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Summary and Evaluation of the Quality of Stormwater in Denver, Colorado, October 2001 to October 2005

Scientific Investigations Report 2008–5134

U.S. Department of the Interior
U.S. Geological Survey

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By Clifford R. Bossong and Andrea C. Fleming

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DIRK KEMPTHORNE, Secretary

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Contents

Figures

Appendix Figures

Tables

Appendix Tables

Conversion Factors

Multiply	By	To obtain
	Length	
foot (ft)	0.3048	meter (m)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
gallon (gal)	3.785	liter (L)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer [$(m^3/s)/km^2$]

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

$$°F = (1.8 \times °C) + 32$$

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

$$°C = (°F - 32)/1.8$$

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29).

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

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).

Water year is defined in this report as the 12-month period October 1 through September 30, designated by the calendar year in which it ends.

Summary and Evaluation of the Quality of Stormwater in Denver, Colorado, October 2001 to October 2005

By Clifford R. Bossong and Andrea C. Fleming

Abstract

Stormwater in the Denver area was sampled by the U.S. Geological Survey, in cooperation with the Urban Drainage and Flood Control District, in a network of five monitoring stations—three on the South Platte River and two on tributary streams, beginning in October 2001 and continuing through October 11, 2005. Composite samples of stormwater were analyzed at the U.S. Geological Survey National Water Quality Laboratory during water years 2003–2005 and the Metro Wastewater Reclamation District Laboratory during water year 2002 for water-quality properties such as pH, specific conductance, hardness, and residue on evaporation at 105 degrees Celsius; and for constituents such as major ions (calcium, chloride, fluoride, magnesium, potassium, sodium, and sulfate) in 2005, organic carbon and nutrients, including ammonia, nitrite plus nitrate, ammonia plus organic nitrogen, phosphorus, and orthophosphate; and for metals, including total and dissolved phases of copper, lead, manganese, and zinc. Samples analyzed for bacteriological indicators such as *Escherichia coli* and fecal coliform collected during selected storms also were analyzed at the Metro Wastewater Reclamation Laboratory. Discrete samples collected during selected storms were analyzed at the U.S. Geological Survey National Water Quality Laboratory for a suite of water-quality properties and constituents similar to those analyzed in the composite samples but that did not include determinations for total phases of metals.

Streamflow characteristics associated with 176 composite stormwater samples indicate that most samples were collected from hydrographs classified as falling or event hydrographs and that only a few samples were collected from rising hydrographs. Results from laboratory analyses of the composite samples indicate spatial patterns in which concentrations for some constituents increase with contributing drainage area in the South Platte River and Sand Creek, but no well-defined relation with the amount of urban land cover was identified using data available from the U.S. Geological Survey National Land Cover data.

Results from 22 discrete samples collected during two storms and used to obtain composited results with various weighting methods indicate that correlation coefficients between time-weighted and volume-weighted concentrations were generally at least 0.65, indicating a strong direct correlation between the two weighting methods for the stations involved in this study. In addition, the central tendency for relative percent differences between the time- and volume-weighting methods typically has an absolute value of about 10 or less, indicating good agreement for these weighting methods for data collected as part of this study.

Comparison of stormwater results to numeric standards for streams developed by the Colorado Department of Public Health and Environment on the basis of use classifications indicates that, for water-quality properties and constituents other than bacteriological indicators, there were very few exceptions to numeric standards. Bacteriological indicators, however, such as *Escherichia coli* and fecal coliform consistently exceeded numeric standards in all bacteriological samples.

An evaluation of laboratory results from composite samples on the basis of annual means indicates the presence of some simple upward and downward temporal trends in concentrations. In general, for annual means of results for all stations, hardness, ammonia plus organic nitrogen, total phosphorus, most dissolved metals (lead, manganese, and zinc), and all total metals (copper, lead, manganese, and zinc) all indicate annual means that decrease each year, or downward trends. Some trends were indicated only at individual stations in the network rather than at all stations. Ammonia as nitrogen at Union, Denver, and Henderson, orthophosphate at Sand Creek, and nitrite plus nitrate at Denver and Henderson all indicate decreasing annual means, or downward trends. Only nitrite plus nitrate at Union and total copper and lead at Sand Creek showed consistently increasing annual means, or upward trends.

Linear regressions and correlation coefficients among the results from composite samples also were computed. The regressions, based on the magnitude of the coefficient of determination (r^2), indicate widespread strong (r^2 equal to or greater than 0.65) regressions among major ions. In addition, many widespread and strong regressions were noted among constituents known to have a particulate component; these include organic nitrogen plus ammonia with total phosphorus, total copper, and total zinc; total phosphorus with total copper, total lead, and total zinc; residue on evaporation at 105 degrees Celsius with total copper and total lead; and several additional regressions involving metals (total copper with total lead, total

manganese, and total zinc; and total lead with total zinc). For nonmajor constituents that involve very soluble compounds (ammonia, nitrite plus nitrate, and orthophosphate) that have a very small or even no particulate component, strong regressions are not often widespread and occur mostly locally at individual stations. The regression between nitrite plus nitrate and orthophosphate is the only strong regression for soluble constituents that are not major ions, at all stations. Together, relatively weak regressions and correlation coefficients between water-quality properties and constituents, and with mean streamflow, indicate a heterogeneous and mixed system.

Results from this study were compared to results from an earlier U.S. Geological Survey study for water years 1998–2001 that collected data from the same network of stations using the same programmatic goals and sample-collection protocols. Samples from the two periods, based on the distribution of mean streamflow associated with composite samples, appear to represent similar conditions. There were many more exceptions to numeric standards in the earlier period than in this study. In addition, the 95-percent confidence intervals for pooled means, from all stations, from this study are numerically lower, do not overlap with those from the earlier study for some metals (dissolved copper, manganese, and zinc; and total zinc), and indicate statistically significant decreases in concentrations. Likewise, simple downward trends were widespread for many constituents, including hardness, organic nitrogen plus ammonia, total phosphorus, most dissolved metals dissolved (lead, manganese, and zinc) and all total metals (copper, lead, manganese, and zinc), and in general were more prevalent than in the earlier study.

Introduction

The quality of stormwater runoff is of interest to many management and regulatory agencies as well as academia, scientists, recreational stream users, and the general public. The basic character of stormwater runoff is of general interest to all, whereas more detailed information concerning spatial and temporal variations is of interest to management and regulatory agencies. In response to these interests, the U.S. Geological Survey (USGS), in cooperation with the Urban Drainage and Flood Control District (UDFCD), systematically collected stormwater samples during wet weather from a monitoring network of five monitoring stations in and around metropolitan Denver, Colorado. The monitoring network addresses conditions in Aurora, Denver, and Lakewood and consists of three stations on the South Platte River, the principal stream draining the area, and two stations on streams that are tributary to the South Platte River (fig. 1). Portions of each of these streams are included in segments 14, 15, and 16A of the South Platte River as designated by the Water-Quality Control Division of the Colorado Department of Public Health and Environment (CDPHE). Segments 14, 15, and 16A are defined by CDPHE and have use classifications and associated numeric standards for some water-quality properties and constituents and bacteriological indicators, such as pH, dissolved chloride, *Escherichia coli*, fecal coliform, nitrite plus nitrate, dissolved copper, lead, manganese, and zinc, and total manganese, that were included in this study (Colorado Department of Public Health and Environment, 2005, 2006).

Purpose and Scope

The purpose of this report is to present summaries and an evaluation of laboratory analyses for water-quality properties and constituents and bacteriological indicators in different types of stormwater samples that characterize the quality of stormwater in and around metropolitan Denver for a contemporary period beginning October 1, 2001, and continuing to October 11, 2005. The term "water year" can also be used to describe the study period; a water year begins on October 1 and ends September 30, and the study period is referred to as "water years 2002–2005" in this report. Specifically, the summaries and evaluation in this report include:

- Characterizations that summarize streamflow associated with composite samples,
- Univariate statistics that summarize stormwater quality,
- Comparison of time-weighted results to discharge and volume-weighted results,
- Comparisons of contemporary stormwater quality and numeric standards for use classifications established by the CDPHE,
- Descriptive statistics that evaluate annual means, tolerance intervals, correlations, and regressions among water-quality properties and constituents, and
- Comparison of previous characterizations of stormwater quality, based on data collected during water years 1998–2001, to the stormwater quality characterized in this report. The data, methods, and findings from 1998–2001 will be designated as "period 1" and the term "period 2" will be used for the 2002–2005 data and findings developed in this report.

Although descriptions of relations between water-quality properties and constituents and bacteriological indicators in stormwater are included, this report does not provide explanations of the physical basis for any identified relations. The summaries presented in this report, however, do provide a basis for comparisons to similar data.

Description of Stations

The five stations in the monitoring network include three stations on the main stem of the South Platte River (fig. 1; table 1). These stations are located below Union Avenue at Englewood, at Denver, and at Henderson and will be referred to in this report as "Union," "Denver," and "Henderson." The stations on the South Platte River receive streamflow from

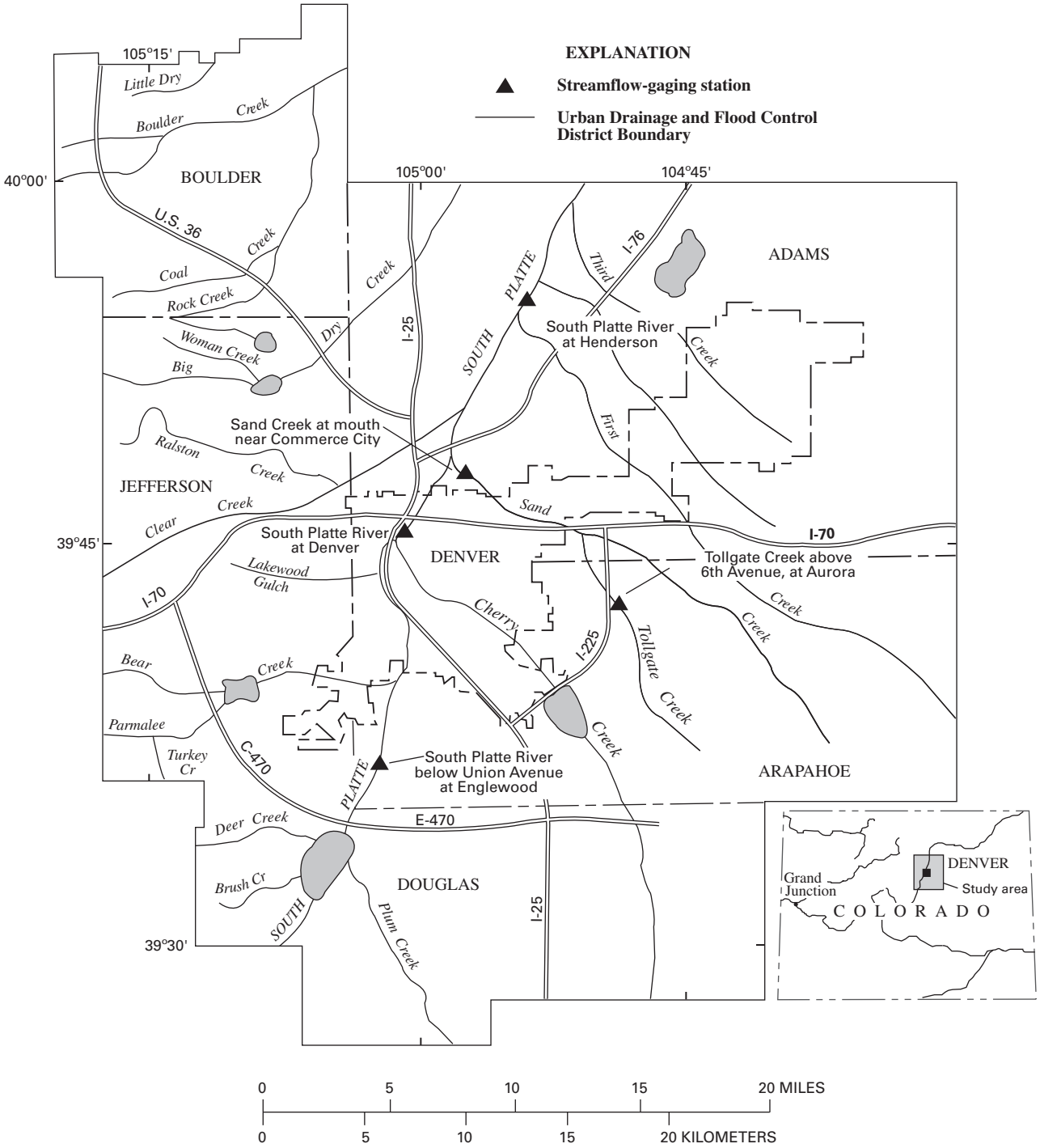


Figure 1. Map showing location of stations.

several tributaries, and the South Platte River is sometimes referred to as a "receiving stream." The two additional stations, Sand Creek at mouth near Commerce City and Tollgate Creek above 6th Avenue at Aurora, represent tributaries and are referred to in this report as "Sand Creek" and "Tollgate." Sand Creek is tributary to the South Platte River and Tollgate is tributary to Sand Creek. Collectively, these five stations define a drainage system that drains most of the area in and around metropolitan Denver.

The South Platte River originates in central Colorado and has a contributing drainage area of 3,861 mi^2 at the Denver station (U.S. Geological Survey, 2002–2005). Snowmelt from mountainous areas of central Colorado is a principal source of spring streamflow in the South Platte River; however, reservoirs and diversions along the South Platte River regulate streamflow. Chatfield Reservoir, which is just upstream from Denver, contains the vast majority of storm runoff generated upstream from Chatfield Reservoir, essentially truncating the

Table 1. Station characteristics.

[Station number and name from the USGS National Water Inventory System. Latitude and Longitude (NAD 27), geographic coordinates in degrees, minutes, seconds. Operating agency indicates agency responsible for streamflow records: USGS, U.S. Geological Survey; CODWR, Colorado Division of Water Resources; UDFCD, Urban Drainage and Flood Control District. RF location, location of precipitation gage associated with station, the source for all precipitation records is UDFCD. CDA, contributing drainage area in square miles; LCDA, local contributing drainage area in square miles adjusted for regulation (excludes CDA upstream from Chatfield Dam for South Platte River stations). Land cover indicates percentage of LCDA on basis of National Land Cover data from 1992 (U.S. Geological Survey, 2003) for undeveloped areas (Und), agricultural areas (Ag), residential areas (Res), and urban areas (Urb). Comments provide important historical operational events. ft^3/s, cubic feet per second; $(ft^3/s)/mi^2$, cubic feet per second per square mile; acre-ft/mi^2, acre-feet per square mile]

Station number	Station name	Station location		Operating agency	RF location	
		Latitude	Longitude		Latitude	Longitude
06710247	South Platte River below Union Avenue at Englewood	39º37'57"	105º00'52"	USGS	39º37'57"	105º00'52"
06714000	South Platte River at Denver	39º45'35"	105º00'10"	CODWR	39º44'32"	104º59'58"
394329104490101	Tollgate Creek above 6th Avenue at Aurora	39º43'29"	104º49'01"	UDFCD	39º43'30"	104º49'06"
394839104570300	Sand Creek at mouth near Commerce City	39º48'36"	104º57'00"	USGS	39º48'39"	104º57'03"
06720500	South Platte River at Henderson	39º55'10"	104º52'04"	CODWR	39º55'19"	104º52'00"

Station number	CDA	LCDA	Land cover, in percentage of local contributing drainage area				Comments
			Und	Ag	Res	Urb	
06710247	3,093	76	43.08	0.70	50.43	5.79	Gage operated as described in Rantz and others (1982). Various other precipitation used previous to water year 2000.
06714000	3,861	844	75.97	1.23	19.41	3.39	Gage operated as described in Rantz and others (1982). Various other precipitation used previous to water year 2001.
394329104490101	35	35	41.56	4.97	47.98	5.49	Gage operated as part of flood warning network. Various other precipitation records used previous to water year 2001.
394839104570300	184	184	62.58	8.72	22.41	6.29	Gage operated as described in Rantz and others (1982). Various other precipitation used previous to water year 2001.
06720500	4,768	1,751	75.30	3.16	17.79	3.75	Gage operated as described in Rantz and others (1982). Various other precipitation used previous to water year 2001.

contributing drainage area for the stations used in this study. Consequently, most stormwater runoff in the South Platte River in the Denver area is derived from a local contributing drainage area that does not extend upstream from Chatfield Reservoir and is simply the contributing drainage area downstream from Chatfield Reservoir. Streamflow regulation also occurs along Sand Creek and Tollgate but does not affect local contributing drainage areas.

Land-cover characteristics used in this report (table 1) represent percentages of the local contributing drainage areas for four aggregated categories developed on the basis of USGS National Land Cover data from 1992 (U.S. Geological Survey, 2003). In the aggregated classification, areas related to crops are classified as "agricultural"; areas identified as commercial, industrial, or transportation and areas related to mining, such as sand and gravel operations, are classified as "urban"; areas identified as residential or recreational are classified as "residential"; and all remaining areas are classified as "undeveloped." The local contributing drainage areas are less than 10 percent urban and consist mostly of undeveloped land (ranging from 41.56 to 75.97 percent in individual basins) and residential areas (17.79 to 50.43 percent). Only the agricultural land-cover classification shows a tendency to increase with local contributing drainage area (from 0.70 to 3.16 percent in the South Platte and from 4.97 to 8.72 percent in Sand Creek).

Previous Investigations

Several investigations of stormwater quality have been conducted in the Denver area. Beginning in 1979 and through 1983, annual data reports were issued summarizing stormwater-monitoring activities by USGS for various stations in the Denver metropolitan area (Ellis, 1978; Ellis and Alley, 1979; Hall and Duncan, 1980, 1981; Gibbs, 1981; Gibbs and Doerfer, 1982; Gibbs and others, 1983). Although these activities included some sampling in the South Platte River, most of the activities focused on tributaries to the South Platte River. Blakely and others (1983) reported on washoff characteristics from two experimental plots, and Ellis and others (1984), Ellis and Mustard (1985), and Mustard and others (1985) provided additional stormwater information on the basis of the USGS stormwater-monitoring activities. In addition, the Denver Regional Council of Governments (1983) summarized their stormwater-monitoring activities in the Denver metropolitan area.

More recently, Bossong and others (2005) summarized stormwater quality in the Denver area on the basis of samples collected form October 1, 1997, to September 30, 2001 (water years 1998 through 2001). The conclusions from the 2005 report indicated that concentrations in stormwater tended to

Table 1. Station characteristics.—Continued

[Station number and name from the USGS National Water Inventory System. Latitude and Longitude (NAD 27), geographic coordinates in degrees, minutes, seconds. Operating agency indicates agency responsible for streamflow records: USGS, U.S. Geological Survey; CODWR, Colorado Division of Water Resources; UDFCD, Urban Drainage and Flood Control District. RF location, location of precipitation gage associated with station, the source for all precipitation records is UDFCD. CDA, contributing drainage area in square miles; LCDA, local contributing drainage area in square miles adjusted for regulation (excludes CDA upstream from Chatfield Dam for South Platte River stations). Land cover indicates percentage of LCDA on basis of National Land Cover data from 1992 (U.S. Geological Survey, 2003) for undeveloped areas (Und), agricultural areas (Ag), residential areas (Res), and urban areas (Urb). Comments provide important historical operational events. ft^3/s, cubic feet per second; $(ft^3/s)/mi^2$, cubic feet per second per square mile; acre-ft/mi^2, acre-feet per square mile]

	Streamflow statistics			
Station name (number)	**Union (06710247)**	**Denver (06714000)**	**Sand Creek (394839104570300)**	**Henderson (06720500)**
Period of record, in water years	1996–2005	1976–2005	2000–2005	1976–2005
Annual mean, in ft^3/s	143	356	29.4	542
Annual mean, in $(ft^3/s)/mi^2$	1.88	0.42		0.31
Highest annual mean, in ft^3/s	293	961	39.0	1379
Highest annual mean, in $(ft^3/s)/mi^2$	3.86	1.14	0.21	0.79
Date	1999	1983	1997	1983
Lowest annual mean, in ft^3/s	29.3	120	20.7	252
Lowest annual mean, in $(ft^3/s)/mi^2$	0.38	0.14	0.11	0.14
Date	2002	2002	2002	1981
Highest daily mean, in ft^3/s	1,940	4,020	926	6,500
Highest daily mean, in $(ft^3/s)/mi^2$	25.5	4.78	5.03	3.73
Date	June 18, 1999	May 27, 1987	May 5, 2001	June 9, 1995
Lowest daily mean, in ft^3/s	3.3	42	2.1	27
Lowest daily mean, in $(ft^3/s)/mi^2$	0.04	0.05	0.01	0.02
Date	April 24, 1996	August 2, 2002	July 14, 2004	April 7, 1977
Annual 7-day minimum, in ft^3/s	5.3	48	3.2	69
Annual 7-day minimum, in $(ft^3/s)/mi^2$	0.07	0.06	0.02	0.04
Date	December 9, 2002	August 14, 2002	July 9, 2004	March 13, 1982
Maximum peak flow, in ft^3/s	2,150	12,600	4,010	12,300
Maximum peak flow, in $(ft^3/s)/mi^2$	28.3	15.0	21.8	7.06
Date	May 28, 1999	July 25, 1998	August 18, 2004	June 27, 1983
Annual runoff, in acre-feet	103,800	258,300	21,300	392,600
Annual runoff, in acre-ft/mi^2	1,366	307	116	226
10 percent exceeds, in acre-feet	367	707	51	1,020
10 percent exceeds, in acre-ft/mi^2	4.83	0.84	0.28	0.58
50 percent exceeds, in acre-feet	63	184	17	333
50 percent exceeds, in acre-ft/mi^2	0.83	0.22	0.09	0.19
90 percent exceeds, in acre-feet	14	84	10	179
90 percent exceeds, in acre-ft/mi^2	0.18	0.10	0.05	0.10

increase in a downstream direction along the South Platte River, that concentrations for many water-quality properties and constituents in stormwater were relatively dilute compared to concentrations in base flow, that exceptions to CDPHE numeric standards (measured concentrations that did not meet standards) for some metals occurred in as many as 10 to 25 percent of samples, and that there were consistent exceptions to numeric standards for bacteriological indicators such as *Escherichia coli* and fecal coliform. This report summarizes a second period, October 1, 2001, to October 11, 2005 (referred to as "water years 2002–2005" in this report) using similar methods and contemporary data that were collected using the same protocols and programmatic goals leading to the Bossong and others (2005) report.

Methods of Study

The methods used to collect and process streamflow data, collect and process stormwater samples, and perform laboratory analyses are described in this section. The section also describes the quality-assurance and quality-control (QA/QC) measures and results used in the study.

Streamflow Data Collection

Streamflow records are maintained for each station by various operating agencies (table 1). Union and Sand Creek are operated by the USGS in accordance with methods described by Rantz and others (1982). The streamflow data for Union and Sand Creek are maintained in the USGS National

Water Information System (NWIS). Daily data, which represent various statistics for a 24-hour period, and subdaily data that are instantaneous values used to develop daily values, are available from NWIS. In addition, the records were published in USGS annual data reports for water years 2002–2005 (U.S. Geological Survey, 2002–2005). The published records received additional processing to obtain a variety of summary streamflow statistics, some of which are included in table 1.

