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Lagrangian Sampling of Wastewater Treatment Plant Effluent in Boulder Creek, Colorado, and Fourmile Creek, Iowa, During the Summer of 2003 and Spring of 2005—Hydrological and Water-Quality Data

By Larry B. Barber, Steffanie H. Keefe, Dana W. Kolpin, Douglas J. Schnoebelen, Jennifer L. Flynn, Gregory K. Brown, Edward T. Furlong, Susan T. Glassmeyer, James L. Gray, Michael T. Meyer, Mark W. Sandstrom, Howard E. Taylor, and Steven D. Zaugg

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Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
square meter (m^2)	10.76	square foot (ft^2)
square kilometer (km^2)	0.3861	square mile (mi^2)
	Volume	
liter (L)	0.2642	gallon (gal)
cubic meter (m^3)	264.2	gallon (gal)
	Flow rate	
cubic meter per second (m^3/s)	35.31	cubic foot per second (ft^3/s)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)
kilogram (kg)	2.205	pound, avoirdupois (lb)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F=(1.8\times °C)+32$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Altitude, as used in this report, refers to distance above the vertical datum.

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Abbreviations

Auto, autosampler
C18-SPE, octadecylsilica solid-phase extraction
CASRN, Chemical Abstract Services Registry Number
CLLE, continuous liquid-liquid extraction
Conc, concentration
D, downstream
E, effluent
EWI, equal-width-integrated
F, filtered
GC/MS, gas chromatography/mass spectrometry
GC/MS/MS, gas chromatography/tandem mass spectrometry
HLB-SPE, hydrophilic-lipophilic-balance solid-phase extraction
ICP/AES, inductively coupled plasma/atomic emission spectrometry
ICP/MS, inductively coupled plasma/mass spectrometry
LC/MS, liquid chromatography/mass spectrometry
LC/MS/MS, liquid chromatography/tandem mass spectrometry
LRL, laboratory reporting level
LS, Lagrangian sampling
MDL, method detection limits
NA, not available
NRPL, National Research Program Laboratory
NWQL, National Water Quality Laboratory
OGRL, Organic Geochemistry Research Laboratory
R, unfiltered
RWT, rhodamine WT
SCUFA, self-contained underwater fluorescence apparatus
SDB-SPE, styrene divinylbenzene solid-phase extraction
SIM, selected ion monitoring
™, trademarked
TT, tracer test
USGS, U.S. Geological Survey
UV254, ultraviolet light absorbance at 254 nanometers
UV280, ultraviolet light absorbance at 280 nanometers
WWTP, wastewater treatment plant
--, not determined

Units

cm, centimeter
col/100 mL, colonies per 100 milliliters
deg C, degree Celsius
hr, hour
km, kilometer
km^2, square kilometer
L, liter
m, meter
m/km, meter per kilometer
m/s, meter per second
m^3/s, cubic meters per second
mg/L, milligram per liter
mg/L C, milligram per liter carbon
mg/L $CaCO_3$, milligram per liter as calcium carbonate
mg/L N, milligram per liter nitrogen
mg/L P, milligram per liter phosphorous
mL, milliliter
min, minute
NTU, nephelometric turbidity units
nm, nanometer
pla/100 mL, plaque forming units per 100 milliliters
Std units, standard pH units
µg/L, microgram per liter
µm, micrometer
µS/cm, microsiemens per centimeter
v/v, volume/volume
<, less than
>, greater than

Lagrangian Sampling of Wastewater Treatment Plant Effluent in Boulder Creek, Colorado, and Fourmile Creek, Iowa, During the Summer of 2003 and Spring of 2005—Hydrological and Water-Quality Data

By Larry B. Barber, Steffanie H. Keefe, Dana W. Kolpin, Douglas J. Schnoebelen, Jennifer L. Flynn, Gregory K. Brown, Edward T. Furlong, Susan T. Glassmeyer, James L. Gray, Michael T. Meyer, Mark W. Sandstrom, Howard E. Taylor, and Steven D. Zaugg

Abstract

This report presents methods and data for a Lagrangian sampling investigation into chemical loading and in-stream attenuation of inorganic and organic contaminants in two wastewater treatment-plant effluent-dominated streams: Boulder Creek, Colorado, and Fourmile Creek, Iowa. Water-quality sampling was timed to coincide with low-flow conditions when dilution of the wastewater treatment-plant effluent by stream water was at a minimum. Sample-collection times corresponded to estimated travel times (based on tracer tests) to allow the same "parcel" of water to reach downstream sampling locations. The water-quality data are linked directly to stream discharge using flow- and depth-integrated composite sampling protocols. A range of chemical analyses was made for nutrients, carbon, major elements, trace elements, biological components, acidic and neutral organic wastewater compounds, antibiotic compounds, pharmaceutical compounds, steroid and steroidal-hormone compounds, and pesticide compounds. Physical measurements were made for field conditions, stream discharge, and time-of-travel studies. Two Lagrangian water samplings were conducted in each stream, one in the summer of 2003 and the other in the spring of 2005. Water samples were collected from five sites in Boulder Creek: upstream from the wastewater treatment plant, the treatment-plant effluent, and three downstream sites. Fourmile Creek had seven sampling sites: upstream from the wastewater treatment plant, the treatment-plant effluent, four downstream sites, and a tributary. At each site, stream discharge was measured, and equal width-integrated composite water samples were collected and split for subsequent chemical, physical, and biological analyses. During the summer of 2003 sampling, Boulder Creek downstream from the wastewater treatment plant consisted of 36 percent effluent, and Fourmile Creek downstream from the respective wastewater treatment plant was 81 percent effluent. During the spring of 2005 samplings, Boulder Creek downstream from the wastewater treatment plant was 40 percent effluent, and Fourmile Creek downstream from that wastewater treatment plant was 28 percent effluent. At each site, 300 individual constituents were determined to characterize the water. Most of the inorganic constituents were detected in all of the stream and treatment-plant effluent samples, whereas detection of synthetic organic compounds was more limited and contaminants typically occurred only in wastewater treatment-plant effluents and at downstream sites. Concentrations ranged from nanograms per liter to milligrams per liter.

Introduction

Municipal wastewater treatment plant (WWTP) effluents play an important role in meeting current and future water-resource needs and have the potential to affect the chemistry of receiving streams (Kolpin and others, 2002; Glassmeyer and others, 2005; Barber and others, 2006). Similar chemical uses in domestic, commercial, and industrial activities result in many contaminants being ubiquitous in WWTP effluents. This study used the Lagrangian approach (Moody, 1993; Brown and others, 2009; Barber and others, 2011), in which a specific parcel of water is sampled as it moves downstream under natural-gradient conditions. Because Lagrangian sampling is closely related to respective stream hydraulic characteristics, it minimizes variability associated with daily fluctuations in stream and WWTP chemistry, and when combined with measurement of stream discharge allows quantitative mass-flow analysis (Barber and others, 2011).

Purpose and Scope

To investigate chemical loading and in-stream attenuation of inorganic and organic contaminants, the U.S. Geological Survey (USGS) conducted Lagrangian sampling in Boulder Creek, Colorado, and Fourmile Creek, Iowa, where similar reaches (7.5 and 10.7 kilometers, km, respectively) in each stream were evaluated. Multiple sample sites included a site upstream from the WWTP outfall, the WWTP effluent, and sites progressively downstream from the WWTP outfall. The number of downstream sites varied between streams and sampling events. Experiments were conducted under low-flow conditions when dilution of effluent by stream water was at a minimum. Prior to conducting Lagrangian sampling, stream velocities and travel times to the downstream locations were established by tracer tests and used to coordinate sampling of the same approximate parcel of water as it moved downstream. Flow-weighted composite water samples were collected for comprehensive inorganic and organic chemical analyses.

This data report compiles the full set of hydrological and chemical data collected as part of or in support of this field investigation into the fate and transport of wastewater-derived contaminants. The (laboratory) analytical methods are described here, and the quality-assurance data are summarized, in support of additional (separate) interpretive reports (Barber and others, 2011).

Methods

Study Site Descriptions

The Boulder Creek Watershed, Colorado (fig. 1, table 1), transects a hydrogeochemical and land-use gradient from relatively pristine snowmelt conditions in the upper watershed to a WWTP effluent-dominated system in the lower basin (Murphy and others, 2003; Barber and others, 2006). The bedrock geology of the upper watershed comprises a Precambrian igneous and metamorphic complex, whereas the lower watershed is underlain by Cretaceous marine shale and sandstone (Lovering and Goddard, 1950). The study reach extends from 0.1 km upstream from the City of Boulder WWTP to 7.4 km downstream. The water supply for the sewage influent to the WWTP originates in Boulder Creek in the upper watershed and has undergone drinking-water treatment and municipal use. The average annual daily WWTP inflow of 0.74 m^3/s (cubic meters per second; City of Boulder, Colorado, Department of Public Works, accessed May 2005, at *http://www.ci.boulder.co.us/publicworks/depts/utilities*) was treated by a trickling filter/solids contact/nitrification process. Downstream from the WWTP, Boulder

Creek flows through areas of mixed land use (residential, croplands, aggregate mines, and oil-well operations). One small tributary in the reach adds inflow, and three diversion ditches remove water.

The Fourmile Creek Watershed is located near Ankeny, Iowa (fig. 2, table 1), and is smaller and exhibits a lower gradient than Boulder Creek. Pleistocene continental glaciation affected the landscape within the watershed, and bedrock (carbonate rocks and shales) is buried under deep glacial soils (Anderson, 1983: Schnoebelen and others, 2006). The Fourmile Creek study site covers the reach from 0.1 km above to 10.6 km downstream from the Ankeny WWTP. The water supply for the city of Ankeny is derived from a mixture of groundwater and surface water from the Des Moines River and several aquifers, undergoes drinking-water treatment and municipal use, and is discharged to the WWTP at an average annual daily inflow of 0.21 m^3/s (City of Ankeny, Iowa, Department of Public Works, accessed May 2005, at *http://www.ankenyiowa.gov*). Sewage was treated by primary clarification, fine-bubble aeration, final clarification, and ultraviolet-light disinfection. Downstream from the WWTP, Fourmile Creek flows through croplands and residential developments, and much of the agricultural landscape has been tiled to enhance surface drainage for farming. There is one substantial tributary, Muchikinock Creek, in the study reach.

Lagrangian Water-Quality Study

Lagrangian water-sampling experiments were conducted in Boulder Creek and Fourmile Creek under low-flow conditions on the falling limb (August–September 2003) and on the rising limb (March–April 2005) of the annual hydrographs (fig. 3), when dilution of WWTP effluent by stream water was at a minimum. Lagrangian sampling follows the same "parcel" of water as it moves downstream. Boulder Creek and Fourmile Creek sampling locations are shown in figures 1 and 2, and details are presented in table 2. Prior to the Boulder Creek summer sampling, a tracer experiment was conducted on August 21, 2003 to estimate stream velocities and travel times. Breakthrough curves were developed for sites at 3.6 km (site BC-D3.6), 5.0 km (BC-D5.0), and 7.4 km (BC-D7.4) downstream from the WWTP outfall (table 2). The spring Boulder Creek tracer experiment was conducted April 16 to 17, 2005, and breakthrough curves were derived for sites BC-D3.6 and BC-D7.4. The summer Fourmile Creek tracer experiment was conducted July 30 to 31, 2003, and breakthrough curves were derived for sites located 2.9 km (site FC-D2.9), 8.4 km (FC-D8.4), and 10.6 km (FC-D10.6) downstream from the WWTP outfall. The spring Fourmile Creek tracer experiment was conducted March 3 to 4, 2005, and breakthrough curves were developed for sites FC-D2.9 and FC-D8.4.

Lagrangian water sampling was conducted in Boulder Creek and Fourmile Creek following the tracer experiments. Water-quality samples were collected from locations (table 2) 0.1 km upstream from the treatment plants (sites BC-U and FC-U), from the WWTP effluents (sites BC-E and FC-E), and from the respective downstream sites. Samples were collected at appropriate time intervals determined from the tracer tests so that the same approximate parcel of water was sampled as it moved downstream under natural flow conditions. On September 3, 2003, five sites were sampled on Boulder Creek (sites BC-U, BC-E, BC-D3.6, BC-D5.0, and BC-D7.4). On April 19, 2005, samples were collected from four sites on Boulder Creek (BC-U, BC-E, BC-D3.6, and BC-D7.4). On August 5, 2003, seven sites were sampled on Fourmile Creek (sites FC-U, FC-E, FC-D0.4, FC-D2.9, FC-D8.4, FC-D10.6, and the Muchikinock Creek tributary (site FC-MC). On March 8, 2005, four sites were sampled on Fourmile Creek (sites FC-U, FC-E, FC-D2.9, and FC-D8.4).

Time-of-Travel Studies

Rhodamine WT (RWT) tracer tests were performed in Boulder Creek and Fourmile Creek to estimate travel times (Kilpatrick, 1993) used to conduct Lagrangian water sampling (table 2). A solution

of RWT was added to the effluent channels of the Boulder and Ankeny WWTPs. During the Boulder Creek summer 2003 tracer experiment, continuously recording self-contained underwater fluorescence apparatuses (SCUFAs) were used at sites BC-D3.6 and BC-D5.0 to measure detailed RWT concentrations as a function of time. At BC-D3.6, an autosampler was placed at 10 percent of the channel width (from the right bank looking upstream), a SCUFA was placed at 50 percent of the channel width, and another autosampler was placed at 90 percent of the channel width. A SCUFA and an autosampler were placed adjacent to each other at 50 percent of the channel width at BC-D5.0. An autosampler was placed at 50 percent of the channel width at site BC-D7.4. The autosamplers collected samples at 5-minute (min) intervals from site BC-D3.6, at 10-min intervals from BC-D5.0, and at 15-min intervals from BC-D7.4. Samples were collected in 125-milliliter (mL) amber polyethylene bottles and stored at room temperature. The spring 2005 Boulder Creek tracer test deployed SCUFAs at 50 percent channel width at BC-D3.6 and BC-D7.4.

During the summer 2003 Fourmile Creek tracer experiment, SCUFAs (set to sample at 15-min intervals) were deployed at 50 percent of the channel width at sites FC-D2.9, FC-D8.4, and FC-D10.6 (table 2). During the spring 2005 Fourmile Creek tracer experiment, SCUFAs were deployed at 50 percent of the channel width at FC-D2.9 and FC-D8.4. In 2003 a 5-percent active RWT solution was used, and in 2005 a 20-percent active RWT solution was used.

Water samples collected by the autosamplers were analyzed for RWT using a Turner Designs Model 10A fluorometer using a G4T5 clear quartz lamp, a 546-nanometer (nm) excitation filter, an emission filter (>570 nm), and a reference (>535 nm) filter. A standard curve ranging from 0.1 to 1000 microgram per liter (µg/L) was developed from RWT stock solutions to determine concentrations in discrete samples and measurements obtained using the SCUFA.

Stream Sampling

Results from the tracer tests were used to determine appropriate timing of sampling in order to track the same approximate parcel of water as it moved downstream under natural flow conditions. At each sampling site, stream discharge was determined using measured depth, width, and flow velocity (Buchanan and Somers, 1969). Equal-width-integrated (EWI) composite water-quality samples (Edwards and Glysson, 1988) were collected using a stainless steel/Teflon™ sampler following clean sampling protocols (U.S. Geological Survey, 2003). The EWI water samples were combined in a glass carboy and split for subsequent chemical analysis using a Teflon™ cone splitter. Samples for nutrient (nitrate, nitrite, ammonium, and phosphate) and anion analysis were collected in pre-cleaned polyethylene bottles and chilled. Water samples for total and particulate organic carbon analysis were collected in cleaned and burned 125-mL amber glass bottles and chilled, and samples for dissolved organic carbon were filtered through 0.7-µm glass-fiber filters. Samples for major ion and selected trace elements were filtered through 0.45-micrometer (µm) Nucleopore™ membranes. Additional samples for major- and trace-element analysis were collected in acid-rinsed Teflon™ holding bottles, filtered through 0.4-µm polycarbonate membrane filters, collected in acid-rinsed high-density polyethylene bottles, and preserved with high-purity nitric acid. Unfiltered samples for phytoplankton pheophytin *a* and chlorophyll *a* were collected in 125-mL amber glass bottles. Samples for microbiological analysis were collected in sterilized polyethylene containers and chilled. Water samples for organic analysis were collected in cleaned and burned 1-liter (L) amber glass bottles, either raw, or filtered through 0.7-µm glass-fiber filters, and chilled. Samples for analysis of acidic organic compounds were preserved with 1-percent (volume/volume, v/v) formalin.

Water Analysis

Field Measurements, Nutrients, Carbon, Major Ions, Trace Elements, and Biological Components

Field measurements including determination of temperature, pH, specific conductance, and dissolved oxygen were made at the time of sample collection (table 3). Specific conductance was measured using a temperature-compensated conductivity meter calibrated daily against USGS standard reference solutions; dissolved oxygen was measured using an electrode calibrated daily against water-saturated air; and pH was measured using an electrode calibrated daily using pH-4, pH-7, and pH-10 standards.

Nutrients, carbon, major ions, and selected trace elements were analyzed at the USGS National Water Quality Laboratory (NWQL) in Denver, Colorado. Table 3 lists the constituents determined, their units, NWQL schedules and lab codes, and laboratory reporting levels. Nitrogen and phosphorus compounds were analyzed by colorimetry (Fishman, 1993; Patton and Truitt, 2000). Dissolved (filtered) organic carbon was analyzed by persulfate oxidation and infrared spectrometry (Brenton and Arnett, 1993). Particulate inorganic and organic carbon and particulate nitrogen were determined by elemental analysis (U.S. Environmental Protection Agency, 1997). Alkalinity was measured in the field with the inflection-point method (U.S. Geological Survey, variously dated) and in the lab by titration (Fishman and Friedman, 1989). Cations were analyzed by inductively coupled plasma/atomic-emission spectrometry (ICP/AES), anions were analyzed by ion chromatography, and fluoride was analyzed by ion-selective electrode (Fishman and Friedman, 1989; Fishman, 1993). Selected trace elements were analyzed by inductively coupled plasma/mass spectrometry (ICP/MS; Garbarino, 1999; Garbarino and others, 2006). Suspended sediment was analyzed at the USGS Iowa Water Science Center Sediment Laboratory in Iowa City, Iowa (IA-SL), using gravimetric methods (Guy, 1969).

Samples for phytoplankton-derived pheophytin *a* and chlorophyll *a* were analyzed at the NWQL using fluorometric methods (Fishman, 1993). Microbiological components were analyzed at the USGS Ohio Water Science Center Microbiology Laboratory in Columbus, Ohio (OH-ML). Coliphage [for the host bacteria *Escherichia (E. coli) CN-013* and *E. coli* F_{amp} (*E. coli* HS(pFamp)R)] were determined by the single-agar-layer quantitative method (U.S. Environmental Protection Agency, 2001). Samples for additional microbiological analysis at the U.S. Environmental Protection Agency (USEPA), Office of Research and Development's National Exposure Research Laboratory in Cincinnati, Ohio (EPA-ORD) were collected in pre-sterilized Teflon™ bottles, and shipped overnight on ice for analysis. Three different aliquots —1, 10, and 100 mL (50 mL at Four Mile Creek in 2003 due to turbidity)—were analyzed in triplicate by two different USEPA methods: the modified *E. coli* Method (modified from Method 1103.1), and the modified Enterococci Method (Method 1600; MEI). Experimental details for each method were published previously (U.S. Environmental Protection Agency, 2000). The time between collection and microbiological analyses exceeded the 8-hour (hr) ideal time between collection and analysis due to shipping considerations. Because all samples associated with a WWTP were subject to the same approximate delay, however, the results show within-site changes in microbial populations, and concentrations reported herein therefore are considered estimates.

Trace Elements and Major Elements

Trace elements were determined at the USGS National Research Program Laboratory (NRPL) in Boulder, Colorado, using ICP/MS (Garbarino and Taylor, 1995). Samples from the 2005 samplings also were analyzed for major elements by ICP/AES (Garbarino and Taylor, 1979). Table 4 lists the elements determined and method detection limits. Multiple internal standards (indium, iridium, and rhodium)

covering the entire mass range were used to normalize the ICP/MS system for drift. Individual samples were analyzed in triplicate to provide a measure of variability.

Acidic Organic Wastewater Compounds

Acidic organic wastewater compounds (Barber and others, 2000) were analyzed by evaporation with derivatization and gas chromatography/mass spectrometry (GC/MS) at the USGS NRPL. Table 5 lists the compounds determined and method detection limits. The general method involves evaporating the sample to dryness, adding formic acid:distilled water (1:1 v/v), and evaporating to dryness again. Acetyl chloride:propanol (1:10 v/v) then is added, the samples are heated to 85ºC for 1 hr (hour), and the esters are extracted into chloroform. The extracts were evaporated, redissolved in toluene, and analyzed by GC/MS in full-scan and selected ion-monitoring (SIM) modes. Concentrations were calculated based on SIM data using diagnostic ions for each compound, and identified based on matching of retention times (± 0.05 min) and ion ratios (± 20 percent) determined from analysis of standards. External calibration-curve and internal-standard procedures were used for calculating concentrations.

Antibiotic Compounds

Antibiotic compounds were analyzed at the USGS Kansas Water Science Center Organic Geochemistry Research Laboratory (OGRL) in Lawrence, Kansas. Table 6 lists the compounds determined and laboratory reporting levels. Samples from Fourmile Creek were analyzed using on-line hydrophilic-lipophilic-balance solid-phase extraction (HLB-SPE) and liquid chromatography/mass spectrometry (LC/MS) analysis (Meyer and others, 2007), and samples from Boulder Creek were analyzed using a liquid chromatography/tandem mass spectrometry (LC/MS/MS) version of the method.

Pharmaceutical Compounds

Pharmaceutical compounds were analyzed at the USGS NWQL by HLB-SPE followed by LC/MS (Cahill and others, 2004). Table 7 lists the compounds determined and laboratory reporting levels. Briefly, the pharmaceutical compounds were removed from filtered 1-L water samples by passing the water through the HLB-SPE cartridge, and elution with methanol was followed by methanol acidified with trifluoroacetic acid (0.1 percent). The two eluents were combined, concentrated to near dryness, reconstituted into formate buffer with an internal standard, and filtered. The concentrated extracts were analyzed by LC/MS. The electrospray ionization source was operated in the positive-ion mode. Analysis by SIM was used to improve sensitivity and specificity. Qualitative identification was based on retention time and at least two compound-specific fragment ions for each compound. Quantitation was by the injection internal-standard method.

Neutral Organic Wastewater Compounds

Neutral organic wastewater compounds were analyzed by continuous liquid-liquid extraction (CLLE) with GC/MS at the USGS NRPL (Barber and others, 2000). Table 8 lists the compounds determined and method detection limits. In this method, 1-L unfiltered water samples were acidified to pH 2 with hydrochloric acid, and the ionic strength adjusted by addition of sodium chloride. The water was extracted continuously for 6 hr with methylene chloride in a distillation-condensation system that dispersed micro-droplets of freshly condensed solvent throughout the water. The extracts were dried over sodium sulfate, and the volume was reduced under a stream of nitrogen gas. The CLLE extracts

were analyzed by electron-impact GC/MS in full-scan and SIM modes, and concentrations were calculated based on SIM data using external calibration-curve and internal-standard procedures.

Neutral organic wastewater compounds also were analyzed by styrene divinylbenzene solid-phase extraction (SDB-SPE) with GC/MS at the USGS NWQL (Zaugg and others, 2002). Table 9 lists the compounds determined and method detection limits. In that method, 1-L glass-fiber-filtered water samples were passed through the SPE cartridge, the cartridge was dried with nitrogen gas and subsequently eluted with methylene chloride. The extract volume was reduced under a stream of nitrogen gas and analyzed by GC/MS in the full-scan mode. Identification was based on matching of retention times and ion ratios against standards. Quantitation was by external calibration curves with internal standards. Neutral organic wastewater compounds were not determined by SDB-SPE in the Fourmile Creek samples collected during the summer of 2003.

Steroid and Steroidal-Hormone Compounds

Steroid and steroidal-hormone compounds were analyzed by solid-phase extraction with derivatization and gas chromatography/tandem mass spectrometry (GC/MS/MS) at the USGS NRPL (Barber and others, 2000; Barber and others, 2003). Table 10 lists the compounds determined and method detection limits. Compounds were isolated from 1-L unfiltered water samples by octadecylsilica solid-phase extraction (C18-SPE). After loading the sample, the SPE sorbent was dried with nitrogen to remove water, rinsed with 20 percent methanol in distilled water, and eluted with 95 percent methanol/5 percent water. The extracts were evaporated to dryness and derivatized with methoxamine hydrochloride in pyridine to form the methoxame ethers of the keto functional groups, followed by reaction with bis(trimethylsilyl)trifluoroacetamide containing trimethylchlorosilane to form the trimethylsilyl ethers of the hydroxy functional groups. The extracts were analyzed by GC/MS/MS with identification based on matching retention times against standards, and the presence of two diagnostic transition ions. Quantitation was based on the surrogate-standard method. Steroid and steroidal-hormone compounds were not determined in the Fourmile Creek samples collected during the spring of 2005.

Pesticide Compounds

Pesticide compounds were analyzed by C18-SPE with GC/MS at the USGS NWQL (Zaugg and others, 1995). Table 11 lists the compounds determined and laboratory reporting levels. Water samples were filtered through 0.7-µm glass-fiber filters, extracted using C18-SPE, and eluted with ethyl acetate. The SPE extracts were analyzed by GC/MS in the SIM mode. Identification was based on matching of retention times and diagnostic ion ratios with standards. Quantitation was by external calibration curves using the internal-standard method. Pesticides were not determined in the Fourmile Creek samples collected during the summer of 2003.

Quality Assurance

In this study, comprehensive chemical characterization was accomplished using multiple analytical methods for inorganic and organic compounds at multiple laboratory facilities. Each laboratory unit had an independent quality-assurance program and used slightly different methods of quantitation. In this report, two different minimum reporting levels are presented in the data tables: method detection limit (MDL) and laboratory reporting level (LRL). Because of the diversity of methods used and their varying sensitivities, MDL values were determined using a variety of statistical, instrumental, and operational criteria. The most basic criteria require that the instrumental signal is greater than three times the background value, and concentrations are three times greater than the

average blank concentration. The LRL values are determined as a multiple (2×) of the long-term MDL (Childress and others, 1999). Two data qualifiers are used in the report: E was used to indicate estimated values because of matrix effects, technical standards, or other factors (Childress and others, 1999), and M was used to indicate the compound was detected at a level less than the LRL but not quantified.

All of the GC/MS and LC/MS analyses used surrogate standards added to the samples prior to isolation to evaluate whole-method recovery (tables 5 to 11). Internal standards were added to the extracts prior to instrumental analysis. When available, surrogate-standard recoveries are provided in data tables 20–26 and 29–35. Quantitation generally was based on internal standards and multipoint external calibration curves for target compounds. The exception was the steroid and steroidal-hormone method in which the compounds were quantified from the surrogate standards that went through the isolation and derivatization process. No standard reference materials were available for the organic compounds evaluated in this study. The basic quality-assurance program consisted of field blanks and field duplicates.

During the Boulder Creek summer 2003 sampling, one field blank was collected, and results are reported in tables 19, 20, 21, 22, 23, and 24. No field-blank data are presented in tables 18, 25, and 26. During the Boulder Creek spring 2005 sampling, one field blank was collected, and results are reported in tables 27, 28, 29, 30, 31, 32, 33, and 35. No field-blank data are presented in table 34. During the Fourmile Creek summer 2003 sampling, one field blank was collected, and results are reported in tables 18, 19, 20, 21, and 22. No field-blank data are presented in tables 23 to 26. During the Fourmile Creek spring 2005 sampling, one field blank was collected, and results are reported in tables 27, 28, 29, 30, 32, 33, and 35. No field-blank data are presented in tables 31 and 34.

During all sampling events, replicate sample splits were made at the time of collection. The results from the analysis of the replicate samples (n=1 to n=4) are presented in the data tables.

Hydrological and Water-Quality Data

Hydrological Data

Results from the rhodamine WT tracer tests in Boulder Creek and Fourmile Creek in the summer of 2003 and the spring of 2005 are presented in tables 12 to 15. Tables 16 and 17 in turn summarize the discharge measurements and flow velocities determined from hydraulic analysis of the tracer tests and field measurements from the Lagrangian samplings.

Discharge measurements differ between tracer tests and Lagrangian sampling because discharge generally changes as a function of time. The Boulder Creek summer 2003 tracer test was conducted several weeks before the Lagrangian sampling. During the Boulder Creek spring 2005 studies, the tracer test was conducted 3 days prior to the Lagrangian sampling, and discharge measurements were made only for the Lagrangian sampling. The Fourmile Creek summer 2003 and spring 2005 tracer tests were conducted approximately 5 days before the Lagrangian sampling. During the summer 2003 sampling, Boulder Creek downstream from the WWTP consisted of 36 percent effluent, and Fourmile Creek downstream from the WWTP was 80 percent effluent (tables 16 and 17). During the spring 2005 samplings, Boulder Creek downstream from the WWTP was 40 percent effluent, and Fourmile Creek downstream from the WWTP was 28 percent effluent.

Quality-Assurance Data

This report presents data on 300 individual measurements and constituents determined at six laboratories: NWQL, NRPL, OGRL, IA-SL, OH-ML, and EPA-OED. Thirty nine of the constituents

were determined by more than one method. Depending on the laboratory and analytical method, the number of replicate analyses ranged from one to four. Results are presented in tables 18 to 35. Values reported in the text include single values, the average of two values, or the median value when more than two replicate values were available. Tables show all available values.

Results from the analysis of the field blanks are summarized (field measurement results are not discussed) in the following section. From the 2003 Lagrangian sampling (table 18), there are no field-blank data for Boulder Creek, Colorado. In the Fourmile Creek, Iowa, blank, phosphorous, organic carbon, calcium, chloride, and silica were detected. For trace elements (table 19), the Boulder Creek blank had aluminum, barium, cadmium, cerium, copper, lanthanum, neodymium, nickel, praseodymium, rubidium, samarium, strontium, yttrium, zinc, and zirconium. The Fourmile Creek blank had aluminum, barium, cadmium, cerium, cesium, copper, lanthanum, neodymium, nickel, praseodymium, rubidium, strontium, yttrium, and zinc. As indicated in table 20, the Boulder Creek blank had ethylenediaminetetraacetic acid, 4-nonylphenolmonoethoxycarboxylic acid, and 4-nonylphenoldiethoxycarboxylic acid, and the Fourmile Creek blank had no detects. In table 21, the Boulder Creek and Fourmile Creek blanks had no detects of antibiotic compounds. In table 22, the Boulder Creek blank had detections of the pharmaceutical compounds caffeine and carbamazapine, and the Fourmile Creek blank had zero detects. In table 23, the Boulder Creek blank had detects of caffeine, cholesterol, coprostanol, and 2,6-di-*tert*-butyl-4-methylphenol. No blank data were reported for Fourmile Creek. In table 24, the Boulder Creek blank had zero detects. No blank data were reported for Fourmile Creek. In tables 25 and 26, no blank data were reported for Boulder Creek or Fourmile Creek.

The Boulder Creek blank from the spring of 2005 sampling (table 27) had detections of particulate nitrogen, phosphorus, organic carbon, calcium, silica, sodium, vanadium, and alkalinity. The Fourmile Creek blank had detections of organic carbon, particulate carbon [inorganic + organic], particulate organic carbon, calcium, chloride, silica, boron, iron, and vanadium. In table 28, the Boulder Creek blank showed trace and major elements including antimony, barium, cadmium, calcium, cerium, copper, gadolinium, lanthanum, lead, magnesium, manganese, rhenium, rubidium, silica, sodium, strontium, sulfur, tungsten, and zinc, and the Fourmile Creek blank had detections of aluminum, antimony, barium, boron, calcium, cerium, copper, gadolinium, iron, lanthanum, lead, lithium, magnesium, molybdenum, nickel, rhenium, rubidium, silica, sodium, strontium, zinc, and zirconium.

In table 29, the Boulder Creek blank had detections of ethylenediaminetetraacetic acid, 4-nonylphenolmonoethoxycarboxylic acid, and 4-nonylphenoldiethoxycarboxylic acid, and the Fourmile Creek blank had 4-nonylphenolmonoethoxycarboxylic acid. In table 30, the Boulder Creek and Fourmile Creek blanks had no detects. In table 31, the Boulder Creek blank had detects of azithromycin, diphenhydramine, and thiabendazole. Blank data were not reported for Fourmile Creek. In table 32, the Boulder Creek blank had bisphenol A and 4-*tert*-octylphenol, and the Fourmile Creek blank had detects of 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene. In table 33, the Boulder Creek blank had phenol, and the Fourmile Creek blank had 3-*tert*-butyl-4-hydroxyanisole, *d*-limonene, naphthalene, and phenol. In table 34, no blank data were reported for Boulder Creek nor for Fourmile Creek. In table 35, the Boulder Creek blank had no detections, but one compound (napropamide) was detected in the Fourmile Creek blank.

Summer 2003 Lagrangian Sampling Data

Results for field measurements, biological analysis, and chemical analysis of samples from Boulder Creek, Colorado, and Fourmile Creek, Iowa, collected during the summer 2003 Lagrangian samplings are presented in tables 18 to 26. Single measurements are presented when necessary, when

two values were available the value average is reported in the text, and when more than two values are available, the median is reported.

