/Substrate</b>					
Sediment Odors	Normal	Normal	Normal	Normal	Normal
Sediment Oils	Absent	Absent	Absent	Absent	Absent
Sediment Deposits	None	None	None	None	None
Undersides of Non-embedded Stones Black?	No	No	No	No	No
<b>Inorganic Substrate Components</b>					
Bedrock	-	40%	65%	-	-
Boulder	10%	5%	-	15%	5%
Cobble	50%	30%	5%	50%	15%
Gravel	10%	20%	10%	35%	80%
Sand	-	-	-	-	-
Silt	-	-	20%	-	-
Clay	-	-	-	-	-
<b>Organic Substrate Components</b>					
Detritus	30%	5%	-	-	-
Muck-Mud	-	-	-	-	-
Marl	-	-	-	-	-
<b>WATER QUALITY</b>					
Temperature	*	*	*	*	*
Dissolved Oxygen	*	*	*	*	*
pH	*	*	*	*	*
Conductivity	*	*	*	*	*
Stream Type	Warmwater	Warmwater	Warmwater	Warmwater	Warmwater
Water Odors	Normal	Normal	Normal	Normal	Normal
Water Surface Oils	None	None	None	None	None
Turbidity	Clear	Clear	Clear	Clear	Slightly Turbid

\* See Appendix 1 for Water Quality Data

Appendix 7. Seco Creek Habitat Assessment Parameters, Condition Scoring and Percent Comparability to Reference Sites.

Condition/Parameter	Condition Scoring					Upper Medina River	Site 5	Metate Creek
	Site 1	Site 2	Site 3	Site 4	Reference Site	Reference Site		
<b>PRIMARY -</b>								
<b>Substrate and Instream Cover</b>								
1. Bottom substrate and available cover	12	12	8	18	20	18	6	
2. Embeddedness	18	18	11	18	20	18	20	
3. Flow/velocity	11	11	8	11	20	8	8	
<b>SECONDARY -</b>								
<b>Channel Morphology</b>								
4. Channel alteration	15	13	13	5	15	13	14	
5. Bottom scouring and deposition	8	8	5	5	15	13	15	
6. Pool/riffle, run/bend ratio	3	5	5	13	15	8	6	
<b>TERTIARY -</b>								
<b>Riparian and Bank Structure</b>								
7. Bank stability	10	10	10	9	10	4	6	
8. Bank vegetation	10	10	10	10	10	7	8	
9. Streamside cover	8	5	4	5	8	9	9	
<b>TOTAL SCORE</b>	<b>95</b>	<b>92</b>	<b>74</b>	<b>94</b>	<b>133</b>	<b>98</b>	<b>92</b>	
<b>% COMPARISON TO REFERENCE SITE</b>	<b>71.4%</b>	<b>69.2%</b>	<b>55.6%</b>	<b>70.7%</b>	<b>-</b>	<b>107%</b>	<b>-</b>	
<b>ASSESSMENT CATEGORY</b>	<b>Partially Supporting</b>	<b>Partially Supporting</b>	<b>Partially Supporting</b>	<b>Partially Supporting</b>	<b>-</b>	<b>Comparable to Reference</b>	<b>-</b>	

Appendix 8 . The Fish Taxa of Seco Creek.

Scientific name	Common name
ORDER CYPRINIFORMES	
CYPRINIDAE	
<i>Campostoma anomalum</i>	Central stoneroller
<i>Cyprinella lutrensis</i>	Red shiner
<i>Cyprinella venusta</i>	Blacktail shiner
<i>Cyprinus carpio</i>	Common carp
<i>Dionda episcopa</i>	Roundnose minnow
<i>Notropis anabilis</i>	Texas shiner
<i>Notropis stramineus</i>	Sand shiner
<i>Pimephales promelas</i>	Fathead minnow
ORDER CHARACIFORMES	
CHARACIDAE	
<i>Astyanax mexicanus</i>	Mexican tetra
ORDER SILURIFORMES	
ICTALURIDAE	
<i>Ameiurus natalis</i>	BULLHEAD
<i>Ictalurus punctatus</i>	CATFISHES
<i>Noturus nocturnus</i>	Yellow bullhead
	Channel catfish
	Freckled madtom
ORDER ATHERINIFORMES	
POECILIIDAE	
<i>Gambusia getseii</i>	LIVEBEARERS
	Largespring gambusia
ORDER PERCIFORMES	
CENTRARCHIDAE	
<i>Lepomis cyanellus</i>	SUNFISHES
<i>Lepomis gulosus</i>	Green sunfish
<i>Lepomis macrochirus</i>	Warmouth
<i>Lepomis megalotis</i>	Bluegill sunfish
<i>Lepomis microlophus</i>	Longear sunfish
<i>Micropterus salmoides</i>	Redear sunfish
	Largemouth bass
CICHLIDAE	
<i>Cichlasoma cyanoguttatum</i>	CICHLIDS
	Rio Grande cichlid