Denver and Henderson are operated by the Colorado Division of Water Resources (CODWR). The CODWR records are reviewed and published by the USGS (U.S. Geological Survey, 2002–2005). Daily streamflow values are maintained in NWIS. Instantaneous values for the most recent year are maintained on a publicly available CODWR Web-based system (URL *http://www.dwr.state.co.us/SurfaceWater/Default.aspx*). All instantaneous values from Denver and Henderson are available on a UDFCD Web-based system (*http://alert.udfcd.org*).

Tollgate is operated by UDFCD using systematic but undocumented methods that involve theoretical stage and streamflow relations developed on the basis of channel geometry. The Tollgate data are used as part of an Automated Local Evaluation in Real Time (ALERT) system operated by UDFCD to assess field conditions in a real-time mode in order to facilitate flood forecasting. Because the UDFCD data are focused on real-time information, data may be available only for periods of storm runoff. The UDFCD records consist only of instantaneous values that are archived but do not receive additional processing or extensive review.

Sample Collection and Analysis

Two principal types of investigative samples, referred to as "composite" and "discrete" samples, were collected as part of this study. Composite samples integrate several aliquots of water collected over a period of time, and discrete samples consist of a single sample that is more representative of an instantaneous sample. All composite and discrete samples were collected using automatic pumping samplers that withdraw water from a fixed point in the channel cross section. The samples at four samplers are refrigerated, and ice is used in the fifth sampler to chill samples. In addition, bacteriological samples were sometimes manually collected during selected storms. The composite, bacteriological, and discrete samples are collectively referred to as "stormwater samples."

During this study, stormwater samples were analyzed by two laboratories in Denver, Colorado: the Metro Wastewater Reclamation District Laboratory (MWRD) and the USGS National Water Quality Laboratory (NWQL). Composite samples were analyzed at MWRD during water year 2002; after water year 2002 all composite samples were analyzed at NWQL, and MWRD only analyzed bacteriological samples. All discrete samples were analyzed at NWQL. The results of all laboratory analyses obtained as part of this study reside in the NWIS database and can be accessed using the USGS Web interface to water data at URL *http://waterdata.usgs.gov/co/nwis/qw/*. Table 2 describes the laboratory analyses and analytical methods used for the principal types of samples collected as part of this study. Results referred to as "dissolved" are from water that has been passed through a filter that removes particles greater than 0.45 micrometer in their smallest diameter. Results referred to as "total" are from unfiltered water that has undergone an in-bottle digestion procedure (Hoffman and others, 1996). Results referred to as "whole water" are from water that has not been filtered or digested. Table 2 also lists the reporting level. The general term "reporting level" specifies the level at which values will be censored, or reported as "less than" and is sometimes referred to as "censored" (Helsel, 2005). Laboratory quantifications of values below the reporting level are sometimes provided and are typically qualified as estimates.

Composite Samples

A total of 176 composite samples were collected using refrigerated, or ice chilled, automatic pumping samplers that were manually activated when stormwater runoff began. Once activated, the samplers obtained aliquots, or sample portions, by withdrawing fixed volumes of water from the stream every 60 minutes. The samplers were equipped with eight 2-L bottles and were programmed to add three aliquots to each bottle. In theory, the samplers could operate unattended for 24 hours; however, in practice, each station was visited by USGS project staff every 12 to 24 hours during storm events. As the stations were visited, the contents of four sequential bottles were composited into a single time-weighted composite sample. For submittal to MWRD, each sample was composited according to churn-splitter procedures described in the USGS National Field Manual (U.S. Geological Survey, variously dated, chapter A5), which documents USGS protocols for collection of water-quality data. Additional sample processing, such as filtration, bottling, and preservation, occurred at MWRD. The compositing, filtration, bottling, and preservation of samples submitted to NWQL took place in the field using procedures described in the USGS National Field Manual. If individual sample bottles were found to contain different volumes of water, it was assumed that individual aliquot volumes varied, and the aliquot sample volumes were adjusted, if possible, or the samples were discarded. The samples were analyzed for physical properties such as pH, specific conductance, hardness, and residue on evaporation at 105 degrees Celsius; for constituents such as major ions (in 2005), organic carbon, and nutrients, including ammonia, nitrite plus nitrate, ammonia plus organic nitrogen, total phosphorus, and orthophosphate; and for metals, including total and dissolved phases of copper, lead, manganese, and zinc (table 2).

The composite samples integrate concentrations over time and are appropriate for evaluating water-quality criteria developed for aquatic wildlife. The aquatic wildlife criteria defined by CDPHE (Colorado Department of Public Health and Environment, 2005, 2006), generally the most stringent criteria in

Table 2. Water-quality properties and constituents for composite, bacteriological, and discrete samples, water years 2002–2005.

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency; C, Celsius; N, nitrogen; P, phosphorus. Phase: W, determination made using whole water; T, total; D, dissolved. Analytical facility, MWRD, Metro Wastewater Reclamation District Laboratory; NWQL, USGS National Water Quality Laboratory. Preferred analytical method indicates the analytical method in use at the Metro Wastewater Reclamation District Laboratory in 2002. Reporting units: stdu, standard pH units; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; col, colonies per 100 milliliters; --, not applicable; ICP, inductively coupled plasma]

Composite samples, water year 2002							
Water-quality property or constituent	**Phase**	**Analytical facility**	**Laboratory property or constituent identifier**	**USGS parameter code**	**Analytical method**	**Reporting units**	**Reporting level**
Physical properties							
pH, laboratory	W	MWRD	PHD001	00403	USEPA 150.1	stdu	--
Specific conductance	W	MWRD	CON001	00095	USEPA 120.1	µS/cm	0.10
Hardness, as calcium carbonate	T	MWRD	HARD001	00900	USEPA 130.2	mg/L	10.00
Residue on evaporation	T	MWRD	TSS001	00530	USEPA 160.2	mg/L	1.00
Organics							
Organic carbon	T	MWRD	TOC001	00680	USEPA 415.1	mg/L	1.00
Nutrients							
Ammonia, as N	T	MWRD	NH3A001	00610	USEPA 350.1	mg/L	0.20
Ammonia + organic N, as N	T	MWRD	TKNH001	[1]00625	USEPA 351.3	mg/L	0.30
Nitrite + nitrate, as N	T	MWRD	NO5001	00630	USEPA 353.2	mg/L	0.02
Phosphorus, as P	T	MWRD	TPW001	00665	USEPA 365.4	mg/L	0.03
Orthophosphate, as P	D	MWRD	OP001	00671	USEPA 365.1	mg/L	0.03
Metals							
Copper	D	MWRD	ICPSW007	[2]01040	USEPA 200.7	µg/L	1.00
Copper	T	MWRD	CURFW001	[3]01119	USEPA 220.2	µg/L	1.00
Lead	D	MWRD	ICPSW003	[2]01049	USEPA 200.7	µg/L	10.00
Lead	T	MWRD	PBRFW001	01114	USEPA 239.2	µg/L	10.00
Manganese	D	MWRD	ICPSW005	[4]01056	USEPA 200.7	µg/L	0.02
Manganese	T	MWRD	ICPSW005	[4]00925	USEPA 200.7	µg/L	0.02
Zinc	D	MWRD	ICPSW001	[2]01090	USEPA 200.7	µg/L	0.30
Zinc	T	MWRD	ZNRFW001	[3]01094	USEPA 289.2	µg/L	0.30

Composite samples, water years 2003 to 2005							
Water-quality property or constituent	**Phase**	**Analytical facility**	**Laboratory property or constituent identifier**	**USGS parameter code**	**Analytical method**	**Reporting units**	**Reporting level**
Physical properties							
pH, laboratory	W	NWQL	68	00403	I-2587-89[5]	stdu	0.1
Alkalinity, as calcium carbonate, fixed endpoint	D	NWQL	2109	29801	I-2030-89[5]	mg/L	5
Specific conductance	W	NWQL	69	00095	I-2781-88[5]	µS/cm	2.6
Residue on evaporation	T	NWQL	169	00530	I-3765-89[5]	mg/L	10
Major ions							
Calcium	D	NWQL	659	00915	I-1472-87[6]	mg/L	0.02
Chloride	D	NWQL	1571	00940	I-2057-85[5]	mg/L	0.20
Fluoride	D	NWQL	31	00950	I-2327-89[5]	mg/L	0.10
Magnesium	D	NWQL	663	00925	I-1472-87[6]	mg/L	0.008
Potassium	D	NWQL	2773	00935	3120-ICP[7]	mg/L	0.16
Sodium	D	NWQL	675	00930	I-1472-87[6]	mg/L	0.20
Sulfate	D	NWQL	1572	00945	I-2057-85[5]	mg/L	0.18
Organics							
Organic carbon	D	NWQL	2612	00681	O-1120-92[8]	mg/L	0.33
Nutrients							
Ammonia, as N	T	NWQL	3116	00608	I-2522-90[6], I-2525-89[6]	mg/L	0.010
Ammonia + organic N, as N	T	NWQL	1986	00625	I-4515-91[9]	mg/L	0.10
Nitrite + nitrate, as N	T	NWQL	1975	00631	I-2545-90[6]	mg/L	0.060
Orthophosphate, as P	D	NWQL	3118	00671	I-2601-90[6], I-2606-89[6]	mg/L	0.006
Phosphorus, as P	T	NWQL	1984	00665	I-4610-91[10]	mg/L	0.040

Table 2. Water-quality properties and constituents for composite, bacteriological, and discrete samples, water years 2002–2005.—Continued

[USGS, U.S. Geological Survey; USEPA, U.S. Environmental Protection Agency; C, Celsius; N, nitrogen; P, phosphorus. Phase: W, determination made using whole water; T, total; D, dissolved. Analytical facility, MWRD, Metro Wastewater Reclamation District Laboratory; NWQL, USGS National Water Quality Laboratory. Preferred analytical method indicates the analytical method in use at the Metro Wastewater Reclamation District Laboratory in 2002. Reporting units: stdu, standard pH units; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; µg/L, micrograms per liter; col, colonies per 100 milliliters; --, not applicable; ICP, inductively coupled plasma]

Composite samples, water years 2003 to 2005—Continued							
Water-quality property or constituent	**Phase**	**Analytical facility**	**Laboratory property or constituent identifier**	**USGS parameter code**	**Analytical method**	**Reporting units**	**Reporting level**
Metals							
Copper	D	NWQL	1791	01040	I-2477-92[11]	µg/L	0.4
Copper	T	NWQL	2379	01042	I-4471-97[12]	µg/L	0.6
Lead	D	NWQL	1792	01049	I-2477-92[11]	µg/L	0.08
Lead	T	NWQL	2380	01051	I-4471-97[12]	µg/L	0.06
Manganese	D	NWQL	1793	01056	I-2477-92[11]	µg/L	0.2
Manganese	T	NWQL	2382	01055	I-4471-97[12]	µg/L	0.6
Zinc	D	NWQL	1798	01090	I-2477-92[11]	µg/L	0.6
Zinc	T	NWQL	2390	01092	I-4471-97[12]	µg/L	2
Bacteriological samples							
Water-quality property or constituent	**Phase**	**Analytical facility**	**Laboratory property or constituent identifier**	**USGS parameter code**	**Analytical method**	**Reporting units**	**Reporting level**
Escherichia coli	W	MWRD	ECMPN001	50468	USEPA 600/8-78-017, 1978	col	2
Fecal coliform	W	MWRD	FCMPN001	31615	USEPA 600/8-78-017, 1978	col	20
Discrete samples							
Water-quality property or constituent	**Phase**	**Analytical facility**	**Laboratory property or constituent identifier**	**USGS parameter code**	**Analytical method**	**Reporting units**	**Reporting level**
Physical properties							
pH, laboratory	W	NWQL	00068	00403	I-2587-89[5]	stdu	0.1
Alkalinity, as calcium carbonate, fixed endpoint	D	NWQL	02109	29801	I-2030-89[5]	mg/L	5
Alkalinity, as calcium carbonate, fixed endpoint	W	NWQL	00070	90410	I-2030-89[5]	mg/L	6
Specific conductance	W	NWQL	00069	00095	I-2781-88[5]	µS/cm	2.6
Residue on evaporation	T	NWQL	00169	00530	I-3765-89[5]	mg/L	10
Major ions							
Calcium	D	NWQL	00659	00915	I-1472-87[6]	mg/L	0.02
Chloride	D	NWQL	01571	00940	I-2057-85[5]	mg/L	0.20
Fluoride	D	NWQL	00031	00950	I-2327-89[5]	mg/L	0.10
Magnesium	D	NWQL	00663	00925	I-1472-87[6]	mg/L	0.008
Potassium	D	NWQL	02773	00935	3120-ICP[7]	mg/L	0.16
Sodium	D	NWQL	00675	00930	I-1472-87[6]	mg/L	0.20
Sulfate	D	NWQL	01572	00945	I-2057-85[5]	mg/L	0.18
Organics							
Organic carbon	D	NWQL	02612	00681	O-1120-92[8]	mg/L	0.33
Nutrients							
Ammonia, as N	T	NWQL	03116	00608	I-2522-90[6], I-2525-89[6]	mg/L	0.010
Ammonia + organic N, as N	T	NWQL	01986	00625	I-4515-91[10]	mg/L	0.10
Nitrite + nitrate, as N	T	NWQL	01975	00631	I-2545-90[6]	mg/L	0.060
Orthophosphate, as P	D	NWQL	03118	00671	I-2601-90[6], I-2606-89[6]	mg/L	0.006
Phosphorus, as P	T	NWQL	01984	00665	I-4610-91[10]	mg/L	0.040
Metals							
Copper	D	NWQL	01791	01040	I-2477-921[1]	µg/L	0.4
Lead	D	NWQL	01792	01049	I-2477-921[1]	µg/L	0.08
Manganese	D	NWQL	01793	01056	I-2477-921[1]	µg/L	0.2
Zinc	D	NWQL	01798	01090	I-2477-921[1]	µg/L	0.6

[1]An analytical facility identifier of TKNL001 sometimes used for low-level determinations.

[2]A different analytical facility identifier sometimes used for furnace determinations using the same USEPA methods used for total determinations.

[3]A different analytical facility identifier sometimes used for ICP determinations made using the same USEPA methods used for furnace dissolved determinations.

[4]Manganese results are available only for a subset of all samples.

[5]Fishman and Friedman, 1989.

[6]Fishman, 1993.

[7]American Public Health Association, 1998.

[8]Brenton and Arnett, 1993.

[9]Patton and Truitt, 2000.

[10]Patton and Truitt, 1992.

[11]Faires, 1993.

[12]Garbarino and Struzeski, 1998.

place, describe acute standards that specify a maximum allowable concentration for a period of time, usually 24 hours. The acute criteria, like the composite samples, describe concentration over a period of time rather than instantaneous concentration.

The samplers can be activated to collect samples automatically in a number of different ways; however, due to the effects of streamflow regulation and relatively complex weather patterns, decisions to activate samplers in this study were made by USGS project staff on the basis of local weather and streamflow conditions. Local weather and streamflow conditions were monitored nearly continuously through a variety of sources including near real-time data available from the World Wide Web. The ALERT system operated by UDFCD provides very near real-time data from an extensive network of precipitation gages. In addition, the ALERT system provides information from many UDFCD gaging stations. It also integrates streamflow data from USGS and CODWR gaging stations into very near real-time Web-based reports. The very near real-time ALERT data typically are available within a few minutes of measurement.

Bacteriological Samples

Twenty-two bacteriological samples were collected during selected storms. The samples were collected manually as grab samples by filling bottles at streamsides and then transporting them directly to MWRD for immediate analysis, typically within an hour of sample collection. The bacteriological samples were analyzed for the bacteriological indicators *Escherichia coli* and fecal coliform (table 2).

Discrete Samples

Twenty-two discrete samples were collected during two storms to help evaluate the effect various weighting methods might have on sample compositing. The automatic pumping samplers were operated manually to obtain individual, or discrete, samples through a storm hydrograph. The discrete samples were analyzed at the NWQL for a suite of constituents that did not include determinations for total copper, lead, manganese, and zinc but otherwise was very similar to the suite of analyses for composite samples analyzed at the NWQL (table 2).

Discrete samples were processed in the field and then submitted to the NWQL for analysis. No physical compositing was done in the field; rather, the results from individual discrete samples were composited by mathematically using three different weighting techniques based on time, streamflow, and volume using a general equation with the form:

$$WC = [\Sigma C \times WF] \div [\Sigma WF] \quad (1)$$

where

WC is weighted concentration,

C is concentration,

and

WF is weighting factor (time, streamflow, or volume).

Quality Assurance and Quality Control

Laboratory QA/QC samples were evaluated as part of this study. Additional QA/QC field samples also were collected to characterize the influence that sampling equipment or ambient field conditions may have had on samples. Information about and descriptions of milliequivalent balances computed for samples analyzed for major ions are discussed in Hem (1985). Specific conductances determined using the pumping samplers and samples collected using methods that integrate cross-section conditions in the channel also are presented in this section of the report.

Laboratory Quality Assurance and Quality Control

It is standard USGS practice to monitor laboratory performance for purposes of qualifying laboratory results. Laboratory performance in this study was evaluated on the basis of the USGS Standard Reference Sample (SRS) program (Woodworth and Connor, 2003) as well as different types of additional QA/QC samples. The SRS program prepares spiked samples and distributes them to as many as 100 laboratories across the Nation. Results from all laboratories are used to determine a most probable value (MPV), and individual laboratory results are compared to the MPV to quantify performance.

The NWQL and MWRD SRS program results for laboratory analyses used in this study are summarized in table 3. In general, the results indicate that the median relative percent difference (RPD) between laboratory results and the SRS MPV, for both laboratories, had an absolute value less than 1 with a standard deviation of about 8. The RPD for two given values (a and b) is calculated according to the following equation:

$$RPD = \{(a - b) \div [(a + b) \div 2]\} \times 100 \quad (2)$$

For example, a laboratory result of 8, when the MPV is 10, results in an RPD of –22.2. The frequency distribution information in table 3 indicates that, for the 41 tests MWRD participated in during 2002, the central 80 percent of the distribution (from the 10th to the 90th percentiles) of RPDs ranged from –2.34 to 3.86; for the 306 tests NWQL participated in, the RPDs ranged from –6.56 to 5.72.

Duplicate samples also were used to evaluate laboratory performance and field procedures. The duplicate samples consisted of field-matrix, or actual, stormwater split into two separate samples and can be more explicitly referred to as "split-replicate samples." The results from these split-replicate samples indicate that results from the field have slightly wider extremes than the results from the SRS program (table 3).

Milliequivalent balances for major ions were calculated according to methods described by Hem (1985) for samples analyzed at the NWQL for major ions. Typically the major ions (cations and anions) are the principal contributors of

Table 3. Laboratory performance evaluation data from U.S. Geological Survey Standard Reference Sample Program, duplicate samples, and milliequivalent balances.

[MWRD, Metro Wastewater Reclamation District Laboratory; NWQL, USGS National Water Quality Laboratory; Stddev, standard deviation; n, number of samples. Univariate statistics for U.S. Geological Survey Standard Reference Sample program most probable values and results from Metro Wastewater Reclamation District Laboratory and U.S. Geological Survey National Water Quality Laboratory]

Laboratory	Mean	Median	Stddev	Skewness	Minimum	Maximum	Range for 10th to 90th percentile	n
MWRD (2002)	2.56	0.57	8.06	3.17	–4.93	34.98	–2.34 to 3.86	41
NWQL (2002–2005)	–0.44	0	8.48	–1.51	–56.66	49.18	–6.56 to 5.72	306
Duplicates	5.24	0	31.81	2.83	–119.74	191.02	–9.11 to 16.42	108
Milliequivalent balances (percent)	0.78	0.78	1.30	0.27	–2.23	5.38	–0.77 to 2.21	63

electrical charge for dissolved constituents in water, and their sum should be close to zero; departures from zero may be an indication of inaccurate analyses. The milliequivalent balances shown in table 3 indicate excellent results at the NWQL.

Field Quality Assurance/Quality Control

Additional QA/QC samples included various blank samples collected to help characterize the potential effects of field procedures and ambient field conditions. Spiked samples were used to define potential contributions of organic carbon introduced by field equipment. Cross-section samples were used to help characterize differences between samples collected using the fixed intakes of the pumping samplers and samples collected manually using depth-integrating techniques (U.S. Geological Survey, variously dated, chapter A5), across the cross section.

Table 4 includes results from field, churn, and equipment blanks. Universal blank water (UBL), obtained from the NWQL and certified to have very low concentrations of inorganic and organic constituents, was used when collecting the blank samples. Field blanks were collected by pouring UBL water directly into sample bottles in the field; the field blank samples are not processed in churn splitters or filters. Churn blanks were collected by processing UBL through churn splitters in the field. The results for field and churn blanks in table 4 indicate no substantial contributions to concentrations from ambient field conditions or the use of churn splitters in the field.

Equipment blanks were collected to characterize the potential effects of sampler intake lines. Three types of equipment blanks were collected: type 1 samples consist of UBL passed through sampler intake lines with no rinse; type 2 samples consist of UBL passed through sampler intake lines after a field rinse with native water; and type 3 samples consist of UBL passed through sampler intake lines after a UBL rinse. The results for equipment blanks in table 4 indicate that there were no substantial contributions to concentrations from sampler intake lines.

Two sets of organic carbon blank samples that were collected in May and June of 2004 were used to evaluate the potential additive effect that pumping sampler bottles, which are plastic, may have on organic carbon concentrations. Each sample set included three samples: type 1 samples consisted of UBL water stored in pumping sampler bottles under field conditions (refrigerated) for at least 2 days; types 2 and 3 samples consisted of water spiked to concentrations approximating ambient field conditions and stored in plastic and glass containers (respectively) under field conditions for at least 2 days. The results for these samples (table 4) do not indicate a substantial contribution to concentrations of organic carbon from pumping sampler bottles.

A comparison of results from the pumping samplers and cross-section depth-integrated samples was made on the basis of specific conductance measurements made during water year 2004 (table 5). The pumping samplers collect water from a fixed point, and depth-integrated samples were collected at 10 points distributed across the individual stream channel. The samples were collected in the field under stable streamflow conditions in June of 2004; the results do not include Tollgate Creek, which was in backwater at that time. The results from the cross-section depth-integrated samples indicate that in all of the streams, except perhaps the South Platte River at Denver, specific conductance is uniform across the channel, under conditions of stable streamflow. The results also indicate that, under conditions of stable streamflow, specific conductance from the fixed sampling points is representative of overall channel conditions. These results are similar to those for stormwater samples collected in the same network during water years 1998–2001 (Bossong and others, 2005).

Summary of Stormwater Quality

The results of stormwater sample-collection activities and analyses of stormwater samples for water-quality properties and constituents and biological indicators are summarized in this section. Descriptions of composite-sample collection activities characterize sampled storms and give the number of samples collected. Summary statistics for the results of laboratory analyses of composite samples describe results collectively, by station, and by hydrograph classification. Stormwater-sample collection activities and laboratory analyses associated with discrete samples also are discussed in this section. In addition, results from composite samples collected in this study are compared to numeric standards established by the CDPHE.

Table 4. Water-quality properties and constituents in blank samples.