Field Measurements, Nutrients, Carbon, Major Ions, Trace Elements, and Biologiacl Components

Specific conductance and water temperature increased at the Boulder Creek sites downstream from the Boulder WWTP effluent discharge relative to the upstream site (table 18). Elevated concentrations of dissolved (filtered) ammonia (8.5 mg/L N; values in parentheses are effluent concentrations), nitrate (7.6 mg/L N), nitrite (0.57 mg/L N), orthophosphate (2.7 mg/L P), and phosphorus (3.0 mg/L P) were detected in the Boulder, Colorado, WWTP effluent and in samples from downstream Boulder Creek sites. Most of the dissolved major ions also were detected at higher concentrations in the Boulder WWTP effluent than at the downstream Boulder Creek sites, including chloride (54 mg/L), fluoride (1.0 mg/L), magnesium (14 mg/L), potassium (9.7 mg/L), silica (9.3 mg/L), sodium (52 mg/L), and sulfate (80 mg/L).

Specific conductance increased and temperature decreased at the Fourmile Creek sites downstream from the Ankeny, Iowa, WWTP effluent discharge relative to the upstream site (table 18). Dissolved nutrients detected at elevated concentrations in the effluent and downstream sites included nitrate (14 mg/L N), nitrite (0.25 mg/L N), orthophosphate (5.1 mg/L P), and phosphorus (5.7 mg/L P). Other dissolved constituents that had a greater concentration in the Ankeny WWTP effluent and downstream Fourmile Creek sites than at the upstream site included chloride (110 mg/L), fluoride (1 mg/L), magnesium (23 mg/L), potassium (13 mg/L), silica (18 mg/L), sodium (79 mg/L), and sulfate (80 mg/L).

Trace Elements and Major Elements

Most of the trace elements (beryllium and thallium were near or below the MDL in all samples) measured were detected in the Boulder WWTP effluent or in samples from Boulder Creek (table 19). Median Boulder WWTP effluent concentrations were greater than upstream Boulder Creek concentrations for many trace elements including aluminum (12 µg/L), boron (200 µg/L), copper (8.3 µg/L), gadolinium (0.15 µg/L), lithium (12 µg/L), manganese (35 µg/L), molybdenum (4.2 µg/L), nickel (2.1 µg/L), rubidium (6.7 µg/L), strontium (330 µg/L), and zinc (24 µg/L). Upstream median concentrations were greater than Boulder WWTP effluent values for additional trace elements including barium, cerium, europium, lanthanum, neodymium, and selenium.

Most trace elements were detected in the Ankeny WWTP effluent and in samples from Fourmile Creek (table 19). Median Ankeny WWTP effluent concentrations were greater than upstream Fourmile Creek concentrations for many trace elements including aluminum (11 µg/L), boron (300 µg/L), copper (4.5 µg/L), lithium (18 µg/L), manganese (42 µg/L), molybdenum (7.3 µg/L), nickel (3.5 µg/L), rubidium (8.2 µg/L), and zinc (40 µg/L). Upstream Fourmile Creek median concentrations were greater than the Ankeny WWTP effluent values for several trace elements including arsenic, barium, strontium, uranium, and vanadium.

Acidic Organic Wastewater Compounds

Acidic organic wastewater compounds were detected in the Boulder and Ankeny WWTP effluents and in samples from the Boulder Creek and Fourmile Creek sites (table 20). Ethylenediaminetetraacetic acid (100 and 230 µg/L for the Boulder and Ankeny WWTP effluents, respectively), 4-nonylphenolmonoethoxycarboxylic acid (110 and 5.3 µg/L, respectively), and 4-nonylphenoldiethoxycarboxylic acid (38 and 7.1 µg/L, respectively) were detected at the highest

concentrations in the WWTP effluents. Low levels of nitrilotriacetic acid, 4-nonylphenoltriethoxycarboxylic acid and 4-nonylphenoltetraethoxycarboxylic acid also were present in both effluents. Concentrations at the Boulder Creek and Fourmile Creek upstream sites were lower than in samples from the WWTP effluents and downstream sites.

Antibiotic Compounds

Several of the antibiotic compounds were detected in the Boulder WWTP effluent (table 21). Median concentrations of *anhydro*-erythromycin (3.7 µg/L), erythromycin (0.54 µg/L), and sulfamethoxazole (0.55 µg/L) were highest in the Boulder WWTP effluent samples, but also were present at downstream Boulder Creek locations. Ofloxacin, sulfadiazine, sulfadimethoxime, and trimethoprim were detected at lower concentrations in the WWTP effluent and in samples from downstream sites.

Two of the antibiotic compounds were detected in the Ankeny WWTP effluent (table 21). The median Ankeny WWTP effluent concentration of ofloxacin was 0.37 µg/L and sulfamethoxazole was 0.27 µg/L. Ofloxacin was detected 2.9 km downstream, whereas sulfamethoxazole was detected 10.6 km downstream. No antibiotic compounds were detected at the upstream sites.

Pharmaceutical Compounds

Several pharmaceutical compounds were detected in the Boulder WWTP effluent (table 22) and downstream Boulder Creek sites including caffeine (0.84 µg/L), carbamazapine (0.18 µg/L), 1,7-dimethylxanthine (1.4 µg/L), diphenhydramine (0.20 µg/L), sulfamethoxazole (0.22 µg/L), and trimethoprim (0.22 µg/L). Codeine, cotinine, dehydronifedipine, and diltiazem also were detected in the effluent. Only caffeine and cotinine were detected in upstream Boulder Creek samples.

Several pharmaceutical compounds also were detected in the Ankeny WWTP effluent and in Fourmile Creek (table 22). The Ankeny WWTP effluent had higher median concentrations of some pharamaceuticals relative to the downstream Fourmile Creek sites including carbamazapine (0.25 µg/L), cimetidine (0.05 µg/L),codeine (0.21 µg/L), cotinine (0.11 µg/L), diphenhydramine (0.24 µg/L), and trimethoprim (0.14 µg/L). Concentrations of cimetidine, dehydronifedipine, diltiazem, and salbutamol also were detected in the WWTP effluent and Fourmile Creek. Acetominphen, caffeine, ranitidine, and sulfamethoxazole only were detected in Fourmile Creek.

Neutral Organic Wastewater Compounds

Almost half of the neutral organic wastewater compounds measured by continuous liquid-liquid extraction were detected in Boulder WWTP effluent (table 23). Average concentrations of several neutral organic wastewater compounds were greater in the Boulder WWTP effluent than at the downstream Boulder Creek sites including caffeine (0.32 µg/L), 4-nonylphenolmonoethoxylate (1.8 µg/L), 4-nonylphenoldiethoxylate (0.33 µg/L), and triclosan (0.032 µg/L). Compounds that were detected at the upstream Boulder Creek site as well as in the WWTP effluent and in samples from downstream sites included cholesterol, coprostanol, and 2,6-di-*tert*-butyl-1,4-benzoquinone. Additional compounds that were detected only in the Boulder WWTP effluent include, 4-nonylphenoltriethoxylate, 4-*tert*-octylphenol, 4-*tert*-octylphenolmonoethoxylate, and 4-*tert*-octylphenoldiethoxylate.

Neutral organic wastewater compounds measured by continuous liquid-liquid extraction also were detected in the Ankeny WWTP effluent (table 23). Coprostanol was detected in the Ankeny WWTP effluent as well as in samples from the downstream Fourmile Creek sites. Cholesterol and 2,6-di-*tert*-butyl-1,4-benzoquinone were detected at the upstream Fourmile Creek site, in the WWTP

effluent, and in multiple downstream sites. Additional neutral organic wastewater compounds were detected in the Ankeny WWTP effluent including caffeine, 1,4-dichlorobenzene, 4-nonylphenol, 4-*tert*-octylphenol, and triclosan.

Almost half of the neutral organic wastewater compounds measured by solid-phase extraction were detected in the Boulder WWTP effluent (table 24). Higher concentrations of several neutral organic wastewater compounds were detected in the Boulder WWTP effluent than at the downstream Boulder Creek locations including caffeine (1.2 µg/L), cholesterol (2.3 µg/L), N,N-diethyl-*meta*-toluamide (1.1 µg/L), hexahydrohexamethylcyclopentabenzopyran (1.4 µg/L), phenol (1.3 µg/L), and tris(2-butoxyethyl) phosphate (1.8 µg/L). Additional neutral organic wastewater compounds detected in the Boulder WWTP effluent included 5-methyl-1H-benzotriazole, 4-nonylphenol, 4-nonylphenolmonoethoxylate, 4-nonylphenoldiethoxylate, 4-*tert*-octylphenolmonoethoxylate, and 4-*tert*-octylphenoldiethoxylate. Caffeine, N,N-diethyl-*meta*-toluamide, and phenol were detected at the upstream Boulder Creek site, in the WWTP effluent, and at the downstream sites. No samples were analyzed by solid-phase extraction for neutral organic wastewater compounds for samples from Fourmile Creek during the summer 2003 sampling.

Steroid and Steroidal-Hormone Compounds

Half of the steroid and steroidal-hormone compounds measured were detected in the Boulder WWTP effluent (table 25). Higher average concentrations of cholesterol (32 µg/L) and coprostanol (40 µg/L) were detected in the Boulder WWTP effluent than in samples collected at the downstream Boulder Creek sites. The upstream Boulder Creek average concentrations for cholesterol and coprostanol were generally lower than or within the range of downstream values. In addition, 17β-estradiol (0.003 µg/L) was detected in the Boulder WWTP effluent.

Two of the steroid and steroidal-hormone compounds were detected in the Ankeny WWTP effluent (table 25). Higher average concentrations of cholesterol (110 µg/L) and coprostanol (38 µg/L) were detected in the Ankeny WWTP effluent than at the downstream Fourmile Creek sites. Although detected at the upstream Fourmile Creek site, the average concentrations for cholesterol and coprostanol were lower than in the Ankeny WWTP effluent and downstream sites.

Pesticide Compounds

Prometon was the only pesticide detected in the Boulder WWTP effluent (table 26). Atrazine and metolachlor were detected in sampling at the Boulder Creek upstream and downstream sites but not in the Boulder WWTP effluent. Pesticide compounds were not analyzed in the Fourmile Creek samples during 2003.

Spring 2005 Lagrangian Sampling Data

Results for field measurements, biological analysis, and chemical analysis of samples from Boulder Creek, Colorado, and Fourmile Creek, Iowa, collected during the spring 2005 Lagrangian samplings are presented in tables 27 to 35.

Field Measurements, Nutrients, Carbon, Major Ions, Trace Elements, and Biological Components

Specific conductance increased downstream from the Boulder WWTP effluent discharge (table 27). Elevated concentrations of nutrients that were detected in the Boulder WWTP effluent and downstream Boulder Creek locations included ammonia (8.6 mg/L N), nitrate (9.0 mg/L N), nitrite (0.35 mg/L N), orthophosphate (3.4 mg/L P), and phosphorus (3.5 mg/L P). Major ions that were

detected in higher concentrations in the Boulder WWTP effluent and Boulder Creek downstream sites relative to the upstream site included calcium (56 mg/L), chloride (75 mg/L), fluoride (1.0 mg/L), magnesium (19 mg/L), potassium (13 mg/L), silica (10 mg/L), sodium (70 mg/L), and sulfate (110 mg/L).

Specific conductance increased in Fourmile Creek downstream from the Ankeny WWTP effluent discharge (table 27). Nutrients detected in the effluent and downstream sites included ammonia (0.12 mg/L), nitrate (11 mg/L N), nitrite (0.18 mg/L N), orthophosphate (4.7 mg/L P), and phosphorus (4.9 mg/L P). Chloride (120 mg/L) and sulfate (89 mg/L) were detected in higher concentrations at the effluent and downstream sites than at the upstream site.

Trace Elements and Major Elements

Most of the trace elements and major elements measured were detected (beryllium and tellurium were near or below the MDL) in the Boulder WWTP effluent and Boulder Creek (table 28). Median Boulder WWTP effluent concentrations were greater than upstream Boulder Creek concentrations for many trace elements including aluminum (22 µg/L), boron (240 µg/L), copper (15 µg/L), gadolinium (0.14 µg/L), iron (110 µg/L), lithium (14 µg/L), manganese (36 µg/L), molybdenum (4.8 µg/L), nickel (2.0 µg/L), rubidium (8.2 µg/L), strontium (450 µg/L), uranium (1.7 µg/L), and zinc (38 µg/L). Median upstream Boulder Creek concentrations were greater than Boulder WWTP effluent concentrations for several trace elements including barium, cerium, lanthanum, neodymium, tungsten, and yttrium.

Most of the trace elements and major elements (beryllium, tellurium, and thallium were near or below the MDL) were detected in the Ankeny WWTP effluent and Fourmile Creek (table 28). Median Ankeny WWTP effluent concentrations were greater than upstream Fourmile Creek concentrations for many of the trace elements including aluminum (9.1 µg/L), boron (260 µg/L), copper (1.9 µg/L), gadolinium (0.26 µg/L), iron (74 µg/L), lithium (14 µg/L), manganese (83 µg/L), molybdenum (3.7 µg/L), nickel (5.6 µg/L), rubidium (7.4 µg/L), and zinc (34 µg/L). Upstream Fourmile Creek median concentrations were greater than Ankeny WWTP effluent concentrations for several trace elements including barium, selenium, strontium, uranium, and vanadium.

Acidic Organic Wastewater Compounds

Most of the acidic organic wastewater compounds were detected in the Boulder and Ankeny WWTP effluents and in samples from the downstream Boulder Creek and Fourmile Creek sites (table 29). Ethylenediaminetetraacetic acid (150 and 180 µg/L for the Boulder and Ankeny WWTP effluents, respectively), 4-nonylphenolmonoethoxycarboxylic acid (100 and 20 µg/L, respectively), and 4-nonylphenoldiethoxycarboxylic acid (90 and 94 µg/L, respectively) were detected at the highest concentrations in the effluents. Concentrations generally were lower at the upstream sites than in the WWTP effluents and the downstream sites. Low concentrations of nitrilotriacetic acid, 4-nonylphenoltriethoxycarboxylic acid, and 4-nonylphenoltetraethoxycarboxylic acid also were present in both WWTP effluents.

Antibiotic Compounds

Several of the antibiotic compounds were detected in the Boulder WWTP effluent (table 30). Most of the compounds detected in the Boulder WWTP effluent, including erythromycin (0.25 µg/L), anhydro-Erythromycin (0.33 µg/L), ofloxacin (0.13 µg/L), sulfamethoxazole (0.16 µg/L), and trimethoprim (0.37 µg/L), also were detected at the downstream Boulder Creek sites. Ciprofloxacin and

tylosin were detected at low concentrations in the Boulder WWTP effluent but not at the downstream Boulder Creek sites. No antibiotic compounds were detected in the upstream Boulder Creek samples.

Several of the antibiotic compounds were detected in the Ankeny WWTP effluent and at downstream Fourmile Creek sites (table 30), including ciprofloxacin (0.48 µg/L), erythromycin (0.25 µg/L), anhydro-Erythromycin (0.52 µg/L), ofloxacin (2.2 µg/L), sulfamethoxazole (0.68 µg/L), and trimethoprim (0.66 µg/L). Additional antibiotic compounds were detected only in the Ankeny WWTP effluent including doxycycline, lincomycin, minocycline, sulfadiazine, and tetracycline. No antibiotic compounds were detected at the upstream Fourmile Creek site.

Pharmaceutical Compounds

Several pharmaceutical compounds were detected in the Boulder WWTP effluent (table 31). Pharmaceuticals that were present in the Boulder WWTP effluent and Boulder Creek downstream sites included carbamazapine (0.10 µg/L), cotinine (0.025 µg/L), diltiazem (0.031 µg/L), diphenhydramine (0.24 µg/L), and trimethoprim (0.23 µg/L). Caffeine, codeine, erythromycin, and ranitidine also were detected in the effluent. Caffeine and cotinine were detected at a low concentrations in the upstream sample.

Several pharmaceutical compounds were detected in the Ankeny WWTP effluent and downstream Fourmile Creek sites (table 31) including carbamazapine (0.12 µg/L), cimetidine (0.12 µg/L), diltiazem (0.042 µg/L), diphenhydramine (0.12 µg/L), and trimethoprim (0.26 µg/L). Additional pharmaceutical compounds were detected in the WWTP effluent including codeine, ranitidine, and salbutamol. Acetaminophen and cotinine were detected at the upstream Fourmile Creek site, Ankeny WWTP effluent, and downstream Fourmile Creek sites.

Neutral Organic Wastewater Compounds

Most of the neutral organic wastewater compounds measured by continuous liquid-liquid extraction were detected in the Boulder WWTP effluent (table 32). Higher average concentrations of cholesterol (2.4 µg/L), coprostanol (3.8 µg/L), 1,4-dichlorobenzene (0.29 µg/L), 5-methyl-1H-benzotriazole (0.60 µg/L), 4-nonylphenolmonoethoxylate (4.7 µg/L), 4-nonylphenoldiethoxylate (1.3 µg/L), and triclosan (0.47 µg/L) were detected in the Boulder WWTP effluent than at the downstream Boulder Creek sites. Compounds that were detected at the upstream Boulder Creek site, in the effluent, and at the downstream sites included bisphenol A, caffeine, 2,6-di-*tert*-butyl-1,4-benzoquinone, N,N-diethyl-*meta*-toluamide, and 4-nonylphenol. Low concentrations of 4-nonylphenoltriethoxylate, 4-*tert*-octylphenoldiethoxylate, 4-*tert*-pentylphenol, and additional compounds also were detected in the Boulder WWTP effluent.

Many of the neutral organic wastewater compounds measured by continuous liquid-liquid extraction were detected in the Ankeny WWTP effluent (table 32). Elevated average concentrations of coprostanol (0.24 µg/L), 5-methyl-1H-benzotriazole (0.27 µg/L), 4-nonylphenoldiethoxylate (0.48 µg/L), 4-*tert*-octylphenoldiethoxylate (1.1 µg/L), and 4-*tert*-octylphenoltriethoxylate (0.21 µg/L) were detected in the Ankeny WWTP effluent and the downstream Fourmile Creek sites. Compounds that were detected at the upstream Fourmile Creek site, in the WWTP effluent, and at the downstream sites included caffeine, cholesterol, 2,6-di-*tert*-butyl-1,4-benzoquinone, N,N-diethyl-*meta*-toluamide, 4-methylphenol, 4-nonylphenol, 4-nonylphenolmonoethoxylate, and 4-*tert*-octylphenol. Low concentrations of 4-nonylphenoltriethoxylate and additional neutral organic wastewater compounds also were present in the Ankeny WWTP effluent.

Neutral organic wastewater compounds measured by solid-phase extraction also were detected in the Boulder WWTP effluent (table 33). Higher average concentrations of

4-nonylphenolmonoethoxylate (11 µg/L), 4-nonylphenoldiethoxylate (10 µg/L), and tris(2-butoxyethyl) phosphate (1.7 µg/L) were detected in the WWTP effluent than at the downstream Boulder Creek sites. Hexahydrohexamethylcyclopentabenzopyran, 4-nonylphenol, 4-*tert*-octylphenolmonoethoxylate, and additional neutral organic wastewater compounds also were present in the Boulder WWTP effluent.

Many of the neutral organic wastewater compounds measured by solid-phase extraction were detected in the Ankeny WWTP effluent (table 33). Higher average concentrations of hexahydrohexamethylcyclopentabenzopyran (3.3 µg/L), 5-methyl-1H-benzotriazole (1.6 µg/L), 4-nonylphenolmonoethoxylate (2.5 µg/L), 4-nonylphenoldiethoxylate (7.6 µg/L), 4-*tert*-octylphenol (1.2 µg/L), 4-*tert*-octylphenolmonoethoxylate (1.7 µg/L), 4-*tert*-octylphenoldiethoxylate (2.9 µg/L), and tris(2-butoxyethyl) phosphate (1.3 µg/L) were detected in the Ankeny WWTP effluent than at the downstream Fourmile Creek sites. Additional neutral organic wastewater compounds also were detected in the Ankeny WWTP effluent.

Steroid and Steroidal-Hormone Compounds

Several steroid and steroidal-hormone compounds were detected in the Boulder WWTP effluent (table 34). Higher average concentrations of estrone (0.11 µg/L) were detected in the Boulder WWTP effluent than at the downstream Boulder Creek sites. Cholesterol and coprostanol was detected at the upstream Boulder Creek site, in the Boulder WWTP effluent, and at the downstream sites. Low concentrations of 17β-estradiol and 17α-ethinylestradiol also were detected in the Boulder WWTP effluent and downstream Boulder Creek locations. No samples were analyzed for steroid and steroidal-hormone compounds for Fourmile Creek during the spring 2005 sampling.

Pesticide Compounds

Although no pesticide compounds were detected in the Boulder WWTP effluent (table 35), metolachlor was detected in the Boulder Creek upstream and downstream samples. Three pesticide compounds (atrazine, deethylatrazine, and metolachlor) were detected in the Ankeny WWTP effluent and the Fourmile Creek upstream and downstream sites (table 35).

Conclusions

This report summarizes an extensive data set for hydrological, chemical, and biological measurements and constituents determined during four Lagrangian sampling events conducted in Boulder Creek, Colorado, and Fourmile Creek, Iowa. Both streams were sampled twice, once during the summer of 2003 and once during the spring of 2005. Lagrangian sampling involved collecting water from the same approximate parcel of water as it moved downstream under natural flow conditions. Estimated transport times to the downstream sampling locations were determined from rhodamine WT tracer experiments conducted prior to each Lagrangian sampling. Water samples were collected from Boulder Creek and Fourmile Creek at sites upstream from the WWTPs, at the WWTP effluents, and at sites downstream from the WWTPs. At each site, stream discharge was measured and equal-width-integrated (EWI) composite water samples were collected and split for subsequent chemical, physical, and biological analysis.

A comprehensive suite of water-quality analyses were conducted at multiple laboratories on the EWI water sample splits. Three hundred constituents were analyzed and can be grouped into eight categories: (1) field measurements, nutrients, carbon, major ions, trace elements, and biological components, (2) trace elements and major elements, (3) acidic organic wastewater compounds, (4) antibiotic compounds, (5) pharmaceutical compounds, (6) neutral organic wastewater compounds, (7)

steroid and steroidal-hormone compounds, and (8) pesticide compounds. Results from the analyses of water samples collected from 12 total sites in Boulder Creek (5 sites) and Fourmile Creek (7 sites) during the summer 2003 Lagrangian sampling, and 8 total sites (4 sites in each stream) during the spring 2005 sampling are presented along with associated quality-assurance data (field blanks, replicate analyses, and surrogate standard recoveries).

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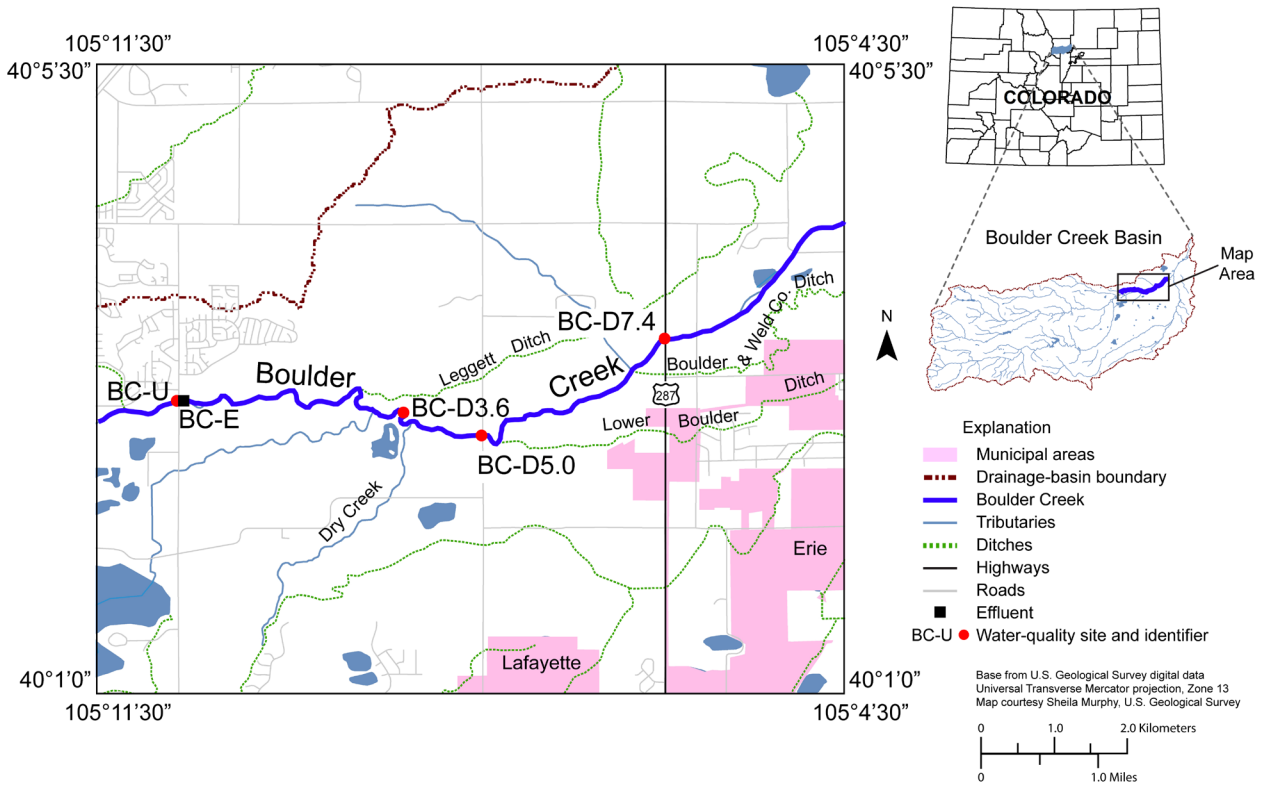

Figure 1. Map showing locations of the Boulder Creek, Colorado, Lagrangian sampling sites. [BC-U, Boulder Creek sampling site upstream from the Boulder wastewater treatment plant (WWTP); BC-E, Boulder WWTP effluent; BC-D3.6, BC-D5.0, and BC-D7.4, sampling sites downstream from the Boulder WWTP, with distance given in kilometers in site title; see table 2 for further details.]

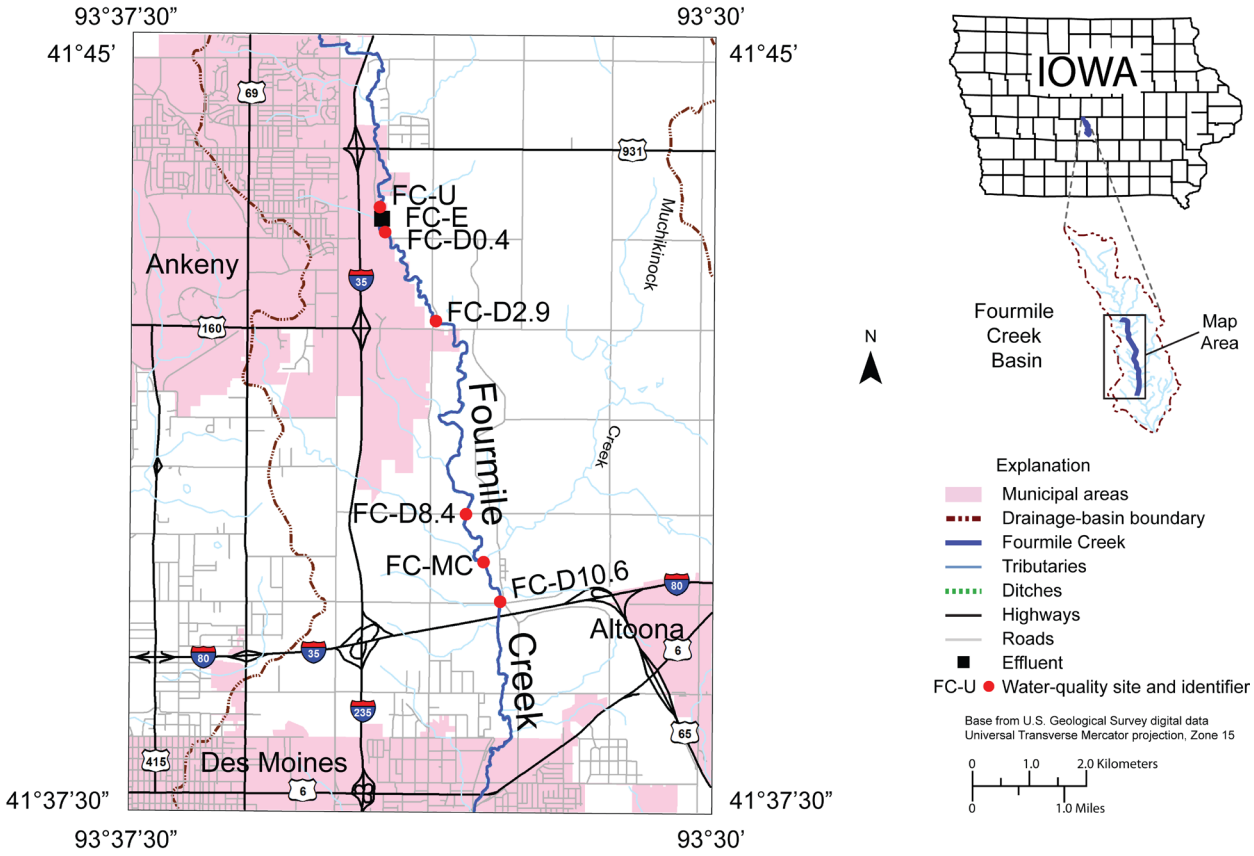

Figure 2. Map showing locations of the Fourmile Creek, Iowa, Lagrangian sampling sites. [FC-U, Fourmile Creek sampling site upstream from the Ankeny wastewater treatment plant (WWTP); FC-E, Ankeny WWTP effluent; FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6, sampling sites downstream from the Ankeny WWTP, with distance given; FC-MC, Muchikinock Creek tributary; see table 2 for further details.]

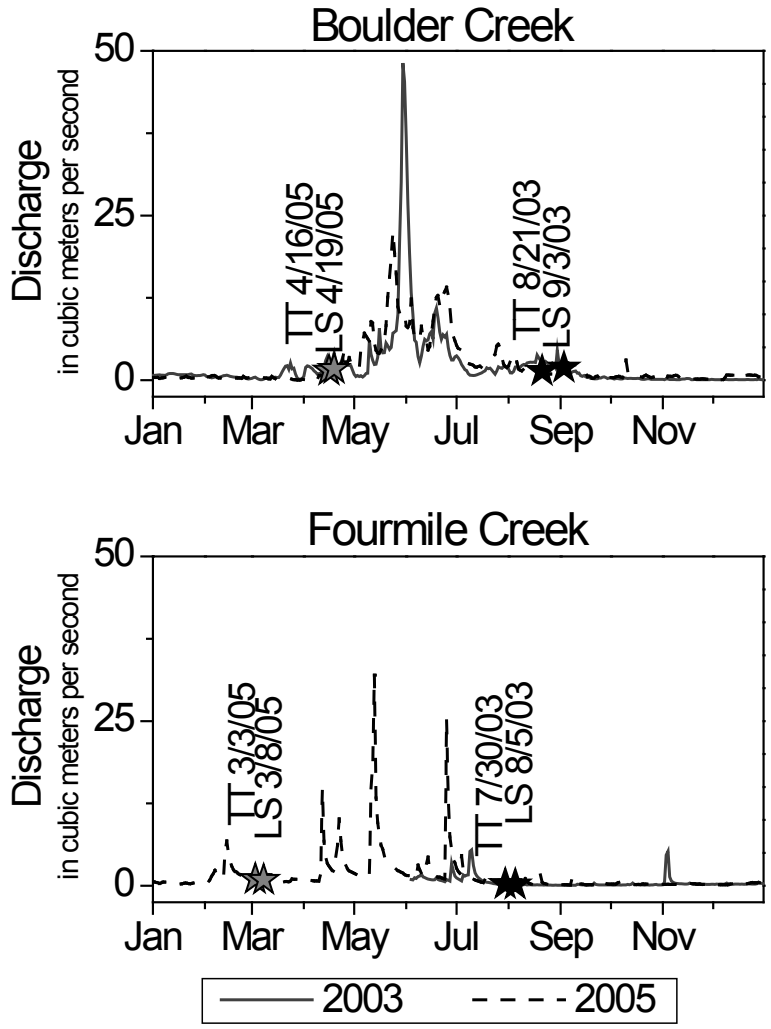

Figure 3. Annual hydrographs for Boulder Creek, Colorado, and Fourmile Creek, Iowa, showing approximate dates of the tracer tests and Lagrangian samplings. [Stream discharge data (http://waterwatch.usgs.gov) for Boulder Creek from U.S. Geological Survey (USGS) 75th Street Gage (06730200) located 50 m upstream from the Boulder wastewater treatment plant (WWTP) outfall; stream discharge data for Fourmile Creek from USGS Ankeny Gage (05485605) located 400 m downstream from the Ankeny WWTP outfall – gage was installed in June 2003; TT=tracer test date; LS=Lagrangian sampling date; stars indicate tracer test and Lagrangian sampling events].

Table 1. Site characteristics for Boulder Creek watershed, Colorado, and Fourmile Creek watershed, Iowa.

[km, kilometer; km^2, square kilometer; m/km, meter per kilometer; m^3/s, cubic meter per second; WWTP, wastewater treatment plant; NA, not available.]

