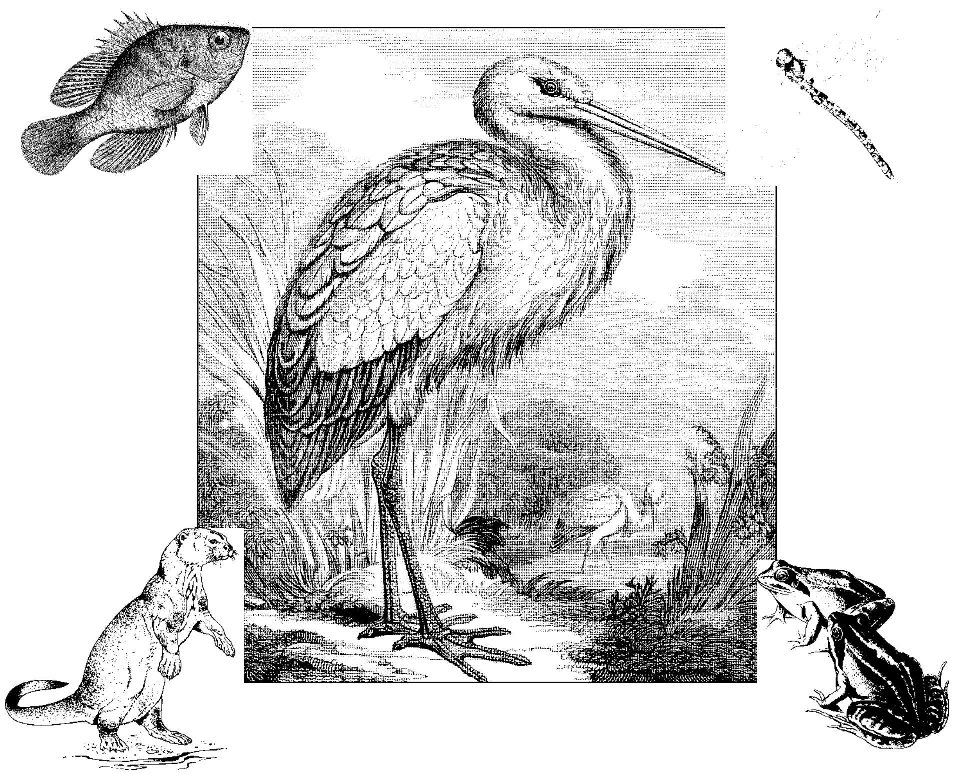
TENNESSEE ECOREGION PROJECT

1994 - 1999

December 2000



Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
Nashville TN 37243-1534

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Prepared by

Deborah H. Arnwine
Joy I. Broach
Linda K. Cartwright
Gregory M. Denton

Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
Nashville TN 37243-1534

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EXECUTIVE SUMMARY

The data obtained from the ecoregion delineation and reference site monitoring project will be used as a tool to implement the requirements of the Tennessee Water Quality Control Act. The Act requires the protection of state waters and their designated uses as defined by the Tennessee Water Quality Standards. These Standards consist of three parts. The first part defines designated uses. All waters have at least the basic four uses: fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. The second part establishes the general water quality criteria needed to protect those uses. The third part is the antidegradation statement, which protects existing uses of all surface waters as established under the Act. The ecoregion and reference site framework should provide scientific, practical, and defensible background data to ensure that the Water Quality Standards fully protect and maintain the waters of the state, and their designated uses.

Understanding how ecoregions affect biological health and water quality is a key step in watershed management. Reference streams serve as control streams in water quality investigations. Comparing impacted sites to ecoregion reference sites provide a tool for measuring stream quality. Monitoring impacted sites and comparing them to reference sites can also measure the progress of water quality trends within watersheds over time.

To establish values that would be representative of actual background conditions, data were collected from least disturbed and minimally impacted reference streams that were representative of an ecological region referred to as an ecoregion. Obtaining these values required delineation of ecoregion boundaries and locating ecoregion reference streams. To accomplish this goal, the Tennessee Ecoregion Delineation and Reference Site Selection Project was initiated in 1994. This project was a cooperative effort between the Tennessee Department of Environment and Conservation, Division of Water Pollution Control (WPC), the USEPA Region IV, the USEPA-National Health Environmental Effects Research Laboratory (NHEERL) and Tetra Tech Inc. Project goals consisted of the following:

1. Refine Level III ecoregions and delineate Level IV ecoregions (subregions) in Tennessee.
2. Locate least impacted and minimally disturbed reference streams in each subregion.
3. Determine baseline physical, chemical, and biological conditions in reference streams.
4. Explore the use of reference data to assist in the interpretation of existing narrative criteria.

Ecoregion delineation is a geographical framework that categorizes large sections of Tennessee into areas of similar geology, soils, physiography, land use, vegetation, climate, and water quality. Evaluation of background water quality and aquatic community health required establishment of ecoregion reference streams. These were streams considered minimally impacted and least disturbed, but were also representative of the subregion in which the stream flowed.

Delineation of Tennessee's Level III and Level IV ecoregions was completed in February 1997 with the generation of the EPA document *Ecoregions of Tennessee* (EPA/600/R-97/022). The

document described in detail the typical characteristics found in each of Tennessee's subregions. The Tennessee map illustrated eight ecoregions (Level III) and identified twenty-five subregions (Level IV).

Glenn Griffith, NHEERL, provided a list of 231 potential candidate reference sites. Site evaluations required field visits to each stream. During this initial screening process, from mid-1995 to mid-1996, additional candidate reference sites were identified resulting in a final list of 353 potential sites. During field verification, 139 sites were eliminated due to impacts. The remaining 214 sites were considered for final reference site selection. The goal was to select three reference sites per subregion. A total of 70 final reference sites was selected by August 1996.

Habitat assessments, physical measurements, chemical, and biological samples were collected at the 70 final reference sites beginning in August 1996. Biological samples were collected twice per year during the low flow period (August - October) and high flow period (March-May). Chemical samples were collected on a quarterly basis using a modified clean technique. Data were collected for three consecutive years through May 1999. During the three-year period, some initial reference sites were dropped and new ones were added depending on data results that indicated developing impacts in the watershed.

Michael Barbour and Jeffrey White of Tetra Tech Inc analyzed the first year of reference stream macroinvertebrate data, producing a report titled: *Evaluation of Tennessee Ecoregions: A Framework for Stream Classification and Bioassessment* (1998). The report addressed general water quality trends, possible seasonal effects, collection methods, metric selection, and a preliminary Tennessee Stream Condition Index (TSCI). It also included recommendations for future reference site collections.

Water quality data collected during this project were entered into the EPA Legacy STORET. Both water chemistry and biological data were entered into Microsoft Access databases. The Access databases were exported into a statistical software package. The data were displayed in standard box plots to show value ranges in each Level III and IV ecoregion. These ranges will be used to define the reference condition in each region.

ACKNOWLEDGEMENTS

The Tennessee Ecoregion Delineation Project was conducted by the Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control (WPC) and the EPA National Health and Environmental Effects Research Laboratory in Corvalis, Oregon. Funding was provided by a 104(b)(3) grant. Greg Denton, Joy Broach, Linda Cartwright (WPC), and Debbie Arnwine, Tennessee Department of Health (TDH), Aquatic Biology Section served as coordinators for this project.

The following individuals participated in the initial site selection and stream monitoring. Many others have been involved in continuing the project through subsequent monitoring activities.

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

Division of Water Pollution Control
Environmental Assistance Centers:

Chattanooga
- Callie Dobson
- Jennifer Hooper
- Tammy Hutchinson
- Greg Russell
- Terry Whalen

Jackson
- Jere Bowen
- Bobby DePriest
- Jere Dougan
- Bob Englert
- Amy Fritz
- Dan Hatch
- Ben Matthews
- Eddie O’Neil
- Roger Orgain
- Gregg Overstreet
- Pat Patrick

Johnson City
- Beverly Brown
- Robin Cooper
- David Hale
- Tina Robinson
- Robert Tipton

Knoxville
- Jonathan Burr
- Amy Mullikin
- John Price
- Paul Stodola
- Allen Wilkinson
- Andy Williams

Knoxville Mining
- Sheri Duren
- Jim Finley
- Michael Robbins
- Dave Turner

Memphis
- Eddy Bouzeid
- Romona Gore
- Lew Hoffman
- Ken Jones
- Burk Martin

Nashville
- Annie Goodhue
- Debbie Hamilton
- Joe Holland
- Ann Morbitt
- Jimmy Smith
- Tim Wilder

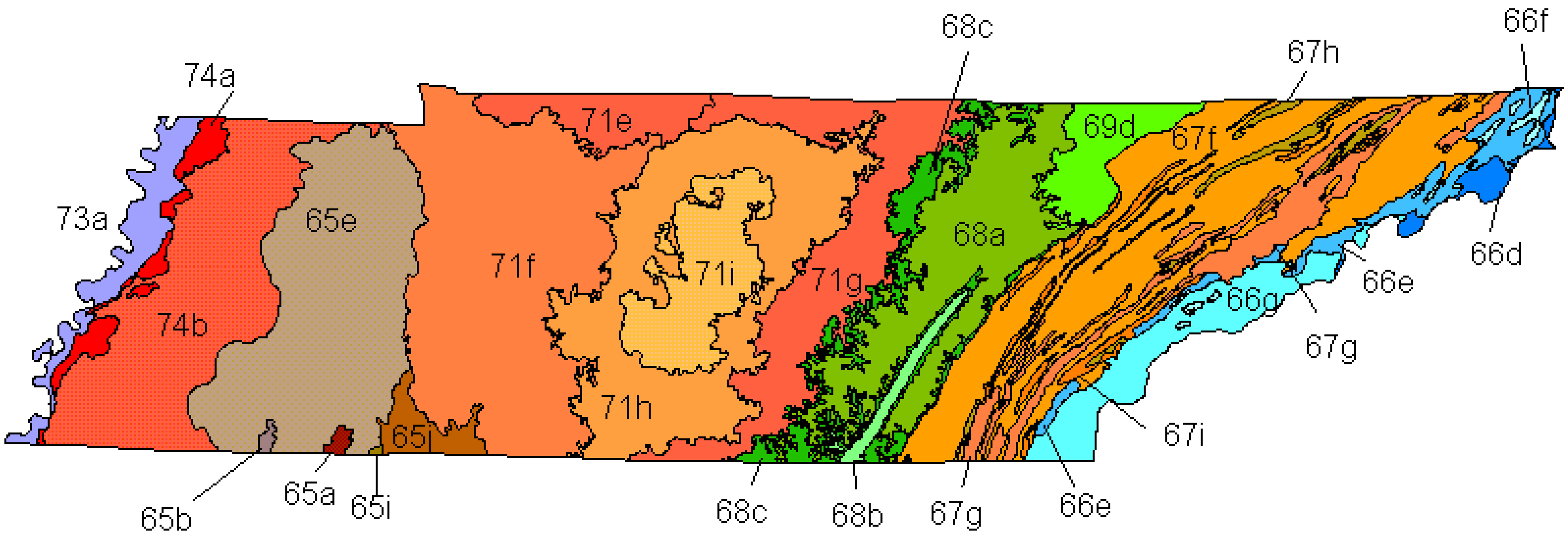
Division of Department of Energy Oversight
- Jessica Kinsall
- Rob Lindbom
- Renee Parker
- John Paryam
- Roger Petrie

TN DEPARTMENT OF HEALTH
Aquatic Biology Section
- Debbie Arnwine
- Pat Dobbe
- Andy McAllister
- Dan Murray
- Kim Sparks
- David Stucki
- Donna Wingfield

Jim Omernick and Glenn Griffith, U.S. EPA, mapped the state into ecological subregions. Michael Barbour and Jeffrey White, Tetra Tech, Inc. provided assistance in sampling design throughout the project. They were also responsible for preliminary data reduction and interpretation. John Jenkins and Rick Livingston with USDA-NRCS assisted in ecoregion delineation and reference site selection. These individuals were essential to the success of the project.

Acknowledgement and appreciation also goes to the Alabama Department of Environmental Management, the Mississippi Department of Environmental Quality, and to the Florida Department of Environmental Protection who assisted Tennessee in developing its monitoring and site selection strategy.

Figure 1: Ecoregions of Tennessee



65a Blackland Prairie	67f Southern Limestone/Dolomite Valleys and Low Rolling Hills	71e Western Pennyroyal Karst
65b Flatwoods/Alluvial Prairie Margins	67g Southern Shale Valleys	71f Western Highland Rim
65e Southeastern Plains and Hills	67h Southern Sandstone Ridges	71g Eastern Highland Rim
65i Fall Line Hills	67i Southern Dissected Ridges & Knobs	71h Outer Nashville Basin
65j Transition Hills	68a Cumberland Plateau	71i Inner Nashville Basin
66d Southern Igneous Ridges and Mtns	68b Sequatchie Valley	73a Northern Mississippi Alluvial Plain
66e Southern Sedimentary Ridges	68c Plateau Escarpment	74a Bluff Hills
66f Limestone Valleys and Coves	69d Cumberland Mountains	74b Loess Plains
66g Southern Metasedimentary Mtns		

1. INTRODUCTION

1.1 Project Background and Funding

In 1994, the Division of Water Pollution Control, Tennessee Department of Environment and Conservation, initiated an Ecoregion Delineation and Reference Site Selection Project. This long-term project was a cooperative effort between WPC, USEPA Region IV (EPA), James Omernik and Glenn Griffith, USEPA-National Health and Environmental Effects Research Laboratory (NHEERL) in Corvallis, Oregon and Michael Barbour and Jeffery White, Tetra Tech Inc. The long-term goals of the project were to:

1. Refine Level III ecoregions and delineate Level IV ecoregions (subregions) in Tennessee.
2. Locate least impacted and minimally disturbed reference streams in each subregion.
3. Determine baseline physical, chemical, and biological conditions in reference streams.
4. Explore the use of reference data to assist in the interpretation of existing narrative criteria.

The Tennessee ecoregion delineation project was initially funded with an FY1994 104(b)(3) grant. This project provided a useful geographical framework that categorized large sections of Tennessee into logical units of similar geology, soils, land use, vegetation, precipitation and water quality. One goal of this grant was to define boundaries for eight ecoregions (Level III) and twenty-five subregions (Level IV). A second goal was to develop a list of least impacted potential reference sites in each subregion. The project was completed February 1997, with publication of the EPA document *Ecoregions of Tennessee* EPA/600/R-97/022, and production of the final ecoregion map into a Geographic Information System (GIS) format.

The Ecoregion Reference Site project was divided into two phases. Phase I was funded by an FY1995 104(b)(3) grant. Phase I consisted of screening a list of 231 potential candidate reference sites located throughout the twenty-five subregions. Each site was evaluated in the field by an experienced biologist. During this screening process, additional candidates were identified resulting in 353 potential sites. One hundred and thirty nine sites were eliminated during field verification due to observable impacts. The remaining 214 sites were considered for final reference site selection. The goal was to select three reference sites in each subregion. Three were considered the minimal number necessary to provide a statistically valid database. A final list of 70 sites was selected for monitoring as potential reference streams by August 1996.

Phase II was funded by an FY1996 104 (b)(3) grant. Phase II consisted of data collection at the 70 proposed reference sites. Data consisted of habitat assessments, stream characterizations, chemical collections, and biological monitoring. Data collection began in August 1996. Biological samples were collected during the low flow period (August - October) in 1996. Chemical and bacteriological samples were collected on a quarterly basis beginning in August 1996. Funding covered chemical analyses and macroinvertebrate sample processing, identification, metric calculations, data entry, and specimen verification.

Phase IIB was a continuation of Phase II. It was funded by an FY1997 104(b)(3) grant. Funding covered macroinvertebrate sample processing, identification, metric calculations, data entry, and specimen verification for the second set of biological samples collected during the high flow period (April - June) in 1997. This grant was also used for a contract with Tetra Tech Inc. to compile the biological data, evaluate sample methodology, define bioregions, assess possible seasonal effects, establish core metrics, and develop a preliminary Tennessee Stream Condition Index (TSCI). This work was published in the report: *Evaluation of Tennessee Ecoregions: A Framework for Stream Classification and Bioassessmen*t (1998). In addition to this document, Tetra Tech Inc. developed a program in Microsoft Access called EDAS (Ecological Data Application System). It was developed to analyze macroinvertebrate data collected. Future development includes direct upload into EPA's national STORET database.

Data collected at reference streams will be used to define baseline conditions in least impacted streams in various regions across Tennessee. The ecoregion reference site framework will be used to enhance water quality criteria.

1.2 Project Goals and Objectives

1.20 Water Quality Criteria and Standards Development

The ecoregion/reference site framework will be used as a tool to implement the requirements of the Tennessee Water Quality Control Act. The Act requires the protection of state waters and their designated uses as defined by the Tennessee Water Quality Standards. These Standards consist of three parts. The first part defines designated uses. All waters have at least the basic four uses: fish and aquatic life, recreation, irrigation, and livestock watering and wildlife. The second part establishes the general water quality criteria needed to protect those uses. The third part is the antidegradation statement, which protects existing uses of all surface waters as established under the Act and strictly regulates authorization of degradation in high quality waters.

Various regions in Tennessee have distinct water quality and biotic characteristics. This makes it necessary to develop criteria specific to unique regions. The ecoregion framework provides a structure for the state to set water quality standards and criteria that vary with the natural background of the land. The framework describes water quality differences across the state. Streams and rivers reflect the land they drain thereby resulting in different water quality patterns. These patterns are affected by terrestrial characteristics such as bedrock, geology, soils, hydrology, wildlife, physiography, vegetation and precipitation. Level III Ecoregions cover thousands of square miles and contain large areas of naturally unique variability. In order to group biological, physical, and chemical characteristics of similar streams within the same geographic area, it is necessary to sub-regionalize the Level III ecoregions into smaller Level IV ecoregions (subregions). Tennessee's 25 subregions delineate areas of different terrestrial and water quality patterns.

In order to understand physical, chemical, and biological quality in subregions, it was necessary to establish reference sites. These sites were located on streams that were relatively undisturbed and had minimal impact. They were also typical of other streams in the subregion they drained. Data collected from reference sites will be used in establishing attainable water quality standards and acceptable biocriteria. Reference data will also be used to facilitate watershed planning, compute waste load allocations, supplement total maximum daily loading calculations, locate monitoring and special study sites, and help identify management practices that would protect stream health and the adjacent terrestrial community.

1.21 Biocriteria Development

In order to assess biological integrity, biocriteria need to be developed. Biocriteria describe the optimal biological health of aquatic communities inhabiting waters designated for aquatic life use. Biological health is measured by community structure, species richness, abundance, trophic composition, tolerance to pollutants or other applicable indices. To establish values that are representative and attainable of actual background conditions, data must be collected from least impacted, minimally disturbed reference streams that are typical of a subregion. Therefore, reference sites needed to be identified and monitored to establish the baseline reference condition from which biological criteria could be developed.

EPA's Region IV Biocriteria Program Support Document (EPA 1992b) provided guidance in establishing reference sites and sampling strategies to document representative aquatic communities (Table 1). Sound methods combined with multiple data points provide meaningful, protective, and scientifically defensible data to describe the expected health of biological communities in reference streams. Tennessee has accomplished steps 1 through 7 as outlined in this document. Development and application of biocriteria (steps 8 through 11) are currently underway.

Table 1 Biocriteria Implementation Guidelines **EPA Region IV Biocriteria Program Support Document (1992b)**
1. Select a regionalization scheme and refine ecoregions/subregions
2. Select candidate unimpacted/relatively unimpacted reference watersheds
3. Scout and select relatively unimpacted reference sites
4. Choose biological communities, physical habitats and chemical parameters for sampling
5. Document sampling protocols and QA/QC procedures
6. Select an appropriate array of biological metrics for evaluation
7. Sample reference sites to establish variability and statistical bounds for biological, physical habitat, and chemical parameters
8. Develop scoring criteria for metrics (e.g., % comparability to reference)
9. Establish condition categories for aquatic ecosystems based on severity of impairment
10. Test applicability at a wide variety of impacted sites
11. Adopt numerical biological criteria in state standards

1.22 The Ecoregion Framework and Watersheds

Watersheds drain ecoregions and subregions. Depending on size, many subwatersheds are contained within an ecological subregion. Comparisons can be made between watersheds, or parts of watersheds, that are contained within the same subregion. Large river systems tend to flow across several subregions and reflect a composite of the water quality characteristics of the subregions they drain. Subregions provide more uniform units of area to inventory, monitor, and assess surface waters than the commonly used USGS hydrologic unit frameworks alone.

EC066G05 Little River, upstream of Elkmont, GSMNP, Blount Co.

2. METHODS

2.1 Delineation Process

In 1986, James Omernik, NHEERL, delineated 76 Level III ecoregions in the contiguous United States on a map scale of 1:3,168,000. Each ecoregion was assigned a unique number. Portions of 8 ecoregions covered Tennessee. Due to the high diversity and complexity of these ecoregions, it was necessary to refine and subdivide the ecoregions into subregions. In 1994, WPC initiated an Ecoregion Delineation and Reference Site Selection Project in cooperation with the USEPA Region IV, and James Omernik and Glenn Griffith, NHEERL. The first step in the project was to refine Level III ecoregions and delineate Level IV ecoregions (subregions).

During the delineation process, small to medium scale (1:250,000 to 1:1,000,000) mapped information was gathered. These maps contained information on bedrock and surface geology, soil, hydrology, physiography, topography, precipitation, land use and vegetation. Interagency cooperation widened the base of maps, information, and resources available to delineate subregions. The USDA Natural Resources Conservation Service provided STATSGO maps based on county soil surveys. Draft maps of the US Forest Service's framework of ecological units were also utilized. The USGS EROS Data Center produced maps from composites of multi-temporal Advanced Very High-Resolution Radiometer (AVHRR) satellite data to assess physical boundaries and regional differences.

Water quality information from Tennessee's 1994 305(b) Report and reports developed by the Tennessee Valley Authority provided patterns of surface water quality. Much of this information was digitized to produce draft maps of ecoregion and subregion boundaries. The maps were revised after review in subsequent meetings with state, federal, and academic representatives. A more detailed description of the delineation process in Tennessee is found in the EPA document *Ecoregions of Tennessee* (EPA/600/R-97/022).

Multiple agencies were invited and represented at one of three ecoregion meetings held during 1994-1995. Attendees included aquatic biologists, ecologists, foresters, chemists, geographers, engineers, university professors, and regulatory personnel (Table 2). The judgment of these experts was applied throughout the selection, analysis, and classification of data to determine the final ecoregion and subregion boundaries in Tennessee.

Table 2. Agencies Represented at Ecoregion Meetings	
Tennessee Department of Environment & Conservation	Tennessee Valley Authority
Tennessee Department of Agriculture	Tennessee Aquarium
Tennessee Department of Health	Tennessee Conservation League
Tennessee Department of Transportation	Tennessee Environmental Council
Tennessee Planning Office	Tennessee Scenic Rivers Association
Tennessee Division of Geology	The Nature Conservancy
Tennessee Division of Forestry	Middle Tennessee State University
Tennessee Wildlife Resources Agency	Austin Peay State University
EPA Region IV – Water Management Division	Metro Nashville Water Services
EPA Region IV – Environmental Services Division	Corps of Engineers – Nashville District
US Fish and Wildlife Service	Great Smoky Mountains National Park
US Geological Survey	USDI, National Biological Survey
Mississippi Department of Environmental Quality	USDA – Forestry Service
Georgia Department of Natural Resources	

2.2 Data Requirements

To describe the physical, chemical, and biological condition of subregion reference sites, it was necessary to define the type of data needed. Achieving this goal involved the following steps:

- Determine reference condition through intensive monitoring of regional reference streams.
- Determine a list of parameters and detection limits needed to make decisions on water quality.
- Develop Standard Operating Procedures (SOP) for field collections and sample analyses.
- Develop a Quality Assurance/Quality Control (QA/QC) strategy for sample collection and analyses.
- Train field personnel
- Collect a minimum of three years of data to determine seasonal influences and provide a sufficient statistical database
- Collect chemical samples quarterly and macroinvertebrate samples biannually.
- Centralize chemical and biological analyses to maximize consistent and efficient use of time, manpower and results.
- Review results to formulate general water quality, aquatic community structure, and habitat data ranges at reference sites.
- Summarize general findings.

It was anticipated that reference site monitoring would be long term and that changes in reference site selection, plus collection and sampling methodologies could occur over time.

2.3 Candidate Reference Site Identification

The next step in the ecoregion delineation process was the search for a set of reference streams. Mapped information, stream survey data, and shared field expertise were essential elements in locating candidate reference sites. In 1995, Glenn Griffith (NHEERL) compiled all available information to produce a statewide list of 231 potential reference sites.

The reference streams were chosen to represent the best attainable conditions for all streams with similar characteristics in a given subregion. Reference condition represents a set of expectations for physical habitat, general water quality, and the health of biological communities in the absence of human disturbance and pollution. Selection criteria for reference sites included minimal impairment and representativeness.

Activities that alter the natural landscape may also impact water quality. These activities may include land development, point source discharges, nonpoint source runoff, riparian destruction and erosion. Most of the reference streams had some degradation, but were less impacted than other streams in the same region. Representativeness meant reference sites had the same characteristics and conditions as the majority of streams in the subregion. Streams that did not flow across subregions were targeted so the unique characteristics of each subregion could be identified.

Site evaluation required field visits by experienced biologists to screen each candidate stream. A set of guidelines developed by Alabama and Mississippi (1994) were used as the basis for field reconnaissance. Potential sites were rated as to how well they met the following criteria:

- The entire watershed was contained within the subregion.
- The watershed was mostly or completely forested (if forest was the natural vegetation type) or has a typical land use for the subregion The watershed may be contained within a National Forest, State Refuge or other protected area.
- The geologic structure and soil pattern was typical of the region.
- The watershed did not contain a municipality, mining area, permitted discharger or any other obvious potential sources of pollutants, including non-regulated sources.
- The watershed was not heavily impacted by nonpoint source pollution.
- The stream flowed in its natural channel and had not been recently channelized. There were no flow or water level modification structures such as dams, irrigation canals or field drains.
- No power or pipelines crossed upstream of the site.
- The watershed contained few roads.

Experienced field biologists conducted the initial site evaluations. Abbreviated screenings of the benthic community focusing on clean water indicator species were conducted at each potential site. Measurements of dissolved oxygen, pH, conductivity and water temperature were taken. Habitat assessments were also conducted. The upstream watershed was investigated for potential impacts. Photographs were taken at most sites. Obviously impacted streams were dropped from consideration.

During field reconnaissance, an additional 122 sites were added to the original candidate list of 231 sites proposed for consideration. One hundred and thirty nine sites were dropped due to observable impacts during the initial field reconnaissance, therefore, 214 sites were left for consideration. The name and location of all sites under consideration can be found in Appendix A.

The original goal was to select three final reference sites per subregion. This was determined as the minimal number necessary to generate a statistically valid database. Three streams could not always be located in smaller subregions. A total of 70 candidate reference sites were selected by August 1996 for intensive monitoring.

2.4 Quality Assurance/Quality Control

The primary goal in data gathering was to maintain consistency, reliability, accuracy, and completeness of the data collected. All aspects of data acquisition, from field collection to laboratory processing and data analysis, were subject to QA/QC. This was accomplished through training, protocol guidelines, standard operating procedures, comprehensive field documentation, sample logging and duplicate sampling. Investigators with a scientific background and experience in field collection methods, stream ecology, and water quality performed all stream surveys. To ensure consistent, accurate, and reliable data collection and assessment, personnel performing stream survey work were trained in a uniform method. Training activities are outlined in Table 3.

Table 3. Field Training

Workshop	Objective	Date
Habitat Assessment and Bioassessment	Develop a Tennessee SOP, update current protocols based on 1989 EPA RBP.	August 1994
Chemical Sampling	Develop a chemical sampling SOP based on a modified version of EPA Clean Techniques. Develop standard QA/QC procedures.	July 1996
Stream Habitat, Bioassessment and Metrics	Update habitat assessment protocols based on revised EPA RBP. Discuss Tennessee specific macroinvertebrate metrics.	March 1998

To achieve consistency throughout the project, it was necessary to update and compile existing regionalized bioassessment protocols into a unified standard operating procedure manual. This manual was an essential part of the QA/QC program because it documented methodologies for habitat assessments, stream characterization, macroinvertebrate collection, sample processing and data reduction.

In November 1994, a Habitat Assessment and Bioassessment workshop was conducted in Tennessee under the guidance of Michael Barbour, Tetra Tech Inc. Attendees were primarily Tennessee State biologists with representatives from federal agencies and adjacent states within EPA Region IV. By consensus, the major goal of the workshop was to obtain *"The most quality data for the least amount of effort*". Participants addressed development of consistent habitat assessments, as well as fish and macroinvertebrate sampling protocols for Tennessee agencies that would be compatible with methods used by adjacent states. Technical issues included updating and refinement of current methods, defining reference conditions, collecting representative samples (standard field sampling methodologies), identifying source and cause (habitat impairment versus water quality), and accounting for seasonal effects.

The workshop laid the groundwork for a written set of Tennessee Standard Operating Procedures (TNSOP). The TNSOP was based on the 1989 EPA document: *Rapid Bioassessment Protocols for Use In Streams And Rivers - Benthic Macroinvertebrates And Fish* (Plafkin et al.). Minor changes to the Rapid Bioassessment Protocol III – Macroinvertebrates, resulted in a modified RBP III for Tennessee collections. The workgroup also reviewed and adopted habitat assessment forms designed by Barbour and Stribling (draft, 1994). The Tennessee Valley Authority (TVA) and Tennessee Wildlife Resources Agency (TWRA) modified the 1989 EPA fish protocols (RBP V) to more appropriately assess fish communities specific to Tennessee.

In 1995, the draft document *Tennessee Biological Standard Operating Procedures Manual: Volume I: Freshwater Aquatic Macroinvertebrates; Volume II: Fish Communities* (TNSOP) was released for review. It was finalized in 1996. In 1997, EPA released the draft EPA publication: *Revisions to Rapid Bioassessment Protocols for Use in Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish* (Barbour et al.). Portions of this updated manual were immediately adopted for use. The TNSOP was updated again in 1998 with adoption of Tennessee specific macroinvertebrate stream habitat and biometrics provided by a contractor (Tetra Tech Inc.). Field training was an ongoing process as sampling protocols were modified and updated. Training allowed immediate modification of field procedures as new protocols and EPA guidelines were adopted.

The 1996 Tennessee Standard Operating Procedures were followed for all macroinvertebrate collections during the ecoregion project. Bioassessment methods used by each team included habitat assessment, stream characterization, field measurements and single habitat semi-quantitative macroinvertebrate collections. All field parameters (dissolved oxygen, pH, conductivity and water temperature) were taken with calibrated Hydrolab or YSI meters. Calibration logs were kept on all meters. Minimally, ten percent of all readings were duplicated. Flow measurements were taken along transects with calibrated Marsh-McBearny flow meters.

To insure consistency in chemical collections, WPC developed a surface water sampling document titled *Standard Operating Procedure for Modified Clean Technique Sampling Protocol*. This document was based on EPA's guidance document: *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels and Appendix C: Guidance Concerning the Use of "Clean Techniques" and QA/QC when Measuring Trace Metals* (EPA821-R-95-034). Field training was conducted to ensure that all water quality samples were collected in a uniform and consistent manner to minimize possible sample contamination. Two samplers were present during collections with only one handling the sample while the other filled out paperwork and handled equipment. Both samplers wore a new set of disposable gloves at each site. Sample bottles were double bagged, placed in clean coolers and delivered directly to the lab by the samplers. Ten percent of chemical collections had duplicate samples, field blanks and trip blanks taken.

Documentation was critical in the data gathering efforts. It provided the information needed to duplicate collection efforts to ensure reproducible results. Any unavoidable deviations from protocol were documented. Field forms and sample tags contained all necessary information. Field equipment maintenance and calibration was documented in logbooks to ensure that the results generated were accurate. Chain of custody was maintained on all chemical and biological samples.

Extensive quality assurance techniques were implemented during sample processing and reporting. All chemical and biological samples were processed at the state's laboratory to insure consistency. Unique log numbers were assigned to all samples for tracking purposes. A random ten percent of all biological samples were re-sorted and re-identified by a second taxonomist. At minimum, a 90% sorting efficiency and 95% identification accuracy was maintained by all taxonomists. Chemical and biological results underwent extensive data review, verification, and documentation. All data entries were verified.

Voucher collections containing representatives of all taxa found in that subregion were created for each of the 25 subregions. A master reference collection containing a representative of every taxa collected during the study was also created. All taxa in the master reference collection were sent to outside experts for verification. The voucher collections and master reference collection are maintained at the state laboratory. Partial reference collections were sent to each field office.

2.5 Habitat Assessment

2.50 Habitat Assessment Forms

Habitat assessments were conducted each time a site was sampled to document changes in habitat structure and availability over the three-year period. Good habitat quality is essential for a diverse macroinvertebrate assemblage. Degraded or altered habitat usually results in a stressed benthic community. Lack of good habitat can sometimes mask the effects of water quality problems such as toxicity or pollution.

Habitat assessment protocols developed by Barbour and Stribling (1994) were used at the beginning of the study. The protocols assessed riparian and in-stream habitat that could affect the structure of the macroinvertebrate community. This method assigned numeric values ranging from 1 to 20 for ten different habitat parameters. A total score of 200 was optimal. Two different forms were used depending on stream type (riffle/run or glide/pool).

In 1998, revised Habitat Assessment forms and protocols from the draft 1997 EPA manual were presented to state biologists in a bioassessment workshop. These were updates of the Barbour and Stribling forms (draft, 1994) designed to assess high gradient (riffle/run prevalent) and low gradient (glide/pool prevalent) streams. They were reviewed and adopted for immediate use. Habitat parameters and scoring criteria in the revised edition were compatible with the 1994 forms, so scores could be compared over time. Copies of the current habitat assessment forms, including scoring criteria, are located in Appendix C. Scoring criteria used in the habitat assessment evaluations are presented in Table 4.

Table 4: Habitat Assessment Parameters	
Riffle/Run (High Gradient)	**Glide/Pool (Low Gradient) Streams**
Epifaunal Substrate/Available Cover	Epifaunal Substrate/Available Cover
Embeddedness	Pool Substrate Characterization
Velocity/Depth Regime	Pool Variability
Sediment Deposition	Sediment Deposition
Channel Flow Status	Channel Flow Status
Channel Alteration	Channel Alteration
Frequency of Riffles (or Bends)	Channel Sinuosity
Bank Stability	Bank Stability
Vegetative Protection	Vegetative Protection
Riparian Vegetative Zone Width	Riparian Vegetative Zone Width

2.51 Stream Survey Form

A stream survey form (Appendix C) was also completed during each sampling event to provide additional information not documented in the habitat assessment. This form evolved over the course of the study (originally called Biological Data Sheet), but the essential information remained consistent. The form provided information on site location, physical/chemical parameters, watershed characteristics, sample point characteristics, physical stream characteristics, substrate type, sampling methods and included a stream sketch.

2.6 Macroinvertebrate Monitoring

2.60 Field Collections

Macroinvertebrate sampling at the reference sites began August 1996. Collection methods followed the 1996 TN SOP. Collections were planned to coincide with low flow (mid-August to mid-October) and high flow (mid-March to mid-May) periods to capture possible seasonal changes in the aquatic community. Six consecutive sampling events occurred over the first three years resulting in three late spring (high flow) and three late summer (low flow) collections by spring 1999. Subsequent monitoring will take place in conjunction with watershed monitoring.

Field teams from the Tennessee Department of Environment and Conservation (TDEC), and Tennessee Department of Health (TDH), participated in macroinvertebrate collections. All staff had experience and training in stream survey work including macroinvertebrate collection and identification methods.

The 1996 TNSOP macroinvertebrate sampling protocol followed a single habitat approach. Semi-quantitative samples were collected from the most productive habitat (either riffle or undercut bank). In streams containing riffle areas, two riffle kicks were collected using a 1 m^2, 500 micron mesh kick net. One $1m^2$ kick was collected in fast moving water, and a second $1m^2$ kick was collected from slower moving water flowing over a riffle. The two kicks were composited and preserved in the field. In non-riffle streams, semi-quantitative samples were collected with a 500 micron mesh A-framed dip net. Three 1 meter sweeps were collected from different areas of the stream banks, composited, and preserved in the field. All samples were sent to the state lab for sorting and identification.

Qualitative samples were collected in all available microhabitats during the first two sampling events. Collections made in each microhabitat were kept separate. Representative organisms were picked from the debris or substrate in the field. The taxa were preserved and sent to the state lab for identification. Qualitative collections were dropped after the first year (2 sampling episodes) in an effort to save field time and laboratory costs. Data were not used in metric development due to inconsistency in collecting techniques between field teams. Semi-quantitative sampling continued for an additional two years. A detailed description of the sampling protocol can be found in the 1996 TN SOP.

2.61 Laboratory Processing of Macroinvertebrate Samples

All macroinvertebrate samples were processed by experienced taxonomists at the central laboratory facility. Use of a centralized group ensured consistency, accuracy and efficiency in sorting, subsampling, identification, data entry and data reduction efforts. The late summer 1996 macroinvertebrate samples were subsampled by combining the entire sample in a 28 grid pan. Grids were selected until a minimum of 200 organisms were collected. If more than 200 organisms were found in the first grid, all individuals were counted. Samples collected after 1996 followed the subsampling protocol presented in the draft 1997 EPA manual. The sample was continuously subsampled in groups of 4 or more grids until a 200 (+/- 20%) sample was achieved. A ratio was taken on the 1996 data to make them comparable to a 200 organism subsample. Organisms were picked from the debris under a dissecting microscope by a taxonomist. Ten percent of all samples were re-sorted by a second taxonomist. All staff maintained a minimum 90% sorting efficiency.

Taxa were identified to the genus level by experienced taxonomists. Ten percent of all samples were re-identified by a second taxonomist. A 95% accuracy rate was maintained. Voucher collections containing representatives of all taxa found in that subregion were made for each of the 25 subregions. A master reference collection containing a representative of every taxa collected during the study was also created. All taxa in the master reference collection were sent to outside experts for verification. Partial reference collections, containing regional taxa, were sent to each field office.

The first year of macroinvertebrate data (late Summer 1996 and late Spring 1997) were sent to Dr. Michael Barbour and Jeffrey White, Tetra Tech Inc. They provided a compilation of biological and habitat data, evaluated sampling methodology, recommended metrics for evaluating biota, and proposed index ranges based on gear type.

2.7 Water Quality Monitoring

In 1996, WPC developed a surface water sampling document, *Standard Operating Procedure for Modified Clean Technique Sampling Protocol*. This document was based on EPA's guidance document: *Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels* EPA821-R-95-034. Field staff in WPC, DOE-O, and TDH participated in a training workshop to ensure that equipment handling, field measurements, and surface water sampling techniques were consistent and accomplished with minimal contamination.

A parameter list was compiled at the initiation of the ecoregion project (Table 5). The list included ambient parameters that have been historically sampled. All parameters were collected at each reference site during the first season of sampling. To reduce costs, cyanide, mercury, sulfate, chloride and nickel were dropped when preliminary analyses showed little or no detection statewide for these parameters. Apparent color, true color, E. coli and enterococcus were added during the final year of the project. Low detection limits were selected to maximize the ability to quantify analytes.

Physical measurements and chemical and bacteriological sample collections began in the spring of 1996. Initially, water samples were collected quarterly for three consecutive days. This design was used to determine background consistency and repeatability of the sample collections provided field conditions remained unchanged. Since 1997, surface water samples were collected one day each quarter.

Chemical and bacteriological samples were collected in accordance with WPC's Standard Operating Procedure for Modified Clean Technique Sampling Protocol. Two trained field staff were present during all collections. Only one collector handled the sample (clean hands) while the other filled out paperwork and handled equipment (dirty hands) to reduce the possibility of cross contamination. Both samplers wore a new set of disposable gloves at each site. All sample bottles were double bagged, placed in clean coolers with ice and delivered directly to the lab by the samplers. Chain of custody was maintained at all times. Ten percent of all water quality collections had duplicate samples, field blanks and trip blanks taken.

Flow, dissolved oxygen, conductivity, pH and water temperature readings were measured in the field concurrent with chemical/bacteriological sampling. All readings were taken with calibrated meters. Calibration logs were maintained for each meter. Readings were taken midstream. At minimum, ten percent of all field readings were duplicated.

Chemical and bacteriological analyses was performed at the state laboratories in the Tennessee Department of Health Labs located in Jackson, Nashville and Knoxville Tennessee. All three labs were under central direction and followed EPA approved methodologies and quality assurance protocols.

Table 5: Chemical and Bacteriological Parameters, Ecoregion Project, Tennessee, 1996-99

Parameter	Database Abbreviation	Units	Detection Limit	Comments
Alkalinity	Alk	mg/L	1	
Ammonia Nitrogen as NH3	Amm_n	mg/L	0.02	
Arsenic, As	As	µg/L	1	
Cadmium, Cd	Cd	µg/L	1	
Chlorides	Chlor	mg/l	0.5	Dropped Oct 96
Chromium, Cr	Cr	µg/L	1	
Color, Apparent	Color_A	PtCoU	3	Added Jan 98
Color, True	Color_T	PtCoU	3	Added Jan 98
Conductivity	Cond	UMHOS @25^{o}C	0	
Copper, Cu	Cu	µg/L	1	
Cyanide, CN	CN	µg/L	0.005	Dropped Oct 96
Dissolved Oxygen	DO	mg/L	0	
E. Coli	E_coli	cfu/100 ml	0	Added Jan 98
Fecal Coliform	F_Col	cfu/100 ml	0	
Enterococcus	Enter	cfu/100 ml	0	Added Jan 98
Iron, Fe	Fe	µg/L	25	
Lead, Pb	Pb	µg/L	1	
Manganese, Mn	Mn	µg/L	5	
Mercury, Hg	Hg	µg/L	0.2	Dropped Oct 96
Nickel, Ni	Ni	µg/L	10	Dropped Oct 96
Nitrate + Nitrite	NO2_NO3	mg/L	0.01	
pH	pH	Standard Unit	0	
Residue Dissolved	Res_Diss	mg/L	10	
Residue, Suspended	Res_Sus	mg/L	10	
Sulfates	SO4	mg/L	2	69d and 68a only
Temperature	Temp	^{o}C	0	
Total Hardness	Hard	mg/L	1	
Total Kjeldahl Nitrogen	TKN	mg/L	0.1	
Total Organic Carbon	TOC	mg/L	1	
Total Phosphorus	TP	mg/L	0.004	
Turbidity	Turb	NTU	0.1	
Zinc, Zn	Zn	µg/L	1	

3 RESULTS

The purpose of this section is to summarize data generated during the three-year study. Additional documents will contain more detailed analyses and interpretation, including data collected after the end of the study in 1999. Recommendations for regional biocriteria and refinement of water quality criteria may be presented in the next series of reports.

3.1 Level III and Level IV Tennessee Ecoregions

Twenty-five Level IV ecoregions were defined within the eight Level III ecoregions in Tennessee (Table 6). Some subregions contain unique benthic communities and water quality parameters. Preliminary analyses indicate some subregions are uniform enough to be combined, while others are unique enough to be kept distinct. The data generated from this study will be used to determine which regions can be combined for stream monitoring purposes. The data will establish expected biotic and water quality ranges for different regions. A more detailed description of the characteristics of each Level III and Level IV ecoregion can be found in Appendix A.

ECO69D01 No Business Branch, Hwy 25 near Morley, Campbell Co.

Table 6: Ecoregions of Tennessee

Ecoregion (Level III)	% of State	Subregion (Level IV)	%of State
65 Southeastern Plains	12.1%	65a Blackland Prairie	0.1%
		65b Flatwoods/Alluvial Prairie Margins	0.08%
		65e Southeastern Plains and Hills	10.9%
		65i Fall Line Hills	0.02%
		65j Transition Hills	1.0%
66 Blue Ridge Mtns	6.0%	66d Southern Igneous Ridges and Mtns	0.6%
		66e Southern Sedimentary Ridges	1.9%
		66f Limestone Valleys and coves	0.3%
		66g Southern Metasedimentary Mtns	3.2%
67 Ridge and Valley	18.2%	67f Southern Limestone Dolomite Valleys and Low Rolling Hills	12.6%
		67g Southern Shale Valleys	3.4%
		67h Southern Sandstone Ridges	0.8%
		67i Southern Dissected Ridges and Knobs	1.4%
68 Southwestern Appalachians	11.4%	68a Cumberland Plateau	7.6%
		68b Sequatchie Valley	0.6%
		68c Plateau Escarpment	3.3%
69 Central Appalachians	2.1%	69d Cumberland Mountains	2.1%
71 Interior Plateau	37.4%	71e Western Pennyroyal Karst	2.0%
		71f Western Highland Rim	13.9%
		71g Eastern Highland Rim	6.9%
		71h Outer Nashville Basin	10.5%
		71i Inner Nashville Basin	4.0%
73 Mississippi Alluvial Plain	2.0%	73a Northern Miss. Alluvial Plain	2.0%
74 Mississippi Valley Loess Plains	10.7%	74a Bluff Hills	1.1%
		74b Loess Plains	9.6%

3.2 Reference Sites

Changes in candidate reference sites occurred throughout the life of the project. Out of the original 70 sites selected for intensive monitoring, nine were dropped when intensive monitoring revealed impacts. Four subregions (65a, 65i, 67h, 67i) were dropped after initial monitoring due to their insignificant area in the state and/or the lack of unimpaired streams. Twenty-six sites were added either to replace dropped sites or to provide additional sites in larger or more diverse subregions. Since these streams were added after initiation of the project, three years of data are not available. The decision to drop or add streams was done at the field office level. By the end of the project, there were 73 sites being monitored (Table 7). These sites, as well as any new streams that may be found, will continue to be monitored on a five-year rotation in conjunction with watershed monitoring. A list of all candidate and final reference sites is provided in Appendix B.

Table 7: Total Reference Sites by Subregion

Ecological Subregion	# Stations Fall 96	# Stations May 99	Stations Changed
65a	2	0	2 dropped
65b	2	1	1 dropped
65e	3	5	2 added
65i	2	0	2 dropped
65j	3	4	1 added
66d	2	3	1 added
66e	3	3	No change
66f	2	1	1 dropped
66g	3	4	2 added, 1 dropped
67 (level III)	1	3	2 added
67f	4	6	3 added, 1 dropped
67g	2	1	1 dropped
67h	3	0	3 dropped
67i	2	0	2 dropped
68a	5	8	4 added, 1 dropped
68b	2	3	1 added
68c	2	2	1 added, 1 dropped
69d	3	5	2 added
71e	2	2	1 added, 1 dropped
71f	6	6	1 added, 1 dropped
71g	3	4	2 added, 1 dropped
71h	4	3	1 dropped
71i	3	2	1 dropped
73a	1	3	3 added, 1 dropped
74a	2	3	1 added
74b	3	3	No change

3.3 Statistical Design:

Box plots were used to evaluate habitat, biological and water quality variations between reference sites and ecoregions. A box plot is a graph that displays the 10th, 25th, 50th, 75th and 90th percentiles of a variable. The plot is composed of a central box divided by a line, and two lines extending out from the box called whiskers. The box contains the middle half of the scores in the distribution. The length of the box indicates the distribution of the middle 50% of the data. The lower and upper hinges of the box mark the 25th and 75th quartiles of the data respectively.