[Equipment blank type: type 1 samples consist of universal blank water (UBL) passed through sampler intake lines with no rinse; type 2 samples consist of UBL passed through sampler intake lines after a field rinse with native water; and type 3 samples consist of UBL passed through sampler intake lines after a UBL rinse. Organic carbon blank type: Type 1 samples consist of UBL water stored in pumping sampler supplies under field conditions (refrigerated) for at least 2 days; Type 2 and 3 samples consist of water spiked to concentrations approximating field conditions and stored in plastic and glass containers (respectively) under field conditions for at least 2 days. Phase: W, determination made using whole water; T, total; D, dissolved; stdu, standard pH units; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; N, nitrogen; P, phosphorus; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; E, estimated value below reporting level; --, not applicable; <, less than]

Property or constituent	Phase	Sample type								
		Field blanks		Churn blanks						
Station name		Tollgate	Sand Creek	Tollgate	Henderson	Denver	Sand Creek	Denver	Henderson	Sand Creek
Date		20030607	20041124	20040718	20040811	20040819	20050604	20050724	20050725	20050912
Time		2211	900	1000	1400	0511	1739	1750	2135	1040
pH, in standard units	W	5.2	7.2	E6.9	E6.9	E6.8	5.9	7.7	8.4	--
Specific conductance, in µS/cm	W	--	--	--	--	--	--	--	--	--
Hardness, as $CaCO_3$, in mg/L	T	--	--	--	--	--	--	--	--	--
Calcium, in mg/L	D	0.02	0.04	0.01	0.05	0.03	<.02	E.01	0.03	--
Magnesium, in mg/L	D	<.008	<.008	<.008	E.004	<.008	<.008	<.008	<.008	--
Potassium, in mg/L	D	--	<.16	--	--	<.16	<.16	<.16	<.16	--
Sodium, in mg/L	D	--	<.20	--	--	--	<.20	<.20	<.20	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	W	--	2	--	--	--	2	<5	<5	--
Chloride, in mg/L	D	--	<.20	--	--	<.20	<.20	<.20	<.20	--
Fluoride, in mg/L	D	--	<.1	--	--	<.2	<.1	<.1	<.1	--
Sulfate, in mg/L	D	--	<.2	--	--	<.2	<.2	<.2	<.2	--
Residue on evaporation at 105°C, in mg/L	T	<10	<10	<10	<10	<10	<10	<10	<10	--
Ammonia + organic N, in mg/L	T	<.10	<.10	<.10	<.10	<.10	--	<.10	<.10	<.10
Ammonia, as N, in mg/L	D	<.04	<.04	<.04	<.04	<.04	--	<.04	<.04	<.04
Nitrite + nitrate, as N, in mg/L	D	<.06	<.06	<.06	<.06	<.06	--	<.06	<.06	<.06
Orthophosphate, as P, in mg/L	D	<.007	<.006	E.003	<.006	<.006	--	<.006	<.006	<.006
Phosphorus, as P, in mg/L	T	<.04	<.04	<.04	<.04	<.04	--	<.04	<.04	<.04
Organic carbon, in mg/L	D	1	<.3	<.3	0.5	0.8	0.5	0.6	0.6	--
Copper, in µg/L	D	<.2	<.4	<.4	<.4	<.4	<.4	<.4	<.4	--
Copper, in µg/L	T	<.6	<.6	<.6	<.6	--	<.6	<.6	<.6	--
Lead, in µg/L	D	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	--
Lead, in µg/L	T	<.06	<.06	<.06	E.04	--	<.06	<.06	<.06	--
Manganese, in µg/L	D	<.2	<.2	<.2	0.3	--	<.2	E.1	<.2	--
Manganese, in µg/L	T	E.2	E.1	<.2	0.9	--	0.3	0.2	<.2	--
Zinc, in µg/L	D	<1.0	<.6	E.3	0.9	<.6	0.7	<.6	3	--
Zinc, in µg/L	T	2	<2	<2	3	--	<2	<2	4	--

Composite and Bacteriological Samples

A summary describing streamflow associated with composite-sample collection is presented in table 6. Daily-value hydrographs for each station indicate sampling events (fig. 2). Table 6 includes summary data for the mean streamflow, streamflow volume, and duration (length of time) associated with individual composite samples collected at individual stations and for all stations pooled together. The data are presented for composite samples from all stations pooled together and for individual stations. The summary in table 6 is further subdivided on the basis of hydrograph classification. Samples were classified as associated with the rising or falling portion of the hydrograph, or a hydrograph that represented an entire storm event. The event hydrograph classification includes both rising and falling portions of the stormwater-runoff hydrograph and may represent only a portion of the stormwater-runoff hydrograph for multi-day or peak events. Table 6 also lists samples for a few storms that could not be classified due to a lack of streamflow information. Additional details of the classification procedure and example hydrographs from all stations (fig. A1) are presented in the "Hydrograph Classification" section of the Appendix.

Table 4. Water-quality properties and constituents in blank samples.—Continued

[Equipment blank type: type 1 samples consist of universal blank water (UBL) passed through sampler intake lines with no rinse; type 2 samples consist of UBL passed through sampler intake lines after a field rinse with native water; and type 3 samples consist of UBL passed through sampler intake lines after a UBL rinse. Organic carbon blank type: Type 1 samples consist of UBL water stored in pumping sampler supplies under field conditions (refrigerated) for at least 2 days; Type 2 and 3 samples consist of water spiked to concentrations approximating field conditions and stored in plastic and glass containers (respectively) under field conditions for at least 2 days. Phase: W, determination made using whole water; T, total; D, dissolved; stdu, standard pH units; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; N, nitrogen; P, phosphorus; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; E, estimated value below reporting level; --, not applicable; <, less than]

Property or constituent	Phase	Sample type								
		Equipment blanks								
Equipment blank type		Type 1	Type 1	Type 2	Type 3	Type 1	Type 2	Type 1	Type 2	Type 3
Station name		Sand Creek	Henderson	Henderson	Henderson	Tollgate	Tollgate	Sand Creek	Sand Creek	Sand Creek
Date		20030818	20030821	20030821	20030821	20030821	20030821	20041124	20041124	20041124
Time		2030	1015	1030	1045	0900	0915	0950	1035	1111
pH, in standard units	W	E6.7	6.1	6.1	6.0	6.1	6.0	7.6	7.1	7.0
Specific conductance, in µS/cm	W	--	--	--	--	--	--	--	--	--
Hardness, as $CaCO_3$, in mg/L	T	--	6	--	--	1	--	--	31	--
Calcium, in mg/L	D	0.03	2.14	0.09	0.08	0.47	0.08	0.06	9.07	0.28
Magnesium, in mg/L	D	E.006	0.273	<.008	E.007	0.071	0.009	E.007	1.95	0.056
Potassium, in mg/L	D	--	--	--	--	--	--	<.16	0.61	<.16
Sodium, in mg/L	D	--	--	--	--	--	--	<.20	15.4	0.5
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	W	--	--	--	--	--	--	<2	17	3
Chloride, in mg/L	D	--	--	--	--	--	--	<.20	14.6	0.43
Fluoride, in mg/L	D	--	--	--	--	--	--	<.1	E.1	<.1
Sulfate, in mg/L	D	--	--	--	--	--	--	<.2	22.9	0.4
Residue on evaporation at 105°C, in mg/L	T	<10	31	<10	<10	<10	<10	<10	<10	<10
Ammonia + organic N, in mg/L	T	<.10	0.8	<.10	<.10	<.10	<.10	E.09	0.3	<.10
Ammonia, as N, in mg/L	D	<.04	<.04	<.04	<.04	<.04	<.04	<.04	0.2	<.04
Nitrite + nitrate, as N, in mg/L	D	<.06	<.06	0.77	<.06	<.06	<.06	<.06	0.28	<.06
Orthophosphate, as P, in mg/L	D	<.007	0.014	<.007	<.007	<.007	<.007	E.004	0.073	<.006
Phosphorus, as P, in mg/L	T	<.04	0.17	<.04	<.04	E.02	<.04	<.04	0.08	<.04
Organic carbon, in mg/L	D	0.4	8.9	0.5	E.3	--	E.3	1.5	0.6	E.2
Copper, in µg/L	D	E.1	0.3	<.2	<.2	<.2	<.2	<.4	0.5	<.4
Copper, in µg/L	T	--	2.2	<.6	<.6	<.6	<.6	<.6	1	<.6
Lead, in µg/L	D	<.08	<.08	<.08	<.08	<.08	<.08	0.09	0.1	<.08
Lead, in µg/L	T	--	1.79	<.06	<.06	0.15	<.06	0.1	0.1	<.06
Manganese, in µg/L	D	--	8.1	0.3	0.4	1.2	E.1	3.2	28.3	1.1
Manganese, in µg/L	T	--	25	0.4	0.6	4.4	0.5	2.8	23.4	1.1
Zinc, in µg/L	D	<1.0	17.9	1.2	<1.0	1.3	<1.0	38.6	10.8	9
Zinc, in µg/L	T	--	31	E1	<2	3	<2	34	10	8

A total of 176 composite samples were collected; 4 of the samples, from Tollgate, had no associated streamflow measurements, and 3 samples from Union were neither rising, falling, or event hydrographs; all of these samples are characterized as unclassified. About 35 to 45 samples were collected at each station except Tollgate where only 24 samples were collected. Overall, and at most stations, hydrographs for composite samples were most commonly classified as falling or event hydrographs. During the study period, these two categories accounted for 78 to 98 percent of the samples collected at individual stations. Relatively few samples were associated with rising hydrographs.

The results of laboratory analyses of composite samples are summarized with univariate statistics in table 7 and figure 3. The results are presented for all stations pooled together or combined, by individual station, and by hydrograph classification. The summary (table 7) includes the

Table 4. Water-quality properties and constituents in blank samples.—Continued

[Equipment blank type: type 1 samples consist of universal blank water (UBL) passed through sampler intake lines with no rinse; type 2 samples consist of UBL passed through sampler intake lines after a field rinse with native water; and type 3 samples consist of UBL passed through sampler intake lines after a UBL rinse. Organic carbon blank type: Type 1 samples consist of UBL water stored in pumping sampler supplies under field conditions (refrigerated) for at least 2 days; Type 2 and 3 samples consist of water spiked to concentrations approximating field conditions and stored in plastic and glass containers (respectively) under field conditions for at least 2 days. Phase: W, determination made using whole water; T, total; D, dissolved; stdu, standard pH units; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; N, nitrogen; P, phosphorus; $CaCO_3$, calcium carbonate; µg/L, micrograms per liter; E, estimated value below reporting level; --, not applicable; <, less than]

Property or constituent	Phase	Sample type								
		Equipment blanks			Organic carbon blanks					
Blank type		Type 1	Type 2	Type 3	Type 1	Type 2	Type 3	Type 1	Type 3	Type 3
Station name		Sand Creek	Sand Creek	Sand Creek	Denver	Denver	Denver	Denver	Denver	Denver
Date		20050829	20050928	20050928	20040518	20040519	20040519	20040630	20040630	20040630
Time		0830	0900	0930	1000	1200	1205	0925	0920	0930
pH, in standard units	W	7.6	7.2	7.5	--	--	--	--	--	--
Specific conductance, in µS/cm	W	--	--	--	--	--	--	--	--	--
Hardness, as $CaCO_3$, in mg/L	T		41	3	--	--	--	--	--	--
Calcium, in mg/L	D	0.22	12.6	0.86	--	--	--	--	--	--
Magnesium, in mg/ L	D	0.033	2.33	0.168	--	--	--	--	--	--
Potassium, in mg/L	D	<.16	0.82	E.10	--	--	--	--	--	--
Sodium, in mg/L	D	E.15	21.1	1.38	--	--	--	--	--	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	W	<5	23	<5	--	--	--	--	--	--
Chloride, in mg/L	D	<.20	16.4	1.04	--	--	--	--	--	--
Fluoride, in mg/L	D	E.1	0.1	E.1	--	--	--	--	--	--
Sulfate, in mg/L	D	<.2	37.6	2.2	--	--	--	--	--	--
Residue on evaporation at 105°C, in mg/L	T	<10	<10	<10	--	--	--	--	--	--
Ammonia + organic N, in mg/L	T	0.14	0.24	<.10	--	--	--	--	--	--
Ammonia, as N, in mg/L	D	<.04	0.15	<.04	--	--	--	--	--	--
Nitrite + nitrate, as N, in mg/L	D	<.06	0.23	<.06	--	--	--	--	--	--
Orthophosphate, as P, in mg/L	D	0.012	0.023	E.004	--	--	--	--	--	--
Phosphorus, as P, in mg/L	T	E.03	0.05	<.04	--	--	--	--	--	--
Organic carbon, in mg/L	D	--	--	--	E.2	14.6	14.5	<.3	13.4	13.2
Copper, in µg/L	D	3.3	0.7	<.4	--	--	--	--	--	--
Copper, in µg/L	T	3.3	0.9	<.6	--	--	--	--	--	--
Lead, in µg/L	D	0.23	0.25	0.09	--	--	--	--	--	--
Lead, in µg/L	T	0.29	0.23	0.09	--	--	--	--	--	--
Manganese, in µg/L	D	5.8	43.7	4.6	--	--	--	--	--	--
Manganese, in µg/L	T	6.6	47.5	5	--	--	--	--	--	--
Zinc, in µg/L	D	14.3	10.4	2.4	--	--	--	--	--	--
Zinc, in µg/L	T	13	12	2	--	--	--	--	--	--

number of samples and the number of missing values for mean streamflow, streamflow volume, and water-quality properties or constituents. For mean streamflow and streamflow volume, the number of missing values indicates the number of samples that either have no associated streamflow information or do not have hydrograph classifications. For water-quality properties and constituents and biological indicators, the number of missing values indicates the number of analyses that were not performed. In addition to statistics for values above censoring limits, table 7 also reports the percentage of samples that had censored values, or unquantifiable concentrations that were less than the reporting level. The reporting level was not always constant and is summarized with a mean and median (table 7). Concentrations for water-quality properties and constituents and biological indicators generally had few censored values except for ammonia and dissolved and total lead, which typically, and especially for dissolved lead, had 10 or more percent censored values.

Table 5. Specific-conductance measurements made at fixed-point sampling and channel locations, June 2004.

[All values in microsiemens per centimeter at 25 degrees Celsius; Union, South Platte River below Union Avenue at Englewood; Denver, South Platte River at Denver; Sand Creek, Sand Creek at mouth near Commerce City; Henderson, South Platte River at Henderson]

	Union	Denver	Sand Creek	Henderson
Fixed point intake	471	525	679	617
Numbered measuring point	**Measurements at numbered points for stream cross sections**			
1	475	493	688	599
2	476	493	686	599
3	474	495	680	602
4	473	497	679	604
5	472	502	676	605
6	471	516	671	606
7	471	526	669	609
8	470	534	668	609
9	473	540	666	612
10	491	542	665	619
Statistics for measurements at stream verticals 1–10				
Average	474.6	513.8	674.8	606.4
Median	473	509	673.5	605.5
Min	470	493	665	599
Max	491	542	688	619

The results from laboratory analyses of composite samples indicate an important spatial pattern. In general and particularly for nutrients, concentration increases downstream in the receiving stream and also in the tributary (table 7). For example, the mean concentration of all samples regardless of hydrograph position for ammonia plus organic nitrogen is 1.85 mg/L at Union, 2.6 mg/L at Denver, and 5.47 mg/L at Henderson. This pattern correlates with the size of the local contributing drainage area, which also increases downstream (table 1). Land-cover data (table 1) indicate that the percentage of agricultural land in the local contributing drainage area also increases in the downstream direction; whereas the percentage of urban land cover does not. For most water-quality properties and constituents, values measured in the tributary streams are higher than values measured in the receiving streams; mean values for most nutrients indicate downstream increases (table 7).

Discrete Samples

Twenty-two discrete samples were collected during two storms, one at Henderson in August 2002, and one at Denver in August 2004. Hydrographs for the storms were 11 and 17 hours long, respectively, and each had a distinct peak; storm hydrographs are shown in the Appendix (fig. A2). The discrete samples were collected to provide a basis for comparison of time-weighted results to alternative weighting methods. Summaries of results from various weighting methods are presented in table 8. The analytical results as well as overall weighted values are in the Appendix (table A1, fig. A2).

Three weighting methods, referred to as "time," "discharge," and "volume," were evaluated to determine the effects of different weighting methods. Weighting computations were made using the general form of equation 2 given in the "Methods of Study" section. Time-weighted results were computed on the basis of the amount of hydrograph time associated with each sample. If sampling intervals are fixed, then time-weighted results are simply the average of all values; however, in the discrete sampling activities presented here, time intervals were not fixed and the hydrograph time associated with each discrete sample was computed on the basis of subdivision methods described by Rantz and others (1982, chapter 15). Discharge-weighted results were computed on the basis of discharge at the time of sample collection. Volume-weighted computations were made on the basis of the product of the subdivided time and streamflow at the time of sample collection. With fixed sampling intervals, the discharge- and volume-weighting methods used in this study are equivalent.

On the basis of the mean and standard deviation for RPDs calculated between time- and volume-weighted concentration results computed in this study, differences between the two weighting methods are consistently small, typically having RPDs with an absolute value of about 10 or less; the RPD was only rarely greater than an absolute value of 20 (table 8). In addition, Pearson's correlation coefficients (Pearson, 1901) for time- and volume-weighted concentration results indicate that intrastorm correlations generally were strong and direct, rarely having a correlation coefficient less than 0.65.

The results from discrete samples also indicate that composited values tend to "smooth" results because the composite value represents a weighted mean of values that typically vary through storm hydrographs. For example, the volume-weighted value for specific conductance during storm 1 in table A1 (August 28, 2002) at Henderson, was 649 µS/cm at 25°C; however, specific-conductance values from discrete samples through the storm ranged from 546 to 950 µS/cm at 25°C (table A1). In this case, the larger values, which were measured near the beginning and end of storm runoff, indicate that the stormwater generally was more dilute than base flow.

Comparison to Numeric Standards

Results from laboratory analyses of composite samples were compared to numeric standards for pH, dissolved chloride, *Escherichia coli*, fecal coliform, nitrite plus nitrate, dissolved copper, lead, manganese, and zinc, and total manganese (Colorado Department of Public Health and Environment, 2005, 2006). All numeric standards do not apply to all stations. For example, dissolved manganese and nitrite plus nitrate standards for Tollgate or Sand Creek do not exist. The numeric standards for pH, dissolved chloride, *Escherichia coli*, fecal coliform,

Table 6. Mean streamflow, streamflow volume, and duration statistics for composite samples, water years 2002–2005.

[Pooled, all samples for given group; q, mean streamflow in cubic feet per second; v, volume in acre-feet; t, time in decimal days; U, unclassified, in some cases no discharge information for the storm was available and the hydrograph could not be characterized; Stddev, standard deviation, Skew, skewness; Min, minimum; Max, maximum; n, number of samples; --, not applicable]

Statistic	Pooled			Rising hydrograph			Falling hydrograph			Event hydrograph			U
	q	v	t	q	v	t	q	v	t	q	v	t	t
All stations													
Mean	636	568	0.44	577	521	0.43	474	380	0.42	809	759	0.46	0.43
Median	292	270	0.45	296	269	0.45	262	233	0.45	403	367	0.45	0.43
Stddev	954	845	0.09	595	543	0.03	656	448	0.11	1,200	1,110	0.08	0.02
Skew	3.75	3.86	1.05	1.19	1.2	2.1	2.9	1.75	0.26	3.32	3.17	3.3	1.45
Min	1	0	0.17	37	25	0.33	1	0	0.17	4	4	0.19	0.42
Max	7,570	6,880	0.95	1,730	1,580	0.47	3,900	1,920	0.91	7,570	6,880	0.95	0.46
n	172	172	176	18	18	18	71	71	71	80	80	80	7
South Platte River below Union Avenue at Englewood													
Mean	216	192	0.42	239	216	0.42	169	141	0.4	248	225	0.44	0.44
Median	154	140	0.44	160	149	0.45	121	110	0.44	212	193	0.44	0.44
Stddev	169	152	0.06	256	234	0.05	149	126	0.1	171	155	0.02	0.02
Skew	1.51	1.54	2.98	1.94	1.9	2.02	1.21	1.16	1.74	1.63	1.63	0.25	0
Min	37	16	0.19	37	25	0.33	38	16	0.19	71	65	0.42	0.42
Max	686	623	0.47	686	623	0.46	452	411	0.47	679	617	0.47	0.46
n	37	37	37	5	5	5	13	13	13	16	16	16	3
South Platte River at Denver													
Mean	878	763	0.43	204	178	0.44	665	546	0.42	1,110	996	0.44	--
Median	636	549	0.45	204	178	0.44	413	376	0.45	757	674	0.45	--
Stddev	837	727	0.07				590	437	0.09	989	884	0.03	--
Skew	2.35	2.59	3.01				1.82	1.64	2.16	2.17	2.23	0.32	--
Min	166	69	0.18	204	178	0.44	166	69	0.18	236	214	0.38	--
Max	4,450	4,040	0.5	204	178	0.44	2,310	1,920	0.5	4,450	4,040	0.5	--
n	46	46	46	1	1	1	22	22	22	23	23	23	0
Tollgate Creek above 6th Avenue at Aurora													
Mean	87.1	82.3	0.44	358	309	0.42	68.9	58.3	0.39	49.5	56.4	0.48	0.43
Median	47	49	0.45	358	309	0.42	14	57	0.44	42	38	0.46	0.43
Stddev	112	102	0.14	67.2	37.5	0.04	91.2	63.3	0.14	43	76.8	0.18	0.01
Skew	1.76	1.55	1.61				1.04	0.94	0.75	1.23	2.6	1.84	0
Min	1	0	0.19	310	282	0.39	1	0	0.2	4	4	0.19	0.42
Max	405	335	0.95	405	335	0.45	207	173	0.56	143	272	0.95	0.43
n	20	20	24	2	2	2	7	7	7	11	11	11	4
Sand Creek at mouth near Commerce City													
Mean	221	229	0.45	134	117	0.43	102	93.1	0.44	366	395	0.46	--
Median	102	99	0.45	99	85	0.43	79	71.5	0.45	178	160	0.45	--
Stddev	346	449	0.08	110	96.6	0.03	79.1	73.4	0.09	482	644	0.07	--
Skew	3.64	4.56	0.72	1.28	1.34	0	1.58	1.41	0.02	2.39	3.06	2.53	--
Min	18	17	0.2	45	41	0.4	18	17	0.2	24	21	0.4	--
Max	1,810	2,550	0.69	257	226	0.46	296	269	0.69	1,810	2,550	0.68	--
n	34	34	34	3	3	3	16	16	16	15	15	15	0
South Platte River at Henderson													
Mean	1,480	1,320	0.46	1,120	1,020	0.45	1,130	865	0.45	1,940	1,840	0.48	--
Median	1,060	1,090	0.45	1,200	1,090	0.45	818	744	0.45	1,070	1,230	0.44	--
Stddev	1,460	1,280	0.11	611	556	0.02	972	523	0.16	1,960	1,750	0.08	--
Skew	2.71	2.97	1.84	0.28	0.29	0.26	2.15	0.47	1.61	2.1	2.08	2.23	--
Min	280	208	0.17	281	255	0.43	280	208	0.17	350	318	0.42	--
Max	7,570	6,880	0.91	1,730	1,580	0.47	3,900	1,670	0.91	7,570	6,880	0.71	--
n	35	35	35	7	7	7	13	13	13	15	15	15	0

nitrite plus nitrate, and dissolved manganese are fixed values and are not designated as either acute or chronic. The numeric standards for dissolved copper and lead, total manganese, and dissolved zinc are each calculated according to equations provided by the CDPHE (Colorado Department of Public Health and Environment, 2005, 2006); in this study, acute values were used. The calculations for these values, often referred to as "table-value standards," are based on hardness; in this study, the hardness value associated with the composite sample was used in the calculation.