Characteristic	Boulder Creek	Fourmile Creek
Total stream length (km)	70	19
Watershed area (km^2)	1190	308
Study reach (km)[a]	7.5	10.7
Drainage area (km^2)[b]	790	160
Stream gradient (m/km)	4	1
Population[c]	110,000	27,000
Population density (people/km^2)	220	170
Treatment type[d,e]	Trickling filter/solids contact	Fine bubble aeration
Mean WWTP discharge (m^3/s)[d,e]	0.89	0.21

[a] Distance from WWTP outfall to most downstream sampling site.

[b] Total drainage basin area upstream from the WWTP outfall.

[c] U.S. Census Bureau, accessed May 2005, at *http://www.census.gov*.

[d] City of Boulder, Colorado, Department of Public Works, accessed May 2005, at *http://www.ci.boulder.co.us/publicworks/depts/utilities.*

[e] City of Ankeny, Iowa, Department of Public Works, accessed May 2005, at *http://www.ankenyiowa.gov*.

Table 2. Sampling site locations for Boulder Creek (BC), Colorado, and Fourmile Creek (FC), Iowa.

[BC-U, site upstream from the Boulder wastewater treatment plant (WWTP); BC-E, Boulder WWTP effluent; BC-D3.6, BC-D5.0, and BC-D7.4, sites downstream from the Boulder WWTP; FC-U, site upstream from the Ankeny WWTP; FC-E, Ankeny WWTP effluent; FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6, sites downstream from the Ankeny WWTP; FC-MC, Muchikinock Creek tributary; on September 3, 2003, five sites were sampled on Boulder Creek (BC-U, BC-E, BC-D3.6, BC-D5.0, and BC-D7.4) and on April 19, 2005, four sites were sampled (BC-U, BC-E, BC-D3.6, and BC-D7.4); on August 5, 2003, seven sites were sampled on Fourmile Creek (FC-U, FC-E, FC-D0.4, FC-D2.9, FC-D8.4, FC-D10.6, and FC-MC) and on March 8, 2005, four sites were sampled (FC-U, FC-E, FC-D2.9, and FC-D8.4); Auto, autosampler – number is percent of channel width from the right bank looking upstream; SCUFA, self-contained underwater fluorescence apparatus - number is percent of channel width from the right bank looking upstream; NAVD88, North American vertical datum of 1988.]

Site Name	Site Identifier	Site Number	Latitude (degree)	Longitude (degree)	Distance (kilometer)	Elevation Above NAVD88 (meter)	Tracer Test		Water Samples	
							2003	2005	2003	2005
Boulder Creek, 75th St	BC-U	06730200	40.051667	-105.177778	-0.1	1556			x	x
Boulder WWTP outfall	BC-E	400305105103901	40.049722	-105.183333	0	1554			x	x
Boulder Creek, Dry Creek	BC-D3.6	400258105084201	40.050278	-105.143333	3.6	1542	AUTO10 SCUFA50 AUTO90	SCUFA50	x	x
Boulder Creek, 95th St.	BC-D5.0	400251105075001	40.047778	-105.130833	5.0	1539	AUTO50 SCUFA50		x	
Boulder Creek, 107th St.	BC-D7.4	400334105061101	40.058889	-105.101944	7.4	1530	AUTO50	SCUFA50	x	x
Fourmile Creek upstream	FC-U	05485603	41.719044	-93.572299	-0.1	265.4			x	x
Ankeny WWTP outfall	FC-E	05485604	41.717377	-93.571661	0	265.0			x	x
Fourmile Creek at gage	FC-D0.4	05485605	41.717377	-93.570133	0.4	265.8			x	
Fourmile Creek, 1st bridge	FC-D2.9	05485608	41.704127	-93.560272	2.9	262.8	SCUFA50	SCUFA50	x	x
Fourmile Creek, 62nd Ave.	FC-D8.4	05485610	41.673016	-93.553021	8.4	256.4	SCUFA50	SCUFA50	x	x
Fourmile Creek, Berwick	FC-D10.6	05485614	41.661944	-93.546666	10.6	253.1	SCUFA50		x	
Muchikinock Creek	FC-MC	05485612	41.665461	-93.549382	9.7	254.7			x	

Table 3. Measurement characteristics, units, and laboratory details of field measurements, nutrients, carbon, major ions, trace elements, and biological components analyzed at the U.S. Geological Survey (USGS) National Water Quality Laboratory (NWQL), the USGS Iowa Water Science Center Sediment Laboratory (IA-SL), the USGS Ohio Water Science Center Microbiology Laboratory (OH-ML), and the U.S. Environmental Protection Agency Microbiology Laboratory (EPA-ML).

[m^3/s, cubic meters per second; R, unfiltered; F, filtered; --, not determined; mg/L, milligram per liter; Std units, standard pH units; µS/cm, microsiemens per centimeter; deg C, degree Celsius; NTU, nephelometric turbidity units; mg/L N, milligram per liter nitrogen; mg/L P, milligram per liter phosphorous; UV254, ultraviolet light absorbance at 254 nanometers; UV280, ultraviolet light absorbance at 280 nanometers; cm, centimeter; mg/L C, milligram per liter carbon; mg/L $CaCO_3$, milligram per liter as calcium carbonate; µg/L, microgram per liter; pla/100 ML, plaque forming units per 100 milliliters; col/100 mL, colonies per 100 milliliters.]

Measurement or Constituent	Unit	Laboratory Reporting Level	NWQL Schedule	NWQL Labcode
Field Measurements				
Discharge	m^3/s	--	--	--
Dissolved oxygen R	mg/L	--	--	--
pH R field	Std units	--	--	--
pH R lab	Std units	--	--	--
Specific conductance R field	µS/cm	--	--	--
Specific conductance R lab	µS/cm	--	--	--
Temperature air	deg C	--	--	--
Temperature water	deg C	--	--	--
Turbidity R	NTU	--	--	--
Nutrients				
Ammonia F	mg/L N	0.02	1010	3116
Ammonia + organic nitrogen R	mg/L N	0.10	1010	1986
Ammonia + organic nitrogen F	mg/L N	0.10	1010	1985
Organic nitrogen F	mg/L N	0.10	--	--
Nitrate + nitrite F	mg/L N	0.04	1010	1975
Nitrate F	mg/L N	0.04	--	--
Nitrite F	mg/L N	0.002	1010	3117
Orthophosphate F	mg/L P	0.008	1010	3118
Particulate nitrogen	mg/L N	0.034	1010	2607
Phosphorus R	mg/L P	0.008	1010	2333
Phosphorus F	mg/L P	0.006	1010	2331
Carbon				
Absorbance UV254 F	cm	0.01	1010	2616
Absorbance UV280 F	cm	0.008	1010	2617
Bicarbonate F field	mg/L	--	--	--
Carbonate F field	mg/L	--	--	--

Measurement or Constituent	Unit	Laboratory Reporting Level	NWQL Schedule	NWQL Labcode
Organic carbon F	mg/L C	0.40	1010	2612
Particulate carbon inorganic + organic	mg/L C	0.10	1010	2606
Particulate carbon inorganic	mg/L C	0.04	1010	2608
Particulate carbon organic	mg/L C	0.12	1010	2611
Major Ions				
Alkalinity F lab	mg/L $CaCO_3$	8.0	998	2109
Alkalinity F field	mg/L $CaCO_3$	--	--	--
Calcium F	mg/L	0.044	998	659
Chloride F	mg/L	0.12	998	1571
Fluoride F	mg/L	0.08	998	31
Magnesium F	mg/L	0.016	998	663
Potassium F	mg/L	0.064	998	2773
Residue on evaporation F	mg/L	10	998	27
Silica F	mg/L	0.058	998	667
Sodium F	mg/L	0.10	998	675
Sulfate F	mg/L	0.18	998	1572
Suspended sediment R	mg/L	1.0	Iowa	--
Trace Elements				
Arsenic F	µg/L	--	--	--
Boron F	µg/L	0.044	998	3122
Iron F	µg/L	2.8	998	2504
Lithium F	µg/L	6.0	998	645
Selenium F	µg/L	0.44	998	2505
Strontium F	µg/L	0.04	998	3132
Vanadium F	µg/L	0.40	998	2507
Biological Components				
Pheophytin *a*	µg/L	0.10	1637	3152
Chlorophyll *a*	µg/L	0.10	1637	3152
Coliphage (*E. coli* CN-13 host)	pla/100mL	1.0	OH-ML	--
Coliphage (*E. coli* HS(pFamp)R host)	pla/100mL	1.0	OH-ML	--
E. coli	col/100mL	--	EPA-ML	--
Entrococci	col/100mL	--	EPA-ML	--

Table 4. Trace elements and major elements measured by inductively coupled plasma/mass spectrometry (Garbarino and Taylor, 1995) and inductively coupled plasma/atomic-emission spectrometry (Garbarino and Taylor, 1979) at the U.S. Geological Survey National Research Program Laboratory, and their method detection limits (MDL).

[atomic symbols shown in parenthesis; µg/L, microgram per liter; mg/L, milligram per liter.]

Element	MDL (µg/L)	Element	MDL (µg/L)
Aluminum (Al)	0.05	Manganese (Mn)	0.02
Antimony (Sb)	0.02	Molybdenum (Mo)	0.03
Arsenic (As)	0.04	Neodymium (Nd)	0.003
Barium (Ba)	0.01	Nickel (Ni)	0.02
Beryllium (Be)	0.02	Potassium (K)	0.02 mg/L
Bismuth (Bi)	0.01	Praseodymium (Pr)	0.005
Boron (B)	4	Rhenium (Re)	0.0013
Cadmium (Cd)	0.006	Rubidium (Rb)	0.002
Calcium (Ca)	0.02 mg/L	Samarium (Sm)	0.003
Cerium (Ce)	0.001	Selenium (Se)	0.2
Cesium (Cs)	0.06	Silica (SiO2)	0.1 mg/L
Chromium (Cr)	0.2	Sodium (Na)	0.02 mg/L
Cobalt (Co)	0.01	Strontium (Sr)	0.02
Copper (Cu)	0.02	Sulfur (S)	0.002 mg/L
Dysprosium (Dy)	0.002	Tellurium (Te)	0.01
Erbium (Er)	0.002	Terbium (Tb)	0.0003
Europium (Eu)	0.001	Thallium (Tl)	0.005
Gadolinium (Gd)	0.003	Thorium (Th)	0.004
Holmium (Ho)	0.0005	Thulium (Tm)	0.0005
Iron (Fe)	0.7	Tungsten (W)	0.004
Lanthanum (La)	0.0005	Uranium (U)	0.002
Lead (Pb)	0.006	Vanadium (V)	0.05
Lithium (Li)	0.1	Ytterbium (Yb)	0.0014
Lutetium (Lu)	0.0005	Yttrium (Y)	0.0004
Magnesium (Mg)	0.002 mg/L	Zinc (Zn)	0.08
		Zirconium (Zr)	0.01

Table 5. Acidic organic wastewater compounds measured by evaporation with derivatization and gas chromatography/mass spectrometry (Barber and others, 2000) at the U.S. Geological Survey National Research Program Laboratory.

[This report contains CAS Registry Numbers® (CASRN), which is a Registered Trademark of the American Chemical Society. CAS recommends the verificaition of the CASRNs through CAS Client Services℠; MDL, method detection limit; µg/L, microgram per liter; NA, not available.]

Compound	CASRN	MDL (µg/L)
Ethylenediaminetetraacetic acid	60-00-4	0.1
Nitrilotriacetic acid	139-13-9	0.1
4-Nonylphenolmonoethoxycarboxylic acid	NA	0.1
4-Nonylphenoldiethoxycarboxylic acid	106807-78-7	0.1
4-Nonylphenoltriethoxycarboxylic acid	NA	0.1
4-Nonylphenoltetraethoxycarboxylic acid	NA	0.1
Surrogate Standard		
4-*normal*-Nonylphenoldiethoxycarboxylate	NA	NA

Table 6. Antibiotic compounds measured by hydrophilic-lipophilic-balance solid-phase extraction with liquid chromatography/mass spectrometry and liquid chromatography/tandem mass spectrometry (Meyer and others, 2007) at the U.S. Geological Survey Organic Geochemistry Research Laboratory.

[CASRN, Chemical Abstract Services Registry Number; LRL, laboratory reporting level for liquid chromatography/mass spectrometry (liquid chromatography/tandem mass spectrometry LRL given in parentheses); µg/L, microgram per liter; NA, not available; --, not determined.]

Compound	CASRN	LRL (µg/L)
Amoxicillin	26787-78-01	0.1 (0.01)
Ampicillin	69-53-4	0.1 (0.01)
Azithromycin	83905-01-5	--
Carbadox	1789875	0.05 (0.005)
Cefotaxime	64485-93-4	0.1 (0.01)
Chlorotetracycline	57-62-5	0.05 (0.005)
anhydro-Chlorotetracycline	4497-08-9	0.1 (0.01)
epi-Chlorotetracycline	14297-93-9	0.1 (0.01)
epi-anhydro-Chlorotetracycline	4497-08-9	0.1 (0.01)
epi-iso-Chlorotetracycline	NA	0.1 (0.01)
iso-Chlorotetracycline	514-53-9	0.1 (0.01)
Ciprofloxacin	85721-33-1	0.05 (0.005)
Clinafloxacin	105956-97-6	0.05 (0.005)
Cloxacillin	7081-44-9	0.1 (0.01)
Demeclocycline	127-33-3	0.1 (0.01)
Doxycycline	564-25-0	0.1 (0.01)
Erythromycin	114-07-8	0.1 (0.01)
anhydro-Erythromycin	114-07-8	0.05 (0.005)
Flumequine	42835-25-6	0.05 (0.005)
Lincomycin	154-21-2	0.05 (0.005)
Lomefloxacin	98079-51-7	0.05 (0.005)
Minocycline	10118-90-8	0.1 (0.01)
Norfloxacin	70458-96-7	0.05 (0.005)
Ofloxacin	82419-36-1	0.05 (0.005)
Ormetoprim	6981-18-6	0.05 (0.005)
Oxacillin	7204-38-2	0.1 (0.01)
Oxolinic Acid	14698-29-4	0.05 (0.005)
Oxytetracycline	79-57-2	0.1 (0.01)
alpha-apo-Oxytetracycline	18695-01-7	--
beta-apo-Oxytetracycline	18751-99-0	--
epi-Oxytetracycline	35259-39-3	--

Compound	CASRN	LRL (µg/L)
Penicillin G	69-57-8	0.1 (0.01)
Penicillin V	87-08-1	0.1 (0.01)
Roxithromycin	80214-83-1	0.1 (0.01)
Sarafloxacin	98105-99-8	0.05 (0.005)
Sulfachloropyridazine	80-32-0	0.05 (0.005)
Sulfadiazine	68-35-9	0.05 (0.005)
Sulfadimethoxine	122-11-2	0.05 (0.005)
Sulfamerazine	127-79-7	0.05 (0.005)
Sulfamethazine	57-68-1	0.05 (0.005)
Sulfamethoxazole	723-46-6	0.05 (0.005)
Sulfathiazole	72-14-0	0.05 (0.005)
Tetracycline	60-54-8	0.1 (0.01)
anhydro-Tetracycline	13803-65-1	0.1 (0.01)
epi-Tetracycline	23313-80-6	0.1 (0.01)
epi-anhydro-Tetracycline	4465-65-0	0.1 (0.01)
Trimethoprim	738-70-5	0.05 (0.005)
Tylosin	1401-69-0	0.1 (0.01)
Virginiamycin	21411-53-0	0.1 (0.01)
Surrogate Standards		
Meclocycline	2013-58-3	NA
Nalidixic Acid	389-08-2	NA
Oleandomycin	7060-74-4	NA
^{13}C6 Sulfamethazine	NA	NA

Table 7. Pharmaceutical compounds measured by hydrophilic-lipophilic-balance solid-phase extraction with liquid chromatography/mass spectrometry (Cahill and others, 2004) at the U.S. Geological Survey National Water Quality Laboratory.

[CASRN, Chemical Abstract Services Registry Number; LRL, laboratory reporting level; µg/L, microgram per liter; NA, not available.]

Compound	CASRN	LRL (µg/L)
Acetaminophen	103-90-2	0.036
Azithromycin	83905-01-5	0.05
Caffeine	58-08-2	0.016
Carbamazepine	298-46-4	0.011
Cimetidine	51481-61-9	0.012
Codeine	76-57-3	0.015
Cotinine	486-56-6	0.014
Dehydronifedipine	67035-22-7	0.015
Diltiazem	42399-41-7	0.016
1,7-Dimethylxanthine	611-59-6	0.144
Diphenhydramine	147-24-0	0.015
Erythromycin	114-07-8	0.05
Fluoxetine	54910-89-3	0.014
Furosemide	54-31-9	0.05
Gemfibrozil	25812-30-0	0.013
Ibuprofen	15687-27-1	0.042
Metformin	657-24-9	0.05
Miconazole	22916-47-8	0.05
Ranitidine	66357-35-5	0.013
Salbutamol	18559-94-9	0.023
Sulfamethoxazole	723-46-6	0.064
Thiabendazole	148-79-8	0.011
Trimethoprim	738-70-5	0.013
Warfarin	81-81-2	0.012
Surrogate Standards		
d4 Ethyl nicotinate	66148-16-1	NA
d4 Nicotinamide	347841-88-1	NA

Table 8. Neutral organic wastewater compounds measured by continuous liquid-liquid extraction using methylene chloride with gas chromatography/mass spectrometry (Barber and others, 2000) at the U.S. Geological Survey National Research Program Laboratory.

[CASRN, Chemical Abstract Services Registry Number; MDL, method detection limit; µg/L, microgram per liter; NA, not available.]

Compound	CASRN	MDL (µg/L)
Bisphenol A	80-05-7	0.005
2[3]-*tert*-Butyl-4-methylphenol	25013-16-5	0.005
4-*tert*-Butylphenol	98-54-4	0.005
Caffeine	58-08-2	0.005
Cholesterol	57-88-5	0.005
Coprostanol	360-68-9	0.005
2,6-Di-*tert*-butyl-1,4-benzoquinone	719-22-2	0.005
2,6-Di-*tert*-butyl-4-methylphenol	128-37-0	0.005
2,6-Di-*tert*-butylphenol	128-39-2	0.005
1,2-Dichlorobenzene	95-50-1	0.005
1,3-Dichlorobenzene	541-73-1	0.005
1,4-Dichlorobenzene	106-46-7	0.005
N,N-Diethyl-*meta*-toluamide	134-62-3	0.005
4-Ethylphenol	123-07-9	0.005
5-Methyl-1H-benzotriazole	136-85-6	0.005
4-Methylphenol	106-44-5	0.005
4-Nonylphenol	25154-52-3	0.005
4-Nonylphenolmonoethoxylate	9016-45-9	0.005
4-Nonylphenoldiethoxylate	NA	0.005
4-Nonylphenoltriethoxylate	NA	0.005
4-Nonylphenoltetraethoxylate	NA	0.005
4-*normal*-Octylphenol	1806-26-4	0.005
4-*tert*-Octylphenol	140-66-9	0.005
4-*tert*-Octylphenolmonoethoxylate	9036-19-5	0.005
4-*tert*-Octylphenoldiethoxylate	NA	0.005
4-*tert*-Octylphenoltriethoxylate	NA	0.005
4-*tert*-Octylphenoltetraethoxylate	NA	0.005
4-*tert*-Octylphenolpentaethoxylate	NA	0.005
4-*tert*-Pentylphenol	80-46-6	0.005
4-Propylphenol	645-56-7	0.005
Triclosan	3380-34-5	0.005

Compound	CASRN	MDL (µg/L)
Surrogate Standards		
d6 Bisphenol A	86588-58-1	NA
d7 Cholesterol	83199-47-7	NA
d21 2,6-Di-*tert*-butyl-4-methylphenol	64502-99-4	NA
d4 17β-Estradiol	66789-03-5	NA
4-*normal*-Nonylphenol	104-40-5	NA
4-*normal*-Nonylphenolmonoethoxylate	NA	NA
4-*normal*-Nonylphenoldiethoxylate	NA	NA

Table 9. Neutral organic wastewater compounds measured by styrene divinylbenzene solid-phase extraction with gas chromatography/mass spectrometry (Zaugg and others, 2002) at the U.S. Geological Survey National Water Quality Laboratory.

[CASRN, Chemical Abstract Services Registry Number; MDL, method detection limit; µg/L, microgram per liter; NA, not available.]

Compound	CASRN	MDL (µg/L)
Acetophenone	98-86-2	0.5
Acetylhexamethyltetrahydronaphthalene	21145-77-7	0.5
Anthracene	120-12-7	0.5
9,10-Anthraquinone	84-65-1	0.5
Atrazine	1912-24-9	0.5
Benzo[a]pyrene	50-32-8	0.5
Benzophenone	119-61-9	0.5
Bisphenol A	80-05-7	1.0
Bromacil	314-40-9	0.5
Bromoform	75-25-2	0.5
3-*tert*-Butyl-4-hydroxyanisole	25013-16-5	5.0
Caffeine	58-08-2	0.5
Camphor	76-22-2	0.5
Carbaryl	63-25-2	1.0
Carbazole	86-74-8	0.5
Chlorpyrifos	2921-88-2	0.5
Cholesterol	57-88-5	2.0
Coprostanol	360-68-9	2.0
Cotinine	486-56-6	1.0
Diazinon	333-41-5	0.5
1,4-Dichlorobenzene	106-46-7	0.5
N,N-Diethyl-*meta*-toluamide	134-62-3	0.5
2,6-Dimethylnaphthalene	581-42-0	0.5
Fluoranthene	206-44-0	0.5
Hexahydrohexamethylcyclopentabenzopyran	1222-05-5	0.5
Indole	120-72-9	0.5
Isoborneol	124-76-5	0.5
Isophorone	78-59-1	0.5
Isoquinoline	119-65-3	0.5
d-Limonene	5989-27-5	0.5
Menthol	89-78-1	0.5
Metalaxyl	57837-19-1	0.5

Compound	CASRN	MDL (µg/L)
5-Methyl-1H-benzotriazole	136-85-6	2.0
3-Methyl-1H-indole	83-34-1	1.0
1-Methylnaphthalene	90-12-0	0.5
2-Methylnaphthalene	91-57-6	0.5
4-Methylphenol	106-44-5	1.0
Methyl salicylate	119-36-8	0.5
Metolachlor	51218-45-2	0.5
Naphthalene	91-20-3	0.5
4-Nonylphenol	84852-15-3	5.0
4-Nonylphenolmonoethoxylate	9016-45-9	5.0
4-Nonylphenoldiethoxylate	NA	5.0
4-*normal*-Octylphenol	1806-26-4	1.0
4-*tert*-Octylphenol	140-66-9	1.0
4-*tert*-Octylphenolmonoethoxylate	9036-19-5	1.0
4-*tert*-Octylphenoldiethoxylate	NA	1.0
Pentachlorophenol	87-86-5	2.0
Phenanthrene	85-01-8	0.5
Phenol	108-95-2	0.5
Prometon	1610-18-0	0.5
iso-Propylbenzene	98-82-8	0.5
4-*iso*-Propylphenol	599-64-4	1.0
Pyrene	129-00-0	0.5
β-Sitosterol	83-46-5	2.0
β-Stigmastanol	19466-47-8	2.0
Tetrachloroethylene	127-18-4	0.5
Tributyl phosphate	126-73-8	0.5
Triclosan	3380-34-5	1.0
Triethyl citrate	77-93-0	0.5
Triphenyl phosphate	115-86-6	0.5
Tris(2-butoxyethyl) phosphate	78-51-3	0.5
Tris(2-chloroethyl) phosphate	115-96-8	0.5
Tris(dichloroisopropyl) phosphate	13674-87-8	0.5
Surrogate Standards		
d3 Bisphenol A	96210-87-6	NA
^{13}C Caffeine	072238-58-8	NA

Compound	CASRN	MDL (µg/L)
Decafluorobiphenyl	434-90-2	NA
d10 Fluoranthene	93951-69-0	NA

Table 10. Steroid and steroidal-hormone compounds measured by octadecylsilica solid-phase extraction with derivatization and gas chromatography/tandem mass spectrometry (Barber and others, 2003) at the U.S. Geological Survey National Research Program Laboratory.

[CASRN, Chemical Abstract Services Registry Number; MDL, method detection limit; µg/L, microgram per liter.]

Compound	CASRN	MDL (µg/L)
cis-Androsterone	53-41-8	0.001
Cholesterol	57-88-5	0.001
Coprostanol	360-68-9	0.001
Diethylstilbesterol	56-53-1	0.001
Equilenin	517-09-9	0.001
Equilin	474-86-2	0.001
17α-Estradiol	57-91-0	0.001
17β-Estradiol	50-28-2	0.001
Estriol	50-27-1	0.001
Estrone	53-16-7	0.001
17α-Ethinylestradiol	57-63-6	0.001
Mestranol	72-33-3	0.001
19-Norethisterone	68-22-4	0.001
Progesterone	57-83-0	0.001
Testosterone	58-22-0	0.001
epi-Testosterone	481-30-1	0.001
11-keto-Testosterone	53187-98-7	0.001
Surrogate Standards		
d7 Cholesterol	83199-47-7	0.001
d4 17β-Estradiol	66789-03-5	0.001

Table 11. Pesticide compounds measured by octadecylsilica solid-phase extraction with gas chromatography/mass spectrometry (Zaugg and others, 1995) at the U.S. Geological Survey National Water Quality Laboratory.

[CASRN, Chemical Abstract Services Registry Number; LRL, laboratory reporting level; µg/L, microgram per liter; NA, not available; --, not determined.]

Compound	CASRN	LRL (µg/L)
Acetochlor	34256-82-1	0.004
Alachlor	15972-60-8	0.002
Atrazine	1912-24-9	0.007
Azinphos-methyl	86-50-0	0.050
Benfluralin	1861-40-1	0.010
Butylate	2008-41-5	0.002
Carbaryl	63-25-2	0.040
Carbofuran	1563-66-2	0.020
Chlorpyrifos	2921-88-2	0.005
Cyanazine	21725-46-2	0.018
Dacthal (DCPA)	1861-32-1	0.003
Deethylatrazine	6190-65-4	0.006
Diazinon	333-41-5	0.005
1,1-Dichloro-2,2-bis(*p*-chlorophenyl)ethylene (*p,p'*-DDE)	72-55-9	0.003
Dieldrin	60-57-1	0.005
2,6-Diethylaniline	579-66-8	0.002
Disulfoton	298-04-4	0.020
Ethalfluralin	55283-68-6	0.009
Ethoprophos	13194-48-4	0.005
S-Ethyldipropylthiocarbamate (EPTC)	759-94-4	0.002
Fipronil	120068-37-3	0.018
Fipronil desulfinyl	205650-65-3	0.012
Fipronil desulfinyl amide	NA	0.029
Fipronil sulfide	120067-83-6	0.012
Fipronil sulfone	120068-36-2	0.024
Fonofos	944-22-9	0.003
α-Hexachlorohexane	319-84-6	0.005
γ-Hexachlorohexane (Lindane)	58-89-9	0.004
Linuron	330-55-2	0.035
Malathion	121-75-5	0.027
Metolachlor	51218-45-2	0.013
Metribuzin	21087-64-9	0.006

Compound	CASRN	LRL (µg/L)
Molinate	2212-67-1	0.002
Napropamide	15299-99-7	0.007
Parathion	56-38-2	0.007
Parathion-methyl	298-00-0	0.006
Pebulate	1114-71-2	0.002
Pendimethalin	40487-42-1	0.010
cis-Permethrin	54774-45-7	0.006
Phorate	298-02-2	0.011
Prometon	1610-18-0	0.015
Propachlor	1918-16-7	0.010
Propanil	709-98-8	0.011
Propargite	2312-35-8	0.023
Propyzamide	23950-58-5	0.004
Simazine	122-34-9	0.011
Tebuthiuron	34014-18-1	0.016
Terbacil	5902-51-2	0.034
Terbufos	13071-79-9	0.017
Thiobencarb	28249-77-6	0.005
Tri-allate	2303-17-5	0.002
Trifluralin	1582-09-8	0.009
Surrogate Standards		
d10 Diazinon	100155-47-3	NA
d6 *a*-Hexachlorohexane	86194-41-4	NA

Table 12. Rhodamine WT (RWT) concentrations at Boulder Creek, Colorado, downstream sites as a function of stream travel time, August 21, 2003.

[RWT was 5 percent active; BC-D3.6, BC-D5.0, and BC-D7.4 are sampling sites located downstream from the wastewater treatment plant (WWTP) and values indicate distance from the WWTP in kilometers (km); Auto, samples collected by autosampler and analyzed in the laboratory; SCUFA, concentrations determined in-stream by self-contained underwater fluorescence apparatus; number following Auto and SCUFA is percent of channel width relative to right bank looking upstream; Conc, concentration; µg/L, microgram per liter.]

Travel Time (hours)	Auto 90 BC-D3.6 Conc (µg/L)	SCUFA 50 BC-D3.6 Conc (µg/L)	Auto 10 BC-D3.6 Conc (µg/L)	Auto 50 BC-D5.0 Conc (µg/L)	SCUFA 50 BC-D5.0 Conc (µg/L)	Auto 50 BC-D7.4 Conc (µg/L)	Sample Time	Sample Date
0.02	0.01		0.02				9:25	8/21/03
0.27	0.01		0.02				9:40	8/21/03
0.52	0.01		0.02				9:55	8/21/03
0.77	0.01		0.03				10:10	8/21/03
1.02	0.01		0.03				10:25	8/21/03
1.10	0.01		0.03				10:30	8/21/03
1.18	0.02		0.03				10:35	8/21/03
1.27	0.01	0.05	0.03				10:40	8/21/03
1.35	0.02	0.04	0.02				10:45	8/21/03
1.43	0.07	0.24	0.03				10:50	8/21/03
1.52	0.04	0.87	0.03				10:55	8/21/03
1.60	0.08	0.62	0.07				11:00	8/21/03
1.68	0.69	0.70	0.52				11:05	8/21/03
1.77	2.63	2.28	2.25	0.04			11:10	8/21/03
1.85	5.06	4.86	4.68				11:15	8/21/03
1.93	6.23	6.64	5.95	0.04			11:20	8/21/03
2.02	5.88	6.12	5.79				11:25	8/21/03
2.10	4.68	4.81	4.80	0.04			11:30	8/21/03
2.18	3.34	3.29	5.91				11:35	8/21/03
2.27	2.31	2.11	2.47	0.15			11:40	8/21/03
2.35	1.46	1.28	1.69				11:45	8/21/03
2.43	0.98	0.77	1.19	1.27	1.37		11:50	8/21/03
2.52	0.72	0.47	0.76		2.03		11:55	8/21/03
2.60	0.50	0.26	0.55	3.36	3.53		12:00	8/21/03
2.68	0.40	0.16	0.41		4.41		12:05	8/21/03
2.77	0.30	0.13	0.32	4.21	4.45		12:10	8/21/03
2.85	0.23	0.20	0.29		3.89		12:15	8/21/03
2.93	0.19	0.12	0.20	3.19	3.20		12:20	8/21/03

Travel Time (hours)	Auto 90 BC-D3.6 Conc (μg/L)	SCUFA 50 BC-D3.6 Conc (μg/L)	Auto 10 BC-D3.6 Conc (μg/L)	Auto 50 BC-D5.0 Conc (μg/L)	SCUFA 50 BC-D5.0 Conc (μg/L)	Auto 50 BC-D7.4 Conc (μg/L)	Sample Time	Sample Date
3.02	0.15	0.05	0.18		2.37		12:25	8/21/03
3.10	0.14		0.15	1.72	1.62		12:30	8/21/03
3.18	0.11		0.13		1.09		12:35	8/21/03
3.27	0.11		0.11	1.00	0.89		12:40	8/21/03
3.35	0.09		0.10		0.46		12:45	8/21/03
3.43	0.09		0.09	0.58	0.25		12:50	8/21/03
3.52	0.07		0.07		0.23		12:55	8/21/03
3.60	0.07		0.08	0.44	0.19		13:00	8/21/03
3.68	0.07		0.08		0.30		13:05	8/21/03
3.77	0.08		0.07	0.26	0.98		13:10	8/21/03
3.85	0.07		0.06		0.29		13:15	8/21/03
3.93	0.06		0.06	0.18	1.12		13:20	8/21/03
4.02	0.06		0.06		0.08		13:25	8/21/03
4.10	0.06		0.06	0.15	0.23		13:30	8/21/03
4.18	0.06		0.06		0.27		13:35	8/21/03
4.27	0.05		0.04	0.14	0.26		13:40	8/21/03
4.35	0.05		0.05		0.14	0.05	13:45	8/21/03
4.43	0.04		0.05	0.12	0.48		13:50	8/21/03
4.52	0.04		0.05		0.14		13:55	8/21/03
4.60				0.10	0.25	0.06	14:00	8/21/03
4.68					0.32		14:05	8/21/03
4.77				0.09	0.35		14:10	8/21/03
4.85					0.25	0.07	14:15	8/21/03
4.92				0.09	0.11		14:20	8/21/03
5.02					0.09		14:25	8/21/03
5.10				0.07	0.10	0.17	14:30	8/21/03
5.18					0.09		14:35	8/21/03
5.27				0.07	0.08		14:40	8/21/03
5.35					0.06	0.71	14:45	8/21/03
5.43				0.07			14:50	8/21/03
5.60				0.07		1.58	15:00	8/21/03
5.77				0.12			15:10	8/21/03
5.85						2.06	15:15	8/21/03
5.93				0.06			15:20	8/21/03

Travel Time (hours)	Auto 90 BC-D3.6 Conc (μg/L)	SCUFA 50 BC-D3.6 Conc (μg/L)	Auto 10 BC-D3.6 Conc (μg/L)	Auto 50 BC-D5.0 Conc (μg/L)	SCUFA 50 BC-D5.0 Conc (μg/L)	Auto 50 BC-D7.4 Conc (μg/L)	Sample Time	Sample Date
6.10				0.05		1.92	15:30	8/21/03
6.27				0.06			15:40	8/21/03
6.35						1.49	15:45	8/21/03
6.43				0.05			15:50	8/21/03
6.60				0.06		1.02	16:00	8/21/03
6.77				0.08			16:10	8/21/03
6.85						0.66	16:15	8/21/03
6.93				0.05			16:20	8/21/03
7.10				0.05		0.47	16:30	8/21/03
7.27				0.04			16:40	8/21/03
7.35						0.33	16:45	8/21/03
7.43				0.04			16:50	8/21/03
7.60				0.04		0.24	17:00	8/21/03
7.77				0.04			17:10	8/21/03
7.85						0.19	17:15	8/21/03
7.93				0.04			17:20	8/21/03
8.10				0.03		0.16	17:30	8/21/03
8.27				0.04			17:40	8/21/03
8.35						0.13	17:45	8/21/03
8.43				0.04			17:50	8/21/03
8.60				0.04		0.12	18:00	8/21/03
8.85						0.11	18:15	8/21/03

Table 13. Rhodamine WT (RWT) concentrations at Boulder Creek, Colorado, downstream sites as a function of stream travel time, April 16 to 17, 2005.