The line through the box represents the sample median. Boxes in which the median does not fall near the middle of the box represent skewed data. The whiskers represent the 10^{th} and 90^{th} percentiles. Whisker length corresponds to the spread of the data. Outliers are points that fall outside of the 90^{th} (10^{th}) percentile. Outliers are a common occurrence in environmental data.

Box plots are useful because they allow direct side-by-side comparison of data from several groups within a single figure. Each box plot graphically illustrates the central tendency (median; center of the data), variability (interquartile range; spread of the middle 50% of the data), minimum and maximum values (the full range) of a data set as a single icon (picture). The relationship between the data sets is shown by the amount of overlap of the median and interquartile between boxplots. When the median and interquartile ranges overlap, the data sets are very similar. When the median and interquartile ranges do not overlap, the data sets are very different. For summarization purposes in this report, data groups were determined to be statistically different when the median and interquartile ranges did not overlap. More rigourous statistics will be used to determine significant difference during metric development in subsequent documents.

3.4 Habitat Assessment

Habitat scores varied significantly between Level III ecoregions (Table 8 and Figure 2). As expected, streams in the Blue Ridge Mountains (66) generally had higher scores than other regions. Many of the reference streams in this region have protected watersheds.

The most western of the Tennessee ecoregions encompassing the Mississippi Alluvial Plains (73) and the Mississippi Valley Loess Plains (74) had the lowest scores. Most of the streams in these regions are low gradient with sandy bottoms. Large areas of cropland dominate both regions. Stream channelization and riparian loss combined with erosion are prevalent in most watersheds in these two regions. Although reference streams were selected for least impairment, all were impacted to some extent.

There were also differences in habitat availability at the subregional level (Level IV) in many ecoregions. Within the Southeastern Plains (65), the Transition Hills (65j) had consistently high scores (Figure 3). The higher gradient cobble-bottom streams in this area are atypical of the rest of the ecoregion. On the other hand, the Blackland Prairie (65a) covers a very small area in Tennessee. Only a few streams are found in this region. This narrowed the reference stream possibilities, which required the selection of relatively impaired streams. This resulted in lower habitat scores in this subregion than in the surrounding regions. Habitat scores from 65a reference sites will be compared to data from other states that have larger areas in 65a to determine if values are typical. If scores are atypical, subregion 65a will be evaluated at the larger ecoregion level.

Within the Blue Ridge Mountains Region (66), the Southern Igneous Ridges and Mountains (66d) had the highest and most consistent habitat scores (Figure 4). As expected, the most variability and lowest scores in this ecoregion were observed in the

Limestone Valleys and Coves (66f). This subregion is the most developed within the Blue Ridge Mountains.

The Southern Shale Valleys (67g) of the Ridges and Valleys ecoregion had low habitat scores compared to the Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f) and the Southern Sandstone Ridges (67h). This would be expected, since land use in the southern shale valleys is heavily agriculture. Due to the lack of suitable streams, only two streams, both of marginal reference quality, were targeted for monitoring. The Southern Dissected Ridges and Knobs (67i) had the lowest overall scores in the subregion (Figure 5). It is generally atypical for wooded ridges to have lower scores than more developed valley areas. The data for these subregions may be misleading since it is based on only 2 reference streams, with one having significantly lower habitat quality. The low scoring parameters were embeddedness, sediment deposition and riparian width.

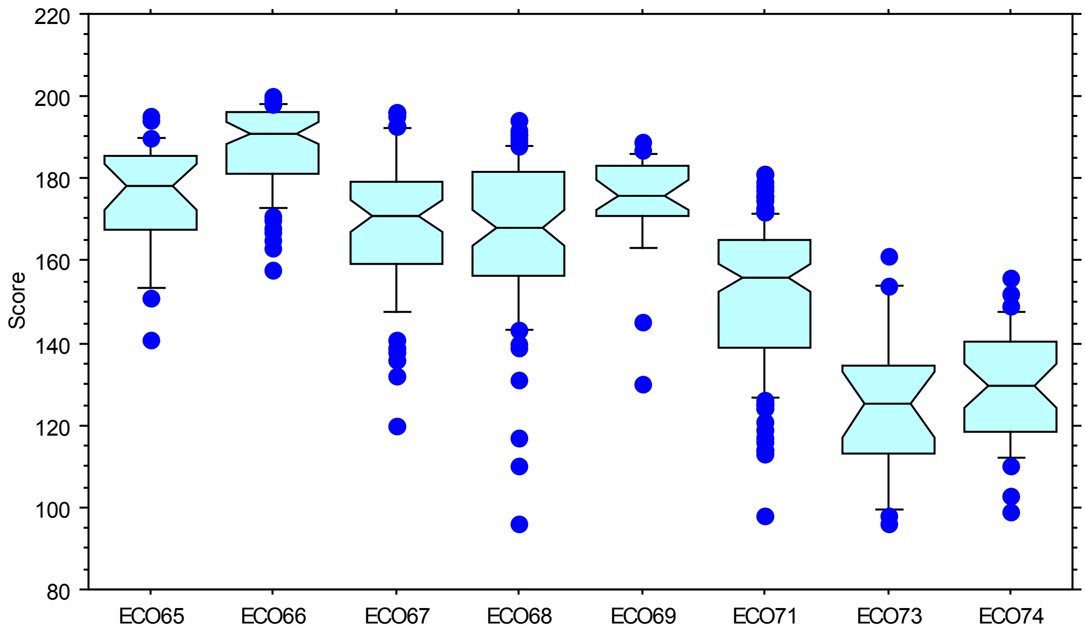
Within the Southwestern Appalachians (68), streams in the Cumberland Plateau (68a) had the highest habitat quality (Figure 6). The heavily developed Sequatchie Valley (68b) had relatively low habitat scores with a mean value of 142. The Plateau Escarpment (68c) fell between these two subregions.

A marked difference was seen between subregional habitat scores in the Interior Plateau (71). The Inner Nashville Basin (71i) had significantly lower scores than other subregions in the Interior Plateau (Figure 7). Streams in this region naturally have poor habitat due to bedrock substrate and extreme seasonal flow variation. There is much urban development in this region, which makes selection of unimpaired streams difficult.

Although they contain different stream types, habitat scores between the Bluff Hills (74a) and the Loess Plains (74b) in the Mississippi Valley Loess Plains were comparable (figure 8). The Bluff Hills streams are gravel bottom riffle streams with a relatively high gradient. Riffle/Run parameters were used to assess the habitat quality. The Loess Plains are lower gradient streams that were assessed using glide/pool parameters. Both subregions have a great deal of human impact as reflected in the low habitat scores. The biggest problems are sedimentation and loss of riparian. The habitat scores for each station are presented in Appendix D.

Table 8: Habitat Assessments by Subregion					
Subregion	**Habitat Type**	**No. of Stations**	**No. of Observations**	**Score range**	**Mean Score**
65a	Glide/Pool	2	7	71-151	88
65b	Glide/Pool	2	9	108-162	126
65e	Glide/Pool	6	34	123-181	150
65i	Glide/Pool	3	9	108-154	130
65j	Riffle/Run	4	25	151-195	178
66d	Riffle/Run	5	19	181-199	194
66e	Riffle/Run	5	15	158-200	189
66f	Riffle/Run	4	14	165-197	182
66g	Riffle/Run	5	26	163-197	185
67f	Riffle/Run	9	28	139-196	178
67g	Riffle/Run	4	11	138-167	155
67h	Riffle/Run	3	10	136-180	166
67i	Riffle/Run	2	5	120-164	143
68a	Riffle/Run	9	39	139-194	177
68b	Riffle/Run	3	15	96-166	142
68c	Riffle/Run	5	22	153-182	166
69d	Riffle/Run	5	25	130-189	174
71e	Riffle/Run	4	19	135-173	154
71f	Riffle/Run	7	48	129-178	161
71g	Riffle/Run	5	25	124-181	154
71h	Riffle/Run	4	28	114-172	150
71i	Riffle/Run	3	21	98-165	129
73a	Glide/Pool	4	17	96-161	126
74a	Riffle/Run	3	18	99-152	125
74b	Glide/Pool	3	22	112-156	133

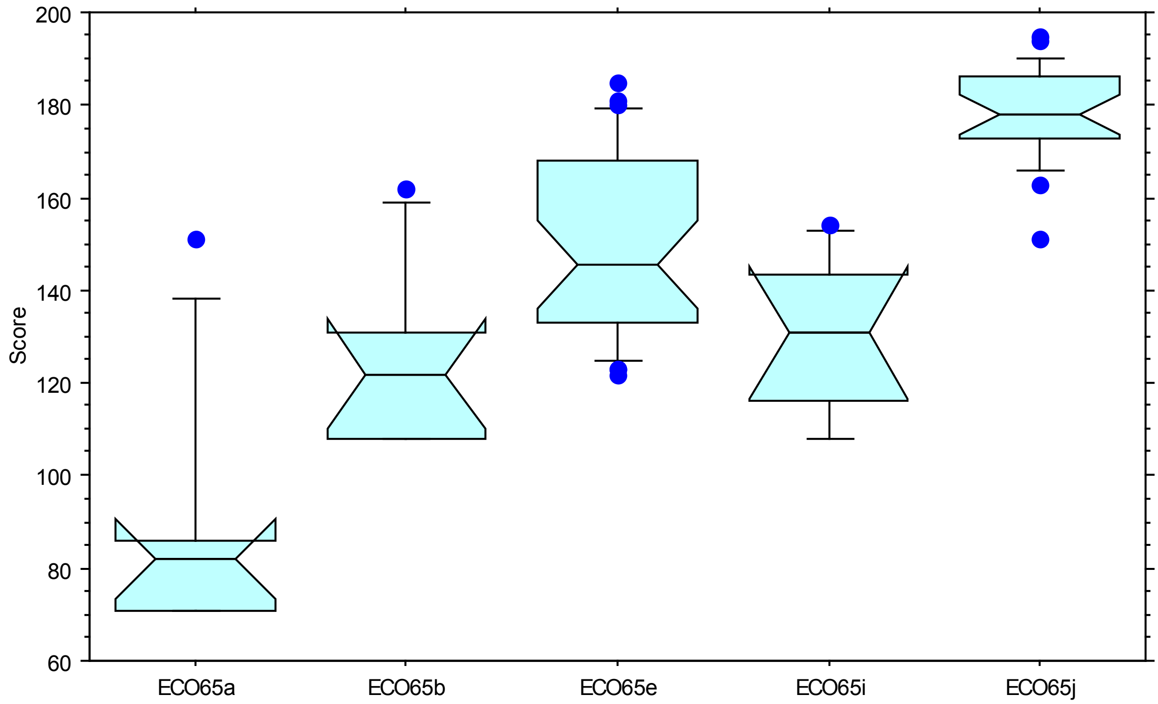
Figure 2: Habitat Scores of Level III Ecoregions



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO65	175.8	13.3	2.6	27	141.0	195.0	178.0
ECO66	187.7	10.2	1.2	74	158.0	200.0	191.0
ECO67	168.6	16.6	2.1	63	120.0	196.0	171.0
ECO68	166.7	19.3	2.2	76	96.0	194.0	168.0
ECO69	174.2	13.2	2.6	25	130.0	189.0	176.0
ECO71	151.7	17.5	1.5	141	98.0	181.0	156.0
ECO73	125.9	19.2	4.7	17	96.0	161.0	125.0
ECO74	129.7	13.8	2.2	40	99.0	156.0	129.5

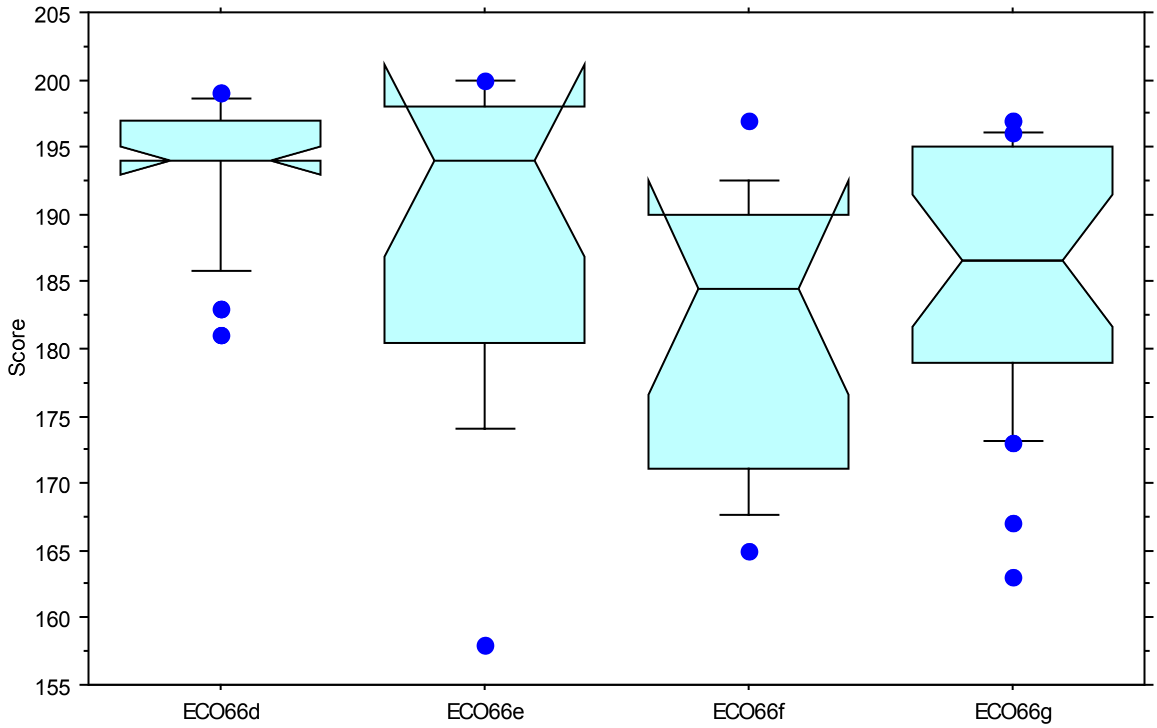
Figure 3: Habitat Scores for Ecoregion 65



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO65a	88.1	28.5	10.8	7	71.0	151.0	82.0
ECO65b	125.4	19.7	6.6	9	108.0	162.0	122.0
ECO65e	149.5	19.9	3.4	34	122.0	185.0	145.5
ECO65i	129.8	16.8	5.6	9	108.0	154.0	131.0
ECO65j	178.2	10.4	2.1	25	151.0	195.0	178.0

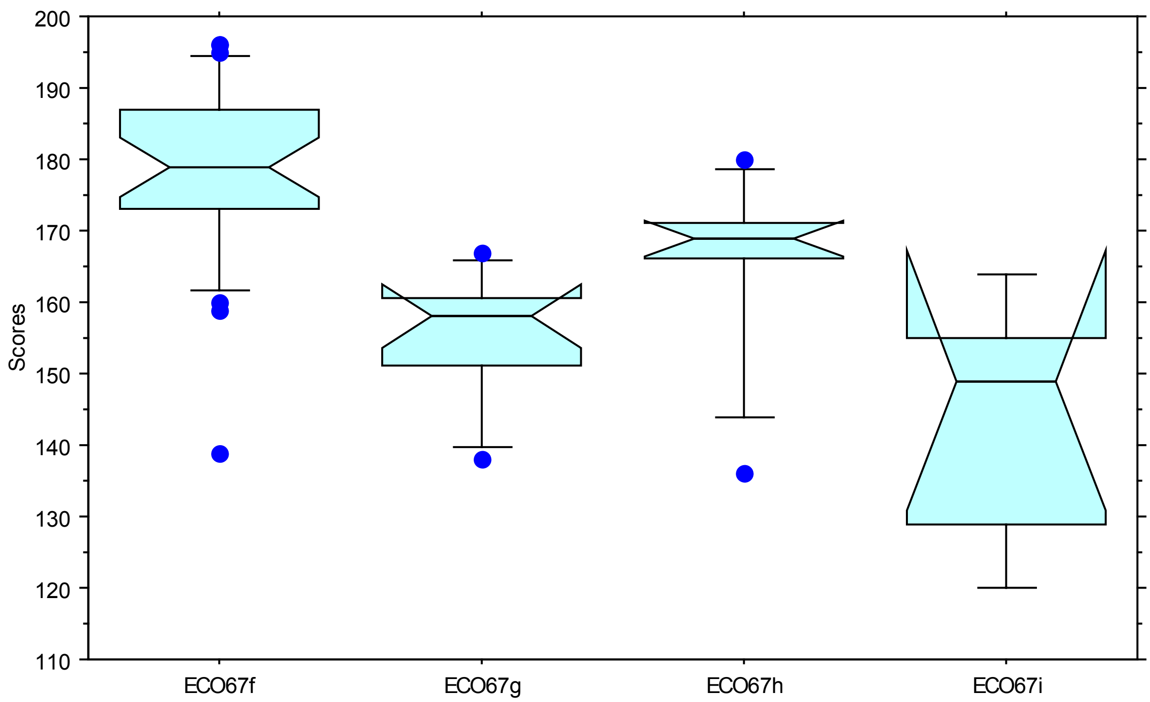
Figure 4: Habitat Scores for Ecoregion 66



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO66d	194.1	4.8	1.1	19	181.0	199.0	194.0
ECO66e	189.0	12.1	3.1	15	158.0	200.0	194.0
ECO66f	182.1	10.1	2.7	14	165.0	197.0	184.5
ECO66g	185.5	9.9	1.9	26	163.0	197.0	186.5

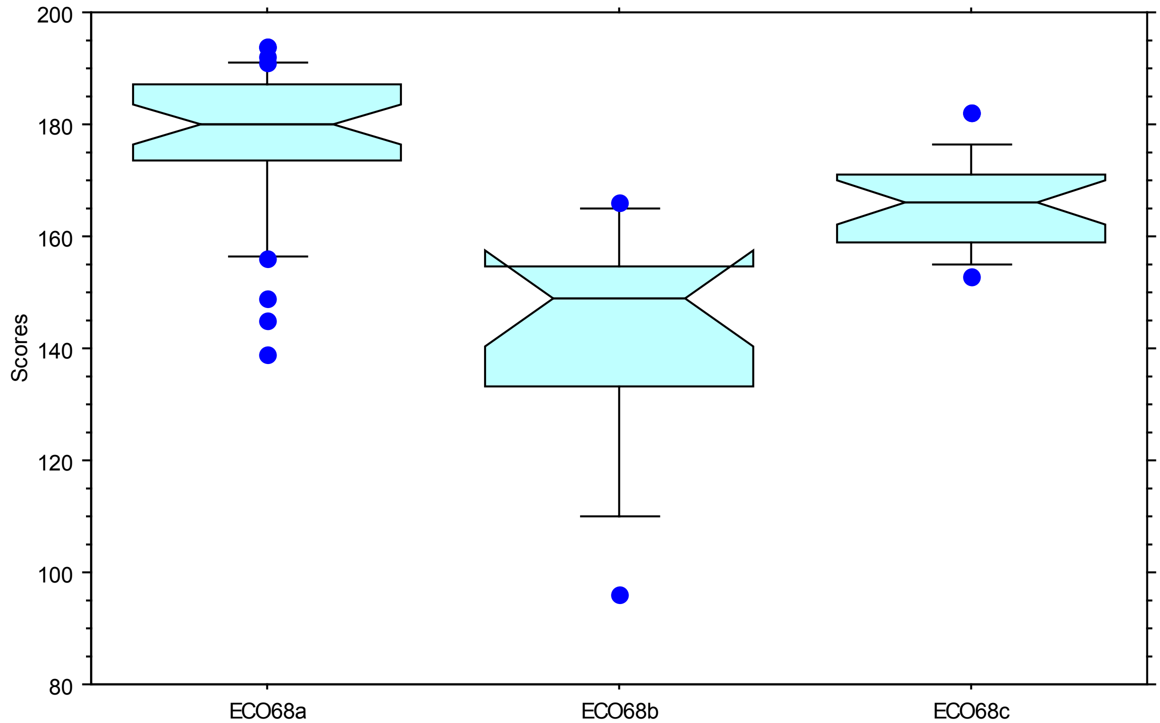
Figure 5: Habitat Scores for Ecoregion 67



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO67f	178.464	13.003	2.457	28	139.000	196.000	179.000
ECO67g	155.000	9.088	2.740	11	138.000	167.000	158.000
ECO67h	165.700	12.789	4.044	10	136.000	180.000	169.000
ECO67i	143.400	17.372	7.769	5	120.000	164.000	149.000

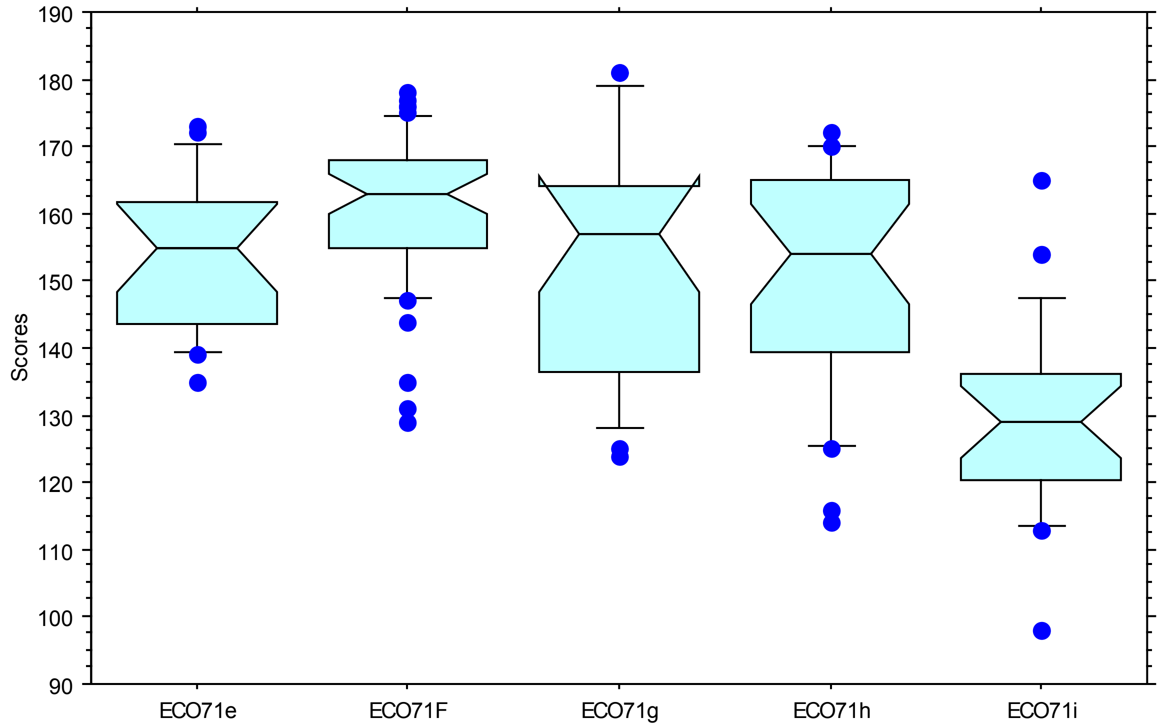
Figure 6: Habitat Scores for Ecoregion 68



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO68a	176.7	14.2	2.3	39	139.0	194.0	180.0
ECO68b	142.0	20.5	5.3	15	96.0	166.0	149.0
ECO68c	165.8	7.9	1.7	22	153.0	182.0	166.0

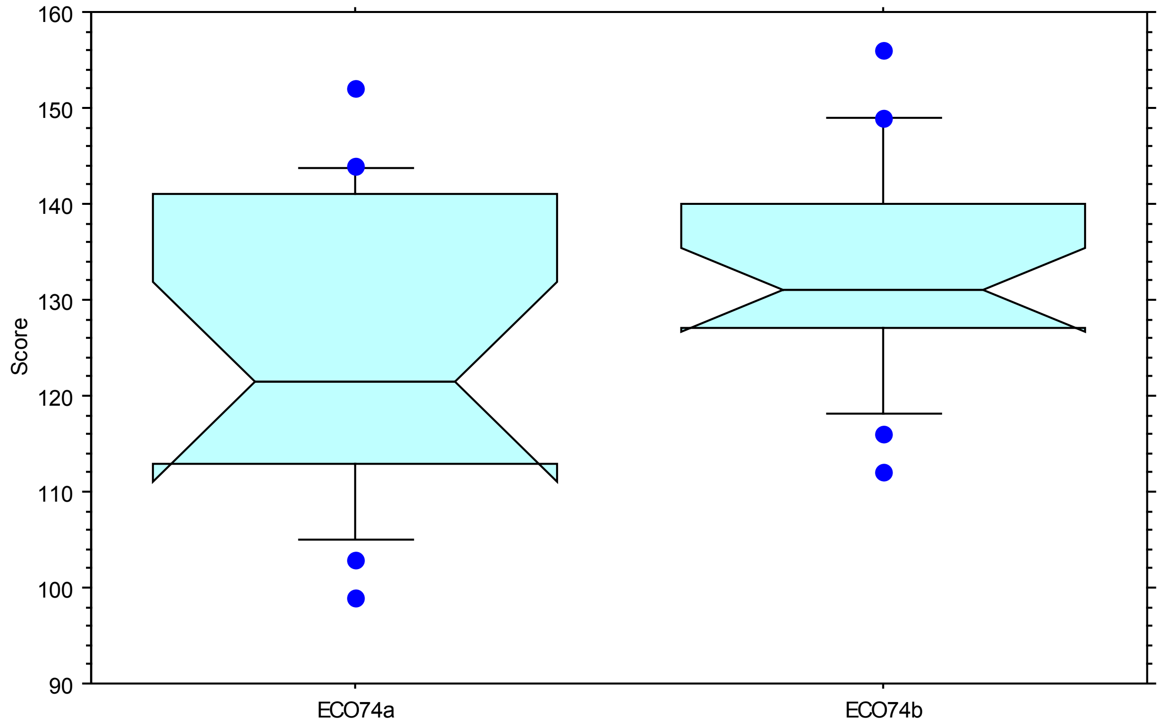
Figure 7: Habitat Scores for Ecoregion 71



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO71e	154.2	11.3	2.6	19	135.0	173.0	155.0
ECO71F	160.6	11.3	1.6	48	129.0	178.0	163.0
ECO71g	153.6	17.9	3.6	25	124.0	181.0	157.0
ECO71h	149.7	17.1	3.2	28	114.0	172.0	154.0
ECO71i	129.4	14.5	3.2	21	98.0	165.0	129.0

Figure 8: Habitat Scores for Ecoregion 74



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO74a	125.0	15.6	3.7	18	99.0	152.0	121.5
ECO74b	133.5	11.1	2.4	22	112.0	156.0	131.0

3.5 Macroinvertebrate Analyses

Biometrics were used to evaluate the macroinvertebrate community at each site. Biometrics measure the characteristics of the biota that change in some predictable way with increased human influence. For a metric to be useful, it must be ecologically relevant to the biological assemblage and to program objectives. It must also be sensitive to stressors and provide a response that can be discriminated from natural variation.

The first year of macroinvertebrate data was analyzed by Dr. Michael Barbour and Jeffery White, Tetra Tech Inc. to develop a core set of metrics that would best fit Tennessee macroinvertebrate community assessments. Seven metrics from four different category types (richness, composition, tolerance and habit) were used to reflect various aspects of the whole community. Richness metrics measure the diversity or variety of the macroinvertebrate community. Composition metrics measure species identity and dominance. Tolerance metrics measure sensitivity to pollution. Habit (trophic) metrics provide information on feeding strategies or guilds.

Use of multiple metrics is the most comprehensive method to assess the health of the benthic community. Use of a single metric can be misleading since different metrics respond differently to various stressors. For example the % of EPT, which is generally considered an indication of a healthy stream, may be high due to the presence of one or two nutrient tolerant taxa such as *Stenonema* spp. or *Cheumatopsyche* spp. However, the dominance of these two EPT groups would result in a low EPT richness and a higher NCBI indicating a stressed macroinvertebrate community.

Barbour and White (98) combined the proposed core metrics into a preliminary stream condition index based on stream type. The Tennessee Stream Condition Index (TSCI) was used to compare subregions. Each of the seven metrics is given a score of 0 to 6 based on the ranges in Table 10. The 7 scores are added for a total possible score of 42. The maximum index score range was quadrisected by Barbour and White (98) into equal ordinal categories of:

"Very Good"	32-42
"Good"	22-30
"Poor"	12-20
"Very Poor"	0-10

The preliminary core metrics proposed by Tetra Tech were adopted in 1997 and were used to analyze the benthic data from the entire three-year period (Table 11). Biometrics used during the three-year project are listed in Table 9. These metrics, as well as others, will be evaluated in subsequent documents to determine which are the most sensitive to disturbances in the benthic community.

Table. 9 Tennessee Preliminary Macroinvertebrate Metrics*			
Category	**Metric**	**Definition**	**Expected response to increasing perturbation**
Richness Metrics	Number of taxa	Measures the overall variety of the macroinvertebrate assemblage	Number Decreases
	Number of EPT taxa	Number of taxa in the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies)	Number Decreases
Compositio n Metrics	% EPT	% of Ephemeroptera, Plecoptera, and Trichoptera	Percent Decreases
	% Chironomidae**	% Chironomidae taxa	Percent Increases
Tolerance/ Intolerance Metrics	% Tolerant organisms	% of all organisms considered to be very tolerant to perturbation	Percent Increases
	NCBI	The North Carolina Biotic Index, which incorporates richness and abundance with a numerical rating of tolerance	Number increases
Habit Metric	% Clingers	% of organisms having fixed retreats or adaptations for attachment to surfaces in fast-moving water	Number Decreases

* Table modified from Kerans and Karr (1994) in Barbour and White (1998) to illustrate Tennessee preliminary metrics only.

Barbour's preliminary index created scoring ranges based on stream type, regardless of ecoregion. One problem associated with using ranges based only on stream type (riffle run or glide pool) is that riffle streams in mountainous areas are compared to riffle streams in valley areas. This results in very broad metric ranges. Based on subsequent data analyses, several subregions appear to have unique benthic characteristics. An eventual goal of this study is to develop expected ranges for each of the eight level III ecoregions as well as any unique subregions.

The preliminary TSCI did not appear sensitive to differences between all level III ecoregions. Benthic communities would be expected to be different at this level. The index indicated that ecoregions 67 (Ridge and Valley), 68 (Southwestern Appalachian), and 71 (Interior Plateau) had similar benthic communities (Figure 9). Before it is determined that these ecoregions are similar, it will be necessary to look closer at metric selection and range determination. The use of a combined index will also be evaluated since it tends to be less sensitive than looking at individual metrics.

Box and whisker plots of TSCI scores for each ecoregion that contains multiple subregions is presented in Figures 10–15. Review of these plots indicate that at least 6 subregions have distinctly different macroinvertebrate communities from other subregions within the same Level III ecoregion. The unique subregions are 65i (Fall Line Hills), 65j (Transition Hills), 67g (Southern Shale Valleys), 68a (Cumberland Plateau), 71i (Inner Nashville Basin) and 74b (Bluff Hills). These subregions will probably warrant different index ranges to determine macroinvertebrate community health.

Using the preliminary TSCI, streams in three subregions, 65i (Fall Line Hills), 73a (Northern Mississippi Alluvial Plain) and 74a (Bluff Hills) fell in the third quartile, which is considered poor (Table 11). Further analysis, as well as comparisons to reference streams in other states, is necessary to determine whether the streams selected in these regions are the best attainable or if they are too impacted for use as reference streams. If they are found to be useable, metric ranges will need to be adjusted in these regions. A table of scores for each station can be found in Appendix E.

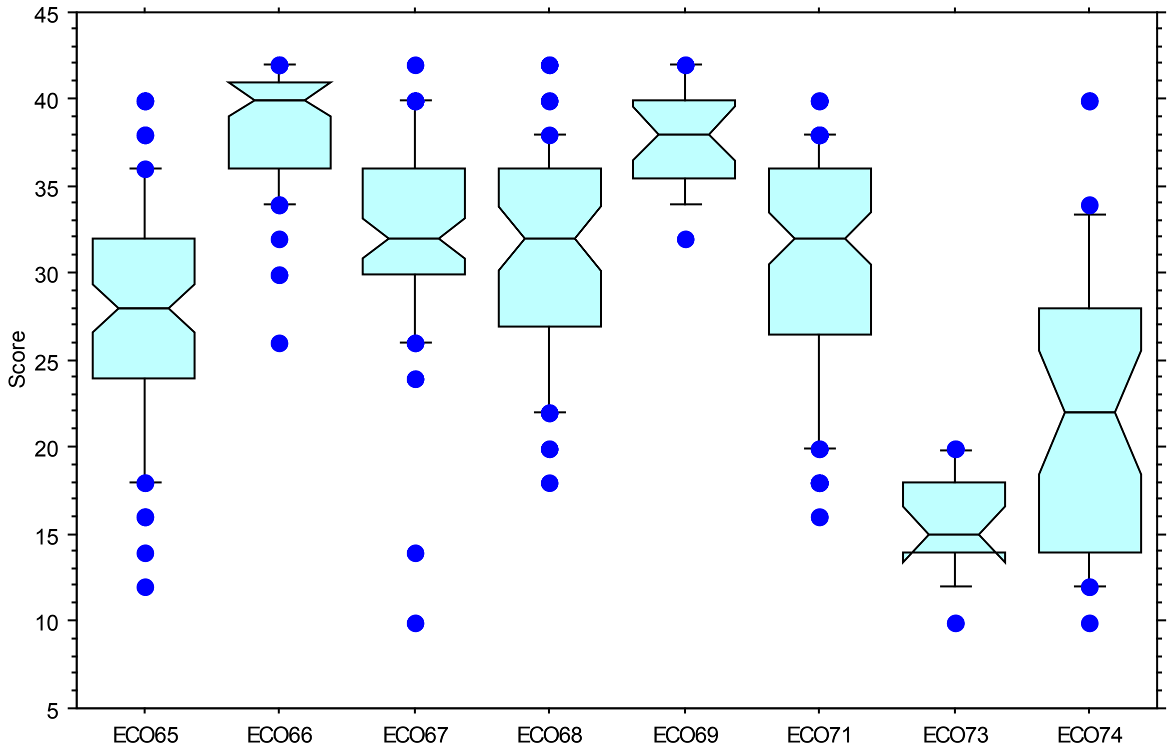
ECO74B12, Wolf River, Yager Road, Fayette County

Table 10: Scoring Criteria for preliminary Tennessee Stream Condition Index (TSCI)				
Metric	**Score**			
	6	**4**	**2**	**0**
Riffle/Run Streams				
Taxa Richness	> 34.7	23.2-34.7	11.6-23.1	< 11.6
EPT Richness	> 13.7	9.2-13.7	4.6-9.1	< 4.6
% EPT	> 54.0	36.1-54.0	81-36.0	< 18
% Chironomidae	< 27.5	27.5-51.6	51.7-75.8	> 75.8
% Tolerant Organisms	< 27.2	27.2-51.4	51.5-75.7	> 75.7
NCBI	< 4.4	4.4-6.2	6.3-8.1	> 8.1
% Clingers	> 56.6	56.6-37.8	18.9-37.7	< 18.9
Glide/Pool Streams				
Taxa Richness	> 40.4	27.0-40.4	13.5-26.9	< 13.5
EPT Richness	> 9.2	6.1-9.2	3.1-6.0	< 3.1
% EPT	> 53.6	35.8-53.6	17.9-35.7	< 17.9
% Chironomidae	< 26.2	26.2-50.7	50.8-75.4	>75.4
% Tolerant Organisms	< 34.8	34.8-56.5	56.6-78.2	>78.2
NCBI	< 5.9	5.9-7.2	7.3-8.6	> 8.6
% Clingers	> 29.1	19.5-29.1	9.7-19.4	< 9.7

* Table modified from Barbour and White (1998) to illustrate preliminary Tennessee Stream Condition Index (TSCI) only.

Table 11: Preliminary Tennessee Stream Condition Index (TSCI) by Subregion					
Subregion	**Stream Type**	**No. of Stations**	**No. of Observations**	**Score range**	**Mean Score**
65a	Glide/Pool	2	6	18-32	24
65b	Glide/Pool	2	9	12-30	25
65e	Glide/Pool	6	32	18-40	29
65i	Glide/Pool	3	9	14-34	20
65j	Riffle/Run	4	23	18-40	31
66d	Riffle/Run	5	19	26-42	38
66e	Riffle/Run	5	16	30-42	39
66f	Riffle/Run	4	11	34-42	38
66g	Riffle/Run	5	22	30-42	38
67f	Riffle/Run	9	30	10-40	33
67g	Riffle/Run	4	11	26-36	30
67h	Riffle/Run	3	9	24-40	33
67i	Riffle/Run	2	6	14-40	31
68a	Riffle/Run	9	33	20-42	33
68b	Riffle/Run	3	13	18-42	30
68c	Riffle/Run	5	14	22-38	30
69d	Riffle/Run	5	21	32-42	38
71e	Riffle/Run	4	15	16-36	32
71f	Riffle/Run	7	36	18-40	33
71g	Riffle/Run	5	18	22-40	34
71h	Riffle/Run	4	19	24-38	34
71i	Riffle/Run	3	14	18-36	22
73a	Glide/Pool	4	16	10-20	16
74a	Riffle/Run	3	17	10-32	14
74b	Glide/Pool	3	20	12-40	22

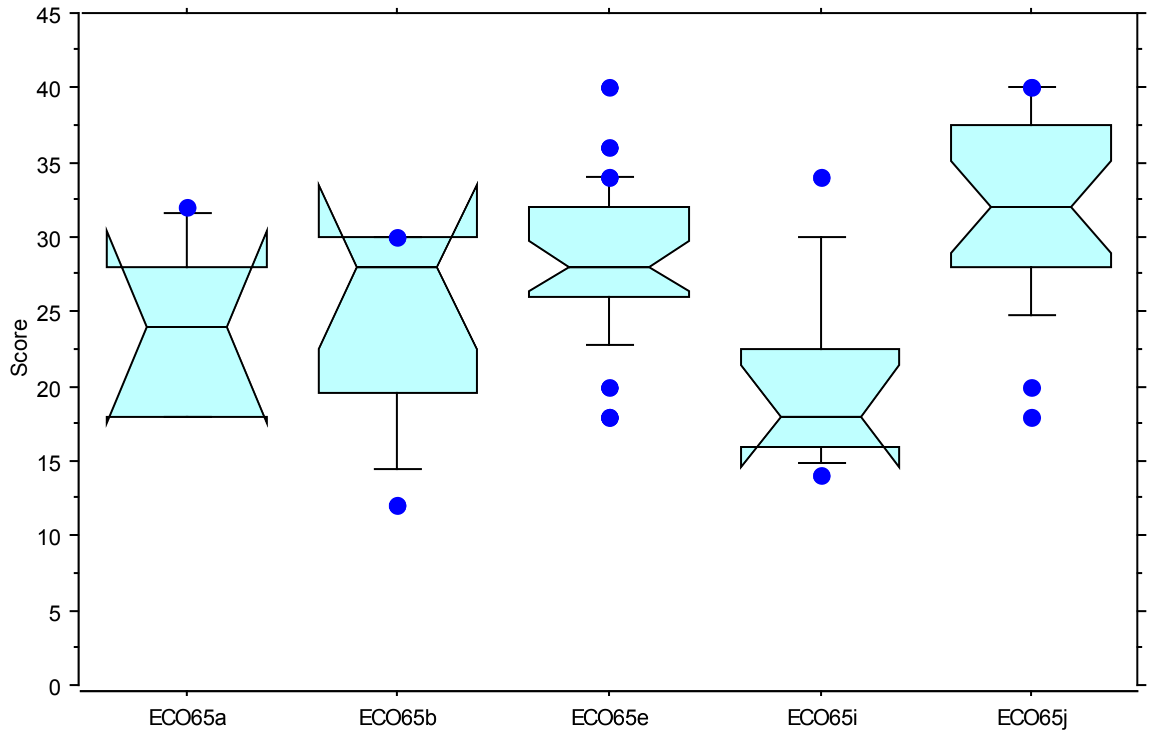
Figure 9: TN Stream Condition Index (TSCI) Level III Ecoregions 1996-1999



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO65	27.8	6.6	.7	79	12.0	40.0	28.0
ECO66	38.6	3.3	.4	68	26.0	42.0	40.0
ECO67	32.7	5.8	.7	68	10.0	42.0	32.0
ECO68	31.5	6.1	.8	60	18.0	42.0	32.0
ECO69	37.7	3.1	.7	21	32.0	42.0	38.0
ECO71	30.8	6.1	.6	103	16.0	40.0	32.0
ECO73	15.6	3.0	.8	16	10.0	20.0	15.0
ECO74	22.6	8.6	1.4	38	10.0	40.0	22.0

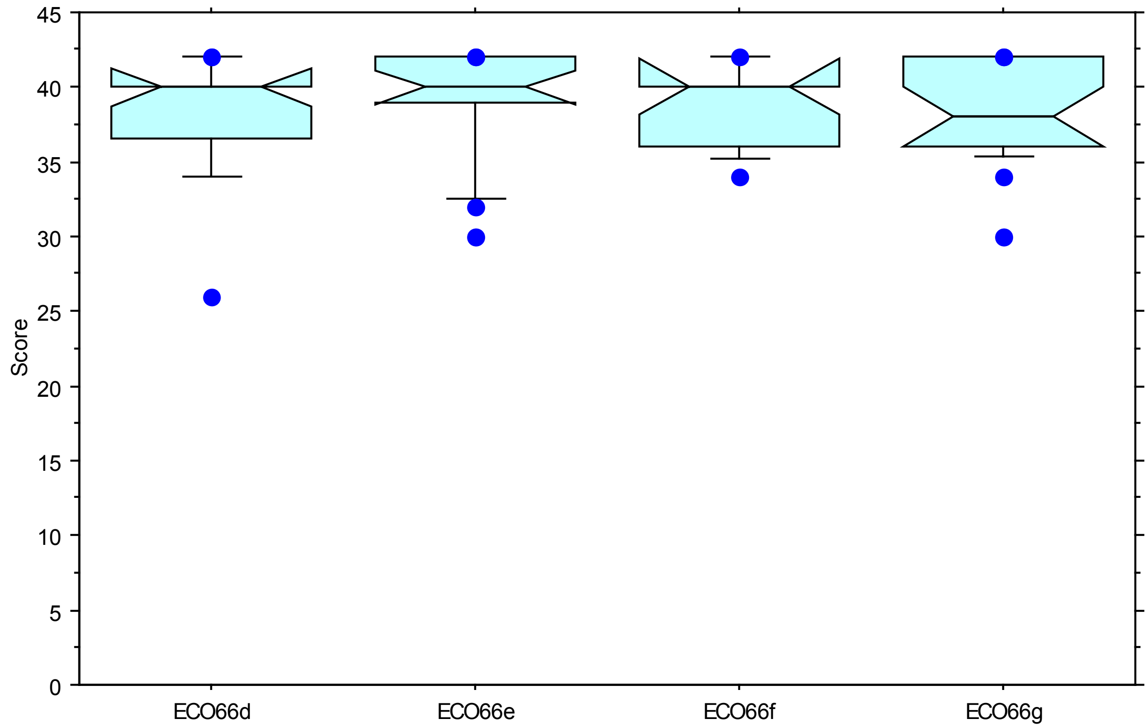
Figure 10: TSCI Scores for Ecoregion 65



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO65a	24.0	5.7	2.3	6	18.0	32.0	24.0
ECO65b	24.9	6.6	2.2	9	12.0	30.0	28.0
ECO65e	28.8	4.9	.9	32	18.0	40.0	28.0
ECO65i	20.4	6.1	2.0	9	14.0	34.0	18.0
ECO65j	31.5	6.1	1.3	23	18.0	40.0	32.0

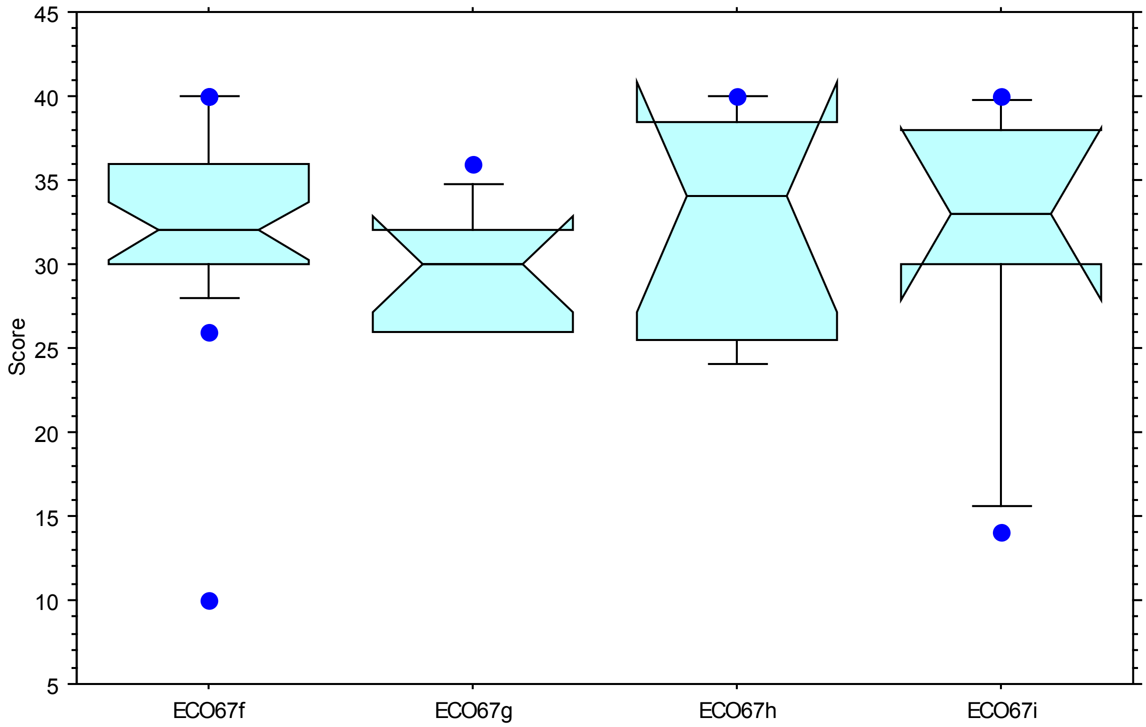
Figure 11: TSCI Scores for Ecoregion 66



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO66d	38.3	3.8	.9	19	26.0	42.0	40.0
ECO66e	39.3	3.5	.9	16	30.0	42.0	40.0
ECO66f	38.5	2.7	.8	11	34.0	42.0	40.0
ECO66g	38.5	3.2	.7	22	30.0	42.0	38.0