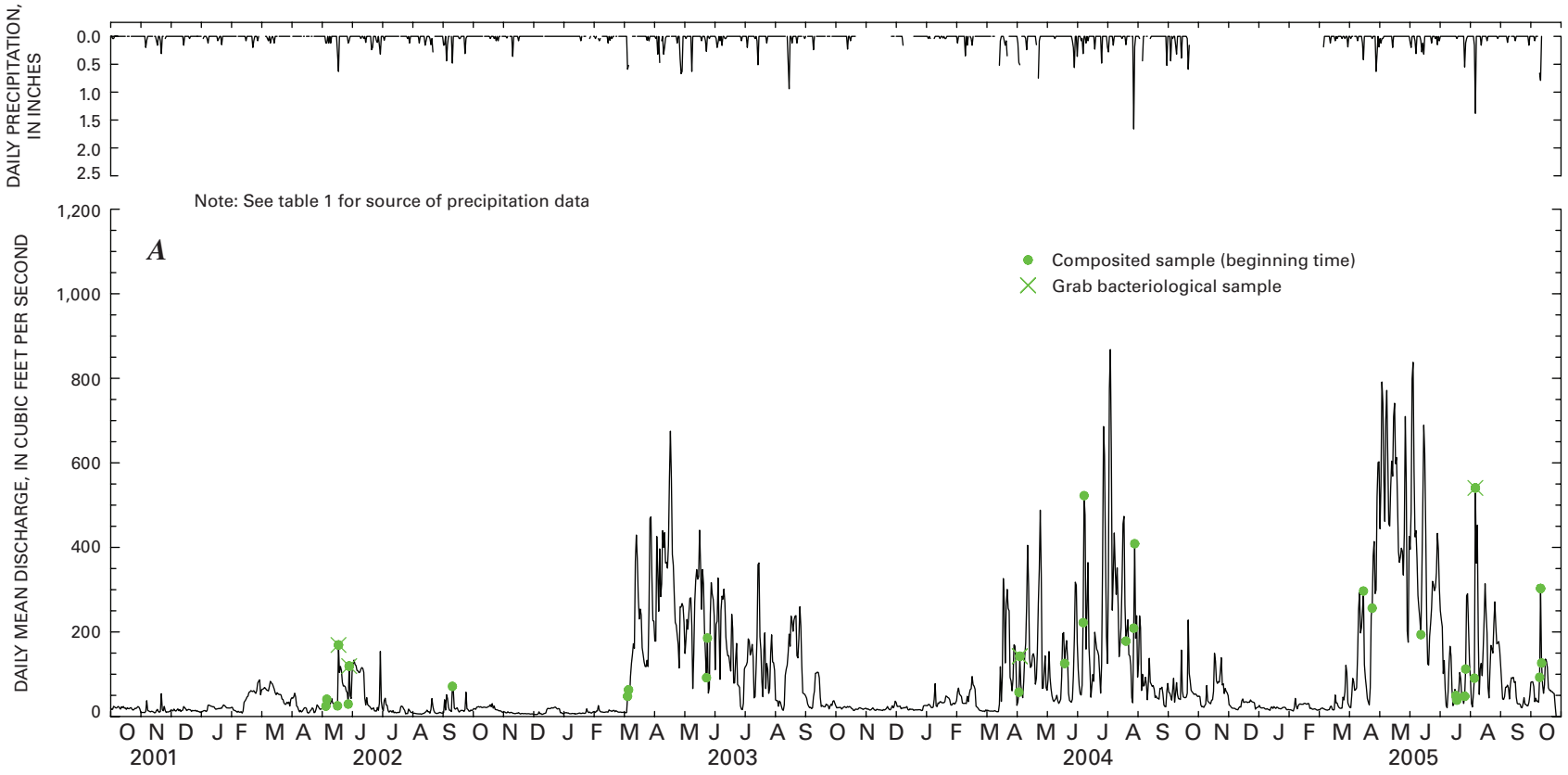
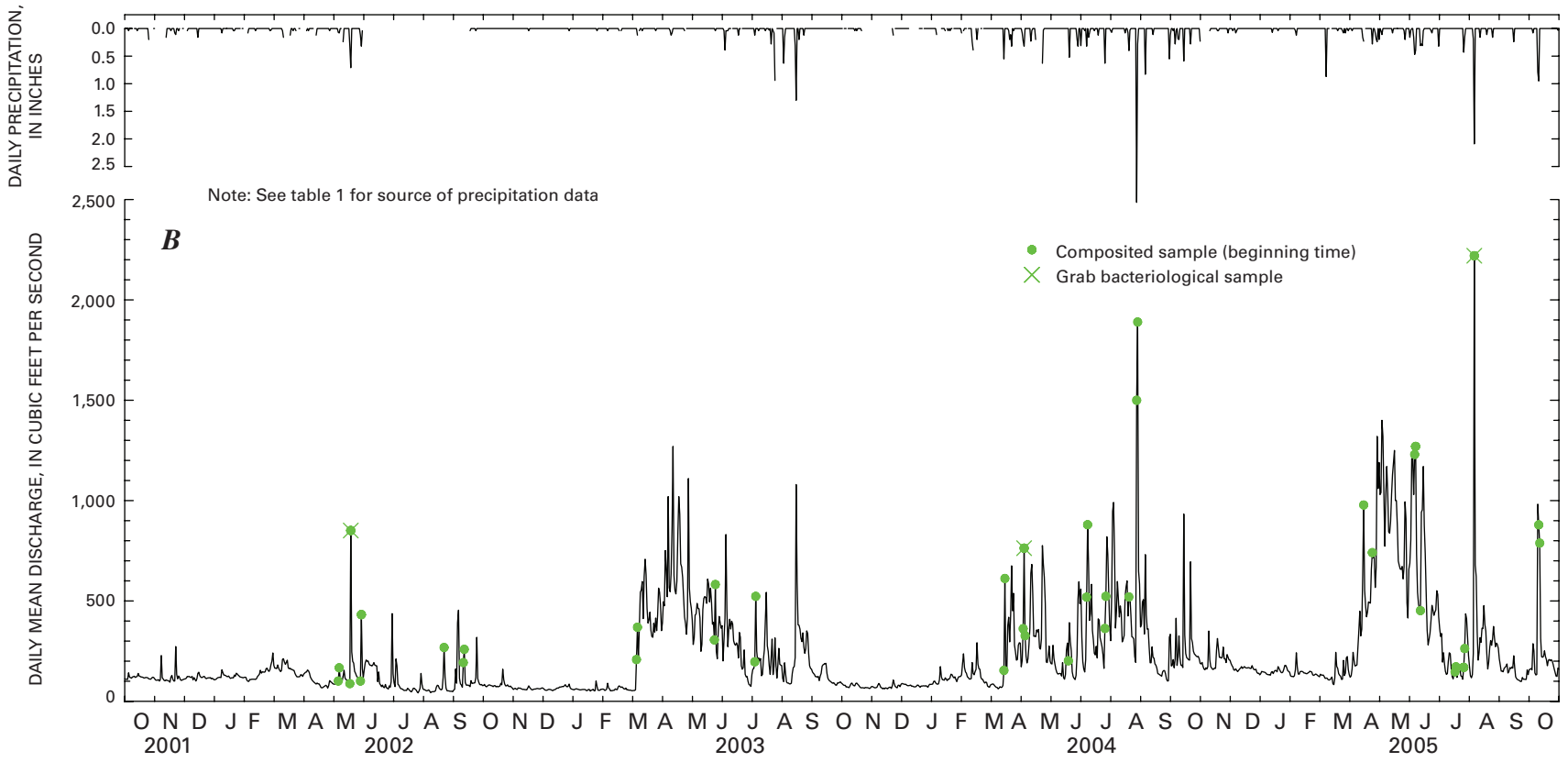


Figure 2. Daily values for streamflow and precipitation at (*A*) South Platte River below Union Avenue at Englewood, (*B*) South Platte River at Denver, (*C*) Tollgate Creek above 6th Avenue at Aurora, (*D*) Sand Creek at mouth near Commerce City, and (*E*) South Platte River at Henderson.



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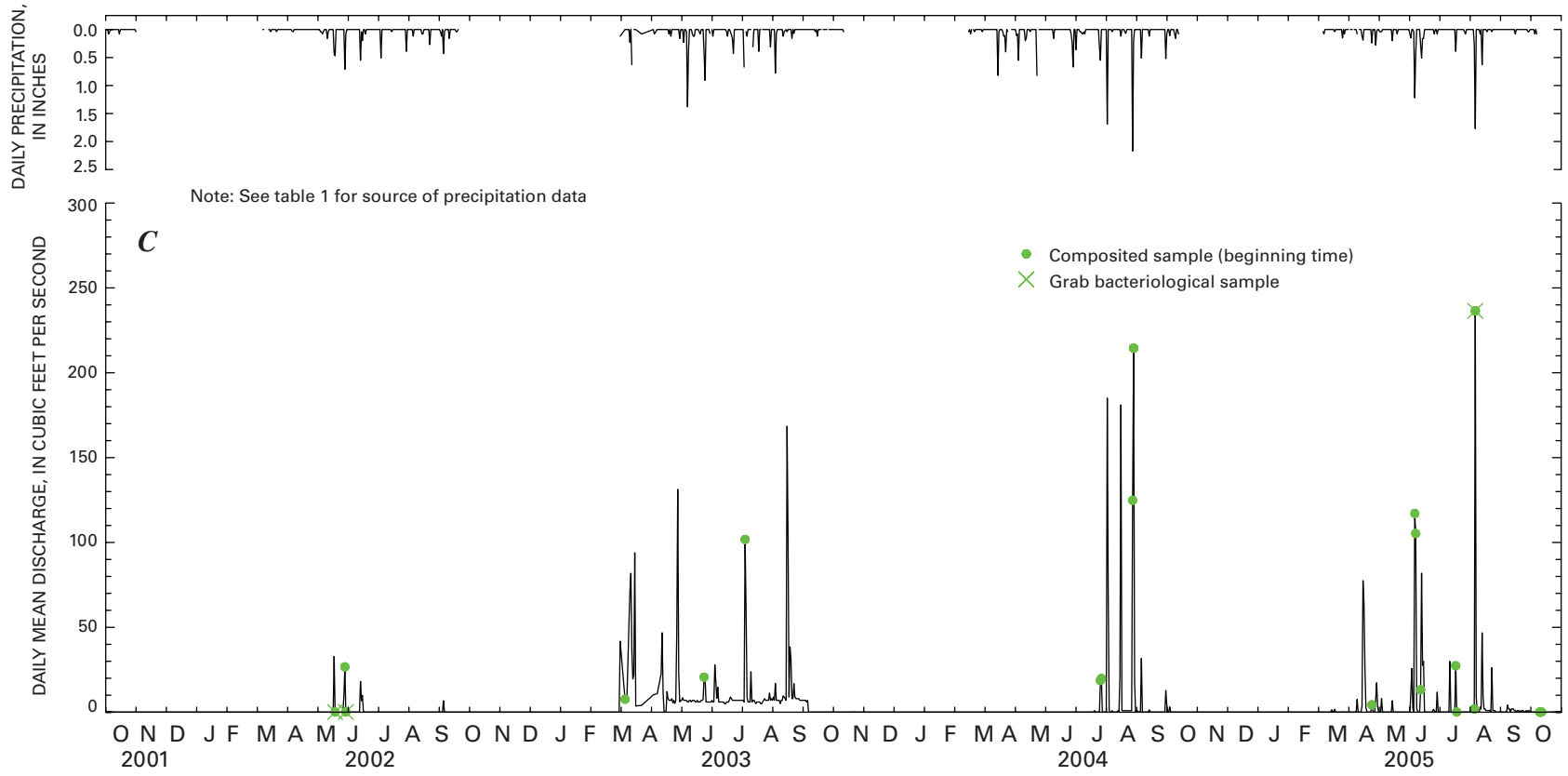

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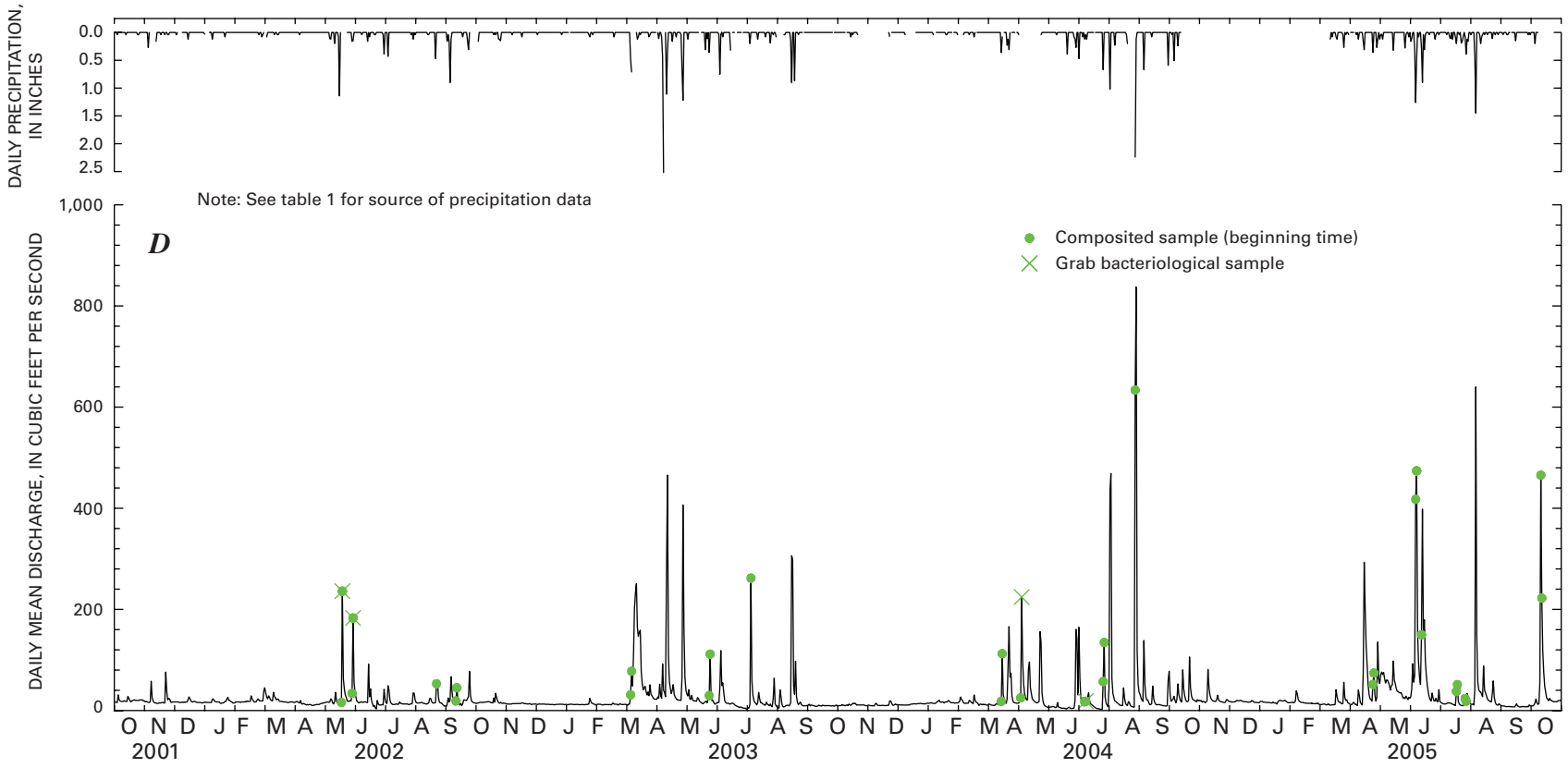

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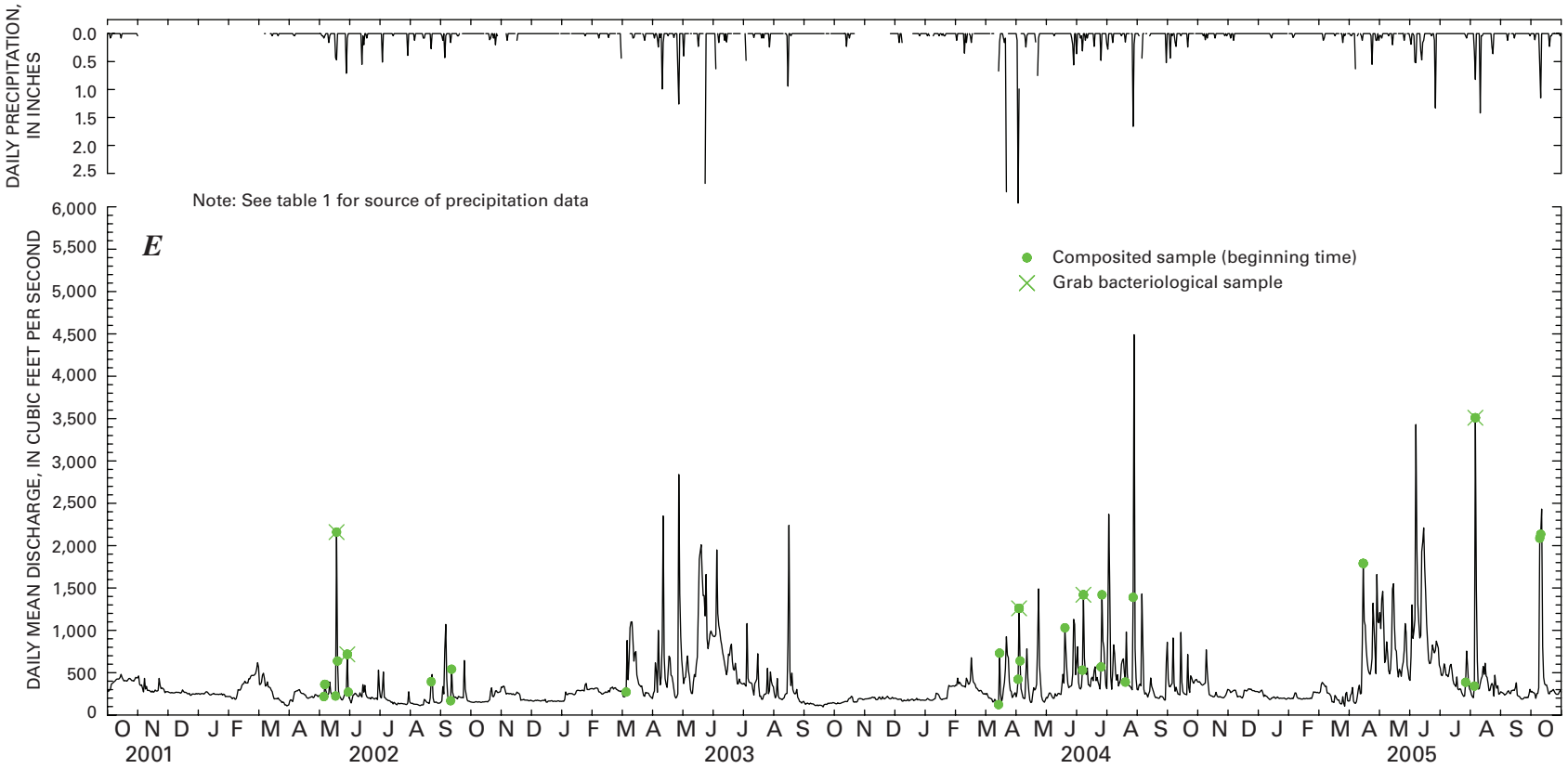

Figure 2. Daily values for streamflow and precipitation at (*A*) South Platte River below Union Avenue at Englewood, (*B*) South Platte River at Denver, (*C*) Tollgate Creek above 6th Avenue at Aurora, (*D*) Sand Creek at mouth near Commerce City, and (*E*) South Platte River at Henderson.—Continued