[RWT was 5 percent active; BC-D3.6 and BC-D7.4 are sampling sites located downstream from the wastewater treatment plant (WWTP) and values indicate distance from the WWTP in kilometers (km); SCUFA, concentrations determined in-stream by self-contained underwater fluorescence apparatus; number following SCUFA is percent of channel width relative to right bank looking upstream; Conc, concentration; µg/L, microgram per liter.]

Travel Time (hours)	SCUFA 50 BC-D3.6 Conc (µg/L)	SCUFA 50 BC-D7.4 Conc (µg/L)	Sample Time	Sample Date
0.02			19:20	4/16/2005
0.27			19:35	4/16/2005
0.52			19:50	4/16/2005
0.77			20:05	4/16/2005
1.02	0.18		20:20	4/16/2005
1.27	0.16		20:35	4/16/2005
1.52	0.25		20:50	4/16/2005
1.77	0.24		21:05	4/16/2005
2.02	0.71		21:20	4/16/2005
2.27	0.66		21:35	4/16/2005
2.52	20.18		21:50	4/16/2005
2.77	40.79		22:05	4/16/2005
3.02	24.42		22:20	4/16/2005
3.27	10.73		22:35	4/16/2005
3.52	5.41		22:50	4/16/2005
3.77	3.33		23:05	4/16/2005
4.02	2.62		23:20	4/16/2005
4.27	1.64		23:35	4/16/2005
4.52	1.48		23:50	4/16/2005
4.77	1.51		0:05	4/17/2005
5.02	1.42		0:20	4/17/2005
5.27	1.42		0:35	4/17/2005
5.52			0:50	4/17/2005
5.77			1:05	4/17/2005
6.02		0.83	1:20	4/17/2005
6.27		4.66	1:35	4/17/2005
6.52		8.67	1:50	4/17/2005
6.77		9.15	2:05	4/17/2005
7.02		7.72	2:20	4/17/2005

Travel Time (hours)	SCUFA 50 BC-D3.6 Conc (μg/L)	SCUFA 50 BC-D7.4 Conc (μg/L)	Sample Time	Sample Date
7.27		5.79	2:35	4/17/2005
7.52		4.26	2:50	4/17/2005
7.77		2.94	3:05	4/17/2005
8.02		2.05	3:20	4/17/2005
8.27		1.37	3:35	4/17/2005
8.52		0.90	3:50	4/17/2005
8.77		0.55	4:05	4/17/2005
9.02		0.36	4:20	4/17/2005
9.27		0.22	4:35	4/17/2005
9.52		0.12	4:50	4/17/2005

Table 14. Rhodamine WT (RWT) concentrations at Fourmile Creek, Iowa, downstream sites as a function of stream travel time, July 30 to 31, 2003.

[RWT was 20 percent active; FC-D2.9, FC-D8.4, and FC-D10.6 are sampling sites located downstream from the wastewater treatment plant (WWTP) and values indicate distance from the WWTP in kilometers (km); SCUFA, concentrations determined in-stream by self-contained underwater fluorescence apparatus; number following SCUFA is percent of channel width relative to right bank looking upstream; Conc, concentration; µg/L, microgram per liter.]

Travel Time (hours)	SCUFA 50 FC-D2.9 Conc (µg/L)	SCUFA 50 FC-D8.4 Conc (µg/L)	SCUFA 50 FC-D10.6 Conc (µg/L)	Sample Time	Sample Date
0.00	2.27			9:45	7/30/2003
0.25	2.30			10:00	7/30/2003
0.50	2.29			10:15	7/30/2003
0.75	2.29			10:30	7/30/2003
1.00	2.22			10:45	7/30/2003
1.25	2.20			11:00	7/30/2003
1.50	2.14			11:15	7/30/2003
1.75	2.23			11:30	7/30/2003
2.00	2.25			11:45	7/30/2003
2.25	2.17			12:00	7/30/2003
2.50	2.18			12:15	7/30/2003
2.75	2.22	2.65		12:30	7/30/2003
3.00	2.22	2.87		12:45	7/30/2003
3.25	2.16	3.06		13:00	7/30/2003
3.50	2.16	3.17		13:15	7/30/2003
3.75	2.29	3.76		13:30	7/30/2003
4.00	2.48	3.67		13:45	7/30/2003
4.25	2.70	3.92		14:00	7/30/2003
4.50	3.76	2.88		14:15	7/30/2003
4.75	5.36	3.85		14:30	7/30/2003
5.00	11.47	3.96		14:45	7/30/2003
5.25	28.52	2.32		15:00	7/30/2003
5.50	59.62	2.32		15:15	7/30/2003
5.75	85.40	2.31		15:30	7/30/2003
6.00	89.84	2.46		15:45	7/30/2003
6.25	90.59	2.36		16:00	7/30/2003
6.50	72.87	2.49		16:15	7/30/2003
6.75	40.02	2.39		16:30	7/30/2003
7.00	27.43	2.55		16:45	7/30/2003

Travel Time (hours)	SCUFA 50 FC-D2.9 Conc (μg/L)	SCUFA 50 FC-D8.4 Conc (μg/L)	SCUFA 50 FC-D10.6 Conc (μg/L)	Sample Time	Sample Date
7.25	21.75	2.32		17:00	7/30/2003
7.50	15.71	2.33		17:15	7/30/2003
7.75	12.99	2.32		17:30	7/30/2003
8.00	9.32	2.33		17:45	7/30/2003
8.25	7.93	2.37		18:00	7/30/2003
8.50	7.61	2.29		18:15	7/30/2003
8.75	8.24	2.25		18:30	7/30/2003
9.00	9.70	2.28		18:45	7/30/2003
9.25	4.45	2.31		19:00	7/30/2003
9.50	5.09	2.34		19:15	7/30/2003
9.75	4.85	2.39		19:30	7/30/2003
10.00	4.62	2.75		19:45	7/30/2003
10.25	5.23	2.24		20:00	7/30/2003
10.50	4.93	2.25		20:15	7/30/2003
10.75		2.24		20:30	7/30/2003
11.00		2.21		20:45	7/30/2003
11.25		2.24		21:00	7/30/2003
11.50		2.25		21:15	7/30/2003
11.75		2.24	2.46	21:30	7/30/2003
12.00		2.29	2.53	21:45	7/30/2003
12.25		2.25	2.48	22:00	7/30/2003
12.50		2.28	2.48	22:15	7/30/2003
12.75		2.27	2.50	22:30	7/30/2003
13.00		2.26	2.46	22:45	7/30/2003
13.25		2.25	2.45	23:00	7/30/2003
13.50		2.21	2.43	23:15	7/30/2003
13.75		2.25	2.40	23:30	7/30/2003
14.00		2.47	2.43	23:45	7/30/2003
14.25		3.13	2.41	0:00	7/31/2003
14.50		4.48	2.44	0:15	7/31/2003
14.75		6.97	2.42	0:30	7/31/2003
15.00		10.89	2.34	0:45	7/31/2003
15.25		16.94	2.35	1:00	7/31/2003

Travel Time (hours)	SCUFA 50 FC-D2.9 Conc (μg/L)	SCUFA 50 FC-D8.4 Conc (μg/L)	SCUFA 50 FC-D10.6 Conc (μg/L)	Sample Time	Sample Date
15.50		23.80	2.36	1:15	7/31/2003
15.75		32.02	2.34	1:30	7/31/2003
16.00		39.63	2.41	1:45	7/31/2003
16.25		46.70	2.37	2:00	7/31/2003
16.50		52.40	2.39	2:15	7/31/2003
16.75		56.20	2.45	2:30	7/31/2003
17.00		57.92	2.44	2:45	7/31/2003
17.25		57.55	2.43	3:00	7/31/2003
17.50		55.41	2.41	3:15	7/31/2003
17.75		51.85	2.43	3:30	7/31/2003
18.00		47.77	2.59	3:45	7/31/2003
18.25		43.22	2.79	4:00	7/31/2003
18.50		38.34	3.40	4:15	7/31/2003
18.75		33.64	4.46	4:30	7/31/2003
19.00		29.39	6.08	4:45	7/31/2003
19.25		25.70	8.53	5:00	7/31/2003
19.50		22.30	11.63	5:15	7/31/2003
19.75		19.46	15.76	5:30	7/31/2003
20.00		17.18	20.52	5:45	7/31/2003
20.25		15.03	24.89	6:00	7/31/2003
20.50		13.41	28.50	6:15	7/31/2003
20.75		11.57	32.45	6:30	7/31/2003
21.00		10.23	34.55	6:45	7/31/2003
21.25		9.27	35.98	7:00	7/31/2003
21.50		8.44	36.26	7:15	7/31/2003
21.75		7.85	35.47	7:30	7/31/2003
22.00		7.38	33.94	7:45	7/31/2003
22.25		6.91	31.99	8:00	7/31/2003
22.50		6.47	29.87	8:15	7/31/2003
22.75		6.11	27.24	8:30	7/31/2003
23.00		5.80	24.58	8:45	7/31/2003
23.25		5.55	22.06	9:00	7/31/2003
23.50		5.27	20.13	9:15	7/31/2003

Travel Time (hours)	SCUFA 50 FC-D2.9 Conc (μg/L)	SCUFA 50 FC-D8.4 Conc (μg/L)	SCUFA 50 FC-D10.6 Conc (μg/L)	Sample Time	Sample Date
23.75		5.10	17.85	9:30	7/31/2003
24.00		4.95	16.17	9:45	7/31/2003
24.25		4.75	14.48	10:00	7/31/2003
24.50		4.58	13.11	10:15	7/31/2003
24.75		4.48	11.94	10:30	7/31/2003
25.00		4.37	10.50	10:45	7/31/2003
25.25		4.33	9.52	11:00	7/31/2003
25.50		4.19	8.74	11:15	7/31/2003
25.75			7.97	11:30	7/31/2003
26.00			7.55	11:45	7/31/2003
26.25			6.99	12:00	7/31/2003
26.50			6.58	12:15	7/31/2003
26.75			6.27	12:30	7/31/2003
27.00			5.93	12:45	7/31/2003
27.25			5.48	13:00	7/31/2003
27.50			5.11	13:15	7/31/2003
27.75			4.89	13:30	7/31/2003
28.00			4.77	13:45	7/31/2003
28.25			5.31	14:00	7/31/2003
28.50			4.99	14:15	7/31/2003
28.75			4.48	14:30	7/31/2003
29.00			4.20	14:45	7/31/2003
29.25			4.61	15:00	7/31/2003
29.50			4.39	15:15	7/31/2003
29.75			4.94	15:30	7/31/2003
30.00			3.83	15:45	7/31/2003
30.25			3.52	16:00	7/31/2003

Table 15. Rhodamine WT (RWT) concentrations at Fourmile Creek, Iowa, downstream sites as a function of stream travel time, March 3 to 4, 2005.

[RWT was 20 percent active; FC-D2.9 and FC-D8.4 are sampling sites located downstream from the wastewater treatment plant (WWTP) and values indicate distance from the WWTP in kilometers (km); SCUFA, concentrations determined in-stream by self-contained underwater fluorescence apparatus; number following SCUFA is percent of channel width relative to right bank looking upstream; raw fluorescence units presented because no RWT calibration was available.]

Travel Time (hours)	SCUFA 50 FC-D2.9 Raw Fluorescence	SCUFA 50 FC-D8.4 Raw Fluorescence	Sample Time	Sample Date
0.00			9:30	3/3/2005
0.25			9:45	3/3/2005
0.50			10:00	3/3/2005
0.75			10:15	3/3/2005
1.00			10:30	3/3/2005
1.25			10:45	3/3/2005
1.50			11:00	3/3/2005
1.75			11:15	3/3/2005
2.00			11:30	3/3/2005
2.25			11:45	3/3/2005
2.50	0.86		12:00	3/3/2005
2.75	66.25		12:15	3/3/2005
3.00	144.80		12:30	3/3/2005
3.25	100.10		12:45	3/3/2005
3.50	41.54		13:00	3/3/2005
3.75	14.88		13:15	3/3/2005
4.00	4.82	0.03	13:30	3/3/2005
4.25	2.08	0.07	13:45	3/3/2005
4.50	0.96	0.10	14:00	3/3/2005
4.75	0.45	0.20	14:15	3/3/2005
5.00	0.14	0.49	14:30	3/3/2005
5.25		0.34	14:45	3/3/2005
5.50		0.19	15:00	3/3/2005
5.75		0.10	15:15	3/3/2005
6.00		0.07	15:30	3/3/2005
6.25		0.05	15:45	3/3/2005
6.50		0.21	16:00	3/3/2005
6.75		0.05	16:15	3/3/2005
7.00		0.00	16:30	3/3/2005
7.25		0.33	16:45	3/3/2005

Travel Time (hours)	SCUFA 50 FC-D2.9 Raw Fluorescence	SCUFA 50 FC-D8.4 Raw Fluorescence	Sample Time	Sample Date
7.50		3.81	17:00	3/3/2005
7.75		16.18	17:15	3/3/2005
8.00		36.12	17:30	3/3/2005
8.25		54.01	17:45	3/3/2005
8.50		58.87	18:00	3/3/2005
8.75		50.85	18:15	3/3/2005
9.00		37.31	18:30	3/3/2005
9.25		25.11	18:45	3/3/2005
9.50		14.70	19:00	3/3/2005
9.75		9.62	19:15	3/3/2005
10.00		5.57	19:30	3/3/2005
10.25		3.85	19:45	3/3/2005
10.50		2.71	20:00	3/3/2005
10.75		2.02	20:15	3/3/2005
11.00		1.53	20:30	3/3/2005
11.25		1.23	20:45	3/3/2005
11.50		1.01	21:00	3/3/2005
11.75		0.88	21:15	3/3/2005
12.00		0.72	21:30	3/3/2005
12.25		0.60	21:45	3/3/2005
12.50		0.50	22:00	3/3/2005
12.75		0.43	22:15	3/3/2005
13.00		0.38	22:30	3/3/2005
13.25		0.36	22:45	3/3/2005
13.50		0.29	23:00	3/3/2005
13.75		0.27	23:15	3/3/2005
14.00		0.26	23:30	3/3/2005
14.25		0.24	23:45	3/3/2005
14.50		0.17	0:00	3/4/2005
14.75		0.15	0:15	3/4/2005
15.00		0.11	0:30	3/4/2005
15.25		0.12	0:45	3/4/2005
15.50		0.11	1:00	3/4/2005
15.75		0.11	1:15	3/4/2005

Travel Time (hours)	SCUFA 50 FC-D2.9 Raw Fluorescence	SCUFA 50 FC-D8.4 Raw Fluorescence	Sample Time	Sample Date
16.00		0.10	1:30	3/4/2005
16.25		0.06	1:45	3/4/2005
16.50		0.04	2:00	3/4/2005
16.75		0.01	2:15	3/4/2005

Table 16. Summary of hydrological data for the Boulder Creek (BC), Colorado, summer 2003 and spring 2005 tracer experiments and Lagrangian samplings.

[Site identifications from table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, and BC-D7.4 are sites downstream from the WWTP with distance in kilometers (km); m^3/s, cubic meter per second; m/s, meter per second; Auto, breakthrough curves from autosamplers; SCUFA, breakthrough curves from self-contained underwater fluorescence apparatus; number following Auto and SCUFA is percent of channel width relative to right bank looking upstream; diversion ditches at 2.6 km, 3.7 km, and 5.2 km downstream from the WWTP remove water from the stream resulting in decreased flow; values in parentheses are ditches (negative) or tributaties (positive); --, not determined.]

Site	Distance (km)	Stream Discharge (m^3/s)	Flow Velocity (m/s)
August 21, 2003 – Tracer Experiment			
BC-D3.6, Auto 10	3.6	2.97	0.48
BC-D3.6, SCUFA 50	3.6	2.97	0.48
BC-D3.6, Auto 90	3.6	2.97	0.48
BC-D5.0, Auto 50	5.0	2.50	0.46
BC-D5.0, SCUFA 50	5.0	2.50	0.46
BC-D7.4, Auto 50	7.4	0.94	0.33
April 16 to 17, 2005 – Tracer Experiment			
BC-D3.6, SCUFA 50	3.6	2.60	0.32
BC-D7.4, SCUFA 50	7.4	1.29	0.32
September 3, 2003 – Lagrangian Sampling			
BC-U	-0.1	1.62	0.27
BC-E	0	0.92	0.31
Leggett Ditch	2.6	(-0.17)	--
BC-D3.6	3.6	2.41	0.36
Dry Creek	3.7	(0.09)	--
BC-D5.0	5.0	2.89	0.23
Lower Boulder Ditch	5.2	(-0.88)	--
Boulder & Weld County Ditch	7.1	(-0.20)	--
BC-D7.4	7.4	1.84	0.60
April 19, 2005 – Lagrangian Sampling			
BC-U	-0.1	1.69	0.28
BC-E	0	1.11	0.29
Leggett Ditch	2.6	(0)	--
BC-D3.6	3.6	2.60	0.45
Dry Creek	3.7	(0.06)	--
Lower Boulder Ditch	5.2	(-1.10)	--
Boulder & Weld County Ditch	7.1	(-0.18)	--
BC-D7.4	7.4	1.29	0.45

Table 17. Summary of hydrological data for the Fourmile Creek (FC), Iowa, summer 2003 and spring 2005 tracer experiments and Lagrangian samplings.

[Site identifications from table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP with distance in kilometers (km); m^3/s, cubic meter per second; m/s, meter per second; SCUFA, breakthrough curves from self-contained underwater fluorescence apparatus; number following SCUFA is percent of channel width relative to right bank looking upstream; values in parentheses are tributary (positive) flows; --, not determined.]

Site	Distance (km)	Stream Discharge (m^3/s)	Flow Velocity (m/s)
July 30 to 31, 2003 – Tracer Experiment			
FC-D2.9, SCUFA 50	2.9	0.33	0.09
FC-D8.4, SCUFA 50	8.4	0.24	0.30
Muchikinock Creek		(0.07)	--
FC-D10.6, SCUFA 50	10.6	0.27	0.13
March 3 to 4, 2005 – Tracer Experiment			
FC-D2.9, SCUFA 50	2.9	1.09	0.36
FC-D8.4, SCUFA 50	8.4	1.12	0.43
Muchikinock Creek		(0.18)	--
August 5, 2003 – Lagrangian Sampling			
FC-U	-0.1	0.04	0.04
FC-E	0	0.14	--
FC-D0.4	0.4	0.18	0.14
FC-D2.9	2.9	0.17	0.07
FC-D8.4	8.4	0.16	0.23
Muchikinock Creek		(0.01)	--
FC-D10.6	10.6	0.16	0.16
March 8, 2005 – Lagrangian Sampling			
FC-U	-0.1	0.62	0.22
FC-E	0	0.24	--
FC-0.4	0.4	0.86	0.39
FC-D2.9	2.9	0.92	0.27
FC-D8.4	8.4	0.90	0.20

Table 18. Summary of field measurement, nutrient, carbon, major element, trace element, and biological component (table 3) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; R, unfiltered; F, filtered; <, less than method detection limit; --, not determined; m^3/s, cubic meter per second; mg/L, milligram per liter; Std units, standard pH units; µS/cm, microsiemen per centimeter; deg C, degree Celsius; NTU, nephelometric turbidity units; mg/L N, milligram per liter nitrogen; mg/L P, milligram per liter phosphorous; mg/L C, milligram per liter carbon; mg/L $CaCO_3$, milligram per liter as calcium carbonate; UV254, ultraviolet light absorbance at 254 nanometers; UV280, ultraviolet light absorbance at 280 nanometers; cm, centimeter; µg/L, microgram per liter; pla/100 mL, plaque forming units per 100 milliliters; col/100 mL, colonies per 100 milliliters.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date	--	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time	--	0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Field Measurements															
Discharge	m^3/s	1.62	0.92	2.41	2.89	1.84	--	0.04	0.14	0.18	0.17	0.16	0.16	0.01	--
Dissolved oxygen R	mg/L	6.6	6.2	7.1	8.6	7.5	--	9.0	7.9	8.8	8.2	6.2	9.0	7.2	--
pH R field	Std units	8.00	7.50	8.10	8.10	8.20	--	8.19	7.27	7.51	7.96	7.85	8.14	7.92	--
pH R lab	Std units	7.60	7.40	7.40	7.50	7.40	--	8.05	7.51	7.59	7.98	7.61	7.98	7.76	6.40
Specific conductance R field	µS/cm	171	670	320	330	350	--	720	930	870	880	860	850	640	--
Specific conductance R lab	µS/cm	171	650	309	320	330	--	700	890	840	830	860	830	610	3
Temperature air	deg C	17.8	17.8	--	24	--	--	23	23	24	24	24	24	23	--
Temperature water	deg C	17.2	21.7	20.0	20.4	20.8	--	22.3	20.1	21.2	23.1	20.9	23.1	21.5	--
Turbidity R	NTU	7.1	3.4	7.4	6.5	6.2	--	--	--	--	--	--	--	--	--
Nutrients															
Ammonia F	mg/L N	<0.04	8.5	1.4	1.3	0.79	--	<0.04	0.31	<0.2	0.15	0.03	<0.04	<0.04	<0.04
Ammonia + organic nitrogen R	mg/L N	0.2	11	2.4	2.0	1.6	--	0.6	2.1	1.7	1.5	1.3	1.1	0.7	<0.1
Ammonia + organic nitrogen F	mg/L N	0.1	11	2.2	2.0	1.4	--	0.5	1.8	1.4	1.3	1.2	1.0	0.6	<0.1
Organic nitrogen F	mg/L N	--	2.6	0.8	0.8	0.6	--	--	1.5	--	1.2	1.2	--	--	<0.1
Nitrate + nitrite F	mg/L N	0.10	8.2	2.9	2.8	3.1	--	3.3	14	11	11	10	8.5	0.87	<0.06
Nitrate F	mg/L N	0.10	7.6	2.6	2.5	2.7	--	3.2	14	11	11	10	8.3	0.82	<0.06
Nitrite F	mg/L N	0.005	0.57	0.30	0.32	0.34	--	0.045	0.25	0.22	0.20	0.22	0.18	0.049	<0.008
Orthophosphate F	mg/L P	<0.007	2.7	0.71	0.55	0.55	--	0.006	5.1	3.6	3.8	3.9	3.0	0.055	<0.007
Particulate nitrogen	mg/L N	0.07	0.35	0.11	0.20	0.10	--	0.21	0.40	0.30	0.21	0.18	0.18	0.13	<0.02
Phosphorus R	mg/L P	0.028	3.0	0.83	0.77	0.76	--	0.054	5.6	4.4	4.2	4.4	3.4	0.17	0.002
Phosphorus F	mg/L P	0.007	3.0	0.84	0.77	0.76	--	0.024	5.7	4.3	4.0	4.2	3.6	0.14	<0.004
Carbon															
Absorbance UV254 F	cm	0.064	0.134	0.085	0.087	0.089	--	0.12	0.13	0.16	0.13	0.14	0.13	0.11	<0.004
Absorbance UV280 F	cm	0.047	0.104	0.063	0.07	0.066	--	0.090	0.098	0.12	0.10	0.11	0.10	0.084	<0.004
Bicarbonate F field	mg/L	--	--	--	--	--	--	220	160	170	180	200	--	--	--
Carbonate F field	mg/L	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	--
Organic carbon F	mg/L C	2.3	7.5	3.6	3.7	4.0	--	5.2	6.6	6.4	6.3	6.1	5.3	4.7	0.5
Particulate carbon inorganic + organic	mg/L C	0.6	2.0	0.7	1.6	1.0	--	1.2	2.2	1.5	1.1	0.9	1.0	0.9	<0.1
Particulate carbon inorganic	mg/L C	<0.1	<0.1	<0.1	<0.1	<0.1	--	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Particulate carbon organic	mg/L C	0.6	2.0	0.7	1.6	0.9	--	1.2	2.2	1.5	1.1	0.9	1.0	0.9	<0.1
Major Ions															
Alkalinity F lab	mg/L $CaCO_3$	47	130	67	81	68	--	190	140	150	150	160	180	260	<2
Alkalinity F field	mg/L $CaCO_3$	--	--	--	--	--	--	180	130	140	150	160	--	--	--
Calcium F	mg/L	17	40	24	25	26	--	67	65	65	65	70	71	77	0.01
Chloride F	mg/L	8.3	54	22	21	22	--	80	110	100	100	110	100	31	0.14
Fluoride F	mg/L	0.2	1.0	0.4	0.5	0.5	--	0.4	1.0	0.8	0.8	0.8	0.8	0.3	<0.2
Magnesium F	mg/L	5.3	14	7.9	10	11	--	30	23	24	24	25	24	30	<0.008
Potassium F	mg/L	1.0	9.7	3.6	3.4	3.5	--	2.9	13	10	10	9.5	9.1	3.5	<0.16
Residue on evaporation F	mg/L	99	380	180	190	200	--	400	570	560	590	530	560	380	<10
Silica F	mg/L	4.3	9.3	5.7	5.7	5.6	--	6.7	18	15	14	14	13	13	0.05
Sodium F	mg/L	7.3	52	21	21	21	--	31	79	67	68	65	62	12	<0.1
Sulfate F	mg/L	21	80	37	41	43	--	41	80	70	71	73	69	33	<0.2
Suspended sediment R	mg/L	9.0	3.0	13	10	12	--	5.0	6.0	5.0	11	8.0	9.0	48	--
Trace Elements															
Arsenic F	µg/L	0.4	0.4	0.5	0.5	0.6	--	1.8	1.0	1.3	1.7	2.4	2.9	3.6	<0.3
Boron F	µg/L	24	210	80	78	83	--	63	270	210	220	210	190	54	<7
Iron F	µg/L	25	61	36	33	31	--	<8	79	50	22	14	8	14	<8
Lithium F	µg/L	4.2	12	6.8	7.2	7.6	--	9.7	17	15	15	15	14	7.6	<0.5
Selenium F	µg/L	0.3	0.7	0.4	0.3	0.3	--	1.5	1.9	1.8	1.9	1.8	1.8	1.0	<0.5
Strontium F	µg/L	170	340	220	240	260	--	200	190	190	190	190	200	190	<0.2
Vanadium F	µg/L	0.5	1.0	0.8	1.0	0.9	--	2.7	1.1	1.6	2.3	2.7	3.5	2.8	<0.1
Biological Components															
Pheophytin *a*	µg/L	3.0	<0.1	2.8	3.1	3.7	--	--	--	--	--	--	--	--	--
Chlorophyll *a*	µg/L	2.8	2.8	2.1	2.3	2.8	--	--	--	--	--	--	--	--	--
Coliphage (*E. coli* CN-13 host)	pla/100mL	26	1700	160	160	92	--	62	1	37	29	32	43	380	--
Coliphage (*E. coli* HS(pFamp)R host)	pla/100mL	<1	12000	1000	500	370	--	<1	4	1	2	1	<1	<1	--
E. coli	col/100mL	280	16	110	92	92	--	430	11	440	240	450	160	550	--
Entrococci	col/100mL	320	11	112	91	85	--	370	4	140	230	200	160	1000	--