Appendix 9. Fish Collected from Seco Creek by Site, Trophic Level, Pollution Tolerance, and Origin.

Taxa	1	2	3	Site 4	5	Trophic Level	Pollution Tolerance	Origin
Centrarchidae (sunfishes)								
<i>Lepomis cyanellus</i>			X		X	insectivore	tolerant	native
<i>Lepomis gulosus</i>					X	insectivore	intermediate	native
<i>Lepomis macrochirus</i>		X	X	X	X	insectivore	intermediate	native
<i>Lepomis megalotis</i>		X	X	X	X	insectivore	intolerant	native
<i>Lepomis microlophus</i>			X			insectivore	intermediate	native
<i>Micropterus salmoides</i>		X	X	X	X	piscivore	intermediate	native
Characidae (characins)								
<i>Astyanax mexicanus</i>	X	X	X	X		insectivore	intermediate	native
Cichlidae (cichlids)								
<i>Cichlasoma cyanooguttatum</i>				X	X	insectivore	intermediate	native
Cyprinidae (minnows)								
<i>Campostoma anomalum</i>		X	X	X		herbivore	intermediate	native
<i>Cyprinella lutrensis</i>	X	X	X	X	X	omnivore	intermediate	native
<i>Cyprinella venusta</i>				X		insectivore	intermediate	native
<i>Cyprinus carpio</i>					observed	omnivore	tolerant	exotic
<i>Dionda episcopa</i>		X	X	X		omnivore	intolerant	native
<i>Notropis amabilis</i>				X	X	insectivore	intermediate	native
<i>Notropis stramineus</i>		X	X	X	X	insectivore	intermediate	native
<i>Pimephales promelas</i>		X				omnivore	tolerant	native
Ictaluridae (bullhead catfishes)								
<i>Ameiurus natalis</i>				X		insectivore	tolerant	native
<i>Ictalurus punctatus</i>		X			X	generalist	intermediate	native
<i>Noturus nocturnus</i>				X	X	insectivore	intermediate	native
Poeciliidae (livebearers)								
<i>Gambusia geiseri</i>		X	X	X	X	insectivore	intermediate	exotic



Appendix 10. Rapid Bioassessment Protocol V Metrics, Biological Condition Scoring and Impairment Assessment.

Sample Date: 16-Oct-91

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	2	1	4	1	3	1	4	1	5	1
# of Catfish Species	0	1	0	1	0	1	0	1	0	1
# of Sunfish Species	0	1	1	1	1	1	1	1	2	1
# of Minnow Species	1	1	1	1	0	1	2	1	2	3
# of Intolerant Species	0	1	0	1	1	1	0	1	0	1
% Green Sunfish	0%	5	0%	5	0%	5	0%	5	0%	5
% Omnivores	17%	5	22%	3	0%	5	4%	5	17%	5
% Insectivores	83%	5	56%	5	100%	5	96%	5	75%	5
% Top Carnivores	0%	1	22%	5	0%	1	0%	1	8%	5
Total # of Individuals	23	1	9	1	37	1	70	1	12	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>	<b>32</b>		<b>34</b>		<b>32</b>		<b>32</b>		<b>38</b>	
<b>Score Interpretation</b>	<b>Poor</b>		<b>Poor</b>		<b>Poor</b>		<b>Poor</b>		<b>Fair</b>	