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
All stations													
Mean streamflow, in ft^3/s	--	a	172	4	0	636	292	954	3.75	1	7,570	--	--
		r	18	0	0	577	296	595	1.19	37	1,730	--	--
		f	71	0	0	474	262	656	2.9	1	3,900	--	--
		e	80	0	0	809	403	1,200	3.32	4	7,570	--	--
		u	3	4	0	209	202	73.7	0.42	139	286	--	--
Streamflow volume, in acre-feet	--	a	172	4	0	568	270	845	3.86	0	6,880	--	--
		r	18	0	0	521	269	543	1.2	25	1,580	--	--
		f	71	0	0	380	233	448	1.75	0	1,920	--	--
		e	80	0	0	759	367	1,110	3.17	4	6,880	--	--
		u	3	4	0	190	184	67.2	0.4	126	260	--	--
pH, in standard pH units	W	a	176	0	0	7.4	7.4	0.32	0.64	6.1	8.35	--	--
		r	18	0	0	7.29	7.33	0.4	0.83	6.3	7.94	--	--
		f	71	0	0	7.44	7.4	0.29	0.27	6.72	8.35	--	--
		e	80	0	0	7.4	7.47	0.3	1.15	6.1	8	--	--
		u	7	0	0	7.14	6.87	0.46	0.54	6.72	7.81	--	--
Specific conductance, in µS/cm	W	a	152	24	0	663	588	309	2.3	212	2,630	--	--
		r	13	5	0	789	784	336	0.79	212	1,600	--	--
		f	64	7	0	665	580	259	1.09	285	1,600	--	--
		e	70	10	0	649	558	349	2.95	244	2,630	--	--
		u	5	2	0	514	505	111	0.68	350	619	--	--
Hardness, as calcium carbonate, in mg/L	T	a	173	3	0	191	176	78.2	1.4	69.1	594	--	--
		r	18	0	0	211	200	81	0.42	69.7	365	--	--
		f	71	0	0	190	183	59.6	0.64	83.3	375	--	--
		e	77	3	0	188	169	91.3	1.68	69.1	594	--	--
		u	7	0	0	188	155	91.2	2.15	113	385	--	--
Calcium, in mg/L	D	a	132	44	0	52.8	47.1	22.6	1.87	21.4	169	--	--
		r	13	5	0	52.9	49.2	17.8	0.59	22	90	--	--
		f	49	22	0	53.5	49.4	19.4	1.18	25.9	117	--	--
		e	63	17	0	51.8	46.6	25.5	2.21	21.4	169	--	--
		u	7	0	0	57.2	47.2	27.7	2.1	33	117	--	--
Magnesium, in mg/L	D	a	132	44	0	10.7	9.93	5.09	2.13	3.61	41.8	--	--
		r	13	5	0	11	11.2	4.32	0.24	3.61	19	--	--
		f	49	22	0	10.9	10.8	3.87	0.56	4.51	21.5	--	--
		e	63	17	0	10.5	8.79	6.04	2.55	3.81	41.8	--	--
		u	7	0	0	11	9.28	5.41	2.24	7.32	22.8	--	--
Potassium, in mg/L	D	a	63	113	0	4.47	4.12	1.33	1.2	2.67	8.37	--	--
		r	5	13	0	4.74	3.39	2.24	1.14	2.89	8.18	--	--
		f	21	50	0	4.63	4.46	0.97	0.11	3.11	6.35	--	--
		e	31	49	0	4.5	4.01	1.46	1.29	2.67	8.37	--	--
		u	6	1	0	3.54	3.43	0.38	0.42	3.06	4.08	--	--
Sodium, in mg/L	D	a	63	113	0	60.7	52.4	33.3	1	13.9	142	--	--
		r	5	13	0	58.3	47.8	50.7	1.47	13.9	142	--	--
		f	21	50	0	61.7	49.1	31.1	0.91	22.6	125	--	--
		e	31	49	0	60	52.4	33.4	1.19	18.2	142	--	--
		u	6	1	0	63.7	61.4	33.7	0.62	24.5	118	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	63	113	0	86.5	85.6	23.3	0.25	48.6	139	--	--
		r	5	13	0	75	74.4	25.2	0.1	48.6	105	--	--
		f	21	50	0	90	85.6	23.3	0.25	51.9	133	--	--
		e	31	49	0	87.1	88.9	23.2	0.27	51	139	--	--
		u	6	1	0	80.6	72	24.3	0.85	57.6	118	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
All stations—Continued													
Chloride, in mg/L	D	a	63	113	0	56.8	50.7	32.2	1.79	11	197	--	--
		r	5	13	0	66.1	38.6	75.3	1.94	11	197	--	--
		f	21	50	0	60.1	48.9	32.6	1.07	21.4	130	--	--
		e	31	49	0	52	50.7	23.2	0.9	15.9	112	--	--
		u	6	1	0	62.6	71.1	23.1	0.76	28.1	85.5	--	--
Fluoride, in mg/L	D	a	63	113	0	0.52	0.45	0.23	0.68	0.2	1.08	--	--
		r	5	13	0	0.44	0.38	0.2	0.79	0.22	0.74	--	--
		f	21	50	0	0.53	0.48	0.21	0.74	0.25	0.97	--	--
		e	31	49	0	0.52	0.48	0.21	0.56	0.26	0.94	--	--
		u	6	1	0	0.51	0.29	0.41	0.93	0.2	1.08	--	--
Sulfate, in mg/L	D	a	63	113	0	125	93.5	88.9	1.62	30.9	386	--	--
		r	5	13	0	82.8	85.7	33.4	0.99	30.9	116	--	--
		f	21	50	0	118	88.6	71.2	1.22	41.8	268	--	--
		e	31	49	0	132	99.1	98.8	1.51	34	385	--	--
		u	6	1	0	155	121	122	1.73	46.9	386	--	--
Residue on evaporation at 105°C, in mg/L	T	a	172	4	1.16	449	237	817	5.98	13	7,360	10	10
		r	18	0	0	313	223	242	0.8	19	805	--	--
		f	69	2	0	365	153	907	7.04	13	7,360	--	--
		e	78	2	0	578	326	831	4.47	38	6,040	--	--
		u	7	0	28.6	79.4	88	41.7	1.12	13	124	10	10
E. coli, colonies per 100 mL	W	a	22	0	0	16,500	13,000	20,000	2.81	460	92,000	--	--
		r	5	0	0	8,670	1,700	14,800	2.17	460	35,000	--	--
		f	13	0	0	14,700	13,000	10,800	0.92	500	35,000	--	--
		e	3	0	0	38,700	13,000	46,200	1.73	11,000	92,000	--	--
		u	1	0	0	13,000	13,000			13,000	13,000	--	--
Fecal coliform, colonies per 100 mL	W	a	22	0	0	20,100	13,000	18,200	0.76	310	54,000	--	--
		r	5	0	0	8,740	2,200	14,800	2.16	310	35,000	--	--
		f	13	0	0	21,100	13,000	17,900	0.97	700	54,000	--	--
		e	3	0	0	39,000	35,000	13,500	1.22	28,000	54,000	--	--
		u	1	0	0	7,900	7,900			7,900	7,900	--	--
Ammonia + organic N, in mg/L	T	a	173	3	0	3.13	2.41	2.19	1.43	0.47	12.2	--	--
		r	18	0	0	3.77	3.23	1.97	0.41	1.3	7.3	--	--
		f	71	0	0	2.77	1.9	2.39	2.04	0.59	12.2	--	--
		e	77	3	0	3.5	3.14	1.97	1.14	0.59	9.63	--	--
		u	7	0	0	0.95	0.81	0.53	1.6	0.47	2	--	--
Ammonia, as N, in mg/L	D	a	132	44	11.4	0.55	0.25	0.71	2.36	0.05	3.55	0.04	0.04
		r	13	5	0	1.15	1.15	1.06	0.5	0.11	3.06	--	--
		f	49	22	14.3	0.52	0.22	0.72	2.45	0.05	3.46	0.04	0.04
		e	63	17	7.94	0.46	0.29	0.56	3.51	0.05	3.55	0.04	0.04
		u	7	0	42.9	0.19	0.19	0.05	0.07	0.13	0.24	0.04	0.04
Nitrite + nitrate, as N, in mg/L	D	a	132	44	2.27	1.53	1.14	1.09	1.07	0.11	4.7	0.06	0.06
		r	13	5	7.69	2.1	1.94	1.33	0.31	0.52	4.1	0.06	0.06
		f	49	22	4.08	1.5	1.3	0.91	0.87	0.24	4.01	0.06	0.06
		e	63	17	0	1.54	0.99	1.15	1.17	0.11	4.7	--	--
		u	7	0	0	0.53	0.55	0.18	0.67	0.33	0.84	--	--
Orthophosphate, as P, in mg/L	D	a	172	4	2.33	0.26	0.16	0.26	1.67	0.01	1.4	0.01	0.01
		r	18	0	5.56	0.4	0.19	0.38	1.26	0.05	1.4	0.01	0.01
		f	71	0	2.82	0.26	0.17	0.23	1.78	0.02	1.06	0.01	0.01
		e	76	4	1.32	0.26	0.16	0.25	1.38	0.01	1	0.01	0.01
		u	7	0	0	0.06	0.05	0.04	0.4	0.01	0.11	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
All stations—Continued													
Phosphorus, as P, in mg/L	T	a	173	3	0.58	0.96	0.77	0.87	4.02	0.07	8.3	0.04	0.04
		r	18	0	0	1.16	1.11	0.62	0.48	0.23	2.52	--	--
		f	71	0	0	0.79	0.54	0.65	1.59	0.1	3.12	--	--
		e	77	3	1.3	1.14	0.93	1.05	4.51	0.2	8.3	0.04	0.04
		u	7	0	0	0.18	0.18	0.11	0.61	0.07	0.36	--	--
Organic carbon, in mg/L	D	a	120	56	0	9.95	8.09	4.86	1.59	3.55	30.1	--	--
		r	9	9	0	9.71	7.7	4.54	2.17	6.66	20.8	--	--
		f	45	26	0	9.74	7.62	5.39	1.59	4.46	30.1	--	--
		e	59	21	0	10.6	9.41	4.6	1.62	4.3	29.8	--	--
		u	7	0	0	6.43	5.91	2.12	1.18	3.55	10.6	--	--
Copper, in µg/L	D	a	173	3	0	3.47	2.71	3.37	5.34	1.14	28	--	--
		r	18	0	0	5.33	2.98	7.04	2.61	1.54	25	--	--
		f	71	0	0	3.34	2.76	1.92	2.64	1.56	12	--	--
		e	77	3	0	3.27	2.81	3.18	6.43	1.14	28	--	--
		u	7	0	0	2.17	2	0.47	0.93	1.72	2.98	--	--
Copper, in µg/L	T	a	132	44	0	23.7	18.7	17.1	1.32	2.82	87.3	--	--
		r	13	5	0	26.4	22.1	14.5	0.83	9.4	56.7	--	--
		f	49	22	0	18.6	12.8	16	2.05	3.78	74.5	--	--
		e	63	17	0	29	24.5	17.2	1.18	5.05	87.3	--	--
		u	7	0	0	6.43	5.41	3.91	0.66	2.82	12.8	--	--
Lead, in µg/L	D	a	173	3	47.4	1.29	0.17	7.03	7.4	0.08	60	4.68	0.08
		r	18	0	44.4	3.27	0.32	9.39	3.16	0.15	30	5.04	5.04
		f	71	0	53.5	2	0.14	10.4	5.74	0.09	60	5.56	10
		e	77	3	40.3	0.41	0.17	1.45	6.73	0.08	10	4.24	0.08
		u	7	0	71.4	0.09	0.09	0		0.09	0.09	0.08	0.08
Lead, in µg/L	T	a	132	44	0	21.3	15.3	19.9	1.62	0.63	114	--	--
		r	13	5	0	21.6	16.1	12.8	0.56	6.34	44.1	--	--
		f	49	22	0	14.8	8.94	15.7	1.87	1.44	63.1	--	--
		e	63	17	0	28.4	20.3	22	1.43	1.88	114	--	--
		u	7	0	0	2.58	1.8	2.17	0.63	0.63	6.05	--	--
Manganese, in µg/L	D	a	132	44	0	73.8	25.9	161	6.72	1.07	1,570	--	--
		r	13	5	0	113	86.7	108	1.11	2.14	356	--	--
		f	49	22	0	74	17.4	226	6.31	1.07	1,570	--	--
		e	63	17	0	69.7	26.1	110	2.7	1.32	550	--	--
		u	7	0	0	37	33.2	22.6	1.61	17.3	82.6	--	--
Manganese, in µg/L	T	a	132	44	0	524	419	405	1.64	62.8	2,090	--	--
		r	13	5	0	601	571	312	0.42	235	1,170	--	--
		f	49	22	0	418	271	399	2.34	79.3	2,090	--	--
		e	63	17	0	623	524	413	1.52	114	2,090	--	--
		u	7	0	0	231	177	214	1.99	62.8	683	--	--
Zinc, in µg/L	D	a	172	4	9.88	23.6	11.2	43.7	4.98	1.99	336	20	20
		r	18	0	5.56	33.6	20	49.7	3.14	1.99	208	20	20
		f	71	0	15.5	28.8	10.8	59.1	4.25	2.26	336	20	20
		e	76	4	6.58	17.8	10.4	23.8	4.12	2.77	165	20	20
		u	7	0	0	13.2	6.35	16.6	2.58	4.52	50.6	--	--
Zinc, in µg/L	T	a	131	45	0	133	84	168	3.83	7	1,150	--	--
		r	13	5	0	205	93	283	3.11	51	1,110	--	--
		f	49	22	0	116	48	196	3.88	8	1,150	--	--
		e	62	18	0	143	108	106	1.76	14	545	--	--
		u	7	0	0	35.7	18	44.1	2.26	7	132	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River below Union Avenue (06710247)													
Mean streamflow, in ft^3/s	--	a	37	0	0	216	154	169	1.51	37	686	--	--
		r	5	0	0	239	160	256	1.94	37	686	--	--
		f	13	0	0	169	121	149	1.21	38	452	--	--
		e	16	0	0	248	212	171	1.63	71	679	--	--
		u	3	0	0	209	202	73.7	0.42	139	286	--	--
Streamflow volume, in acre-feet	--	a	37	0	0	192	140	152	1.54	16	623	--	--
		r	5	0	0	216	149	234	1.9	25	623	--	--
		f	13	0	0	141	110	126	1.16	16	411	--	--
		e	16	0	0	225	193	155	1.63	65	617	--	--
		u	3	0	0	190	184	67.2	0.4	126	260	--	--
pH, in standard pH units	W	a	37	0	0	7.51	7.55	0.32	0.17	6.82	8.35	--	--
		r	5	0	0	7.41	7.6	0.37	1.34	6.82	7.74	--	--
		f	13	0	0	7.55	7.47	0.36	0.51	6.9	8.35	--	--
		e	16	0	0	7.49	7.53	0.3	0.61	6.89	7.99	--	--
		u	3	0	0	7.62	7.62	0.19	0	7.43	7.81	--	--
Specific conductance, in µS/cm	W	a	31	6	0	491	478	165	0.98	212	917	--	--
		r	3	2	0	507	465	319	0.59	212	845	--	--
		f	11	2	0	535	495	188	1.17	342	917	--	--
		e	14	2	0	464	462	126	0.41	244	736	--	--
		u	3	0	0	445	480	83.2	1.56	350	505	--	--
Hardness, as calcium carbonate, in mg/L	T	a	37	0	0	170	155	61.1	1.27	69.7	365	--	--
		r	5	0	0	198	150	118	0.66	69.7	365	--	--
		f	13	0	0	179	183	41.8	0.46	113	270	--	--
		e	16	0	0	159	138	56.4	1.52	96	310	--	--
		u	3	0	0	146	155	29.5	1.24	113	170	--	--
Calcium, in mg/L	D	a	28	9	0	43.5	42.6	9.68	0.14	22	66.1	--	--
		r	3	2	0	37.1	42.8	13.3	1.58	22	46.6	--	--
		f	9	4	0	48	51	8.78	0.3	35.1	60.1	--	--
		e	13	3	0	41.9	40.7	9.3	1.38	30	66.1	--	--
		u	3	0	0	43.6	46.6	9.49	1.28	33	51.2	--	--
Magnesium, in mg/L	D	a	28	9	0	9.27	8.6	3.52	1.14	3.61	19.6	--	--
		r	3	2	0	6.15	6.7	2.31	1.01	3.61	8.14	--	--
		f	9	4	0	11	10.8	3.3	0.09	6.29	15.7	--	--
		e	13	3	0	8.83	8.04	3.79	2.08	5.1	19.6	--	--
		u	3	0	0	8.96	9.28	1.44	0.95	7.39	10.2	--	--
Potassium, in mg/L	D	a	15	22	0	3.81	3.39	0.92	0.78	2.67	5.46	--	--
		r	2	3	0	3.39	3.39	0		3.38	3.39	--	--
		f	4	9	0	4.57	4.75	0.92	0.95	3.33	5.46	--	--
		e	7	9	0	3.64	3.38	0.99	1.1	2.67	5.46	--	--
		u	2	1	0	3.28	3.28	0.32		3.06	3.51	--	--
Sodium, in mg/L	D	a	15	22	0	34.7	32	13.6	0.78	13.9	64.6	--	--
		r	2	3	0	19.1	19.1	7.38		13.9	24.4	--	--
		f	4	9	0	38.8	41.6	11.8	1.13	22.6	49.1	--	--
		e	7	9	0	38.3	32	15.2	1.15	24	64.6	--	--
		u	2	1	0	29.5	29.5	7.12		24.5	34.6	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	15	22	0	84.4	81.7	21.3	0.14	48.6	124	--	--
		r	2	3	0	61.5	61.5	18.2		48.6	74.4	--	--
		f	4	9	0	96.5	100	16.8	0.96	74	112	--	--
		e	7	9	0	82.4	81.7	23	0.89	56	124	--	--
		u	2	1	0	90	90	16.5		78.3	102	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River below Union Avenue (06710247)—Continued													
Chloride, in mg/L	D	a	15	22	0	37.8	36.8	16.4	0.87	11	77.6	--	--
		r	2	3	0	17.9	17.9	9.78		11	24.8	--	--
		f	4	9	0	40.4	45.6	12.8	1.81	21.4	48.9	--	--
		e	7	9	0	42.9	36.8	18.6	1.37	27.5	77.6	--	--
		u	2	1	0	34.7	34.7	9.33		28.1	41.2	--	--
Fluoride, in mg/L	D	a	15	22	0	0.67	0.63	0.29	0.04	0.29	1.08	--	--
		r	2	3	0	0.35	0.35	0.05		0.32	0.38	--	--
		f	4	9	0	0.72	0.73	0.24	0.12	0.45	0.97	--	--
		e	7	9	0	0.62	0.63	0.29	0.09	0.29	0.94	--	--
		u	2	1	0	1.03	1.03	0.07		0.98	1.08	--	--
Sulfate, in mg/L	D	a	15	22	0	74.1	74.4	31.8	1.25	30.9	155	--	--
		r	2	3	0	52.6	52.6	30.8		30.9	74.4	--	--
		f	4	9	0	88.8	88.6	26.8	0.04	56.2	122	--	--
		e	7	9	0	75.5	73.1	37.6	1.94	42.4	155	--	--
		u	2	1	0	61.4	61.4	20.5		46.9	75.9	--	--
Residue on evaporation at 105°C, in mg/L	T	a	37	0	5.41	354	204	381	1.73	13	1,530	10	10
		r	5	0	0	450	468	352	0.19	19	805	--	--
		f	13	0	0	231	111	234	1	23	662	--	--
		e	16	0	0	446	244	467	1.64	54	1,530	--	--
		u	3	0	66.7	13	13			13	13	10	10
E. coli, colonies per 100 mL	W	a	5	0	0	26,500	13,000	36,900	2.13	1,700	92,000	--	--
		r	1	0	0	1,700	1,700			1,700	1,700	--	--
		f	2	0	0	13,000	13,000	0	0	13,000	13,000	--	--
		e	1	0	0	92,000	92,000			92,000	92,000	--	--
		u	1	0	0	13,000	13,000			13,000	13,000	--	--
Fecal coliform, colonies per 100 mL	W	a	5	0	0	12,800	13,000	9,580	1.03	2,200	28,000	--	--
		r	1	0	0	2,200	2,200			2,200	2,200	--	--
		f	2	0	0	13,000	13,000	0	0	13,000	13,000	--	--
		e	1	0	0	28,000	28,000			28,000	28,000	--	--
		u	1	0	0	7,900	7,900			7,900	7,900	--	--
Ammonia + organic N, in mg/L	T	a	37	0	0	1.85	1.45	1.37	2.44	0.47	7	--	--
		r	5	0	0	2.16	2.23	0.8	0.48	1.3	3.3	--	--
		f	13	0	0	1.35	1.3	0.55	0.37	0.59	2.4	--	--
		e	16	0	0	2.39	1.82	1.78	1.9	0.99	7	--	--
		u	3	0	0	0.57	0.61	0.08	1.7	0.47	0.62	--	--
Ammonia, as N, in mg/L	D	a	28	9	28.6	0.12	0.1	0.07	1.6	0.05	0.34	0.04	0.04
		r	3	2	0	0.15	0.16	0.04	1.08	0.11	0.18	--	--
		f	9	4	44.4	0.13	0.12	0.08	0.27	0.05	0.22	0.04	0.04
		e	13	3	7.69	0.12	0.1	0.08	2.36	0.05	0.34	0.04	0.04
		u	3	0	100	--	--	--	--	--	--	0.04	0.04
Nitrite + nitrate, as N, in mg/L	D	a	28	9	0	0.86	0.78	0.37	0.74	0.4	1.65	--	--
		r	3	2	0	0.82	0.71	0.32	1.4	0.57	1.19	--	--
		f	9	4	0	0.96	0.76	0.47	0.35	0.4	1.65	--	--
		e	13	3	0	0.84	0.8	0.33	0.61	0.41	1.5	--	--
		u	3	0	0	0.66	0.59	0.16	1.59	0.55	0.84	--	--
Orthophosphate, as P, in mg/L	D	a	37	0	0	0.1	0.08	0.08	2.66	0.01	0.45	--	--
		r	5	0	0	0.11	0.09	0.04	1.6	0.08	0.17	--	--
		f	13	0	0	0.1	0.1	0.05	0.14	0.03	0.18	--	--
		e	16	0	0	0.11	0.07	0.11	2.4	0.02	0.45	--	--
		u	3	0	0	0.03	0.03	0.01	0.59	0.01	0.03	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River below Union Avenue (06710247)—Continued													
Phosphorus, as P, in mg/L	T	a	37	0	0	0.48	0.37	0.4	1.6	0.07	1.75	--	--
		r	5	0	0	0.65	0.62	0.36	0.01	0.23	1.02	--	--
		f	13	0	0	0.34	0.29	0.22	1.19	0.1	0.85	--	--
		e	16	0	0	0.63	0.43	0.47	1.45	0.22	1.75	--	--
		u	3	0	0	0.08	0.08	0.02	0.94	0.07	0.1	--	--
Organic carbon, in mg/L	D	a	25	12	0	7.37	6.66	3.15	1.62	3.55	16.2	--	--
		r	2	3	0	7.03	7.03	0.52		6.66	7.4	--	--
		f	8	5	0	7.97	6.45	3.97	1.6	4.71	16.2	--	--
		e	12	4	0	7.53	6.76	3.12	1.46	4.3	15	--	--
		u	3	0	0	5.39	5.71	1.7	0.82	3.55	6.91	--	--
Copper, in µg/L	D	a	37	0	0	4.13	2.13	5.75	3.37	1.14	28	--	--
		r	5	0	0	7.12	2.58	9.51	2.15	1.91	24	--	--
		f	13	0	0	3.79	2.3	3.33	2.02	1.92	12	--	--
		e	16	0	0	3.91	2.06	6.5	3.86	1.14	28	--	--
		u	3	0	0	1.78	1.79	0.05	1.05	1.72	1.82	--	--
Copper, in µg/L	T	a	28	9	0	14.6	12.9	10.9	1.52	2.82	48.8	--	--
		r	3	2	0	22.4	22.1	9.53	0.13	13	32.1	--	--
		f	9	4	0	10.3	8.3	6	1.17	3.78	23	--	--
		e	13	3	0	18.4	14.8	12.3	1.59	5.05	48.8	--	--
		u	3	0	0	2.94	2.99	0.1	1.6	2.82	3.02	--	--
Lead, in µg/L	D	a	37	0	81.1	12.9	0.15	23.5	1.76	0.09	60	2.39	0.08
		r	5	0	60	15.1	15.1	21.1		0.15	30	3.39	0.08
		f	13	0	76.9	20.1	0.14	34.6	1.73	0.09	60	3.06	0.08
		e	16	0	87.5	0.13	0.13	0.04		0.1	0.16	2.21	0.08
		u	3	0	100	--	--	--	--	--	--	0.08	0.08
Lead, in µg/L	T	a	28	9	0	11.6	9.59	11.6	2.01	0.63	51.9	--	--
		r	3	2	0	17.8	16.1	9.07	0.84	9.75	27.6	--	--
		f	9	4	0	6.96	4.84	5.45	1.27	1.44	18.4	--	--
		e	13	3	0	15.8	11.1	13.9	1.84	1.88	51.9	--	--
		u	3	0	0	0.67	0.67	0.04	0.1	0.63	0.72	--	--
Manganese, in µg/L	D	a	28	9	0	28.8	12.8	46.9	3.73	1.07	241	--	--
		r	3	2	0	8.37	7.25	6.86	0.72	2.14	15.7	--	--
		f	9	4	0	18.9	13.2	17.7	1.18	1.07	52.2	--	--
		e	13	3	0	35.5	12.3	65.1	3.06	2.75	241	--	--
		u	3	0	0	49.3	46.9	32.1	0.35	18.6	82.6	--	--
Manganese, in µg/L	T	a	28	9	0	355	285	266	1.77	62.8	1,270	--	--
		r	3	2	0	507	571	247	1.08	235	716	--	--
		f	9	4	0	234	161	152	1.03	79.3	519	--	--
		e	13	3	0	457	337	302	1.91	167	1,270	--	--
		u	3	0	0	125	117	67.2	0.54	62.8	196	--	--
Zinc, in µg/L	D	a	37	0	16.2	6.67	5.29	6.02	2.75	1.99	30	20	20
		r	5	0	20	8.99	6.99	7.75	1.37	1.99	20	20	20
		f	13	0	23.1	6.83	4.21	8.36	2.87	2.26	30	20	20
		e	16	0	12.5	5.89	4.53	4.24	3.22	2.86	20	20	20
		u	3	0	0	6.72	6.02	2.63	1.12	4.52	9.63	--	--
Zinc, in µg/L	T	a	28	9	0	52.5	45	47.3	2.22	7	230	--	--
		r	3	2	0	82.7	85	30.6	0.34	51	112	--	--
		f	9	4	0	30.4	26	18.7	0.72	8	66	--	--
		e	13	3	0	70.7	58	56.8	2.11	14	230	--	--
		u	3	0	0	9.33	9	2.52	0.59	7	12	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Denver (06714000)													
Mean streamflow, in ft^3/s	--	a	46	0	0	878	636	837	2.35	166	4,450	--	--
		r	1	0	0	204	204			204	204	--	--
		f	22	0	0	665	413	590	1.82	166	2,310	--	--
		e	23	0	0	1,110	757	989	2.17	236	4,450	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Streamflow volume, in acre-feet	--	a	46	0	0	763	549	727	2.59	69	4,040	--	--
		r	1	0	0	178	178			178	178	--	--
		f	22	0	0	546	376	437	1.64	69	1,920	--	--
		e	23	0	0	996	674	884	2.23	214	4,040	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
pH, in standard pH units	W	a	46	0	0	7.41	7.47	0.27	0.61	6.72	7.9	--	--
		r	1	0	0	7.2	7.2			7.2	7.2	--	--
		f	22	0	0	7.43	7.51	0.29	0.59	6.72	7.9	--	--
		e	23	0	0	7.41	7.47	0.25	0.88	6.8	7.72	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Specific conductance, in µS/cm	W	a	41	5	0	543	509	184	0.96	247	1,060	--	--
		r	1	0	0	972	972			972	972	--	--
		f	19	3	0	552	532	169	0.8	285	940	--	--
		e	21	2	0	515	474	179	1.25	247	1,060	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Hardness, as calcium carbonate, in mg/L	T	a	45	1	0	154	154	44.8	0.01	69.1	255	--	--
		r	1	0	0	255	255			255	255	--	--
		f	22	0	0	157	160	40.6	0.07	83.3	242	--	--
		e	22	1	0	146	154	44.7	0.2	69.1	210	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Calcium, in mg/L	D	a	35	11	0	42	42.9	11.1	0.06	21.4	63.3	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	42.8	43.5	10.5	0.09	25.9	63.3	--	--
		e	19	4	0	41.3	40.5	11.8	0.11	21.4	60.5	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Magnesium, in mg/L	D	a	35	11	0	8.71	8.22	3.04	0.37	3.81	16.5	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	8.99	8.56	2.76	0.02	4.51	13.1	--	--
		e	19	4	0	8.47	8.22	3.31	0.63	3.81	16.5	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Potassium, in mg/L	D	a	15	31	0	4.67	4.46	1.26	0.61	3.23	7.03	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	4.4	3.8	1.11	0.82	3.23	6	--	--
		e	8	15	0	4.91	4.7	1.4	0.42	3.25	7.03	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sodium, in mg/L	D	a	15	31	0	46.8	50.7	17.3	0.39	18.2	84.8	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	50.3	46.4	19.5	0.92	31.2	84.8	--	--
		e	8	15	0	43.8	51.3	15.9	0.58	18.2	64.4	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	15	31	0	87.3	85.4	22.4	0.25	51	117	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	86.1	85.1	23.6	0.17	51.9	117	--	--
		e	8	15	0	88.3	96.8	22.9	0.69	51	111	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Denver (06714000)—Continued													
Chloride, in mg/L	D	a	15	31	0	49.2	50.7	24.1	1.9	15.9	122	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	56.2	51.1	30.8	2.06	29.9	122	--	--
		e	8	15	0	43.2	50.2	16.3	0.73	15.9	60.8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fluoride, in mg/L	D	a	15	31	0	0.58	0.55	0.19	0.18	0.25	0.83	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	0.56	0.51	0.23	0.08	0.25	0.83	--	--
		e	8	15	0	0.6	0.62	0.17	0.42	0.33	0.82	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sulfate, in mg/L	D	a	15	31	0	79.4	75.2	30.5	0.28	34	136	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	7	15	0	77.8	67.6	31.6	1.12	41.8	136	--	--
		e	8	15	0	80.9	89.5	31.7	0.33	34	124	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Residue on evaporation at 105°C, in mg/L	T	a	45	1	0	272	186	251	1.76	28	1,240	--	--
		r	1	0	0	150	150			150	150	--	--
		f	21	1	0	166	110	147	1.6	28	604	--	--
		e	23	0	0	374	272	289	1.33	60	1,240	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
E. coli, colonies per 100 mL	W	a	5	0	0	13,000	13,000	6,870	0.2	4,900	22,000	--	--
		r	1	0	0	4,900	4,900			4,900	4,900	--	--
		f	3	0	0	15,600	17,000	7,150	0.83	7,900	22,000	--	--
		e	1	0	0	13,000	13,000			13,000	13,000	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	a	5	0	0	21,000	22,000	14,400	0.12	4,900	35,000	--	--
		r	1	0	0	4,900	4,900			4,900	4,900	--	--
		f	3	0	0	21,600	22,000	13,600	0.12	7,900	35,000	--	--
		e	1	0	0	35,000	35,000			35,000	35,000	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia + organic N, in mg/L	T	a	45	1	0	2.6	2.09	1.82	2.63	0.87	10.2	--	--
		r	1	0	0	3	3			3	3	--	--
		f	22	0	0	2.04	1.62	1.93	3.95	0.87	10.2	--	--
		e	22	1	0	3.14	2.96	1.61	2.11	1.18	8.8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia, as N, in mg/L	D	a	35	11	5.71	0.33	0.22	0.34	2.89	0.06	1.8	0.04	0.04
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	0.28	0.14	0.42	3.49	0.06	1.8	--	--
		e	19	4	10.5	0.38	0.25	0.25	1.34	0.14	0.91	0.04	0.04
		u	0	0	0	--	--	--	--	--	--	--	--
Nitrite + nitrate, as N, in mg/L	D	a	35	11	0	2.09	2	1.11	0.74	0.71	4.7	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	1.89	1.71	0.89	0.54	0.76	3.49	--	--
		e	19	4	0	2.27	2.13	1.26	0.62	0.71	4.7	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Orthophosphate, as P, in mg/L	D	a	45	1	0	0.29	0.24	0.17	1.25	0.09	0.86	--	--
		r	1	0	0	0.86	0.86			0.86	0.86	--	--
		f	22	0	0	0.26	0.22	0.14	1.01	0.09	0.62	--	--
		e	22	1	0	0.29	0.25	0.15	0.73	0.1	0.59	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