Table 19. Summary of trace element and major element (table 4) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; number after element indicates replicate analysis; values are means of triplicate analyses; <, less than method detection limit; --, not determined; µg/L, microgram per liter; mg/L, milligram per liter.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Element															
Aluminum 1	µg/L	7.7	12	6.6	6.3	5.8	0.51	0.76	10	7.9	4.0	0.94	0.73	0.77	0.64
Aluminum 2	µg/L	3.6	12	6.8	6.5	5.7	2.3	0.88	11	7.7	2.9	0.78	1.0	--	1.5
Aluminum 3	µg/L	3.3	14	6.4	6.7	--	--	1.1	11	8.2	3.1	2.0	--	--	--
Antimony 1	µg/L	0.098	0.26	0.14	0.14	0.15	<0.003	0.31	0.56	0.55	0.52	0.50	0.46	0.26	<0.003
Antimony 2	µg/L	0.091	0.25	0.14	0.14	0.14	<0.003	0.31	0.57	0.51	0.51	0.50	0.47	--	<0.003
Antimony 3	µg/L	0.098	0.26	0.14	0.14	0.16	--	0.30	0.56	0.51	0.51	0.49	--	--	--
Arsenic 1	µg/L	0.40	0.41	0.47	0.51	0.61	<0.03	1.7	1.1	1.3	1.7	2.3	2.8	3.4	<0.03
Arsenic 2	µg/L	0.40	0.41	0.49	0.51	0.59	<0.03	1.6	1.1	1.3	1.7	2.3	2.8	--	<0.03
Arsenic 3	µg/L	0.41	0.39	0.48	0.51	0.58	--	1.7	1.1	1.3	1.7	2.4	--	--	--
Barium 1	µg/L	29	23	29	30	32	<0.02	110	30	49	52	65	72	120	0.0188
Barium 2	µg/L	29	22	29	30	32	0.0666	110	30	50	53	65	75	--	0.0316
Barium 3	µg/L	29	23	29	30	34	--	110	29	50	53	66	--	--	--
Beryllium 1	µg/L	<0.003	0.003	0.004	0.003	0.003	<0.003	<0.003	<0.003	0.005	0.003	0.003	<0.003	<0.003	<0.003
Beryllium 2	µg/L	0.005	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	--	<0.003
Beryllium 3	µg/L	0.004	<0.003	<0.003	<0.003	<0.003	--	0.003	<0.003	<0.003	0.003	<0.003	--	--	--
Bismuth 1	µg/L	<0.002	0.061	0.008	0.007	0.008	<0.002	<0.002	0.058	0.032	0.021	0.012	0.009	<0.002	<0.002
Bismuth 2	µg/L	<0.002	0.063	0.008	0.008	0.005	<0.002	<0.002	0.060	0.032	0.019	0.011	0.009	--	<0.002
Bismuth 3	µg/L	<0.002	0.066	0.008	0.008	0.007	--	<0.002	0.058	0.033	0.019	0.012	--	--	--
Boron 1	µg/L	20	200	77	73	77	<4	76	300	250	250	240	220	66	<4
Boron 2	µg/L	19	190	76	74	77	<4	78	300	250	250	240	220	--	<4
Boron 3	µg/L	20	200	75	72	79	--	78	290	250	250	240	--	--	--
Cadmium 1	µg/L	0.007	0.019	0.011	0.012	0.010	0.0017	0.010	0.076	0.071	0.087	0.104	0.101	0.009	0.0047
Cadmium 2	µg/L	0.007	0.022	0.013	0.014	0.012	0.0024	0.010	0.071	0.064	0.083	0.101	0.106	--	0.0043
Cadmium 3	µg/L	0.006	0.023	0.011	0.015	0.024	--	0.008	0.072	0.069	0.083	0.110	--	--	--
Calcium 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Calcium 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cerium 1	µg/L	0.036	0.008	0.034	0.033	0.032	<0.0005	0.015	0.006	0.011	0.019	0.017	0.016	0.022	0.0010
Cerium 2	µg/L	0.030	0.008	0.033	0.034	0.032	0.0029	0.016	0.006	0.011	0.019	0.017	0.018	--	0.0013
Cerium 3	µg/L	0.030	0.010	0.034	0.034	0.072	--	0.016	0.005	0.012	0.019	0.018	--	--	--
Cesium 1	µg/L	<0.002	0.059	0.022	0.020	0.020	<0.002	<0.002	0.042	0.038	0.010	0.0050	0.0037	0.0027	<0.002
Cesium 2	µg/L	<0.002	0.058	0.023	0.020	0.019	<0.002	<0.002	0.043	0.028	0.010	0.0035	0.0086	--	0.0061
Cesium 3	µg/L	<0.002	0.061	0.021	0.020	0.020	--	<0.002	0.040	0.029	0.011	0.0060	--	--	--
Chromium 1	µg/L	<0.1	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	0.23	0.15	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium 2	µg/L	<0.1	0.21	<0.1	<0.1	<0.1	<0.1	<0.1	0.23	0.12	<0.1	<0.1	<0.1	--	<0.1
Chromium 3	µg/L	<0.1	0.23	<0.1	<0.1	<0.1	--	<0.1	0.22	0.14	<0.1	<0.1	--	--	--
Cobalt 1	µg/L	0.018	0.27	0.11	0.10	0.12	<0.006	0.19	0.26	0.27	0.47	0.64	0.73	0.37	<0.006
Cobalt 2	µg/L	0.014	0.26	0.11	0.10	0.12	<0.006	0.20	0.27	0.28	0.44	0.64	0.73	--	<0.006
Cobalt 3	µg/L	0.015	0.28	0.11	0.11	0.12	--	0.20	0.26	0.26	0.45	0.62	--	--	--
Copper 1	µg/L	1.7	8.3	2.8	2.5	2.6	<0.1	1.7	4.2	4.2	4.4	4.5	4.0	1.0	0.6458
Copper 2	µg/L	1.4	8.6	2.7	2.6	2.6	0.25	1.7	4.5	3.9	4.3	4.5	4.1	--	0.2062
Copper 3	µg/L	1.4	8.1	2.8	2.8	2.6	--	1.6	4.5	4.0	4.4	4.4	--	--	--
Dysprosium 1	µg/L	0.0038	0.0026	0.0037	0.0032	0.0042	<0.0004	0.0066	0.0021	0.0043	0.0068	0.0077	0.0095	0.0048	<0.0004
Dysprosium 2	µg/L	0.0029	0.0026	0.0034	0.0035	0.0041	<0.0004	0.0062	0.0023	0.0036	0.0067	0.0075	0.0090	--	<0.0004
Dysprosium 3	µg/L	0.0033	0.0024	0.0038	0.0038	0.0057	--	0.0064	0.0025	0.0038	0.0060	0.0088	--	--	--
Erbium 1	µg/L	0.0022	0.0035	0.0028	0.0026	0.0030	<0.0003	0.0046	0.0021	0.0029	0.0044	0.0057	0.0063	0.0036	<0.0003
Erbium 2	µg/L	0.0029	0.0029	0.0031	0.0026	0.0028	<0.0003	0.0044	0.0019	0.0030	0.0040	0.0056	0.0061	--	<0.0003
Erbium 3	µg/L	0.0020	0.0032	0.0028	0.0027	0.0041	--	0.0045	0.0017	0.0031	0.0043	0.0063	--	--	--
Europium 1	µg/L	0.0006	0.0005	0.0012	0.0004	0.0007	<0.0002	0.0015	0.0003	<0.0002	0.0006	0.0013	0.0012	<0.0002	<0.0002
Europium 2	µg/L	0.0010	0.0002	0.0009	0.0007	0.0008	<0.0002	0.0025	<0.0002	0.0007	0.0011	0.0011	0.0009	--	<0.0002
Europium 3	µg/L	0.0008	<0.0002	0.0009	0.0006	0.0011	--	0.0004	0.0003	0.0008	0.0007	0.0005	--	--	--
Gadolinium 1	µg/L	0.0047	0.15	0.042	0.041	0.039	<0.0003	0.0064	0.058	0.046	0.050	0.054	0.046	0.014	<0.0003
Gadolinium 2	µg/L	0.0039	0.14	0.047	0.041	0.041	<0.0003	0.0072	0.057	0.047	0.051	0.054	0.047	--	<0.0003
Gadolinium 3	µg/L	0.0048	0.15	0.045	0.042	0.044	--	0.0063	0.055	0.050	0.052	0.055	--	--	--
Holmium 1	µg/L	0.0008	0.0009	0.0008	0.0008	0.0008	<0.0001	0.0013	0.0005	0.0007	0.0012	0.0019	0.0022	0.0011	<0.0001
Holmium 2	µg/L	0.0008	0.0008	0.0008	0.0008	0.0009	<0.0001	0.0015	0.0005	0.0010	0.0012	0.0021	0.0022	--	<0.0001
Holmium 3	µg/L	0.0008	0.0009	0.0009	0.0008	0.0012	--	0.0016	0.0005	0.0009	0.0012	0.0020	--	--	--
Iron 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Iron 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Lanthanum 1	µg/L	0.026	0.0084	0.023	0.021	0.021	<0.0002	0.014	0.0040	0.0079	0.013	0.012	0.011	0.015	0.0006
Lanthanum 2	µg/L	0.021	0.0089	0.022	0.022	0.021	0.0014	0.015	0.0039	0.0084	0.013	0.012	0.011	--	0.0008
Lanthanum 3	µg/L	0.020	0.0091	0.022	0.021	0.038	--	0.014	0.0042	0.0083	0.013	0.013	--	--	--
Lead 1	µg/L	<0.09	0.36	0.18	0.15	0.18	<0.09	0.16	0.68	1.2	0.51	0.45	0.34	<0.09	<0.09
Lead 2	µg/L	<0.09	0.38	0.20	0.14	0.18	<0.09	0.24	0.69	0.53	0.50	0.45	0.35	--	<0.09
Lead 3	µg/L	<0.09	0.38	0.18	0.15	0.38	--	0.09	0.75	0.59	0.52	0.47	--	--	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D5.0	BC-D7.4	Blank	FC-U	FC-E	FC-D0.4	FC-D2.9	FC-D8.4	FC-D10.6	FC-MC	Blank
Lithium 1	µg/L	3.9	12	6.3	6.7	7.1	<0.02	11	17	17	17	16	15	8.5	<0.02
Lithium 2	µg/L	3.8	11	6.2	6.7	7.1	<0.02	11	18	16	16	16	15	--	<0.02
Lithium 3	µg/L	3.9	12	6.2	6.6	7.0	--	11	18	17	17	16	--	--	--
Lutetium 1	µg/L	0.0004	0.0013	0.0008	0.0006	0.0008	<0.0001	0.0012	0.0011	0.0010	0.0013	0.0015	0.0016	0.0008	<0.0001
Lutetium 2	µg/L	0.0004	0.0011	0.0007	0.0008	0.0009	<0.0001	0.0012	0.0011	0.0011	0.0013	0.0015	0.0017	--	<0.0001
Lutetium 3	µg/L	0.0005	0.0012	0.0008	0.0007	0.0010	--	0.0011	0.0009	0.0009	0.0013	0.0019	--	--	--
Magnesium 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Magnesium 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Manganese 1	µg/L	10	35	18	15	14	<0.07	10	41	31	41	13	61	434	<0.07
Manganese 2	µg/L	10	35	18	15	13	<0.07	10	42	32	40	13	62	--	<0.07
Manganese 3	µg/L	10	35	18	15	14	--	10	42	32	40	13	--	--	--
Molybdenum 1	µg/L	0.82	4.2	1.8	1.8	2.0	<0.05	3.1	7.2	6.3	6.6	6.4	6.1	2.5	<0.05
Molybdenum 2	µg/L	0.83	4.3	1.8	1.8	2.0	<0.05	3.1	7.3	6.4	6.5	6.6	6.2	--	<0.05
Molybdenum 3	µg/L	0.82	4.2	1.9	1.9	1.8	--	3.0	7.3	6.5	6.7	6.4	--	--	--
Neodymium 1	µg/L	0.026	0.0059	0.024	0.024	0.025	0.0006	0.018	0.0051	0.0096	0.017	0.020	0.019	0.017	0.0005
Neodymium 2	µg/L	0.025	0.0066	0.023	0.024	0.023	0.0021	0.020	0.0053	0.012	0.018	0.018	0.020	--	0.0008
Neodymium 3	µg/L	0.022	0.0065	0.024	0.025	0.039	--	0.017	0.0053	0.011	0.017	0.020	--	--	--
Nickel 1	µg/L	0.33	2.1	0.88	0.75	0.90	0.0271	2.0	3.5	3.2	3.9	4.6	4.7	2.3	0.0357
Nickel 2	µg/L	0.28	2.1	0.84	0.81	0.87	0.0343	2.0	3.7	3.4	3.7	4.7	4.8	--	0.0329
Nickel 3	µg/L	0.26	2.2	0.86	0.80	0.90	--	2.0	3.5	3.4	3.8	4.6	--	--	--
Potassium 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Potassium 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Praseodymuim 1	µg/L	0.0062	0.0012	0.0053	0.0059	0.0052	<0.0001	0.0036	0.0010	0.0022	0.0039	0.0038	0.0037	0.0034	<0.0001
Praseodymuim 2	µg/L	0.0052	0.0014	0.0055	0.0057	0.0050	0.0001	0.0036	0.0011	0.0023	0.0034	0.0041	0.0037	--	0.0001
Praseodymuim 3	µg/L	0.0053	0.0012	0.0054	0.0054	0.0098	--	0.0038	0.0011	0.0023	0.0035	0.0039	--	--	--
Rhenium 1	µg/L	0.010	0.032	0.016	0.017	0.017	<0.0002	0.029	0.055	0.050	0.050	0.050	0.044	0.018	<0.0002
Rhenium 2	µg/L	0.010	0.029	0.017	0.017	0.018	<0.0002	0.029	0.058	0.051	0.049	0.049	0.049	--	<0.0002
Rhenium 3	µg/L	0.009	0.031	0.016	0.016	0.018	--	0.028	0.054	0.053	0.050	0.052	--	--	--
Rubidium 1	µg/L	0.78	6.8	2.7	2.5	2.5	0.0014	0.992	8.2	6.5	6.1	5.3	4.6	1.5	0.0014
Rubidium 2	µg/L	0.76	6.6	2.6	2.5	2.5	0.0044	0.998	8.2	6.4	5.9	5.3	4.7	--	0.0016
Rubidium 3	µg/L	0.77	6.7	2.6	2.5	2.6	--	0.988	8.2	6.5	6.1	5.4	--	--	--
Samarium 1	µg/L	0.0056	0.0020	0.0055	0.0050	0.0052	<0.0007	0.0047	0.0012	0.0035	0.0038	0.0057	0.0060	0.0041	<0.0007
Samarium 2	µg/L	0.0044	0.0018	0.0051	0.0046	0.0049	0.0007	0.0059	0.0012	0.0029	0.0045	0.0055	0.0050	--	<0.0007
Samarium 3	µg/L	0.0042	0.0016	0.0045	0.0044	0.0076	--	0.0051	0.0015	0.0029	0.0047	0.0052	--	--	--
Selenium 1	µg/L	0.16	<0.04	<0.04	<0.04	<0.04	<0.04	1.0	1.0	1.1	1.1	1.0	1.0	0.680	<0.04
Selenium 2	µg/L	0.16	<0.04	<0.04	<0.04	<0.04	<0.04	1.0	1.1	1.1	1.1	1.1	1.1	--	<0.04
Selenium 3	µg/L	0.19	<0.04	<0.04	<0.04	<0.04	--	1.0	1.1	1.1	1.1	1.0	--	--	--
Silica 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silica 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Silica 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sodium 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Strontium 1	µg/L	150	330	210	230	250	0.020	210	190	200	200	190	200	190	0.028
Strontium 2	µg/L	150	320	220	240	250	0.11	200	190	190	190	190	200	--	0.040
Strontium 3	µg/L	160	330	210	240	250	--	200	190	200	190	200	--	--	--
Sulfur 1	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur 2	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur 3	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tellurium 1	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	0.007	<0.004	0.005	<0.004	0.006	0.007	0.009	<0.004
Tellurium 2	µg/L	<0.004	0.006	<0.004	<0.004	<0.004	<0.004	0.007	0.005	0.007	<0.004	<0.004	0.005	--	<0.004
Tellurium 3	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	0.008	<0.004	<0.004	0.007	0.007	--	--	--
Terbium 1	µg/L	0.0005	0.0003	0.0006	0.0007	0.0006	<0.0001	0.0011	0.0003	0.0006	0.0010	0.0012	0.0013	0.0008	<0.0001
Terbium 2	µg/L	0.0005	0.0004	0.0007	0.0007	0.0007	<0.0001	0.0008	0.0003	0.0006	0.0009	0.0011	0.0014	--	<0.0001
Terbium 3	µg/L	0.0005	0.0004	0.0006	0.0007	0.0010	--	0.0010	0.0004	0.0006	0.0010	0.0014	--	--	--
Thallium 1	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Thallium 2	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	--	<0.02
Thallium 3	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	--	<0.02	<0.02	<0.02	<0.02	<0.02	--	--	--
Thorium 1	µg/L	0.0043	0.0041	0.0045	0.0038	0.0069	<0.0008	0.0021	0.0027	0.0027	0.0024	0.0017	0.0018	0.0011	<0.0008
Thorium 2	µg/L	0.0044	0.0030	0.0049	0.0054	0.0042	<0.0008	0.0014	0.0054	0.0019	0.0030	0.0015	0.0009	--	<0.0008
Thorium 3	µg/L	0.0045	0.0044	0.0043	0.0050	0.0091	--	0.0010	0.0046	0.0011	0.0022	0.0013	--	--	--
Thulium 1	µg/L	0.0005	0.0005	0.0005	0.0005	0.0006	<0.0001	0.0008	0.0005	0.0006	0.0007	0.0011	0.0010	0.0006	<0.0001
Thulium 2	µg/L	0.0004	0.0005	0.0005	0.0006	0.0006	<0.0001	0.0008	0.0005	0.0006	0.0006	0.0010	0.0011	--	<0.0001
Thulium 3	µg/L	0.0003	0.0006	0.0006	0.0005	0.0008	--	0.0008	0.0004	0.0005	0.0007	0.0011	--	--	--
Tungsten 1	µg/L	0.18	0.23	0.21	0.22	0.22	<0.005	0.011	<0.005	0.005	0.007	0.008	0.009	<0.005	<0.005
Tungsten 2	µg/L	0.17	0.23	0.22	0.22	0.22	<0.005	0.011	<0.005	<0.005	0.006	0.008	0.008	--	<0.005
Tungsten 3	µg/L	0.18	0.22	0.21	0.22	0.24	--	0.010	<0.005	0.005	0.006	0.009	--	--	--
Uranium 1	µg/L	0.68	0.91	0.81	1.0	1.2	<0.003	4.2	0.48	1.5	1.5	1.4	1.8	3.5	<0.003
Uranium 2	µg/L	0.68	0.91	0.82	1.1	1.2	<0.003	4.2	0.50	1.5	1.5	1.4	1.8	--	<0.003
Uranium 3	µg/L	0.69	0.91	0.81	1.1	1.2	--	4.2	0.48	1.4	1.5	1.4	--	--	--
Vanadium 1	µg/L	<0.2	0.44	0.32	0.47	0.61	<0.2	1.9	0.44	0.97	1.7	2.2	2.6	1.9	<0.2
Vanadium 2	µg/L	<0.2	0.32	0.36	0.38	0.55	<0.2	1.9	0.45	0.92	1.6	2.2	2.7	--	<0.2
Vanadium 3	µg/L	<0.2	0.35	0.37	0.41	0.47	--	1.9	0.47	0.92	1.7	2.1	--	--	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D5.0	BC-D7.4	Blank	FC-U	FC-E	FC-D0.4	FC-D2.9	FC-D8.4	FC-D10.6	FC-MC	Blank
Ytterbium 1	µg/L	0.0028	0.0057	0.0038	0.0040	0.0043	<0.0003	0.0057	0.0036	0.0044	0.0057	0.0073	0.0085	0.0041	<0.0003
Ytterbium 2	µg/L	0.0024	0.0052	0.0039	0.0038	0.0045	<0.0003	0.0066	0.0039	0.0042	0.0053	0.0082	0.0091	--	<0.0003
Ytterbium 3	µg/L	0.0027	0.0057	0.0037	0.0040	0.0050	--	0.0054	0.0033	0.0045	0.0063	0.0085	--	--	--
Yttrium 1	µg/L	0.022	0.019	0.024	0.022	0.024	<0.0001	0.044	0.018	0.027	0.043	0.059	0.059	0.041	0.0003
Yttrium 2	µg/L	0.020	0.019	0.023	0.023	0.024	0.0010	0.044	0.020	0.027	0.043	0.062	0.061	--	0.0006
Yttrium 3	µg/L	0.020	0.019	0.023	0.023	0.033	--	0.044	0.019	0.027	0.043	0.058	--	--	--
Zinc 1	µg/L	1.7	24	8.2	7.3	7.3	0.6592	1.7	40	32	33	27	22	0.84	0.4977
Zinc 2	µg/L	3.3	24	7.9	7.3	7.0	3.1298	1.7	40	32	31	27	22	--	0.4437
Zinc 3	µg/L	1.0	23	7.6	7.3	8.0	--	1.5	42	34	32	28	--	--	--
Zirconium 1	µg/L	0.023	0.142	0.037	0.029	0.049	0.0026	0.056	0.072	0.071	0.053	0.052	0.054	0.057	<0.0006
Zirconium 2	µg/L	0.083	0.131	0.036	0.039	0.037	0.0068	0.050	0.073	0.064	0.054	0.046	0.060	--	<0.0006
Zirconium 3	µg/L	0.020	0.107	0.029	0.026	0.055	--	0.051	0.077	0.097	0.050	0.054	--	--	--

Table 20. Summary of acidic organic wastewater compound (table 5) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1640	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
Ethylenediaminetetraacetic acid 1	µg/L	0.1	100	16	--	13	0.5	0.3	230	130	110	95	58	0.6	<0.1
Ethylenediaminetetraacetic acid 2	µg/L	0.2	100	15	--	18	0.3	--	--	--	--	--	--	--	--
Ethylenediaminetetraacetic acid 3	µg/L	0.2	100	16	--	22	0.3	--	--	--	--	--	--	--	--
Nitrilotriacetic acid 1	µg/L	<0.1	1.5	0.5	--	0.4	<0.1	0.0	0.6	0.5	0.4	0.6	0.3	<0.1	<0.1
Nitrilotriacetic acid 2	µg/L	<0.1	1.1	0.4	--	0.7	<0.1	--	--	--	--	--	--	--	--
Nitrilotriacetic acid 3	µg/L	<0.1	1.2	0.4	--	0.9	<0.1	--	--	--	--	--	--	--	--
4-Nonylphenolmonoethoxycarboxylic acid 1	µg/L	0.6	130	46	--	38	1.6	0.5	5.3	6.5	4.6	8.5	4.5	1.8	<0.1
4-Nonylphenolmonoethoxycarboxylic acid 2	µg/L	0.8	110	54	--	52	0.7	--	--	--	--	--	--	--	--
4-Nonylphenolmonoethoxycarboxylic acid 3	µg/L	0.6	110	42	--	71	1.3	--	--	--	--	--	--	--	--
4-Nonylphenoldiethoxycarboxylic acid 1	µg/L	0.1	38	15	--	15	1.1	0.2	7.1	7.1	6.0	8.3	4.4	1.0	<0.1
4-Nonylphenoldiethoxycarboxylic acid 2	µg/L	0.2	37	16	--	21	0.5	--	--	--	--	--	--	--	--
4-Nonylphenoldiethoxycarboxylic acid 3	µg/L	0.2	42	17	--	27	2.1	--	--	--	--	--	--	--	--
4-Nonylphenoltriethoxycarboxylic acid 1	µg/L	<0.1	1.0	0.4	--	0.4	<0.1	0.1	0.5	0.5	0.3	0.4	0.2	0.1	<0.1
4-Nonylphenoltriethoxycarboxylic acid 2	µg/L	<0.1	1.2	0.4	--	0.4	<0.1	--	--	--	--	--	--	--	--
4-Nonylphenoltriethoxycarboxylic acid 3	µg/L	<0.1	1.2	0.4	--	0.6	<0.1	--	--	--	--	--	--	--	--
4-Nonylphenoltetraethoxycarboxylic acid 1	µg/L	<0.1	0.5	0.2	--	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
4-Nonylphenoltetraethoxycarboxylic acid 2	µg/L	<0.1	0.6	0.2	--	0.2	<0.1	--	--	--	--	--	--	--	--
4-Nonylphenoltetraethoxycarboxylic acid 3	µg/L	<0.1	0.6	0.2	--	0.2	<0.1	--	--	--	--	--	--	--	--
Surrogate Standards															
4-*normal*-Nonylphenoldiethoxycarboxylic acid 1	percent	92	77	91	--	95	310	32	28	12	38	26	27	41	--
4-*normal*-Nonylphenoldiethoxycarboxylic acid 2	percent	100	80	100	--	140	200	--	--	--	--	--	--	--	--
4-*normal*-Nonylphenoldiethoxycarboxylic acid 3	percent	69	93	100	--	150	230	--	--	--	--	--	--	--	--

Table 21. Summary of antibiotic compound (table 6) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; values in italics were analyzed at a lower detection limit using liquid chromatography/tandem mass spectrometry; number after compound indicates replicate analysis; <, less than laboratory reporting level; --not determined; µg/L, microgram per liter.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
Amoxicillin 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Amoxicillin 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
Amoxicillin 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
Ampicillin 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Ampicillin 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Ampicillin 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Azithromycin 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Azithromycin 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Azithromycin 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbadox 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	--	--	--	--	--	--	--	--
Carbadox 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	--	--	--	--	--	--	--	--
Carbadox 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	--	--	--	--	--	--	--	--
Cefotaxime 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cefotaxime 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Cefotaxime 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Chlorotetracycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Chlorotetracycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Chlorotetracycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
anhydro-Chlorotetracycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
anhydro-Chlorotetracycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
anhydro-Chlorotetracycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
epi-Chlorotetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Chlorotetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Chlorotetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Chlorotetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Chlorotetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Chlorotetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-iso-Chlorotetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-iso-Chlorotetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-iso-Chlorotetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iso-Chlorotetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iso-Chlorotetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
iso-Chlorotetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ciprofloxacin 1	µg/L	*<0.005*	*0.033*	*0.002*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ciprofloxacin 2	µg/L	*<0.005*	*0.028*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Ciprofloxacin 3	µg/L	*<0.005*	*0.033*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Clinafloxacin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Clinafloxacin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Clinafloxacin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Cloxacillin 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cloxacillin 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Cloxacillin 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Demeclocycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Demeclocycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Demeclocycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Doxycycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Doxycycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Doxycycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Erythromycin 1	µg/L	*<0.005*	*0.56*	*0.080*	*0.060*	*0.087*	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.05
Erythromycin 2	µg/L	*<0.005*	*0.083*	*0.10*	*0.091*	*0.10*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Erythromycin 3	µg/L	*<0.005*	*0.54*	*0.08*	*0.091*	*0.12*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
anhydro-Erythromycin 1	µg/L	*<0.005*	*4.2*	*0.82*	*0.70*	*0.61*	*<0.005*	<0.05	<0.05	<0.05	0.16	0.14	0.08	<0.05	<0.05
anhydro-Erythromycin 2	µg/L	*<0.005*	*0.35*	*0.62*	*0.55*	*0.44*	--	<0.05	<0.05	<0.05	0.16	0.12	0.09	<0.05	--
anhydro-Erythromycin 3	µg/L	*<0.005*	*3.7*	*0.79*	*0.77*	*0.64*	--	<0.05	<0.05	<0.05	0.16	0.12	0.09	<0.05	--
Flumequine 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Flumequine 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Flumequine 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Lincomycin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lincomycin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Lincomycin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Lomefloxacin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lomefloxacin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Lomefloxacin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Minocycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Minocycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
Minocycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
Norfloxacin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Norfloxacin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Norfloxacin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Ofloxacin 1	µg/L	*<0.005*	*0.097*	*0.007*	*<0.005*	*0.004*	<0.05	<0.05	0.37	0.18	0.09	<0.05	<0.05	<0.05	<0.05
Ofloxacin 2	µg/L	*<0.005*	*0.092*	*0.012*	*0.010*	*0.007*	--	<0.05	0.40	0.20	0.09	<0.05	<0.05	<0.05	--
Ofloxacin 3	µg/L	*<0.005*	*0.10*	*0.006*	*0.010*	*0.005*	--	<0.05	0.34	0.22	0.09	<0.05	<0.05	<0.05	--
Ormetoprim 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ormetoprim 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Ormetoprim 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Oxacillin 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Oxacillin 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Oxacillin 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Oxolinic Acid 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Oxolinic Acid 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Oxolinic Acid 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Oxytetracycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Oxytetracycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Oxytetracycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
alpha-apo-Oxytetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
alpha-apo-Oxytetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
alpha-apo-Oxytetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
beta-apo-Oxytetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
beta-apo-Oxytetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
beta-apo-Oxytetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Oxytetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Oxytetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Oxytetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Penicillin G 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Penicillin G 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Penicillin G 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Penicillin V 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Penicillin V 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Penicillin V 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Roxithromycin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Roxithromycin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Roxithromycin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Sarafloxacin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sarafloxacin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sarafloxacin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfachloropyridazine 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfachloropyridazine 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfachloropyridazine 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfadiazine 1	µg/L	*<0.005*	*0.11*	*0.046*	*<0.005*	*0.067*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfadiazine 2	µg/L	*<0.005*	*0.17*	*0.036*	*<0.005*	*0.034*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfadiazine 3	µg/L	*<0.005*	*0.097*	*0.028*	*0.042*	*0.046*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfadimethoxine 1	µg/L	*<0.005*	*0.005*	*0.003*	*<0.005*	*0.002*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfadimethoxine 2	µg/L	*<0.005*	*0.004*	*0.002*	*<0.005*	*0.001*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfadimethoxine 3	µg/L	*<0.005*	*0.004*	*0.002*	*<0.005*	*0.002*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfamerazine 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfamerazine 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfamerazine 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfamethazine 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfamethazine 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfamethazine 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfamethoxazole 1	µg/L	*<0.005*	*0.53*	*0.19*	*0.017*	*0.20*	<0.05	<0.05	0.28	0.15	0.20	0.18	0.24	<0.05	<0.05
Sulfamethoxazole 2	µg/L	*<0.005*	*0.87*	*0.20*	*0.042*	*0.17*	--	<0.05	0.22	0.16	0.19	0.16	0.19	<0.05	--
Sulfamethoxazole 3	µg/L	*<0.005*	*0.55*	*0.12*	*0.093*	*0.20*	--	<0.05	0.27	0.17	0.19	0.18	0.21	<0.05	--
Sulfathiazole 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulfathiazole 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Sulfathiazole 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Tetracycline 1	µg/L	*<0.01*	*0.034*	*<0.01*	*<0.01*	*<0.01*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tetracycline 2	µg/L	*<0.01*	*0.023*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Tetracycline 3	µg/L	*<0.01*	*0.040*	*<0.01*	*<0.01*	*<0.01*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
anhydro-Tetracycline 1	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
anhydro-Tetracycline 2	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
anhydro-Tetracycline 3	µg/L	*<0.01*	*<0.01*	*<0.01*	*<0.01*	*<0.01*	--	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	--
epi-Tetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Tetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Tetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Tetracycline 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Tetracycline 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-anhydro-Tetracycline 3	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trimethoprim 1	µg/L	*<0.005*	*0.061*	*0.090*	*0.57*	*0.067*	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Trimethoprim 2	µg/L	*<0.005*	*0.25*	*0.068*	*0.041*	*0.007*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Trimethoprim 3	µg/L	*<0.005*	*0.31*	*0.093*	*0.065*	*0.021*	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Tylosin 1	µg/L	*<0.005*	*0.028*	*0.003*	*<0.005*	*<0.005*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Tylosin 2	µg/L	*<0.005*	*0.025*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Tylosin 3	µg/L	*<0.005*	*0.029*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Virginiamycin 1	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Virginiamycin 2	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Virginiamycin 3	µg/L	*<0.005*	*<0.005*	*<0.005*	*<0.005*	*<0.005*	--	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	--
Surrogate Standards															
Meclocycline	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nalidixic Acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Oleandomycin	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
^{13}C6 Sulfamethazine	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 22. Summary of pharmaceutical compound (table 7) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than laboratory reporting level; --, not determined; E, estimated value.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
Acetaminophen 1	µg/L	<0.036	<0.036	<0.036	<0.036	<0.036	<0.036	<0.036	<0.036	0.017	<0.036	<0.036	<0.036	<0.036	<0.036
Acetaminophen 2	µg/L	--	0.29	0.0004	--	<0.036	<0.036	<0.036	<0.036	<0.036	E0.006	<0.036	<0.036	--	--
Acetaminophen 3	µg/L	--	--	--	--	--	--	<0.036	<0.036	<0.036	0.016	<0.036	<0.036	--	--
Azithromycin 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Azithromycin 2	µg/L	--	0.083	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Azithromycin 3	µg/L	--	--	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Caffeine 1	µg/L	0.013	0.71	0.23	0.21	0.21	0.001	E0.003	<0.016	<0.016	E0.004	<0.016	<0.016	E0.005	<0.016
Caffeine 2	µg/L	--	0.97	0.25	--	0.21	0.029	E0.002	<0.016	<0.016	<0.016	<0.016	<0.016	--	--
Caffeine 3	µg/L	--	--	--	--	--	--	E0.001	<0.016	<0.016	<0.016	<0.016	<0.016	--	--
Carbamazapine 1	µg/L	<0.011	0.090	0.040	0.040	0.041	0.001	<0.011	0.23	0.20	0.18	0.18	0.17	<0.011	<0.011
Carbamazapine 2	µg/L	--	0.27	0.038	--	0.039	0.001	<0.011	0.25	0.18	0.091	0.20	0.18	--	--
Carbamazapine 3	µg/L	--	--	--	--	--	--	<0.011	0.25	0.19	0.19	0.22	0.21	--	--
Cimetidine 1	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.050	0.025	0.020	0.019	0.013	<0.012	<0.012
Cimetidine 2	µg/L	--	0.22	<0.012	--	<0.012	<0.012	<0.012	0.060	0.037	0.010	0.023	0.019	--	--
Cimetidine 3	µg/L	--	--	--	--	--	--	<0.012	0.046	0.032	0.022	0.026	0.019	--	--
Codeine 1	µg/L	<0.015	0.065	0.018	0.017	0.016	<0.015	<0.015	0.18	0.14	0.10	0.066	0.045	<0.015	<0.015
Codeine 2	µg/L	--	0.53	0.018	--	0.015	<0.015	<0.015	0.21	0.12	0.036	0.077	0.048	--	--
Codeine 3	µg/L	--	--	--	--	--	--	<0.015	0.21	0.14	0.099	0.079	0.052	--	--
Cotinine 1	µg/L	0.002	0.079	0.020	0.019	0.019	<0.014	E0.004	0.096	0.055	0.059	0.042	0.040	E0.004	<0.014
Cotinine 2	µg/L	--	0.71	0.019	--	0.018	<0.014	<0.014	0.11	0.068	0.022	0.051	0.049	--	--
Cotinine 3	µg/L	--	--	--	--	--	--	<0.014	0.11	0.078	0.054	0.054	0.047	--	--
Dehydronifedipine 1	µg/L	<0.015	0.003	<0.015	<0.015	<0.015	<0.015	<0.015	0.010	E0.007	E0.008	E0.007	E0.006	<0.015	<0.015
Dehydronifedipine 2	µg/L	--	0.60	<0.015	--	<0.015	<0.015	<0.015	0.010	E0.008	E0.005	E0.008	E0.007	--	--
Dehydronifedipine 3	µg/L	--	--	--	--	--	--	<0.015	0.010	E0.008	E0.007	E0.008	E0.008	--	--
Diltiazem 1	µg/L	<0.016	0.016	0.006	0.005	0.004	<0.016	<0.016	0.032	0.027	0.015	0.009	E0.004	<0.016	<0.016
Diltiazem 2	µg/L	--	0.21	0.007	--	0.004	<0.016	<0.016	0.037	0.019	E0.006	E0.008	E0.005	--	--
Diltiazem 3	µg/L	--	--	--	--	--	--	<0.016	0.035	0.019	0.016	E0.010	E0.007	--	--
1,7-Dimethylxanthine 1	µg/L	<0.144	1.3	0.28	0.23	0.27	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144
1,7-Dimethylxanthine 2	µg/L	--	1.5	0.28	--	0.20	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	--	--
1,7-Dimethylxanthine 3	µg/L	--	--	--	--	--	--	<0.144	<0.144	<0.144	<0.144	<0.144	<0.144	--	--
Diphenhydramine 1	µg/L	<0.015	0.10	0.018	0.014	0.015	<0.015	<0.015	0.22	0.15	E0.009	<0.015	<0.015	<0.015	<0.015
Diphenhydramine 2	µg/L	--	0.30	0.020	--	0.011	<0.015	<0.015	0.26	0.13	E0.004	<0.015	<0.015	--	--
Diphenhydramine 3	µg/L	--	--	--	--	--	--	<0.015	0.24	0.14	0.012	<0.015	<0.015	--	--
Erythromycin 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Erythromycin 2	µg/L	--	<0.05	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Erythromycin 3	µg/L	--	--	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Fluoxetine 1	µg/L	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014
Fluoxetine 2	µg/L	--	0.023	<0.014	--	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	--	--
Fluoxetine 3	µg/L	--	--	--	--	--	--	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	--	--
Furosemide 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Furosemide 2	µg/L	--	<0.05	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Furosemide 3	µg/L	--	--	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Gemfibrozil 1	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Gemfibrozil 2	µg/L	--	0.32	<0.013	--	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	--	--
Gemfibrozil 3	µg/L	--	--	--	--	--	--	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	--	--
Ibuprofen 1	µg/L	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042
Ibuprofen 2	µg/L	--	<0.042	<0.042	--	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	--	--
Ibuprofen 3	µg/L	--	--	--	--	--	--	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	--	--
Metformin 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Metformin 2	µg/L	--	<0.05	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Metformin 3	µg/L	--	--	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Miconazole 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Miconazole 2	µg/L	--	0.038	<0.05	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Miconazole 3	µg/L	--	--	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--	--
Ranitidine 1	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	0.021	<0.013	<0.013	<0.013	<0.013	<0.013
Ranitidine 2	µg/L	--	0.10	<0.013	--	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	--	--
Ranitidine 3	µg/L	--	--	--	--	--	--	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	--	--
Salbutamol 1	µg/L	<0.023	<0.023	0.002	<0.023	<0.023	<0.023	<0.023	0.013	<0.023	0.012	<0.023	E0.006	<0.023	<0.023
Salbutamol 2	µg/L	--	0.48	<0.023	--	<0.023	<0.023	<0.023	E0.019	E0.011	<0.023	E0.010	E0.004	--	--
Salbutamol 3	µg/L	--	--	--	--	--	--	<0.023	E0.018	E0.013	E0.007	E0.011	E0.005	--	--
Sulfamethoxazole 1	µg/L	<0.064	0.18	0.043	0.049	0.038	<0.064	<0.064	<0.064	0.10	<0.064	0.11	0.094	E0.003	<0.064
Sulfamethoxazole 2	µg/L	--	0.26	0.052	--	0.033	<0.064	<0.064	<0.064	<0.064	0.036	0.11	0.10	--	--
Sulfamethoxazole 3	µg/L	--	--	--	--	--	--	<0.064	<0.064	<0.064	0.089	0.12	0.12	--	--
Thiabendazole 1	µg/L	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Thiabendazole 2	µg/L	--	0.019	<0.011	--	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	--	--
Thiabendazole 3	µg/L	--	--	--	--	--	--	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	--	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D5.0	BC-D7.4	Blank	FC-U	FC-E	FC-D0.4	FC-D2.9	FC-D8.4	FC-D10.6	FC-MC	Blank
Trimethoprim 1	µg/L	<0.013	0.13	0.052	0.050	0.048	<0.013	<0.013	0.14	0.12	0.085	0.048	0.032	<0.013	<0.013
Trimethoprim 2	µg/L	--	0.32	0.055	--	0.045	<0.013	<0.013	0.038	0.10	0.043	0.050	0.033	--	--
Trimethoprim 3	µg/L	--	--	--	--	--	--	<0.013	0.14	0.095	0.088	0.052	0.038	--	--
Warfarin 1	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Warfarin 2	µg/L	--	0.24	<0.012	--	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	--	--
Warfarin 3	µg/L	--	--	--	--	--	--	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	--	--
Surrogate Standards															
d4 Ethyl nicotinate 1	percent	88	120	100	98	100	85	88	88	91	100	90	96	83	89
d4 Ethyl nicotinate 2	percent	--	110	100	--	100	87	89	100	110	85	110	110	--	--
d4 Ethyl nicotinate 3	percent	--	--	--	--	--	--	92	100	100	99	120	110	--	--
d4 Nicotinamide 1	percent	100	100	100	100	100	100	100	100	100	100	99	96	97	98
d4 Nicotinamide 2	percent	--	96	100	--	100	98	100	100	100	100	100	97	--	--
d4 Nicotinamide 3	percent	--	--	--	--	--	--	100	100	100	99	99	100	--	--