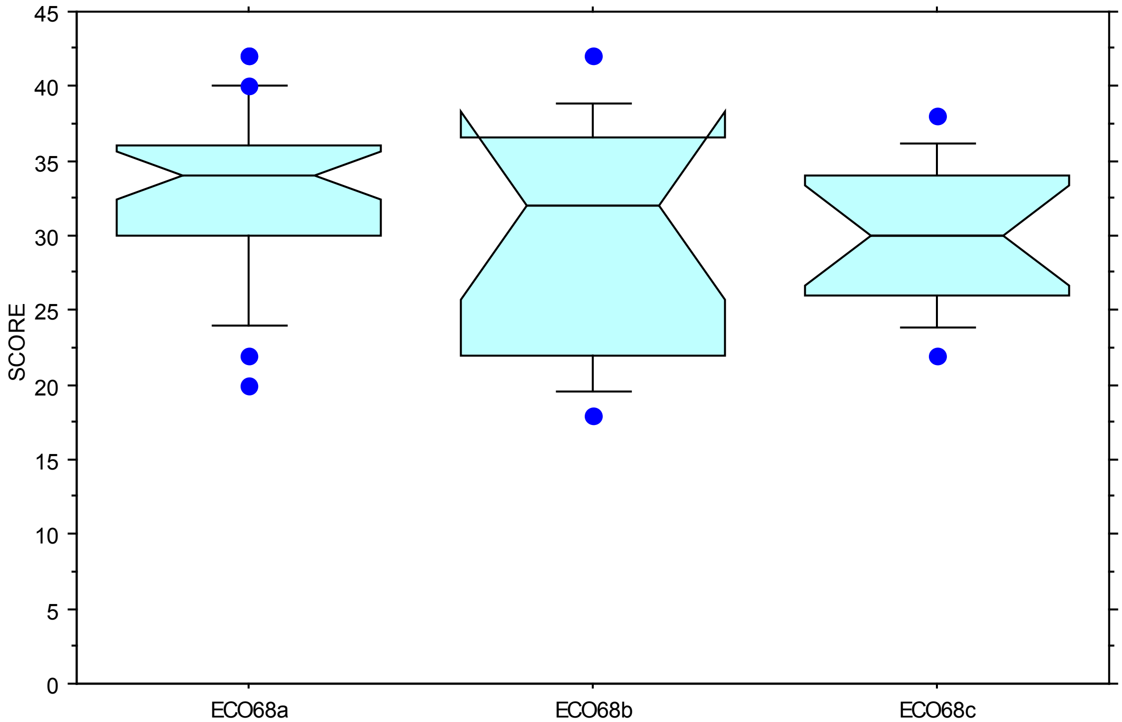
Figure 12: TSCI Scores for Ecoregion 67



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO67f	32.9	5.8	1.1	30	10.0	40.0	32.0
ECO67g	29.8	3.6	1.1	11	26.0	36.0	30.0
ECO67h	32.7	6.6	2.2	9	24.0	40.0	34.0
ECO67i	31.3	9.4	3.9	6	14.0	40.0	33.0

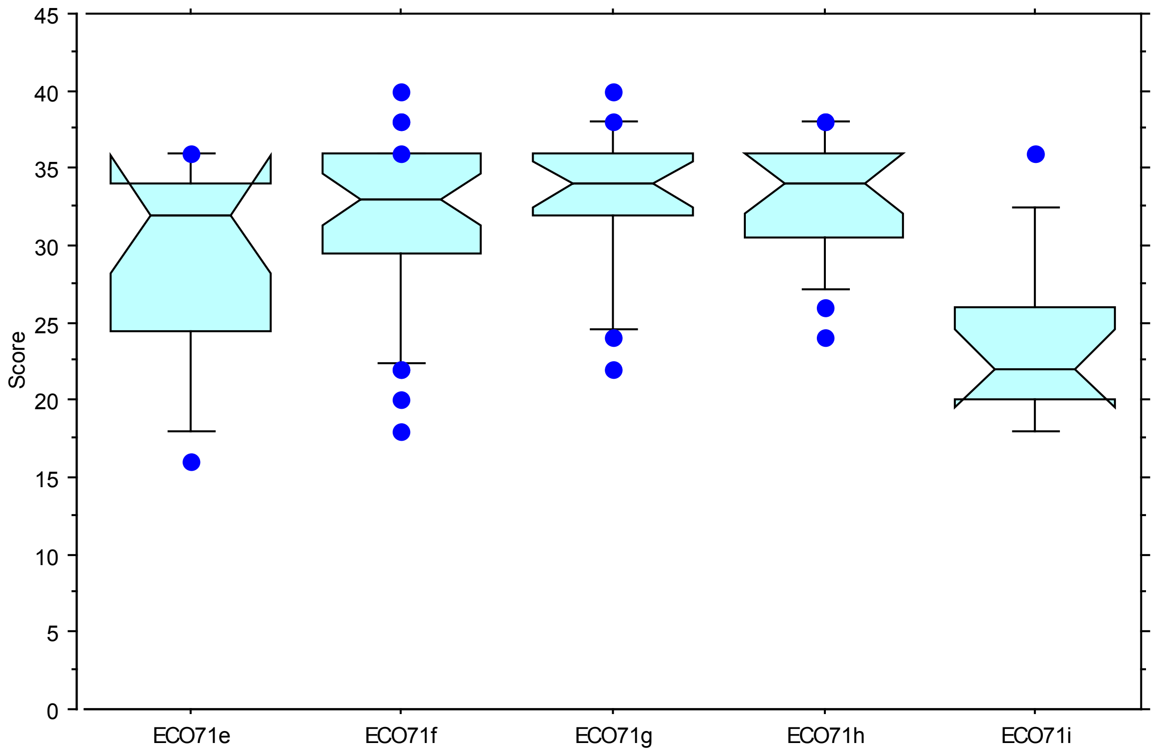
Figure 13: TSCI Scores for Ecoregion 68



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO68a	32.8	5.6	1.0	33	20.0	42.0	34.0
ECO68b	29.8	7.9	2.2	13	18.0	42.0	32.0
ECO68c	29.9	4.8	1.3	14	22.0	38.0	30.0

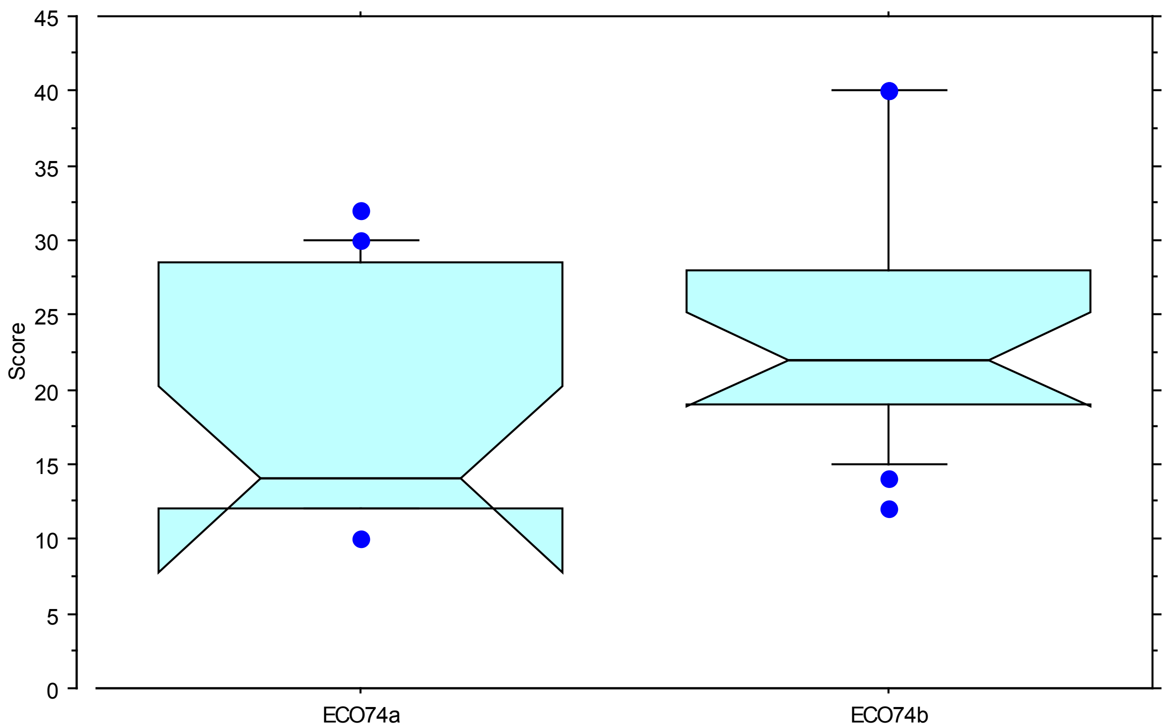
Figure 14: TSCI Scores for Ecoregion 71



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO71e	28.7	6.9	1.8	15	16.0	36.0	32.0
ECO71f	31.9	5.2	.9	36	18.0	40.0	33.0
ECO71g	33.3	5.0	1.2	18	22.0	40.0	34.0
ECO71h	33.2	4.1	.9	19	24.0	38.0	34.0
ECO71i	23.7	5.6	1.5	14	18.0	36.0	22.0

Figure 15: TSCI Scores for Ecoregion 74



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
ECO74a	19.8	8.2	2.0	17	10.0	32.0	14.0
ECO74b	24.6	8.4	1.9	20	12.0	40.0	22.0

3.6 Seasonal Variation

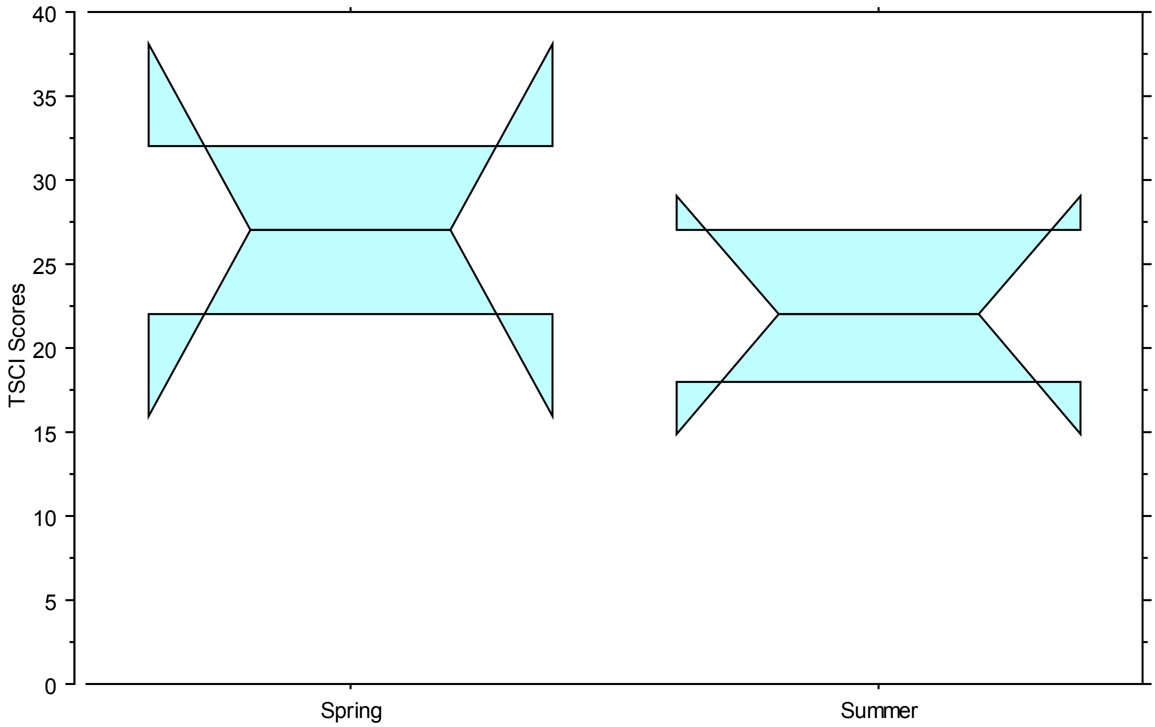
Most subregions were not collected within a sufficient time period to determine possible seasonal variations. Although different taxa would be expected in different seasons, the stream condition index may not vary significantly since the overall community structure could remain stable. It would be preferable to have a single expected range for each metric that could be used year round.

In order to determine if there is seasonal variation, it would be necessary to collect samples in tighter windows (6 weeks) within subregions. Ten of the 25 subregions were collected within 6 week (42 day windows) for both summer and spring samples. These subregions are highlighted in Table 12. They are primarily in the smaller subregions. Of the ten subregions sampled within seasonal windows, five showed an observable variation in TSCI scores between the summer and spring sample periods (Figures 16-25).

Table 12: Macroinvertebrate Samples by Season, TN Ecoregion Project, 1996-99

Late Summer						
Subregion	**Date Range**	**Days Spread**	**Date Range**	**Days Spread**	**Window Met**	**Seasonal Variation**
	9/8-20	13	4/15-28	14	Yes	Possible
65b	9/2-17	16	4/7-23	17	Yes	No
65e	8/9-10/7	60	3/24-6/2	71	No	Undetermined
65i	9/9-10/7	29	4/15-4/15	1	Yes	No
	8/21-9/17	28	4/20-5/9	19	Yes	
66d	9/15-11/7	54	4/13-6/23	72	No	Undetermined
66e	8/21-11/6	77	4/7-6/9	64	No	Undetermined
66f	8/28-11/12	76	4/13-6/10	58	No	Undetermined
66g	8/31-10/2	32		42	Yes	Possible
67f	8/31-10/30	60	3/31-6/27	89	No	Undetermined
67g	8/22-12/2	102	5/12-21	10	No	Undetermined
	9/5-10/9	34	4/30-5/6	7	Yes	Possible
67i	9/9-10/2	24	4/16-5/12	27	Yes	Possible
68a	8/23-9/30	38	3/30-6/26	89	No	Undetermined
68b	9/2-23		4/16-5/19	34	Yes	Possible
68c	8/23-9/6	15	4/14-6/3	51	No	Undetermined
69d	9/1-10/3	32	3/20-5/16	57	No	Undetermined
71e	8/26-10/16	51	5/4-6/29	56	No	Undetermined
71f	8/5-10/9	65	4/21-6/7	48	No	Undetermined
71g	8/26-10/10	45	4/23-6/16	55	No	Undetermined
71h	8/19-10/21	63	4/13-6/11	60	No	Undetermined
71i	9/1-10/18	48	4/23-6/3	42	No	Undetermined
73a	8/15-27	12	4/20-5/27	38	Yes	No
74a	8/7-9/19	44	4/13-4/27	14	No	Undetermined
74b	8/13-9/11	30	4/14-5/6	23	Yes	No

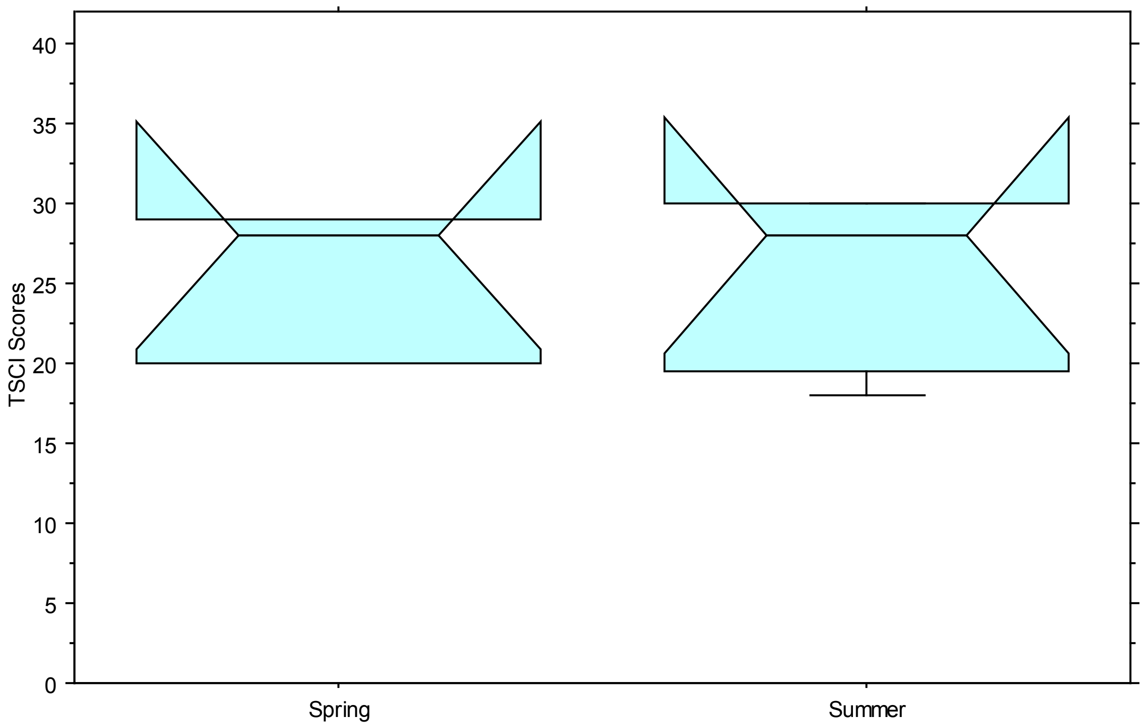
Figure 16: 65a TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	27.0	7.1	5.0	2	22.0	32.0	27.0
Summer	22.5	5.3	2.6	4	18.0	28.0	22.0

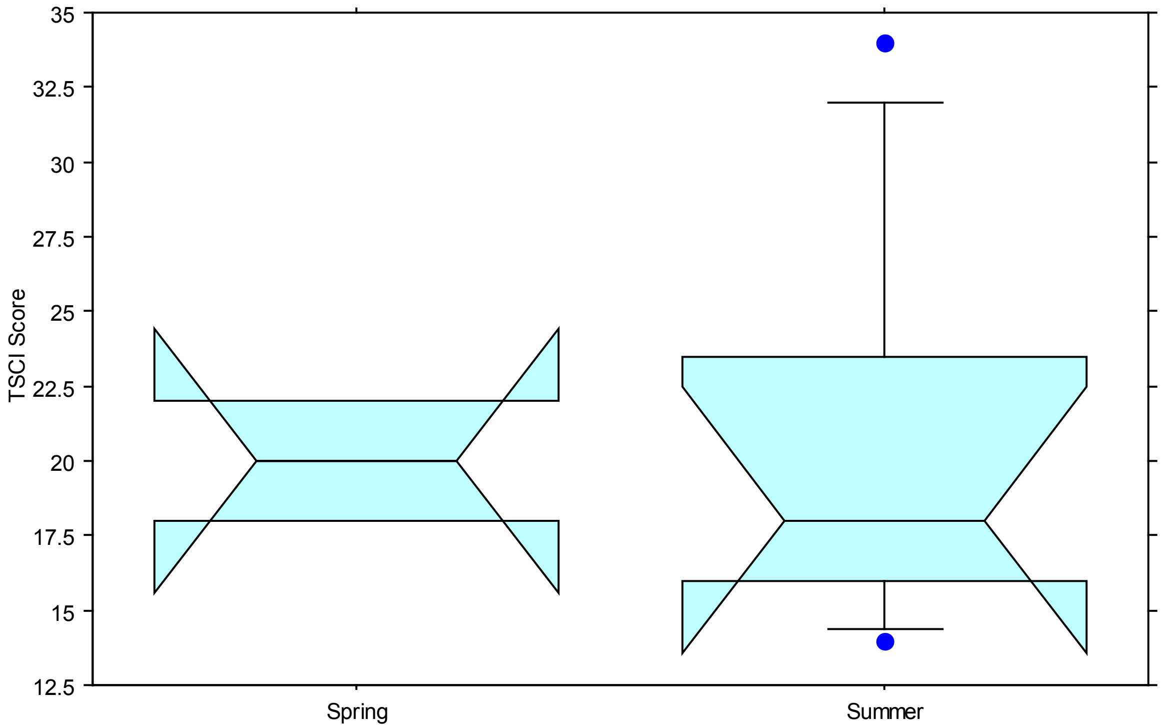
Figure 17: 65b TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	24.5	8.4	4.2	4	12.0	30.0	28.0
Summer	25.2	5.8	2.6	5	18.0	30.0	28.0

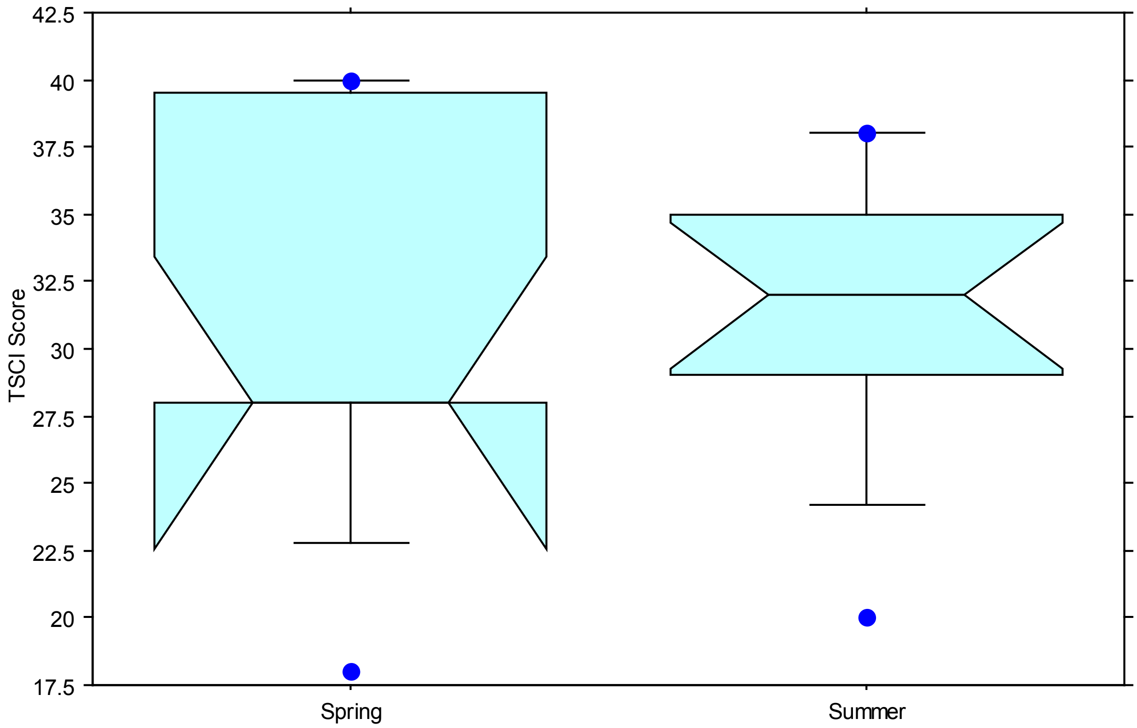
Figure 18: 65i TSCI by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	20.0	2.8	2.0	2	18.0	22.0	20.0
Summer	20.6	6.9	2.6	7	14.0	34.0	18.0

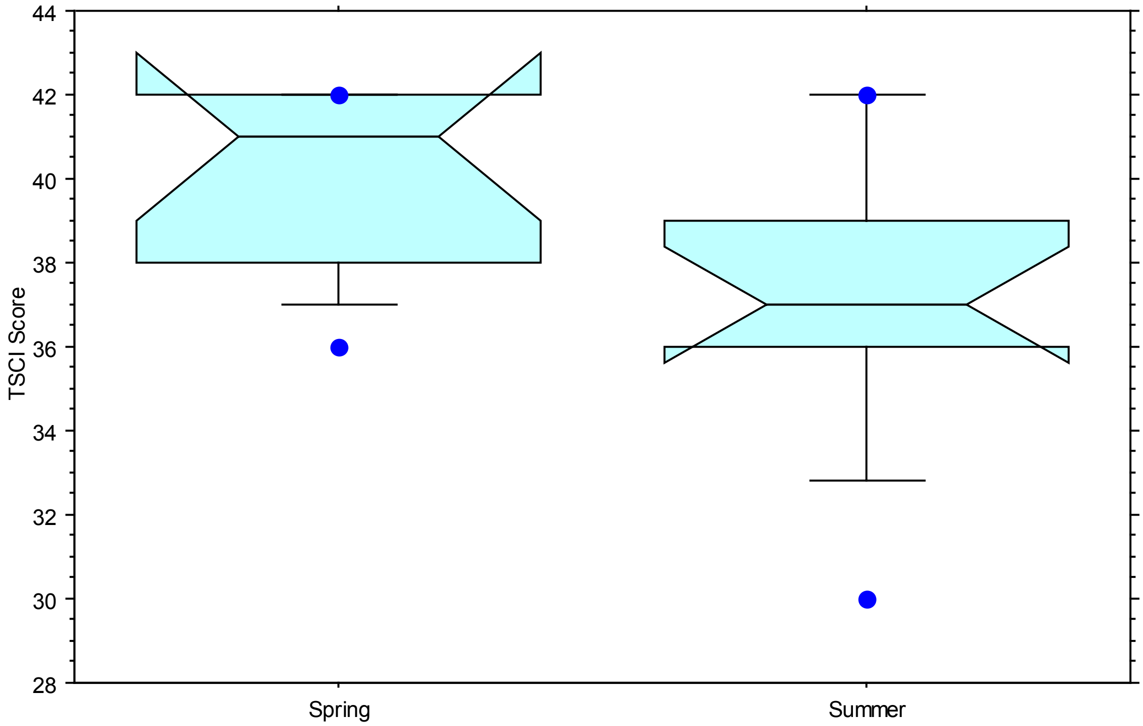
Figure19: 65j TSCI by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	31.3	7.2	2.2	11	18.0	40.0	28.0
Summer	31.7	5.2	1.5	12	20.0	38.0	32.0

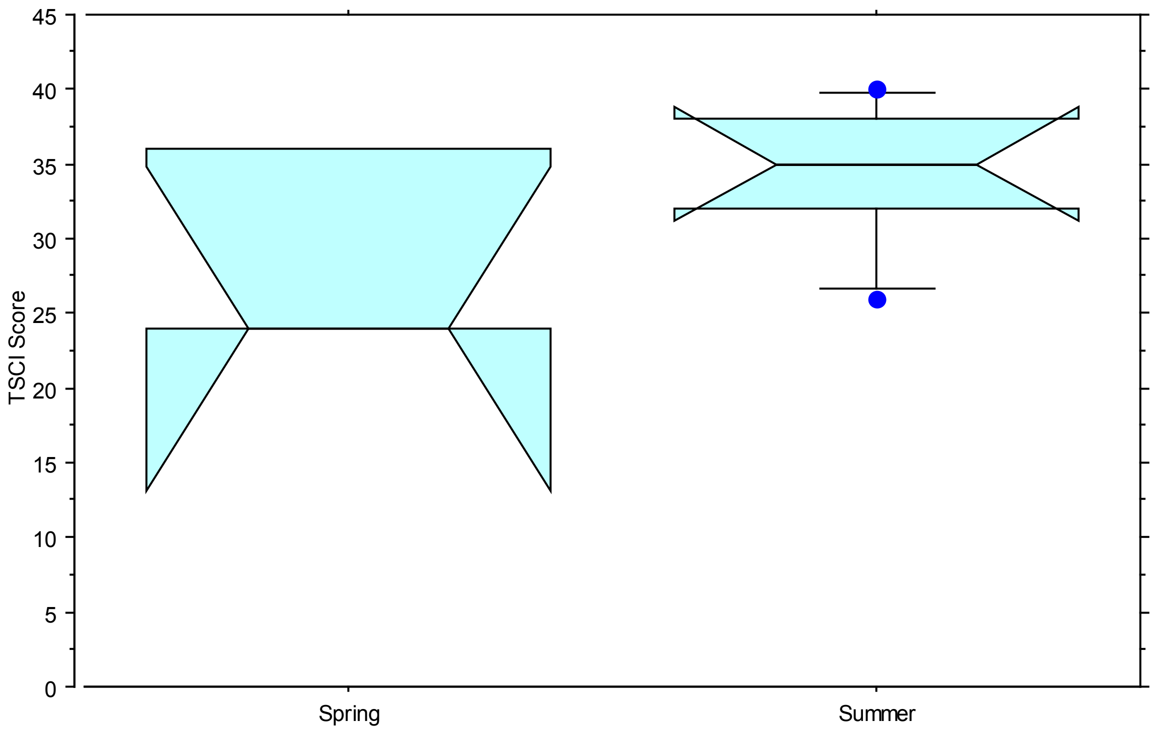
Figure 20: 66g TSCI by season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	40.2	2.2	.7	10	36.0	42.0	41.0
Summer	37.2	3.4	1.0	12	30.0	42.0	37.0

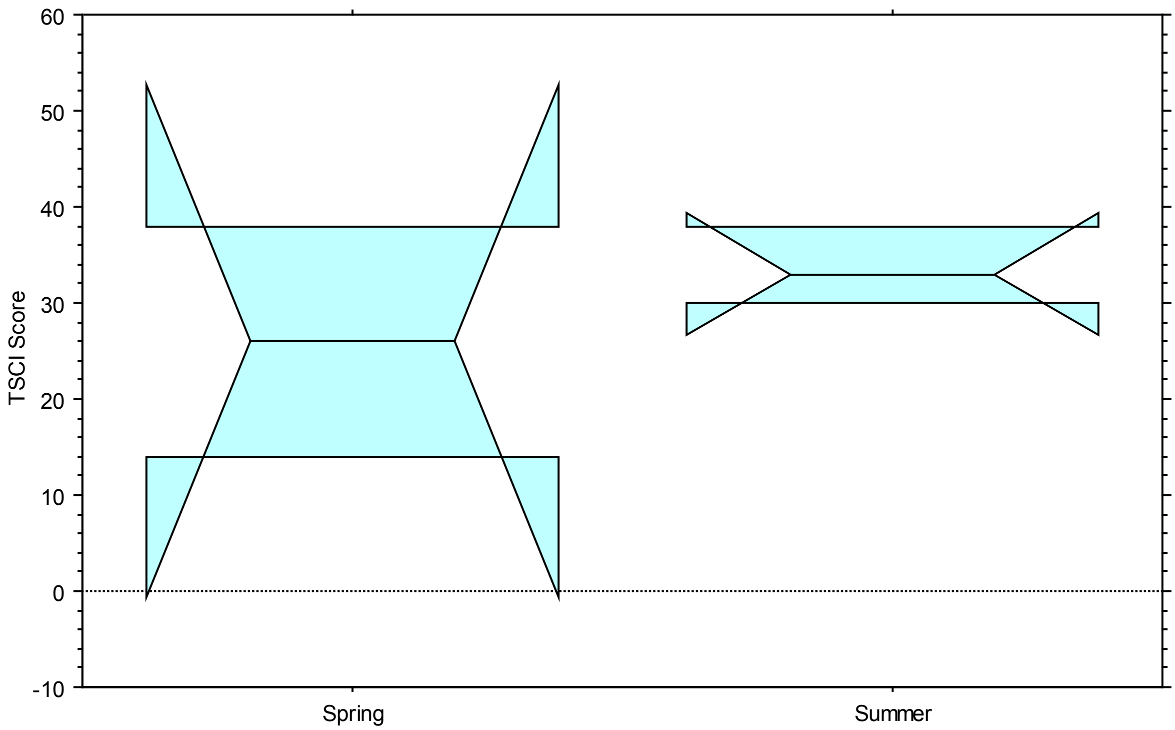
Figure 21: 67h TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	29.3	9.2	5.3	3	24.0	40.0	24.0
Summer	34.3	5.0	2.0	6	26.0	40.0	35.0

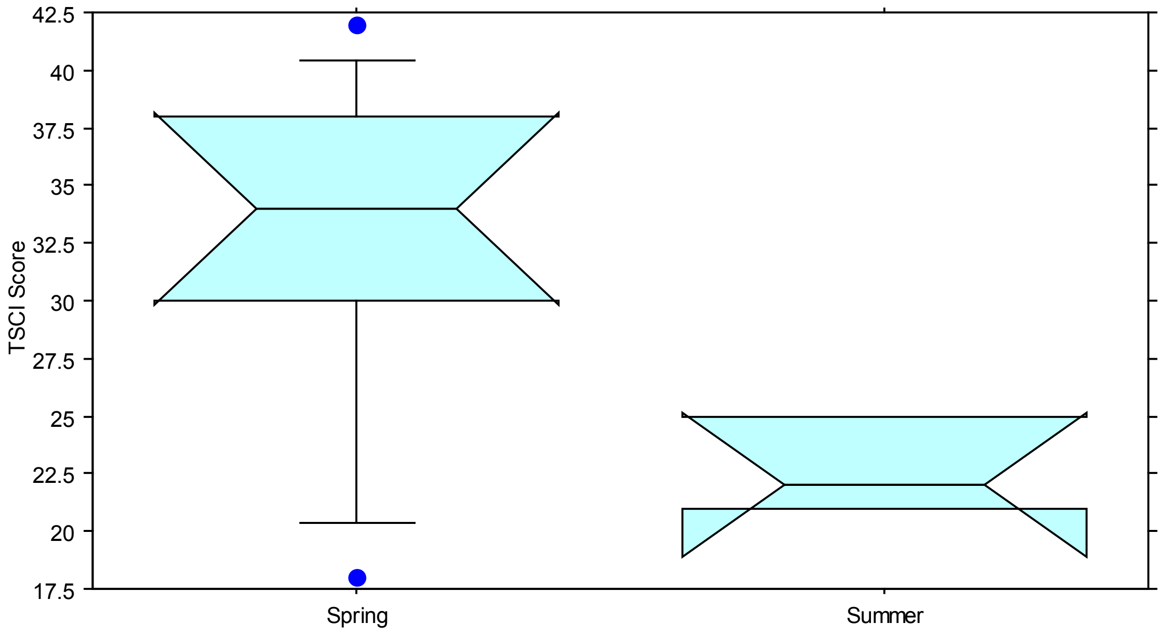
Figure 22: 67i TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	26.0	17.0	12.0	2	14.0	38.0	26.0
Summer	34.0	4.9	2.4	4	30.0	40.0	33.0

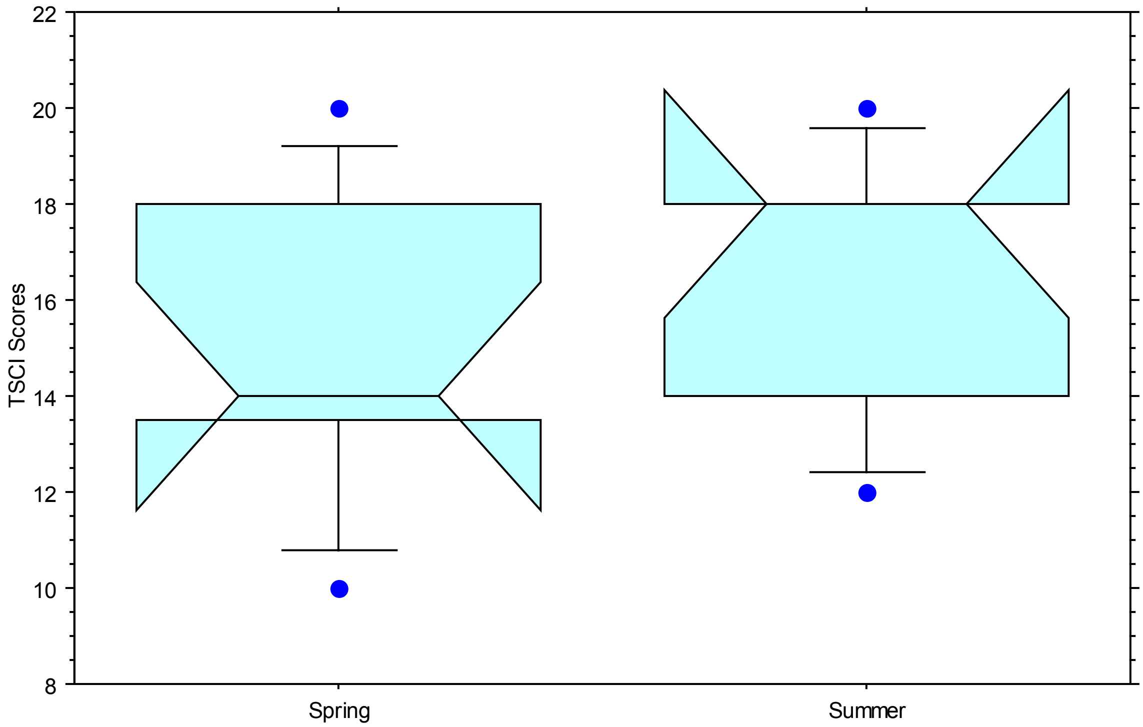
Figure 23: 68b TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	32.9	7.5	2.5	9	18.0	42.0	34.0
Summer	23.0	3.5	1.7	4	20.0	28.0	22.0

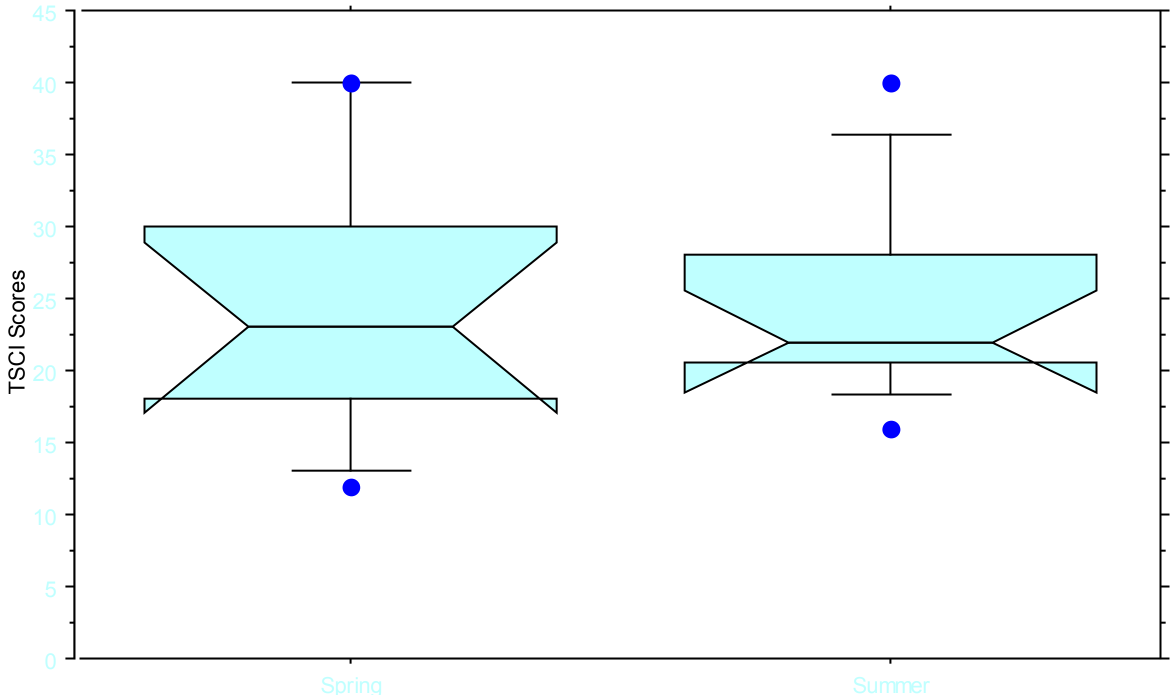
Figure 24: 73a TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	15.1	3.2	1.1	9	10.0	20.0	14.0
Summer	16.3	2.9	1.1	7	12.0	20.0	18.0

Figure 25: 74b TSCI Scores by Season



Descriptive Statistics

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
Spring	24.600	9.980	3.156	10	12.000	40.000	23.000
Summer	25.091	6.949	2.095	11	16.000	40.000	22.000

3.7 Water Quality Analyses

As with habitat and macroinvertebrate data, many water quality parameters were statistically different between the eight Level III ecoregions. For example, Figure 26 illustrates that the dissolved residue levels were highest in ecoregions 67 (Ridge and Valley), 71 (Interior Plateau), 73 (Mississippi Alluvial Plain) and 74 (Mississippi Valley Loess Plains). Nitrate and nitrite levels were also highest in ecoregions 67 and 71, while 73 and 74 were in line with the other ecoregions (Figure 27). Of the metals, copper was the most variable between ecoregions (Figure 28).

Some water quality parameters were different between level IV subregions while others were not. Within the five subregions of the Interior Plateau (71), combined nitrate and nitrite levels varied considerably (Figure 29). The Western Pennyroyal Karst subregion (71e) had the highest levels while the Western Highland Rim (71f) had the lowest. Other parameters, such as copper, were consistent between subregions in the Interior Plateau (Figure 30).

3.8 Relationship of Results to Water Quality Standards

National criteria for toxic substances are developed by EPA to identify levels of substances that are generally non-toxic to a wide range of test organisms. Criteria are based on specific toxicity testing results, but also contain "uncertainty factors" designed to compensate for unknown factors such as synergistic effects. Criteria are normally established at both acute and chronic levels.

States are encouraged by EPA to establish criteria at the national criteria levels, but are free to set criteria at more conservative levels, if desired. States may also set criteria at less conservative levels, but must provide an acceptable scientific justification. For those substances included in our study of reference streams, Tennessee has criteria established at the national criteria level, where available.

Prior to initiation of the ecoregion reference stream sampling, it was commonly theorized by people in the regulated community that even at true background levels, chemical substances routinely violated numerical criteria for protection of fish and aquatic life. This view was often presented as support for the notion that water quality standards were set inappropriately low.

Reference stream sampling results appear to refute this theory. Some substances were rarely detected, even when analytical methods that ensured very low detection levels were used. One of the most significant findings of this study is that the majority of chemical substances never exceeded water quality standards at any reference stream.

Additional information about the relationship between chemical and bacteriological results and water quality standards is presented in Table 13. For those substances where toxicity is a function of hardness, appropriate adjustments have been made.

Table 13: Relationship Between Concentrations of Various Substances and Water Quality Standards*		
Occurrence	**Substance(s)**	**Comments**
Substances never or rarely detected in reference stream sampling.	Cyanide Mercury Nickel Cadmium Ammonia	Cyanide, mercury, and nickel were dropped from reference stream sampling after the first year due to the absence of detections and the need to reduce analytical costs.
Substances occasionally detected in reference stream sampling.	Total chromium	The most toxic form is hexavalent chromium. However, total chromium was generally at undetectable levels
Substances regularly detected in reference stream sampling, but at levels less than applicable standards.	Copper Arsenic Lead Zinc	These substances were more commonly detected, but only lead levels in low hardness systems ever approached criteria levels. (EPA is in the process of revising the arsenic criteria for drinking water.) Zinc was detected in some of the "blank" samples used for quality control purposes.
Substances that occasionally violated applicable water quality standards.	Fecal coliforms *E. coli* Dissolved oxygen pH	The applicable water quality standards for pathogens are those established for protection of recreational uses. See text below for more discussion.

At the time of writing, numeric fish and aquatic life standards are not available for the following substances: conductivity, turbidity, nutrients, color, iron, manganese, suspended or dissolved solids.

Pathogens - While metals concentrations rarely approached criteria levels, a different pattern was documented for pathogens. Almost all reference sites indicated spikes in bacterial concentrations, especially during high flows. Some of these spikes exceeded water quality standards for pathogen levels in an instantaneous sample. However, no station had geometric mean levels that exceeded water quality standards.

Dissolved Oxygen - In ecoregion 73 (Mississippi Alluvial Plain), the average dissolved oxygen level in reference streams was 4.1 mg/L, less than the 5 mg/L water quality standard for fish and aquatic life protection. In all other ecoregions, average oxygen levels were higher than 5.0 mg/L. However, in several subecoregions, dissolved oxygen levels occasionally violated the water quality standard, especially during low flow conditions. These violations were especially obvious in ecoregion 74 (Mississippi Valley Loess Plains) and in subecoregion 71i (Inner Nashville Basin).

pH - In all ecoregions, the average pH readings were within the range of 6.5 to 9.0 established as Tennessee's water quality standard for fish and aquatic life protection. (The authors are aware that it is not entirely proper to average pH levels).   However, in almost every subecoregion, pH levels occasionally to regularly fell below 6.5, especially in subecoregions 68a (Cumberland Plateau) and 69d (Cumberland Mountains), and in west Tennessee. In west Tennessee, these are generally considered to reflect natural pH fluctuations, including the influence of groundwater. Along the Cumberland Plateau and Cumberland Mountains, the possible influence of historical mining activities cannot be ruled out.

Temperature - Temperature values did not exceed the 30.5°C standard at any reference stream. However, one observation in a stream in subecoregion 71i (Inner Nashville Basin) equaled the standard. 71i streams commonly have flat bedrock substrates and reduced flows. It is not uncommon for summertime water temperatures to be elevated in these streams.

Tables 14 through 21 present summary statistics for chemical, physical and bacteriological data for each Level III ecoregion. Raw water quality data are presented in Appendix F.   (Due to publication considerations, not all copies of this report contain Appendix F. STORET data may be obtained through EPA's webpage.)

ECO71I10, Flat Creek u/s Hazelwood Rd, Marshall Co

Parameter abbreviations in the tables correspond to database fields.

Database Abbreviation	Parameter	Units	Detection Limit
TEMP	Temperature (Field)	Celsius	0
DO	Dissolved Oxygen (Field)	mg/l	0
PH_FIELD	pH (Field)	pH units	0
SPCOND_FLD	Specific Conductivity (Field)	umho	0
SUS_RES	Suspended Residue	mg/l	10
DISS_RES	Dissolved Residue	mg/l	10
TURBIDITY	Turbidity	NTU	0.1
TOT_ALK	Total Alkalinity	mg/l	1
TOT_HRD	Total Hardness	mg/l	1
AMM_N	Ammonia	mg/l	0.02
NO2_3	Nitrates and Nitrites	mg/l	0.01
TOT_K_N	Total Kjeldahl Nitrogen	mg/l	0.10
TOT_PHOS	Total Phosphate	mg/l	0.004
TOC	Total Organic Carbon	mg/l	1
T_COLOR	True Color	PtCo units	3
A_COLOR	Apparent Color	PtCo units	3
ARSENIC	Arsenic	ug/l	1
CADMIUM	Cadmium	ug/l	1
TOT_CHROM	Total Chromium	ug/l	1
COPPER	Copper	ug/l	1
IRON	Iron	ug/l	25
LEAD	Lead	ug/l	1
MANGANESE	Manganese	ug/l	5
ZINC	Zinc	ug/l	1
FEC_COL	Fecal Coliform	CFU/100 ml	0
E_COL	E. Coliform	CFU/100 ml	0
ENTERO	Enterococcus	CFU/100 ml	0

Table 14: Descriptive Statistics of Chemical and Physical Data, Ecoregion 65 Reference Sites, Tennessee, 1996 - 1999.