IBI = Index of Biotic Integrity

Sample Date: 22-Jan-92

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	1	1	3	1	5	1	6	1	4	1
# of Catfish Species	0	1	0	1	0	1	0	1	0	1
# of Sunfish Species	0	1	0	1	2	1	2	1	2	1
# of Minnow Species	1	1	2	1	2	1	2	1	0	1
# of Intolerant Species	0	1	0	1	0	1	1	1	1	5
% Green Sunfish	0%	5	0%	5	0%	5	0%	5	0%	5
% Omnivores	100%	1	17%	5	6%	5	3%	5	0%	5
% Insectivores	0%	1	83%	5	88%	5	97%	5	100%	5
% Top Carnivores	0%	1	0%	1	6%	5	0%	1	0%	1
Total # of Individuals	1	1	12	1	16	1	29	1	8	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>	<b>24</b>		<b>32</b>		<b>36</b>		<b>32</b>		<b>36</b>	
<b>Score Interpretation</b>	<b>Poor</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>		<b>Fair</b>	

Appendix 10. Continued.

Sample Date: 22-Apr-92

	Site 1 Raw	Site 1 Metric	Site 2 Raw	Site 2 Metric	Site 3 Raw	Site 3 Metric	Site 4 Raw	Site 4 Metric	Site 5 Raw	Site 5 Metric
<b>Metrics Used:</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>
Total # of Species	1	1	8	3	7	1	9	3	4	1
# of Catfish Species	0	1	0	1	0	1	1	3	0	1
# of Sunfish Species	0	1	1	1	5	3	2	1	3	3
# of Minnow Species	0	1	5	5	1	1	3	3	1	1
# of Intolerant Species	0	1	1	1	1	1	2	3	1	5
% Green Sunfish	0%	5	0%	5	11%	3	0%	5	0%	5
% Omnivores	0%	5	14%	5	0%	5	11%	5	25%	3
% Insectivores	100%	5	64%	5	97%	5	89%	5	75%	5
% Top Carnivores	0%	1	0%	1	3%	3	0%	1	0%	1
Total # of Individuals	21	1	28	1	37	1	36	1	4	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>		<b>32</b>		<b>38</b>		<b>34</b>		<b>40</b>		<b>36</b>
<b>Score Interpretation</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>		<b>Fair</b>		<b>Fair</b>

Sample Date: 5-Jul-92

	Site 1 Raw	Site 1 Metric	Site 2 Raw	Site 2 Metric	Site 3 Raw	Site 3 Metric	Site 4 Raw	Site 4 Metric	Site 5 Raw	Site 5 Metric
<b>Metrics Used:</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>	<b>Score</b>
Total # of Species	1	1	4	1	5	1	10	3	5	1
# of Catfish Species	0	1	0	1	0	1	1	3	1	3
# of Sunfish Species	0	1	0	1	3	1	2	1	2	1
# of Minnow Species	0	1	3	3	2	1	5	5	1	1
# of Intolerant Species	0	1	0	1	1	1	1	1	0	1
% Green Sunfish	0%	5	0%	5	0%	5	0%	5	0%	5
% Omnivores	0%	5	15%	5	0%	5	12%	5	0%	5
% Insectivores	100%	5	50%	5	90%	5	70%	5	92%	5
% Top Carnivores	0%	1	0%	1	0%	1	0	1	8%	5
Total # of Individuals	20	1	20	1	20	1	33	1	13	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>		<b>32</b>		<b>34</b>		<b>32</b>		<b>40</b>		<b>38</b>
<b>Score Interpretation</b>		<b>Poor</b>		<b>Poor</b>		<b>Poor</b>		<b>Fair</b>		<b>Fair</b>

Appendix 10. Continued.