Table 23. Summary of neutral organic wastewater compound (table 8) data determined by continuous liquid-liquid extraction for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
Bisphenol A 1	µg/L	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
Bisphenol A 2	µg/L	0.005	<0.005	<0.005	0.005	0.006	--	--	<0.005	<0.005	0.015	0.017	0.009	<0.005	--
2[3]-*tert*-Butyl-4-methylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
2[3]-*tert*-Butyl-4-methylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Butylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Butylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	0.007	<0.005	0.009	0.009	0.006	<0.005	--
Caffeine 1	µg/L	0.009	0.44	0.15	0.031	0.081	0.072	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
Caffeine 2	µg/L	0.023	0.20	0.075	0.11	0.17	--	--	0.035	<0.005	0.042	0.044	0.015	0.010	--
Cholesterol 1	µg/L	0.097	1.2	0.56	0.14	0.40	0.123	0.34	0.78	0.75	0.58	<0.005	0.63	0.83	--
Cholesterol 2	µg/L	1.2	1.1	0.26	0.32	1.3	--	--	0.15	0.15	0.11	0.062	0.041	0.089	--
Coprostanol 1	µg/L	<0.005	1.0	0.14	0.076	0.037	0.206	<0.005	0.66	0.14	0.16	<0.005	<0.005	<0.005	--
Coprostanol 2	µg/L	0.72	1.1	0.057	0.17	0.66	--	--	0.016	<0.005	0.026	0.015	<0.005	0.019	--
2,6-Di-*tert*-butyl-1,4-benzoquinone 1	µg/L	0.040	0.15	0.13	0.017	0.055	<0.005	0.021	0.22	0.14	0.16	<0.005	<0.005	<0.005	--
2,6-Di-*tert*-butyl-1,4-benzoquinone 2	µg/L	0.044	0.083	0.058	0.066	0.063	--	--	<0.005	<0.005	0.076	<0.005	0.043	<0.005	--
2,6-Di-*tert*-butyl-4-methylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
2,6-Di-*tert*-butyl-4-methylphenol 2	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	--
2,6-Di-*tert*-butylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
2,6-Di-*tert*-butylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	0.006	<0.005	0.008	0.007	<0.005	<0.005	--
1,2-Dichlorobenzene 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	<0.005	<0.005	--
1,2-Dichlorobenzene 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
1,3-Dichlorobenzene 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
1,3-Dichlorobenzene 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
1,4-Dichlorobenzene 1	µg/L	<0.005	0.047	<0.005	<0.005	<0.005	<0.005	<0.005	0.017	0.005	0.005	<0.005	<0.005	<0.005	--
1,4-Dichlorobenzene 2	µg/L	<0.005	<0.005	0.006	<0.005	<0.005	--	--	<0.005	<0.005	0.009	<0.005	<0.005	<0.005	--
N,N-Diethyl-*meta*-toluamide 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N,N-Diethyl-*meta*-toluamide 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Ethylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-Ethylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
5-Methyl-1H-benzotriazole 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
5-Methyl-1H-benzotriazole 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol 1	µg/L	<0.005	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-Methylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	0.006	--	--	<0.005	<0.005	<0.005	0.005	<0.005	<0.005	--
4-Nonylphenol 1	µg/L	<0.05	0.057	0.051	<0.05	<0.05	<0.05	<0.05	0.079	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenol 2	µg/L	<0.05	<0.05	<0.05	0.051	0.062	--	--	<0.05	<0.05	<0.05	0.051	<0.05	<0.05	--
4-Nonylphenolmonoethoxylate 1	µg/L	<0.05	2.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenolmonoethoxylate 2	µg/L	0.020	1.2	0.019	0.030	0.047	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenoldiethoxylate 1	µg/L	<0.05	0.46	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenoldiethoxylate 2	µg/L	<0.05	0.21	<0.05	<0.05	<0.05	--	--	<0.05	<0.05	0.094	0.063	<0.05	<0.05	--
4-Nonylphenoltriethoxylate 1	µg/L	<0.05	0.17	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenoltriethoxylate 2	µg/L	<0.05	0.17	<0.05	<0.05	<0.05	--	--	<0.05	<0.05	0.14	<0.05	<0.05	<0.05	--
4-Nonylphenoltetraethoxylate 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-Nonylphenoltetraethoxylate 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
4-*normal*-Octylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*normal*-Octylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	0.007	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenol 1	µg/L	<0.005	0.009	0.007	<0.005	<0.005	<0.005	<0.005	0.011	0.005	0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenol 2	µg/L	<0.005	0.005	<0.005	0.007	0.008	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenolmonoethoxylate 1	µg/L	<0.005	0.041	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenolmonoethoxylate 2	µg/L	<0.005	0.017	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	0.002	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenoldiethoxylate 1	µg/L	<0.005	0.094	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenoldiethoxylate 2	µg/L	<0.005	0.031	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	0.006	0.009	<0.005	<0.005	--
4-*tert*-Octylphenoltriethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenoltriethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenoltetraethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenoltetraethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenolpentaethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Octylphenolpentaethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Pentylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-*tert*-Pentylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-Propylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--
4-Propylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	0.007	<0.005	0.010	0.010	0.009	<0.005	--
Triclosan 1	µg/L	<0.005	0.054	0.015	<0.005	0.005	<0.005	<0.005	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	--
Triclosan 2	µg/L	<0.005	0.009	0.005	0.009	0.017	--	--	<0.005	<0.005	0.013	0.010	<0.005	<0.005	--
Surrogate Standards															
d6 Bisphenol A 1	percent	8	0	22	1	37	21	12	24	9	17	0	0	0	--
d6 Bisphenol A 2	percent	42	0	51	21	61	--	--	25	--	62	63	75	36	--
d7 Cholesterol 1	percent	5	9	6	1	5	2	0	3	2	3	0	0	0	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D5.0	BC-D7.4	Blank	FC-U	FC-E	FC-D0.4	FC-D2.9	FC-D8.4	FC-D10.6	FC-MC	Blank
d7 Cholesterol 2	percent	6	10	12	5	5	--	--	2	--	4	5	3	3	--
d21 2,6-Di-*tert*-butyl-4-methylphenol 1	percent	9	1	3	1	4	7	1	1	1	1	0	0	0	--
d21 2,6-Di-*tert*-butyl-4-methylphenol 2	percent	6	0	2	4	1	--	--	13	--	28	20	28	5	--
d4 17β-Estradiol 1	percent	7	1	25	1	27	12	0	14	0	0	0	0	0	--
d4 17β-Estradiol 2	percent	25	0	33	16	40	--	--	15	--	39	39	37	16	--
4-*normal*-Nonylphenol 1	percent	9	1	19	2	31	32	4	7	5	5	0	0	0	--
4-*normal*-Nonylphenol 2	percent	32	0	32	19	35	--	--	26	--	45	44	41	22	--
4-*normal*-Nonylphenolmonoethoxylate 1	percent	16	29	24	3	19	18	0	0	0	0	0	0	0	--
4-*normal*-Nonylphenolmonoethoxylate 2	percent	23	20	30	22	32	--	--	15	--	29	29	23	19	--
4-*normal*-Nonylphenoldiethoxylate 1	percent	11	18	19	1	12	16	0	0	0	0	0	0	0	--
4-*normal*-Nonylphenoldiethoxylate 2	percent	17	13	24	14	23	--	--	11	--	25	22	12	12	--

Table 24. Summary of neutral organic wastewater compound (table 9) data determined by solid-phase extraction for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; µg/L, microgram per liter; <, less than method detection limit; E, estimated value; --,not determined.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	9/3/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1640
Compound															
Acetophenone	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Acetylhexamethyltetrahydronaphthalene	µg/L	<0.50	E0.30	E0.07	E0.06	E0.04	<0.50	--	--	--	--	--	--	--	--
Anthracene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
9,10-Anthraquinone	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Atrazine	µg/L	0.01	<0.007	<0.007	<0.007	<0.007	<0.007	--	--	--	--	--	--	--	--
Benzo[a]pyrene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Benzophenone	µg/L	<0.50	E0.38	E0.11	E0.10	E0.08	<0.50	--	--	--	--	--	--	--	--
Bisphenol A	µg/L	<1.0	E0.16	E0.11	E0.12	E0.11	<1.0	--	--	--	--	--	--	--	--
Bromacil	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Bromoform	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--	--
3-*tert*-Butyl-4-hydroxyanisole	µg/L	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	--	--	--	--	--	--	--	--
Caffeine	µg/L	E0.04	1.2	E0.44	E0.34	E0.35	<0.50	--	--	--	--	--	--	--	--
Camphor	µg/L	E0.02	E0.02	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Carbaryl	µg/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	--	--	--	--	--	--	--	--
Carbazole	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Chlorpyrifos	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--
Cholesterol	µg/L	<2.0	2.3	E1.8	E1.7	E1.1	<2.0	--	--	--	--	--	--	--	--
Coprostanol	µg/L	<2.0	E1.5	E1.2	E0.94	<2.0	<2.0	--	--	--	--	--	--	--	--
Cotinine	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--
Diazinon	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	µg/L	<0.50	E0.19	E0.05	<0.50	E0.04	<0.50	--	--	--	--	--	--	--	--
N,N-Diethyl-*meta*-toluamide	µg/L	E0.1	1.1	E0.39	0.57	0.51	--	--	--	--	--	--	--	--	--
2,6-Dimethylnaphthalene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Fluoranthene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Hexahydrohexamethylcyclopentabenzopyran	µg/L	<0.50	1.4	E0.38	E0.36	E0.27	<0.50	--	--	--	--	--	--	--	--
Indole	µg/L	<0.50	E0.05	E0.01	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Isoborneol	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Isophorone	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Isoquinoline	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
d-Limonene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Menthol	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Metalaxyl	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
5-Methyl-1H-benzotriazole	µg/L	<2.0	E1.7	E0.52	E0.51	E0.36	<2.0	--	--	--	--	--	--	--	--
3-Methyl-1H-indole	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--
1-Methylnaphthalene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
2-Methylnaphthalene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
4-Methylphenol	µg/L	<1.0	E0.26	E0.06	E0.05	E0.05	<1.0	--	--	--	--	--	--	--	--
Methyl salicylate	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Metolachlor	µg/L	E0.01	<0.01	E0.01	E0.01	E0.01	<0.01	--	--	--	--	--	--	--	--
Naphthalene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
4-Nonylphenol	µg/L	<5.0	E1.5	<5.0	<5.0	<5.0	<5.0	--	--	--	--	--	--	--	--
4-Nonylphenolmonoethoxylate	µg/L	<1.5	E14	3.3	3.0	2.0	<1.5	--	--	--	--	--	--	--	--
4-Nonylphenoldiethoxylate	µg/L	<5.0	E11	E3.7	E4.0	E2.3	<5.0	--	--	--	--	--	--	--	--
4-*normal*-Octylphenol	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--
4-*tert*-Octylphenol	µg/L	<1.0	E0.09	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--
4-*tert*-Octylphenolmonoethoxylate	µg/L	<1.0	E1.6	E0.52	E0.45	<1.0	<1.0	--	--	--	--	--	--	--	--
4-*tert*-Octylphenoldiethoxylate	µg/L	<1.0	E0.22	E0.12	E0.13	<1.0	<1.0	--	--	--	--	--	--	--	--
Pentachlorophenol	µg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	--	--	--	--	--	--	--	--
Phenanthrene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Phenol	µg/L	1.1	1.3	E0.19	0.74	2.0	<0.30	--	--	--	--	--	--	--	--
Prometon	µg/L	<0.015	E0.01	E0.01	E0.01	E0.01	<0.01	--	--	--	--	--	--	--	--
iso-Propylbenzene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
4-*iso*-Propylphenol	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	--	--	--	--	--	--	--	--
Pyrene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
β-Sitosterol	µg/L	<2.0	E1.5	E1.6	E1.8	<2.0	<2.0	--	--	--	--	--	--	--	--
β-Stigmastanol	µg/L	<2.0	E1.5	E1.5	E0.72	<2.0	<2.0	--	--	--	--	--	--	--	--
Tetrachloroethylene	µg/L	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	--	--	--	--	--	--	--	--
Tributyl phosphate	µg/L	<0.50	E0.19	E0.07	<0.50	E0.06	<0.50	--	--	--	--	--	--	--	--
Triclosan	µg/L	<1.0	E0.54	E0.14	E0.13	E0.10	<1.0	--	--	--	--	--	--	--	--
Triethyl citrate	µg/L	<0.50	E0.20	E0.06	E0.05	E0.05	<0.50	--	--	--	--	--	--	--	--
Triphenyl phosphate	µg/L	<0.50	E0.10	E0.03	E0.03	E0.03	<0.50	--	--	--	--	--	--	--	--
Tris(2-butoxyethyl) phosphate	µg/L	<0.50	1.8	0.61	0.64	0.52	<0.50	--	--	--	--	--	--	--	--
Tris(2-chloroethyl) phosphate	µg/L	<0.50	E0.31	E0.12	E0.09	E0.10	<0.50	--	--	--	--	--	--	--	--
Tris(dichloroisopropyl) phosphate	µg/L	<0.50	E0.27	E0.10	E0.08	E0.08	<0.50	--	--	--	--	--	--	--	--
Surrogate standards								--	--	--	--	--	--	--	--
d3 Bisphenol A	percent	70	100	87	87	83	17	--	--	--	--	--	--	--	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D5.0	BC-D7.4	Blank	FC-U	FC-E	FC-D0.4	FC-D2.9	FC-D8.4	FC-D10.6	FC-MC	Blank
13C Caffeine	percent	91	83	91	91	87	83	--	--	--	--	--	--	--	--
Decafluorobiphenyl	percent	61	48	70	70	44	33	--	--	--	--	--	--	--	--
d10 Fluoranthene	percent	91	87	91	87	91	96	--	--	--	--	--	--	--	--

Table 25. Summary of steroid and steroidal-hormone compound (table 10) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date	--	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time	--	0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
cis -Androsterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis -Androsterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Cholesterol 1	µg/L	5.7	43	2.6	11	11	--	4.4	160	36	34	29	9.4	33	--
Cholesterol 2	µg/L	1.8	22	5.8	6.2	5.6	--	--	61	65	23	15	28	29	--
Coprostanol 1	µg/L	0.14	53	2.5	9.0	5.7	--	0.067	60	5.6	7.9	3.8	0.51	0.14	--
Coprostanol 2	µg/L	0.031	28	5.2	5.2	4.7	--	--	17	7.5	5.0	2.0	0.64	0.086	--
Diethylstilbestrol 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Diethylstilbestrol 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equilenin 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equilenin 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equilin 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Equilin 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17α-Estradiol 1	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
17α-Estradiol 2	µg/L	--	<0.001	<0.001	<0.001	<0.001	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
17β-Estradiol 1	µg/L	<0.001	0.002	0.002	0.001	0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
17β-Estradiol 2	µg/L	--	0.003	0.002	0.001	0.002	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
Estriol 1	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
Estriol 2	µg/L	--	<0.001	<0.001	<0.001	<0.001	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
Estrone1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Estrone2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17α-Ethinylestradiol 1	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
17α-Ethinylestradiol 2	µg/L	--	<0.001	<0.001	<0.001	<0.001	--	--	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	--
Mestranol 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Mestranol 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19-Norethisterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19-Norethisterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Progesterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Progesterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Testosterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Testosterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi -Testosterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
epi-Testosterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11-keto-Testosterone 1	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
11-keto-Testosterone 2	µg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 26. Summary of pesticide compound (table 11) data for the summer 2003 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D5.0, BC-D7.4, FC-D0.4, FC-D2.9, FC-D8.4, and FC-D10.6 are sites downstream from the WWTP indicating distance in kilometers; MC, Muchikinock Creek; µg/L, microgram per liter; <, less than laboratory reporting level; --, not determined.]

		Boulder Creek						Fourmile Creek							
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D5.0**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D0.4**	**FC-D2.9**	**FC-D8.4**	**FC-D10.6**	**FC-MC**	**Blank**
Date		9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	9/3/2003	8/5/2003	8/5/2003	8/5/2003	8/5/2003	8/6/2003	8/6/2003	8/6/2003	8/6/2003
Time		0830	0915	1215	1330	1540	1639	1130	1245	1300	1845	0700	1130	0745	1110
Compound															
Acetochlor	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	--	--	--	--	--	--	--	--	--
Alachlor	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	--	--	--	--	--	--	--	--
Atrazine	µg/L	0.007	<0.007	0.006	0.007	0.007	--	--	--	--	--	--	--	--	--
Azinphos-methyl	µg/L	<0.050	<0.050	<0.050	<0.050	<0.050	--	--	--	--	--	--	--	--	--
Benfluralin	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	--	--	--	--	--	--	--	--	--
Butylate	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--	--	--
Carbaryl	µg/L	<0.041	<0.041	<0.041	<0.041	<0.041	--	--	--	--	--	--	--	--	--
Carbofuran	µg/L	<0.020	<0.020	<0.020	<0.020	<0.020	--	--	--	--	--	--	--	--	--
Chlorpyrifos	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
Cyanazine	µg/L	<0.018	<0.018	<0.018	<0.018	<0.018	--	--	--	--	--	--	--	--	--
Dacthal (DCPA)	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	--	--	--	--	--	--	--	--	--
Deethylatrazine	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006									
Diazinon	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
1,1-Dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p'-DDE)	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	--	--	--	--	--	--	--	--	--
Dieldrin	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
2,6-Diethylaniline	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	--	--	--	--	--	--	--	--	--
Disulfoton	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	--	--	--	--	--	--	--	--	--
Ethalfluralin	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	--	--	--	--	--	--	--	--	--
Ethoprophos	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
S -Ethyldipropylthiocarbamate (EPTC)	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--	--	--
Fipronil	µg/L	<0.007	<0.007	<0.007	<0.007	<0.007	--	--	--	--	--	--	--	--	--
Fipronil desulfinyl	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	--	--	--	--	--	--	--	--
Fipronil desulfinyl amide	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	--	--	--	--	--	--	--	--	--
Fipronil sulfide	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
Fipronil sulfone	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
Fonofos	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	--	--	--	--	--	--	--	--	--
α-Hexachlorohexane	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
γ-Hexachlorohexane (Lindane)	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	--	--	--	--	--	--	--	--
Linuron	µg/L	<0.035	<0.035	<0.035	<0.035	<0.035	--	--	--	--	--	--	--	--	--
Malathion	µg/L	<0.027	<0.027	<0.027	<0.027	<0.027	--	--	--	--	--	--	--	--	--
Metolachlor	µg/L	0.006	<0.013	0.006	0.006	0.006	--	--	--	--	--	--	--	--	--
Metribuzin	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	--	--	--	--	--	--	--	--	--
Molinate	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--	--	--
Napropamide	µg/L	<0.007	<0.007	<0.007	<0.007	<0.007	--	--	--	--	--	--	--	--	--
Parathion	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	--	--	--	--	--	--	--	--	--
Parathion-methyl	µg/L	<0.006	<0.100	<0.070	<0.030	<0.006	--	--	--	--	--	--	--	--	--
Pebulate	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	--	--	--	--	--	--	--	--
Pendimethalin	µg/L	<0.022	<0.022	<0.022	<0.022	<0.022	--	--	--	--	--	--	--	--	--
cis -Permethrin	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	--	--	--	--	--	--	--	--	--
Phorate	µg/L	<0.011	<0.011	<0.011	<0.011	<0.011	--	--	--	--	--	--	--	--	--
Prometon	µg/L	<0.01	0.01	0.01	0.01	0.01	--	--	--	--	--	--	--	--	--
Propachlor	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	--	--	--	--	--	--	--	--	--
Propanil	µg/L	<0.011	<0.011	<0.011	<0.011	<0.011	--	--	--	--	--	--	--	--	--
Propargite	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	--	--	--	--	--	--	--	--	--
Propyzamide	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	--	--	--	--	--	--	--	--	--
Simazine	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
Tebuthiuron	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	--	--	--	--	--	--	--	--	--
Terbacil	µg/L	<0.034	<0.034	<0.034	<0.034	<0.034	--	--	--	--	--	--	--	--	--
Terbufos	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	--	--	--	--	--	--	--	--	--
Thiobencarb	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	--	--	--	--	--	--	--	--	--
Tri-allate	µg/L	<0.002	<0.002	<0.002	<0.002	<0.002	--	--	--	--	--	--	--	--	--
Trifluralin	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	--	--	--	--	--	--	--	--	--
Surrogate Standards															
d10 Diazinon	percent	110	120	120	120	120	--	--	--	--	--	--	--	--	--
d6 α-Hexachlorohexane	percent	79	78	81	82	81	--	--	--	--	--	--	--	--	--

Table 27. Summary of field measurement, nutrient, carbon, major ion, trace element, and biological component (table 3) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; R, unfiltered; F, filtered; --, not determined; m^3/s, cubic meter per second; mg/L, milligram per liter; Std units, standard pH units; µS/cm, microsiemen per centimeter; deg C, degree Celsius; NTU, nephelometric turbidity units; mg/L N, milligram per liter nitrogen; mg/L P, milligram per liter phosphorous; mg/L C, milligram per liter carbon; mg/L $CaCO_3$, milligram per liter as calcium carbonate; UV254, ultraviolet light absorbance at 254 nanometers; UV280, ultraviolet light absorbance at 280 nanometers; cm, centimeter; µg/L, microgram per liter; pla/100 mL, plaque forming units per 100 milliliters; col/100 mL, colonies per 100 milliliters; <, less than method detection limit; E, estimated value.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Field Measurements											
Discharge	m^3/s	1.69	1.11	2.60	1.29	--	0.62	0.24	0.92	0.90	--
Dissolved oxygen R	mg/L	8.7	7.9	12.7	8.1	--	15.4	12.5	12.7	13.4	--
pH R field	Std unit	8.20	7.60	7.90	8.20	--	8.36	8.10	8.24	7.96	--
pH R lab	Std unit	7.80	7.50	7.60	7.80	7.20	7.99	7.59	7.88	7.99	E6.4
Specific conductance R field	uS/cm	310	830	500	490	--	840	850	890	870	--
Specific conductance R lab	uS/cm	290	790	480	440	5	800	980	850	830	5.42
Temperature air	deg C	13.5	13.5	23.1	20.8	--	--	--	2.5	--	--
Temperature water	deg C	11.9	15.3	14.7	16.5	--	0.7	2.7	3.9	6.0	--
Turbidity R	NTU	6.1	2.7	5.2	3.4	<2	2.9	<2	11.3	10.5	<2
Nutrients											
Ammonia F	mg/L N	<0.04	8.6	2.8	1.3	<0.04	<0.04	0.12	E0.031	E0.031	<0.04
Ammonia + organic nitrogen R	mg/L N	0.4	11	4.0	2.3	<0.1	0.44	1.5	0.72	0.61	<0.10
Ammonia + organic nitrogen F	mg/L N	0.2	10	4.1	2.2	<0.1	0.36	1.1	0.54	0.47	<0.10
Organic nitrogen F	mg/L N	--	1.4	1.3	0.9	--	--	1.0	--	--	--
Nitrate + nitrite F	mg/L N	<0.06	9.4	3.5	3.7	<0.06	17	11	15	15	<0.60
Nitrate F	mg/L N	<0.06	9.0	3.3	3.3	<0.06	17	11	15	15	--
Nitrite F	mg/L N	<0.008	0.35	0.23	0.33	<0.008	0.023	0.18	0.056	0.052	<0.008
Orthophosphate F	mg/L P	<0.006	3.4	1.2	0.92	<0.006	0.017	4.7	0.84	0.60	<0.006
Particulate nitrogen	mg/L N	0.20	0.48	0.22	0.14	0.03	0.086	0.52	0.33	0.23	<0.022
Phosphorus R	mg/L P	0.042	3.4	1.2	0.98	E0.002	0.035	5.1	1.0	0.68	<0.004
Phosphorus F	mg/L P	0.008	3.5	1.2	0.95	<0.004	0.025	4.9	1.0	0.63	<0.004
Carbon											
Absorbance UV254 F	cm	0.15	0.14	0.14	0.13	<0.004	0.062	0.11	0.070	0.068	<0.0035
Absorbance UV280 F	cm	0.11	0.11	0.11	0.098	<0.004	0.046	0.088	0.052	0.050	<0.0036
Bicarbonate, F	mg/L C	--	--	--	--	--	--	--	--	--	--
Carbonate, F	mg/L C	--	--	--	--	--	--	--	--	--	--
Organic carbon F	mg/L C	4.4	--	5.5	5.1	E0.2	3.2	6.0	3.1	2.7	0.64
Particulate carbon inorganic + organic	mg/L C	1.6	3.1	1.7	1.0	<0.1	0.61	2.3	2.5	1.6	0.14
Particulate carbon inorganic	mg/L C	<0.1	<0.1	<0.1	<0.1	<0.1	<0.12	<0.12	<0.12	<0.12	<0.12
Particulate carbon organic	mg/L C	1.6	3.0	1.7	1.0	<0.1	0.58	2.3	2.5	1.6	0.14
Major Ions											
Alkalinity F lab	mg/L $CaCO_3$	69	140	91	92	2.0	280	180	270	280	<2
Alkalinity F, field	mg/L $CaCO_3$	--	--	--	--	--	--	--	--	--	--
Calcium F	mg/L	24	56	38	38	0.04	110	110	110	110	0.051
Chloride F	mg/L	32	75	47	43	<0.2	49	120	64	59	E0.11
Fluoride F	mg/L	0.3	1.0	0.5	0.5	<0.1	0.37	1.3	0.57	0.47	<0.10
Magnesium F	mg/L	10	19	14	15	<0.008	33	32	32	33	<0.008
Potassium F	mg/L	1.9	13	5.9	5.0	<0.16	2.3	3.0	3.0	2.4	<0.16
Residue on evaporation F	mg/L	182	482	289	291	<10	470	590	510	510	<10
Silica F	mg/L	6.7	10	7.9	6.8	0.5	17	17	18	17	0.12
Sodium F	mg/L	22	70	39	37	E0.12	25	30	31	25	<0.20
Sulfate F	mg/L	28	110	59	65	<0.2	29	89	43	38	<0.18
Suspended sediment, R	mg/L	11	4.0	13	5.0	--	110	5.0	34	21	--
Trace Elements											
Arsenic F	µg/L	0.5	0.7	0.6	0.7	<0.2	1.4	0.82	0.93	1.3	<0.2
Boron F	µg/L	33	250	110	90	<8	42	310	91	75	E5.3
Iron F	µg/L	40	81	56	51	<6	6.4	10	10	8.9	E3.4

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Lithium F	µg/L	8.2	12	9.8	9.7	<0.6	10	15	11	11	<0.6
Selenium F	µg/L	<0.4	1.2	0.7	0.4	<0.4	4.1	2.4	3.3	3.5	<0.4
Strontium F	µg/L	250	450	320	360	<0.4	270	200	250	260	<0.4
Vanadium F	µg/L	0.80	0.80	1.1	1.3	0.70	2.7	1.0	2.2	2.4	E0.08
Biological Components											
Pheophytin *a*	µg/L	4.1	0.50	5.5	<0.1	--	1.6	0.63	2.2	2.4	<0.32
Chlorophyll *a*	µg/L	6.2	0.50	8.1	0.40	--	2.2	0.92	3.9	4.0	<0.32
Coliphage (*E. coli* CN-13 host)	pla/100mL	--	--	--	--	--	--	--	--	--	--
Coliphage (*E. coli* HS(pFamp)R host)	col/100mL	--	--	--	--	--	--	--	--	--	--
E. coli	col/100mL	26	6	31	99		25	250	320	43	
Enterococci	col/100mL	37	3	14	13		33	1100	120	34	