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[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Denver (06714000)—Continued													
Phosphorus, as P, in mg/L	T	a	45	1	0	0.79	0.67	0.51	1.99	0.28	2.68	--	--
		r	1	0	0	1.33	1.33			1.33	1.33	--	--
		f	22	0	0	0.61	0.52	0.44	3.32	0.28	2.39	--	--
		e	22	1	0	0.95	0.86	0.52	1.81	0.3	2.68	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Organic carbon, in mg/L	D	a	31	15	0	9.29	7.81	5.09	2.43	4.46	29.8	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	14	8	0	7.67	5.69	3.81	1.69	4.46	17.5	--	--
		e	17	6	0	10.6	8.87	5.7	2.6	5.88	29.8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	D	a	45	1	0	3.06	2.96	1.11	0.82	1.44	6.16	--	--
		r	1	0	0	5	5			5	5	--	--
		f	22	0	0	3.04	2.63	1.09	0.73	1.71	5	--	--
		e	22	1	0	3	2.97	1.11	1.11	1.44	6.16	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	T	a	35	11	0	22.8	18	16.8	1.72	5.89	74.5	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	16.9	12.4	17.1	2.88	5.89	74.5	--	--
		e	19	4	0	27.8	21.8	15.3	1.56	11.7	72.8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	D	a	45	1	26.7	0.17	0.15	0.1	2.06	0.08	0.52	8.35	10
		r	1	0	100	--	--	--	--	--	--	10	10
		f	22	0	36.4	0.16	0.13	0.08	1.39	0.09	0.36	7.52	10
		e	22	1	13.6	0.18	0.15	0.11	2.27	0.08	0.52	10	10
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	T	a	35	11	0	21.4	15.4	18.8	1.25	2.79	66	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	13	7.48	15.2	2.6	2.79	62.5	--	--
		e	19	4	0	28.4	21.2	18.9	0.9	8.31	66	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	D	a	35	11	0	26.7	16.4	31.4	2.23	1.29	150	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	27.1	16.7	26.1	0.94	1.29	80.1	--	--
		e	19	4	0	26.4	14.2	35.9	2.67	1.32	150	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	T	a	35	11	0	355	285	235	1.24	109	999	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	278	191	229	2.36	109	999	--	--
		e	19	4	0	421	404	226	0.81	114	959	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	D	a	45	1	13.3	13.2	11.7	8.61	1.43	2.69	40	20	20
		r	1	0	0	30	30			30	30	--	--
		f	22	0	18.2	12.6	9.49	9.63	1.73	2.69	40	20	20
		e	22	1	9.09	13	13.3	7.07	1.42	4.38	34.3	20	20
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	T	a	35	11	0	101	83	79.7	1.66	24	348	--	--
		r	0	1	0	--	--	--	--	--	--	--	--
		f	16	6	0	70.1	41	81.6	2.99	24	348	--	--
		e	19	4	0	127	101	70	1.47	52	333	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Tollgate Creek above 6th Avenue at Aurora (394329104490101)													
Mean streamflow, in ft^3/s	--	a	20	4	0	87.1	47	112	1.76	1	405	--	--
		r	2	0	0	358	358	67.2		310	405	--	--
		f	7	0	0	68.9	14	91.2	1.04	1	207	--	--
		e	11	0	0	49.5	42	43	1.23	4	143	--	--
		u	0	4	0	--	--	--	--	--	--	--	--
Streamflow volume, in acre-feet	--	a	20	4	0	82.3	49	102	1.55	0	335	--	--
		r	2	0	0	309	309	37.5		282	335	--	--
		f	7	0	0	58.3	57	63.3	0.94	0	173	--	--
		e	11	0	0	56.4	38	76.8	2.6	4	272	--	--
		u	0	4	0	--	--	--	--	--	--	--	--
pH, in standard pH units	W	a	24	0	0	7.16	7.3	0.43	0.86	6.1	7.8	--	--
		r	2	0	0	6.66	6.66	0.5		6.3	7.01	--	--
		f	7	0	0	7.44	7.4	0.21	1.02	7.22	7.8	--	--
		e	11	0	0	7.21	7.31	0.45	1.67	6.1	7.67	--	--
		u	4	0	0	6.79	6.78	0.07	0.38	6.72	6.87	--	--
Specific conductance, in µS/cm	W	a	20	4	0	860	719	493	2.6	350	2,630	--	--
		r	2	0	0	639	639	205		494	784	--	--
		f	7	0	0	749	676	255	0.44	498	1,130	--	--
		e	9	2	0	1,050	957	667	1.86	350	2,630	--	--
		u	2	2	0	617	617	2.83		615	619	--	--
Hardness, as calcium carbonate, in mg/L	T	a	24	0	0	259	251	115	1.09	107	594	--	--
		r	2	0	0	173	173	65.1		127	219	--	--
		f	7	0	0	245	263	75.3	0.49	142	375	--	--
		e	11	0	0	299	287	137	0.78	107	594	--	--
		u	4	0	0	220	178	114	1.65	138	385	--	--
Calcium, in mg/L	D	a	21	3	0	77.2	67.4	33.8	1.04	35.6	169	--	--
		r	2	0	0	53.6	53.6	19.5		39.8	67.4	--	--
		f	6	1	0	75.2	72.4	25.2	0.78	45.4	117	--	--
		e	9	2	0	88.2	89.4	40.6	0.77	35.6	169	--	--
		u	4	0	0	67.4	55	33.9	1.65	43.2	117	--	--
Magnesium, in mg/L	D	a	21	3	0	14.5	12.4	8.28	1.79	4.33	41.8	--	--
		r	2	0	0	9.54	9.54	4.04		6.68	12.4	--	--
		f	6	1	0	13.2	13.2	4.68	0.25	6.99	20.2	--	--
		e	9	2	0	17.5	16	10.8	1.38	4.33	41.8	--	--
		u	4	0	0	12.5	9.88	7.09	1.65	7.32	22.8	--	--
Potassium, in mg/L	D	a	13	11	0	3.96	3.88	0.71	1.04	2.89	5.68	--	--
		r	1	1	0	2.89	2.89			2.89	2.89	--	--
		f	3	4	0	4.7	4.22	0.84	1.73	4.21	5.68	--	--
		e	5	6	0	3.96	3.85	0.5	0.93	3.37	4.75	--	--
		u	4	0	0	3.67	3.62	0.37	0.27	3.35	4.08	--	--
Sodium, in mg/L	D	a	13	11	0	80.5	68	31.1	0.68	42.8	142	--	--
		r	1	1	0	47.8	47.8			47.8	47.8	--	--
		f	3	4	0	65.2	64.8	22.7	0.1	42.8	88.2	--	--
		e	5	6	0	96.1	102	37	0.08	50.5	142	--	--
		u	4	0	0	80.7	73.5	26.7	1.21	58.3	118	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	13	11	0	80.5	69.8	22.7	0.56	51.8	118	--	--
		r	1	1	0	51.8	51.8			51.8	51.8	--	--
		f	3	4	0	80.2	85.6	14.7	1.45	63.5	91.3	--	--
		e	5	6	0	90	90.3	22.1	0.03	66.4	115	--	--
		u	4	0	0	75.9	63.9	28.4	1.92	57.6	118	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Tollgate Creek above 6th Avenue at Aurora (394329104490101)—Continued													
Chloride, in mg/L	D	a	13	11	0	61.4	62	23.3	0.63	29.9	112	--	--
		r	1	1	0	38.6	38.6			38.6	38.6	--	--
		f	3	4	0	43.7	44.9	13.3	0.39	29.9	56.4	--	--
		e	5	6	0	64.5	62	29.5	1.17	34.6	112	--	--
		u	4	0	0	76.5	78.2	8.94	1.1	64.1	85.5	--	--
Fluoride, in mg/L	D	a	13	11	0	0.3	0.34	0.06	0.59	0.2	0.37	--	--
		r	1	1	0	0.22	0.22			0.22	0.22	--	--
		f	3	4	0	0.34	0.35	0.03	1.68	0.3	0.36	--	--
		e	5	6	0	0.34	0.34	0.04	1.53	0.28	0.37	--	--
		u	4	0	0	0.25	0.23	0.07	1.65	0.2	0.35	--	--
Sulfate, in mg/L	D	a	13	11	0	220	180	107	0.62	116	386	--	--
		r	1	1	0	116	116			116	116	--	--
		f	3	4	0	187	170	73.7	0.98	123	268	--	--
		e	5	6	0	275	315	111	0.53	130	385	--	--
		u	4	0	0	202	153	126	1.72	116	386	--	--
Residue on evaporation at 105°C, in mg/L	T	a	22	2	0	718	246	1,560	4.07	40	7,360	--	--
		r	2	0	0	290	290	266		102	478	--	--
		f	7	0	0	1,230	153	2,710	2.62	40	7,360	--	--
		e	9	2	0	691	529	614	1.67	90	2,090	--	--
		u	4	0	0	96	94	21.9	0.49	72	124	--	--
E. coli, colonies per 100 mL	W	a	3	0	0	25,700	35,000	16,200	1.73	7,000	35,000	--	--
		r	1	0	0	35,000	35,000			35,000	35,000	--	--
		f	2	0	0	21,000	21,000	19,800		7,000	35,000	--	--
		e	0	0	0	--	--	--	--	--	--	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	a	3	0	0	32,000	35,000	23,600	0.56	7,000	54,000	--	--
		r	1	0	0	35,000	35,000			35,000	35,000	--	--
		f	2	0	0	30,500	30,500	33,200		7,000	54,000	--	--
		e	0	0	0	--	--	--	--	--	--	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia + organic N, in mg/L	T	a	24	0	0	2.57	2.24	1.55	0.98	0.59	6.32	--	--
		r	2	0	0	1.9	1.9	0.46		1.57	2.23	--	--
		f	7	0	0	1.94	1.92	0.59	0.28	1.32	2.8	--	--
		e	11	0	0	3.58	3.82	1.72	0.14	0.59	6.32	--	--
		u	4	0	0	1.23	1.06	0.55	1.3	0.81	2	--	--
Ammonia, as N, in mg/L	D	a	21	3	9.52	0.23	0.22	0.12	0.94	0.05	0.54	0.04	0.04
		r	2	0	0	0.2	0.2	0.08		0.15	0.26	--	--
		f	6	1	16.7	0.22	0.19	0.19	1.52	0.05	0.54	0.04	0.04
		e	9	2	11.1	0.27	0.29	0.11	0.13	0.1	0.44	0.04	0.04
		u	4	0	0	0.19	0.19	0.05	0.07	0.13	0.24	--	--
Nitrite + nitrate, as N, in mg/L	D	a	21	3	14.3	0.54	0.54	0.24	0.3	0.11	0.99	0.06	0.06
		r	2	0	50	0.52	0.52			0.52	0.52	0.06	0.06
		f	6	1	33.3	0.55	0.49	0.32	1.02	0.24	0.99	0.06	0.06
		e	9	2	0	0.59	0.67	0.26	0.52	0.11	0.99	--	--
		u	4	0	0	0.44	0.39	0.14	1.72	0.33	0.64	--	--
Orthophosphate, as P, in mg/L	D	a	23	1	17.4	0.05	0.05	0.03	0.45	0.01	0.11	0.01	0.01
		r	2	0	50	0.05	0.05			0.05	0.05	0.01	0.01
		f	7	0	28.6	0.07	0.06	0.03	0.27	0.02	0.1	0.01	0.01
		e	10	1	10	0.03	0.03	0.02	1.97	0.01	0.09	0.01	0.01
		u	4	0	0	0.08	0.08	0.03	0.29	0.05	0.11	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Tollgate Creek above 6th Avenue at Aurora (394329104490101)—Continued													
Phosphorus, as P, in mg/L	T	a	24	0	4.17	0.8	0.57	0.61	1.19	0.18	2.44	0.04	0.04
		r	2	0	0	0.79	0.79	0.31		0.57	1.01	--	--
		f	7	0	0	0.8	0.44	0.63	0.8	0.23	1.82	--	--
		e	11	0	9.09	1.01	0.95	0.67	1.13	0.2	2.44	0.04	0.04
		u	4	0	0	0.26	0.24	0.08	0.82	0.18	0.36	--	--
Organic carbon, in mg/L	D	a	21	3	0	10.4	8.41	4.31	0.85	5.89	18.4	--	--
		r	2	0	0	7.77	7.77	0.1		7.7	7.85	--	--
		f	6	1	0	10.5	8.14	5.06	1	6.09	18.3	--	--
		e	9	2	0	12.2	12	4.21	0.33	7.53	18.4	--	--
		u	4	0	0	7.21	6.17	2.28	1.93	5.89	10.6	--	--
Copper, in µg/L	D	a	24	0	0	2.82	2.8	0.93	0.37	1.25	5	--	--
		r	2	0	0	1.75	1.75	0.3		1.54	1.96	--	--
		f	7	0	0	3.08	3.29	1.08	0.78	1.98	5	--	--
		e	11	0	0	2.99	3.08	0.94	0.63	1.25	4.16	--	--
		u	4	0	0	2.46	2.43	0.42	0.34	2	2.98	--	--
Copper, in µg/L	T	a	21	3	0	21.4	16.6	15.2	1.5	5.41	66.9	--	--
		r	2	0	0	16.9	16.9	10.6		9.4	24.4	--	--
		f	6	1	0	16	12.4	10.6	0.9	5.51	32.6	--	--
		e	9	2	0	31.5	25.5	16.6	1.29	12.4	66.9	--	--
		u	4	0	0	9.05	8.97	3.04	0.15	5.41	12.8	--	--
Lead, in µg/L	D	a	24	0	70.8	0.12	0.1	0.03	1.29	0.09	0.18	1.83	0.08
		r	2	0	100	--	--	--	--	--	--	0.08	0.08
		f	7	0	100	--	--	--	--	--	--	1.5	0.08
		e	11	0	54.5	0.13	0.13	0.04	0.87	0.09	0.18	3.39	0.08
		u	4	0	50	0.09	0.09	0		0.09	0.09	0.08	0.08
Lead, in µg/L	T	a	21	3	0	14.6	9.17	13.3	1.57	1.8	53.2	--	--
		r	2	0	0	12.5	12.5	8.79		6.34	18.8	--	--
		f	6	1	0	9.99	5.85	9.53	1.18	2.47	25.9	--	--
		e	9	2	0	22.9	17.5	15	1.26	6.79	53.2	--	--
		u	4	0	0	4.01	4.1	1.74	0.3	1.8	6.05	--	--
Manganese, in µg/L	D	a	21	3	0	183	41.8	347	3.49	2.11	1,570	--	--
		r	2	0	0	182	182	247		7.53	356	--	--
		f	6	1	0	293	44.7	626	2.44	2.11	1,570	--	--
		e	9	2	0	179	113	167	0.64	2.95	474	--	--
		u	4	0	0	27.8	29.1	8.39	0.58	17.3	35.7	--	--
Manganese, in µg/L	T	a	21	3	0	751	683	519	0.79	89.5	1,950	--	--
		r	2	0	0	749	749	162		635	864	--	--
		f	6	1	0	670	502	563	1.18	222	1,650	--	--
		e	9	2	0	1,000	982	523	0.53	260	1,950	--	--
		u	4	0	0	311	235	262	1.42	89.5	683	--	--
Zinc, in µg/L	D	a	24	0	8.33	10.7	7.66	10.5	2.9	2.69	50.6	20	20
		r	2	0	0	7.14	7.14	6.3		2.69	11.6	--	--
		f	7	0	14.3	6.81	5.03	4.55	1.51	3.29	15.1	20	20
		e	11	0	9.09	10.7	9.12	6.87	0.9	2.77	23.8	20	20
		u	4	0	0	18.1	7.78	21.7	1.98	6.35	50.6	--	--
Zinc, in µg/L	T	a	21	3	0	95.6	93	64.4	1.37	18	293	--	--
		r	2	0	0	77	77	22.6		61	93	--	--
		f	6	1	0	59	43.5	38.9	1.24	24	126	--	--
		e	9	2	0	142	124	63.6	1.87	72	293	--	--
		u	4	0	0	55.5	36	51.7	1.83	18	132	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Sand Creek at mouth near Commerce City (394839104570300)													
Mean streamflow, in ft^3/s	--	a	34	0	0	221	102	346	3.64	18	1,810	--	--
		r	3	0	0	134	99	110	1.28	45	257	--	--
		f	16	0	0	102	79	79.1	1.58	18	296	--	--
		e	15	0	0	366	178	482	2.39	24	1,810	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Streamflow volume, in acre-feet	--	a	34	0	0	229	99	449	4.56	17	2,550	--	--
		r	3	0	0	117	85	96.6	1.34	41	226	--	--
		f	16	0	0	93.1	71.5	73.4	1.41	17	269	--	--
		e	15	0	0	395	160	644	3.06	21	2,550	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
pH, in standard pH units	W	a	34	0	0	7.43	7.4	0.27	0.17	6.88	7.94	--	--
		r	3	0	0	7.63	7.7	0.35	0.86	7.25	7.94	--	--
		f	16	0	0	7.37	7.39	0.29	0.34	6.88	7.9	--	--
		e	15	0	0	7.45	7.45	0.22	0.18	7.1	7.9	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Specific conductance, in µS/cm	W	a	30	4	0	861	765	314	0.69	342	1,600	--	--
		r	2	1	0	1,180	1,180	599		753	1,600	--	--
		f	15	1	0	880	915	314	0.59	488	1,600	--	--
		e	13	2	0	792	747	268	0.35	342	1,280	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Hardness, as calcium carbonate, in mg/L	T	a	33	1	0	229	234	72.9	0.24	87	360	--	--
		r	3	0	0	309	297	45.8	1.12	271	360	--	--
		f	16	0	0	229	233	62.5	0.31	113	323	--	--
		e	14	1	0	211	195	80	0	87	325	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Calcium, in mg/L	D	a	25	9	0	65.6	68.6	21.3	0.23	27.7	95.8	--	--
		r	2	1	0	83.6	83.6	9		77.3	90	--	--
		f	11	5	0	68.8	68.9	20.1	0.5	35.1	93.8	--	--
		e	12	3	0	59.7	53.9	22.5	0.29	27.7	95.8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Magnesium, in mg/L	D	a	25	9	0	12.8	14	4.84	0.11	4.33	21.5	--	--
		r	2	1	0	18.2	18.2	1.05		17.5	19	--	--
		f	11	5	0	13.4	14.4	4.56	0.18	6.09	21.5	--	--
		e	12	3	0	11.5	11	4.95	0.31	4.33	20.2	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Potassium, in mg/L	D	a	12	22	0	4.46	4.2	1.09	0.17	2.81	6.35	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	4.8	5.21	1.23	0.29	3.11	6.35	--	--
		e	7	8	0	4.22	4.01	1	0.33	2.81	5.76	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sodium, in mg/L	D	a	12	22	0	85	73.2	36.4	0.26	42.9	138	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	92	114	38.2	0.57	48.4	125	--	--
		e	7	8	0	80.1	67	37.2	0.88	42.9	138	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	12	22	0	94.8	90.9	29	0.17	53.5	139	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	101	116	33.4	0.57	58.5	133	--	--
		e	7	8	0	90.2	88.9	27.2	0.74	53.5	139	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