Sample Date: 18-Nov-92 (Sites 2-4), 21-Nov-92 (Site 1)  
(Site 5 not accessible this date)

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	1	1	7	1	7	1	7	1	No data this date	
# of Catfish Species	0	1	1	3	0	1	1	3		
# of Sunfish Species	0	1	1	1	4	3	2	1		
# of Minnow Species	0	1	3	3	2	1	2	1		
# of Intolerant Species	0	1	1	1	1	1	1	1		
% Green Sunfish	0%	5	0%	5	11%	3	0%	5		
% Omnivores	0%	5	6%	5	33%	3	2%	5		
% Insectivores	100%	5	45%	3	56%	5	71%	5		
% Top Carnivores	0%	1	0%	1	11%	5	4%	3		
Total # of Individuals	4	1	67	1	18	1	49%	1		
% Hybrids	0%	5	0%	5	0%	5	0%	5		
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5		
<b>IBI Score</b>	<b>32</b>		<b>34</b>		<b>34</b>		<b>36</b>			
<b>Score Interpretation</b>	<b>Poor</b>		<b>Poor</b>		<b>Poor</b>		<b>Fair</b>			

Sample Date: 28-Feb-93 (Site 5), 18-Mar-93 (Sites 1-4)

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	1	1	5	1	6	1	7	1	5	1
# of Catfish Species	0	1	0	1	0	1	1	3	0	1
# of Sunfish Species	0	1	1	1	3	1	3	1	3	3
# of Minnow Species	0	1	2	1	2	1	2	1	1	1
# of Intolerant Species	0	1	1	1	1	1	1	1	1	5
% Green Sunfish	0%	5	0%	5	0%	5	0%	5	4%	5
% Omnivores	0%	5	0%	5	0%	5	0%	5	0%	5
% Insectivores	100%	5	41%	3	88%	5	69%	5	100%	5
% Top Carnivores	0%	1	0%	1	8%	5	3%	3	0%	1
Total # of Individuals	3	1	68	1	25	1	39	1	28	1
% Hybrids	0	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0	5	0%	5	0%	5	3%	3	4%	3
<b>IBI Score</b>	<b>32</b>		<b>30</b>		<b>36</b>		<b>34</b>		<b>36</b>	
<b>Score Interpretation</b>	<b>Poor</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>		<b>Fair</b>	

Appendix 10. Continued.

Sample Date: 26-May-93

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	2	1	7	1	7	1	9	3	4	1
# of Catfish Species	0	1	0	1	0	1	0	1	0	1
# of Sunfish Species	0	1	3	1	3	1	3	1	2	1
# of Minnow Species	1	1	4	3	4	3	4	3	2	3
# of Intolerant Species	0	1	2	3	1	1	2	3	1	5
% Green Sunfish	0%	5	0%	5	2%	5	4%	5	0%	5
% Omnivores	57%	1	8%	5	67%	1	56%	1	92%	1
% Insectivores	43%	3	87%	5	25%	3	43%	3	6%	1
% Top Carnivores	0	1	2%	3	1%	3	0%	1	2%	3
Total # of Individuals	7	1	114	1	232	3	97	1	50	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>		<b>26</b>		<b>38</b>		<b>32</b>		<b>32</b>		<b>32</b>
<b>Score Interpretation</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>		<b>Poor</b>		<b>Poor</b>

Sample Date: 18-July-93

	Site 1	Site 1	Site 2	Site 2	Site 3	Site 3	Site 4	Site 4	Site 5	Site 5
	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric	Raw	Metric
Metrics Used:	Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Total # of Species	2	1	8	3	6	1	8	3	7	1
# of Catfish Species	0	1	0	1	0	1	0	1	1	3
# of Sunfish Species	0	1	2	1	2	1	2	1	3	3
# of Minnow Species	1	1	4	3	4	3	4	3	2	3
# of Intolerant Species	0	1	2	3	2	3	2	3	1	5
% Green Sunfish	0%	5	0%	5	0%	5	0%	5	13%	3
% Omnivores	55%	1	71%	1	25%	3	78%	1	30%	3
% Insectivores	45%	3	27%	3	61%	5	20%	3	65%	5
% Top Carnivores	0%	1	0%	1	3%	3	1%	3	0%	1
Total # of Individuals	11	1	277	5	70	1	146	3	23	1
% Hybrids	0%	5	0%	5	0%	5	0%	5	0%	5
% Diseased/Anomalies	0%	5	0%	5	0%	5	0%	5	0%	5
<b>IBI Score</b>		<b>26</b>		<b>36</b>		<b>32</b>		<b>36</b>		<b>33</b>
<b>Score Interpretation</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>		<b>Fair</b>		<b>Poor</b>