Table 28. Summary of trace element and major element (table 4) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after element indicates replicate analysis; values are means of triplicate analyses; µg/L, microgram per liter; mg/L, milligram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	03/08/05	03/08/05	03/08/05	03/08/05	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Element											
Aluminum 1	µg/L	2.9	23	7.9	6.0	<0.1	1.1	9.0	1.3	0.42	6.4
Aluminum 2	µg/L	3.1	22	8.4	5.9	<0.1	0.81	9.3	<0.1	0.75	5.1
Aluminum 3	µg/L	2.8	21	8.3	7.3	<0.1	0.67	9.1	2.2	0.89	--
Aluminum 4	µg/L	2.8	--	--	--	<0.1	--	--	--	--	--
Antimony 1	µg/L	0.13	0.25	0.18	0.17	<0.002	0.13	0.51	0.20	0.18	0.010
Antimony 2	µg/L	0.14	0.25	0.18	0.17	<0.002	0.13	0.51	0.22	0.19	0.005
Antimony 3	µg/L	0.14	0.24	0.17	0.17	0.004	0.13	0.50	0.22	0.18	--
Antimony 4	µg/L	0.14	--	--	--	0.003	--	--	--	--	--
Arsenic 1	µg/L	0.42	0.44	0.49	0.53	<0.06	1.0	1.0	1.0	1.1	<0.06
Arsenic 2	µg/L	0.44	0.47	0.51	0.59	<0.06	1.0	1.0	1.0	1.1	<0.06
Arsenic 3	µg/L	0.43	0.43	0.51	0.57	<0.06	1.1	1.0	1.2	1.1	--
Arsenic 4	µg/L	0.44	--	--	--	<0.06	--	--	--	--	--
Barium 1	µg/L	47	39	44	45	0.036	110	43	100	100	0.062
Barium 2	µg/L	50	40	46	46	0.040	120	42	100	98	0.069
Barium 3	µg/L	49	38	44	45	0.041	120	42	100	100	--
Barium 4	µg/L	48	--	--	--	0.048	--	--	--	--	--
Beryllium 1	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	<0.002	<0.009	<0.009	<0.009	<0.009
Beryllium 2	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	<0.002	<0.009	<0.009	<0.009	<0.009
Beryllium 3	µg/L	<0.009	<0.009	0.014	<0.009	<0.009	<0.002	<0.009	<0.002	<0.009	--
Beryllium 4	µg/L	<0.009	--	--	--	<0.009	--	--	--	--	--
Bismuth 1	µg/L	<0.003	0.12	0.017	0.014	<0.003	0.0007	0.046	0.0033	<0.003	<0.003
Bismuth 2	µg/L	<0.003	0.11	0.017	0.012	<0.003	<0.0005	0.045	<0.003	<0.003	<0.003
Bismuth 3	µg/L	<0.003	0.11	0.016	0.010	<0.003	<0.0005	0.046	0.0049	<0.003	--
Bismuth 4	µg/L	<0.003	--	--	--	<0.003	--	--	--	--	--
Boron 1	µg/L	35	240	100	96	<3	28	260	79	62	<3
Boron 2	µg/L	32	240	110	92	<3	29	260	79	59	4
Boron 3	µg/L	31	240	110	94	<3	30	260	77	61	--
Boron 4	µg/L	31	--	--	--	<3	--	--	--	--	--
Cadmium 1	µg/L	0.0074	0.034	0.014	0.014	<0.003	0.0093	0.045	0.024	0.027	<0.003
Cadmium 2	µg/L	0.0063	0.032	0.015	0.019	<0.003	0.014	0.046	0.022	0.028	<0.003
Cadmium 3	µg/L	0.0060	0.034	0.018	0.019	0.003	0.011	0.043	0.024	0.023	--
Cadmium 4	µg/L	0.0058	--	--	--	<0.003	--	--	--	--	--
Calcium 1	mg/L	24	52	34	36	0.04	100	75	100	110	0.03
Calcium 2	mg/L	26	53	36	35	0.04	110	74	100	100	0.05
Calcium 3	mg/L	25	52	35	37	0.03	110	74	110	100	--
Calcium 4	mg/L	25	--	--	--	0.06	--	--	--	--	--
Cerium 1	µg/L	0.096	0.013	0.068	0.069	<0.0004	0.026	0.0047	0.017	0.018	<0.0004
Cerium 2	µg/L	0.090	0.016	0.069	0.071	0.0010	0.024	0.0043	0.018	0.017	0.0018
Cerium 3	µg/L	0.089	0.016	0.072	0.072	<0.0004	0.026	0.0045	0.019	0.019	--
Cerium 4	µg/L	0.093	--	--	--	<0.0004	--	--	--	--	--
Cesium 1	µg/L	<0.003	0.18	0.075	0.081	<0.003	<0.001	0.022	<0.003	<0.003	<0.003
Cesium 2	µg/L	<0.003	0.18	0.075	0.083	<0.003	<0.001	0.023	<0.003	<0.003	<0.003
Cesium 3	µg/L	<0.003	0.17	0.076	0.082	<0.003	<0.001	0.022	<0.001	<0.003	--
Cesium 4	µg/L	<0.003	--	--	--	<0.003	--	--	--	--	--
Chromium 1	µg/L	<0.4	0.43	<0.4	0.48	<0.4	<0.07	1.3	0.52	<0.4	<0.4
Chromium 2	µg/L	<0.4	0.51	<0.4	<0.4	<0.4	<0.07	0.81	<0.4	<0.4	<0.4
Chromium 3	µg/L	<0.4	0.48	<0.4	0.46	<0.4	<0.07	0.81	<0.4	<0.4	--
Chromium 4	µg/L	<0.4	--	--	--	<0.4	--	--	--	--	--
Cobalt 1	µg/L	0.073	0.26	0.16	0.17	<0.002	0.083	0.27	0.18	0.19	<0.002
Cobalt 2	µg/L	0.072	0.27	0.16	0.18	<0.002	0.088	0.27	0.17	0.17	<0.002
Cobalt 3	µg/L	0.068	0.25	0.16	0.17	<0.002	0.086	0.26	0.18	0.19	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Cobalt 4	µg/L	0.069	--	--	--	<0.002	--	--	--	--	--
Copper 1	µg/L	1.6	15	5.4	4.2	0.09	1.1	1.9	1.2	1.3	0.04
Copper 2	µg/L	1.6	15	5.3	4.3	0.11	1.2	2.1	1.2	1.3	0.06
Copper 3	µg/L	1.6	15	5.4	4.5	0.17	1.2	1.9	1.3	1.2	--
Copper 4	µg/L	1.6	--	--	--	0.16	--	--	--	--	--
Dysprosium 1	µg/L	0.0089	0.0034	0.0064	0.0061	<0.0008	0.0066	0.0024	0.0055	0.0062	<0.0008
Dysprosium 2	µg/L	0.010	0.0017	0.0063	0.0052	<0.0008	0.0065	0.0026	0.0051	0.0058	<0.0008
Dysprosium 3	µg/L	0.0081	0.0021	0.0070	0.0074	<0.0008	0.0071	0.0025	0.0047	0.0061	--
Dysprosium 4	µg/L	0.0079	--	--	--	<0.0008	--	--	--	--	--
Erbium 1	µg/L	0.0051	0.0022	0.0048	0.0040	<0.0010	0.0040	<0.0010	0.0042	0.0043	<0.0010
Erbium 2	µg/L	0.0065	0.0031	0.0049	0.0033	<0.0010	0.0039	0.0024	0.0039	0.0052	<0.0010
Erbium 3	µg/L	0.0057	0.0024	0.0055	0.0039	<0.0010	0.0050	0.0031	0.0042	0.0043	--
Erbium 4	µg/L	0.0054	--	--	--	<0.0010	--	--	--	--	--
Europium 1	µg/L	0.0026	0.0008	0.0016	0.0020	<0.0004	0.0003	0.0013	0.0023	0.0022	<0.0004
Europium 2	µg/L	0.0038	0.0013	0.0023	0.0024	<0.0004	<0.0002	<0.0004	0.0029	0.0016	<0.0004
Europium 3	µg/L	0.0023	0.0005	0.0017	0.0023	<0.0004	0.0030	0.0008	0.0013	0.0026	--
Europium 4	µg/L	0.0030	--	--	--	<0.0004	--	--	--	--	--
Gadolinium 1	µg/L	0.011	0.15	0.061	0.047	0.0009	0.0073	0.26	0.060	0.033	0.0004
Gadolinium 2	µg/L	0.0087	0.14	0.062	0.047	0.0006	0.0074	0.26	0.063	0.035	<0.0004
Gadolinium 3	µg/L	0.011	0.14	0.062	0.049	0.0005	0.0070	0.25	0.056	0.035	--
Gadolinium 4	µg/L	0.012	--	--	--	<0.0004	--	--	--	--	--
Holmium 1	µg/L	0.0018	0.0008	0.0014	0.0016	<0.0003	0.0013	0.0007	0.0009	0.0015	<0.0003
Holmium 2	µg/L	0.0015	0.0008	0.0012	0.0015	<0.0003	0.0013	0.0006	0.0013	0.0013	<0.0003
Holmium 3	µg/L	0.0016	0.0009	0.0019	0.0017	<0.0003	0.0015	0.0009	0.0012	0.0015	--
Holmium 4	µg/L	0.0017	--	--	--	<0.0003	--	--	--	--	--
Iron 1	µg/L	55	120	69	60	<2	12	74	21	11	6
Iron 2	µg/L	56	110	70	60	<2	12	75	27	24	<2
Iron 3	µg/L	51	110	73	74	<2	5.8	73	38	10	--
Iron 4	µg/L	59	--	--	--	<2	--	--	--	--	--
Lanthanum 1	µg/L	0.070	0.026	0.052	0.050	<0.0003	0.021	0.0039	0.016	0.016	<0.0003
Lanthanum 2	µg/L	0.067	0.027	0.053	0.052	0.0005	0.020	0.0033	0.014	0.015	0.0010
Lanthanum 3	µg/L	0.062	0.027	0.054	0.054	<0.0003	0.021	0.0039	0.017	0.016	--
Lanthanum 4	µg/L	0.069	--	--	--	<0.0003	--	--	--	--	--
Lead 1	µg/L	0.076	0.51	0.24	0.20	<0.01	0.015	0.33	0.080	0.060	0.019
Lead 2	µg/L	0.068	0.54	0.24	0.22	0.01	0.014	0.31	0.083	0.044	<0.01
Lead 3	µg/L	0.067	0.51	0.24	0.30	<0.01	0.013	0.31	0.084	0.049	--
Lead 4	µg/L	0.073	--	--	--	<0.01	--	--	--	--	--
Lithium 1	µg/L	9.7	14	11	11	<0.03	8.8	14	10	10	0.04
Lithium 2	µg/L	9.5	14	11	11	<0.03	9.2	14	11	10	0.04
Lithium 3	µg/L	9.6	14	11	11	<0.03	9.1	14	10	10	--
Lithium 4	µg/L	9.4	--	--	--	<0.03	--	--	--	--	--
Lutetium 1	µg/L	0.0011	0.0007	0.0011	0.0010	<0.0003	0.0010	0.0007	0.0008	0.0010	<0.0003
Lutetium 2	µg/L	0.0011	0.0007	0.0012	0.0008	<0.0003	0.0009	0.0010	0.0007	0.0010	<0.0003
Lutetium 3	µg/L	0.0011	0.0009	0.0011	0.0011	<0.0003	0.0008	0.0007	0.0009	0.0008	--
Lutetium 4	µg/L	0.0012	--	--	--	<0.0003	--	--	--	--	--
Magnesium 1	mg/L	9.2	18	13	15	0.0040	29	26	30	31	0.002
Magnesium 2	mg/L	9.8	19	13	14	0.0026	30	25	29	30	0.005
Magnesium 3	mg/L	9.5	19	13	15	0.0045	30	26	31	30	--
Magnesium 4	mg/L	9.6	--	--	--	0.0054	--	--	--	--	--
Manganese 1	µg/L	23	36	32	29	<0.08	24	84	51	54	<0.08
Manganese 2	µg/L	24	36	34	28	<0.08	24	83	50	52	<0.08
Manganese 3	µg/L	24	36	33	29	0.08	25	82	48	52	--
Manganese 4	µg/L	24	--	--	--	<0.08	--	--	--	--	--
Molybdenum 1	µg/L	0.88	4.8	2.2	2.1	<0.05	1.5	3.8	1.8	1.8	0.06
Molybdenum 2	µg/L	0.81	5.1	2.3	2.2	<0.05	1.5	3.7	1.9	1.8	<0.05
Molybdenum 3	µg/L	0.83	4.7	2.2	2.1	<0.05	1.5	3.7	1.9	1.8	--
Molybdenum 4	µg/L	0.83	--	--	--	<0.05	--	--	--	--	--
Neodymium 1	µg/L	0.070	0.0050	0.049	0.053	<0.0010	0.023	0.0055	0.019	0.020	<0.0010
Neodymium 2	µg/L	0.064	0.0065	0.048	0.055	<0.0010	0.023	0.0055	0.018	0.016	<0.0010
Neodymium 3	µg/L	0.063	0.0074	0.052	0.053	<0.0010	0.023	0.0044	0.019	0.020	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Neodymium 4	µg/L	0.070	--	--	--	<0.0010	--	--	--	--	--
Nickel 1	µg/L	0.54	2.0	1.1	1.0	<0.01	0.24	5.6	1.7	1.5	0.17
Nickel 2	µg/L	0.56	2.0	1.1	1.0	<0.01	0.36	5.4	1.5	1.2	0.13
Nickel 3	µg/L	0.55	2.0	1.1	1.0	<0.01	0.58	5.6	1.4	1.1	--
Nickel 4	µg/L	0.51	--	--	--	<0.01	--	--	--	--	--
Potassium 1	mg/L	1.8	12	5.6	4.8	<0.02	0.93	11	3.0	2.3	<0.02
Potassium 2	mg/L	1.9	13	5.6	4.6	<0.02	0.98	11	3.0	2.4	<0.02
Potassium 3	mg/L	1.9	12	5.4	4.8	<0.02	0.98	11	3.1	2.3	--
Potassium 4	mg/L	1.9	--	--	--	<0.02	--	--	--	--	--
Praseodymium 1	µg/L	0.019	0.0017	0.012	0.012	<0.0002	0.0048	0.0012	0.0036	0.0041	<0.0002
Praseodymium 2	µg/L	0.017	0.0015	0.013	0.012	<0.0002	0.0049	0.0011	0.0035	0.0039	<0.0002
Praseodymium 3	µg/L	0.016	0.0015	0.013	0.013	<0.0002	0.0051	0.0007	0.0039	0.0042	--
Praseodymium 4	µg/L	0.018	--	--	--	<0.0002	--	--	--	--	--
Rhenium 1	µg/L	0.011	0.041	0.023	0.023	<0.0004	0.023	0.040	0.028	0.029	0.001
Rhenium 2	µg/L	0.011	0.043	0.025	0.024	0.001	0.023	0.041	0.028	0.025	0.001
Rhenium 3	µg/L	0.011	0.041	0.022	0.024	<0.0004	0.024	0.040	0.028	0.026	--
Rhenium 4	µg/L	0.012	--	--	--	<0.0004	--	--	--	--	--
Rubidium 1	µg/L	1.1	8.2	3.6	3.1	0.005	0.29	7.4	1.5	1.0	0.0014
Rubidium 2	µg/L	1.1	8.2	3.7	3.1	0.005	0.29	7.4	1.5	0.99	0.0020
Rubidium 3	µg/L	1.1	7.9	3.6	3.2	0.005	0.29	7.2	1.6	0.98	--
Rubidium 4	µg/L	1.1	--	--	--	0.005	--	--	--	--	--
Samarium 1	µg/L	0.012	<0.0020	0.010	0.010	<0.0020	0.0056	0.0016	0.0046	0.0046	<0.0020
Samarium 2	µg/L	0.012	0.0021	0.0081	0.010	<0.0020	0.0052	<0.0020	0.0036	0.0052	<0.0020
Samarium 3	µg/L	0.011	0.0024	0.0097	0.0084	<0.0020	0.0058	<0.0020	0.0040	0.0042	--
Samarium 4	µg/L	0.012	--	--	--	<0.0020	--	--	--	--	--
Selenium 1	µg/L	<0.08	0.19	0.15	<0.08	<0.08	3.0	1.4	2.6	2.9	<0.08
Selenium 2	µg/L	<0.08	0.12	0.096	<0.08	<0.08	3.2	1.5	2.9	2.9	<0.08
Selenium 3	µg/L	<0.08	0.080	<0.08	<0.08	<0.08	3.2	1.5	2.9	2.8	--
Selenium 4	µg/L	<0.08	--	--	--	<0.08	--	--	--	--	--
Silica 1	mg/L	6.3	9.6	7.4	6.5	0.43	15	18	16	16	0.10
Silica 2	mg/L	6.7	9.8	7.8	6.3	0.42	16	18	16	15	0.11
Silica 3	mg/L	6.5	9.7	7.5	6.6	0.40	16	18	17	15	--
Silica 4	mg/L	6.5	--	--	--	0.44	--	--	--	--	--
Sodium 1	mg/L	18	65	34	33	0.1	14	89	29	24	0.065
Sodium 2	mg/L	19	67	37	32	<0.2	15	87	29	24	0.081
Sodium 3	mg/L	18	66	35	33	0.1	16	88	33	24	--
Sodium 4	mg/L	19	--	--	--	0.2	--	--	--	--	--
Strontium 1	µg/L	230	450	310	360	0.09	220	180	220	230	0.094
Strontium 2	µg/L	230	450	310	350	0.09	230	180	220	230	0.088
Strontium 3	µg/L	230	440	310	350	0.09	230	180	220	230	--
Strontium 4	µg/L	230	--	--	--	0.09	--	--	--	--	--
Sulfur 1	mg/L	11	43	24	26	0.04	11	34	17	15	<0.02
Sulfur 2	mg/L	12	44	24	25	0.03	11	35	17	15	<0.02
Sulfur 3	mg/L	11	43	24	26	0.04	11	36	18	15	--
Sulfur 4	mg/L	11	--	--	--	0.05	--	--	--	--	--
Tellurium 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.0064	<0.010	<0.010	<0.010	<0.010
Tellurium 2	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	0.0085	<0.010	0.012	0.017	<0.010
Tellurium 3	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.006	<0.010	0.0060	<0.010	--
Tellurium 4	µg/L	<0.010	--	--	--	<0.010	--	--	--	--	--
Terbium 1	µg/L	0.0013	<0.0003	0.0009	0.0010	<0.0003	0.0008	0.0003	0.0007	0.0008	<0.0003
Terbium 2	µg/L	0.0016	0.0004	0.0010	0.0012	<0.0003	0.0008	0.0004	0.0007	0.0009	<0.0003
Terbium 3	µg/L	0.0013	0.0004	0.0008	0.0012	<0.0003	0.0009	<0.0003	0.0006	0.0009	--
Terbium 4	µg/L	0.0014	--	--	--	<0.0003	--	--	--	--	--
Thallium 1	µg/L	0.0047	0.019	<0.003	0.0051	<0.003	0.017	<0.003	<0.003	<0.003	<0.003
Thallium 2	µg/L	<0.003	0.036	<0.003	<0.003	<0.003	<0.005	<0.003	<0.003	<0.003	<0.003
Thallium 3	µg/L	<0.003	0.0064	<0.003	<0.003	<0.003	<0.005	<0.003	0.0069	<0.003	--
Thallium 4	µg/L	<0.003	--	--	--	<0.003	--	--	--	--	--
Thorium 1	µg/L	0.050	0.13	0.071	0.065	<0.004	0.0053	0.050	0.015	0.022	<0.004
Thorium 2	µg/L	0.049	0.059	0.057	0.076	<0.004	0.0029	0.073	0.011	0.013	<0.004
Thorium 3	µg/L	0.042	0.048	0.059	0.056	<0.004	0.0022	0.032	0.0070	0.017	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Thorium 4	µg/L	0.052	--	--	--	<0.004	--	--	--	--	--
Thulium 1	µg/L	0.0008	0.0004	0.0007	0.0007	<0.0002	0.0006	0.0004	0.0006	0.0009	<0.0002
Thulium 2	µg/L	0.0010	0.0004	0.0008	0.0006	<0.0002	0.0006	0.0005	0.0007	0.0009	<0.0002
Thulium 3	µg/L	0.0012	0.0004	0.0009	0.0008	<0.0002	0.0008	0.0004	0.0007	0.0007	--
Thulium 4	µg/L	0.0009	--	--	--	<0.0002	--	--	--	--	--
Tungsten 1	µg/L	0.12	0.054	0.11	0.14	<0.004	0.0048	<0.004	<0.004	0.0047	<0.004
Tungsten 2	µg/L	0.14	0.051	0.13	0.15	<0.004	0.0049	<0.004	0.0041	0.0053	<0.004
Tungsten 3	µg/L	0.12	0.048	0.12	0.15	<0.004	0.0036	<0.004	0.0040	0.0049	--
Tungsten 4	µg/L	0.13	--	--	--	0.005	--	--	--	--	--
Uranium 1	µg/L	1.3	1.7	1.6	2.1	<0.01	5.9	0.95	5.1	5.4	<0.01
Uranium 2	µg/L	1.3	1.8	1.6	2.1	<0.01	6.1	0.97	5.1	5.3	<0.01
Uranium 3	µg/L	1.3	1.7	1.6	2.0	<0.01	6.4	0.95	5.2	5.4	--
Uranium 4	µg/L	1.3	--	--	--	<0.01	--	--	--	--	--
Vanadium 1	µg/L	0.29	0.38	0.44	0.50	<0.10	1.9	0.63	1.4	1.6	<0.10
Vanadium 2	µg/L	0.30	0.39	0.49	0.58	<0.10	1.9	0.66	1.4	1.6	<0.10
Vanadium 3	µg/L	0.31	0.35	0.40	0.61	<0.10	1.4	0.70	2.0	1.6	--
Vanadium 4	µg/L	0.23	--	--	--	<0.10	--	--	--	--	--
Ytterbium 1	µg/L	0.0071	0.0048	0.0064	0.0062	<0.0009	0.0047	0.0044	0.0045	0.0047	<0.0009
Ytterbium 2	µg/L	0.0066	0.0042	0.0070	0.0062	<0.0009	0.0048	0.0038	0.0049	0.0052	<0.0009
Ytterbium 3	µg/L	0.0059	0.0038	0.0072	0.0051	<0.0009	0.0055	0.0042	0.0048	0.0049	--
Ytterbium 4	µg/L	0.0063	--	--	--	<0.0009	--	--	--	--	--
Yttrium 1	µg/L	0.047	0.023	0.037	0.036	<0.0004	0.061	0.015	0.051	0.060	<0.0004
Yttrium 2	µg/L	0.043	0.022	0.037	0.038	<0.0004	0.059	0.015	0.048	0.058	<0.0004
Yttrium 3	µg/L	0.047	0.023	0.039	0.036	<0.0004	0.063	0.015	0.050	0.056	--
Yttrium 4	µg/L	0.046	--	--	--	<0.0004	--	--	--	--	--
Zinc 1	µg/L	1.3	38	14	11	0.85	1.2	34	7.4	4.4	0.65
Zinc 2	µg/L	1.2	38	14	11	0.95	0.81	34	7.4	4.4	0.81
Zinc 3	µg/L	1.6	37	14	11	0.80	0.70	33	7.5	4.3	--
Zinc 4	µg/L	1.2	--	--	--	0.80	--	--	--	--	--
Zirconium 1	µg/L	0.061	0.639	0.133	0.172	<0.003	0.081	0.27	0.13	0.14	<0.003
Zirconium 2	µg/L	0.082	0.350	0.139	0.168	<0.003	0.060	0.24	0.11	0.17	0.0030
Zirconium 3	µg/L	0.074	0.442	0.153	0.165	<0.003	0.069	0.17	0.15	0.13	--
Zirconium 4	µg/L	0.090	--	--	--	<0.003	--	--	--	--	--

Table 29. Summary of acidic organic wastewater compound (table 5) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	03/08/05	03/08/05	03/08/05	03/08/05	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Compound											
Ethylenediaminetetraacetic acid 1	µg/L	0.38	150	54	32	0.16	0.43	180	32	21	<0.1
Ethylenediaminetetraacetic acid 2	µg/L	0.37	170	49	33	0.14	0.77	180	20	16	<0.1
Ethylenediaminetetraacetic acid 3	µg/L	0.15	110	42	32	--	0.53	160	20	13	--
Nitrilotriacetic acid 1	µg/L	0.09	1.3	0.58	0.34	<0.1	<0.1	0.89	0.27	0.18	<0.1
Nitrilotriacetic acid 2	µg/L	0.07	1.4	0.54	0.34	<0.1	<0.1	1.0	0.23	0.19	<0.1
Nitrilotriacetic acid 3	µg/L	<0.1	0.42	0.49	0.40	--	<0.1	1.0	0.18	0.22	--
4-Nonylphenolmonoethoxycarboxylic acid 1	µg/L	0.43	100	47	33	<0.1	0.95	20	3.3	2.0	0.2
4-Nonylphenolmonoethoxycarboxylic acid 2	µg/L	0.25	110	46	33	0.20	2.4	22	5.7	2.5	<0.1
4-Nonylphenolmonoethoxycarboxylic acid 3	µg/L	0.12	33	39	39	--	0.62	11	3.8	3.9	--
4-Nonylphenoldiethoxycarboxylic acid 1	µg/L	0.16	90	41	31	<0.1	0.87	94	12	6.7	<0.1
4-Nonylphenoldiethoxycarboxylic acid 2	µg/L	0.34	99	41	30	0.27	0.78	98	16	8.7	<0.1
4-Nonylphenoldiethoxycarboxylic acid 3	µg/L	<0.1	35	34	36	--	0.40	45	11	10	--
4-Nonylphenoltriethoxycarboxylic acid 1	µg/L	<0.1	2.1	0.71	0.42	<0.1	<0.1	1.1	0.15	0.22	<0.1
4-Nonylphenoltriethoxycarboxylic acid 2	µg/L	<0.1	1.8	0.59	0.41	<0.1	<0.1	1.1	0.28	0.13	<0.1
4-Nonylphenoltriethoxycarboxylic acid 3	µg/L	<0.1	0.74	0.67	0.48	--	<0.1	0.60	0.20	0.17	--
4-Nonylphenoltetraethoxycarboxylic acid 1	µg/L	<0.1	0.76	0.26	0.11	<0.1	<0.1	0.27	<0.1	0.10	<0.1
4-Nonylphenoltetraethoxycarboxylic acid 2	µg/L	<0.1	1.0	0.14	0.17	<0.1	<0.1	0.23	<0.1	<0.1	<0.1
4-Nonylphenoltetraethoxycarboxylic acid 3	µg/L	<0.1	0.69	0.21	0.25	--	<0.1	<0.1	<0.1	<0.1	--
Surrogate Standard											
4-*normal*-Nonylphenoldiethoxycarboxylic acid 1	percent	53	56	84	53	21	110	110	67	78	96
4-*normal*-Nonylphenoldiethoxycarboxylic acid 2	percent	41	72	53	54	3	180	59	84	74	83
4-*normal*-Nonylphenoldiethoxycarboxylic acid 3	percent	2	6	48	64	--	110	34	70	73	--

Table 30. Summary of antibiotic compound (table 6) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9,and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than laboratory reporting level; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Compound											
Amoxicillin 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Amoxicillin 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Amoxicillin 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Ampicillin 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ampicillin 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Ampicillin 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Azithromycin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Azithromycin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Azithromycin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Carbadox 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005
Carbadox 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Carbadox 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Cefotaxime 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cefotaxime 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Cefotaxime 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
anhydro-Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
anhydro-Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
anhydro-Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
epi-Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-anhydro-Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
epi-anhydro-Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-anhydro-Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-iso-Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.017	<0.010	<0.010	<0.010
epi-iso-Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-iso-Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
iso-Chlorotetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.041	0.019	0.019	<0.010
iso-Chlorotetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
iso-Chlorotetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Ciprofloxacin 1	µg/L	<0.005	0.091	<0.005	<0.005	<0.005	<0.005	0.48	0.012	0.006	<0.005
Ciprofloxacin 2	µg/L	<0.005	0.091	<0.005	<0.005	--	<0.005	0.52	0.016	0.013	--
Ciprofloxacin 3	µg/L	--	--	--	--	--	<0.005	0.44	0.014	<0.005	--
Clinafloxacin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Clinafloxacin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Clinafloxacin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Cloxacillin 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cloxacillin 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Cloxacillin 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Demeclocycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Demeclocycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Demeclocycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Doxycycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.18	<0.010	<0.010	<0.010
Doxycycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	0.16	<0.010	<0.010	--
Doxycycline 3	µg/L	--	--	--	--	--	<0.010	0.18	<0.010	<0.010	--
Erythromycin 1	µg/L	<0.005	0.25	0.21	0.14	<0.005	<0.005	0.21	0.045	0.040	<0.005
Erythromycin 2	µg/L	<0.005	0.24	0.19	0.087	--	<0.005	0.25	0.053	0.019	--
Erythromycin 3	µg/L	--	--	--	--	--	<0.005	0.27	0.051	0.27	--
anhydro-Erythromycin 1	µg/L	<0.005	0.35	0.13	0.093	<0.005	<0.005	0.60	0.088	0.038	<0.005
anhydro-Erythromycin 2	µg/L	<0.005	0.31	0.11	0.099	--	<0.005	0.47	0.080	0.065	--
anhydro-Erythromycin 3	µg/L	--	--	--	--	--	<0.005	0.52	0.076	0.068	--
Flumequine 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Flumequine 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Flumequine 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Lincomycin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005
Lincomycin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Lincomycin 3	µg/L	--	--	--	--	--	<0.005	0.008	<0.005	<0.005	--
Lomefloxacin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Lomefloxacin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Lomefloxacin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Minocycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.033	<0.010	<0.010	<0.010
Minocycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	0.028	<0.010	<0.010	--
Minocycline 3	µg/L	--	--	--	--	--	<0.010	0.019	<0.010	<0.010	--
Norfloxacin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Norfloxacin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Norfloxacin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Ofloxacin 1	µg/L	<0.005	0.13	0.13	0.069	<0.005	<0.005	2.3	0.14	0.064	<0.005
Ofloxacin 2	µg/L	<0.005	0.13	0.12	0.066	--	<0.005	2.2	0.13	0.086	--
Ofloxacin 3	µg/L	--	--	--	--	--	<0.005	2.0	0.14	0.086	--
Ormetoprim 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Ormetoprim 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Ormetoprim 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Oxacillin 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Oxacillin 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Oxacillin 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Oxolinic Acid 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Oxolinic Acid 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Oxolinic Acid 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Oxytetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Oxytetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Oxytetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
alpha-apo-Oxytetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
alpha-apo-Oxytetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
alpha-apo-Oxytetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
beta-apo-Oxytetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beta-apo-Oxytetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
beta-apo-Oxytetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-Oxytetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
epi-Oxytetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-Oxytetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Penicillin G 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Penicillin G 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Penicillin G 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Penicillin V 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Penicillin V 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
Penicillin V 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Roxithromycin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Roxithromycin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Roxithromycin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	0.027	--
Sarafloxacin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sarafloxacin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sarafloxacin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Sulfachloropyridazine 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfachloropyridazine 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sulfachloropyridazine 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Sulfadiazine 1	µg/L	<0.005	0.090	<0.005	0.071	<0.005	<0.005	0.26	<0.005	<0.005	<0.005
Sulfadiazine 2	µg/L	<0.005	0.12	<0.005	<0.005	--	<0.005	0.43	<0.005	<0.005	--
Sulfadiazine 3	µg/L	--	--	--	--	--	<0.005	0.28	<0.005	<0.005	--
Sulfadimethoxine 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfadimethoxine 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sulfadimethoxine 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Sulfamerazine 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfamerazine 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sulfamerazine 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Sulfamethazine 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfamethazine 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sulfamethazine 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Sulfamethoxazole 1	µg/L	<0.005	0.14	0.24	0.26	<0.005	<0.005	0.81	0.17	0.17	<0.005
Sulfamethoxazole 2	µg/L	<0.005	0.18	0.21	0.25	--	<0.005	0.67	0.21	0.12	--
Sulfamethoxazole 3	µg/L	--	--	--	--	--	<0.005	0.68	0.17	0.10	--
Sulfathiazole 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Sulfathiazole 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Sulfathiazole 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Tetracycline 1	µg/L	<0.010	0.13	<0.010	0.022	<0.010	<0.010	0.41	<0.010	<0.010	<0.010
Tetracycline 2	µg/L	<0.010	0.11	0.012	<0.010	--	<0.010	0.40	<0.010	<0.010	--
Tetracycline 3	µg/L	--	--	--	--	--	<0.010	0.44	<0.010	<0.010	--
anhydro-Tetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
anhydro-Tetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
anhydro-Tetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-Tetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
epi-Tetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-Tetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
epi-anhydro-Tetracycline 1	µg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
epi-anhydro-Tetracycline 2	µg/L	<0.010	<0.010	<0.010	<0.010	--	<0.010	<0.010	<0.010	<0.010	--
epi-anhydro-Tetracycline 3	µg/L	--	--	--	--	--	<0.010	<0.010	<0.010	<0.010	--
Trimethoprim 1	µg/L	<0.005	0.37	0.086	0.059	<0.005	<0.005	0.64	0.13	0.089	<0.005
Trimethoprim 2	µg/L	<0.005	0.36	0.085	0.054	--	<0.005	0.66	0.12	0.048	--
Trimethoprim 3	µg/L	--	--	--	--	--	<0.005	0.76	0.11	0.064	--
Tylosin 1	µg/L	<0.005	0.022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tylosin 2	µg/L	<0.005	0.019	<0.005	<0.005	--	<0.005	<0.005	<0.005	0.018	--
Tylosin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	0.014	--
Virginiamycin 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Virginiamycin 2	µg/L	<0.005	<0.005	<0.005	<0.005	--	<0.005	<0.005	<0.005	<0.005	--
Virginiamycin 3	µg/L	--	--	--	--	--	<0.005	<0.005	<0.005	<0.005	--
Surrogate Standards											
Meclocycline	--	--	--	--	--	--	--	--	--	--	--
Nalidixic Acid	--	--	--	--	--	--	--	--	--	--	--
Oleandomycin	--	--	--	--	--	--	--	--	--	--	--
$^{13}C_6$-Sulfamethazine	--	--	--	--	--	--	--	--	--	--	--