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[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Sand Creek at mouth near Commerce City (394839104570300)—Continued													
Chloride, in mg/L	D	a	12	22	0	73.6	66.3	27.4	0.1	33.7	110	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	83.7	98.2	29.7	0.74	42.9	110	--	--
		e	7	8	0	66.4	57.2	25.3	0.57	33.7	107	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fluoride, in mg/L	D	a	12	22	0	0.45	0.49	0.14	0.1	0.26	0.67	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	0.47	0.5	0.16	0.19	0.26	0.67	--	--
		e	7	8	0	0.44	0.48	0.13	0.21	0.26	0.61	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sulfate, in mg/L	D	a	12	22	0	174	150	90	0.64	78.9	347	--	--
		r	0	3	0	--	--	--	--	--	--	--	--
		f	5	11	0	176	190	87.9	0.19	81.8	267	--	--
		e	7	8	0	172	130	98.4	1.13	78.9	347	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Residue on evaporation at 105°C, in mg/L	T	a	34	0	0	440	347	442	2.16	13	1,930	--	--
		r	3	0	0	357	416	244	1.02	89	566	--	--
		f	16	0	0	279	244	209	0.62	13	690	--	--
		e	15	0	0	629	416	580	1.44	38	1,930	--	--
		u	0	0	0	--	--	--	--	--	-	--	--
E. coli, colonies per 100 mL	W	a	4	0	0	13,500	9,150	16,300	0.95	500	35,000	--	--
		r	1	0	0	1,300	1,300			1,300	1,300	--	--
		f	3	0	0	17,500	17,000	17,300	0.13	500	35,000	--	--
		e	0	0	0	--	--	--	--	--	--	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	a	4	0	0	13,500	9,150	16,200	0.95	700	35,000	--	--
		r	1	0	0	1,300	1,300			1,300	1,300	--	--
		f	3	0	0	17,600	17,000	17,200	0.15	700	35,000	--	--
		e	0	0	0	--	--	--	--	--	--	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia + organic N, in mg/L	T	a	33	1	0	3.28	2.94	1.89	1.06	0.88	8.61	--	--
		r	3	0	0	4.35	4.7	2.62	0.59	1.57	6.78	--	--
		f	16	0	0	2.9	2	2.08	1.74	0.88	8.61	--	--
		e	14	1	0	3.48	3.35	1.49	0.67	1.09	6.56	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia, as N, in mg/L	D	a	25	9	12	0.44	0.37	0.34	0.81	0.05	1.15	0.04	0.04
		r	2	1	0	0.65	0.65	0.7		0.16	1.15	--	--
		f	11	5	18.2	0.47	0.37	0.37	0.71	0.05	1.08	0.04	0.04
		e	12	3	8.33	0.37	0.38	0.25	0.28	0.06	0.77	0.04	0.04
		u	0	0	0	--	--	--	--	--	--	--	--
Nitrite + nitrate, as N, in mg/L	D	a	25	9	0	1.09	0.87	0.56	1.11	0.36	2.29	--	--
		r	2	1	0	1.43	1.43	0.44		1.12	1.74	--	--
		f	11	5	0	1.13	0.85	0.62	1.27	0.59	2.29	--	--
		e	12	3	0	1	0.86	0.54	1.43	0.36	2.15	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Orthophosphate, as P, in mg/L	D	a	33	1	0	0.16	0.15	0.08	1.32	0.04	0.44	--	--
		r	3	0	0	0.16	0.19	0.05	1.73	0.1	0.19	--	--
		f	16	0	0	0.17	0.16	0.07	0.54	0.05	0.32	--	--
		e	14	1	0	0.15	0.13	0.11	1.73	0.04	0.44	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

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Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
Sand Creek at mouth near Commerce City (394839104570300)—Continued													
Phosphorus, as P, in mg/L	T	a	33	1	0	0.91	0.83	0.57	1.18	0.24	2.76	--	--
		r	3	0	0	1.11	1.45	0.65	1.71	0.37	1.53	--	--
		f	16	0	0	0.7	0.49	0.45	1.3	0.24	1.83	--	--
		e	14	1	0	1.11	0.96	0.62	1.4	0.33	2.76	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Organic carbon, in mg/L	D	a	24	10	0	13.2	12.9	5.89	1.1	5.86	30.1	--	--
		r	1	2	0	20.8	20.8			20.8	20.8	--	--
		f	11	5	0	13.1	12.1	7.23	1.31	5.86	30.1	--	--
		e	12	3	0	12.6	12.3	4.4	0.88	7.27	22.6	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	D	a	33	1	0	3.84	3	4.13	4.54	1.25	25	--	--
		r	3	0	0	10.3	3.46	12.7	1.72	2.46	25	--	--
		f	16	0	0	3.52	3.05	1.98	2.52	1.74	10	--	--
		e	14	1	0	2.82	2.89	1.27	1.06	1.25	6	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	T	a	25	9	0	26.2	19.2	19.8	1.51	5.36	87.3	--	--
		r	2	1	0	22.5	22.5	16.3		11	34.1	--	--
		f	11	5	0	19	14	13.7	1.53	5.36	51.7	--	--
		e	12	3	0	33.4	25.8	23.5	1.17	7.86	87.3	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	D	a	33	1	39.4	0.19	0.17	0.11	1.62	0.08	0.48	6.18	10
		r	3	0	33.3	0.36	0.36	0.17		0.24	0.48	10	10
		f	16	0	43.8	0.18	0.13	0.11	1.42	0.1	0.41	7.17	10
		e	14	1	35.7	0.16	0.17	0.05	0.73	0.08	0.21	4.05	0.08
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	T	a	25	9	0	26.9	19.1	27.3	1.76	1.45	114	--	--
		r	2	1	0	22.7	22.7	19.8		8.77	36.7	--	--
		f	11	5	0	16.3	9.19	15.8	1.7	1.45	55.7	--	--
		e	12	3	0	37.4	23	33.6	1.25	3.65	114	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	D	a	25	9	0	85.1	35.1	127	2.42	2.69	550	--	--
		r	2	1	0	172	172	140		72.6	271	--	--
		f	11	5	0	66.6	14.2	93.7	1.2	2.69	235	--	--
		e	12	3	0	87.7	35.1	154	2.93	4.12	550	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	T	a	25	9	0	720	602	548	1.2	84	2,090	--	--
		r	2	1	0	705	705	665		235	1,170	--	--
		f	11	5	0	567	415	574	2.13	84	2,090	--	--
		e	12	3	0	864	813	519	1.05	141	2,090	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	D	a	32	2	0	63.7	34.4	83.4	2.1	3.01	336	--	--
		r	3	0	0	114	93.3	86.1	1.02	40	208	--	--
		f	16	0	0	76.1	34.8	101	1.97	3.01	336	--	--
		e	13	2	0	36.9	10	47.9	1.89	4.24	165	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	T	a	24	10	0	289	148	320	1.67	18	1,150	--	--
		r	2	1	0	726	726	539		345	1,110	--	--
		f	11	5	0	263	80	363	1.87	18	1,150	--	--
		e	11	4	0	235	154	179	0.59	39	545	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

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Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Henderson (06720500)													
Mean streamflow, in ft^3/s	--	a	35	0	0	1,480	1,060	1,460	2.71	280	7,570	--	--
		r	7	0	0	1,120	1,200	611	0.28	281	1,730	--	--
		f	13	0	0	1,130	818	972	2.15	280	3,900	--	--
		e	15	0	0	1,940	1,070	1,960	2.1	350	7,570	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Streamflow volume, in acre-feet	--	a	35	0	0	1,320	1,090	1,280	2.97	208	6,880	--	--
		r	7	0	0	1,020	1,090	556	0.29	255	1,580	--	--
		f	13	0	0	865	744	523	0.47	208	1,670	--	--
		e	15	0	0	1,840	1,230	1,750	2.08	318	6,880	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
pH, in standard pH units	W	a	35	0	0	7.38	7.36	0.26	0.19	6.72	8	--	--
		r	7	0	0	7.25	7.35	0.26	1.72	6.72	7.48	--	--
		f	13	0	0	7.44	7.34	0.24	1.08	7.1	8	--	--
		e	15	0	0	7.39	7.4	0.29	0.46	6.92	8	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Specific conductance, in µS/cm	W	a	30	5	0	676	655	210	0.36	316	1,090	--	--
		r	5	2	0	827	800	177	0.19	646	1,020	--	--
		f	12	1	0	648	655	194	0.33	367	1,020	--	--
		e	13	2	0	645	600	224	0.75	316	1,090	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Hardness, as calcium carbonate, in mg/L	T	a	34	1	0	180	172	58.4	1.14	84.5	380	--	--
		r	7	0	0	183	174	34.5	0.57	136	240	--	--
		f	13	0	0	179	170	47.2	0.24	100	250	--	--
		e	14	1	0	180	163	77.8	1.3	84.5	380	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Calcium, in mg/L	D	a	23	12	0	44.3	44	9.14	0.06	26.2	62.7	--	--
		r	6	1	0	50.3	50.3	7.7	0.45	40	62.7	--	--
		f	7	6	0	42.4	42.6	6.32	0.81	31.3	49.4	--	--
		e	10	5	0	42.1	41.4	10.6	0.33	26.2	61.2	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Magnesium, in mg/L	D	a	23	12	0	9.88	10.1	2.77	0.01	4.62	16	--	--
		r	6	1	0	11.6	11.4	1.69	0.42	8.86	13.8	--	--
		f	7	6	0	9.5	9.06	2.27	0.86	5.43	11.9	--	--
		e	10	5	0	9.13	8.57	3.33	0.79	4.62	16	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Potassium, in mg/L	D	a	8	27	0	6.18	5.73	1.81	0.32	4.26	8.37	--	--
		r	2	5	0	7.01	7.01	1.65		5.84	8.18	--	--
		f	2	11	0	5.01	5.01	0.85		4.41	5.61	--	--
		e	4	11	0	6.36	6.4	2.26	0.01	4.26	8.37	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sodium, in mg/L	D	a	8	27	0	67.1	65.3	38.5	1.06	27.1	142	--	--
		r	2	5	0	103	103	55.7		63.4	142	--	--
		f	2	11	0	66	66	45.2		34.1	98	--	--
		e	4	11	0	49.8	50.9	22.1	0.08	27.1	70.4	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	a	8	27	0	86.3	90.7	22.2	0.11	57.7	121	--	--
		r	2	5	0	100	100	6.48		95.6	105	--	--
		f	2	11	0	77	77	14.9		66.5	87.6	--	--
		e	4	11	0	83.9	78.5	29.5	0.66	57.7	121	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Henderson (06720500)—Continued													
Chloride, in mg/L	D	a	8	27	0	74	58.1	60.2	1.51	23.3	197	--	--
		r	2	5	0	128	128	97.7		58.9	197	--	--
		f	2	11	0	79.1	79.1	72.2		28.1	130	--	--
		e	4	11	0	44.5	44.6	20	0.02	23.3	65.3	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fluoride, in mg/L	D	a	8	27	0	0.56	0.51	0.19	0.43	0.35	0.84	--	--
		r	2	5	0	0.64	0.64	0.15		0.53	0.74	--	--
		f	2	11	0	0.44	0.44	0.05		0.41	0.48	--	--
		e	4	11	0	0.58	0.57	0.26	0.08	0.35	0.84	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Sulfate, in mg/L	D	a	8	27	0	82.1	80.4	26.2	0.05	47.4	117	--	--
		r	2	5	0	96.2	96.2	14.9		85.7	107	--	--
		f	2	11	0	65.8	65.8	13.2		56.4	75.1	--	--
		e	4	11	0	83.3	84.4	34	0.08	47.4	117	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Residue on evaporation at 105°C, in mg/L	T	a	34	1	0	615	265	1,150	3.85	76	6,040	--	--
		r	7	0	0	225	154	147	1.05	108	486	--	--
		f	12	1	0	472	223	573	2.26	76	2,060	--	--
		e	15	0	0	911	326	1,630	2.78	90.7	6,040	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
E. coli, colonies per 100 mL	W	a	5	0	0	6,950	7,000	5,210	0.1	460	13,000	--	--
		r	1	0	0	460	460			460	460	--	--
		f	3	0	0	7,770	7,000	4,900	0.69	3,300	13,000	--	--
		e	1	0	0	11,000	11,000			11,000	11,000	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	a	5	0	0	24,800	11,000	26,900	0.52	310	54,000	--	--
		r	1	0	0	310	310			310	310	--	--
		f	3	0	0	23,300	11,000	26,800	1.63	4,900	54,000	--	--
		e	1	0	0	54,000	54,000			54,000	54,000	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia + organic N, in mg/L	T	a	34	1	0	5.47	4.95	2.3	0.89	1.98	12.2	--	--
		r	7	0	0	5.32	4.98	1.38	0.06	3.15	7.3	--	--
		f	13	0	0	5.72	5.44	2.82	0.83	1.98	12.2	--	--
		e	14	1	0	5.31	4.26	2.27	0.88	2.66	9.63	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Ammonia, as N, in mg/L	D	a	23	12	0	1.59	1.48	0.93	0.68	0.32	3.55	--	--
		r	6	1	0	2.12	2.12	0.63	0.32	1.36	3.06	--	--
		f	7	6	0	1.61	1.48	1.06	0.65	0.34	3.46	--	--
		e	10	5	0	1.26	1.01	0.91	1.95	0.32	3.55	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Nitrite + nitrate, as N, in mg/L	D	a	23	12	0	2.71	2.57	0.92	0.03	1.14	4.1	--	--
		r	6	1	0	3.22	3.38	0.8	0.44	2.14	4.1	--	--
		f	7	6	0	2.43	2.52	0.83	1.11	1.47	4.01	--	--
		e	10	5	0	2.61	2.55	1	0.09	1.14	4	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Orthophosphate, as P, in mg/L	D	a	34	1	0	0.63	0.6	0.28	0.63	0.2	1.4	--	--
		r	7	0	0	0.7	0.7	0.35	1.37	0.35	1.4	--	--
		f	13	0	0	0.59	0.53	0.26	0.51	0.21	1.06	--	--
		e	14	1	0	0.62	0.62	0.26	0.03	0.2	1	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

Table 7. Summary statistics for water-quality properties and constituents from composite and bacteriological samples at all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ: a, all samples regardless of hydrograph position; r, sample from rising limb portion of hydrograph; f, sample from falling limb portion of hydrograph; e, sample from rising and falling limbs of hydrograph; u, unclassified. n, number of samples; M, number of samples with missing values; Pct, percentage of samples below reporting level (unsaved value); Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; col, colonies per 100 milliliters; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Medium
South Platte River at Henderson (06720500)—Continued													
Phosphorus, as P, in mg/L	T	a	34	1	0	1.85	1.59	1.3	3.89	0.73	8.3	--	--
		r	7	0	0	1.62	1.5	0.58	0.37	0.83	2.52	--	--
		f	13	0	0	1.66	1.65	0.74	0.44	0.73	3.12	--	--
		e	14	1	0	2.14	1.59	1.86	3.18	0.84	8.3	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Organic carbon, in mg/L	D	a	19	16	0	9.88	10.6	3.25	0.27	5.39	16.6	--	--
		r	4	3	0	9.27	9.13	2.58	0.08	6.91	11.9	--	--
		f	6	7	0	9.91	8.34	4.72	0.57	5.86	16.6	--	--
		e	9	6	0	10.1	10.7	2.66	0.56	5.39	14	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	D	a	34	1	0	3.39	2.95	1.74	1.79	1.56	9	--	--
		r	7	0	0	2.99	3	0.64	0.57	1.9	3.77	--	--
		f	13	0	0	3.32	3	1.51	1.36	1.56	7	--	--
		e	14	1	0	3.65	2.79	2.29	1.52	1.8	9	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Copper, in µg/L	T	a	23	12	0	35.3	32.4	16.3	0.5	11.6	71.9	--	--
		r	6	1	0	32.9	30.1	17	0.39	16	56.7	--	--
		f	7	6	0	34.3	34.2	21.6	0.87	11.6	71.9	--	--
		e	10	5	0	37.5	32.2	13	0.57	22.7	57.2	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	D	a	34	1	29.4	0.69	0.28	1.99	4.87	0.13	10	10	10
		r	7	0	14.3	0.3	0.32	0.07	1.03	0.18	0.37	10	10
		f	13	0	46.2	0.26	0.19	0.17	2.21	0.13	0.64	10	10
		e	14	1	21.4	1.17	0.31	2.93	3.31	0.16	10	10	10
		u	0	0	0	--	--	--	--	--	--	--	--
Lead, in µg/L	T	a	23	12	0	33.1	33.2	17.9	0.42	6.92	68.2	--	--
		r	6	1	0	26.1	25.1	14.1	0.18	12.2	44.1	--	--
		f	7	6	0	30.7	28.8	21.1	0.59	6.92	63.1	--	--
		e	10	5	0	39	38.9	17.3	0.43	17.6	68.2	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	D	a	23	12	0	88.5	80.8	65.6	0.86	7.21	242	--	--
		r	6	1	0	123	106	43.8	1.02	85.8	194	--	--
		f	7	6	0	76.5	56.2	80.6	1.73	7.3	242	--	--
		e	10	5	0	76.3	66.7	63.8	1.21	7.21	217	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Manganese, in µg/L	T	a	23	12	0	565	545	237	0.28	236	1,010	--	--
		r	6	1	0	563	465	309	0.74	257	1,010	--	--
		f	7	6	0	525	541	281	0.45	236	966	--	--
		e	10	5	0	595	592	173	0.11	329	895	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	D	a	34	1	8.82	21.2	19.8	10.4	1.11	7.86	50	20	20
		r	7	0	0	21.3	20.7	5.5	0.45	14.7	30	--	--
		f	13	0	23.1	17.6	17.3	6.69	0.54	9.71	30	20	20
		e	14	1	0	23.8	19.9	13.6	0.67	7.86	50	--	--
		u	0	0	0	--	--	--	--	--	--	--	--
Zinc, in µg/L	T	a	23	12	0	154	145	74	0.35	45	299	--	--
		r	6	1	0	136	128	64.9	0.17	70	211	--	--
		f	7	6	0	151	145	97	0.57	45	299	--	--
		e	10	5	0	168	148	65.7	0.35	96	265	--	--
		u	0	0	0	--	--	--	--	--	--	--	--