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	14.765	5.506	.457	145	2.250	29.640	14.230
DO	9.269	1.945	.162	144	3.100	18.600	9.380
PH_FIELD	6.817	.496	.041	146	5.400	7.860	6.760
SPCOND_FLD	42.302	32.502	2.699	145	10.140	198.000	32.000
SUS_RES	39.075	353.865	27.975	160	5.000	4480.000	5.000
DISS_RES	37.369	29.165	2.306	160	5.000	160.000	29.000
TURBIDITY	22.711	142.601	11.309	159	.400	1800.000	8.900
TOT_ALK	11.808	10.214	.808	160	1.000	53.000	10.000
TOT_HRD	13.931	13.769	1.089	160	.500	66.000	9.000
AMM_N	.012	.008	.001	159	.010	.080	.010
NO2_3	.163	.185	.015	160	.010	2.130	.150
TOT_K_N	.081	.072	.006	152	.050	.490	.050
TOT_PHOS	.028	.049	.004	160	.002	.500	.010
TOC	3.340	11.652	.936	155	.180	143.000	1.690
T_COLO0	40.750	34.479	4.607	56	4.000	120.000	39.000
A_COLOR	60.482	48.039	6.419	56	6.000	180.000	61.000
ARSENIC	.953	1.570	.124	160	.500	19.000	.500
CADMIUM	.516	.087	.007	160	.500	1.000	.500
TOT_CHROM	1.299	5.417	.430	159	.500	68.000	.500
COPPER	1.094	2.348	.186	160	.500	28.000	.500
IRON	1549.124	5457.799	435.580	157	0.000	67700.000	1090.000
LEAD	1.341	4.662	.369	160	0.000	57.000	.500
MANGANESE	136.066	182.100	14.396	160	1.000	1810.000	114.000
ZINC	3.995	12.611	1.146	121	.500	138.000	1.900

Table 14a: Bacteriological Data, Ecoregion 65 Reference Sites, Tennessee 1996-1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Geom. Mean	Median
FEC_COL	217.1	319.6	25.7	155	0.0	1960.0	90.5	120.0
E_COLI	161.4	392.8	55.5	50	0.0	2419.2	13.8	67.6
ENTERO	33.4	208.1	33.3	39	0.0	1299.7	0.0	0.0

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Table 15: Descriptive Statistics of Chemical and Physical Data, Ecoregion 66 Reference Sites, Tennessee, 1996 – 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	11.673	5.490	.444	153	1.010	24.720	11.600
DO	10.311	1.703	.138	152	7.740	16.600	10.065
PH_FIELD	7.284	.706	.058	149	3.610	9.230	7.240
SPCOND_FLD	33.854	26.126	2.133	150	9.000	145.000	27.000
SUS_RES	5.506	3.695	.289	164	5.000	49.000	5.000
DISS_RES	26.957	17.567	1.372	164	5.000	126.000	22.000
TURBIDITY	1.503	2.079	.163	163	.100	15.000	.900
TOT_ALK	13.164	16.627	1.306	162	3.000	108.000	8.000
TOT_HRD	17.320	21.822	1.704	164	.500	211.000	12.000
AMM_N	.011	.009	.001	164	.010	.120	.010
NO2_3	.168	.154	.012	164	.005	1.470	.160
TOT_K_N	.055	.021	.002	160	.050	.240	.050
TOT_PHOS	.010	.033	.003	163	.002	.400	.005
TOC	1.856	2.291	.184	155	.500	19.800	1.400
T_COLOR	10.377	7.971	1.056	57	1.500	40.000	10.000
A_COLOR	17.416	11.516	1.525	57	1.500	50.000	13.000
ARSENIC	.510	.069	.005	157	.500	1.000	.500
CADMIUM	.500	0.000	0.000	158	.500	.500	.500
TOT_CHROM	.529	.287	.023	154	.500	4.000	.500
COPPER	.942	1.571	.134	137	.500	12.000	.500
IRON	95.121	138.628	11.207	153	12.500	944.000	50.000
LEAD	.513	.080	.006	155	.500	1.000	.500
MANGANESE	7.745	9.306	.752	153	2.500	63.000	5.000
ZINC	3.686	4.272	.334	164	.500	34.000	2.000

Table 15a: Bacteriological Data, Ecoregion 66 Reference Sites, Tennessee 1996-1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Geom. Mean	Median
FEC_COL	122.6	778.2	61.5	160	0.0	8400.0	3.6	8.0
E_COLI	5.7	10.3	1.4	58	0.0	40.0	.2	0.0
ENTERO	3.8	26.3	3.5	57	0.0	199.0	0.0	0.0

Table 16: Descriptive Statistics of Chemical and Physical Data, Ecoregion 67 Reference Sites, Tennessee, 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	11.631	5.287	.471	126	3.000	24.260	9.890
DO	10.643	1.641	.146	126	5.560	15.420	10.710
PH_FIELD	7.941	.470	.042	124	4.750	8.890	8.005
SPCOND_FLD	275.450	134.690	12.245	121	32.500	699.000	251.000
SUS_RES	6.116	4.686	.413	129	5.000	38.000	5.000
DISS_RES	168.460	86.755	7.791	124	15.000	409.000	157.500
TURBIDITY	6.233	9.379	.832	127	.200	65.000	4.000
TOT_HRD	176.171	108.774	9.540	130	10.000	899.400	164.500
AMM_N	.012	.007	.001	130	.010	.060	.010
TOT_ALK	132.426	53.213	4.685	129	1.000	236.000	140.000
NO2_3	.610	.478	.042	130	.005	2.270	.525
TOT_K_N	.087	.128	.011	129	.050	1.000	.050
TOT_PHOS	.047	.265	.023	130	.002	3.000	.008
TOC	3.183	4.891	.436	126	.500	28.700	1.915
T_COLOR	20.947	21.310	2.823	57	3.000	148.000	17.000
A_COLOR	40.161	46.212	6.175	56	3.000	332.000	30.000
ARSENIC	.508	.063	.006	125	.500	1.000	.500
CADMIUM	.500	0.000	0.000	130	.500	.500	.500
TOT_CHROM	.554	.371	.034	120	.500	4.000	.500
COPPER	1.780	2.507	.242	107	.500	11.000	.500
IRON	222.685	343.507	30.848	124	12.500	2300.000	114.000
LEAD	.508	.065	.006	119	.500	1.000	.500
MANGANESE	19.887	19.458	1.747	124	2.500	104.000	14.000
ZINC	6.198	14.346	1.263	129	.500	158.000	4.000

Table 16a: Bacteriological Data, Ecoregion 67 Reference Sites, Tennessee 1996-1999

	Mean	Std. Dev.	Std. Error	Count	Mini...	Maxi...	Geom. Mean	Median
FEC_COL	452.4	1123.3	98.5	130	0.0	6700.0	107.2	132.0
E_COLI	222.0	397.1	52.6	57	0.0	2419.0	32.0	82.0
ENTERO	64.3	297.9	40.2	55	0.0	1733.0	.5	2.0

Table 17: Descriptive Statistics of Chemical and Physical Data, Ecoregion 68 Reference Sites, Tennessee, 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	12.027	5.029	.409	151	.940	24.300	11.400
DO	9.929	1.868	.152	150	5.000	14.920	10.195
PH_FIELD	7.053	.965	.079	148	4.000	8.750	7.295
SPCOND_FLD	88.805	74.996	6.103	151	10.400	315.000	52.000
SUS_RES	5.617	3.862	.311	154	1.000	40.000	5.000
DISS_RES	60.000	44.853	3.603	155	5.000	181.000	48.000
TURBIDITY	2.297	2.562	.206	155	.050	18.000	1.470
TOT_ALK	38.226	40.306	3.347	145	1.040	147.000	15.000
TOT_HRD	52.812	45.489	3.654	155	.500	177.000	31.830
AMM_N	.011	.005	0.000	155	.010	.050	.010
NO2_3	.142	.136	.011	155	.005	.890	.100
TOT_K_N	.055	.037	.003	155	.050	.460	.050
TOT_PHOS	.016	.044	.004	155	.002	.400	.005
TOC	1.927	1.838	.154	142	.500	16.800	1.740
T_COLO0	9.661	8.962	1.147	61	1.500	37.000	7.000
A_COLOR	14.693	13.066	1.659	62	1.500	60.000	11.500
ARSENIC	.554	.211	.017	149	.500	2.000	.500
CADMIUM	.503	.040	.003	154	.500	1.000	.500
COPPER	1.184	1.717	.145	141	.500	10.000	.500
IRON	114.191	116.278	9.526	149	12.500	854.000	88.000
TOT_CHROM	.523	.145	.012	151	.500	2.000	.500
LEAD	.726	.858	.071	148	.500	7.000	.500
MANGANESE	18.037	39.808	3.261	149	2.500	467.000	10.000
ZINC	4.174	5.049	.414	149	.500	28.000	2.000

Table 17a: Bacteriological Data, Ecoregion 68 Reference Sites, Tennessee 1996-1999

	Mean	Std. D...	Std. Err...	Count	Mini...	Maxim...	Geom. M...	Median
FEC_C...	613.0	2563.0	206.5	154	0.0	17200.0	19.7	26.0
E_COLI	42.4	185.0	23.7	61	0.0	1400.0	.7	2.0
ENTERO	37.7	207.0	24.6	71	0.0	1700.0	.1	0.0

Table 18: Descriptive Statistics of Chemical and Physical Data, Ecoregion 69 Reference Sites, Tennessee, 1996 - 1999.

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	12.474	5.652	.755	56	3.190	20.900	13.120
DO	9.951	2.044	.278	54	1.930	13.450	9.880
PH_FIELD	7.003	.614	.089	48	5.260	8.230	6.990
SPCOND_FLD	92.073	91.881	12.278	56	20.000	470.000	49.000
SUS_RES	5.000	0.000	0.000	56	5.000	5.000	5.000
DISS_RES	59.339	69.856	9.335	56	10.000	393.000	34.500
TURBIDITY	2.906	3.851	.515	56	.050	23.900	1.600
TOT_ALK	20.607	21.085	2.818	56	3.000	107.000	12.000
TOT_HRD	45.689	53.841	7.195	56	4.000	304.000	24.050
NO2_3	.118	.135	.018	54	.010	.790	.080
AMM_N	.010	0.000	0.000	56	.010	.010	.010
TOT_K_N	.051	.008	.001	56	.050	.110	.050
TOT_PHOS	.009	.020	.003	56	.002	.140	.002
TOC	1.786	1.189	.160	55	.500	5.140	1.520
T_COLO0	18.704	31.415	6.046	27	3.000	160.000	10.000
A_COLOR	29.370	41.565	7.999	27	3.000	212.000	17.000
ARSENIC	.500	0.000	0.000	53	.500	.500	.500
CADMIUM	.500	0.000	0.000	56	.500	.500	.500
TOT_CHROM	.500	0.000	0.000	56	.500	.500	.500
COPPER	1.170	2.386	.328	53	.500	12.000	.500
IRON	240.589	453.579	60.612	56	12.500	1800.000	41.000
LEAD	.575	.484	.067	53	.500	4.000	.500
MANGANESE	12.170	14.241	1.903	56	2.500	59.000	6.000
ZINC	3.884	5.124	.685	56	.500	29.000	2.000

Table 18a: Bacteriological Data, Ecoregion 69 Reference Sites, Tennessee 1996-1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Geom. Mean	Median
FEC_COL	35.5	75.7	10.1	56	0.0	510.0	5.3	10.0
E_COLI	18.2	39.5	7.6	27	0.0	172.0	.7	1.0
ENTERO	.8	2.5	.5	27	0.0	11.0	0.0	0.0

Table 19: Descriptive Statistics of Chemical and Physical Data, Ecoregion 71 Reference Sites, Tennessee, 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	14.844	4.677	.273	293	3.000	30.480	14.030
DO	9.938	1.966	.116	287	3.800	26.000	10.020
PH_FIELD	7.738	.501	.029	290	5.650	8.940	7.760
SPCOND_FLD	241.642	138.775	8.121	292	27.000	650.000	235.500
SUS_RES	6.925	8.395	.489	295	5.000	96.000	5.000
DISS_RES	141.712	81.678	4.756	295	5.000	380.000	135.000
TURBIDITY	3.319	10.639	.618	296	.170	177.000	1.665
TOT_ALK	108.157	71.297	4.158	294	11.100	711.000	104.500
TOT_HRD	130.516	67.499	3.923	296	9.610	314.000	128.000
AMM_N	.035	.344	.020	296	.010	5.890	.010
NO2_3	.691	.851	.050	294	.010	4.110	.350
TOT_K_N	.130	.803	.047	296	.050	13.700	.050
TOT_PHOS	.077	.543	.032	295	.002	8.860	.019
TOC	1.975	1.795	.106	287	.500	20.800	1.610
T_COLOR	4.856	5.377	.549	96	1.500	31.300	1.500
A_COLOR	6.674	7.098	.724	96	1.500	39.800	3.525
ARSENIC	.656	.334	.019	295	.500	3.000	.500
CADMIUM	.527	.281	.016	296	.500	5.000	.500
TOT_CHROM	.615	.560	.033	295	.500	6.000	.500
COPPER	1.873	2.494	.145	295	.500	27.000	1.000
IRON	140.611	171.723	10.101	289	12.500	1540.000	87.000
LEAD	.914	1.334	.078	296	.500	12.000	.500
ZINC	1.628	3.240	.189	293	.500	26.000	.500
MANGANESE	18.068	24.265	1.410	296	2.500	199.000	10.000

Table 19a: Bacteriological Data, Ecoregion 71 Reference Sites, Tennessee 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Geom. Mean	Median
FEC_COL	360.0	1002.4	59.9	280	1.0	13000.0	82.3	77.0
E_COLI	195.6	426.1	44.7	91	0.0	2400.0	24.6	46.0
ENTERO	33.1	237.3	23.4	103	0.0	2400.0	.3	1.0

Table 20: Descriptive Statistics of Chemical and Physical Data, Ecoregion 73 Reference Sites, Tennessee, 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	20.262	5.711	1.246	21	10.830	27.500	22.640
DO	4.081	1.926	.420	21	1.640	10.130	3.640
PH_FIELD	7.056	.660	.144	21	4.850	8.550	7.000
SPCOND_FLD	344.500	135.239	30.240	20	191.000	680.000	311.000
SUS_RES	43.826	73.139	15.250	23	5.000	368.000	23.000
DISS_RES	208.217	86.828	18.105	23	63.000	397.000	192.000
TURBIDITY	30.310	48.529	10.346	22	5.500	243.000	19.000
TOT_ALK	165.565	82.538	17.210	23	53.000	350.000	139.000
TOT_HRD	169.957	81.701	17.036	23	56.000	349.000	146.000
AMM_N	.146	.187	.039	23	.010	.620	.080
NO2_3	.223	.372	.078	23	.005	1.840	.100
TOT_K_N	.512	.338	.071	23	.050	1.470	.440
TOT_PHOS	.170	.200	.043	22	.007	1.000	.135
TOC	6.064	2.106	.460	21	2.000	10.000	6.000
T_COLOR	58.177	74.851	20.760	13	7.000	280.000	30.000
A_COLOR	245.792	399.259	110.735	13	13.400	1540.000	140.000
ARSENIC	4.364	3.768	.803	22	.500	17.000	4.000
CADMIUM	.543	.144	.030	23	.500	1.000	.500
TOT_CHROM	1.341	1.978	.422	22	.500	7.000	.500
COPPER	2.543	2.820	.588	23	.500	13.000	1.000
IRON	2419.579	2526.734	579.672	19	323.000	10400.000	1610.000
LEAD	1.565	2.488	.519	23	.500	12.000	.500
MANGANESE	512.895	230.587	52.900	19	153.000	1080.000	528.000
ZINC	6.978	9.361	1.952	23	.500	47.000	5.000

Table 20a: Bacteriological Data, Ecoregion 73 Reference Sites, Tennessee 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Mini...	Maxi...	Geom. Mean	Median
FEC_COL	70.0	62.8	13.1	23	7.0	260.0	48.0	52.0
E_COLI	61.3	43.4	12.0	13	0.0	178.2	29.8	49.0
ENTERO	56.9	90.9	28.7	10	2.0	291.0	16.4	7.2

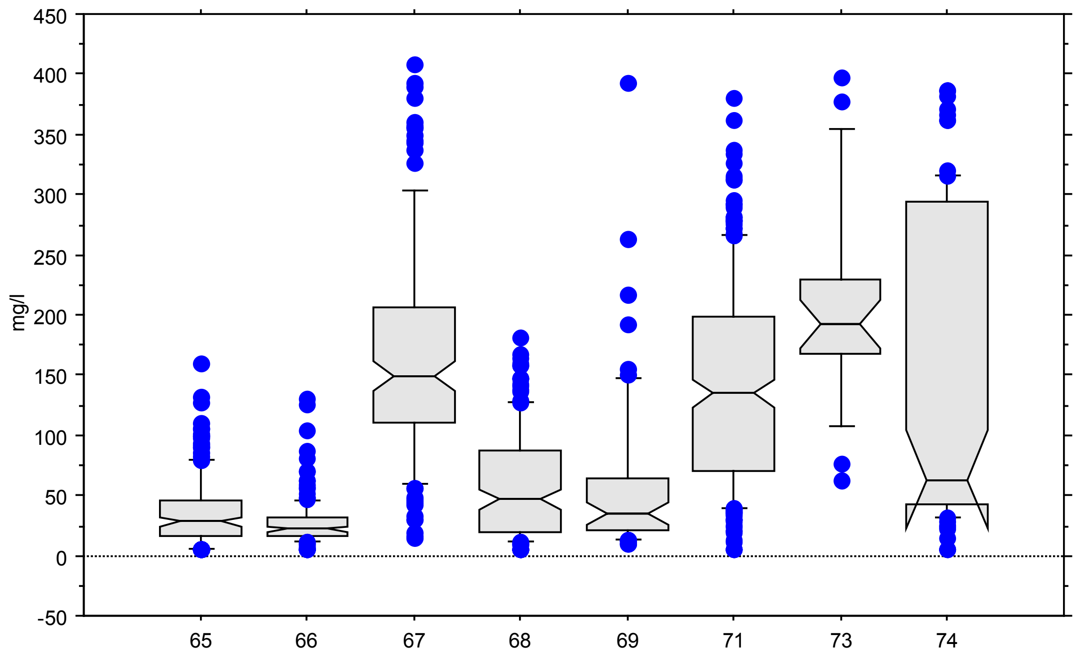
Table 21: Descriptive Statistics of Chemical and Physical Data, Ecoregion 74 Reference Sites, Tennessee, 1996 - 1999

	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
TEMP	14.747	5.525	.579	91	5.890	25.020	14.480
DO	9.399	1.768	.185	91	2.740	12.400	9.350
PH_FIELD	7.194	.702	.075	88	5.750	8.340	7.310
SPCOND_FLD	196.112	216.425	22.813	90	10.500	710.000	62.800
SUS_RES	12.096	20.619	2.127	94	5.000	166.000	5.000
DISS_RES	152.170	130.273	13.437	94	0.000	387.000	59.500
TURBIDITY	18.598	88.756	9.204	93	.100	860.000	7.000
TOT_ALK	129.424	135.106	13.935	94	.500	384.400	17.000
TOT_HRD	133.976	139.251	14.363	94	.500	393.000	21.000
AMM_N	.018	.037	.004	94	.010	.310	.010
NO2_3	.292	.382	.040	93	.005	1.610	.160
TOT_K_N	.098	.133	.014	91	.050	.850	.050
TOT_PHOS	.083	.163	.017	94	.002	1.400	.040
TOC	4.609	10.708	1.110	93	.500	64.900	2.160
T_COLOR	24.906	23.508	3.974	35	1.500	90.000	21.000
A_COLOR	42.729	41.056	6.940	35	1.500	170.000	33.000
ARSENIC	1.184	1.183	.121	95	.500	9.000	1.000
CADMIUM	.532	.176	.018	95	.500	2.000	.500
TOT_CHROM	.882	1.457	.151	93	.500	13.000	.500
COPPER	1.416	2.008	.206	95	.500	12.000	.500
IRON	863.860	1019.319	109.916	86	12.500	5700.000	663.500
LEAD	1.116	1.170	.120	95	.500	7.000	.500
MANGANESE	174.400	183.103	19.860	85	2.500	1610.000	144.000
ZINC	4.271	4.501	.488	85	.500	28.000	3.000

Table 21a: Bacteriological Data, Ecoregion 74 Reference Sites, Tennessee 1996 - 1999

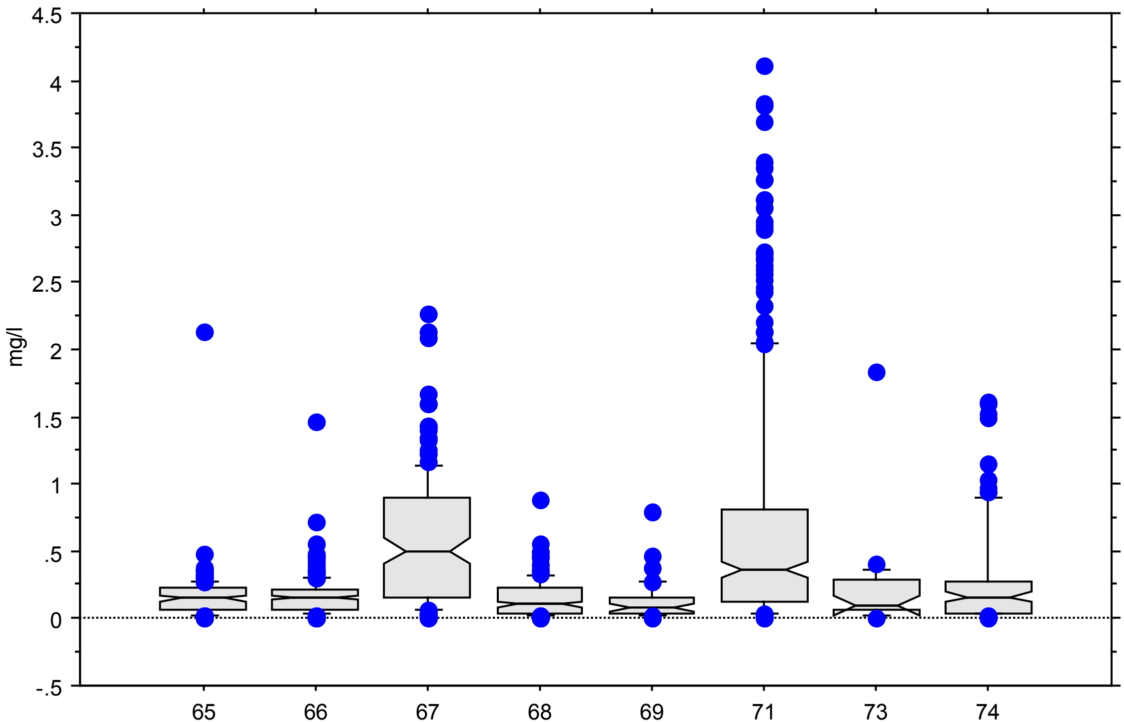
	Mean	Std. Dev.	Std. Error	Count	Mini...	Maxi...	Geom. Mean	Median
FEC_COL	358.5	982.5	103.0	91	1.0	8100.0	125.3	120.0
E_COLI	277.6	449.4	78.2	33	0.0	2419.0	110.4	123.6
ENTERO	122.7	328.9	59.1	31	0.0	1553.0	.6	0.0

Figure 26: Dissolved Residue Levels by Ecoregion, April 1996 - November 1999, Tennessee



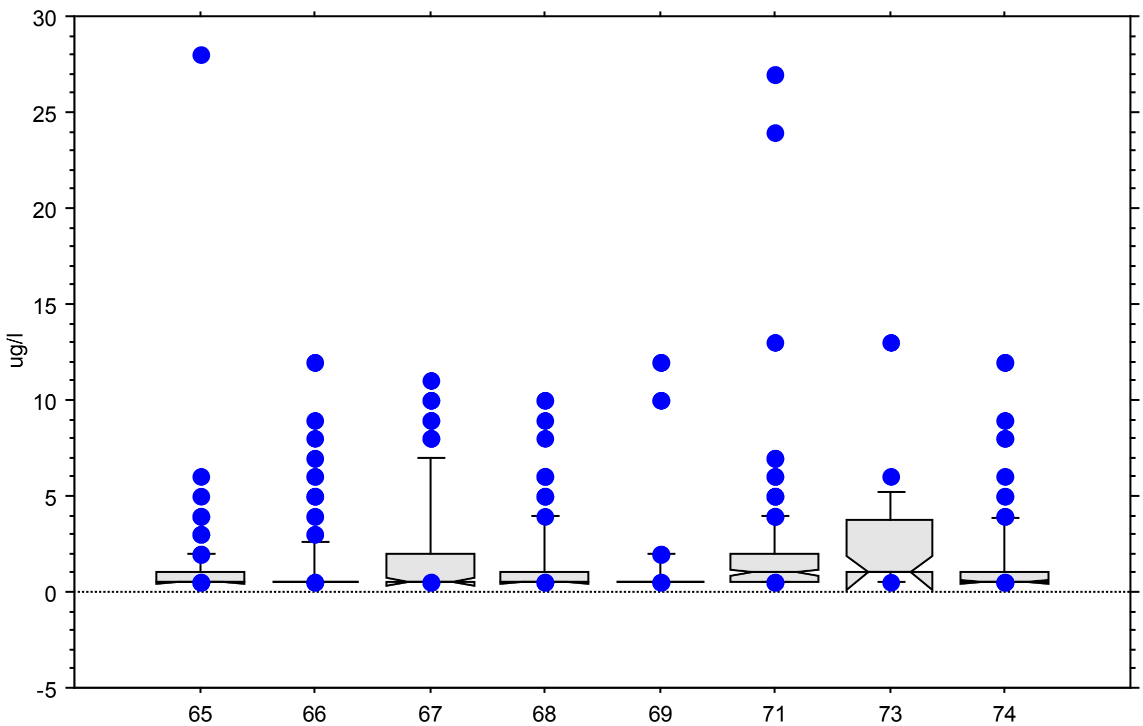
	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
DISS_RES, Total	97.8	90.8	2.7	1114	5.0	409.0	60.0
DISS_RES, 65	36.7	28.9	2.2	167	5.0	160.0	28.0
DISS_RES, 66	27.4	19.0	1.5	171	5.0	131.0	22.0
DISS_RES, 67	166.7	88.6	7.6	135	15.0	409.0	149.0
DISS_RES, 68	59.9	44.7	3.5	162	5.0	181.0	47.0
DISS_RES, 69	59.3	69.9	9.3	56	10.0	393.0	34.5
DISS_RES, 71	141.7	80.9	4.6	305	5.0	380.0	135.0
DISS_RES, 73	208.2	86.8	18.1	23	63.0	397.0	192.0
DISS_RES, 74	153.1	129.8	13.3	95	5.0	387.0	63.0

Figure 27: NO2 & NO3 Levels by Ecoregion, April 1996 - November 1999, Tennessee



	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
NO2_3, Total	.372	.563	.017	1116	.005	4.110	.180
NO2_3, 65	.161	.182	.014	167	.010	2.130	.150
NO2_3, 66	.167	.152	.012	170	.005	1.470	.160
NO2_3, 67	.591	.471	.039	142	.005	2.270	.500
NO2_3, 68	.147	.140	.011	162	.005	.890	.105
NO2_3, 69	.118	.135	.018	54	.010	.790	.080
NO2_3, 71	.702	.860	.049	304	.005	4.110	.360
NO2_3, 73	.223	.372	.078	23	.005	1.840	.100
NO2_3, 74	.293	.380	.039	94	.005	1.610	.160

Figure 28 Copper Levels by Ecoregion, April 1996 - November 1999, Tennessee



	Mean	Std. Dev.	Std. Error	Count	Minimum	Maximum	Median
COPPER, Total	1.52	2.33	.07	1041	.50	28.00	.50
COPPER, 65	1.08	2.30	.18	167	.50	28.00	.50
COPPER, 66	1.07	1.79	.15	139	.50	12.00	.50
COPPER, 67	2.09	2.85	.27	115	.50	11.00	.50
COPPER, 68	1.32	1.90	.16	145	.50	10.00	.50
COPPER, 69	1.17	2.39	.33	53	.50	12.00	.50
COPPER, 71	1.87	2.46	.14	303	.50	27.00	1.00
COPPER, 73	2.54	2.82	.59	23	.50	13.00	1.00
COPPER, 74	1.41	2.00	.20	96	.50	12.00	.50

Figure 29: Nitrate & Nitrite Levels for Ecoregion 71, April 1996 - November 1999, Tennessee

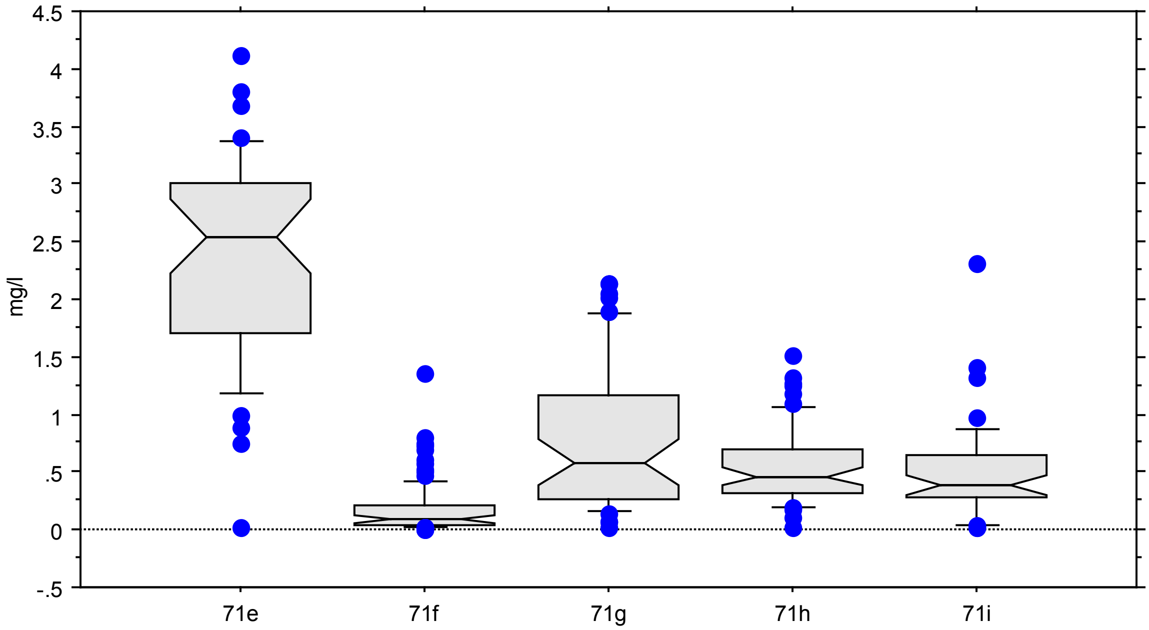
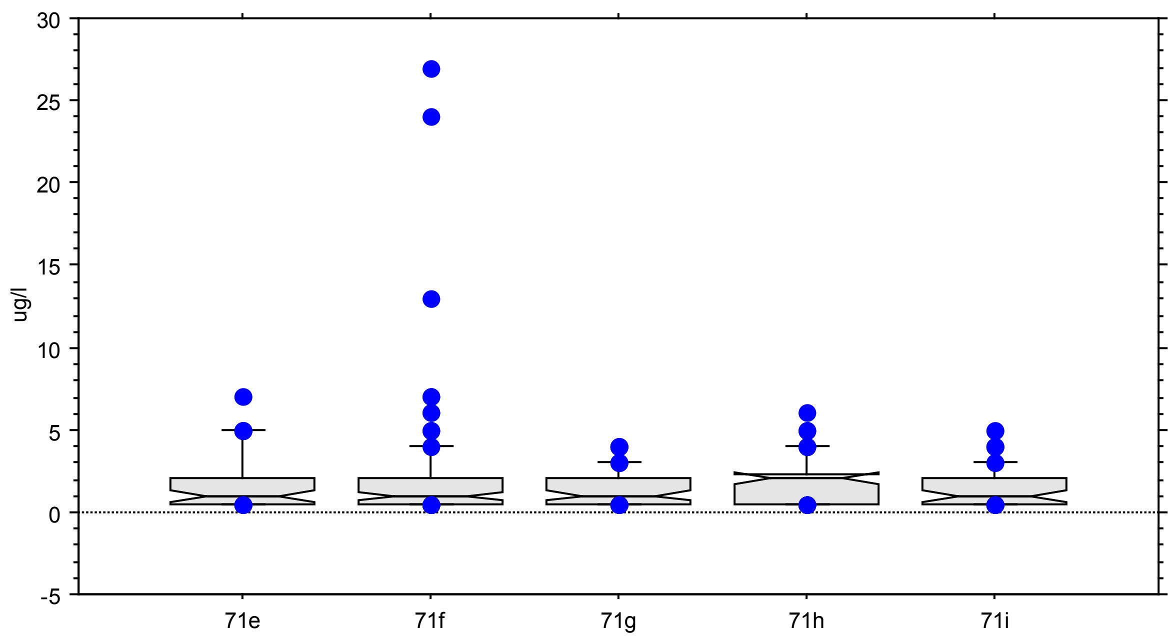


Figure 30: Copper Levels for Ecoregion 71, April 1996 - November 1999, Tennessee



4 CONCLUSIONS

Tennessee's eight Level III ecoregions have been delineated into 25 level IV subregions. Preliminary analyses of reference streams indicate that all eight ecoregions and at least six subregions have unique macroinvertebrate populations. The six subregions that appear to have distinct macroinvertebrate communities are 65i (Fall Line Hills), 65j (Transition Hills), 67g (Southern Shale Valleys), 68a (Cumberland Plateau), 71i (Inner Nashville Basin) and 74b (Bluff Hills). These subregions will probably warrant different stream condition index ranges to determine macroinvertebrate community health. Other regions appear to have similar macroinvertebrate communities and can probably be combined for assessment purposes.

Using the preliminary TSCI, three subregions, 65i (Fall Line Hills), 73a (Northern Mississippi Alluvial Plain) and 74a (Bluff Hills) fell in the third quartile (poor category). Further analysis as well as comparisons to reference streams in other states is necessary to determine whether the streams selected in these regions are the best attainable in the subregion.

Habitat assessment scores varied between many subregions. Variations were sometimes due to a lack of suitable reference quality streams, especially in the smaller subregions. Good habitat is critical to a healthy macroinvertebrate community. Habitat alteration is clearly an important reason for loss of use support in streams. Currently, Tennessee does not have a narrative or numeric criteria that establishes a goal for habitat quality. However, habitat alteration is specifically mentioned in the narrative criteria for biological integrity.

The results of the reference stream sampling indicate that the reasonable expectation for habitat scores should vary across the state. Thus, ecoregion or subregion specific criteria would be more accurate and meaningful than a statewide criteria. The data collected at the reference streams could be used to create such criteria. One potential impediment to acceptance of such a criteria would be the perception that habitat scoring is more subjective than other types of chemical or biological analyses.

Most subregions were not collected in close enough windows to determine whether there was significant seasonal variation. Although different macroinvertebrate taxa would be expected in different seasons, the stream condition index may not vary significantly since the overall community structure would remain stable. A single expected range for each metric that could be used year round would be preferable. In order to determine if there is seasonal variation, additional samples in a tighter time of collection (6 weeks) within each subregions would be necessary. Ten of the 25 subregions were collected within 6 week (42 day windows) for both summer and spring samples. They are primarily in the smaller subregions. Of the ten subregions sampled within seasonal windows, five of them showed a possibly significant difference in TSCI scores between the summer and spring sample periods. If seasonal ranges are not refined, a single broad index scale will be used to evaluate both spring and summer macroinvertebrate assemblages.

As with habitat and macroinvertebrate data, many water quality parameters varied between Level III ecoregions. For example, dissolved residue levels were highest in ecoregions 67 (Ridge and Valley), 71 (Interior Plateau), 73 (Mississippi Alluvial Plain) and 74 (Mississippi Valley Loess Plains). Nitrate and nitrite levels were also highest in ecoregions 67 and 71, while 73 and 74 were comparable to the other ecoregions. Of the metals, copper was the most variable between ecoregions.

Some water quality parameters were significantly different between Level IV subregions while others were not. Within the five subregions of the Interior Plateau (71), combined nitrate and nitrite levels varied significantly. The Western Pennyroyal Karst subregion (71e) had the highest levels while the Western Highland Rim (71f) had the lowest. Other parameters, such as copper, were consistent between subregions in the Interior Plateau.

The results of the reference stream sampling do not provide a rationale for the consideration of ecoregion specific criteria for the following substances since there was little or no variation between subregions:

Lead	Manganese	Arsenic
Copper	Iron	Cadmium
Chromium	Zinc	Ammonia

For multiple additional substances, while there is little justification to consider ecoregion-specific criteria revisions at this time, the Division should consider the patterns of violations of water quality standards at reference streams while assessing use support in other similar streams within the same subecoregions. (The reader should note that this ability to use judgement in considering the "magnitude and duration" of water quality violations is specifically given to the Division in Chapter 1200-4-3.05.) These substances are:

Dissolved oxygen	Fecal coliform	pH
Temperature	*E. coli*	

Reference stream data could and perhaps should be used to create regional interpretations for the following substances for which Tennessee currently only has narrative criteria:

Nitrate+Nitrite	Total nitrogen	Suspended residue
Total phosphorus	Turbidity	True color

Additional analysis will be necessary before specific criteria recommendations are possible. This work will be the subject of future reports.

5 Future Goals

The purpose of this report was to summarize data generated during the three year ecoregion delineation and reference stream selection study. A series of additional documents will be produced which will contain more detailed analyses and interpretation, especially for those substances for which the Division will propose ecoregion specific water quality criteria. These documents will also include data collected at reference sites after the end of the three year study in 1999.

The next phase of macroinvertebrate analyses will be to develop numeric biocriteria for unique subregions and will be presented in the next report. The objectives will be to:

1. Compare individual stations within subregions both by macroinvertebrate and chemical composition to determine if they are reference quality.

2. Determine which subregions need additional or better quality streams to have enough data for biocriteria determination.

3. Compare subregions to determine which ones have unique macroinvertebrate communities.

4. Review preliminary core metrics to determine if they are the most sensitive to differences in the macroinvertebrate communities across the state.

5. Determine appropriate metric scores for each subregion.

6. Calibrate reference metrics by comparison to impaired streams in each subregion.

Habitat scores also varied significantly between many subregions. Currently, Tennessee does not have a narrative or numeric criteria that establishes a goal for habitat quality. Since good habitat is critical to the macroinvertebrate community, the Division will also consider development of habitat goals.

The results of the reference stream sampling indicate that the reasonable expectation for habitat scores should vary across the state. Thus, ecoregion or subregion specific criteria would be more accurate and meaningful than a statewide criteria. The data collected at the reference streams could be used to create such criteria. One potential impediment to acceptance of such a criteria would be the perception that habitat scoring is more subjective than other types of chemical or biological analyses.

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APPENDIX A

Physical Characteristics of Level III and Level IV Ecoregions in Tennessee

Adapted from Griffith et al. 1997 Ecoregions of Tennessee EPA/600/R-97/022

LEVEL III ECOREGIONS

Ecoregion 65. Southeastern Plains

These irregular plains are a mosaic of cropland, pasture, woodland, and oak-hickory-pine forest. The Cretaceous or Tertiary -age sands, silts and clays of the region contrast geologically with the older limestone, chert, and shale found in the Interior Plateau (71). Elevations and relief are greater than the loess plains of Ecoregion 74 to the west, but generally less than the Interior Plateau (71) to the east. Streams in this area are relatively low-gradient and sandy-bottomed.

Ecoregion 66 Blue Ridge Mountains

The Blue Ridge Mountains of Tennessee are characterized by forested slopes, and cool, clear high gradient streams. The rugged terrain is a mix of igneous, metamorphic, and sedimentary geology. Annual precipitation of nearly 80 inches can occur on the well - exposed high peaks of the Great Smoky Mountains that reach over 6000 feet. The southern Blue Ridge is one of the richest centers of biodiversity in the eastern U.S. It is the most floristically diverse ecoregion of the state, and includes Appalachian oak forests, northern hardwoods, and Southeastern spruce-fir forests. Shrub, grass, and heath balds, hemlock, cove hardwoods, and oak-pine communities are also significant.

Ecoregion 67 Ridge and Valley

Also known as the Great Valley of East Tennessee, this is a relatively low-lying region between the Blue Ridge Mountains to the east and the Cumberland Plateau on the west. As a result of extreme folding and faulting events, the roughly parallel ridges and valleys come in a variety of widths and heights. Geologic materials include limestone, dolomite, shale, siltstone, sandstone, chert, mudstone, and marble. Springs and caves are relatively numerous. Present-day forests cover about 50% of the region. The ecoregion has great aquatic habitat diversity in Tennessee and supports a diverse fish fauna rivaled only by that of the Highland Rim.

Ecoregion 68 Southwestern Appalachians

Stretching from Kentucky to Alabama, these open low mountains contain a mosaic of forest and woodland with some cropland and pasture. The eastern boundary of the ecoregion in Tennessee, along the more abrupt escarpment where it meets the Ridge and Valley (67), is relatively smooth and only slightly notched by small eastward flowing stream drainages. The western boundary, next to the Interior Plateau's Eastern Highland Rim (71g), is more crenulated with a rougher escarpment that is more deeply incised. The mixed mesophytic forest is restricted mostly to the deeper ravines and escarpment slopes. The upland forests are dominated by mixed oaks and short leaf pine.

Ecoregion 69 Central Appalachians

The Central Appalachian ecoregion, stretching from northern Tennessee to central Pennsylvania, is primarily a high dissected plateau composed of sandstone, shale, conglomerate, and coal. The rugged terrain, cool climate, and infertile soils limit agriculture resulting in a mostly forested landcover. The high hills and low mountains are covered by a mixed mesophytic forest with areas of Appalachian oak and northern hardwoods. Bituminous coal mines are common, and have caused siltation and acidification of streams.

Ecoregion 71 Interior Plateau

The Interior Plateau is a diverse ecoregion extending from southern Indiana and Ohio to northern Alabama. Rock types are distinctly different from the coastal plain sands of western Tennessee ecoregions, and elevations are lower than the Appalachian ecoregions to the east. Mississippian to Ordovician-age limestone, chert, sandstone, siltstone and shale compose the landforms of open hills, irregular plains, and tablelands. The natural vegetation is primarily oak-hickory forest, with some areas of bluestem prarie and cedar glades. The region has the most diverse fish fauna in Tennessee.

Ecoregion 73 Mississippi Alluvial Plain

This riverine ecoregion extends from southern Illinois, at the confluence of the Ohio and Mississippi River, south to the Gulf of Mexico. It is mostly a flat, broad floodplain with river terraces and levees providing the main elements of relief. Regionally, the soils tend to be poorly drained, although locally, some sandy soils have good drainage. Winters are mild and summers are hot, with temperatures and precipitation increasing from north to south. Bottomland deciduous forest vegetation covered the region before clearance for cultivation.

Ecoregion 74 Mississippi Valley Loess Plains

This ecoregion stretches from near the Ohio River in western Kentucky to Louisiana. It consists primarily of irregular plains, with oak-hickory and oak-hickory-pine natural vegetation. Thick loess tends to be the distinguishing characteristic. With flatter topography than the Southeastern plains (65) to the east, streams tend to have less gradient and more silty substrates. In Tennessee, row crops are the dominant land use.

LEVEL IV ECOREGIONS

65a The **Blackland Prairie,** extending north from Mississippi, is a flat to undulating lowland region entirely within a small portion of McNairy County, Tennessee. Although there is some of the Cretaceous-age chalk, marl, and calcareous clay that characterizes the region in Mississippi and Alabama, the northern extent of the Blackland Prairie in Tennessee is not distinct. The natural vegetation was sweetgum, post oak, and red cedar, along with patches of bluestem prairie. Today, the area is mostly in cropland and pasture, with small patches of mixed hardwoods.

65b The **Flatwoods/Alluvial Prairie Margins** extend north from Mississippi, but the distinctiveness of this narrow ecoregion belt fades quickly from Ripley, Mississippi north into Tennessee. In Mississippi and Alabama, this is a transition region between the Blackland Prairie and the more forested plains and hills. Some areas are heavily forested, but the prairie and alluvial areas have significant amounts of cropland and pasture. In Tennessee, the small region stands out as lower, less hilly agricultural land compared to the forested Southeastern Plains and Hills (65e) that surround it.

65e The **Southeastern Plains and Hills** contain several north-south bands of sand and clay formations. Tertiary sand, clay, and lignite are to the west, and Cretaceous fine sand, fossiliferous micaceous sand, and silty clays are to the east. With elevations reaching over 650 feet, and more rolling topography and more relief than the Loess Plains (74b) to the west, streams have increased gradient, generally sandy substrates, and distinctive faunal characteristics for west Tennessee. The natural vegetation is oak-hickory, grading into oak-hickory-pine to the south.

65i **The Fall Line Hills** ecoregion, comprising the Tennessee or Tombigbee Hills in Mississippi and the Fall Line Hills in Alabama, is composed primarily of Cretaceous coastal plain sandy sediments. The sand and chert gravel surficial materials are covered by sandy loam topsoils. It is mostly forested terrain of oak-hickory-pine on open hills with 100-200 feet of relief. Elevations in the small Tennessee portion, roughly between Chambers Creek and Pickwick Lake in Hardin County, are 450-685 feet.

65j **The Transition Hills** have the highest elevations in Ecoregion 65, and contain characteristics of both the Southeastern Plains (65e) and the Interior Plateau (71). Many streams of this transition area have cut down into the Mississippian, Devonian, and Silurian-age rocks and may look similar to those of the Interior Plateau (71). Cretaceous-age coastal plain deposits of silt, sand, clay, and gravel overlie the older limestone, shale, and chert. It is a mostly forested region of oak-hickory-pinewith pine plantations associated with pulp and paper operations.

66d **The Southern Igneous Ridges and Mountains** occur in Tennessee's northeastern Blue Ridge near the North Carolina border, primarily on Precambrian igneous, gneiss, schist, and metavolcanics, covered by well-drained, acidic brown loamy soils. Elevations of this rough, dissected region range from 2000-6200 feet, with Roan Mountain reaching 6286 feet. Although there are a few small areas of pasture and apple orchards, the region is mostly forested. Appalachian oak and northern hardwoods forests predominate.

66e The **Southern Sedimentary Ridges** in Tennessee include some of the westernmost foothill areas of the Blue Ridge Mountains ecoregion, such as Bean, Starr, Chilhowee, English, Stone, Bald, and Iron Mountain. Slopes are steep with elevations of 1000-4500 feet. The rocks are primarily Cambrian-age sedimentary (shale, sandstone, siltstone, quartzite, conglomerate), although some lower stream reaches occur on limestone. Soils are predominantly friable loams and fine sandy loams with variable amounts of sandstone rock fragments. Natural vegetation is mostly mixed oak and oak-pine forests.

66f **Limestone Valleys and Coves** are small but distinct lowland areas of the Blue Ridge, with elevations mostly between 1500 and 2500 feet. About 450 million years ago, older Blue Ridge rocks to the east were forced up and over younger rocks to the west. In places, the Precambrian rocks have eroded through to Cambrian or Ordovician-age limestones, as seen especially in isolated, deep cove areas that are surrounded by steep mountains. The main areas of limestone include the Mountain City lowland area and Shady Valley in the north; and Wear Cove, Tuckaleechee Cove, and Cades Cove of the Great Smoky Mountains in the south. Hay and pasture, with some tobacco patches on small farms, are typical land uses.

66g The **Southern Metasedimentary Mountains** are steep, dissected, biologically-diverse mountains that include Clingmans Dome (6643 feet), the highest point in Tennessee. The Precambrian-age metamorphic and sedimentary geologic materials are generally older and more metamorphosed than the Southern Sedimentary Ridges (66e) to the west and north. The Appalachian oak forests and, at higher elevation, the northern hardwoods include a variety of oaks and pines, as well as silverbell, hemlock, yellow poplar, basswood, buckeye, yellow birch, and beech. The native spruce-fir forest, found generally above 5500 feet, has been affected greatly over the past twenty-five years by the great woolly aphid. The Copper Basin, in the southeast corner of Tennessee, was the site of copper mining and smelting from the 1850's to 1987, and once left more than fifty square miles of eroded bare earth.

67f The **Southern Limestone/Dolomite Valleys and Low Rolling Hills** form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly low rolling ridges and valleys, and the soils vary in their productivity. Landcover includes intensive agriculture, urban and industrial uses, as well as areas of thick forest. White oak forest, bottomland oak forest, and sycamore-ash-elm riparian forests are the common forest types. Grassland barrens intermixed with cedar-pine glades also occur here.