Table 31. Summary of pharmaceutical compound (table 7) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than laboratory reporting level; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	03/08/05	03/08/05	03/08/05	03/08/05	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	--
Compound											
Acetaminophen 1	µg/L	<0.036	<0.036	<0.036	<0.036	<0.036	0.049	0.046	0.052	0.022	--
Acetaminophen 2	µg/L	<0.036	<0.036	<0.036	<0.036	<0.036	--	0.055	--	--	--
Acetaminophen 3	µg/L	--	--	--	--	--	--	0.038	--	--	--
Azithromycin 1	µg/L	<0.05	<0.05	<0.05	<0.05	0.001	<0.05	<0.05	<0.05	<0.05	--
Azithromycin 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	--	--	--
Azithromycin 3	µg/L	--	--	--	--	--	--	<0.05	--	--	--
Caffeine 1	µg/L	0.020	0.10	0.041	<0.016	<0.016	0.012	<0.016	0.006	0.006	--
Caffeine 2	µg/L	<0.016	<0.016	0.037	0.029	<0.016	--	<0.016	--	--	--
Caffeine 3	µg/L	--	--	--	--	--	--	0.009	--	--	--
Carbamazapine 1	µg/L	<0.011	0.11	0.038	0.037	<0.011	<0.011	0.14	0.032	0.017	--
Carbamazapine 2	µg/L	<0.011	0.10	0.037	0.036	<0.011	--	0.12	--	--	--
Carbamazapine 3	µg/L	--	--	--	--	--	--	0.065	--	--	--
Cimetidine 1	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	0.12	0.037	0.023	--
Cimetidine 2	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	--	0.23	--	--	--
Cimetidine 3	µg/L	--	--	--	--	--	--	0.095	--	--	--
Codeine 1	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.35	0.027	<0.015	--
Codeine 2	µg/L	<0.015	0.056	<0.015	<0.015	<0.015	--	0.34	--	--	--
Codeine 3	µg/L	--	--	--	--	--	--	0.076	--	--	--
Cotinine 1	µg/L	0.003	0.025	0.008	0.007	<0.014	0.009	0.081	0.012	0.013	--
Cotinine 2	µg/L	<0.014	0.024	0.018	0.006	<0.014	--	0.080	--	--	--
Cotinine 3	µg/L	--	--	--	--	--	--	0.037	--	--	--
Dehydronifedipine 1	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	0.004	--
Dehydronifedipine 2	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	--	<0.015	--	--	--
Dehydronifedipine 3	µg/L	--	--	--	--	--	--	0.046	--	--	--
Diltiazem 1	µg/L	<0.016	0.031	0.008	0.012	<0.016	<0.016	0.054	<0.016	0.008	--
Diltiazem 2	µg/L	<0.016	0.031	0.009	0.007	<0.016	--	0.042	--	--	--
Diltiazem 3	µg/L	--	--	--	--	--	--	0.035	--	--	--
1,7-Dimethylxanthine 1	µg/L	<0.144	<0.144	<0.144	<0.144	<0.144	0.025	<0.144	0.021	0.056	--
1,7-Dimethylxanthine 2	µg/L	<0.144	<0.144	<0.144	<0.144	<0.144	--	0.099	--	--	--
1,7-Dimethylxanthine 3	µg/L	--	--	--	--	--	--	--	--	--	--
Diphenhydramine 1	µg/L	<0.015	0.25	0.049	0.049	0.008	<0.015	0.17	<0.015	0.002	--
Diphenhydramine 2	µg/L	<0.015	0.23	0.058	0.041	0.001	--	0.12	--	--	--
Diphenhydramine 3	µg/L	--	--	--	--	--	--	0.082	--	--	--
Erythromycin 1	µg/L	<0.05	0.18	0.046	0.044	<0.05	<0.05	<0.05	<0.05	<0.05	--
Erythromycin 2	µg/L	<0.05	<0.05	0.056	0.036	<0.05	--	<0.05	--	--	--
Erythromycin 3	µg/L	--	--	--	--	--	--	<0.05	--	--	--
Fluoxetine 1	µg/L	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	<0.014	--
Fluoxetine 2	µg/L	<0.014	<0.014	<0.014	<0.014	<0.014	--	<0.014	--	--	--
Fluoxetine 3	µg/L	--	--	--	--	--	--	<0.014	--	--	--
Furosemide 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Furosemide 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	--	--	--
Furosemide 3	µg/L	--	--	--	--	--	--	<0.05	--	--	--
Gemfibrozil 1	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	--
Gemfibrozil 2	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	--	<0.013	--	--	--
Gemfibrozil 3	µg/L	--	--	--	--	--	--	<0.013	--	--	--
Ibuprofen 1	µg/L	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	<0.042	--
Ibuprofen 2	µg/L	<0.042	<0.042	<0.042	<0.042	<0.042	--	<0.042	--	--	--
Ibuprofen 3	µg/L	--	--	--	--	--	--	<0.042	--	--	--
Metformin 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Metformin 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	--	--	--
Metformin 3	µg/L	--	--	--	--	--	--	<0.05	--	--	--

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Miconazole 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	--
Miconazole 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	--	<0.05	--	--	--
Miconazole 3	µg/L	--	--	--	--	--	--	<0.05	--	--	--
Ranitidine 1	µg/L	<0.013	<0.013	0.007	0.007	<0.013	<0.013	0.32	0.033	<0.013	--
Ranitidine 2	µg/L	<0.013	0.062	<0.013	<0.013	<0.013	--	0.22	--	--	--
Ranitidine 3	µg/L	--	--	--	--	--	--	0.11	--	--	--
Salbutamol 1	µg/L	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	<0.023	--
Salbutamol 2	µg/L	<0.023	<0.023	<0.023	<0.023	<0.023	--	0.021	--	--	--
Salbutamol 3	µg/L	--	--	--	--	--	--	0.031	--	--	--
Sulfamethoxazole 1	µg/L	<0.064	<0.064	<0.064	<0.064	<0.064	<0.064	<0.064	<0.064	<0.064	--
Sulfamethoxazole 2	µg/L	<0.064	<0.064	<0.064	<0.064	<0.064	--	<0.064	--	--	--
Sulfamethoxazole 3	µg/L	--	--	--	--	--	--	<0.064	--	--	--
Thiabendazole 1	µg/L	<0.011	<0.011	<0.011	<0.011	0.007	<0.011	<0.011	<0.011	<0.011	--
Thiabendazole 2	µg/L	<0.011	<0.011	<0.011	<0.011	<0.011	--	<0.011	--	--	--
Thiabendazole 3	µg/L	--	--	--	--	--	--	<0.011	--	--	--
Trimethoprim 1	µg/L	<0.013	0.23	0.061	0.046	<0.013	<0.013	0.33	0.069	0.049	--
Trimethoprim 2	µg/L	<0.013	0.22	0.064	0.044	<0.013	--	0.26	--	--	--
Trimethoprim 3	µg/L	--	--	--	--	--	--	0.11	--	--	--
Warfarin 1	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	--
Warfarin 2	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	--	<0.012	--	--	--
Warfarin 3	µg/L	--	--	--	--	--	--	0.025	--	--	--
Surrogate Standards											
d4 Ethyl Nicotinate 1	percent	100	100	100	100	100	100	110	100	100	--
d4 Ethyl Nicotinate 2	percent	100	100	100	100	100	--	100	--	--	--
d4 Ethyl Nicotinate 3	percent	--	--	--	--	--	--	110	--	--	--
d4 Nicotinamide 1	percent	58	120	75	63	120	84	130	92	90	--
d4 Nicotinamide 2	percent	140	120	68	66	85	--	72	--	--	--
d4 Nicotinamide 3	percent	--	--	--	--	--	--	--	--	--	--

Table 32. Summary of neutral organic wastewater compound (table 8) data determined by continuous liquid-liquid extraction for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection limit; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005
Time		855	900	1145	1630	1430	740	745	1120	1540	--
Compound											
Bisphenol A 1	µg/L	0.032	0.14	0.015	0.083	0.008	<0.005	0.010	<0.005	0.005	<0.005
Bisphenol A 2	µg/L	0.023	0.033	0.054	0.006	<0.005	<0.005	<0.005	0.005	<0.005	<0.005
2[3]-*tert*-Butyl-4-methylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2[3]-*tert*-Butyl-4-methylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Butylphenol 1	µg/L	<0.005	0.066	<0.005	0.029	<0.005	<0.005	0.032	0.010	0.014	<0.005
4-*tert*-Butylphenol 2	µg/L	<0.005	0.026	<0.005	<0.005	<0.005	<0.005	0.033	0.016	0.009	<0.005
Caffeine 1	µg/L	0.10	0.23	0.064	0.65	<0.005	0.037	0.015	0.026	0.041	<0.005
Caffeine 2	µg/L	0.055	0.14	0.13	0.065	<0.005	0.041	0.024	0.037	0.030	<0.005
Cholesterol 1	µg/L	0.10	3.0	0.20	2.2	<0.005	0.043	0.22	0.15	0.13	<0.005
Cholesterol 2	µg/L	0.092	1.9	1.1	0.71	<0.005	0.042	0.24	0.27	0.083	<0.005
Coprostanol 1	µg/L	<0.005	5.4	0.29	14	<0.005	<0.005	0.24	0.11	0.063	<0.005
Coprostanol 2	µg/L	<0.005	2.2	1.4	0.75	<0.005	<0.005	0.24	0.23	0.048	<0.005
2,6-Di-*tert*-butyl-1,4-benzoquinone 1	µg/L	0.26	1.4	0.76	0.99	<0.005	0.071	0.32	0.16	0.19	<0.005
2,6-Di-*tert*-butyl-1,4-benzoquinone 2	µg/L	0.33	0.58	0.77	0.28	<0.005	0.25	0.41	0.30	0.19	<0.005
2,6-Di-*tert*-butyl-4-methylphenol 1	µg/L	<0.005	0.051	0.017	0.022	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,6-Di-*tert*-butyl-4-methylphenol 2	µg/L	0.013	0.010	0.013	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,6-Di-*tert*-butylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
2,6-Di-*tert*-butylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,2-Dichlorobenzene 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.012	0.006	<0.005	0.006
1,2-Dichlorobenzene 2	µg/L	<0.005	0.033	0.023	<0.005	<0.005	<0.005	0.011	0.005	<0.005	<0.005
1,3-Dichlorobenzene 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006
1,3-Dichlorobenzene 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,4-Dichlorobenzene 1	µg/L	<0.005	0.35	0.10	<0.005	<0.005	<0.005	0.23	0.061	0.029	0.008
1,4-Dichlorobenzene 2	µg/L	<0.005	0.23	0.13	0.027	<0.005	<0.005	0.22	0.069	0.020	<0.005
N,N-Diethyl-*meta*-toluamide 1	µg/L	0.039	0.46	0.19	0.13	<0.005	<0.005	0.009	0.005	0.011	<0.005
N,N-Diethyl-*meta*-toluamide 2	µg/L	0.024	0.21	0.20	0.062	<0.005	0.006	0.011	0.011	0.009	<0.005
4-Ethylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-Ethylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
5-Methyl-1H-benzotriazole 1	µg/L	<0.005	0.89	0.066	<0.005	<0.005	<0.005	0.25	0.084	0.062	<0.005
5-Methyl-1H-benzotriazole 2	µg/L	<0.005	0.31	0.35	<0.005	<0.005	<0.005	0.30	0.12	0.042	<0.005
4-Methylphenol 1	µg/L	<0.005	0.057	0.042	<0.005	<0.005	0.005	0.008	0.010	0.018	<0.005
4-Methylphenol 2	µg/L	<0.005	0.035	0.067	<0.005	<0.005	0.007	0.010	0.015	<0.005	<0.005
4-Nonylphenol 1	µg/L	0.10	0.84	0.19	0.92	<0.05	0.043	0.12	0.082	0.108	<0.05
4-Nonylphenol 2	µg/L	0.13	0.60	0.48	0.16	<0.05	0.15	0.28	0.22	0.073	<0.05
4-Nonylphenolmonoethoxylate 1	µg/L	0.058	5.6	0.27	0.58	<0.05	0.012	0.13	<0.05	<0.05	<0.05
4-Nonylphenolmonoethoxylate 2	µg/L	<0.05	3.8	0.69	0.16	<0.05	0.016	0.16	0.079	<0.05	<0.05
4-Nonylphenoldiethoxylate 1	µg/L	0.15	1.5	0.15	9.2	<0.05	<0.05	0.41	0.067	0.075	<0.05
4-Nonylphenoldiethoxylate 2	µg/L	<0.05	1.2	0.29	0.43	<0.05	<0.05	0.56	0.13	<0.05	<0.05
4-Nonylphenoltriethoxylate 1	µg/L	<0.05	0.73	<0.05	<0.05	<0.05	<0.05	0.17	<0.05	<0.05	<0.05
4-Nonylphenoltriethoxylate 2	µg/L	<0.05	0.34	<0.05	<0.05	<0.05	<0.05	0.39	<0.05	<0.05	<0.05
4-Nonylphenoltetraethoxylate 1	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-Nonylphenoltetraethoxylate 2	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-*normal*-Octylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*normal*-Octylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Octylphenol 1	µg/L	0.012	0.17	0.054	0.067	0.008	<0.005	0.18	0.067	0.060	<0.005
4-*tert*-Octylphenol 2	µg/L	0.025	0.077	0.11	0.020	<0.005	0.010	0.21	0.093	0.043	<0.005
4-*tert*-Octylphenolmonoethoxylate 1	µg/L	<0.005	0.15	0.010	0.014	<0.005	<0.005	0.044	0.011	0.009	<0.005
4-*tert*-Octylphenolmonoethoxylate 2	µg/L	<0.005	0.098	0.024	0.006	<0.005	<0.005	0.046	0.015	0.007	<0.005
4-*tert*-Octylphenoldiethoxylate 1	µg/L	<0.005	0.35	<0.005	<0.005	<0.005	<0.005	1.1	0.24	0.14	<0.005
4-*tert*-Octylphenoldiethoxylate 2	µg/L	<0.005	0.24	<0.005	<0.005	<0.005	<0.005	1.2	0.34	0.099	<0.005

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
4-*tert*-Octylphenoltriethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.17	0.049	0.035	<0.005
4-*tert*-Octylphenoltriethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.24	0.082	0.026	<0.005
4-*tert*-Octylphenoltetraethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Octylphenoltetraethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Octylphenolpentaethoxylate 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Octylphenolpentaethoxylate 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Pentylphenol 1	µg/L	<0.005	0.044	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-*tert*-Pentylphenol 2	µg/L	<0.005	0.018	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
4-Propylphenol 1	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	0.005	<0.005
4-Propylphenol 2	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.007	<0.005	<0.005	<0.005
Triclosan 1	µg/L	0.009	0.58	0.077	0.20	<0.005	<0.005	0.033	0.013	0.011	<0.005
Triclosan 2	µg/L	<0.005	0.36	0.22	0.043	<0.005	<0.005	0.042	0.023	0.008	<0.005
Surrogate Standards											
d6 Bisphenol A 1	percent	110	70	45	56	87	22	12	27	85	13
d6 Bisphenol A 2	percent	93	60	130	1	89	23	22	100	50	0
d7 Cholesterol 1	percent	4	8	3	13	9	6	4	5	8	4
d7 Cholesterol 2	percent	2	3	11	11	10	6	6	11	5	0
d21 2,6-Di-*tert*-butyl-4-methylphenol 1	percent	28	5	5	2	22	4	2	2	6	21
d21 2,6-Di-*tert*-butyl-4-methylphenol 2	percent	41	2	6	4	29	3	2	4	4	0
d4 17β-Estradiol 1	percent	71	43	23	55	24	46	20	37	77	9
d4 17β-Estradiol 2	percent	65	29	79	14	20	32	25	73	47	0
4-*normal*-Nonylphenol 1	percent	56	20	16	33	36	60	21	40	87	32
4-*normal*-Nonylphenol 2	percent	50	11	47	4	30	37	24	74	56	0
4-*normal*-Nonylphenolmonoethoxylate 1	percent	27	26	15	43	18	45	33	39	80	13
4-*normal*-Nonylphenolmonoethoxylate 2	percent	27	18	39	28	17	40	41	80	49	0
4-*normal*-Nonylphenoldiethoxylate 1	percent	15	17	8	33	10	38	24	28	61	12
4-*normal*-Nonylphenoldiethoxylate 2	percent	17	10	26	15	5	33	32	64	39	0

Table 33. Summary of neutral organic wastewater compound (table 9) data determined by solid-phase extraction for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; µg/L, microgram per liter; <, less than method detection limit; E, estimated value; M, detected but not quantified; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005
Time		855	900	1145	1630	1420	741	746	1121	1541	1200
Compound											
Acetophenone 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acetophenone 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Acetylhexamethyltetrahydronaphthalene 1	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	0.7	E0.2	E0.1	<0.5
Acetylhexamethyltetrahydronaphthalene 2	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	0.6	--	E0.1	--
Anthracene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
9,10-Anthraquinone 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
9,10-Anthraquinone 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
Atrazine 1	µg/L	--	--	--	--	--	--	--	--	--	--
Atrazine 2	µg/L	--	--	--	--	--	--	--	--	--	--
Benzo[a]pyrene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo[a]pyrene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Benzophenone 1	µg/L	<0.5	E0.2	E0.1	E0.1	<0.5	<0.5	E0.2	E0.1	E0.1	<0.5
Benzophenone 2	µg/L	<0.5	E0.1	E0.1	E0.1	<0.5	<0.5	E0.2	--	E0.1	--
Bisphenol A 1	µg/L	<1	M	M	<1	<1	<1	E0.1	<1	<1	<1
Bisphenol A 2	µg/L	<1	M	<1	M	<1	<1	<1	--	<1	--
Bromacil 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromacil 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Bromoform 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	<0.5	<0.5	<0.5
Bromoform 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
3-*tert*-Butyl-4-hydroxyanisole 1	µg/L	<5	M	<5	<5	<5	<5	E0.2	E0.1	<5	5.00
3-*tert*-Butyl-4-hydroxyanisole 2	µg/L	<5	M	<5	<5	<5	<5	E0.2	--	<5	--
Caffeine 1	µg/L	E0.1	E0.2	E0.1	E0.1	<0.5	E0.1	E0.1	E0.1	E0.1	<0.5
Caffeine 2	µg/L	E0.1	E0.2	E0.1	E0.1	<0.5	E0.1	E0.1	--	E0.1	--
Camphor 1	µg/L	<0.5	M	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Camphor 2	µg/L	<0.5	M	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Carbaryl 1	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<0.5
Carbaryl 2	µg/L	<1	<1	<1	<1	<1	<1	<1	--	<1	--
Carbazole 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbazole 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Chlorpyrifos 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chlorpyrifos 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
Cholesterol 1	µg/L	<2	E2	M	M	<2	<2	E1.4	E0.6	<2	<2
Cholesterol 2	µg/L	<2	<2	M	M	<2	<2	E1.0	--	<2	--
Coprostanol 1	µg/L	<2	E1	M	M	<2	<2	E1.0	E0.43	<2	<2
Coprostanol 2	µg/L	<2	E1	M	M	<2	<2	E0.5	--	<2	--
Cotinine 1	µg/L	<1	<1	<1	<1	<1	<1	E0.2	E0.1	<1	<1
Cotinine 2	µg/L	<1	<1	<1	<1	<1	<1	E0.2	--	<1	--
Diazinon 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Diazinon 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
1,4-Dichlorobenzene 1	µg/L	<0.5	E0.1	M	M	<0.5	<0.5	E0.2	E0.1	E0.1	<0.5
1,4-Dichlorobenzene 2	µg/L	<0.5	E0.2	M	M	<0.5	<0.5	E0.2	--	E0.1	--
N,N-Diethyl-*meta*-toluamide 1	µg/L	<0.5	E0.4	E0.2	E0.1	<0.5	E0.1	E0.1	E0.1	E0.1	<0.5
N,N-Diethyl-*meta*-toluamide 2	µg/L	E0.1	E0.4	E0.2	E0.1	<0.5	E0.1	E0.1	--	E0.1	--
2,6-Dimethylnaphthalene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-Dimethylnaphthalene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Fluoranthene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Hexahydrohexamethylcyclopentabenzopyran 1	µg/L	<0.5	1.8	0.6	E0.4	<0.5	E0.1	3.4	0.7	E0.4	<0.5
Hexahydrohexamethylcyclopentabenzopyran 2	µg/L	<0.5	1.8	0.6	E0.4	<0.5	E0.1	3.1	--	E0.5	--
Indole 1	µg/L	<0.5	E0.1	<0.5	<0.5	<0.5	<0.5	E0.1	<0.5	<0.5	<0.5

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Indole 2	µg/L	<0.5	E0.1	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
Isoborneol 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isoborneol 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Isophorone 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isophorone 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Isoquinoline 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Isoquinoline 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
d-Limonene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	<0.5	E0.04
d-Limonene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Menthol 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Menthol 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Metalaxyl 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Metalaxyl 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
5-Methyl-1H-benzotriazole 1	µg/L	<2	E1	M	M	<2	<0.5	E1.6	<2	<2	<2
5-Methyl-1H-benzotriazole 2	µg/L	<2	E2	M	M	<2	<0.5	E1.6	--	<2	--
3-Methyl-1H-indole 1	µg/L	M	<1	M	M	<1	<1	E0.1	E0.1	<1	<1
3-Methyl-1H-indole 2	µg/L	M	<1	M	M	<1	<1	E0.1	--	<1	--
1-Methylnaphthalene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1-Methylnaphthalene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
2-Methylnaphthalene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Methylnaphthalene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
4-Methylphenol 1	µg/L	<1	M	M	M	<1	E0.1	E0.2	E0.1	E0.1	<1
4-Methylphenol 2	µg/L	M	M	M	M	<1	E0.1	E0.2	--	E0.1	--
Methyl salicylate 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	<0.5	<0.5	<0.5
Methyl salicylate 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
Metolachlor 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	E0.2	E0.1	E0.1	<0.5
Metolachlor 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	E0.1	--	E0.1	--
Naphthalene 1	µg/L	M	<0.5	<0.5	<0.5	M	E0.1	E0.1	E0.1	E0.1	E0.02
Naphthalene 2	µg/L	M	<0.5	<0.5	<0.5	M	E0.1	E0.1	--	E0.2	--
4-Nonylphenol 1	µg/L	<5	E2	M	M	<5	<5	E1.9	<5	<5	<5
4-Nonylphenol 2	µg/L	<5	E2	M	M	<5	<5	E1.7	--	<5	--
4-Nonylphenolmonoethoxylate 1	µg/L	<1.5	E10	E3.6	E2.1	<1.5	<1.5	E2.4	<1.5	<1.5	<1.5
4-Nonylphenolmonoethoxylate 2	µg/L	<1.5	E11	E3.4	E2.1	<1.5	<1.5	E2.5	--	<1.5	--
4-Nonylphenoldiethoxylate 1	µg/L	<5	E10	E3	E2	<5	<5	E7.5	E2.4	<5	<5
4-Nonylphenoldiethoxylate 2	µg/L	<5	E10	E3	E2	<5	<5	E7.6	--	<5	--
4-*normal*-Octylphenol 1	µg/L	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1
4-*normal*-Octylphenol 2	µg/L	<1	<1	<1	<1	<1	<0.5	<1	--	<1	--
4-*tert*-Octylphenol 1	µg/L	<1	M	M	M	<1	<0.5	1.2	E0.3	E0.1	<1
4-*tert*-Octylphenol 2	µg/L	<1	M	M	M	<1	<0.5	1.1	--	E0.1	--
4-*tert*-Octylphenolmonoethoxylate 1	µg/L	<1	E2	M	M	<1	<1	1.7	E0.3	<1	<1
4-*tert*-Octylphenolmonoethoxylate 2	µg/L	<1	E2	M	M	<1	<1	1.6	--	<1	--
4-*tert*-Octylphenoldiethoxylate 1	µg/L	<1	M	M	M	<1	<1	3.0	E0.4	<1	<1
4-*tert*-Octylphenoldiethoxylate 2	µg/L	<1	M	M	M	<1	<1	2.7	--	<1	--
Pentachlorophenol 1	µg/L	--	--	--	--	--	<2	E1.2	<2	<2	<2
Pentachlorophenol 2	µg/L	--	--	--	--	--	<2	E1.4	--	<2	--
Phenanthrene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
Phenol 1	µg/L	<0.5	E0.7	E0.6	E0.1	E0.8	<0.5	E0.2	E0.2	<0.5	E0.19
Phenol 2	µg/L	E0.3	E0.6	E0.3	E0.3	E0.1	<0.5	E0.2	--	<0.5	--
Prometon 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Prometon 2	µg/L	<0.5	<0.5	<0.5	E0.01	<0.5	<0.5	<0.5	--	<0.5	--
iso-Propylbenzene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
iso-Propylbenzene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	--	<0.5	--
4-*iso*-Propylphenol 1	µg/L	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<1
4-*iso*-Propylphenol 2	µg/L	<1	<1	<1	<1	<1	<0.5	<1	--	<1	--
Pyrene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
β-Sitosterol 1	µg/L	<2	M	<2	<2	<2	<2	E1.3	<2	<2	<2
β-Sitosterol 2	µg/L	<2	E1	<2	<2	<2	<2	E0.9	--	<2	--
β-Stigmastanol 1	µg/L	<2	<2	<2	<2	<2	<2	E1.5	<2	<2	<2

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
β-Stigmastanol 2	µg/L	<2	E1	<2	<2	<2	<2	E0.9	--	<2	--
Tetrachloroethylene 1	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	E0.1	<0.5	<0.5
Tetrachloroethylene 2	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	E0.1	--	<0.5	--
Tributyl phosphate 1	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	E0.3	E0.1	E0.1	<0.5
Tributyl phosphate 2	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	E0.3	--	E0.1	--
Triclosan 1	µg/L	<1	M	M	M	<1	<1	E0.4	E0.1	E0.1	<1
Triclosan 2	µg/L	<1	M	M	M	<1	<1	E0.4	--	E0.1	--
Triethyl citrate 1	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	E0.5	E0.12	E0.1	<0.5
Triethyl citrate 2	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	0.7	--	E0.2	--
Triphenyl phosphate 1	µg/L	<0.5	E0.1	E0.1	M	<0.5	<0.5	E0.1	E0.1	E0.1	<0.5
Triphenyl phosphate 2	µg/L	<0.5	E0.1	E0.1	M	<0.5	<0.5	E0.1	--	E0.1	--
Tris(2-butoxyethyl) phosphate 1	µg/L	<0.5	1.7	0.9	0.9	<0.5	<0.5	1.3	E0.4	E0.4	<0.5
Tris(2-butoxyethyl) phosphate 2	µg/L	<0.5	1.6	0.7	1.0	<0.5	<0.5	1.3	--	E0.4	--
Tris(2-chloroethyl) phosphate 1	µg/L	<0.5	E0.5	E0.2	E0.2	<0.5	<0.5	E0.4	E0.1	E0.1	<0.5
Tris(2-chloroethyl) phosphate 2	µg/L	<0.5	E0.5	E0.2	E0.2	<0.5	<0.5	E0.4	--	E0.1	--
Tris(dichloroisopropyl) phosphate 1	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	E0.4	E0.1	E0.1	<0.5
Tris(dichloroisopropyl) phosphate 2	µg/L	<0.5	E0.3	E0.1	E0.1	<0.5	<0.5	E0.3	--	E0.1	--
Surrogate Standards											
d3 Bisphenol A 1	percent	62	89	87	88	27	33	110	58	42	25
d3 Bisphenol A 2	percent	69	92	78	86	34	26	110	--	66	--
13C Caffeine 1	percent	81	79	80	89	79	73	94	89	91	79
13C Caffeine 2	percent	89	82	78	89	75	82	88	--	84	--
Decafluorobiphenyl 1	percent	77	69	74	68	70	98	94	82	77	76
Decafluorobiphenyl 2	percent	80	78	75	65	79	94	86	--	78	--
d10 Fluoranthene 1	percent	96	64	82	96	92	90	91	98	84	92
d10 Fluoranthene 2	percent	99	64	79	99	92	93	84	--	85	--

Table 34. Summary of steroid and steroidal-hormone compound (table 10) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; number after compound indicates replicate analysis; µg/L, microgram per liter; <, less than method detection level; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	3/8/2005	3/8/2005	3/8/2005	3/8/2005	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Compound											
cis -Androsterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
cis -Androsterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
cis -Androsterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Cholesterol 1	µg/L	0.54	0.21	0.56	0.26	--	--	--	--	--	--
Cholesterol 2	µg/L	0.92	0.23	0.33	0.43	--	--	--	--	--	--
Cholesterol 3	µg/L	--	--	0.41	0.28	--	--	--	--	--	--
Coprostanol 1	µg/L	0.080	14	40	15	--	--	--	--	--	--
Coprostanol 2	µg/L	0.060	15	23	22	--	--	--	--	--	--
Coprostanol 3	µg/L	--	--	16	16	--	--	--	--	--	--
Diethylstilbestrol 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Diethylstilbestrol 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Diethylstilbestrol 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Equilenin 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Equilenin 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Equilenin 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Equilin 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Equilin 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Equilin 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
17α-Estradiol 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
17α-Estradiol 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
17α-Estradiol 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
17β-Estradiol 1	µg/L	<0.001	0.003	0.002	0.001	--	--	--	--	--	--
17β-Estradiol 2	µg/L	<0.001	0.003	0.002	0.001	--	--	--	--	--	--
17β-Estradiol 3	µg/L	--	--	0.001	0.001	--	--	--	--	--	--
Estriol 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Estriol 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Estriol 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Estrone1	µg/L	<0.001	0.13	0.037	0.016	--	--	--	--	--	--
Estrone2	µg/L	<0.001	0.084	0.039	0.025	--	--	--	--	--	--
Estrone3	µg/L	--	--	0.034	0.020	--	--	--	--	--	--
17α-Ethinylestradiol 1	µg/L	<0.001	0.002	0.001	<0.001	--	--	--	--	--	--
17α-Ethinylestradiol 2	µg/L	<0.001	0.002	<0.001	<0.001	--	--	--	--	--	--
17α-Ethinylestradiol 3	µg/L	--	--	0.001	<0.001	--	--	--	--	--	--
Mestranol 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Mestranol 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Mestranol 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
19-Norethisterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
19-Norethisterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
19-Norethisterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Progesterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Progesterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Progesterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
Testosterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Testosterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
Testosterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
epi -Testosterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
epi -Testosterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
epi -Testosterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--
11-keto-Testosterone 1	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
11-keto-Testosterone 2	µg/L	<0.001	<0.001	<0.001	<0.001	--	--	--	--	--	--
11-keto-Testosterone 3	µg/L	--	--	<0.001	<0.001	--	--	--	--	--	--

Table 35. Summary of pesticide compound (table 11) data for the spring 2005 Boulder Creek, Colorado (BC) and Fourmile Creek, Iowa (FC) Lagrangian samplings.
[Site identifier defined in table 2; U, upstream from wastewater treatment plant (WWTP); E, WWTP effluent; BC-D3.6, BC-D7.4, FC-D2.9, and FC-D8.4 are sites downstream from the WWTP indicating distance in kilometers; µg/L, microgram per liter; <, less than laboratory reporting level; --, not determined.]

		Boulder Creek					Fourmile Creek				
Constituent	**Unit**	**BC-U**	**BC-E**	**BC-D3.6**	**BC-D7.4**	**Blank**	**FC-U**	**FC-E**	**FC-D2.9**	**FC-D8.4**	**Blank**
Date		4/19/2005	4/19/2005	4/19/2005	4/19/2005	4/19/2005	03/08/05	03/08/05	03/08/05	03/08/05	03/08/05
Time		855	900	1145	1630	1430	740	745	1120	1540	1200
Compound											
Acetochlor	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Alachlor	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Atrazine	µg/L	<0.007	<0.007	<0.007	<0.007	<0.007	0.038	0.026	0.036	0.046	<0.007
Azinphos-methyl	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benfluralin	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Butylate	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Carbaryl	µg/L	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041	<0.041
Carbofuran	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chlorpyrifos	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.02	<0.005	<0.005	<0.005
Cyanazine	µg/L	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
Dacthal (DCPA)	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Deethylatrazine	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	0.020	0.006	0.020	0.021	<0.006
Diazinon	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
1,1-Dichloro-2,2-bis(p-chlorophenyl)ethylene (p,p'-DDE)	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Dieldrin	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
2,6-Diethylaniline	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Disulfoton	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.021	<0.021	<0.021	<0.021	<0.021
Ethalfluralin	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Ethoprophos	µg/L	<0.005	<0.13	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
S -Ethyldipropylthiocarbamate (EPTC)	µg/L	<0.004	<0.02	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Fipronil	µg/L	<0.016	<0.016	<0.016	<0.016	<0.016	<0.016	0.037	<0.016	<0.016	<0.016
Fipronil desulfinyl	µg/L	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012	<0.012
Fipronil desulfinyl amide	µg/L	<0.029	<0.029	<0.029	<0.029	<0.029	<0.029	<0.029	<0.029	<0.029	<0.029
Fipronil sulfide	µg/L	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013	<0.013
Fipronil sulfone	µg/L	<0.024	<0.024	<0.024	<0.024	<0.024	<0.024	<0.013	<0.013	<0.013	<0.024
Fonofos	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
α-Hexachlorohexane	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
γ-Hexachlorohexane (Lindane)	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Linuron	µg/L	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035	<0.035
Malathion	µg/L	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027	<0.027
Metolachlor	µg/L	0.007	<0.006	<0.006	0.005	<0.006	0.060	0.075	0.065	0.076	<0.006
Metribuzin	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Molinate	µg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Napropamide	µg/L	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	0.007
Parathion	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Parathion-methyl	µg/L	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015	<0.015
Pebulate	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Pendimethalin	µg/L	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022	<0.022
cis -Permethrin	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Phorate	µg/L	<0.011	<0.02	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Prometon	µg/L	<0.01	<0.01	<0.01	0.007	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propachlor	µg/L	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Propanil	µg/L	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011	<0.011
Propargite	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.023	<0.023	<0.023	<0.023	<0.023
Propyzamide	µg/L	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Simazine	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Tebuthiuron	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.016	<0.016	<0.016	<0.016	<0.016
Terbacil	µg/L	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034	<0.034
Terbufos	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.017	<0.017	<0.017	<0.017	<0.017
Thiobencarb	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tri-allate	µg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006

Constituent	Unit	BC-U	BC-E	BC-D3.6	BC-D7.4	Blank	FC-U	FC-E	FC-D2.9	FC-D8.4	Blank
Trifluralin	µg/L	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009
Surrogate Standards											
d10 Diazinon	percent	110	140	120	120	100	130	110	110	130	98
d6 α-Hexachlorohexane	percent	96	100	100	98	92	92	100	100	100	94