

Methods

DATA COLLECTION

Between April 2005 and February 2006, SRBC collected quarterly water chemistry samples and measured flow at 23 stream sites and 10 springs. Macroinvertebrate samples were collected, and habitat assessments were completed at the stream sites in April 2005. Appendix A contains a list of station names, sampling location descriptions, drainage areas, and latitude and longitude coordinates. Spring sites are listed below the stream sites and are in red. The sampling sites were selected so that biological, water quality, and habitat data from specific stream segments could be collected as well as water quality information for several spring sources throughout the Cove. Greater emphasis was placed on Halter Creek Watershed because it is located in the potentially stressed groundwater area of Roaring Spring. Ten stream sites and five springs were located in the Halter Creek Watershed. The information collected from the stream segments allowed for the determination of lengths and severity of impacted streams.



Taking a flow measurement in Plum Creek.

Water chemistry samples were collected in April 2005, July 2005, October 2005 and January/February 2006 and analyzed for field and laboratory parameters (Table 1). Water was collected using a hand-held depth integrated sampler

at six verticals across the stream channel. The water was put into a churn splitter, mixed thoroughly, and split into a 125-ml bottle acidified with nitric acid for metals and a 500-ml bottle used to complete the field chemistry analyses. Temperature was measured in degrees Celsius with a field thermometer. A Cole-Parmer Model

5996 meter was used to measure pH. Conductivity was measured with a Cole-Parmer Model 1481 meter, and dissolved oxygen was measured with a YSI 55 meter. Field alkalinity was determined by titration of a known volume of sample water to pH 4.5 with 0.02N H₂SO₄.

Flow at stream locations and in tributaries from large springs was measured using a Scientific Instruments pygmy or AA meter according to the USGS methods (Buchanan and Somers, 1969). At smaller springs and tributaries, where it was impossible to use a flow meter, a bucket with a known volume and a stopwatch were used to estimate flow. Numerous tributaries and springs were dry at different times during the sampling period due to below normal precipitation during the summer and fall.

In April 2005, staff sampled 22 stations in Morrison Cove for benthic macroinvertebrates (organisms that live on the stream bottom, including aquatic insects, crayfish, clams, snails, and worms), using a modified version of Rapid Bioassessment Protocol III (Barbour and others, 1999). Two kick-screen samples were obtained at each

Table 1. Water Quality Parameters Sampled in Morrison Cove

FIELD PARAMETERS	
Flow, instantaneous cfs ^a	Conductivity, μ mhos/cm ^b
Temperature, °C	Alkalinity, mg/l
Dissolved Oxygen, mg/l ^c	
pH	
LABORATORY ANALYSIS PARAMETERS	
Total Nitrate, mg/l	Total Sulfate, mg/l
Total Hardness, mg/l	Total Potassium, mg/l
Total Magnesium, mg/l	Total Calcium, mg/l
Total Sodium, mg/l	Total Silica, mg/l
Total Chloride, mg/l	Alkalinity, mg/l

^a cfs = cubic feet per second

^b μ mhos/cm = micromhos per centimeter

^c mg/l = milligram per liter

station by disturbing the substrate of representative riffle/run areas and collecting dislodged material with a one-meter-square 600-micron mesh screen. Each sample was preserved in 95 percent denatured ethyl alcohol and returned to SRBC's lab, where the entire sample was picked and sorted into a subsample of at least 200 organisms. The remainder of the sample was examined for additional taxa that were not in the 200-count subsample. This enumeration of additional taxa was performed due to low diversity in the samples, which is characteristic of limestone streams. Organisms were identified to genus, except for midges and aquatic worms, which were identified to family.

Habitat conditions were rated using a modified version of RBP III (Plafkin and others 1989; Barbour and others, 1999). Stream sites were evaluated based on physical characteristics relating to pool and riffle composition, substrate, conditions of banks, and the extent of the riparian zone. Each habitat parameter was assessed on a scale of 0-20, with 20 being optimal; and all parameter scores were added together to generate the total habitat score for each site. Other field observations also were recorded regarding weather, land use, and substrate composition, as well as any other relevant watershed features.