67g The **Southern Shale Valleys** consist of lowlands, rolling valleys, slopes and hilly areas that are dominated by shale materials. The northern areas are associated with Ordovician-age calcareous shale, and the well-drained soils are often slightly acid to neutral. In the south, the shale valleys are associated with Cambrian-age shales that contain some narrow bands of limestone, but the soils tend to be strongly acid. Small farms and rural residences subdivide the land. The steeper slopes are used for pasture or have reverted to brush and forested land, while small fields of hay, corn, tobacco, and garden crops are grown on the foot slopes and bottom land.

67h The **Southern Sandstone Ridges** ecoregion encompasses the major sandstone ridges, but these ridges also have areas of shale and siltstone. The steep, forested ridges have narrow crests with soils that are typically stony, sandy, and of low fertility. The chemistry of streams flowing down the ridges can vary greatly depending on the geological material. The higher elevation ridges are in the north, including Wallen Ridge, Powell Mountain, Clinch Mountain and Bays Mountain. White Oak Mountain in the south has some sandstone on the west side, but abundant shale and limestone as well. Grindstone Mountain, capped by the Gizzard Group sandstone, is the only remnant of Pennsylvanian-age strata in the ridge and valley of Tennessee.

67i The **Southern Dissected Ridges and Knobs** contain more crenulated, broken, or hummocky ridges, compared to the smoother, more sharply pointed sandstone geologic materials. The ridges on the east side of Tennessee's Ridge and Valley tend to be associated with the Ordovician-age Sevier shale, Athens shale, and Holston and Lenoir limestones. These can include calcareous shale, limestone, siltstone, sandstone, and conglomerate. In the central and western part of Ecoregion 67i, the shale ridges are associated with the Cambrian-age Rome Formation: shale and siltstone with beds of sandstone. Chestnut oak forests and pine forests are typical for the higher elevations of the ridges, with areas of white oak, mixed mesophytic forest, and tulip poplar on the lower slopes, knobs, and draws.

68a The **Cumberland Plateau's** tablelands and open low mountains are about 1000 feet higher than the Eastern Highland Rim (71g) to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains (69d) or the Plateau Escarpment (68c). Elevations are generally 1200-2000 feet, with the Crab Orchard Mountains reaching over 3000 feet. Pennsylvanian-age conglomerate, sandstone, siltstone, and shale is covered by well-drained, acid soils of low fertility. The region is forested with some agriculture and coal mining activities.

68b The **Sequatchie Valley** is structurally associated with an anticline, where erosion of broken rock to the south of the Crab Orchard Mountains scooped out the linear valley. The open, rolling, valley floor, 600-1000 feet in elevation, is generally 1000 feet below the top of the Cumberland Plateau. A low, central, cherty ridge separates the west and east valleys of Mississippian to Ordovician-age limestones, dolomites, and shales. Similar to parts of the Ridge and Valley (67), this is an agriculturally productive region, with areas of pasture, hay, soybeans, small grain, corn, and tobacco.

68c The **Plateau Escarpment** is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky streamsides and river birch along floodplain terraces.

69d The **Cumberland Mountains**, in contrast to the sandstone-dominated Cumberland Plateau (68a) to the west and southwest, are more highly dissected, with narrow-crested steep slopes, and younger Pennsylvanian-age shales, sandstones, siltstones, and coal. Narrow, winding valleys separate the mountain ridges, and relief is often 2000 feet. Cross Mountain, west of Lake City, reaches 3534 feet in elevation. Soils are generally well-drained, loamy, and acidic, with low fertility. The natural vegetation is a mixed mesophytic forest, although composition and abundance vary greatly depending on aspect, slope position, and degree of shading from adjacent landmasses. Large tracts of land are owned by lumber and coal companies, and there are many areas of stripmining. Acid mine drainage is primarily limited to first and second order systems. Siltation as surface run-off remains the primary pollutant from past mining, timber harvest and unpaved roads.

71e The **Western Pennyroyal Karst** is a flatter area of irregular plains, with fewer perennial streams compared to the open hills of the Western Highland Rim (71f). Small sinkholes and depressions are common. The productive soils of this highly agricultural area formed mostly from a thin loess mantle over Mississippian-age limestones. Most of the region is cultivated or in pasture. Tobacco and livestock are the principal agricultural products, with some corn, soybeans, and small grains. The natural vegetation consisted of oak-hickory forest with mosaics of bluestem prairie. The barrens of Kentucky that extended south into Stewart, Montgomery, and Robertson counties, were once some of the largest grasslands in Tennessee.

71f The **Western Highland Rim** is characterized by dissected, rolling terrain of open hills, with elevations of 400-1000 feet. The geologic base of Mississippian-age limestone, chert, and shale is covered by soils that tend to be cherty and acidic with low to moderate fertility. Streams are relatively clear with a moderate gradient. Substrates are coarse chert, gravel and sand with areas of bedrock. The native oak-hickory forests were removed over broad areas in the mid-to late 1800's in conjunction with the iron-ore related mining and smelting of the mineral limonite, however today the region is again heavily forested. Some agriculture occurs on the flatter interfluves and in the stream and river valleys. The predominant land uses are hay, pasture, and cattle with some cultivation of corn and tobacco.

71g The **Eastern Highland Rim** has more level terrain than the Western Highland Rim (71f), with landforms characterized as tablelands of moderate relief and irregular plains. Mississippian-age limestone, chert, shale and dolomite predominate. Karst terrain sinkholes and depressions are especially noticeable between Sparta and McMinnville. Numerous springs and spring-associated fish fauna typify the region. Natural vegetation is transitional between the oak-hickory forests to the west and the mixed mesophytic forests of the Appalachian ecoregions (68, 69) to the east. Bottomland hardwoods forests were once abundant in some areas, although much of the original bottomland forest has been inundated by several large impoundments. Barrens and former prairie areas are now primarily oak thickets, pasture or cropland.

71h The **Outer Nashville Basin** is a more heterogeneous region than the Inner Nashville Basin (71I), with rolling and hilly topography with slightly higher elevations. The region encompasses most of the outer areas of the generally non-cherty Ordovician limestone bedrock. The higher hills and knobs are capped by the more cherty Mississippian-age formation, and some Devonian-age Chattanooga shale, remnants of the Highland Rim. The region's limestone rocks and soils are high in phosphorus, and commercial phosphate is mined. Deciduous forest with pasture and cropland are the dominant land covers. The region has areas of intense urban development with the city of Nashville occupying the northwest region. Streams are low to moderate gradient, with productive, nutrient-rich waters, resulting in algae, rooted vegetation, and occasionally high densities of fish. The Nashville Basin has a distinctive fish fauna, notable for fish that avoid the region, as well as those that are present.

71i The **Inner Nashville Basin** is less hilly and lower than the Outer Nashville Basin (71h). Outcrops of the Ordovician-age limestone are common. The generally shallow soils are redder and lower in phosphorous than those of the outer basin. Streams are lower gradient than surrounding regions, often flowing over large expanses of limestone bedrock. The most characteristic hardwoods within the inner basin are a maple-oak-hickory-ash-association. The limestone cedar glades of Tennessee, a unique mixed grassland/forest cedar glades vegetation type with many endemic species, are located primarily on the limestones of the Inner Nashville Basin. The more xeric, open characteristics and shallow soils of the cedar glades also result in a distinct distribution of amphibian and reptile species. Urban, suburban, and industrial land use in the region is increasing.

73a The **Northern Mississippi Alluvial Plain** within Tennessee is a relatively flat region of the Quaternary alluvial deposits of sand, silt, clay, and gravel. It is bounded distinctly on the east by the Bluff Hills (74a), and on the west by the Mississippi River. Average elevations are 200-300 feet with little relief. Most of the region is in cropland, with isolated areas of deciduous forest. Soybeans, cotton, corn, sorghum, and vegetables are the main crops. The natural vegetation consists of Southern floodplain forest (oak, tupelo, bald cypress). The two main distinctions in the Tennessee portion of the ecoregion are between areas of loamy, silty, and sandy soils with better drainage, and areas of more clayey soils of poor drainage that may contain wooded swamp-land and oxbow lakes. Waterfowl, raptors, and migratory songbirds are relatively abundant in the region.

74a The **Bluff Hills** consist of sand, clay, silt, and lignite, and are capped by loess greater than 60 feet deep. The disjunct region in Tennessee encompasses those thick loess areas that are generally the steepest, most dissected, and forested. The carved loess has a mosaic of microenvironments, including dry slopes and ridges, moist slopes, ravines, bottomland areas, and small cypress swamps. While oak-hickory is the general forest type, some of the undisturbed bluff vegetation is rich in mesophytes, such as beech and sugar maple, with similarities to hardwood forests of eastern Tennessee. Smaller streams of the Bluff Hills have localized reaches of increased gradient and small areas of gravel substrate that create aquatic habitats that are distinct from those of the Loess Plains (74b) to the east.

74b The **Loess Plains** are gently rolling, irregular plains, 250-500 feet in elevation, with loess up to 50 feet thick. The region is a productive agricultural area of soybeans cotton, corn, milo, and sorghum crops, along with livestock and poultry. Soil erosion can be a problem on the steeper, upland Alfisol soils. Bottom soils are mostly silty Entisols. Oak-hickory and southern floodplain forests are the natural vegetation types, although most of the forest cover has been removed for cropland. Some less-disturbed bottomland forest and cypress-gum swamp habitats still remain. Several large river systems with wide floodplains; the Obion, Forked Deer, Hatchie, Loosahatchie, and Wolf, cross the region. Streams are low-gradient and murky with silt and sand bottoms. Most of the streams have been channelized.

APPENDIX B

LIST OF CANDIDATE AND FINAL REFERENCE SITES

TENNESSEE CANDIDATE AND FINAL ECOREGION REFERENCE STREAMS

65. SOUTHEASTERN PLAINS

Sites in bold were selected as final reference streams

65a Blackland Prairie					
SITE #	STREAM/LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣65A01 ^^^	**Unnamed trib. to Muddy Cr at Matt Dammonds Rd**	**08010207 Upper Hatchie**	**S. Central Miss. River**	**McNairy**	**Added 9/96**
ECO♣65A02 ^^^	Little Owl Creek at Michie Pebble Hill Road or at Perkins Road (the southern trib.)	06040001 TN Western Valley (Beech)	Tennessee River	McNairy	Poor site, all ditched with extremely unstable banks and no habitat. Too much agriculture in watershed, no bank, riffle or snag habitat.
ECO♣65A03 ^^^	**Wardlow Cr. at Hamburg Rd**	**06040001 TN West. Valley (Beech)**	**Tennessee River**	**McNairy**	**Added 9/96**
ECO♣65A04 xxx	Wardlow Creek at Liberty Rd	06040001 TN Western Valley (Beech)	Tennessee River	McNairy	Good riparian zone and instream habitat, low flow but deep. Appears to be in 65e
ECO♣65A05 ^^^	Little Owl Cr. at Pebble Hill Rd	06040001 TN Western Valley (Beech)	Tennessee River	McNairy	Intensive agriculture, unstable banks, no habitat.

65b Flatwoods/Alluvial Pairie Margins					
SITE #	STREAM/LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣65B01 xxx	Magbee Branch at Lower Serles Road or Pea Vine Road	08010207 Upper Hatchie	S. Central Miss. River	Hardeman	Degraded by construction and farming, banks unstable, stream shallow.
ECO♣65B02 xxx	Colonel Fork at Highway 125	08010207 Upper Hatchie	S. Central Miss. River	Hardeman	Impact from possible industrial runoff and mining impacts at Highway 125.
ECO♣65B03 xxx	Upper unnamed trib. To Hatchie River at Pea Vine Rd	08010207 Upper Hatchie	S. Central Miss. River	Hardeman	Fairly good riparian, but bank instability and extreme sand load/flow fluctuations, scouring.
ECO♣65B04 ***	**Cypress Creek at Buster King Road**	**08010207 UpperHatchie**	**S. Central Miss. River**	**Hardeman**	**Added 9/96.**
ECO♣65B05 эээ	**Prairie Br at Pea Vine Rd**	**08010207 Upper Hatchie**	**S. Central Miss. River**	**Hardeman**	**Dropped due to impacts**
ECO♣65B06 ^^^	Lower unnamed trib. to Hatchie River at Pea Vine Rd	08010207 Upper Hatchie	S. Central Miss. River	Hardeman	Moderate habitat availability including snag and bank habitat, banks were undercut indicating sporadic high flow.

65e Southeastern Plains and Hills					
SITE #	STREAM/LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO65E01 xxx	Gin Creek at Copper Spring Road, above Big Sandy River	06040005 TN Western Valley (Ky Lake)	Tennessee River	Henry	Appears almost all forested on map. Bank instability. Water clear in Natchez Trace State Park, turbid outside of park.
ECO65E02 ^^^	Slickup/Pettijohn Creek (trib. to Guins Cr) at Barham Rd	08010203 South Fork Obion	S. Central Miss. River	Henry	Slow flow, bank and riffle habitats available, beaver dam nearby, freshwater sponges indicate good water quality.
ECO65E03A xxx	Spring Creek at Highway 140, 3 mi N of McKenzie	08010203 South Fork Obion	S. Central Miss. River	Henry	Sections channelized, mining in watershed.
ECO65E03B xxx	Caledonia Creek at Verdell Store Road and Caledonia Rd	08010203 South Fork Obion	S. Central Miss. River	Henry	Impoundment built on stream 2 years ago, creek turbid.
ECO65E04 ***	**Blunt Creek (trib. to Big Sandy River) above Clark Rd, 2 mi SE of Buena Vista**	**06040005 TN Western Valley (Ky Lake)**	Tennessee River	**Carroll**	**Added 9/96**
ECO65E05 xxx	Coon Cr. (trib. to Birdsong Cr) at Highway 192 or above Old SR 69, 3 mi n of Holladay	06040005 TN Western Valley (Ky Lake	Tennessee River	Benton	Too small with little flow, appeared to be choked with gravel. Stream is surrounded by agriculture.
ECO65E06 ^^^	**Griffin Creek, Hwy 104 at Henderson/Carroll County line near Cedar Grove**	**08010204 South Fork Forked Deer**	**S. Central Miss. River**	**Henderson Carroll**	**Added 6/98**
ECO65E07 xxx	Scarce Cr, at Scarce Creek Rd. trib. to Big Sandy, Timberlake Rd near Wildersville	06040005 TN Western Valley (Ky Lake)	Tennessee River	Henderson	Or move site into Natchez Trace State Forest. McNairy Sand geology, turbid outside of park, small flow.
ECO65E08 ***	**Harris Creek, Potts Chapel Road, 7 mi east of Jackson**	**08010201 North Fork Forked Deer**	**S. Central Miss. River**	**Madison**	**Added 8/96.**
ECO65E09 xxx	Spencer Creek, Spencer Creek Rd or upriver at Hammlett Rd, 1 mi E of Beech Bluff near Madison Co. line	08010201 North Fork Forked Deer	S. Central Miss. River	Henderson	Not much flow, impoundment on creek.
ECO65E10 ***	**Marshall Cr. (trib. to Snow Spring Cr) at Van Buren Rd, 3 mi e of Hickory Valley**	**08010208 Lower Hatchie**	**S. Central Miss. River**	**Hardeman**	**Added 8/96.**
ECO65E11 ^^^	**West Fork Spring Creek, Van Buren Rd, 3.5 mi north of Saulsbury**	**08010208 Lower Hatchie**	**S. Central Miss. River**	**Hardeman**	**Added 8/96**
ECO65E12 ^^^	East Fork Spring Creek, Old State Line Road, 3 mi east of Saulsbury	08010208 Lower Hatchie	S. Central Miss. River	Hardeman	Narrow, fairly swift dark sandy substrates, watershed wooded.

65e Southeastern Plains and Hills cont.					
SITE #	STREAM/LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO65E13 xxx	Cypress Creek above Little Hatchie River at McNairy/Hardeman County line, 4 mi se of Hornsby	08010208 Lower Hatchie	S. Central Miss. River	McNairy	Small creek, nice meander. Too easily accessible to fishermen and campers. Unimproved private road. Beaver impoundment, ponded area at the confluence of Cypress Creek with Little Hatchie River.
ECO65E14 ^^^	Reedy Branch (trib. To Cypress Cr./ Tuscumbia Ri) at Blanship Road, 2 mi wnw of Ramer	08010208 Lower Hatchie	S. Central Miss. River	McNairy	Too small. Good flow, substrate sandy, possibly logging on one small trib.
ECO65E15 ***	Waldrop Creek (trib. to Chambers Cr.) at Hwy 142, 4 mi south of Southside	06030005 TN Pickwick Lake	Tennessee	McNairy Hardin	Most of watershed is in Tennessee but access is 400 yds. in Mississippi. Water appears very black, wetlands and beaver dam present
ECO♣65E16 xxx	Skipper Creek at Powell Chapel Road	08010208 Lower Hatchie	S. Central Miss. River	McNairy	No channelization apparent in the drainage area, does not reach Hatchie, beaver dams on streams, lack of flow.
ECO♣65E17 ^^^	Mosses Creek upstream of Vernie Taylor Road	08010208 Lower Hatchie	S. Central Miss. River	McNairy	Much channelization in the watershed, excellent riparian, primarily black sand substrate. Not wadeable, no boat access.
ECO♣65E18 ***	Hatchie River at Pocohontas	08010208 Lower Hatchie	S. Central Miss. River	McNairy	Wooded area provides good riparian, no channelization on the river, but tribs are channelized.
ECO♣65E19 xxx	Guins Creek at Barham Road	08010201 North Fork Obion	S. Central Miss. River	Carroll	Flow good, water clear, substrate diverse, but discharger in the far upstream reaches.

65i Fall Line Hills					
SITE #	STREAM/LOCATION		MAJOR BASIN	COUNTY	COMMENTS - DROPPED ECOREGION DUE TO SMALL SIZE OF ECOREGION
ECO♣65I01 эээ	**Robinson Creek at Red Sulphur Road**	**06030005 TN Pickwick La)**	**Tennessee River**	**Hardin**	**Dropped due to impacts**
ECO♣65I02 ***	**Battles Branch at Old Kendrick Road**	**06030005 TN Pickwick La)**	**Tennessee River**	**Hardin**	**Added 9/96**
ECO♣65I03 эээ	**Unnamed trib. to East Fork Robinson Creek**	**06030005 TN Pickwick La)**	**Tennessee River**	**Hardin**	**Dropped due to impacts**

65j Transition Hills					
SITE #	STREAM/LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO65J01 xxx	Whitlow-Turner-Alexander Br (trib. to Indian Cr) above Whitlow Rd, 3 mi east of Cerro Gordo	06040001 TN Western Valley (Beech)	Tennessee River	Hardin	Sandier bottom with less gravel than other streams in this subregion. Some agriculture at Whitlow Road, atypical of region, manure odor in the creek.
ECO65J02 ^^^	Turkey Creek below Gobbler Cr and Lone Pine, Center Star Road, 4 mi e of Burnt Church	06040001 TN Western Valley (Beech)	Tennessee River	Hardin	Open area with fallow fields, good variety of caddisflies and mayflies, some logging, substrates were primarily coarse gravel, some silt and sand in pools.
ECO65J03 xxx	Howard Br (trib. To Horse Cr) at Hwy 69, 3 mi se of Maddox	06040001 TN Western Valley (Beech)	Tennessee River	Hardin	Stream sluggish and ran through cow pasture, water appeared turbid and green.
ECO65J04 ***	**Pompeys Br (trib. To Pickwick Lake) at Pompeys Br Rd**	**06030005** **TN Pickwick Lake**	**Tennessee River**	**Hardin**	**Added 8/96**
SITE #	STREAM/LOCATION		MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO65J05 ***	**Dry Creek, Dry Creek Road**	**06030005** **TN Pickwick Lake**	**Tennessee River**	**Hardin**	**Added 8/96**
ECO65J06 ***	**Right Fork Whites Creek above Morris Lane Road, 1 mi north of Walnut Grove**	**06040001** **TN Western Valley (Beech)**	**Tennessee River**	**Hardin**	**Added 8/96**
ECO65J07 ^^^	May Branch at May Branch Road, 3 mi east of Cypress Inn	06030004 Lower Elk	Tennessee River	Wayne	Downstream access in Alabama, some pasture and farming in the watershed. Size of the watershed is small.
ECO♣65J08 ^^^	Cypress Creek at Natchez Trace Parkway, RM 4.8 from state line	06030004 Lower Elk	Tennessee River	Wayne	Bank scouring, construction on Natchez Trace Parkway. Watershed is 80% protected because it flows along the Natchez Trace Parkway. Logging or growing of monoculture pines will probably not take place in this watershed. Cursory examination of the benthics found a good assemblage.
ECO♣65J09 xxx	Grassy Creek on Grassy Creek Road	06030004 Lower Elk	Tennessee River	Wayne	Watershed within monoculture pine plantation and would not be acceptable as a reference stream. Cursory benthic examination found a number of stoneflies.
ECO♣65J10 xxx	Gobbler Branch at Lonesome Pine Road	06040001 TN Western Valley (Beech)	Tennessee River	Hardin	Pine plantation and recent logging in watershed.
ECO♣65J11 ***	**Unnamed trib Right Fork Whites Cr above Morris Lane Rd, 1 mi north of Walnut Grove, north branch**	**06040001** **TN Western Valley (Beech)**	**Tennessee River**	**Hardin**	**Added 2/97.**

66. BLUE RIDGE MOUNTAINS

66d Southern Igneous Ridges and Mountains					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO66D01 ***	**Black Branch (trib. to Row Branch, Elk River), above Hwy 321 near Elk Mills**	**06010103 Watauga**	**Tennessee River**	**Carter**	**Added 8/96**
ECO66D02 xxx	Heaton Branch (trib. to Elk River), Heaton Branch Road, near Elk Mills	06010103 Watauga	Tennessee River	Carter	Not fully protected. Road parallels most of the stream.
ECO66D03 ***	**Laurel Fork (Doe River), above Big Branch and Dennis Cove Road across from campground**	**06010103 Watauga**	**Tennessee River**	**Carter**	**Added 8/96**
ECO66D04 xxx	Big Bald Creek (trib. to Coffee Ridge Creek), Farnor Road, 3 mi south of Ernestville	06010108 Nolichucky	Tennessee River	Unicoi	Streams in this part of 66D look more disturbed with roads and clearings. Logging immediately along the stream.
ECO66D05	**Doe River, in Cherokee NF, along Hwy 19**	**06010103 Watauga**	**Tennessee River**	**Carter**	**Added 5/98**
ECO♣66D06	**Tumbling Creek**	**06010108 Nolichucky**	**Tennessee River**	**Carter**	**Added 11/97, benthics only**
ECO♣66D07	**Little Stoney Creek**	**06010103 Watauga**	**Tennessee River**	**Carter**	**Added 11/97, benthics only**

66e Southern Sedimentary Ridges					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO66E01	Lyons Branch, above Laurel Cr, Hwy 91, 1.5 mi north of Laurel Bloomery	06010102 South Fork Holston	Tennessee River	Johnson	Unable to locate this stream. The drainage area is very small.
ECO66E02 xxx	Chalk Branch, at Highway 133, 4 mi south of Sutherland (trib. to Beaverdam Creek)	06010102 South Fork Holston	Tennessee River	Johnson	The drainage area is very small.
ECO66E03 xxx	Fagall Branch, at Highway 133, above Beaverdam Creek	06010102 South Fork Holston	Tennessee River	Johnson	Because of its small size, it would not make a good fisheries reference. Birch Branch to the south is an alternative, or tribs to Beaverdam Creek across from Fagall Branch.
ECO66E04 ^^^	**Gentry Cr, below Grindstone Br 2.5 mi se of Laurel Bloomery**	**06010102 South Fork Holston**	**Tennessee Rover**	**Johnson**	**Sampled 11/97 only**
ECO66E05 xxx	Morgan Br, 3/4 mi above Big Dry Run, east of Watauga Lake	06010103 Watauga	Tennessee River	Johnson	Recommended by Dean Whitworth-Sierra Club. Big Dry Run has poor (30) TVA-IBI score. Stream not good fisheries reference because of its size, also on private land.

66e Southern Sedimentary Ridges cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO66E06 xxx	Pine Bottom Branch, above Watauga River/Lake	06010103 Watauga	Tennessee River	Johnson	Recommended by Dean Whitworth-Sierra Club. Access would require boat to cross Watauga River/Lake.
ECO66E07 xxx	Little Stony Cr (trib. to Stony Cr.) via FR 202A above Hunter, 5 mi ne of Elizabethton	06010103 Watauga	Tennessee River	Carter	Near-stream forest road. Miller or Laurel Br to the E near Carter may be less impacted, densely populated resid./agric. area.
ECO66E08 xxx	Rat Br, (trib. to south shore Watauga Lake by Appalachian Trail), above Hwy 321/67, 2.5 mi ne of Braemar	06010103 Watauga	Tennessee River	Carter	Drainage area very small. Stream was dry in August, flow goes underground in December.
ECO66E09 ***	**Clark Creek via Clarks Cr Rd and Forest Rd 25, 3 mi sw of Bumpus Cove**	**06010108 Nolichucky**	**Tennessee River**	**Unicoi**	**Added 8/96**
ECO66E10 ^^^	Granny Lewis Cr (trib. to South Indian Cr), 2 mi nw of Ernestville	06010108 Nolichucky	Tennessee River	Unicoi	Watershed lies within Cherokee National Forest, heavy impact at site observed, possibly better upstream good alternative reference stream.
ECO66E11 ***	**Lower Higgins Cr (trib. to South Indian Cr), via Lower Higgins Cr Road, 1 mi nw of Ernestville**	**06010108 Nolichucky**	**Tennessee River**	**Unicoi**	**Added 8/96.**
ECO66E12 xxx	Cassi Cr (trib. to Nolichucky River), Sampson Mountain Wilderness via Cassi Road, 2 mi south of Liberty	06010108 Nolichucky	Tennessee River	Green	Stream too small. Classified as naturally reproducing trout stream. Impacted by residential/agricultural areas.
ECO66E13 xxx	Dry Creek (trib. to Camp Cr), above Mission Rd, 2 mi south of Bethany	06010108 Nolichucky	Tennessee River	Green	Ecoregion boundary is about 1/4 mile upstream from Mission Road.
ECO66E14 xxx	Laurel Br (trib. to French Broad R, 1 mi E of Del Rio. Upper reach via FR 38 & Hwy 107; lower reach above Hwy 25 / 70.	06010105 Upper French Broad	Tennessee River	Cocke	No protection of watershed, pH and conductivity levels much higher than expected, USFS impacted list.
ECO66E15 xxx	Mill Creek (trib. to Pigeon River), above Mill Creek Road, 1 mi north of Hartford	06010106 Pigeon River	Tennessee River	Cocke	Conductivity high for subregion.
ECO66E16 xxx	Laurel Cr (trib. to Walden Cr) via McMahan Sawmill Rd, Chilhowee Mtn, 6 mi west of Dollywood	06010107 Lower French Broad	Tennessee River	Sevier	Significant impacts from residential development, riparian zone destruction, and channelization.

66e Southern Sedimentary Ridges cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO66E17 ***	**Double Br above Reed Cr, Chilhowee Mtn. WMA, east Millers Cove Rd**	**06010201 Watts Bar Lake**	**Tennessee River**	**Blount**	**Added 9/97.**
ECO66E18 ***	**Gee Creek, E of Wetmore, near Gee Cr Wilderness boundary**	**06020002 Hiwassee**	**Tennessee River**	**Polk**	**Added 8/96**
ECO66E19 xxx	Rock Creek, near Hwy 30/64 junction above Lake Ocoee	06020003 Ocoee	Tennessee River	Polk	Subregion boundary is about 1/2 mi. above Highway 30.

66f Limestone Valleys and Coves					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO66F01 xxx	Drystone Br (trib. to Laurel Cr), between Atchison Cr Rd and Red Brush Rd, 3 mi south of Laurel Bloomery	06010102 South Fork Holston	Tennessee River	Johnson	Impacts. Riparian zone is very disturbed and there is no protection of the watershed. Good valley sites are hard to find.
ECO66F02 ^^^	**Jim Wright Branch, above Beaverdam Cr, Hwy 91, Shady Valley**	**06010102 South Fork Holston**	**Tennessee River**	**Johnson**	**Sampled 11/97, benthics only**
ECO66F03	Unnamed trib to upper Beaverdam Cr, at Orchard Rd, 1.5 mi south of Hwy 421/34, 0.3 mi. north of Brinkley Rd	06010102 South Fork Holston	Tennessee River	Johnson	Unable to find this stream. Valley impacts?
ECO66F04 xxx	Harbin Br (trib. to Doe Creek), above Hwy 67 near Little Doe, 4 mi wsw of Mountain City	06010102 South Fork Holston	Tennessee River	Johnson	Some forest cover. Cattle impacts, small watershed.
ECO66F05 ^^^	Stony Creek (trib. to Watauga River) near Sadie	06010103 Watauga	Tennessee River	Carter	TVA-IBI score near mouth was 36 poor/fair. Much of watershed is in 66G. Watershed is heavily residential and agricultural.
ECO66F06 ***	**Abrams Cr., west end of Cades Cove, above Mill Cr, Cades Cove Loop Rd, GSMNP**	**06010204 Little Tennessee**	**Tennessee River**	**Blount**	**Added 9/96**
ECO♣66F07 ***	**Beaverdam Creek near Backbone Rock approximately 0.5 mi**	**06010102 South Fork Holston**	**Tennessee River**	**Johnson**	**Added 9/96**
ECO♣66F08	**Stony Creek**	**06010103 Watauga**	**Tennessee River**	**Carter**	**Added 11/97, benthics only**

66g Southern Metasedimentary Mountains					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO66G01 ^^^	Paint Creek, above Hurricane Gap Road/Paint Creek Road intersection	06010105 Upper French Broad	Tennessee River	Greene	Upper watershed not completely protected. Etnier et al. 1983 baseline stream site was near mouth.
ECO66G02 xxx	Trail Fork Big Creek (trib. to French Broad Road at Del Rio), upper reach above Blue Mill via Norwood Road	06010105 Upper French Broad	Tennessee River	Cocke	Lack of protection of the watershed is a major concern. Upper reach on both forks look potentially impacted. Posted on 303(d) list for pathogens Hepatitis outbreak in 1997.
ECO66G03 xxx	Cosby Cr (trib. to Pigeon R), upper reach near Hwy 32, 3 mi se of Cosby, GSMNP	06010105 Upper French Broad	Tennessee River	Cocke	Not recommended due to influence of campground, small size and diffuse channel morphology at this point.
ECO66G04 ***	**Middle Prong Little Pigeon River at Greenbriar Cove**	**06010107 Lower French Broad**	**Tennessee River**	**Sevier**	**Added 8/96**
ECO♣66G05 ***	**Little River above Elkmont, GSMNP**	**06010201 Fort Loudon/Little River**	**Tennessee River**	**Sevier**	**Added 8/96**
ECO66G06	Tabcat Creek (trib. to Little Tenn. R) above Highway 129 near Calderwood, GSMNP	06010204 Little Tennessee	Tennessee River	Blount	Stream was inaccessible, reservoir embayment, need National Park Service permission to build trail.
ECO66G07 ***	**Citico Cr., 1 mi upstream confl. with Jakes Cr.**	**06010204 Little Tennessee**	**Tennessee River**	**Monroe**	**Added 5/98.**
ECO66G08 xxx	Cane Cr, Cane Cr Rd, 1 mi E of Ballplay Road, ne of Tellico Plains	06010204 Little Tennessee	Tennessee River	Monroe	Upstream impacts, septic drain fields, cattle farms. Watershed unprotected
ECO66G09 ^^^	**North River (trib. to Tellico River)**	**06010204 Little Tennessee**	**Tennessee River**	**Monroe**	**Added 5/98**
ECO66G10 xxx	Towee Creek (trib. to Hiwassee River)	06020002 Hiwassee	Tennessee River	Polk	Small stream with very steep gradient, deeply incised, TVA-IBI score 50.
ECO66G11 xxx	Big Lost Creek near Reliance	06020002 Hiwassee	Tennessee River	Polk	Etnier et al 1983 baseline stream site, TVA-IBI score: 50 .
ECO66G12 ***	**Sheeds Creek, 6 mi east of Conasauga**	**03150101 Conasauga**	**Tennessee River**	**Polk**	**Added 8/96**
ECO66G13	misnumbering occurred				
ECO♣66G14 xxx	Spring Creek	06020002 Hiwassee	Tennessee River	Polk	Site upstream from railroad crossing. Good habitat, canopy, cobble, rubble and sand.
ECO♣66G15 xxx	Rough Creek	06020003 Ocoee	Tennessee River	Polk	Good habitat, covered canopy, cobble rubble and sand.
ECO♣66G16 xxx	Tumbling Creek	06020003 Ocoee	Tennessee River	Polk	Site at Tumbling Creek Campground. Good habitat, canopy, boulder, cobble, rubble.
ECO♣66G17 xxx	Abrams Creek or Hesse Creek near western GSMNP boundary	06010204 Little Tennessee	Tennessee River	Blount	GSMNP Federally endangered - Spotfin chub, Smoky madtom, Yellowfin madtom. Flows through 66f and 66g.

66g Southern Metasedimentary Mountains cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣66G18 ***	Little River, above Middle Prong, inside GSMNP, (13 miles d/s Elkmont site)	06010201 Fort Loudon/Little River	Tennessee River	Sevier	Greatest biological diversity occurs.
ECO♣66G19 ^^^	Middle Prong Little River toward Tremont	06010201 Fort Loudon/Little River	Tennessee River	Blount	Good riffle and run area, banks stable.

67. RIDGE AND VALLEY

67f Southern Limestone/Dolomite Valleys and Low Rolling Hills					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS(Initial Screening)
ECO67F01 * **	**Turkey Ck (trib. to Clinch R.), at Chestnut Ridge Rd., 2 mi sw of Kyles Ford**	**06010205 Upper Clinch**	**Tennessee River**	**Hancock**	**Added 10/97, benthics only**
ECO67F02 ^^^	Canoe Branch (trib. to Powell River), near Poplar Grove	06010206 Powell River	Tennessee River	Claiborne	Small size and lack of protection in watershed, watershed in good shape, with most of steep slopes and riparian forested.
ECO67F03 xxx	Caney Creek, (trib. to Holston River), near East Caney Cr. Rd, W Rogersville	06010104 Holston River	Tennessee River	Hawkins	Too disturbed, sawmill nearby, and ag. impact. (TVA-IBI score was 48, good)
ECO67F04 xxx	Clear Creek (trib. to Norris Lake), Chuck Swan WMA	06010205 Upper Clinch	Tennessee River	Union	TN Dept. of Health reference site. Protected watershed.
ECO67F05 xxx	Raccoon Cr (trib. to Bullrun Cr) at Hwy 33, Maynardville Pike, near Paulette	06010205 Upper Clinch	Tennessee River	Union	Impacts from roads, residential, agriculture. Nearby White Creek a larger stream and better choice.
ECO67F06	**Clear Creek, Clear Creek Road, Norris Municipal Park, n of Norris**	**06010207 Lower Clinch**	**Tennessee River**	**Anderson**	**Added 5/98**
ECO67F07 xxx	Wolf Creek (trib to Watts Bar Lake) near Dogwood	06010201 Watts Bar	Tennessee River	Roane	Small stream, watershed all private land, no protection. Good water quality and habitat - excellent mix of bedrock, gravel, cobble and boulder. Benthics looked good.
ECO67F08 эээ	**Little Sewee Creek near Collins Mill and SR 225**	**06020001 Tennessee**	**Tennessee River**	**Meigs McMinn**	**Added 9/96, dropped after one sampling due to impacts from ag. and development**
ECO67F09 xxx	South Chestuee Cr (trib. to Hiwassee River), near Ocoee, W of Bradley/Polk County line	06020002 Hiwassee	Tennessee River	Bradley	Extremely turbid. Not good reference site, fish hatchery upstream. TVA-IBI score 24 (poor).
ECO67F10 xxx	Poe Branch, at ammo plant, US military reservation, NE of Chattanooga	06020001 Tennessee	Tennessee River	Hamilton	Site covered with second growth forest, possible soil contamination, site scheduled for restoration in near future.

67f Southern Limestone/Dolomite Valleys and Low Rolling Hills cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS(Initial Screening)

ECO67F11 xxx	Brymer Creek (trib. to Candies Creek), 5 mi sw of Cleveland	06020002 Hiwassee	Tennessee River	Bradley	Springs. Good riparian zone. Potential problem, I 75 crosses headwaters. Located in 67G subregion after map changes 11/96.
ECO67F12 xxx	Coahulla Cr, S of Cleveland	03150101 Conasauga	Tennessee River	Bradley	Large impacts from cattle, residential.
ECO♣67F13 * **	**White Creek, located just below old gauging station in Chuck Swan WMA**	**06010205 Upper Clinch**	**Tennessee River**	**Union**	**Added 12/96.**
ECO♣67F14 ^^^	**Powell River south of Alanthus Hill, u/s ambient station approx. 4.0 mi,**	**06010206 Powell**	**Tennessee River**	**Hancock**	**Added 6/98**
ECO♣67F15 ^^^	Russell Creek	06010206 Powell	Tennessee River	Claiborne	Good benthic and fish, concern with STP discharge 5-6 miles upstream.
ECO♣67F16 ^^^	**Hardy Creek**	**06010206 Powell**	**Tennessee River**	**Lee County, VA**	**Added 6/98**
ECO♣67F17 ^^^	**Big War Creek, near Papaw Road**	**06010205 Upper Clinch**	**Tennessee River**	**Hancock**	**Added 12/96.**
ECO♣67F18 xxx	War Creek	06010205 Upper Clinch	Tennessee River	Hawkins	Remote area, tributary to Clinch River.
ECO♣67F19 xxx	Blackwater Creek	06010205 Upper Clinch	Tennessee River	Hancock	Intensive cattle farms.
ECO♣67F20 xxx	Mulberry Creek	06010205 Upper Clinch	Tennessee River	Hancock	The watershed is heavily agricultural.
ECO♣67F21 xxx	Thomas Creek	06010102 South Fork Holston	Tennessee River	Sullivan	Cattle and horse operations located next to the stream.
ECO♣67F22 xxx	Fourmile Creek	06010206 Powell River	Tennessee River	Hancock	Heavily impacted by agriculture (mainly cattle). Originates in Virginia
ECO♣67F23 ^^^	**Martin Creek**	**06010206 Powell**	**Tennessee River**	**Hancock**	**Added 6/98**
ECO67F24	misnumbering occurred				
ECO♣67F25 * **	**Powell R., River Rd above gaging station at RM 65.5**	**06010206 Powell**	**Tennessee River**	**Claiborne**	**Added 12/96 Water quality only, no benthics**
ECO♣67F26 эээ	**Indian Creek**	**06010206 Powell**	**Tennessee River**	**Claiborne**	**Added 8/97, dropped after one sample, impacted from cattle and sedimentation.**

67g Southern Shale Valleys					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO67G01 * **	**Little Chucky Cr. at Denver Bible Rd, near Warrensburg**	**06010108 Nolichucky**	**Tennessee River**	**Greene**	**Added 11/96.**

ECO67G02 xxx	Muddy Cr (trib. to Douglas Lake), Rainwater Scholl Road, 1.5 mi N of Chestnut Hill	060101017 Lower French Broad	Tennessee River	Jefferson	Forested, but heavy agricultural impacts. Riparian zone and bank stability severely compromised.
ECO♣67G03 ^^^	Flat Creek, bridge at Chucky Creek Bridge	06010108 Nolichucky	Tennessee River	Hamblen	Some silt, upper watershed is primarily residential and agricultural.
ECO♣67G04 ***	Fishdam Creek, near Big Creek Road	06010105 Upper French Broad	Tennessee River	Sullivan	SE side of South Holston Lake, more similar to Blue Ridge streams.
ECO♣67G05 ^^^	**Bent Creek, s of Highway 81, e of Bent Creek Road**	**06010108 Nolichucky**	**Tennessee River**	**Hamblen**	**Added 11/96**
ECO♣67G06	Slate Creek, along Highway 160	06010108 Nolichucky	Tennessee River	Cocke	High bacteria, solids, nutrients, and chlorides. Also rejected because of degraded condition of watershed. Sampled for comparison.
ECO♣67G07	Lick Creek, near Mohawk Road	06010108 Nolichucky	Tennessee River	Greene	Sampled for comparison of other streams in subregion.
ECO♣67G08 * **	**Brymer Cr at Roark Lane Rd, 5 miles sw Cleveland**	**06020002 Hiwassee**	**Tennessee River**	**Bradley**	**Added 12/96**
ECO♣67G09	**Harris Creek, along Hwy 312, near Baugh Spring**	**06020002 Hiwassee**	**Tennessee River**	**Bradley**	**Added 11/97**

67h Southern Sandstone Ridges					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	
ECO67H01 xxx	Big Sycamore Cr at Hancock/Claiborne Co. line, Powell Mtn. / Newman Ridge	06010205 Upper Clinch	Tennessee River	Hancock	Six cemeteries (and other human impacts).
ECO67H02 Xxx	Briar Fork (trib to Cherokee Lake), near Briar Hollow Rd./Hwy 25E, Clinch Mountain	06010104 Holston	Tennessee River	Grainger	Many garbage dumps on slopes, dangerous area.
ECO67H03 xxx	Harris Branch (trib. To Tellico Lake) at Harris Branch Road, 1 mi E of Union Hall	06010204 Little Tennessee	Tennessee River	Monroe	Small stream, fairly heavy siltation. Mostly forested despite residences, good riparian. Bays formation – claystone, siltstone, sandstone. Flow backed up by Tellico Lake? Laurel Cr. To the sw is probably better but has an impoundment in headwaters.

67h Southern Sandstone Ridges cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	
ECO67H04 * **	**Blackburn Creek, Whiteoak Mtn, N of Baugh Spring**	**06020002 Hiwassee**	**Tennessee River**	**Bradley**	**Added 12/96**
ECO67H05 xxx	Little Ooltewah Creek, Whiteoak Mountain, near I-	06020001 Tennessee	Tennessee River	Bradley	Subregion boundary is about ½ mi. downstream from I-75 bridge. State geology

	75, S of Baugh Spring				map shows creek mostly in Mfp – chert, limestone, shale. Excessive sediment.
ECO♣67H06 ***	**Laurel Creek, tributary to Big Creek and Tellico River**	**06010204 Little Tennessee**	**Tennessee River**	**Monroe**	**Added 9/96, benthics only.**
ECO♣67H07 ***	Laurel Hollow Branch, tributary to Lea Creek sw end of Clinch Mountain	06010205 Upper Clinch	Tennessee River	Grainger	Private land, forest, stream small, intermittent, benthics sparse, water quality excellent. Dropped to reduce number of streams Atypical of ecoregion, low pH
ECO♣67H08 ***	**Parker Br, on Holston Army Ammunition Plant property**	**06010104 Holston**	**Tennessee River**	**Hawkins**	**Added 9/96**
ECO♣67H09 xxx	Laurel Run Creek, near Barrett Hollow Road	06010104 Holston	Tennessee River	Hawkins	Upper part of watershed is impacted, near Holston Army Ammunition Plant and Bays Mountain Park
ECO♣67H10 xxx	Beech Creek, near Burem Pike	06010104 Holston	Tennessee River	Hawkins	Flows through highly agricultural area, the riparian zone of stream is disturbed.

67i Southern Dissected Ridges and Knobs					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	
ECO67I01 xxx	Gum Hollow Br (trib. to East Fork Poplar Cr), 1 mi east of Hiwy 95/58 near county line, south of Oak Ridge	06010207 Lower Clinch	Tennessee River	Roane	Small stream, inaccessible upstream of DOE boundary. Excessive silt load.
ECO67I02 xxx	Red Branch (trib. to Bat Cr), Anderson Road, 2 mi se of Rockville	06010204 Little Tennessee	Tennessee River	Monroe	Entire length along Anderson Road silted in with a heavy load of dark red, fine silt.
ECO67I03 ^^^	Shanty Branch near Poland Hollow Road, 5 mi east of Rockwood	06010201 Watts Bar	Tennessee River	Roane	Or other less-disturbed small streams on Coaling Grounds Ridge S of Rockwood, houses on streams, too impacted.
ECO67I04 xxx	Dry Fork Creek (trib. To Sewee Cr), on No Pone Ridge, 2 mi ne of Decatur	06020001 Tennessee	Tennessee River	Meigs	Stream begins in 67F. Poor IBI score: 30.
ECO67I05 xxx	Big Branch (trib. To Conasauga Creek), 3 mi ne of Etowah	06020002 Hiwassee	Tennessee River	McMinn	Development in area, houses near stream could have septic/sewage discharge, sedimentation is heavy.

67i Southern Dissected Ridges and Knobs cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	
ECO67I06 xxx	Meadow Fork (trib. to Oostanaula Creek), ne of Calhoun	06020002 Hiwassee	Tennessee River	McMinn	Good flow and riparian zone. Excessive sediment at bridge, agriculture in headwaters. Possible clearcutting downstream of bridge.
ECO67I07 xxx	Horns Cr (trib. to Cookson Cr), above Gap Road north of	06020003 Ocoee	Tennessee River	Polk	Marginal stream with agricultural and developmental impacts.

	Conasauga				
ECO67I08 xxx	Ball Play Cr (trib. to Conasauga R), north of Conasauga	03150101 Conasauga	Tennessee River	Polk	Headwaters may have been clearcut in the '70's.
ECO♣67I09 xxx	Big Sycamore Creek, along Big Sycamore Creek Road	06010205 Upper Clinch	Tennessee River	Hancock or Claiborne	Residences and agricultural operations in watershed, trash noted in high water zone.
ECO♣67I10 xxx	Prospect Branch just east near Prospect	06020003 Ocoee	Tennessee River	McMinn	Excessive agricultural and residential impacts.
ECO♣67I11 эээ	**Thompson Creek**	**06020002 Hiwassee**	**Tennessee River**	**McMinn**	**Dropped due to anaerobic silt and excessive sediment.**
ECO♣67I12 ^^^	**Mill Creek, Tuskegee Drive**	**06010207 Lower Clinch**	**Tennessee River**	**Anderson**	**Added 8/96**

67 Ecoregion (Watersheds cross subregions)					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO6701 ^^^	**Big Creek, below Fisher Cr, at Stanley Valley Rd, 4.5 mi west of Surgoinsville**	**06010104 Holston**	**Tennessee River**	**Hawkins**	**Some headwaters on 67I and 67H. Added 6/98**
ECO6702 * **	**Fisher Creek (trib. to Big Cr), at Bray Rd Crossing**	**06010104 Holston**	**Tennessee River**	**Hawkins**	**Stream crosses subregions, lower mile or two is within 67F, and exhibits parameters similar to 67F. Added 12/96.**
ECO6703 xxx	Horse Creek, south of Kingsport	06010104 Holston	Tennessee River	Sullivan	Slow moving, low gradient with gravel cobble bottom typical of valley streams. Agricultural impacts. TVA-IBI score 46 fair/good.
ECO6704 ^^^	Hogskin Cr (trib. to Norris Lake) near Union Co./ Grainger Co. line	06010205 Upper Clinch	Tennessee River	Grainger	Watershed heavily impacted by cattle, residential land use and riparian loss.
ECO6705 xxx	Hardin Cr (trib. to Goodfield Cr), north of Goodfield	06020001 Tennessee	Tennessee River	Meigs	Impacts from industrial park, residential development and logging.
ECO6706 xxx	Little Wolftever Creek, near Whiteoak / Grindstone Mountain e of Chattanooga	06020001 Tennessee	Tennessee River	Hamilton	Impacts from agriculture and residential development, stability of site could be a problem.
ECO♣6707 * **	**Possum Ck, Weaver Pike**	**06010102 South Fork Holston**	**Tennessee River**	**Sullivan**	**Added 6/98**

68. SOUTHWESTERN APPALACHIANS

68A Cumberland Plateau					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO68A01 * **	**Rock Creek, Highway 154, Pickett State Forest**	**05130104 South Fork Cumberland**	**Cumberland River**	**Pickett**	**Added 11/96.**
ECO68A02 xxx	Thompson Creek, Highway 154, Pickett State Forest	05130104 South Fork Cumberland	Cumberland River	Pickett	Thompson Creek described in 'The Fishes of TN' as a typical Cumberland Plateau Stream in natural state. Pickett State Park STP has

					a permit to discharge to this stream, site is just below a dam.
ECO68A03 ***	**Laurel Fork of Station Camp Creek, Big South Fork NRRA**	**05130104 South Fork Cumberland**	**Cumberland River**	**Fentress Scott**	**Added 11/96**
ECO68A04 xxx	Bandy Creek at Highway 297, Scott State Forest	05130104 South Fork Cumberland	Cumberland River	Scott Fentress	Impacts from Big South Fork's Bandy Creek Campground, including horse stables and a small WWTP.
ECO68A05 ***	Laurel Fork of White Oak Creek, Big South Fork National River and Recreation Area	05130104 South Fork Cumberland	Cumberland River	Scott Fentress	Mouth of Laurel Fork is in 68C. Larger portion of watershed not in park boundaries (headwaters tribs), access much more difficult, and existing data much more scarce.
ECO68A06 xxx	Clear Fork River	05130104 South Fork Cumberland	Cumberland River	Scott Fentress Morgan	Large watershed has disturbances: agricultural, residential, oil fields. BSFNRRA, evidence of impact in form of filamentous algae and sedimentation.
ECO68A07 xxx	White Creek, near Highway 62, 3 mi ssw of Deer Lodge	06010208 Emory	Tennessee River	Morgan	Oil fields? A great deal of sediment.
ECO68A08 ***	**Clear Creek at Genesis Rd (Hwy 298), 5 mi west of Lancing**	**06010208 Emory**	**Tennessee River**	**Morgan**	**Added 11/96**
ECO68A09 xxx	Otter Creek, at Otter Creek Road, Catoosa Wildlife Management Area	06010208 Emory	Tennessee River	Cumberland	Upper portion affected by major new impoundment finished this year, a 90-foot dam built for water withdrawal purposes. This major hydrologic modification alone disqualifies this site.
ECO68A10 xxx	Piney Creek, in Mt. Roosevelt State Forest near I-40, W of Rockwood	06010201 Watts Bar Lake	Tennessee River	Cumberland	Headwaters in Crab Orchard Mtns. Piney Cr. flows through 68C Plateau Escarpment below Hwy 70 at Westel. Mostly unprotected, with homes and small farms.
ECO68A11 ^^^	Daddys Creek, below Rhea / Browns Rd intersection, 1.5 mi nne of Big Lick Renfro Cr	06010208 Emory	Tennessee River	Cumberland Cumberland	Some agriculture in upper reach, but more potential impacts appear downstream.

68A Cumberland Plateau cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO68A12 xxx	Whites Creek at Possum Trot Road, 3 mi nw of Roddy	06010201 Watts Bar Lake	Tennessee River	Rhea Cumberland	Impacts from development. Mining in upper headwaters? Accessible at Possum Trot Rd
ECO68A13 ^^^	**Piney Cr / Piney R, upper reach via Wash Pelfrey Rd**	**06010201 Watts Bar Lake**	**Tennessee River**	**Rhea**	**Added 2/99**
ECO68A14 xxx	Bee Cr, upper reach, Grape Vine Rd, 1 mi e of Winesap, Richland Cr hw sites	05130108 Caney Fork	Cumberland River	Bledsoe Cumberland Rhea	Watershed disturbances, unprotected status, and algal/bacterial growth on substrates.
ECO68A15 xxx	Cane Cr at Old CC Rd or downstream near Park Rd in Fall Cr Falls SP	05130108 Caney Fork	Cumberland River	Bledsoe	Impacts from mining and logging.
ECO68A16 xxx	Hall Cr, near Hendon Road, 1.5 mi S of Hickory Grove	06020004 Sequatchie	Tennessee River	Bledsoe	Impacts from logging and mining.
ECO68A17 xxx	Rock Cr below the confluence with Stewart Cr	06020001 Tennessee	Tennessee River	Bledsoe	Lower Rock Creek flows through 68C.
ECO68A18 xxx	Cain Cr at Cain Cr Rd off of Barker Cp. Rd. 6.5 mi west of Huckleberry	06020001 Tennessee	Tennessee River	Sequatchie	Impacts from logging and mining.
ECO68A19 xxx	Little Gizzard Creek, above Foster Falls, 4WD road	06030003 Upper Elk	Tennessee River	Marion	Mining in headwaters near White City?
ECO68A20 * **	**Mullens Creek, 4WD road W of Suck Crk Mt Rd, below Shelton Cr, Prentice Cooper State Forest**	**06020001 Tennessee**	**Tennessee River**	**Marion**	**Added 11/96**
ECO♣68A21 эээ	**Firescald Creek, at Northcutts Cove Road,**	**05130107 Collins**	**Cumberland River**	**Grundy**	**Dropped due to impacts from upstream impoundment.**
ECO♣68A22 xxx	Horns Creek, at the Hendon Road Crossing	06020001 Tennessee	Tennessee River	Marion	Impacts from logging and residences.
ECO♣68A23 xxx	Laurel Creek	06020001 Tennessee	Tennessee River	Marion	Impacts from logging and residences.
ECO♣68A24 xxx	Rock Creek, off the sharp curve on Legget Road	06020001 Tennessee	Tennessee River	Hamilton	Impacts from logging, site clearing and residences.
ECO♣68A25 xxx	Piney Creek, at the Pelfrey Road crossing	06020001 Tennessee	Tennessee River	Marion	Watershed primarily on Bowater property with minor agricultural impacts.
ECO♣68A26	**Daddy's Creek at Hebbertsburg Road**	**06010208 Emory**	**Tennessee River**	**Cumberland**	**Added 8/96**
ECO♣68A27	**Island Creek**	**06010208 Emory**	**Tennessee River**	**Morgan**	**Added 5/98**
ECO♣68A28	**Rock Creek, Hwy 127 north out of Wartburg Hwy 62 towards Lancing**	**06010208 Emory**	**Tennessee River**	**Morgan**	**Added 5/98**

68b Sequatchie Valley					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO68B01 ***	**Crystal Creek, 5 mi south of Pikeville**	**06020004 Sequatchie**	**Tennessee River**	**Bledsoe**	**Added 2/97.**
ECO68B02 ***	**McWilliams Creek, ne of Dunlap**	**06020004 Sequatchie**	**Tennessee River**	**Sequatchie Bledsoe**	**Added 11/96**
ECO68B03 xxx	Stone Creek near Daus	06020004 Sequatchie	Tennessee River	Sequatchie	Dropped due to trash and backhoe in stream, bridge construction. Impacts include coal storage/haul yard, old mine sites. Random dumping of garbage and debris in creek.
ECO♣68B04 xxx	Owen Spring	06020004 Sequatchie	Tennessee River	Marion	Sawmill, town of Sequatchie located on stream. Cattle have unrestricted access to stream, highly impacted.
ECO♣68B05 xxx	Town Creek	06020004 Sequatchie	Tennessee River	Marion	Stream flooded when observed. Garbage and large debris in creek.
ECO♣68B06 ^^^	Cold Spring Creek	06020004 Sequatchie	Tennessee River	Bledsoe	Highly impacted by cattle, unlimited access. Impacts from residential area.
ECO♣68B07 ^^^	Clear Spring Branch	06020004 Sequatchie	Tennessee River	Marion	Agriculture poses biggest threat along stream. Some sedimentation problems.
ECO♣68B08 ^^^	Skillern Creek	06020004 Sequatchie	Tennessee River	Bledsoe	Agriculture poses biggest threat along stream. Some sedimentation problems.
ECO♣68B09 ^^^	**Mill Branch (creek), u/s of bridge construction site**	**06020004 Sequatchie**	**Tennessee River**	**Bledsoe**	**Added 10/96**

68c Plateau Escarpment					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO68C01 xxx	Bills Creek, above East Fork Obey River, Boatland Road	05130105 Obey	Cumberland River	Fentress	Disappearing streams in limestone bedrock. Lost Cane Creek Road paralleling stream may add sediment. Dry when checked.
ECO68C02 xxx	Moredock Br, trib. to West Fk Obey R, 1.5 mi N of Allred	05130105 Obey	Cumberland River	Overton	Stream is dry most of the entirety. Many cows observed. No access.
ECO68C03 xxx	Falling Water River above Macedonia Cemetery Road, 6 mi west of Monterey	05130108 Caney Fork	Cumberland River	Putnam	Monterey STP is permitted to discharge to this stream and the downstream section mixes with the effluent from Pigeon Roost Creek of Cookeville STP.
ECO68C04 ^^^	Bridge Creek, Cumberland Cove Wildlife Management Area, 8 mi south of Monterey	05130108 Caney Fork	Cumberland River	Putnam	No longer protected by the WMA. Cattle impacts, flow probably not perennial. However, the watershed is in good shape and has good access. Need to check access to stream above agriculture area. Approx. 11 sq. mi. on Cumberland Plateau.

68c Plateau Escarpment cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO68C05 xxx	Taylor Creek via Gross Cove Road, above Isham Creek	05130107 Collins	Cumberland River	Grundy	Upper part of watershed above RM 0.6 is completely dry. According to the landowner it flows only in response to rainfall. Below RM 0.6 the banks are broken down with no riparian zone and much livestock.
ECO68C06 xxx	Savage Creek / Big Creek / Collins River, Savage Gulf State Natural Area	05130107 Collins	Cumberland River	Grundy	Only access to flowing portion is by backpacking down the escarpment. Large watershed area on Cumberland Plateau. Some strip mining in headwaters on Plateau.
ECO68C07 xxx	Jumpoff Cove Br, (trib. to Battle Cr), at end of Jumpoff Cove Rd, near Martin Springs	06030003 Upper Elk	Tennessee River	Marion	Impacts from agriculture and residences.
ECO68C08 xxx	Sweden Cr (Sweeten Cr), Franklin State Forest	06030003 Upper Elk	Tennessee River	Marion	Impacts from logging and agriculture.
ECO68C09 xxx	Cross Cr (trib. to Crow Cr), via Cross Cr Rd below Franklin State Forest	06030003 Upper Elk	Tennessee River	Franklin Marion	Impacts from logging and agriculture. Access is a problem.
ECO68C10 ^^^	Keller Creek, tributary to Estill Fork	06030003 Upper Elk	Tennessee River	Franklin	No access to this stream except via a jeep trail straight down the escarpment.
ECO68C11 xxx	Dry Cr above Mullens Cove Rd, in or near Prentice Cooper State Forest	06020001 Tennessee	Tennessee River	Marion	68A headwaters. Observed dry.
ECO68C12 ***	**Ellis Gap Br above Mullens Cove Rd in Prentice Cooper State Forest**	**06020001 Tennessee**	**Tennessee River**	**Marion**	**Added 12/97**
ECO♣68C13 ***	**Mud Creek at East Roarks Cove Road**	**06030003 Upper Elk**	**Tennessee River**	**Franklin**	**Added 8/96**
ECO68C14 ***	Richland Creek, at the wilderness area	06020001 Tennessee	Tennessee River	Rhea	Site is in a pocket wilderness area. Some impacts from logging, agriculture (cattle), and residential development.
ECO♣68C15 ***	**Crow Cr., off Lost Cove Rd at RM 34.2, Carter SNA**	**06030001 Guntersville Lake**	**Tennessee River**	**Franklin**	**Added 8/96**
ECO♣68C16 xxx	Bill Mc Nabb Gulf, located in Prentice Cooper WMA	06020001 Tennessee	Tennessee River	Marion	Impacts from development, no water. High gradient and large substrate.
ECO♣68C17 xxx	Ritchie Creek at the Kelly's Ferry Road crossing	06020001 Tennessee	Tennessee River	Marion	Logging in watershed, extremely high gradient, seasonality of flow problem.
ECO♣68C18 xxx	Roberts Mill Branch	06020001 Tennessee	Tennessee River	Hamilton	Impacts from development.

68c Plateau Escarpment cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣68C19	**Unnamed trib in Pauley King Cove, near Pigeon Point**	**06030001 Guntersville Lake**	**Tennessee River**	**Marion**	**Benthics collected on 4/97. Different geology than other streams collected in subregion. Will need more of this type stream to represent subregion.**
ECO♣68C20	**Crow Creek u/s of ECO♣68C15**	**06030001 Guntersville Lake**	**Tennessee River**	**Franklin**	**Added 8/98**

69. CENTRAL APPALACHIANS

69d Cumberland Mountains					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO69D01 ***	**No Business Branch at Highway 9 near Morley**	**05130101 Upper Cumberland**	**Cumberland River**	**Campbell**	**Added 8/96**
ECO69D02 xxx	Old Town Cr (trib. to Powell R), 4 mi west of Arthur	06010206 Powell	Tennessee River	Claiborne	All accesses were on private property and gated off.
ECO69D03 ***	**Flat Fork, upper reach at Emory Gap/Judge Br confl., Frozen Head SNA**	**06010208 Emory**	**Tennessee River**	**Morgan**	**Added 11/96**
ECO♣69D04 ***	**Stinking Creek, just within Royal Blue WMA**	**05130101 Upper Cumberland**	**Cumberland River**	**Campbell**	**Added 8/96. Good-sized watershed, may have some impacts, historic mining activity.**
ECO♣69D05	**New River, Hwy 116**	**05130104 South Fork Cumberland**	**Cumberland River**	**Morgan/ Anderson**	**Added 11/97**
ECO♣69D06	**Round Rock Creek, off Stony Fk Ck**	**05130104 South Fork Cumberland**	**Cumberland River**	**Campbell**	**Added 5/98**

71. INTERIOR PLATEAU

71e Western Pennyroyal Karst					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71E01 эээ	**Noahs Spring Branch, Ft. Campbell Military Res.**	**05130206 Red**	**Cumberland River**	**Montgomery Stewart Christian KY**	**Dropped due to impacts from army base.**
ECO71E02 ^^^	Dry Fork Creek, Ft. Campbell Military Reservation	05130206 Red	Cumberland River	Montgomery Christian KY	Watershed flows through Ft. Campbell reservation which provides some protection. Transitional area land cover, clearcut? Spring fed stream with mud bottom.

71e Western Pennyroyal Karst cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71E03 xxx	Piney Fork, Ft. Campbell Military Reservation	05130206 Red	Cumberland River	Montgomery Stewart	Several access points. According to biologist with Ft. Campbell stream flows through center of reservation and receives a lot of disturbance. Stream was very turbid with a greenish tinge (planktonic algae).
ECO71E04 xxx	Jordan Creek, (trib. to Piney Fork), Ft. Campbell Military Reservation	05130206 Red	Cumberland River	Montgomery	Biologist with Ft. Campbell says stream receives a lot of disturbance from the fort activities and is dry most of the year.
ECO71E05 xxx	Raccoon Branch near mouth, above Fletchers Fork, Ft. Campbell Military Reservation	05130206 Red	Cumberland River	Montgomery	Part of watershed outside of military reservation. More ag. and resid. disturbances. Biologist with Ft. Campbell says stream receives a lot of disturbance from fort activities and is dry most of year.
ECO71E06 xxx	Spring Creek, upper reach	05130206 Red	Cumberland River	Montgomery Todd KY	Near Jim Johnson Road. Upper watershed in KY very heavy row crop agriculture. Stream banks lack canopy and are eroding. Industrial discharge located at RM 11.5
ECO71E07 ^^^	Sturgeon Creek (trib. to Red River), at Sturgeon Creek Road, 2 mi east of Adams	05130206 Red	Cumberland River	Robertson	Dry. Fairly large channel. Revisited in June 1997 to verify if water in stream, very low flow, no samples taken.
ECO71E08 ^^^	Brush Creek (trib. to Sulphur Fork), Edd Ross Road, 2 mi N of Stroudville	05130206 Red	Cumberland River	Robertson	Added 4th quarter 97 for chemicals, benthics looked, will not be collected again. Watershed almost entirely forest/pasture with no row crops. Silt at Stroudsville Rd. It was flatrock at this point and at Hwy 256. Ellis Rd (u/s) was gravel. Lots of darters present. Evidence of excessive nutrient enrichment and high iron content.
ECO71E09 *******	**Buzzard Creek (trib. to Red River) near Buzzard Ck Rd, 4 mi N of Cedar Hill**	**05130206** **Red**	**Cumberland River**	**Robertson**	**Added 8/96**
ECO71E10 xxx	Hopewell Branch (trib. to South Fork Red Rv) at Ralph Fisher Rd, 2 mi west of Milldale	05130206 Red	Cumberland River	Robertson	Dry
ECO♣71E11 xxx	Fletchers Fork above Lake Taal	05130206 Red	Cumberland River	Montgomery	Stream dry for most of its length and for most of the year. There is a landfill and a dam downstream.
ECO♣71E12 xxx	Piney Fork, upper end of the stream	05130206 Red	Cumberland River	Montgomery	Eliminated on Ecotour, 1995. Stream sluggish, substrate was cobble overlying limestone bedrock. Pine plantations.

71e Western Pennyroyal Karst cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣71E13 ***	Sulphur Fork Red River	05130206 Red	Cumberland River	Robertson	Not chosen because reference area crosses 71E and 71F. Watershed in excellent shape with no cultivated fields or livestock. Good buffer zone. The cursory bug survey yielded typical benthics for bedrock stream.
ECO♣71E14	**Passenger Creek**	**05130206 Red**	**Cumberland River**	**Montgomery**	**Added 6/97**
ECO♣71E15 эээ	**Little West Fork Red River**	**05130206 Red**	**Cumberland River**	**Montgomery**	**Dropped due to excessive sediment**

71f Western Highland Rim					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO71F01 * **	**Panther Creek, S of Ft. Henry Road, LBL**	**06040005 TN Western Valley (Ky Lake)**	**Tennessee River**	**Stewart**	**Added 8/96.**
ECO71F02 ***	Bear Creek, near Blue Springs Road, Land Between the Lakes	05130205 Lower Cumberland (Lake Barkley)	Cumberland River	Stewart	Lower part of the stream visited during Ecotour on 8/26/95. Dry, in middle of cornfield. Upper part of watershed is perennial. Some bottomland agriculture. Entire stream within LBL so protection status is promising. Lots of data exists from APSU on the benthics and chemistry.
ECO71F03 ***	Lost Creek, north of Highway 79, Land Between the Lakes	06040005 TN Western Valley (Ky Lake)	Tennessee River	Stewart	Cobble bottom stream with good flow. Bridge and pond upstream may be causing impacts. Entire stream is within LBL. Lots of data exists from APSU on benthics and chemistry.
ECO71F04 ***	East Fork Leatherwood Creek, 1 mi below Harris Branch	06040005 TN Western Valley (Ky Lake)	Tennessee River	Stewart	Clear water except for tributaries affected by sawdust runoff. Mostly all forested.
ECO71F05 ***	Whiteoak Creek, (city of Tennessee Ridge located in headwaters of Lewis Branch)	06040005 TN Western Valley (Ky Lake)	Tennessee River	Houston Humphreys	Agriculture and roads near stream. Large stream, popular for canoeing. Some forested reaches.
ECO71F06 ***	Little Crooked Creek at Smith Road, 3 mi se of Faxon	06040005 TN Western Valley (Ky Lake)	Tennessee River	Benton	Nice creek, good habitat diversity, near WMA. Some bank scouring.
ECO71F07 ***	Big Richland Creek at Clydeton Road, 1 mi east of Trinity	06040005 TN Western Valley (Ky Lake)	Tennessee River	Humphreys	Clear water, biota excellent. Some slight disturbance caused by road/bridge construction and from encroachment into riparian zone by farming activities. Etnier et al. 1983 baseline stream site. Roads, cropland and pasture in the-stream area.
ECO71F08 xxx	Blue Spring Creek at Carney Winters Road (at George Boyd Road), east of Sycamore	05130202 Lower Cumberland	Cumberland River	Cheatham	Watershed affected by residential construction and logging. Area is developing at a rapid rate. Excessive silt in stream.

71f Western Highland Rim cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO71F09 xxx	Big Bluff Creek above Highway 49, 3 mi west of Ashland City	05130202 Lower Cumberland	Cumberland River	Cheatham	Very small stream, small watershed, excessive silt and algae on rocks. Numerous accesses and tire tracks within the creek. Most of watershed is in Cheatham State Wildlife Management Area.
ECO71F10 xxx	Little Marrowbone Creek, upper reach	05130202 Lower Cumberland	Cumberland River	Davidson	Biological evaluations show impact from siltation, possibly from historical impoundments in the headwaters and a wood chipping operation.
ECO71F11 ***	Turnbull Creek 0.6 mi east of Craggie Hope, approximately 2 mi above Harpeth River	05130204 Harpeth	Cumberland River	Cheatham Dickson	Excellent bug assemblage and chemistry. This stream is probably as good or better than South Harpeth River and Big Turnbull can be used as a reference for most of its length. Etnier et al. 1983 baseline stream site. Diverse substrates and some siltation.
ECO71F12 * **	**South Harpeth River, at Harpeth Rd off old Hwy 96**	**05130204 Harpeth**	**Cumberland River**	**Williamson**	**Added 8/96**
ECO71F13 ***	Hurricane Creek, near Spain Road	06040003 Lower Duck	Tennessee River	Humphreys	Very good benthics and chemistry. Water clear with very little silt. Upper part of watershed in very good shape. Roads, cropland and pasture in near-stream areas.
ECO71F14 ^^^	Dalton Creek near Mount Moriah	06040005 TN Western Valley (Ky Lake)	Tennessee River	Benton	Moderate amount of bank scouring, appears to be some fluctuation in flows, w side of TN River. Stream is near the transition zone between 71F and 65E. Also could look at Ballard Branch immed. west.
ECO71F15 xxx	Happy Hollow Creek above Coble-To-Only Road, 2 mi se of Only	06040003 Lower Duck	Tennessee River	Hickman	Highway 56 is under construction and part of stream has been put in culvert. Little Piney Creek to the se may be similar but road parallels stream. Pine trees in watershed.
ECO71F16	**Wolf Creek, Wolf Creek Road, 4 mi nw of Coble**	**06040003 Lower Duck**	**Tennessee River**	**Hickman**	**Added 2/98**
ECO71F17 ^^^	Ricketts Cr, Bohanas-Hayes Rd or downstream Cherokee Heights Rd, 2 mi east of Cozette	06040005 TN Western Valley (Ky Lake)	Tennessee River	Decatur	Chert darkly stained, faint musty odor. Pasture, some residential, some forest. west side of Tennessee River.
ECO71F18 xxx	Big Swan Creek (above Langford Branch, Highway 412/99	06040003 Lower Duck	Tennessee River	Lewis	Bridge construction impacts. Good size stream with moderately slow flow. Very large watershed with more disturbances than Little Swan Cr. Charlie Saylor (TVA) recommends downstream sites in Hickman Co.

71f Western Highland Rim cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS
ECO71F19 ***	**Brush Creek, near Gandy Road, 3.5 mi west of Napier & Natchez Trace Pkwy.**	**06040004 Buffalo**	**Tennessee River**	**Lewis Lawrence**	**Added 8/96**
ECO71F20 xxx	Fortyeight Cr, along Fortyeight Cr Rd, east of Waynesboro	06040004 Buffalo	Tennessee River	Wayne	Impacted by development from city of Waynesboro.
ECO71F21 ***	Buffalo River above Green River confluence	06040004 Buffalo	Tennessee River	Wayne Lewis Lawrence	Probably too big a watershed to use as reference. Excellent riparian zone. The Little Buffalo River would be a better choice since its headwaters are in a management area.
ECO71F22 xxx	Beech Creek near Leatherwood & Eagle Creek Wildlife Management Area	06040001 TN Western Valley (Beech)	Tennessee River	Wayne	Impacts from old PCB dumpsite in headwaters. (This is a Superfund site.) There is a landfill located on this stream.
ECO71F23 xxx	Eagle Creek, downstream of Eagle Creek Wildlife Management Area	06040001 TN Western Valley (Beech)	Tennessee River	Wayne	Cows observed in the creek along road. Lots of disturbance in the watershed and within the stream (gravel dredging).
ECO71F24 xxx	Franklin Branch (trib to Indian Cr), Old Bethlehem Rd, 1 mi N of Olivehill & Hwy 64	06040001 TN Western Valley (Beech)	Tennessee River	Hardin	Too small. Impacts from camping, heavy load of chert gravel.
ECO71F25 xxx	Butler Creek at Swanegan Branch	06030004 Lower Elk	Tennessee River	Wayne	Lots of activity in the watershed. Headwaters are in subregion 65J transition. (Etnier et al. 1983 baseline stream: one of the most pristine fourth order streams in the state.)
ECO♣71F26 эээ	**Pryor Creek, at Land Between the Lakes**	**05130205 Cumberland (Lake Barkley)**	**Cumberland River**	**Stewart**	**Dropped due to small watershed size.**
ECO♣71F27 ***	**Swanegan Branch at Thomas Woodard Road**	**06030005 Pickwick Lake**	**Tennessee River**	**Wayne**	**Added 8/96**
ECO♣71F28 ***	**Little Swan Creek at Meriwether Lewis NM**	**06040003 Lower Duck**	**Tennessee River**	**Lewis**	**Added 8/96**

71g Eastern Highland Rim					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71G01 ^^^	Clifty Creek (trib. to Long Creek), 2 mi north of Oakdale	05110002 Barren River	Ohio River	Macon	The benthic populations and the fact that the stream was crystal clear with little growth on the rocks indicated that it was not perennial
ECO71G02 ^^^	Long Fork, near Bohanan Road, 1.5 mi nw of Enon	05110002 Barren River	Ohio River	Macon	Need to check long term impacts of hwy construction. Stream has been cut down to Ordovician limestone.
ECO71G03 ^^^	**Flat Creek, below Highway 136, 4 mi south of Hilham**	**05130106 Upper Cumberland (Cordell Hull)**	**Cumberland River**	**Overton Putnam**	**Added 11/97**

71g Eastern Highland Rim cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71G04 ^^^	**Spring Creek at Highway 136**	**05130106 Upper Cumberland (Cordell Hull)**	**Cumberland River**	**Overton Putnam**	**Added 2/98**
ECO71G05 эээ	**Cherry Cr, below Hwy 84 near Yankeetown, ne of Sparta,**	**05130108 Caney Fork**	**Cumberland River**	**White**	**Dropped due to sediment impact from agriculture and development.**
ECO71G06 xxx	Mountain Creek, near Francis Ferry Road	05130108 Caney Fork	Cumberland River	Warren Cannon	Cumulative effect of agricultural activity and stream alterations are evident.
ECO71G07 ^^^	Barren Fork, above Jacksboro Road (Highway 287), near Trousdale	05130108 Caney Fork	Cumberland River	Warren Cannon Coffee	Watershed typical for this region but may have too much disturbance on it to be considered reference quality. Dams downstream would block fish.
ECO71G08 xxx	Flint River, at Vanntown Road (Highway 275), near Lincoln	06030003 Upper Elk	Tennessee River	Lincoln	Significant agricultural activity in this watershed. Much of the land is cleared.
ECO♣71G09 xxx	Charles Creek at Bratchers Crossroads	05130107 Collins	Cumberland River	Warren	Recent channelization at bridge. There was gravel dredging occurring around bridge.
ECO♣71G10 ^^^	**Hurricane Creek, located in the Barrens within Cumberland Springs WMA, fuzzy boundary stream**	**06030003 Upper Elk**	**Tennessee River**	**Moore**	**Added 9/96**
ECO♣71G11 Эээ	**West Fork Long Creek, along Long Creek Road, east of New Zion**	**05110002 Barren**	**Tennessee River**	**Macon**	**Dropped due to stressed macroinvertebrate community.**
ECO♣71G12 ^^^	Puncheon Camp Creek, at Williams Road	05110002 Barren	Tennessee River	Macon	A road that runs along the stream has disturbed the riparian zone. Otherwise a very nice stream with very little disturbance.
ECO♣71G13 ^^^	Mountain Creek, at Green Hill Road	05130108 Caney Fork	Cumberland River	Warren Cannon	Stream is known to be an excellent fishery. Minor headwaters on Short Mountain in 71H. Cherty bottom and gravel.

71h Outer Nashville Basin					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71H01 Xxx	Brushy Fork Creek near Red Tuttle Road	05130201 Cumberland (Old Hickory Lake)	Cumberland River	Sumner	Watershed is residential and disturbed. Stream had green algae prevalent.
ECO71H02 Xxx	Station Camp Creek, at Cottontown	05130201 Cumberland (Old Hickory Lake)	Cumberland River	Sumner	Watershed is in poor condition - lots of residences and road crossings. Agriculture and roads near stream.
ECO71H03 ***	**Flynn Creek, upper reach above Dry Fork**	**05130106 Upper Cumberland (Cordell Hull Lake)**	**Cumberland River**	**Jackson**	**Added 8/96**

71h Outer Nashville Basin cont.					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71H04 ^^^	Indian Creek, near Buffalo Valley	05130108 Caney Fork	Cumberland River	Putnam	Upper part of watershed in good shape but it is a small stream and high gradient similar to Flynn Creek.
ECO71H05 Xxx	Smith Fork, north of Woodbury	05130108 Caney Fork	Cumberland River	DeKalb Cannon Wilson	Cow density very high, broken up riparian zone, many residences.
ECO71H06 * **	**Clear Fork (trib. to Smith Fork), south of Liberty**	**05130108 Caney Fork**	**Cumberland River**	**DeKalb Cannon**	**Added 8/96.**
ECO71H07 ***	West Harpeth River, below gaging station near Murfrees Fork, above Leipers Fork	05130204 Harpeth	Cumberland River	Williamson	Watershed in relatively good shape. Good to excellent riparian zone, zero cow density. Typical Outer Nashville Basin stream representing the dominant types of streams. Watershed mostly cropland/pasture. Impoundment immediately upstream.
ECO71H08 Xxx	East Fork Stones River, above Parchcorn Hollow Branch, east of Woodbury	05130203 Stones	Cumberland River	Cannon	Watershed in poor shape with little riparian and some channelization because of the road alongside. Cattle observed in stream.
ECO71H09 * **	**Carson Fork, above Burt-Petty Gap Road near Burt**	**05130203 Stones**	**Cumberland River**	**Cannon**	**Added 8/96**
ECO71H10 Xxx	Thompson Creek, upper reach, near Raus or Midway	06040002 Upper Duck	Tennessee River	Bedford	Too much livestock activity in the area to consider. Only upper part of watershed could be considered because of a landfill below highway 130.
ECO71H11 Xxx	Fountain Creek near Highway 373 Mooresville Highway, 2 mi east of Culleoka	06040002 Upper Duck	Tennessee River	Maury	Watershed in poor shape. Little riparian zone, high cow density. TVA proposing dam. Etnier et al. 1983 baseline stream; their sample site below Highway; noted siltation.
ECO71H12 Xxx	West Fork Mulberry Creek, above Mulberry	06030003 Upper Elk	Tennessee River	Lincoln	Evaluated for additional site. Too much activity in the area (livestock) to consider.
ECO71H13 Xxx	Indian Creek, near Bryson Road	06030003 Upper Elk	Tennessee River	Giles	Too much activity in the area (livestock and residential) to consider
ECO♣71H14 ^^^	New Herman Fork, at Ward Hollow Road	06040002 Upper Duck	Tennessee River	Bedford	The watershed is in poor condition. Lots of livestock and broken down banks.
ECO♣71H15 Эээ	**West Harpeth River, off Highway 431 W of I-65, dropped after 3rd qtr 97**	**05130204 Harpeth**	**Cumberland River**	**Williamson**	**Dropped due to siltation and highway impacts**

71i Inner Nashville Basin					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO71I01 ^^^	Hurricane Cr, Cedars of Lebanon SF, Vesta Rd	05130203 Stones	Cumberland River	Wilson	Dry with trees and vegetation growing in it at Highway 231. Atypical?
ECO71I02 xxx	Fall Cr, s Cedars of Lebanon State Forest, near Hwy 231	05130203 Stones	Cumberland River	Wilson	Little riparian, cow density very high, broken down banks and lots of cow access. Headwaters are in 71H.
ECO71I03 ^^^	**Stewart Creek, upper reach, (d/s N Rd), 3 mi n Almaville**	**05130203 Stones**	**Cumberland River**	**Rutherford**	**Added 9/96 in 71H.**
ECO71I04 ^^^	Cripple Cr, lower reach, between Halls Hill /Cranor Rd, 7 mi e Murfreesboro	05130203 Stones	Cumberland River	Rutherford	Good benthics, lots of habitat. Some forest cover near the Dry Branch stretch? Headwaters are in 71H.
ECO71I05 ***	Spring Creek, near Old Columbia Road, Henry Horton State Park	06040002 Upper Duck	Tennessee River	Marshall	Watershed excellent, however, increasing livestock impacts threaten stream. Stream flows all year. Typical of region. Good benthics, chemistry. Headwaters in 71H.
ECO71I06 xxx	Wilson Creek, near mouth, Old Columbia Road	06040002 Upper Duck	Tennessee River	Marshall	Evaluated on Ecotour, not revisited at same site by NFO.
ECO71I07 ^^^	Sinking Cr below Warner Brdg Rd, 7 mi wnw of Shelbyville	06040002 Upper Duck	Tennessee River	Marshall	Stream nearly dry. Terrestrial vegetation growing within indicates it rarely flows.
ECO♣71I08 ^^^	N Fork Creek east of Henry Horton State Park	06040002 Upper Duck	Tennessee River	Marshall	Cow access and eroded banks. Upper part of watershed goes under hwy. Flat bedrock.
ECO♣71I09 * **	**West Fork Stones River at Rock Spring Road**	**05130203 Stones**	**Cumberland River**	**Rutherford**	**Added 9/96**
ECO♣71I10 * **	**Flat Creek at Talley Moore Road**	**06040002 Upper Duck**	**Tennessee River**	**Marshall**	**Added 9/96**
ECO♣71I11 ^^^	Wilson Creek at Manire Road Bridge near Cedar Grove	06040002 Upper Duck	Tennessee River	Marshall	Watershed in relatively good shape. Stream flows all year. Typical Inner Basin stream.
ECO♣71I12	**Cedar Cr off Centerville Rd, 0.5 mi south Hwy 141**	**05130201 Cumberland (Old Hickory)**	**Cumberland River**	**Wilson**	**Added 4/00 Original 71i Probabilistic CEDAR004.6WS**
ECO♣71I13	**Fall Creek, 100 yds u/s Mona Rd**	**05130203 Stones**	**Cumberland River**	**Rutherford**	**Added 4/00 Original 71i Probabilistic FALL003.6RU**
ECO♣71I14	**Little Flat Creek, 200 yds u/s Will Brown Rd**	**06040002 Upper Duck**	**Tennessee River**	**Maury**	**Added 4/00 Original 71i Probabilistic LFLAT003.6MY**
ECO♣71I15	**Harpeth River, 125 yds d/s McDaniel Rd**	**05130204 Harpeth**	**Cumberland River**	**Williamson**	**Added 4/00 Original 71i Probabilistic HARPE076.0WI (actually RM 105.7) Some tribs drain 71h**

73 MISSISSIPPI ALLUVIAL PLAIN

73a Northern Mississippi Alluvial Plain					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO♣73A01 эээ	**Cold Creek at Long Hole Road**	**08010100 Mississippi**	**S. Central Miss. River**	**Lauderdale**	**Added 9/96. Dropped 9/97, found more representative site upstream**
ECO♣73A02	**Middle Fork Forked Deer**	**08010100 Mississippi**	**S. Central Miss. River**	**Lauderdale**	**Added 5/98.**
ECO♣73A03	**Cold Creek at Crutcher Lake Road**	**08010100 Mississippi**	**S. Central Miss. River**	**Lauderdale**	**Added 5/98**
ECO♣73A04	**Bayou du Chien, ¾ mile upstream boat ramp on Walnut Log Road**	**08010202 Obion**	**S. Central Miss. River**	**Lake**	**Added 5/98**

74 MISSISSIPPI VALLEY LOESS PLAINS

74a Bluff Hills					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO74A01 xxx	Indian Creek above Old Samburg Road	08010202 Obion	S. Central Miss. River	Obion	Stream is impounded as a lake. No access, sheer bluffs.
ECO74A02 xxx	Carrol Creek above PawPaw Creek	08010202 Obion	S. Central Miss. River	Obion	Access via Putnam Hill Road and Pawpaw Creek could be difficult. Channel is too small and undefined, sheer bluffs.
ECO74A03 xxx	Brown Creek above Cat Corner, Lasiter Foothill Road	08010202 Obion	S. Central Miss. River	Obion	Small, sluggish stream, excellent riparian. Large fields on both sides. PVC pipe was in stream. Strong chemical odor (pesticides). Old unlined landfill present in watershed.
ECO74A04 xxx	Possum Creek above Coon Creek at Lenox-Nauvoo Road	08010202 Obion	S. Central Miss. River	Dyer	May be too small. Surrounding land use pasture and forest. Hog pens and cars in stream. Coon Creek has a reservoir.
ECO74A05 xxx	Knob Creek at Porter Gap Road	08010100 Mississippi	S. Central Miss. River	Lauderdale	Excessive green algal growth, impacted by some nutrient source. Extensive bulldozer work around bridge site.
ECO74A06 ^^^	**Sugar Creek, Highway 59**	**08010100 Mississippi**	**S. Central Miss. River**	**Tipton**	**Added 4/96**
ECO74A07 ^^^	Bear Cr above Bluff Road, 3 mi SW of Drummonds	08010100 Mississippi	S. Central Miss. River	Tipton	Lots of agriculture in watershed, septic tank impacting streams.
ECO♣74A08 * **	**PawPaw Creek upstream confluence with Carroll Cr.**	**08010202 Obion**	**Mississippi**	**Obion**	**Added 8/96**
ECO♣74A09	Unnamed trib. to Brinkley Bayou, in Meeman Shelby SP	08010100 Mississippi	S. Central Miss. River	Shelby	Small wadeable stream. Sediment is predominately sand with gravel

ECO♣74A10 эээ	**Unnamed trib. to Running Reelfoot Bayou**	**08010202 Obion**	S. Central Miss. River	**Obion**	**Dropped small, spring like, atypical**

74B Loess Plains					
SITE #	STREAM / LOCATION	USGS HUC CODE	MAJOR BASIN	COUNTY	COMMENTS (Initial Screening)
ECO74B01 ^^^	**Terrapin Creek above Highway 69**	**08010202 Obion**	**S. Central Miss. River**	**Henry**	**Added 9/96**
ECO74B02 xxx	Sugar Creek at N Fork Church Road (trib. to Terrapin Creek)	08010202 Obion	S. Central Miss. River	Henry	May be too small. Some channelization, agricultural impacts, but appears to have relatively more riparian forest.
ECO74B03 xxx	Biggs / Hurricane Creek at Hwy 89, 3.5 mi N of Palmersville; or downstream	08010202 Obion	S. Central Miss. River	Weakley	It had a curve or two and a small patch of green, but probably too impacted. Channelized.
ECO74B04 ^^^	**Powell Cr at McLains Levee Road**	**08010202 Obion**	**S. Central Miss. River**	**Weakley**	**Added 9/96.**
ECO74B05 xxx	Unnamed tributary to N Fork Obion River, at Highway 118, 1 mi N of Latham	08010202 Obion	S. Central Miss. River	Weakley	Small watershed. Recent logging, iron flocculant. Upper half is all ag with some channelization, lower half meanders and is forested into the N Fork Obion floodplain.
ECO74B06 ^^^	Lagoon Creek at Estes Lane, 12 mi W of Brownsville	08010208 Lower Hatchie	S. Central Miss. River	Haywood	Channelization of tribs and ag. impacts in the upper watershed impact this creek.
ECO74B07 xxx	Cypress Cr at Herbert Willis Rd or next upstream crossing, 9 mi W of Brownsville	08010208 Lower Hatchie	S. Central Miss. River	Haywood	Too much agriculture in the watershed.
ECO74B08 xxx	Unnamed trib to Jeffers Cr, 1st trib. above Bachelor Levee Rd at Harold Stanley Rd near Haywood/Madison county line	08010208 Lower Hatchie	S. Central Miss. River	Haywood Madison	No trespassing signs on land, plowed fields.
ECO74B09 xxx	Little Muddy Creek in Hatchie Bottom	08010208 Lower Hatchie	S. Central Miss. River	Haywood	Too small, too little flow, access a problem. Small unimproved road from Post Road.
ECO74B10 xxx	East Beaver Cr above Hendrick Rd, 1/2 mi SE of Mason	08010209 Loosahatchie	S. Central Miss. River	Tipton	Channel degradation.
ECO74B11 xxx	Unnamed trib to Wolf River at Knox Road, 3.5 mi SSW of Rossville, 1/2 mi N of state line	08010210 Wolf	S. Central Miss. River	Fayette	Channel degradation.
ECO74B12 ^^^	**Wolf River upstream Yager Rd, 1 mi S of La Grange**	**08010210 Wolf**	**S. Central Miss. River**	**Fayette**	**Added 9/96**
ECO♣74B13 xxx	Original meander of the N Fork Obion, 0.75 mi N of Latham on Highway 118	08010202 Obion	S. Central Miss. River	Weakley	Iron floc was present, plowed fields near stream. Old meander of original river, more typical of bigger streams in Loess area.

Sites in bold were selected as final reference streams

Legend

϶϶϶ Site dropped after sampling due to impacts
♣ Site not on EPA candidate list, added by WPC or other agencies
***** Good Candidate Reference Stream**
^^^ Probably not a good reference stream, but keep in mind
xxx Eliminate from consideration

References:

Original table provided by Glen Griffith and Jim Omernick, NHREEL, U.S.EPA, Corvalis, Oregon

Etnier, D.A., D.L. Bunting, W.O. Smith and G.A. Vaughan. 1983. *Tennessee Baseline Stream Survey*. Research Report No. 95. Tennessee Water Resources Research Center. University of Tennessee, Knoxville. 239 pp.

APPENDIX C

FIELD FORMS

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION #_______________ RIVER MILE______	STREAM CLASS
LAT______________________ LONG___________	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE_______ TIME________ AM PM / REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m)	Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low)	Dominated by 1 velocity/depth regime (usually slow-deep)
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low –gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand/or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization usually near bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Frequency of Riffles (or bends)	Occurrence of riffles frequent; ratio of distance between riffles divided by stream width <7:1 (generally 5-7); variety of habitat is key. If riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >35.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability (score each bank) **Note: determine left or right side by facing downstream.**	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded area; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protective (score each bank) **Note: determine left or right side by facing downstream**	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

TOTAL SCORE ________________

Adapted from Appendix A-1 Habitat Assessment and Physiochemical Characterization Field Data Sheets – Form

HABITAT ASSESSMENT DATA SHEET- LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION
STATION #______________ RIVER MILE______	STREAM CLASS
LAT____________________ LONG___________	RIVER BASIN
STORET#	AGENCY
INVESTIGATORS	
FORM COMPLETED BY	DATE_______ TIME________ AM PM / REASON FOR SURVEY

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient)	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale)	10-30% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation present.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
3. Pool Variabilitly	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low –gradient streams) of the bottom affected by sediment deposition	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills> 75% of the available channel; or 25 % of channel substrate is exposed.	Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1

HABITAT ASSESSMENT DATA SHEET- LOW GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present	Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
7. Channel Sinuosity	Bends increase the stream length 3-4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2-3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
8. Bank Stability (score each bank) **Note: determine left or right side by facing downstream.**	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods	Unstable; many eroded areas; "raw" areas; obvious bank sloughing; 60-100% of bank has erosional scars
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protective (score each bank) **Note: determine left or right side by facing downstream.**	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

TOTAL SCORE ________________

Adapted from Appendix A-1 Habitat Assessment and Physiochemical Characterization Field Data Sheets – Form

APPENDIX D

HABITAT ASSESSMENT SCORES

Habitat Scores for Ecoregion Reference Streams, Tennessee
April 1996-May 1999

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO65A01	UNNAMED TRIB TO MUDDY CR	85	9/18/96	DHA,PAD-LAB
ECO65A01	UNNAMED TRIB TO MUDDY CR	86	4/14/97	PAD-LAB
ECO65A01	UNNAMED TRIB TO MUDDY CR	82	9/8/97	PAD,PDS-LAB
ECO65A01	UNNAMED TRIB TO MUDDY CR	151	6/2/98	AJF-JEAC
ECO65A03	WARDLOW CREEK	71	9/20/96	DHA,PAD-LAB
ECO65A03	WARDLOW CREEK	71	4/15/97	PAD,PDS-LAB
ECO65A03	WARDLOW CREEK	71	9/9/97	PAD,PDS-LAB
ECO65B04	CYPRESS CREEK	122	9/16/96	PAD-LAB
ECO65B04	CYPRESS CREEK	122	4/14/97	PAD,PDS-LAB
ECO65B04	CYPRESS CREEK	122	9/8/97	PAD-LAB
ECO65B04	CYPRESS CREEK	154	4/23/98	AJF,GSO-JEAC
ECO65B04	CYPRESS CREEK	123	9/2/98	AJF,GSO-JEAC
ECO65B04	CYPRESS CREEK	162	4/7/99	AJF-JEAC
ECO65B05	PRAIRIE BRANCH	108	9/17/96	PAD,DHA-LAB
ECO65B05	PRAIRIE BRANCH	108	4/14/97	PAD,PDS-LAB
ECO65B05	PRAIRIE BRANCH	108	9/8/97	PAD,PDS-LAB
ECO65E02	SLICKUP CREEK	123	4/17/97	PAD,PDS-LAB
ECO65E02	SLICKUP CREEK	123	9/10/97	PAD,PDS-LAB
ECO65E04	BLUNT CREEK	134	4/17/97	PAD,PDS-LAB
ECO65E04	BLUNT CREEK	128	10/7/97	PAD,PDS-LAB
ECO65E04	BLUNT CREEK	133	4/22/98	AJF,GSO-JEAC
ECO65E04	BLUNT CREEK	134	9/9/98	AJF,GSO-JEAC
ECO65E04	BLUNT CREEK	136	4/19/99	AJF-JEAC
ECO65E06	GRIFFEN CREEK	125	4/16/97	PAD,PDS-LAB
ECO65E06	GRIFFEN CREEK	125	9/10/97	PAD,PDS-LAB
ECO65E06	GRIFFEN CREEK	147	4/22/98	GSO,AJF-JEAC
ECO65E06	GRIFFEN CREEK	130	9/9/98	GSO,AJF-JEAC
ECO65E06	GRIFFEN CREEK	125	4/19/99	AJF-JEAC
ECO65E08	HARRIS CREEK	140	8/22/96	AJF,GSO-JEAC
ECO65E08	HARRIS CREEK	122	9/20/96	DHA,PAD-LAB
ECO65E08	HARRIS CREEK	143	5/5/97	GSO-JEAC
ECO65E08	HARRIS CREEK	144	8/15/97	AJF-JEAC
ECO65E08	HARRIS CREEK	151	6/2/98	AJF-JEAC
ECO65E08	HARRIS CREEK	163	9/11/98	GSO,AJF-JEAC
ECO65E08	HARRIS CREEK	154	3/24/99	AJF-JEAC
ECO65E08	HARRIS CREEK	163	9/11/99	GSO-JEAC
ECO65E10	MARSHALL CREEK	144	9/16/96	DHA,PAD-LAB

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO65E10	MARSHALL CREEK	180	4/17/97	AJF,GSO-JEAC
ECO65E10	MARSHALL CREEK	181	8/14/97	AJF-JEAC
ECO65E10	MARSHALL CREEK	179	4/23/98	AJF,GSO-JEAC
ECO65E10	MARSHALL CREEK	159	9/2/98	AJF,GSO-JEAC
ECO65E10	MARSHALL CREEK	169	4/7/99	AJF-JEAC
ECO65E11	WEST FORK SPRING CREEK	174	8/15/96	AJF,PCP-JEAC
ECO65E11	WEST FORK SPRING CREEK	143	9/16/96	DHA-LAB
ECO65E11	WEST FORK SPRING CREEK	152	4/17/97	GSO-JEAC
ECO65E11	WEST FORK SPRING CREEK	173	8/14/97	AJF-JEAC
ECO65E11	WEST FORK SPRING CREEK	168	4/23/98	AJF,GSO-JEAC
ECO65E11	WEST FORK SPRING CREEK	163	9/2/98	AJF,GSO-JEAC
ECO65E11	WEST FORK SPRING CREEK	171	4/7/99	AJF-JEAC
ECO65E11	WEST FORK SPRING CREEK	185	4/29/99	AJF,GSO-JEAC
ECO65I01	ROBINSON CREEK	108	9/20/96	DHA,PAD-LAB
ECO65I01	ROBINSON CREEK	154	4/15/97	PAD,PDS-LAB
ECO65I01	ROBINSON CREEK	108	9/9/97	PAD,PDS-LAB
ECO65I02	BATTLES CREEK	131	9/18/96	DHA,PAD-LAB
ECO65I02	BATTLES CREEK	131	4/15/97	PAD,PDS-LAB
ECO65I02	BATTLES CREEK	119	10/7/97	PAD-LAB
ECO65I02	BATTLES CREEK	125	10/7/97	PAD,PDS-LAB
ECO65I03	UT EAST FK ROBINSON CR	151	4/15/97	PDS,PAD-LAB
ECO65I03	UT EAST FK ROBINSON CR	141	9/9/97	PAD,PDS-LAB
ECO65J04	POMPEYS BRANCH	181	8/29/96	JIB-CO
ECO65J04	POMPEYS BRANCH	184	8/29/96	AJF,PCP-JEAC
ECO65J04	POMPEYS BRANCH	178	5/2/97	AJF-JEAC
ECO65J04	POMPEYS BRANCH	186	8/21/97	AJF-JEAC
ECO65J04	POMPEYS BRANCH	195	4/29/98	AJF,GSO-JEAC
ECO65J04	POMPEYS BRANCH	176	9/17/98	GSO,AJF-JEAC
ECO65J04	POMPEYS BRANCH	176	9/17/98	GSO,AJF-JEAC
ECO65J04	POMPEYS BRANCH	180	4/20/99	AJF,SKRS-JEAC
ECO65J05	DRY CREEK	151	8/29/96	JIB-CO
ECO65J05	DRY CREEK	174	8/29/96	AJF,PCP-JEAC
ECO65J05	DRY CREEK	166	5/2/97	AJF-JEAC
ECO65J05	DRY CREEK	190	8/21/97	AJF-JEAC
ECO65J05	DRY CREEK	178	9/17/98	AFJ,GSO-JEAC
ECO65J05	DRY CREEK	169	4/20/99	AJF,SKRS-JEAC
ECO65J06	RIGHT FORK WHITES CREEK	163	8/29/96	JIB-CO
ECO65J06	RIGHT FORK WHITES CREEK	179	8/29/96	AJF,JIB-JEAC
ECO65J06	RIGHT FORK WHITES CREEK	167	5/2/97	AJF-JEAC
ECO65J06	RIGHT FORK WHITES CREEK	190	8/22/97	AJF-JEAC
ECO65J06	RIGHT FORK WHITES CREEK	176	4/28/98	AJF,GSO-JEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO65J06	RIGHT FORK WHITES CREEK	184	9/17/98	AJF,GSO-JEAC
ECO65J06	RIGHT FORK WHITES CREEK	186	4/29/99	AJF,GSO-JEAC
ECO65J11	UT RT FRK WHITES CK	167	5/2/97	AJF-JEAC
ECO65J11	UT RT FRK WHITES CK	194	8/22/97	AJF-JEAC
ECO65J11	UT RT FRK WHITES CK	189	4/29/98	AJF,GSO-JEAC
ECO65J11	UT RT FRK WHITES CK	176	9/17/98	AJF,GSO-JEAC
ECO66D01	BLACK BRANCH	197	4/25/97	BTB-JCEAC
ECO66D01	BLACK BRANCH	198	9/26/97	TDR,RGC-JCEAC
ECO66D01	BLACK BRANCH	193	5/15/98	WDH-JCEAC
ECO66D01	BLACK BRANCH	197	10/7/98	TAR,WDH-JCEAC
ECO66D01	BLACK BRANCH	198	4/19/99	TAR,WDH-JCEAC
ECO66D03	LAUREL FORK	195	10/2/96	BTB,TAR-JCEAC
ECO66D03	LAUREL FORK	196	4/25/97	BTB-JCEAC
ECO66D03	LAUREL FORK	197	9/15/97	BTB,TAR-JCEAC
ECO66D03	LAUREL FORK	181	4/13/98	WDH,RLT-JCEAC
ECO66D03	LAUREL FORK	194	10/9/98	WDH,TAR-JCEAC
ECO66D03	LAUREL FORK	194	4/19/99	TAR,WDH-JCEAC
ECO66D05	DOE RIVER	194	6/23/97	TAR-JCEAC
ECO66D05	DOE RIVER	199	11/5/97	TAR,RGC-JCEAC
ECO66D05	DOE RIVER	194	5/15/98	WDH-JCEAC
ECO66D05	DOE RIVER	194	9/15/98	TAR,RLT-JCEAC
ECO66D05	DOE RIVER	194	4/22/99	RGC,TAR-JCEAC
ECO66D06	TUMBLING CREEK	190	11/7/97	TAR,RGC-JCEAC
ECO66D07	LITTLE STONY CREEK	199	11/5/97	TAR,RGC-JCEAC
ECO66E04	GENTRY CREEK	195	11/6/97	TAR,RGC-JCEAC
ECO66E09	CLARK CREEK	194	5/5/97	BTB-JCEAC
ECO66E09	CLARK CREEK	191	8/22/97	BTB,TAR-JCEAC
ECO66E09	CLARK CREEK	158	5/13/98	WDH-JCEAC
ECO66E09	CLARK CREEK	199	4/7/99	TAR,WDH-JCEAC
ECO66E11	LOWER HIGGINS CREEK	195	5/23/97	BTB-JCEAC
ECO66E11	LOWER HIGGINS CREEK	198	8/21/97	BTB-JCEAC
ECO66E11	LOWER HIGGINS CREEK	198	4/2/98	WDH,RLT-JCEAC
ECO66E11	LOWER HIGGINS CREEK	200	9/10/98	TAR,RLT-JCEAC
ECO66E11	LOWER HIGGINS CREEK	200	6/9/99	WDH,RGC-JCEAC
ECO66E17	DOUBLE BRANCH	178	9/30/97	PES,AEW-KEAC
ECO66E18	GEE CREEK	174	4/9/96	GDR-CHEAC
ECO66E18	GEE CREEK	188	4/14/97	GDR-CHEAC
ECO66F02	JIM WRIGHT BRANCH	185	11/12/97	TAR,RGC-JCEAC
ECO66F06	ABRAMS CREEK	171	3/27/96	JEB-KEAC
ECO66F06	ABRAMS CREEK	177	9/3/96	KEAC
ECO66F06	ABRAMS CREEK	165	9/4/96	PDS,PAD-LAB

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO66F06	ABRAMS CREEK	170	5/20/97	JEB,PES-KEAC
ECO66F06	ABRAMS CREEK	185	9/30/97	PES,AEW-KEAC
ECO66F06	ABRAMS CREEK	184	4/13/98	PES,JCP-KEAC
ECO66F06	ABRAMS CREEK	191	8/28/98	PES,JCP-KEAC
ECO66F06	ABRAMS CREEK	184	4/22/99	JEB,JCP-KEAC
ECO66F07	BEAVERDAM CREEK	168	9/10/96	APM,KJS-LAB
ECO66F07	BEAVERDAM CREEK	192	10/2/96	JCEAC
ECO66F07	BEAVERDAM CREEK	197	6/10/97	BTB,TAR-JCEAC
ECO66F07	BEAVERDAM CREEK	190	10/13/97	TAR,WDH-JCEAC
ECO66F08	STONY CREEK	190	11/7/97	TAR,RGC-JCEAC
ECO66G04	MID PRONG LITTLE PIGEON R	194	4/22/96	JEB-KEAC
ECO66G04	MID PRONG LITTLE PIGEON R	197	9/4/96	JEB,PES-KEAC
ECO66G04	MID PRONG LITTLE PIGEON R	194	10/2/97	PES,AEW-KEAC
ECO66G05	LITTLE RIVER	197	4/22/96	JEB-KEAC
ECO66G05	LITTLE RIVER	195	9/4/96	JEB,PES-KEAC
ECO66G05	LITTLE RIVER	196	5/20/97	JEB,PES-KEAC
ECO66G05	LITTLE RIVER	195	10/2/97	PES,AEW-KEAC
ECO66G05	LITTLE RIVER	196	4/13/98	PES,JCP-KEAC
ECO66G05	LITTLE RIVER	193	9/11/98	JEB,JCP-KEAC
ECO66G05	LITTLE RIVER	196	4/22/99	JEB,JCP-KEAC
ECO66G07	CITICO CREEK	173	10/1/97	PES,AEW-KEAC
ECO66G07	CITICO CREEK	189	4/16/98	PES,JCP-KEAC
ECO66G07	CITICO CREEK	175	9/10/98	JEB,KMJ-KEAC
ECO66G07	CITICO CREEK	175	9/10/98	JEB,KMJ-KEAC
ECO66G07	CITICO CREEK	186	4/8/99	PES,AJM-KEAC
ECO66G09	NORTH RIVER	186	10/1/97	PES,AEW-KEAC
ECO66G09	NORTH RIVER	167	5/18/98	CLD-CHEAC
ECO66G09	NORTH RIVER	181	9/10/98	JEB,KMJ-KEAC
ECO66G09	NORTH RIVER	183	4/8/99	PES,AJM-KEAC
ECO66G12	SHEEDS CREEK	179	4/24/96	KEAC
ECO66G12	SHEEDS CREEK	188	4/15/97	GDR-CHEAC
ECO66G12	SHEEDS CREEK	163	9/8/97	GDR-CHEAC
ECO66G12	SHEEDS CREEK	187	5/13/98	GDR-CHEAC
ECO66G12	SHEEDS CREEK	175	8/31/98	KJS,JCA-LAB
ECO66G12	SHEEDS CREEK	181	4/26/99	JCA,APM-LAB
ECO66G12	SHEEDS CREEK	181	4/26/99	JCA,APM-LAB
ECO6701	BIG CREEK	163	9/22/98	TAR,WDH-JCEAC
ECO6701	BIG CREEK	177	4/16/99	TAR,SKV-JCEAC
ECO6702	FISHER CREEK	167	8/26/97	BTB-JCEAC
ECO6702	FISHER CREEK	172	9/22/98	TAR,WDH-JCEAC
ECO6702	FISHER CREEK	172	4/16/99	TAR,SKV-JCEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO6707	POSSUM CREEK	193	5/13/98	WDH,RLT-JCEAC
ECO6707	POSSUM CREEK	173	9/14/98	TAR,WDH-JCEAC
ECO6707	POSSUM CREEK	173	4/22/99	RGC,RLT-JCEAC
ECO67F01	TURKEY CREEK	177	10/30/97	TAR,RGC-JCEAC
ECO67F06	CLEAR CREEK	176	5/5/98	PES,AEW-KEAC
ECO67F06	CLEAR CREEK	139	8/31/98	JEB-KEAC
ECO67F06	CLEAR CREEK	174	4/20/99	JEB,KMJ-KEAC
ECO67F08	LITTLE SEWEE CREEK	160	9/5/96	PDS,PAD-LAB
ECO67F13	WHITE CREEK	186	4/8/96	KEAC
ECO67F13	WHITE CREEK	181	9/5/96	PDS,PAD-LAB
ECO67F13	WHITE CREEK	183	5/5/97	JEB,PES-KEAC
ECO67F13	WHITE CREEK	182	9/11/97	JEB,PES-KEAC
ECO67F13	WHITE CREEK	187	5/6/98	JEB,NRH-KEAC
ECO67F13	WHITE CREEK	173	8/31/98	JEB-KEAC
ECO67F13	WHITE CREEK	187	4/20/99	JEB,KMJ-KEAC
ECO67F14	POWELL RIVER	174	10/3/96	JCEAC
ECO67F14	POWELL RIVER	174	10/2/97	TAR,WDH-JCEAC
ECO67F14	POWELL RIVER	166	3/31/98	WDH,RLT-JCEAC
ECO67F14	POWELL RIVER	186	9/1/98	TAR,WDH-JCEAC
ECO67F16	HARDY CREEK	182	9/24/98	TAR,WDH-JCEAC
ECO67F16	HARDY CREEK	196	4/1/99	TAR,WDH-JCEAC
ECO67F17	BIG WAR CREEK	192	6/13/97	BTB,TAR-JCEAC
ECO67F17	BIG WAR CREEK	193	9/12/97	TAR,JEB-JCEAC
ECO67F17	BIG WAR CREEK	193	5/28/98	WDH,RCT-JCEAC
ECO67F17	BIG WAR CREEK	195	10/2/98	WDH,TAR-JCEAC
ECO67F17	BIG WAR CREEK	196	5/28/99	TAR,WDH-JCEAC
ECO67F23	MARTIN CREEK	173	9/24/98	TAR,WDH-JCEAC
ECO67F23	MARTIN CREEK	175	4/1/99	TAR,WDH-JCEAC
ECO67F26	INDIAN CREEK	159	6/27/97	PES,AJM-KEAC
ECO67F26	INDIAN CREEK	167	9/11/97	PES,JEB-KEAC
ECO67G01	LITTLE CHUCKY CREEK	167	10/2/96	JCEAC
ECO67G01	LITTLE CHUCKY CREEK	159	5/12/97	TAR-JCEAC
ECO67G01	LITTLE CHUCKY CREEK	165	8/22/97	BTB-JCEAC
ECO67G01	LITTLE CHUCKY CREEK	154	5/14/98	WDH-JCEAC
ECO67G01	LITTLE CHUCKY CREEK	161	9/3/98	TAR,WDH-JCEAC
ECO67G01	LITTLE CHUCKY CREEK	158	5/25/99	TAR,CAB-JCEAC
ECO67G05	BENT CREEK	141	4/25/96	JEB-KEAC
ECO67G05	BENT CREEK	138	9/9/96	JEB,PES-KEAC
ECO67G05	BENT CREEK	154	5/22/97	JEB,AJM-KEAC
ECO67G09	HARRIS CREEK	158	10/9/97	CLD-CHEAC
ECO67GO8	BRYMER CREEK	150	5/21/97	TYH-CHEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO67H04	BLACKBURN CREEK	136	4/10/96	CHEAC
ECO67H04	BLACKBURN CREEK	167	10/2/97	CLD,GDR-CHEAC
ECO67H06	LAUREL CREEK	171	4/10/96	KEAC
ECO67H06	LAUREL CREEK	169	9/11/96	JEB,PES-KEAC
ECO67H06	LAUREL CREEK	170	5/1/97	JEB,PES-KEAC
ECO67H06	LAUREL CREEK	166	9/29/97	APM,PDS-LAB
ECO67H08	PARKER BRANCH CREEK	152	9/12/96	APM,KJS-LAB
ECO67H08	PARKER BRANCH CREEK	169	10/3/96	JCEAC
ECO67H08	PARKER BRANCH CREEK	177	4/30/97	TAR-JCEAC
ECO67H08	PARKER BRANCH CREEK	180	10/9/97	TAR,WDH-JCEAC
ECO67I11	THOMPSON BR	132	5/12/97	TYH-CHEAC
ECO67I11	THOMPSON BR	120	10/2/97	GDR,CLD-CHEAC
ECO67I12	MILL CREEK	164	9/19/96	KEAC
ECO67I12	MILL CREEK	149	4/16/97	JEB,PES-KEAC
ECO67I12	MILL CREEK	152	9/22/97	PAD,KJS-LAB
ECO68A01	ROCK CREEK	178	4/17/96	KEAC
ECO68A01	ROCK CREEK	178	9/13/96	KEAC
ECO68A01	ROCK CREEK	180	5/7/97	JEB,AEW-KEAC
ECO68A01	ROCK CREEK	182	9/26/97	PES,AEW-KEAC
ECO68A01	ROCK CREEK	187	5/8/98	PES,AEW-KEAC
ECO68A01	ROCK CREEK	173	9/17/98	JEB,JCP-KEAC
ECO68A01	ROCK CREEK	181	4/12/99	PES,AJM-KEAC
ECO68A03	LAUREL FORK STATION CAMP	180	4/17/96	KEAC
ECO68A03	LAUREL FORK STATION CAMP	178	9/13/96	KEAC
ECO68A03	LAUREL FORK STATION CAMP	188	5/14/97	JEB,PES-KEAC
ECO68A03	LAUREL FORK STATION CAMP	192	9/26/97	PES,AEW-KEAC
ECO68A03	LAUREL FORK STATION CAMP	185	5/18/98	JEB,KMJ-KEAC
ECO68A03	LAUREL FORK STATION CAMP	156	9/17/98	JEB,JCP-KEAC
ECO68A03	LAUREL FORK STATION CAMP	191	4/12/99	PES,AJM-KEAC
ECO68A08	CLEAR CREEK	179	4/17/96	KEAC
ECO68A08	CLEAR CREEK	175	9/12/96	KEAC
ECO68A08	CLEAR CREEK	177	6/26/97	JEB-KEAC
ECO68A08	CLEAR CREEK	163	9/22/97	JEB,PES-KEAC
ECO68A08	CLEAR CREEK	183	5/22/98	JEB,SLD-KEAC
ECO68A08	CLEAR CREEK	181	9/2/98	JEB,KMJ-KEAC
ECO68A08	CLEAR CREEK	190	4/26/99	PES,AEW-KEAC
ECO68A13	PINEY RIVER	158	5/3/99	DRL,PAD-LAB
ECO68A20	MULLENS CREEK	157	4/15/96	CHEAC
ECO68A20	MULLENS CREEK	189	5/27/97	GDR-CHEAC
ECO68A20	MULLENS CREEK	158	9/30/97	GDR-CHEAC
ECO68A20	MULLENS CREEK	184	5/4/98	GDR-CHEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO68A20	MULLENS CREEK	179	4/26/99	JCA,APM-LAB
ECO68A21	FIRESCALD CREEK	158	4/15/96	KEAC
ECO68A21	FIRESCALD CREEK	145	8/21/96	PAD,APM-LAB
ECO68A26	DADDY'S CREEK	179	9/5/97	JEB,PES-KEAC
ECO68A26	DADDY'S CREEK	191	5/22/98	JEB,SLD-KEAC
ECO68A26	DADDY'S CREEK	182	9/2/98	JEB,KMJ-KEAC
ECO68A26	DADDY'S CREEK	194	4/26/99	PES,AEW-KEAC
ECO68A27	ISLAND CREEK	187	3/30/98	JEB,KMJ-KEAC
ECO68A27	ISLAND CREEK	139	9/2/98	JEB,KMJ-KEAC
ECO68A27	ISLAND CREEK	182	4/26/99	PES,AEW-KEAC
ECO68A28	ROCK CREEK	194	3/30/98	JEB,KMJ-KEAC
ECO68A28	ROCK CREEK	149	9/16/98	JEB,KMJ-KEAC
ECO68A28	ROCK CREEK	188	5/3/99	JEB,AWB-KEAC
ECO68B01	CRYSTAL CREEK	117	4/16/96	CHEAC
ECO68B01	CRYSTAL CREEK	165	5/7/97	GDR-CHEAC
ECO68B01	CRYSTAL CREEK	150	5/6/98	GDR-CHEAC
ECO68B01	CRYSTAL CREEK	166	5/3/99	DRL,PAD-LAB
ECO68B02	MCWILLIAMS CREEK	131	4/16/96	CHEAC
ECO68B02	MCWILLIAMS CREEK	110	9/4/96	CHEAC
ECO68B02	MCWILLIAMS CREEK	155	5/19/97	GDR-CHEAC
ECO68B02	MCWILLIAMS CREEK	153	5/12/98	GDR-CHEAC
ECO68B02	MCWILLIAMS CREEK	149	5/3/99	DRL,PAD-LAB
ECO68B02	MCWILLIAMS CREEK	149	5/3/99	DRL,PAD-LAB
ECO68B09	MILL CREEK	140	4/16/97	GDR-CHEAC
ECO68B09	MILL CREEK	143	9/23/97	CLD-CHEAC
ECO68B09	MILL CREEK	163	5/5/98	GDR-CHEAC
ECO68B09	MILL CREEK	96	9/8/98	DRL,DHA-LAB
ECO68B09	MILL CREEK	143	5/3/99	DRL,PAD-LAB
ECO68C12	ELLIS GAP	155	4/29/96	CHEAC
ECO68C12	ELLIS GAP	170	6/3/97	TYH-CHEAC
ECO68C13	MUD CREEK	159	5/1/96	LAB
ECO68C13	MUD CREEK	161	8/22/96	APM,PAD-LAB
ECO68C13	MUD CREEK	171	4/16/97	DRM,APM-LAB
ECO68C13	MUD CREEK	155	9/3/97	DRM-LAB
ECO68C13	MUD CREEK	169	11/12/97	APM,KJS-LAB
ECO68C13	MUD CREEK	172	2/10/98	APM,DRL-LAB
ECO68C15	CROW CREEK	171	5/6/96	LAB
ECO68C15	CROW CREEK	165	8/22/96	PAD,APM-LAB
ECO68C15	CROW CREEK	159	9/6/96	APM,DHA-LAB
ECO68C15	CROW CREEK	167	4/16/97	DRM-LAB
ECO68C15	CROW CREEK	153	9/3/97	DRM-LAB

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO68C15	CROW CREEK	167	11/12/97	APM,KJS-LAB
ECO68C15	CROW CREEK	167	2/10/98	APM,DRL-LAB
ECO68C15	CROW CREEK	159	4/14/98	APM,JCA-LAB
ECO68C15	CROW CREEK	161	8/31/98	APM,LAH-LAB
ECO68C15	CROW CREEK	182	4/28/99	APM,JCA-LAB
ECO68C19	UNAMED TRIB POLLY KING COVE	165	4/29/97	DRM,APM-LAB
ECO68C20	CROW CREEK	174	4/14/98	APM,JCA-LAB
ECO68C20	CROW CREEK	164	8/31/98	APM,LAH-LAB
ECO68C20	CROW CREEK	182	4/28/99	APM,JCA-LAB
ECO69D01	NO BUSINESS BRANCH	186	4/29/96	JEB-KEAC
ECO69D01	NO BUSINESS BRANCH	172	9/10/96	JEB,PES-KEAC
ECO69D01	NO BUSINESS BRANCH	176	4/25/97	JEB,PES-KEAC
ECO69D01	NO BUSINESS BRANCH	176	10/3/97	JEB-KEAC
ECO69D01	NO BUSINESS BRANCH	187	4/2/98	JEB,JCP-KEAC
ECO69D01	NO BUSINESS BRANCH	170	9/1/98	JEB,JCP-KEAC
ECO69D01	NO BUSINESS BRANCH	185	4/9/99	JEB,JCP-KEAC
ECO69D03	FLAT FORK	186	4/29/96	KEAC
ECO69D03	FLAT FORK	177	9/12/96	KEAC
ECO69D03	FLAT FORK	176	4/17/97	PES-KEAC
ECO69D03	FLAT FORK	189	3/30/98	JEB,KMJ-KEAC
ECO69D03	FLAT FORK	130	9/2/98	JEB,KMJ-KEAC
ECO69D04	STINKING CREEK	167	4/29/96	KEAC
ECO69D04	STINKING CREEK	163	9/10/96	JEB,PES-KEAC
ECO69D04	STINKING CREEK	171	5/16/97	JEB,PES-KEAC
ECO69D04	STINKING CREEK	172	10/3/97	JEB-KEAC
ECO69D04	STINKING CREEK	176	4/2/98	JEB,JCP-KEAC
ECO69D04	STINKING CREEK	168	9/1/98	JEB,JCA-KEAC
ECO69D04	STINKING CREEK	183	4/9/99	JEB,JCP-KEAC
ECO69D05	NEW RIVER	183	4/6/98	JEB,AEW-KEAC
ECO69D05	NEW RIVER	145	9/16/98	JEB,KMJ-KEAC
ECO69D05	NEW RIVER	183	4/30/99	PES,MJA-KEAC
ECO69D06	ROUND ROCK CREEK	180	4/6/98	JEB,AEW-KEAC
ECO69D06	ROUND ROCK CREEK	172	9/16/98	JEB,KMJ-KEAC
ECO69D06	ROUND ROCK CREEK	181	4/9/99	JEB,JCP-KEAC
ECO71E01	NOAH'S SPRING BRANCH	172	7/9/96	DHL,RWK-NEAC
ECO71E01	NOAH'S SPRING BRANCH	173	8/19/96	AMG,AMM-NEAC
ECO71E01	NOAH'S SPRING BRANCH	168	10/3/96	RWK-NEAC
ECO71E01	NOAH'S SPRING BRANCH	160	5/7/97	JRS-NEAC
ECO71E09	BUZZARD CREEK	164	7/8/96	DLH,RWK-NEAC
ECO71E09	BUZZARD CREEK	150	8/19/96	AMG,AMM-NEAC
ECO71E09	BUZZARD CREEK	140	10/1/96	AMG,AMM-NEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO71E09	BUZZARD CREEK	142	5/19/97	JRS,AMG-NEAC
ECO71E09	BUZZARD CREEK	135	10/16/97	JRS-NEAC
ECO71E09	BUZZARD CREEK	161	5/12/98	RWK,JRS-NEAC
ECO71E09	BUZZARD CREEK	145	8/26/98	RWK-NEAC
ECO71E09	BUZZARD CREEK	155	5/4/99	RWK-NEAC
ECO71E14	PASSENGER CREEK	155	6/6/97	RWK-NEAC
ECO71E14	PASSENGER CREEK	143	9/4/97	JRS,AMG-NEAC
ECO71E14	PASSENGER CREEK	154	5/12/98	RWK,JRS-NEAC
ECO71E14	PASSENGER CREEK	162	8/26/98	RWK-NEAC
ECO71E14	PASSENGER CREEK	159	5/4/99	RWK-NEAC
ECO71E15	LITTLE WEST FORK	153	6/29/98	AMG,AMM-NEAC
ECO71E15	LITTLE WEST FORK	139	9/22/98	JRS-NEAC
ECO71F01	PANTHER CREEK	163	7/9/96	DLH,RWK-NEAC
ECO71F01	PANTHER CREEK	176	8/27/96	RWR-NEAC
ECO71F01	PANTHER CREEK	169	10/2/96	RWK,AMG-NEAC
ECO71F01	PANTHER CREEK	131	5/21/97	RWK-NEAC
ECO71F01	PANTHER CREEK	158	9/5/97	JRS-NEAC
ECO71F01	PANTHER CREEK	157	5/18/98	AMG-NEAC
ECO71F01	PANTHER CREEK	168	9/22/98	JRS-NEAC
ECO71F01	PANTHER CREEK	175	5/6/99	JRS,AMG-NEAC
ECO71F12	SOUTH HARPETH RIVER	158	6/18/95	DLH,JRS-NEAC
ECO71F12	SOUTH HARPETH RIVER	157	8/28/96	PDS-LAB
ECO71F12	SOUTH HARPETH RIVER	150	9/25/96	JRS,AMG-NEAC
ECO71F12	SOUTH HARPETH RIVER	135	4/22/97	AMG,AMM-NEAC
ECO71F12	SOUTH HARPETH RIVER	159	4/22/98	AMG-NEAC
ECO71F12	SOUTH HARPETH RIVER	165	9/9/98	RWK,JRS-NEAC
ECO71F12	SOUTH HARPETH RIVER	154	11/9/98	AMG,JRS-NEAC
ECO71F12	SOUTH HARPETH RIVER	167	5/10/99	JRS,RWK-NEAC
ECO71F16	WOLF CREEK	169	5/29/98	TCW,JRS-NEAC
ECO71F16	WOLF CREEK	165	9/9/98	RWK,JRS-NEAC
ECO71F16	WOLF CREEK	166	5/10/99	JRS,RWK-NEAC
ECO71F19	BRUSH CREEK	173	7/15/96	DLH,RWK-NEAC
ECO71F19	BRUSH CREEK	144	8/28/96	AMG-NEAC
ECO71F19	BRUSH CREEK	176	10/4/96	AMM-NEAC
ECO71F19	BRUSH CREEK	147	5/14/97	JRS,AMG-NEAC
ECO71F19	BRUSH CREEK	163	9/3/97	RWK-NEAC
ECO71F19	BRUSH CREEK	163	5/11/98	RWK,JRS-NEAC
ECO71F19	BRUSH CREEK	166	9/21/98	JRS-NEAC
ECO71F19	BRUSH CREEK	171	6/7/99	JRS,AMG-NEAC
ECO71F26	PRYOR CREEK	152	7/9/96	DLH,RWK-NEAC
ECO71F26	PRYOR CREEK	150	8/27/96	RWK,TCW-NEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO71F26	PRYOR CREEK	156	10/2/96	AMG,RWK-NEAC
ECO71F26	PRYOR CREEK	129	5/21/97	NEAC
ECO71F26	PRYOR CREEK	148	8/27/97	RWK-NEAC
ECO71F27	SWANEGAN BRANCH	159	7/11/96	DLH,RWK-NEAC
ECO71F27	SWANEGAN BRANCH	161	8/28/96	AMG-NEAC
ECO71F27	SWANEGAN BRANCH	177	10/7/96	AMG,AMM-NEAC
ECO71F27	SWANEGAN BRANCH	164	4/21/97	JRS-NEAC
ECO71F27	SWANEGAN BRANCH	149	9/11/97	JRS,AMG-NEAC
ECO71F27	SWANEGAN BRANCH	165	5/5/98	RWK,JTK-NEAC
ECO71F27	SWANEGAN BRANCH	167	9/21/98	JRS-NEAC
ECO71F27	SWANEGAN BRANCH	169	6/7/99	JRS,AMG-NEAC
ECO71F28	LITTLE SWAN CREEK	172	6/27/96	DLH,JRS-NEAC
ECO71F28	LITTLE SWAN CREEK	164	8/28/96	AMG-NEAC
ECO71F28	LITTLE SWAN CREEK	178	10/4/96	RWK-NEAC
ECO71F28	LITTLE SWAN CREEK	158	5/14/97	RWK,WCO-NEAC
ECO71F28	LITTLE SWAN CREEK	165	9/3/97	RWK-NEAC
ECO71F28	LITTLE SWAN CREEK	168	5/5/98	RWK,JTR-NEAC
ECO71F28	LITTLE SWAN CREEK	153	9/21/98	JRS-NEAC
ECO71F28	LITTLE SWAN CREEK	162	6/7/99	JRS,AMG-NEAC
ECO71G03	FLAT CREEK	181	4/28/98	NEAC
ECO71G03	FLAT CREEK	172	9/14/98	JRS,AMG-NEAC
ECO71G03	FLAT CREEK	181	6/16/99	JRS,AMG-NEAC
ECO71G04	SPRING CREEK	161	4/28/98	NEAC
ECO71G04	SPRING CREEK	152	9/14/98	JRS,AMG-NEAC
ECO71G04	SPRING CREEK	161	6/16/99	JRS,AMG-NEAC
ECO71G05	CHERRY CREEK	147	7/17/96	NEAC
ECO71G05	CHERRY CREEK	125	8/27/96	APM,DRM-LAB
ECO71G05	CHERRY CREEK	128	8/27/96	APM,DRM-LAB
ECO71G05	CHERRY CREEK	138	5/20/97	JRS,RWK-NEAC
ECO71G05	CHERRY CREEK	128	9/2/97	JRS,AMG-NEAC
ECO71G10	HURRICANE CREEK	158	7/18/96	DLH,JRS-NEAC
ECO71G10	HURRICANE CREEK	179	9/4/96	AMG-NEAC
ECO71G10	HURRICANE CREEK	164	9/30/96	AMG,MLR-NEAC
ECO71G10	HURRICANE CREEK	165	5/1/97	AMG-NEAC
ECO71G10	HURRICANE CREEK	163	10/10/97	RWK-NEAC
ECO71G10	HURRICANE CREEK	170	4/23/98	AMG-NEAC
ECO71G10	HURRICANE CREEK	157	9/8/98	JRS,AMG-NEAC
ECO71G10	HURRICANE CREEK	157	9/9/98	JRS,AMG-NEAC
ECO71G10	HURRICANE CREEK	158	6/8/99	JRS-NEAC
ECO71G11	WEST FORK LONG CREEK	154	7/8/96	DLH,RWK-NEAC
ECO71G11	WEST FORK LONG CREEK	124	8/27/96	APM,DRM-LAB

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO71G11	WEST FORK LONG CREEK	156	9/20/96	JRS,AMG-NEAC
ECO71G11	WEST FORK LONG CREEK	128	5/13/97	RWK-NEAC
ECO71G11	WEST FORK LONG CREEK	132	8/26/97	AMG-NEAC
ECO71H03	FLYNN CREEK	165	7/17/96	DLH,RWK-NEAC
ECO71H03	FLYNN CREEK	159	8/27/96	APM,DRL-LAB
ECO71H03	FLYNN CREEK	157	10/14/96	JRS,AMG-NEAC
ECO71H03	FLYNN CREEK	170	5/6/97	AMG,RWK-NEAC
ECO71H03	FLYNN CREEK	170	8/20/97	RWK-NEAC
ECO71H03	FLYNN CREEK	165	5/4/98	JRS-NEAC
ECO71H03	FLYNN CREEK	165	9/17/98	AMG-NEAC
ECO71H03	FLYNN CREEK	156	6/2/99	JRS,RLH-NEAC
ECO71H06	CLEAR FORK	165	7/10/96	RWK,DLH-NEAC
ECO71H06	CLEAR FORK	170	8/19/96	RWK,MCR-NEAC
ECO71H06	CLEAR FORK	141	10/16/96	TCW-NEAC
ECO71H06	CLEAR FORK	172	11/12/96	RWK,AER-NEAC
ECO71H06	CLEAR FORK	157	8/21/97	AMG,JRS-NEAC
ECO71H06	CLEAR FORK	153	4/13/98	JRS-NEAC
ECO71H06	CLEAR FORK	144	8/31/98	AMG-NEAC
ECO71H06	CLEAR FORK	149	6/11/99	RWK-NEAC
ECO71H09	CARSON FORK	141	7/10/96	DLH-NEAC
ECO71H09	CARSON FORK	155	9/19/96	MLR,RWK-NEAC
ECO71H09	CARSON FORK	126	10/16/96	TCW-NEAC
ECO71H09	CARSON FORK	151	11/12/96	RWK,AER-NEAC
ECO71H09	CARSON FORK	164	4/30/97	RWK-NEAC
ECO71H09	CARSON FORK	139	8/19/97	RWK-NEAC
ECO71H09	CARSON FORK	135	4/13/98	NEAC
ECO71H09	CARSON FORK	125	8/31/98	AMG-NEAC
ECO71H09	CARSON FORK	140	6/11/99	RWK-NEAC
ECO71H15	WEST HARPETH RIVER	127	7/18/96	NEAC
ECO71H15	WEST HARPETH RIVER	116	8/28/96	PDS-LAB
ECO71H15	WEST HARPETH RIVER	114	10/26/96	RWK,AMM-NEAC
ECO71I03	STEWART CREEK	140	7/26/96	RWK,JRS-NEAC
ECO71I03	STEWART CREEK	129	9/4/96	DKW,KJS-LAB
ECO71I03	STEWART CREEK	134	9/5/96	DHA,KJS-LAB
ECO71I03	STEWART CREEK	119	9/26/96	AMG,JRS-NEAC
ECO71I03	STEWART CREEK	139	4/23/97	AMG,AMM-NEAC
ECO71I03	STEWART CREEK	127	10/1/97	AMG-NEAC
ECO71I09	WEST FORK STONES RIVER	121	7/18/96	NEAC
ECO71I09	WEST FORK STONES RIVER	131	9/4/96	DKW,KJS-NEAC
ECO71I09	WEST FORK STONES RIVER	124	10/8/96	AMM,AMG-NEAC
ECO71I09	WEST FORK STONES RIVER	130	4/23/97	AMG-NEAC

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO71I09	WEST FORK STONES RIVER	114	10/1/97	AMG-NEAC
ECO71I09	WEST FORK STONES RIVER	125	5/19/98	RWK,JRS-NEAC
ECO71I09	WEST FORK STONES RIVER	143	9/1/98	RWK-NEAC
ECO71I09	WEST FORK STONES RIVER	117	6/3/99	RWK-NEAC
ECO71I10	FLAT CREEK	135	7/18/96	DLH,JRS-NEAC
ECO71I10	FLAT CREEK	131	9/4/96	AMG-NEAC
ECO71I10	FLAT CREEK	98	10/15/96	NEAC
ECO71I10	FLAT CREEK	165	5/1/97	RWK-NEAC
ECO71I10	FLAT CREEK	128	10/9/97	RWK,JRS-NEAC
ECO71I10	FLAT CREEK	154	5/19/98	JRS,RWK-NEAC
ECO71I10	FLAT CREEK	113	6/8/99	JRS,RWK-NEAC
ECO73A01	COLD CREEK	130	5/2/96	RBM,LEH-MEAC
ECO73A01	COLD CREEK	125	8/15/96	DHA,KJS-LAB
ECO73A01	COLD CREEK	105	4/21/97	APM-KJS,LAB
ECO73A01	COLD CREEK	98	8/26/97	PAD,KJS-LAB
ECO73A02	MIDDLE FORK FORKED DEER R	118	4/24/97	APM,KJS-LAB
ECO73A02	MIDDLE FORK FORKED DEER R	96	8/27/97	PAD,KJS-LAB
ECO73A02	MIDDLE FORK FORKED DEER R	114	5/27/98	KJS,PDS-LAB
ECO73A02	MIDDLE FORK FORKED DEER R	110	8/25/98	KJS,DRL-LAB
ECO73A02	MIDDLE FORK FORKED DEER R	122	4/21/99	KJS,PAD-LAB
ECO73A03	COLD CREEK	128	4/24/97	APM,KJS-LAB
ECO73A03	COLD CREEK	130	8/26/97	PAD,KJS-LAB
ECO73A03	COLD CREEK	122	5/26/98	KJS,PDS-LAB
ECO73A03	COLD CREEK	147	8/25/98	KJS,DRL-LAB
ECO73A03	COLD CREEK	126	4/20/99	KJS,PAD-LAB
ECO73A04	BAYOU DU CHIEN	154	5/28/98	KJS,PDS-LAB
ECO73A04	BAYOU DU CHIEN	161	8/19/98	APM,JCA-LAB
ECO73A04	BAYOU DU CHIEN	154	4/21/99	KJS,PAD-LAB
ECO74A06	SUGAR CREEK	142	4/16/96	LEH,RBM-MEAC
ECO74A06	SUGAR CREEK	99	8/14/96	DHA,KJS-LAB
ECO74A06	SUGAR CREEK	113	4/22/97	KJS,APM-LAB
ECO74A06	SUGAR CREEK	118	8/25/97	PAD,KJS-LAB
ECO74A06	SUGAR CREEK	112	4/27/98	KJS,PDS-LAB
ECO74A06	SUGAR CREEK	119	8/24/98	KJS,DRL-LAB
ECO74A06	SUGAR CREEK	103	4/19/99	KJS,PAD-LAB
ECO74A08	PAW PAW CREEK	143	9/19/96	AJF,RDO-JEAC
ECO74A08	PAW PAW CREEK	114	4/22/97	AJF-JEAC
ECO74A08	PAW PAW CREEK	130	8/7/97	AJF,JBC-JEAC
ECO74A08	PAW PAW CREEK	110	4/21/98	APM,DRL-LAB
ECO74A08	PAW PAW CREEK	129	8/18/98	APM,JCA-LAB
ECO74A08	PAW PAW CREEK	124	4/13/99	APM,JCA-LAB

StationID	StreamName	Habitat Score	Collection Date	Field Assesors
ECO74A10	UT RUNNING REELFOOT BAYOU	139	4/24/97	APM,KJS-LAB
ECO74A10	UT RUNNING REELFOOT BAYOU	141	8/7/97	AJF-JEAC
ECO74A10	UT RUNNING REELFOOT BAYOU	118	4/21/98	APM,DRL-LAB
ECO74A10	UT RUNNING REELFOOT BAYOU	144	8/18/98	APM,JCA-LAB
ECO74A10	UT RUNNING REELFOOT BAYOU	152	4/13/99	APM,JCA-LAB
ECO74B01	TERRAPIN CREEK	143	9/11/96	AJF,MBM-JEAC
ECO74B01	TERRAPIN CREEK	137	5/6/97	GSO-JEAC
ECO74B01	TERRAPIN CREEK	149	8/20/97	AJF-JEAC
ECO74B01	TERRAPIN CREEK	127	4/20/98	APM,DRL-LAB
ECO74B01	TERRAPIN CREEK	130	4/20/98	APM,DRL-LAB
ECO74B01	TERRAPIN CREEK	139	8/20/98	APM,JCA-LAB
ECO74B01	TERRAPIN CREEK	146	4/14/99	APM,JCA-LAB
ECO74B04	POWELL CREEK	129	9/11/96	AJF,MBW-LAB
ECO74B04	POWELL CREEK	127	5/6/97	GSO-JEAC
ECO74B04	POWELL CREEK	125	8/20/97	AJF-JEAC
ECO74B04	POWELL CREEK	112	4/20/98	APM,DRL-LAB
ECO74B04	POWELL CREEK	116	4/20/98	APM,DRL-LAB
ECO74B04	POWELL CREEK	119	8/19/98	APM,JCA-LAB
ECO74B04	POWELL CREEK	131	8/19/98	APM,JCA-LAB
ECO74B04	POWELL CREEK	129	4/14/99	APM,JCA-LAB
ECO74B12	WOLF RIVER	156	5/16/96	RBM,LEH-MEAC
ECO74B12	WOLF RIVER	140	8/13/96	DHA,KJS-LAB
ECO74B12	WOLF RIVER	128	4/27/97	APM,KJS-LAB
ECO74B12	WOLF RIVER	140	8/25/97	DHA,KJS-LAB
ECO74B12	WOLF RIVER	133	4/27/98	KJS,JCA-LAB
ECO74B12	WOLF RIVER	149	8/24/98	KJS,DRL-LAB
ECO74B12	WOLF RIVER	149	8/24/98	KJS,DRL-LAB
ECO74B12	WOLF RIVER	131	4/19/99	KJS,PAD-LAB

APPENDIX E

BIOMETRICS

Biometric Scores for Ecoregion Reference Sites 1996-1999

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO65A01	SQBANK	4/28/97	189	33	8	52.9	23.8	5.62	11.1	32.2	32
ECO65A01	SQBANK	9/9/96	225	27	1	10.7	24.0	7.18	19.1	64.7	18
ECO65A01	SQBANK	9/8/97	202	31	4	30.2	19.3	6.13	22.3	51.0	26
ECO65A03	SQBANK	4/15/97	168	38	2	8.3	19.6	6.83	28.0	47.7	22
ECO65A03	SQBANK	9/20/96	445	28	3	14.2	14.4	6.31	18.4	58.5	18
ECO65A03	SQBANK	9/9/97	179	25	6	28.5	12.3	5.36	29.6	36.9	28
ECO65B04	SQBANK	4/14/97	161	41	9	46.6	44.1	5.82	11.2	39.8	30
ECO65B04	SQBANK	4/23/98	175	40	9	42.3	32.0	6.29	18.3	30.4	28
ECO65B04	SQBANK	4/7/99	189	39	7	15.3	43.9	6.40	5.3	46.2	20
ECO65B04	SQBANK	9/16/96	208	26	8	71.6	17.3	6.04	16.8	55.1	28
ECO65B04	SQBANK	9/8/97	178	34	5	40.4	41.0	5.00	20.2	14.9	30
ECO65B04	SQBANK	9/2/98	238	38	5	27.7	42.0	5.12	29.0	31.7	28
ECO65B05	SQBANK	4/14/97	189	38	3	8.5	56.6	6.71	11.1	27.7	18
ECO65B05	SQBANK	9/17/96	65	11	1	7.7	1.5	7.59	0.0	43.5	12
ECO65B05	SQBANK	9/8/97	237	34	4	61.6	22.4	3.37	6.3	13.5	30
ECO65E02	SQBANK	4/15/97	221	48	13	16.7	57.0	6.26	9.0	30.2	24
ECO65E02	SQBANK	9/10/97	234	40	10	33.3	48.7	5.10	22.6	6.9	32
ECO65E04	SQBANK	4/17/97	197	47	11	17.8	54.3	5.80	22.3	23.1	30
ECO65E04	SQBANK	4/22/98	184	41	13	14.1	71.2	5.97	22.8	22.1	28
ECO65E04	SQBANK	4/19/99	211	37	11	21.8	64.9	5.40	35.1	18.1	32
ECO65E04	SQBANK	10/7/97	168	40	9	27.4	49.4	5.69	19.0	26.8	28
ECO65E04	SQBANK	9/5/98	202	26	6	27.7	46.5	4.93	23.8	27.4	26
ECO65E06	SQBANK	4/16/97	174	39	10	47.7	36.2	4.41	36.2	15.8	36
ECO65E06	SQBANK	4/22/98	228	31	14	28.1	61.4	5.18	24.6	3.8	30
ECO65E06	SQBANK	4/19/99	179	40	11	20.7	64.8	5.65	14.5	11.0	28
ECO65E06	SQBANK	9/10/97	213	52	9	22.1	53.5	5.40	27.7	9.5	30
ECO65E06	SQBANK	9/9/98	172	35	9	7.0	76.7	6.20	14.5	12.3	20
ECO65E08	SQBANK	5/5/97	217	24	8	81.6	15.7	6.34	10.6	61.6	26
ECO65E08	SQBANK	6/2/98	233	46	11	45.5	44.2	6.44	21.0	42.1	32
ECO65E08	SQBANK	3/24/99	208	33	8	26.4	57.7	4.96	31.3	8.6	30
ECO65E08	SQKICK	9/10/96	209	33	4	15.8	44.5	5.91	29.2	22.9	26
ECO65E08	SQBANK	8/15/97	167	29	7	16.2	65.3	6.27	37.1	7.8	26
ECO65E08	SQBANK	9/10/98	211	32	6	13.7	58.3	5.82	40.3	20.2	26
ECO65E10	SQBANK	4/17/97	195	31	7	27.7	62.6	4.34	24.6	14.9	28
ECO65E10	SQBANK	4/23/98	213	50	14	28.6	43.2	5.43	23.0	26.0	34
ECO65E10	SQBANK	4/7/99	194	39	8	18.0	46.4	5.46	16.0	11.1	28
ECO65E10	SQBANK	8/9/96	200	39	8	44.5	47.5	3.37	42.0	10.5	34
ECO65E10	SQBANK	9/16/96	242	60	10	18.2	26.0	5.81	19.0	41.4	32
ECO65E10	SQBANK	8/14/97	200	37	14	58.5	23.0	4.14	37.0	8.8	40
ECO65E10	SQBANK	9/2/98	170	37	8	46.5	41.2	3.93	42.9	9.2	34

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO65E11	SQBANK	4/17/97	240	37	8	7.5	14.6	7.28	2.1	61.9	18
ECO65E11	SQBANK	4/23/98	228	38	5	4.4	40.8	6.90	5.3	42.2	18
ECO65E11	SQBANK	4/7/99	178	50	11	15.2	39.9	5.90	14.6	28.0	28
ECO65E11	SQBANK	8/15/96	147	28	9	21.1	43.5	5.83	17.0	13.1	28
ECO65E11	SQBANK	9/16/96	198	54	8	12.1	16.7	6.33	12.1	57.1	24
ECO65E11	SQBANK	8/14/97	174	45	10	19.0	38.5	6.32	20.7	19.6	32
ECO65E11	SQBANK	9/2/98	216	43	10	25.5	31.9	5.69	19.9	17.1	34
ECO65I01	SQBANK	9/20/96	206	31	5	7.8	61.2	6.54	2.9	48.1	16
ECO65I01	SQBANK	9/9/97	166	31	3	3.0	64.5	6.77	7.8	44.8	14
ECO65I02	SQKICK	4/15/97	176	25	6	28.4	45.5	5.19	46.0	56.5	22
ECO65I02	SQKICK	9/18/96	223	25	5	66.8	23.8	4.45	76.7	4.2	34
ECO65I02	SQBANK	10/7/97	184	48	8	14.1	28.3	5.99	14.7	40.2	24
ECO65I02	SQKICK	10/7/97	200	34	4	30.6	33.9	5.31	35.1	26.3	22
ECO65I03	SQBANK	4/15/97	163	28	2	1.2	72.4	6.49	17.8	12.9	18
ECO65I03	SQBANK	9/9/97	167	31	6	10.2	79.0	6.14	3.6	1.2	16
ECO65I03	SQKICK	9/9/97	175	39	8	9.1	77.7	5.65	13.1	21.2	18
ECO65J04	SQKICK	5/2/97	226	38	18	59.3	27.4	3.34	41.2	12.4	40
ECO65J04	SQKICK	4/29/98	194	49	16	61.3	16.5	2.87	54.1	9.0	40
ECO65J04	SQKICK	4/20/99	212	27	14	62.7	21.2	2.79	59.0	21.0	40
ECO65J04	SQKICK	8/29/96	216	37	13	51.4	11.6	3.56	70.4	6.0	38
ECO65J04	SQKICK	8/21/97	173	27	12	67.6	15.0	3.56	57.2	9.5	38
ECO65J04	SQKICK	9/17/98	170	30	12	60.6	22.4	4.05	41.8	14.2	36
ECO65J05	SQKICK	5/2/97	229	37	13	34.9	34.1	3.86	37.6	33.5	28
ECO65J05	SQKICK	5/9/98	180	30	11	30.0	33.3	4.00	57.2	35.0	30
ECO65J05	SQKICK	8/29/96	201	27	11	64.2	7.0	3.94	36.3	10.2	34
ECO65J05	SQKICK	8/21/97	196	29	12	38.3	21.4	4.38	44.4	25.3	34
ECO65J05	SQKICK	9/17/98	166	40	7	25.9	56.0	5.53	44.6	23.9	26
ECO65J05	SQKICK	8/31/99	195	35	12	45.6	36.4	4.05	27.7	6.2	32
ECO65J06	SQKICK	5/2/97	208	25	6	45.2	34.6	4.23	21.2	27.1	28
ECO65J06	SQKICK	4/28/98	227	33	12	28.2	51.1	3.05	39.6	37.9	28
ECO65J06	SQKICK	4/29/99	178	25	11	18.0	28.7	4.06	66.3	55.1	28
ECO65J06	SQKICK	8/29/96	200	49	12	29.5	50.0	4.63	34.5	14.1	28
ECO65J06	SQKICK	8/22/97	222	34	10	45.0	29.7	4.14	50.9	20.5	32
ECO65J06	SQKICK	9/17/98	180	27	10	26.1	25.0	4.35	61.1	48.3	32
ECO65J11	SQKICK	5/2/97	224	35	10	33.5	44.2	4.66	18.8	24.0	26
ECO65J11	SQKICK	4/29/98	214	32	12	61.2	15.4	2.76	71.5	8.1	38
ECO65J11	SQKICK	4/29/99	214	22	8	7.9	66.4	4.72	29.9	25.8	18
ECO65J11	SQKICK	8/22/97	210	33	13	40.5	46.7	4.40	44.3	3.9	30
ECO65J11	SQKICK	9/17/98	192	25	6	8.3	59.4	4.87	39.6	34.4	20
ECO66D01	SQKICK	4/25/97	222	45	20	53.2	18.0	2.73	65.8	18.2	40
ECO66D01	SQKICK	5/15/98	173	35	16	55.5	23.7	2.61	54.9	16.0	40
ECO66D01	SQKICK	4/19/99	193	39	13	35.8	24.9	3.18	54.9	22.5	34
ECO66D01	SQKICK	9/18/96	213	35	16	73.7	4.7	3.06	59.6	14.9	40

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO66D01	SQKICK	9/26/97	207	42	15	35.3	22.2	3.69	49.3	20.3	36
ECO66D01	SQKICK	10/7/98	177	39	12	32.2	26.0	3.81	44.6	10.8	34
ECO66D03	SQKICK	4/25/97	170	40	18	63.5	12.4	3.03	64.1	17.5	42
ECO66D03	SQKICK	4/13/98	176	38	22	79.0	6.8	1.89	85.8	7.0	42
ECO66D03	SQKICK	4/19/99	223	38	19	58.3	9.0	2.44	69.5	15.0	42
ECO66D03	SQKICK	9/18/96	209	50	15	33.0	23.4	3.97	63.2	28.6	36
ECO66D03	SQKICK	9/15/97	186	40	16	40.3	25.8	3.49	57.0	12.6	40
ECO66D03	SQKICK	10/9/98	185	33	20	87.6	4.3	1.88	72.4	2.2	40
ECO66D05	SQKICK	6/23/97	174	33	15	64.9	7.5	2.96	55.7	23.3	38
ECO66D05	SQKICK	5/15/98	229	32	13	39.7	55.9	3.53	24.9	36.1	26
ECO66D05	SQKICK	4/22/99	196	31	13	76.0	18.4	2.12	67.9	7.1	38
ECO66D05	SQKICK	11/5/97	191	33	16	75.9	8.4	2.32	72.8	5.8	40
ECO66D05	SQKICK	9/15/98	196	32	17	77.0	9.2	3.36	62.2	14.2	40
ECO66D06	SQKICK	11/7/97	175	40	18	52.6	25.1	2.76	59.4	6.9	40
ECO66D07	SQKICK	11/5/97	187	42	20	67.9	9.6	2.23	56.1	11.6	40
ECO66E04	SQKICK	11/6/97	196	31	16	79.1	15.3	1.94	75.0	3.1	40
ECO66E09	SQKICK	5/5/97	177	40	20	62.7	28.2	3.00	55.4	7.1	38
ECO66E09	SQKICK	5/13/98	166	33	17	75.9	10.2	2.19	62.7	1.7	40
ECO66E09	SQKICK	4/7/99	171	35	17	41.5	13.5	2.96	70.8	38.2	38
ECO66E09	SQKICK	9/9/96	217	32	15	79.3	6.5	3.51	67.3	0.5	40
ECO66E09	SQKICK	8/22/97	202	36	18	77.7	11.4	2.83	60.9	3.8	42
ECO66E11	SQKICK	5/23/97	193	36	18	66.8	17.1	3.34	42.0	14.0	40
ECO66E11	SQKICK	4/2/98	180	29	14	65.0	7.8	1.77	83.3	6.7	40
ECO66E11	SQKICK	6/9/99	184	38	19	70.1	10.3	2.76	63.0	1.8	42
ECO66E11	SQKICK	9/5/96	200	37	20	71.7	15.1	2.20	73.7	11.5	42
ECO66E11	SQKICK	8/21/97	171	35	13	58.5	15.2	2.73	70.8	7.3	40
ECO66E11	SQKICK	9/10/98	168	40	17	69.0	11.9	3.02	60.7	5.1	42
ECO66E17	SQKICK	9/30/97	188	47	18	54.8	13.3	3.57	62.2	10.4	42
ECO66E18	SQKICK	4/14/97	185	38	14	33.5	42.7	3.27	36.8	19.3	32
ECO66E18	SQKICK	9/10/96	210	43	17	26.2	46.2	3.17	35.2	30.7	30
ECO66E18	SQKICK	9/16/97	166	39	19	56.0	16.3	2.65	50.6	10.8	40
ECO66F02	SQKICK	11/12/97	160	41	17	71.3	18.1	1.83	38.8	8.2	40
ECO66F06	SQKICK	5/20/97	163	30	17	71.2	6.7	2.14	81.0	3.8	40
ECO66F06	SQKICK	4/13/98	180	21	10	54.4	11.1	2.41	83.9	6.1	36
ECO66F06	SQKICK	4/22/99	182	28	11	54.4	6.0	2.41	73.6	5.1	38
ECO66F06	SQKICK	9/3/96	200	36	16	48.0	10.8	3.08	68.4	13.1	40
ECO66F06	SQKICK	9/30/97	176	29	9	44.9	6.3	3.30	82.4	8.1	34
ECO66F06	SQKICK	8/28/98	179	32	14	64.8	7.3	3.48	65.4	10.4	40
ECO66F07	SQKICK	6/10/97	164	30	18	78.7	11.6	3.00	35.4	7.4	36
ECO66F07	SQKICK	9/19/96	200	47	16	46.1	28.7	3.83	43.4	19.9	36
ECO66F07	SQKICK	10/13/97	170	37	22	82.9	8.8	2.58	72.9	1.3	42
ECO66F08	SQKICK	11/7/97	211	41	21	56.9	16.6	2.56	58.8	4.1	42
ECO66G04	SQKICK	9/4/96	245	44	17	28.6	62.0	4.45	38.0	7.6	30

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO66G04	SQKICK	10/2/97	180	42	21	71.1	13.3	3.14	72.8	2.4	42
ECO66G05	SQKICK	5/19/97	175	36	22	60.6	8.0	2.55	60.6	13.9	42
ECO66G05	SQKICK	4/13/98	170	29	13	80.0	14.1	1.45	75.3	8.9	38
ECO66G05	SQKICK	4/22/99	167	40	20	57.5	28.1	2.45	60.5	14.1	42
ECO66G05	SQKICK	9/4/96	209	35	17	69.9	22.5	3.02	27.8	13.9	36
ECO66G05	SQKICK	10/2/97	169	25	22	97.0		2.41	63.3		40
ECO66G05	SQKICK	9/11/98	177	24	14	76.8	17.5	3.30	37.9	3.5	38
ECO66G07	SQKICK	4/16/98	207	37	16	36.2	23.2	3.90	73.9	9.0	40
ECO66G07	SQKICK	4/8/99	228	35	13	28.9	16.7	4.11	78.5	21.7	36
ECO66G07	SQKICK	10/1/97	175	30	10	53.1	8.6	4.13	73.1	9.5	36
ECO66G07	SQKICK	9/10/98	182	28	13	53.3	26.4	4.35	71.4	9.1	36
ECO66G09	SQKICK	5/18/98	174	44	21	62.1	19.0	2.51	70.1	2.6	42
ECO66G09	SQKICK	4/8/99	173	38	19	62.4	23.1	3.28	60.1	8.8	42
ECO66G09	SQKICK	10/1/97	218	40	16	62.4	11.0	2.89	69.7	11.2	42
ECO66G09	SQKICK	9/10/98	203	38	18	57.1	30.0	3.82	48.8	6.6	38
ECO66G12	SQKICK	4/15/97	166	40	17	53.6	33.7	3.17	58.4	5.8	38
ECO66G12	SQKICK	5/13/98	172	37	14	54.1	27.3	3.05	44.2	2.4	40
ECO66G12	SQKICK	4/26/99	178	36	16	66.3	19.1	2.95	60.1	5.8	42
ECO66G12	SQKICK	9/12/96	200	47	16	40.4	32.6	3.95	47.6	12.2	36
ECO66G12	SQKICK	9/8/97	231	47	16	45.0	26.8	3.81	42.0	9.8	34
ECO66G12	SQKICK	8/31/98	172	48	18	50.0	19.8	3.91	45.9	9.2	38
ECO6701	SQKICK	5/29/98	210	35	13	17.1	34.3	4.45	61.4	6.3	30
ECO6701	SQKICK	4/16/99	186	31	14	36.6	25.8	3.88	66.1	14.8	38
ECO6701	SQKICK	9/22/98	181	23	8	51.9	4.4	3.99	83.4	2.2	32
ECO6702	SQKICK	6/18/97	203	36	11	38.4	40.9	4.78	38.9	14.4	32
ECO6702	SQKICK	5/29/98	172	31	12	37.2	14.0	4.73	65.1	14.5	34
ECO6702	SQKICK	4/16/99	171	31	14	38.0	23.4	3.67	67.8	4.1	38
ECO6702	SQKICK	10/1/96	200	41	16	41.7	41.7	4.32	49.1	15.1	36
ECO6702	SQKICK	8/29/97	165	27	8	47.9	25.5	4.26	47.9	7.6	34
ECO6702	SQKICK	9/22/98	166	29	13	55.4	21.1	4.51	62.7	4.3	36
ECO6707	SQKICK	5/13/98	189	35	16	68.8	12.2	2.79	77.2	8.9	42
ECO6707	SQKICK	4/22/99	200	37	14	57.0	26.0	4.03	40.5	10.3	40
ECO6707	SQKICK	9/14/98	182	28	11	75.3	12.1	4.68	65.9	7.9	36
ECO67F01	SQKICK	10/30/97	162	38	20	50.0	11.1	3.66	72.2	10.3	40
ECO67F06	SQKICK	5/5/98	198	31	16	55.1	4.0	2.77	64.1	15.4	40
ECO67F06	SQKICK	4/20/99	229	34	16	48.5	15.3	3.12	47.2	21.5	36
ECO67F06	SQKICK	8/31/98	205	27	10	34.1	1.5	4.09	59.0	34.2	32
ECO67F08	SQKICK	9/4/96	200	39	8	46.7	36.5	5.10	51.5	10.3	30
ECO67F13	SQKICK	5/5/97	200	23	12	39.9	0.4	2.93	58.5	9.4	36
ECO67F13	SQKICK	5/6/98	180	23	12	33.3	1.1	4.17	60.6	5.2	32
ECO67F13	SQKICK	4/20/99	169	20	12	50.3	0.6	3.58	65.7	16.7	34
ECO67F13	SQKICK	9/5/96	200	20	10	31.3	1.1	4.50	55.5	19.2	28
ECO67F13	SQKICK	9/11/97	191	22	10	32.5	2.6	4.33	57.1	19.6	32

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO67F13	SQKICK	8/31/98	168	27	14	45.8	3.0	3.57	68.5	7.6	38
ECO67F14	SQKICK	6/27/97	209	28	7	27.3	14.8	4.62	71.3	48.7	28
ECO67F14	SQKICK	3/31/98	167	39	17	43.1	16.8	3.96	56.9	27.0	40
ECO67F14	SQKICK	9/20/96	200	27	9	50.7	9.9	4.05	54.4	8.3	32
ECO67F14	SQKICK	10/2/97	200	24	8	28.0	4.0	3.64	71.0	0.6	32
ECO67F14	SQKICK	9/1/98	198	23	9	32.8	5.1	3.85	60.6	6.4	30
ECO67F16	SQKICK	5/22/98	229	22	10	40.2	7.0	3.27	54.1	12.0	32
ECO67F16	SQKICK	4/1/99	235	44	21	52.8	8.5	3.54	59.6	16.2	40
ECO67F16	SQKICK	9/24/98	184	32	14	48.4	10.3	3.82	56.5	11.5	36
ECO67F17	SQKICK	6/13/97	230	35	12	43.0	27.0	4.30	49.1	11.6	32
ECO67F17	SQKICK	5/28/98	170	41	13	21.8	31.2	4.60	55.3	15.0	30
ECO67F17	SQKICK	5/28/99	193	29	12	40.9	15.5	4.04	64.2	7.3	36
ECO67F17	SQKICK	9/25/96	200	29	9	50.2	24.2	4.31	44.8	9.2	30
ECO67F17	SQKICK	9/12/97	188	26	9	47.9	16.5	4.05	63.3	1.6	34
ECO67F17	SQKICK	10/2/98	236	29	10	48.7	14.0	4.00	72.5	4.4	36
ECO67F23	SQKICK	5/22/98	174	30	11	54.0	15.5	3.72	34.5	10.8	32
ECO67F23	SQKICK	4/1/99	223	34	14	32.7	9.9	2.82	74.9	4.2	36
ECO67F23	SQKICK	9/24/98	167	26	12	61.1	8.4	3.13	61.7	3.6	38
ECO67F26	SQKICK	6/25/97	240	25	5	5.0	5.8	7.09	9.6	84.4	10
ECO67F26	SQKICK	9/11/97	168	24	9	33.3	5.4	4.26	32.7	35.5	26
ECO67G01	SQKICK	5/12/97	195	32	10	19.0	47.7	5.06	47.7	32.6	26
ECO67G01	SQKICK	5/14/98	192	32	3	3.6	37.5	5.27	55.2	4.9	26
ECO67G01	SQKICK	5/25/99	192	22	6	29.7	28.6	4.95	72.4	6.5	26
ECO67G01	SQKICK	12/2/96	200	28	7	59.3	24.3	4.44	52.2	16.9	32
ECO67G01	SQKICK	8/22/97	178	24	9	50.0	21.3	4.82	53.4	18.1	30
ECO67G01	SQKICK	9/3/98	222	24	7	43.2	33.8	5.47	43.7	21.3	26
ECO67G05	SQKICK	5/22/97	178	24	10	44.9	35.4	5.00	65.7	4.6	32
ECO67G05	SQKICK	9/9/96	231	36	9	39.0	13.0	5.15	69.3	25.0	32
ECO67G05	SQKICK	9/27/97	218	27	9	66.1	12.8	3.96	63.3	10.9	36
ECO67G08	SQKICK	5/21/97	207	26	5	39.6	15.0	5.30	56.5	28.5	28
ECO67G09	SQKICK	10/9/97	176	29	9	68.2	18.8	4.31	50.6	10.1	34
ECO67H04	SQKICK	5/6/97	180	29	8	26.1	64.4	1.89	21.7	4.6	24
ECO67H04	SQKICK	9/5/96	200	25	8	44.2	11.6	4.29	40.9	20.6	32
ECO67H04	SQKICK	10/2/97	168	23	8	21.4	10.1	4.44	60.1	27.6	26
ECO67H06	SQKICK	5/1/97	231	41	15	63.2	14.7	3.39	49.4	6.4	40
ECO67H06	SQKICK	9/11/96	236	43	15	62.3	9.7	4.69	76.7	6.5	40
ECO67H06	SQKICK	9/29/97	229	35	10	41.0	9.6	4.12	64.2	18.6	36
ECO67H08	SQKICK	4/30/97	183	24	13	27.3	7.1	5.81	20.2	62.2	24
ECO67H08	SQKICK	9/26/96	200	38	10	55.9	15.4	2.85	52.0	19.1	38
ECO67H08	SQKICK	10/9/97	178	38	10	37.1	14.6	4.12	30.9	19.5	34
ECO67I11	SQKICK	5/12/97	205	20	2	2.9	22.0	6.60	21.5	66.1	14
ECO67I11	SQKICK	9/20/96	201	35	6	24.9	37.8	5.24	77.6	16.1	30
ECO67I11	SQKICK	10/2/97	169	26	4	45.6	17.8	4.72	78.7	16.9	30

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO67I12	SQKICK	4/16/97	219	49	19	53.0	13.2	3.36	42.9	8.5	38
ECO67I12	SQKICK	9/9/96	200	42	15	58.9	20.9	4.08	42.3	14.3	40
ECO67I12	SQKICK	9/22/97	187	31	11	55.1	13.4	4.16	53.5	8.9	36
ECO68A01	SQKICK	5/7/97	167	38	11	13.2	53.3	4.45	44.3	28.3	24
ECO68A01	SQKICK	5/8/98	169	41	10	27.2	50.3	4.01	42.0	13.7	32
ECO68A01	SQKICK	4/12/99	161	43	13	33.5	29.2	4.34	38.5	38.5	30
ECO68A01	SQKICK	9/13/96	200	32	7	20.3	58.1	4.13	34.0	7.6	24
ECO68A01	SQKICK	9/26/97	226	43	12	41.6	35.4	3.86	54.0	7.0	34
ECO68A01	SQKICK	9/17/98	170	37	11	30.0	35.3	4.93	38.2	21.2	26
ECO68A03	SQKICK	5/14/97	169	38	15	39.1	45.6	3.82	34.9	9.3	34
ECO68A03	SQKICK	5/18/98	182	39	13	48.9	30.2	2.93	51.6	8.3	34
ECO68A03	SQKICK	4/12/99	179	42	14	54.7	24.6	3.00	60.3	7.5	42
ECO68A03	SQKICK	9/13/96	217	47	16	47.5	29.0	3.05	61.8	7.6	38
ECO68A03	SQKICK	9/26/97	195	46	20	57.4	24.6	2.79	64.6	11.9	42
ECO68A03	SQKICK	9/17/98	162	36	15	50.0	38.3	3.58	46.9	10.3	36
ECO68A08	SQKICK	6/26/97	196	30	13	36.7	19.9	3.95	68.9	6.3	36
ECO68A08	SQKICK	5/22/98	175	35	14	45.7	18.9	4.05	46.3	18.1	38
ECO68A08	SQKICK	4/26/99	193	46	10	28.5	33.2	4.58	50.3	15.6	30
ECO68A08	SQKICK	9/12/96	200	47	18	32.0	26.5	4.72	64.7	25.6	36
ECO68A08	SQKICK	9/22/97	192	31	11	43.8	28.6	4.57	68.2	4.2	32
ECO68A08	SQKICK	9/2/98	171	29	15	32.7	34.5	4.59	66.7	15.2	32
ECO68A13	SQKICK	5/3/99	173	29	13	39.3	46.2	4.08	22.5	12.4	30
ECO68A20	SQKICK	5/27/97	167	38	11	31.7	46.1	4.04	34.1	10.5	30
ECO68A20	SQKICK	5/4/98	170	36	11	38.2	35.9	3.07	47.1	25.3	34
ECO68A20	SQKICK	4/26/99	169	33	8	32.5	50.3	2.84	20.7	9.3	26
ECO68A20	SQKICK	9/11/96	200	41	14	43.0	35.5	4.08	45.0	5.9	36
ECO68A20	SQKICK	9/30/97	172	31	9	48.8	16.9	4.08	53.5	7.4	32
ECO68A21	SQKICK	8/23/96	200	35	5	16.0	50.2	4.73	30.9	47.7	22
ECO68A26	SQKICK	5/22/98	185	35	18	57.8	7.0	3.65	58.4	27.9	40
ECO68A26	SQKICK	4/26/99	184	28	11	45.1	16.8	3.99	59.8	17.3	36
ECO68A26	SQKICK	9/5/97	219	35	12	49.8	18.7	4.16	60.3	12.7	38
ECO68A26	SQKICK	9/2/98	170	32	18	57.6	10.0	4.14	59.4	11.2	40
ECO68A27	SQKICK	3/30/98	196	37	12	38.8	15.3	3.80	38.3	20.2	36
ECO68A27	SQKICK	4/26/99	178	41	11	39.9	34.3	3.03	43.3	12.1	34
ECO68A28	SQKICK	4/14/98	182	14	4	13.7	2.2	3.90	83.0	81.5	20
ECO68A28	SQKICK	5/3/99	172	33	13	30.8	16.9	3.78	55.8	51.8	28
ECO68B01	SQKICK	5/7/97	165	32	13	72.1	14.5	3.81	31.5	12.7	34
ECO68B01	SQKICK	5/6/98	189	28	15	84.7	3.7	3.56	39.2	7.4	38
ECO68B01	SQKICK	5/3/99	193	41	15	49.7	32.6	4.30	32.6	18.6	42
ECO68B02	SQKICK	5/19/97	184	30	13	60.3	19.0	4.56	49.5	12.6	34
ECO68B02	SQKICK	5/12/98	239	29	14	69.5	5.9	4.34	52.3	8.9	38
ECO68B02	SQKICK	5/3/99	193	23	5	24.9	40.4	5.10	14.5	38.0	18
ECO68B02	SQKICK	9/4/96	200	35	9	30.0	42.6	4.77	39.7	11.8	28

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO68B09	SQKICK	4/16/97	240	29	14	62.9	15.4	3.70	28.3	17.3	36
ECO68B09	SQKICK	5/5/98	237	38	12	53.2	12.7	4.34	34.6	27.6	32
ECO68B09	SQKICK	5/3/99	192	40	8	19.3	57.8	5.17	31.3	24.0	24
ECO68B09	SQKICK	9/19/96	200	33	6	27.2	53.3	5.04	36.1	14.4	22
ECO68B09	SQKICK	9/23/97	227	32	8	22.9	67.8	5.23	32.6	7.3	22
ECO68B09	SQKICK	9/8/98	193	33	9	17.1	68.4	5.31	36.8	14.4	20
ECO68C12	SQKICK	6/3/97	158	32	8	38.6	11.4	5.42	22.2	58.8	24
ECO68C13	SQKICK	4/16/97	212	31	9	42.0	8.5	2.50	75.5	11.7	34
ECO68C13	SQKICK	8/23/96	200	26	5	17.3	35.9	3.70	58.5	16.9	28
ECO68C13	SQKICK	9/3/97	183	31	9	28.4	54.6	4.84	53.6	19.1	24
ECO68C15	SQKICK	4/16/97	202	38	12	57.9	17.3	3.23	54.0	9.7	38
ECO68C15	SQKICK	4/14/98	184	23	13	80.4	3.8	2.82	48.4	5.5	34
ECO68C15	SQKICK	4/28/99	170	32	13	75.3	9.4	3.17	44.1	7.0	36
ECO68C15	SQKICK	9/6/96	200	32	8	38.4	29.0	3.92	55.9	16.7	30
ECO68C15	SQKICK	9/3/97	203	31	8	19.2	56.7	5.01	46.3	29.9	22
ECO68C15	SQKICK	8/31/98	186	28	10	27.4	59.1	4.76	50.5	13.0	26
ECO68C19	SQKICK	4/29/97	231	41	11	17.7	66.2	4.71	11.7	11.4	28
ECO68C20	SQKick	4/14/98	180	25	9	58.9	6.7	3.85	35.6	21.6	32
ECO68C20	SQKICK	4/28/99	205	33	10	72.7	5.9	4.57	10.2	12.3	30
ECO68C20	SQKICK	8/31/98	186	26	6	41.9	23.7	4.05	49.5	22.5	32
ECO69D01	SQKICK	4/25/97	213	37	11	36.6	22.5	3.49	37.1	11.2	34
ECO69D01	SQKICK	4/2/98	239	39	14	38.5	30.1	3.52	34.3	15.7	34
ECO69D01	SQKICK	4/9/99	196	36	14	36.7	33.7	3.61	38.3	4.3	36
ECO69D01	SQKICK	9/10/96	200	35	13	55.4	22.9	3.28	67.2	3.5	38
ECO69D01	SQKICK	10/3/97	182	40	14	55.5	10.4	3.85	62.1	17.4	42
ECO69D01	SQKICK	9/1/98	200	36	11	49.5	27.5	3.84	65.5	10.3	36
ECO69D03	SQKICK	4/17/97	164	34	12	48.8	36.6	2.68	45.7	13.7	32
ECO69D03	SQKICK	3/20/98	188	24	15	86.2	6.4	1.51	81.4	8.2	40
ECO69D03	SQKICK	4/30/99	189	29	14	85.2	10.6	1.12	78.8	1.9	40
ECO69D03	SQKICK	9/12/96	200	28	11	45.6	27.0	3.53	58.7	2.5	36
ECO69D04	SQKICK	5/16/97	210	41	20	67.1	18.1	3.80	35.7	10.4	38
ECO69D04	SQKICK	4/2/98	224	48	21	60.3	15.6	3.58	50.4	12.7	42
ECO69D04	SQKICK	4/9/99	201	43	18	47.3	9.0	3.45	65.2	27.0	40
ECO69D04	SQKICK	9/21/96	217	26	7	68.2	9.2	3.76	70.5	6.5	36
ECO69D04	SQKICK	6/5/98	177	38	14	59.3	12.4	3.98	66.7	11.8	40
ECO69D04	SQKICK	9/1/98	236	37	11	49.2	18.6	4.19	57.6	11.5	38
ECO69D05	SQKICK	4/6/98	230	37	22	80.9	11.3	1.90	72.2	3.2	42
ECO69D05	SQKICK	4/30/99	224	43	18	71.4	16.1	2.73	48.7	7.1	40
ECO69D06	SQKICK	4/6/98	178	27	14	67.4	9.0	2.43	72.5	4.2	40
ECO69D06	SQKICK	4/9/99	240	30	12	62.9	13.8	4.05	37.5	16.4	34
ECO69D06	SQKICK	9/16/98	191	21	9	79.1	4.7	4.30	74.9	3.8	34
ECO71E01	SQKICK	5/7/97	171	25	7	14.6	27.5	6.61	14.6	19.4	18
ECO71E01	SQKICK	10/3/96	200	16	4	14.1	2.7	6.36	34.4	11.9	18

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO71E09	SQKICK	5/19/97	182	20	4	5.5	18.1	4.25	68.7	27.3	24
ECO71E09	SQKICK	5/12/98	176	22	5	4.5	1.7	4.58	58.5	22.7	26
ECO71E09	SQKICK	5/4/99	173	32	11	43.9	20.8	4.39	47.4	7.8	34
ECO71E09	SQKICK	10/1/96	200	19	7	9.7	0.2	3.48	76.2	14.8	28
ECO71E09	SQKICK	10/16/97	237	30	9	62.9	5.1	4.83	85.2	2.2	34
ECO71E09	SQKICK	8/26/98	213	29	7	27.2	8.9	3.89	66.7	7.8	32
ECO71E14	SQKICK	6/6/97	197	32	10	50.8	28.4	4.81	32.0	14.1	28
ECO71E14	SQKICK	5/12/98	200	30	8	57.8	7.0	3.26	73.8	8.9	36
ECO71E14	SQKICK	5/4/99	194	31	10	42.8	23.2	4.17	45.4	18.6	34
ECO71E14	SQKICK	9/4/97	182	27	11	53.8	18.7	4.79	65.4	4.0	34
ECO71E14	SQKICK	8/26/98	200	25	10	69.0	6.5	4.98	58.5	25.0	36
ECO71E15	SQKICK	6/29/98	178	17	3	6.7	10.7	7.80	14.6	3.4	16
ECO71E15	SQKICK	9/22/98	224	26	9	76.8	12.5	5.13	53.6	4.1	32
ECO71F01	SQKICK	5/21/97	186	14	5	7.0	16.7	7.89	7.0	1.1	18
ECO71F01	SQKICK	5/18/98	198	19	10	16.7	3.5	7.26	25.3	1.0	22
ECO71F01	SQKICK	5/6/99	174	23	10	29.9	14.9	5.89	33.3	1.8	26
ECO71F01	SQKICK	10/2/96	200	22	13	65.4	3.1	5.17	58.7	1.2	34
ECO71F01	SQKICK	9/5/97	196	22	10	41.3	4.6	5.97	34.2	1.6	28
ECO71F01	SQKICK	9/22/98	182	20	11	42.9	4.4	6.02	31.9	3.7	28
ECO71F12	SQKICK	4/22/97	177	31	10	41.2	48.6	3.82	32.2	6.0	30
ECO71F12	SQKICK	4/22/98	192	30	8	22.4	37.5	5.27	28.1	33.3	22
ECO71F12	SQKICK	5/10/99	179	30	12	31.3	12.3	4.85	69.3	14.7	32
ECO71F12	SQKICK	9/25/96	200	28	11	54.6	11.9	4.62	65.4	15.9	36
ECO71F12	SQKICK	8/25/97	187	31	11	51.9	5.9	4.91	47.6	16.3	32
ECO71F12	SQKICK	8/5/98	188	31	11	65.4	9.6	4.68	53.2	17.9	34
ECO71F16	SQKICK	5/29/98	189	30	13	37.6	3.2	4.25	58.2	4.5	36
ECO71F16	SQKICK	5/10/99	203	30	10	30.5	42.9	3.93	40.4	8.9	29
ECO71F16	SQKICK	9/9/98	190	27	10	41.6	16.3	4.85	43.7	7.7	32
ECO71F19	SQKICK	5/14/97	185	28	10	58.4	25.9	3.25	48.1	14.2	36
ECO71F19	SQKICK	5/19/98	187	33	11	54.5	18.7	3.24	61.0	21.9	38
ECO71F19	SQKICK	6/7/99	176	31	10	35.8	31.3	3.69	58.5	8.1	32
ECO71F19	SQKICK	10/4/96	200	33	11	50.2	6.5	3.89	53.6	12.7	34
ECO71F19	SQKICK	9/3/97	178	32	11	68.0	14.0	3.64	53.4	14.3	36
ECO71F19	SQKICK	9/21/98	197	31	13	58.9	16.8	4.22	38.6	14.4	36
ECO71F26	SQKICK	5/21/97	166	20	6	30.1	46.4	6.21	19.9	20.6	20
ECO71F26	SQKICK	10/2/96	200	26	9	44.3	13.8	5.77	56.5	4.5	30
ECO71F26	SQKICK	8/27/97	212	28	6	41.0	19.8	5.48	62.7	2.9	32
ECO71F27	SQKICK	4/21/97	194	38	17	44.3	13.4	3.78	45.9	18.9	38
ECO71F27	SQKICK	5/5/98	208	43	16	52.9	10.6	2.96	56.7	18.2	40
ECO71F27	SQKICK	6/7/99	170	32	11	47.6	14.7	3.72	59.4	13.2	36
ECO71F27	SQKICK	10/9/96	227	38	13	45.8	7.0	4.61	30.0	27.3	30
ECO71F27	SQKICK	9/11/97	190	38	13	22.1	16.8	4.09	48.4	22.0	34
ECO71F27	SQKICK	9/21/98	182	39	12	33.5	23.6	4.12	43.4	17.2	34

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO71F28	SQKICK	5/14/97	184	25	9	32.6	20.1	3.36	65.2	7.8	32
ECO71F28	SQKICK	5/5/98	184	24	8	43.5	13.0	2.58	76.6	6.6	34
ECO71F28	SQKICK	6/7/99	228	22	10	62.7	27.6	5.73	39.9	31.1	28
ECO71F28	SQKICK	10/4/96	200	25	10	53.0	3.8	3.24	75.4	4.1	36
ECO71F28	SQKICK	9/3/97	208	29	13	66.8	1.9	4.10	46.6	18.0	36
ECO71F28	SQKICK	9/21/98	239	26	10	63.2	24.7	4.37	55.6	2.6	36
ECO71G03	SQKICK	4/28/98	226	41	18	41.2	13.7	3.88	57.1	14.0	40
ECO71G03	SQKICK	6/16/99	213	35	15	35.7	14.1	4.06	58.2	8.3	36
ECO71G03	SQKICK	9/14/98	188	29	12	56.9	7.4	4.11	69.1	5.4	38
ECO71G04	SQKICK	4/28/98	237	36	11	65.8	9.3	3.66	44.7	16.0	38
ECO71G04	SQKICK	6/16/99	175	26	9	48.6	9.1	4.28	54.9	9.9	32
ECO71G04	SQKICK	9/14/98	201	33	7	55.7	26.4	4.28	44.3	9.5	32
ECO71G05	SQKICK	5/20/97	169	32	10	29.0	29.6	4.75	37.3	30.2	24
ECO71G05	SQKICK	10/3/96	200	19	6	26.4	11.2	4.48	63.1	27.3	26
ECO71G05	SQKICK	9/2/97	214	33	6	27.1	22.0	4.58	60.7	13.3	30
ECO71G10	SQKICK	5/1/97	223	36	14	74.9	15.7	3.01	43.5	2.8	36
ECO71G10	SQKICK	4/23/98	231	32	13	77.5	6.5	2.60	51.9	5.4	36
ECO71G10	SQKICK	6/8/99	188	29	13	50.5	12.8	4.28	75.0	31.1	34
ECO71G10	SQKICK	9/30/96	200	24	9	75.2	3.2	3.70	49.8	4.2	34
ECO71G10	SQKICK	10/10/97	164	24	9	85.4	4.3	4.53	67.7	1.9	34
ECO71G10	SQKICK	9/8/98	190	25	11	80.5	6.3	4.07	67.4	3.7	38
ECO71G11	SQKICK	5/13/97	191	33	13	32.5	37.2	5.54	13.1	39.6	22
ECO71G11	SQKICK	9/20/96	200	32	12	61.7	22.7	5.02	65.1	12.3	36
ECO71G11	SQKICK	8/26/97	212	32	12	67.0	17.9	5.10	45.3	24.9	34
ECO71H03	SQKICK	5/6/97	231	30	12	61.9	6.9	2.43	70.1	3.5	38
ECO71H03	SQKICK	5/4/98	215	31	14	49.3	1.9	2.15	84.2	5.3	38
ECO71H03	SQKICK	6/2/99	182	30	11	52.2	22.5	4.35	36.3	13.3	34
ECO71H03	SQKICK	10/14/96	200	25	12	39.7	2.0	3.22	75.3	9.9	36
ECO71H03	SQKICK	8/20/97	186	36	11	43.0	15.6	4.77	38.7	30.2	34
ECO71H03	SQKICK	9/17/98	186	29	11	55.9	21.5	4.30	60.8	12.8	38
ECO71H06	SQKICK	5/12/97	169	29	8	62.7	18.3	3.07	43.2	10.1	34
ECO71H06	SQKICK	4/13/98	188	20	8	70.7	2.1	2.59	62.2	3.8	34
ECO71H06	SQKICK	6/11/99	196	33	10	43.4	43.9	5.29	21.4	33.5	26
ECO71H06	SQKICK	10/16/96	200	30	11	38.5	6.9	3.33	61.5	6.8	36
ECO71H06	SQKICK	8/21/97	176	27	14	72.2	13.1	3.44	50.6	5.7	38
ECO71H06	SQKICK	8/31/98	191	22	9	58.1	19.4	4.35	40.8	10.1	32
ECO71H09	SQKICK	4/30/97	183	21	10	63.9	14.2	3.68	33.9	0.6	32
ECO71H09	SQKICK	4/13/98	172	15	8	34.3	1.2	5.71	32.6	1.2	24
ECO71H09	SQKICK	6/11/99	199	28	10	45.2	20.6	5.22	37.2	14.4	29
ECO71H09	SQKICK	10/16/96	200	26	10	61.6	14.5	5.19	46.2	8.0	34
ECO71H09	SQKICK	8/19/97	210	33	15	54.3	12.4	5.11	40.5	6.2	34
ECO71H09	SQKICK	8/31/98	199	21	10	58.8	9.0	5.53	34.7	20.1	29
ECO71H15	SQKICK	10/21/96	200	23	7	20.4	12.5	5.69	57.8	20.7	30

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO71I03	SQKICK	4/23/97	200	28	9	56.0	19.5	4.19	37.5	18.1	32
ECO71I03	SQKICK	9/26/96	200	24	5	12.6	74.0	5.49	19.8	11.7	20
ECO71I03	SQKICK	10/1/97	174	27	3	5.7	43.7	6.05	24.7	23.8	20
ECO71I09	SQBANK	4/23/97	225	45	12	44.4	24.0	5.81	24.4	50.2	18
ECO71I09	SQBANK	5/19/98	218	43	8	9.2	18.3	6.64	6.9	69.7	22
ECO71I09	SQBANK	6/3/99	187	42	6	13.9	27.3	5.80	22.5	43.7	26
ECO71I09	SQKICK	10/8/96	200	31	7	55.5	8.1	6.74	21.3	68.5	24
ECO71I09	SQKICK	10/1/97	162	36	4	5.6	46.9	5.57	13.6	29.9	36
ECO71I09	SQBANK	9/1/98	178	44	8	6.7	58.4	5.87	31.5	23.1	30
ECO71I10	SQBANK	5/1/97	192	43	8	21.4	31.8	6.80	9.9	50.0	26
ECO71I10	SQBANK	5/19/98	239	32	3	2.9	36.0	6.56	16.3	44.3	18
ECO71I10	SQBANK	6/8/99	212	37	5	17.0	8.5	7.20	8.5	76.4	18
ECO71I10	SQBANK	10/18/96	200	23	2	44.2	10.8	7.22	16.5	78.2	20
ECO71I10	SQBANK	10/9/97	161	23	2	37.3	2.5	6.99	23.6	68.1	22
ECO73A01	SQBANK	4/21/97	170	26	3	7.1	5.9	7.75	0.6	80.4	10
ECO73A01	SQBANK	8/15/96	209	38	3	16.7	31.6	7.49	6.7	71.9	12
ECO73A01	SQBANK	8/26/97	175	26	1	38.3	14.9	7.32	0.6	82.7	14
ECO73A02	SQBANK	4/24/97	178	18			1.7	7.88		44.4	14
ECO73A02	SQBANK	5/27/98	189	28	2	27.0	2.1	7.36	2.1	83.0	14
ECO73A02	SQBANK	4/21/99	187	25	1	1.1	1.1	7.36	0.5	16.9	18
ECO73A02	SQBANK	8/27/97	182	24	1	2.2	26.9	7.22	1.1	31.1	18
ECO73A02	SQBANK	8/25/98	206	30	3	35.0	24.8	7.06	3.9	57.0	14
ECO73A03	SQBANK	4/24/97	209	22	2	2.4	3.3	8.14	1.0	40.4	14
ECO73A03	SQBANK	5/26/98	177	34	1	4.0	22.6	6.71	1.1	28.1	20
ECO73A03	SQBANK	4/20/99	177	26			17.5	6.13	1.1	39.6	16
ECO73A03	SQBANK	8/26/97	201	29	1	1.5	19.4	6.85	8.5	37.2	18
ECO73A03	SQBANK	8/25/98	205	34			37.6	7.10	31.2	66.9	20
ECO73A04	SQBANK	5/28/98	199	34	1	6.5	7.0	5.74	2.5	77.1	18
ECO73A04	SQBANK	4/21/99	200	39	1	0.5	7.0	7.58	0.5	88.1	12
ECO73A04	SQBANK	8/19/98	222	33	2	19.8	14.0	5.76	1.4	79.7	18
ECO74A06	SQKICK	4/22/97	186	18	2	1.6	73.1	4.61	23.1	67.9	12
ECO74A06	SQKICK	4/27/98	167	20	4	4.8	82.6	5.40	12.6	23.6	12
ECO74A06	SQKICK	4/19/99	216	22	3	7.4	58.3	5.37	21.3	57.0	12
ECO74A06	SQKICK	8/14/96	223	25	5	65.9	17.0	3.91	13.9	13.3	30
ECO74A06	SQKICK	8/25/97	174	13	4	70.7	13.8	5.28	72.4	16.7	30
ECO74A06	SQKICK	8/24/98	192	16	2	23.4	72.9	6.42	12.5	23.0	14
ECO74A08	SQKICK	4/22/97	203	14	4	7.4	86.7	4.96	4.4	43.1	10
ECO74A08	SQKICK	4/21/98	178	26	10	41.0	25.8	5.23	27.0	31.2	28
ECO74A08	SQKICK	4/13/99	175	20	3	39.4	48.6	5.06	4.6	18.3	20
ECO74A08	SQKICK	9/19/96	200	17	8	89.7	5.5	3.41	41.8	8.5	32
ECO74A08	SQKICK	8/7/97	239	20	6	84.5	7.5	5.27	52.3	5.1	30
ECO74A08	SQKICK	8/18/98	191	22	8	62.8	29.8	5.53	51.3	1.6	28
ECO74A10	SQKICK	4/24/97	191	15	1	4.2	47.6	6.82	4.2	16.8	14

StationID	CollMeth	Date	Total No.	``TR	EPT	%EPT	%Chiro	NCBI	%Clinger	%Tolerant	TSCI
ECO74A10	SQKICK	4/21/98	170	9	2	1.2	0.6	7.80	1.2	3.0	14
ECO74A10	SQKICK	4/13/99	181	17	2	11.0	54.7	5.70	3.9	27.8	12
ECO74A10	SQKICK	8/7/97	191	30	5	30.9	42.4	5.85	21.5	11.2	24
ECO74A10	SQKICK	8/18/98	239	27	2	13.0	66.5	6.34	16.3	10.7	14
ECO74B01	SQKICK	5/6/97	168	26	6	17.9	49.4	4.97	33.3	55.6	18
ECO74B01	SQBANK	4/20/98	184	32	5	27.7	57.1	6.73	20.1	70.5	20
ECO74B01	SQKICK	4/20/98	179	16	5	21.2	65.4	5.72	15.1	14.4	18
ECO74B01	SQBANK	4/14/99	238	35	3	13.4	43.3	6.72	3.4	63.1	14
ECO74B01	SQKICK	9/11/96	200	21	5	20.7	74.6	5.94	19.7	8.2	20
ECO74B01	SQKICK	8/20/97	206	37	9	26.7	55.8	5.84	10.7	17.6	22
ECO74B01	SQBANK	8/20/98	178	42	8	36.5	44.4	6.28	19.1	36.5	28
ECO74B04	SQBANK	5/6/97	189	52	10	19.0	56.6	5.78	16.9	35.0	28
ECO74B04	SQBANK	4/20/98	221	51	8	9.0	53.4	6.17	7.7	35.4	20
ECO74B04	SQKICK	4/20/98	173	10	2	14.5	52.6	4.10	32.4	51.8	12
ECO74B04	SQBANK	4/14/99	185	43	8	18.9	57.3	5.41	8.6	16.8	26
ECO74B04	SQBANK	9/11/96	213	40	11	35.2	50.7	5.93	7.0	30.8	24
ECO74B04	SQKICK	8/20/97	189	26	8	29.1	51.3	6.01	58.7	6.5	28
ECO74B04	SQBANK	8/19/98	212	40	6	15.6	47.2	6.14	12.3	17.2	22
ECO74B04	SQKICK	8/19/98	185	28	4	13.5	68.1	4.99	22.7	29.9	16
ECO74B12	SQBANK	4/27/97	167	41	14	55.7	29.3	4.95	38.9	27.4	40
ECO74B12	SQBANK	4/27/98	172	39	16	68.0	15.1	4.51	50.6	21.6	40
ECO74B12	SQBANK	4/19/99	207	49	14	33.8	34.3	6.06	22.7	43.2	30
ECO74B12	SQBANK	8/13/96	224	45	8	11.2	33.5	5.52	2.2	57.1	22
ECO74B12	SQBANK	8/25/97	180	45	12	40.6	25.0	5.11	39.4	22.0	40
ECO74B12	SQBANK	8/24/98	163	43	10	35.6	23.9	5.92	29.4	43.3	34