A

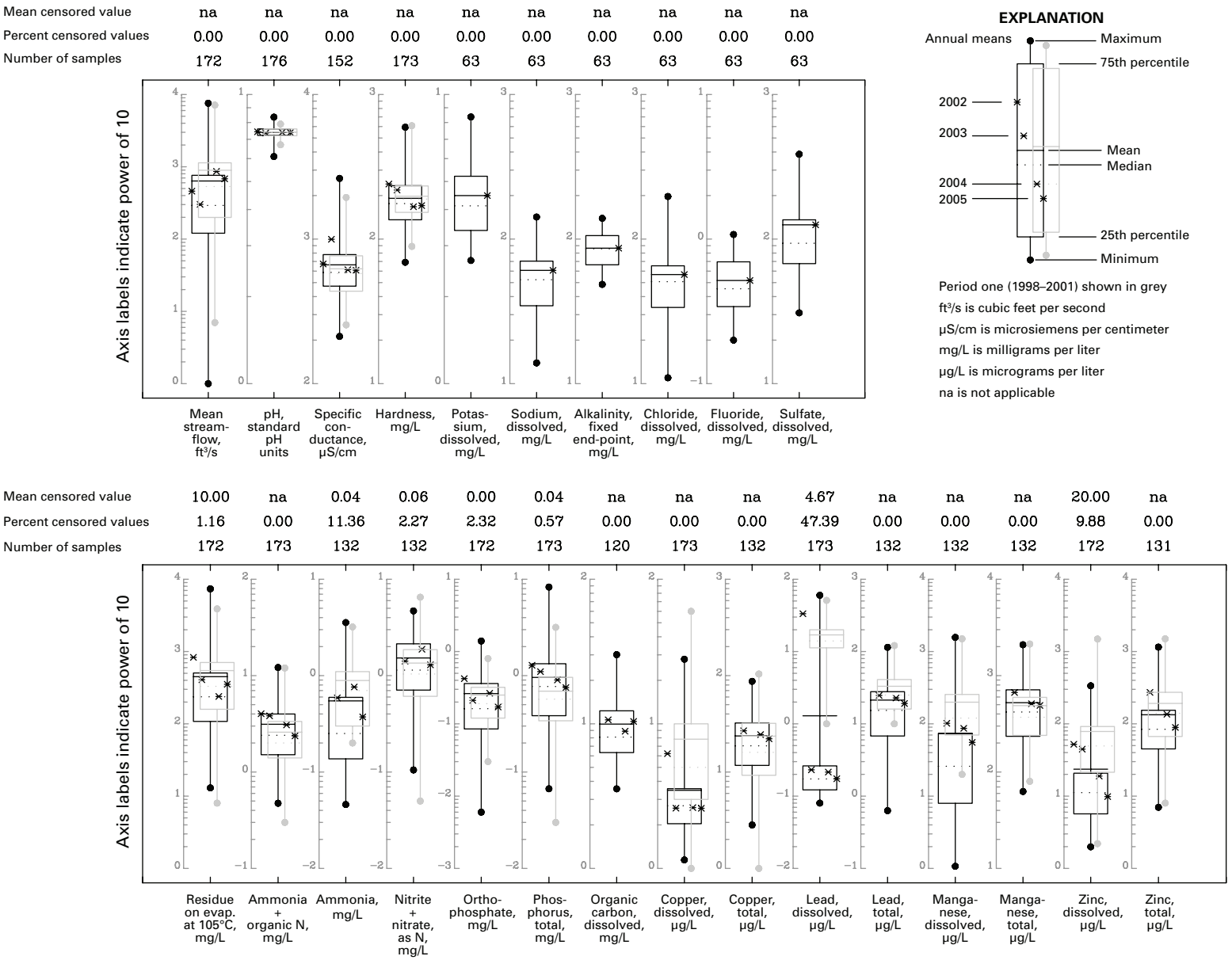
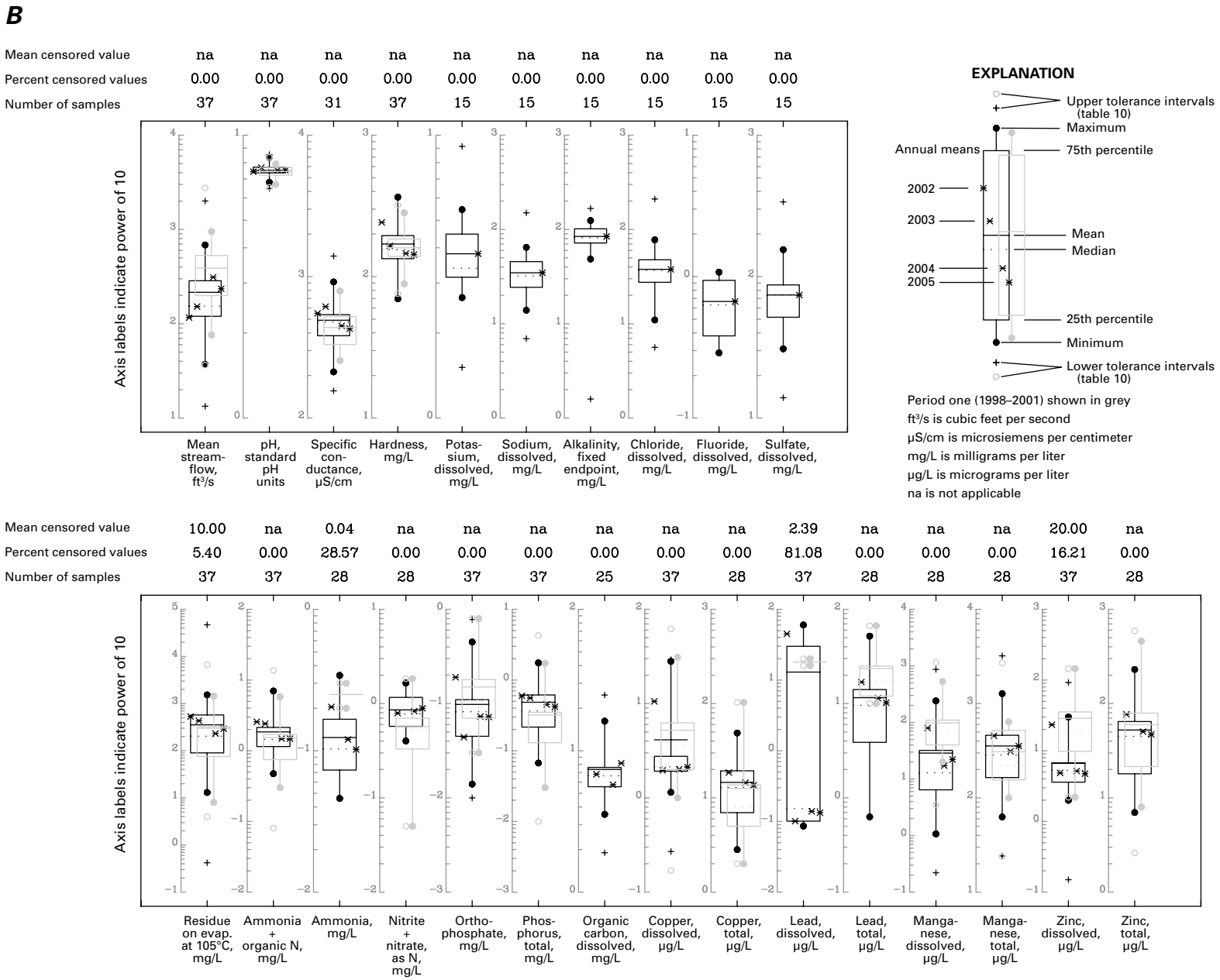


Figure 3. Boxplots showing distribution of water-quality properties and constituents at (*A*) all stations, (*B*) South Platte River below Union Avenue at Englewood, (*C*) South Platte River at Denver, (*D*) Tollgate Creek above 6th Avenue at Aurora, (*E*) Sand Creek at mouth near Commerce City, and (*F*) South Platte River at Henderson, water years 1998–2001 and water years 2002–2005.



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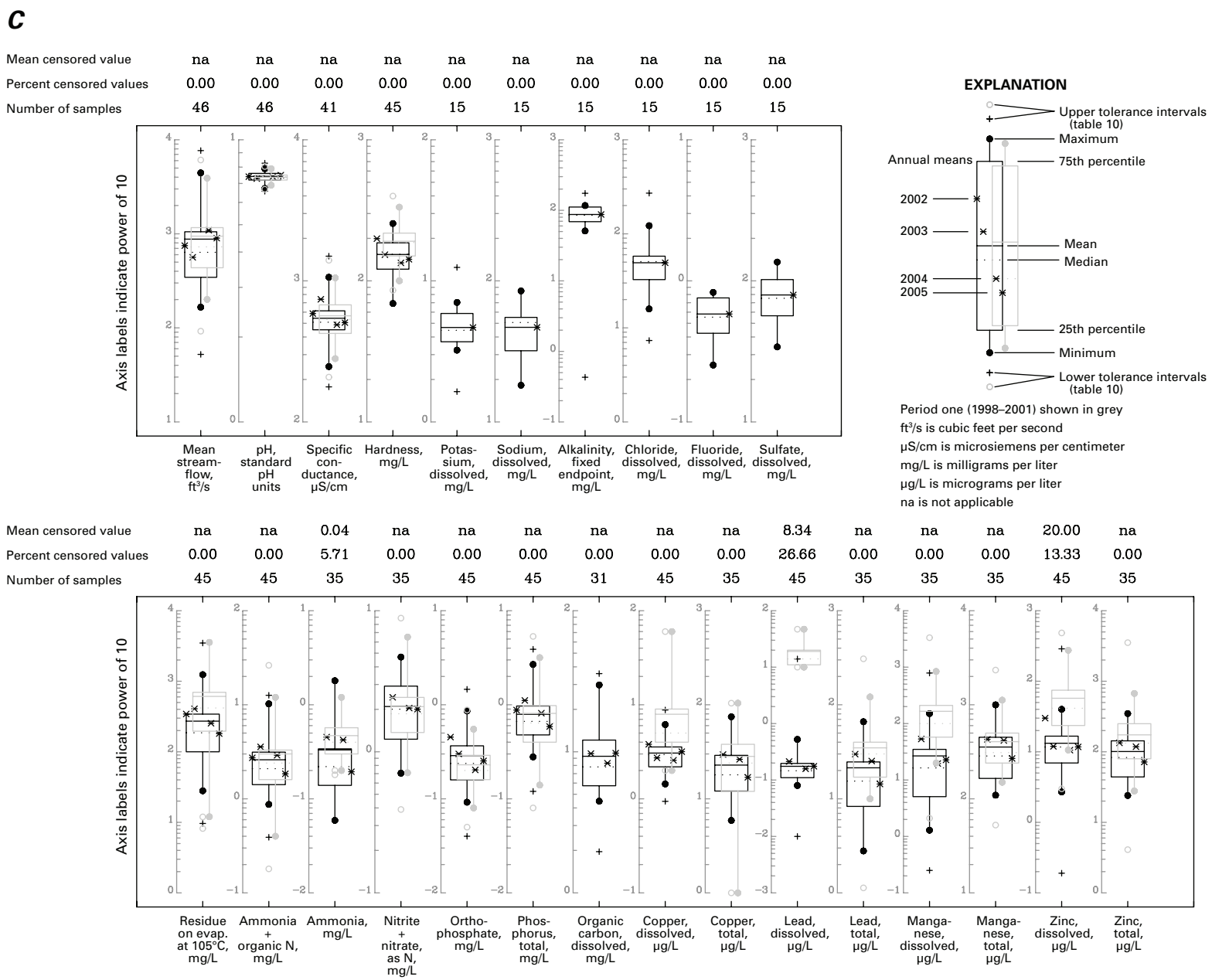

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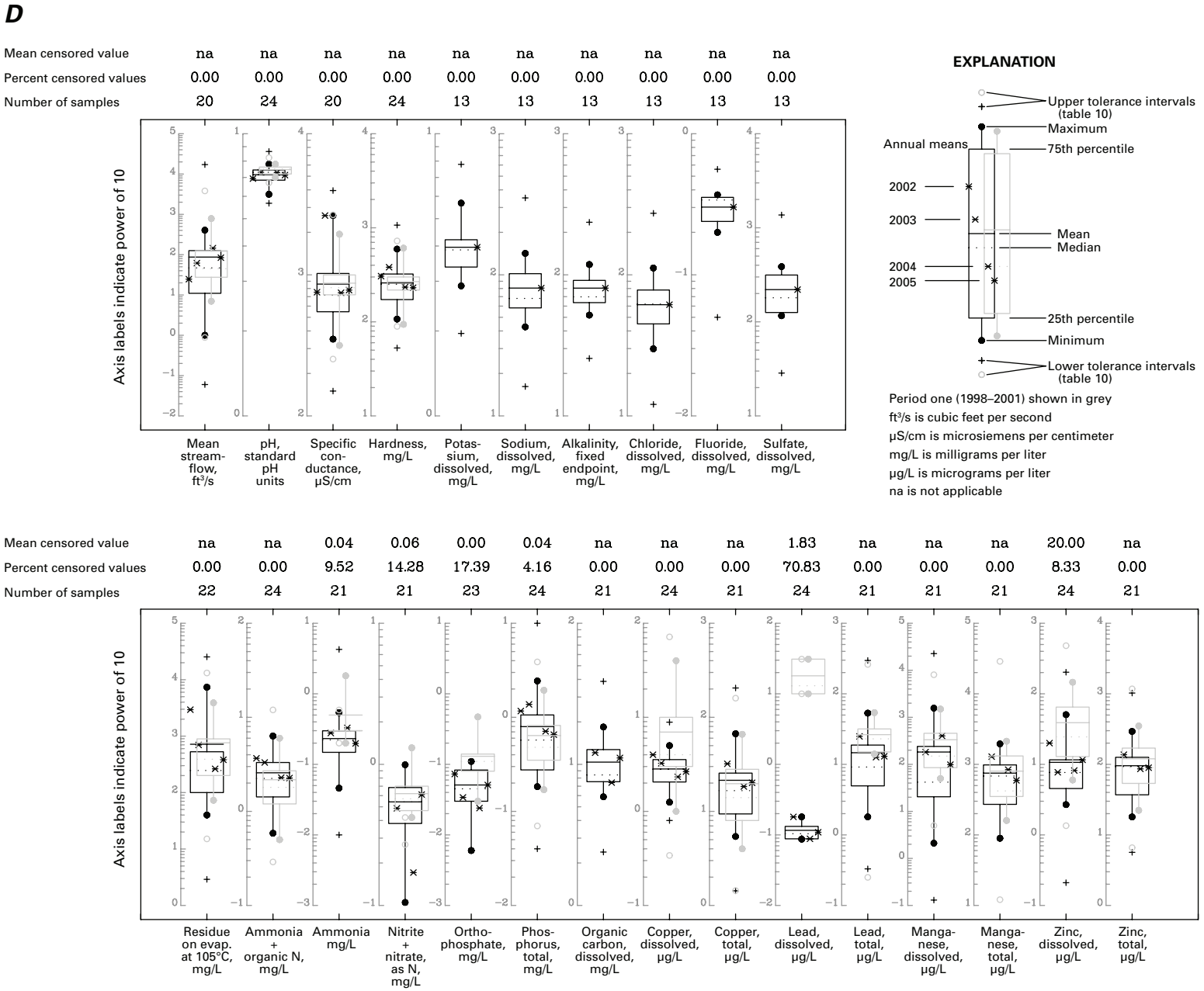

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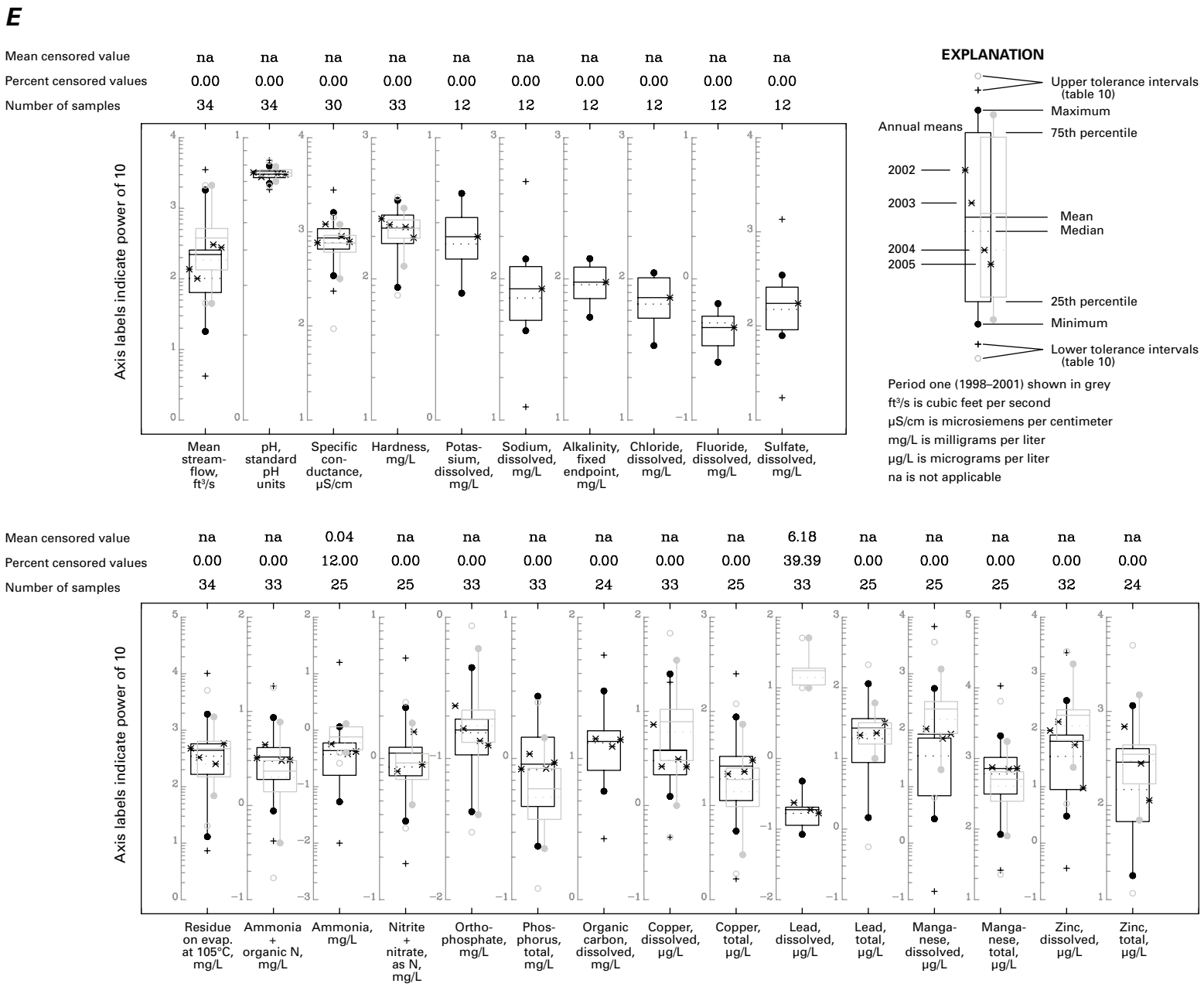

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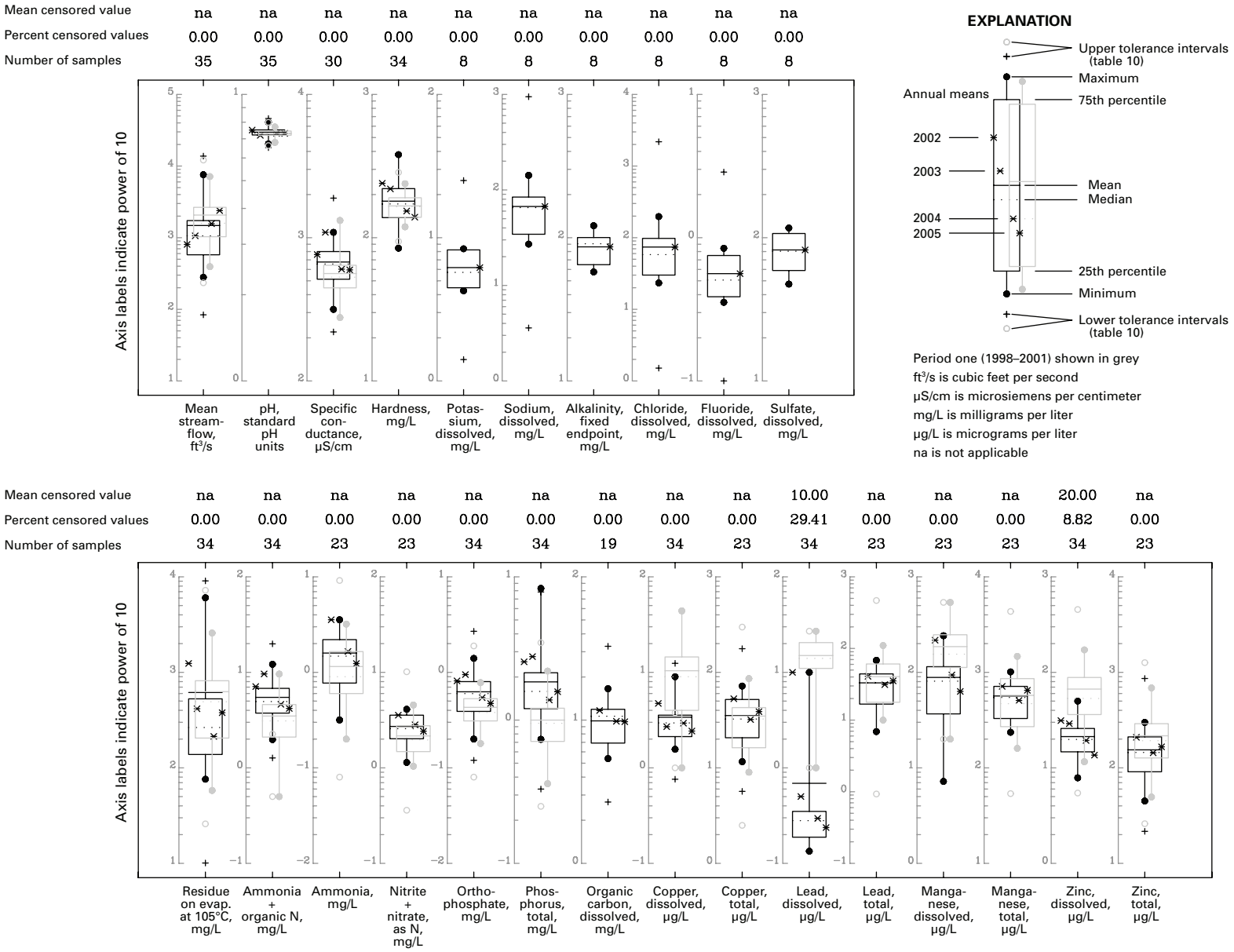
F



Mean censored value	na	na	na	na	na	na	na	na	na	na						
Percent censored values	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
Number of samples	35	35	30	34	8	8	8	8	8	8						
Mean censored value	na	na	na	na	na	na	na	na	na	10.00	na	na	na	20.00	na	
Percent censored values	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.41	0.00	0.00	0.00	8.82	0.00	
Number of samples	34	34	23	23	34	34	19	34	23	34	23	23	23	34	23	

Figure 3. Boxplots showing distribution of water-quality properties and constituents at (*A*) all stations, (*B*) South Platte River below Union Avenue at Englewood, (*C*) South Platte River at Denver, (*D*) Tollgate Creek above 6th Avenue at Aurora, (*E*) Sand Creek at mouth near Commerce City, and (*F*) South Platte River at Henderson, water years 1998–2001 and water years 2002–2005.—Continued

Table 8. Summary of relative percent differences and correlations between various weighting methods for analytical determinations of discrete samples, water years 2002–2005.

[All determinations made at USGS National Water Quality Laboratory. RPD: 1, relative percent difference between time- and discharge-weighted concentrations; 2, relative percent difference between time- and volume-weighted concentrations; 3, relative percent difference between discharge- and volume-weighted concentrations. Stddev, standard deviation; Pct, percentage of samples with a relative percent difference of 20 or less (absolute value); Np, number of water-quality property and constituent pairs in relative percent difference calculation. Phase: W, determination made using whole water; T, total; D, dissolved. Corr, Pearson correlation coefficient; n, number of discrete storm samples; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; --, not applicable]

Relative percent differences from discrete sampling events								
RPD	**Mean**	**Median**	**Stddev**	**Skewness**	**Minimum**	**Maximum**	**Pct**	**Np**
All storms								
1	–1.74	–3.62	15.74	0.07	–38.30	27.44	76.92	39
2	2.04	0.91	10.10	0.19	–16.35	23.70	92.31	39
3	3.78	2.20	7.36	0.61	–6.47	23.69	97.44	39
Storm 1								
1	–11.25	–7.52	11.08	–1.40	–38.30	0.41	82.35	17
2	–2.73	–1.90	6.88	–0.39	–15.36	11.47	100.00	17
3	8.55	7.72	7.11	0.39	–2.84	23.69	94.12	17
Storm 2								
1	5.61	4.51	15.00	–0.09	–22.73	27.44	72.73	22
2	5.73	7.02	10.76	–0.26	–16.36	21.84	86.36	22
3	0.10	0.98	5.19	0.28	–6.47	9.50	100.00	22

Correlation coefficients between time- and volume-weighted concentrations from discrete samples collected during storms						
Property or constituent	**All**		**Storm number**			
			1		**2**	
	Corr	**n**	**Corr**	**n**	**Corr**	**n**
Specific conductance, in µS/cm	0.538	22	0.689	9	0.726	13
Hardness, as calcium carbonate, in mg/L	0.556	22	0.712	9	0.733	13
Residue at 105°C, in mg/L	0.370	22	0.963	9	0.806	13
Dissolved organic carbon, in mg/L	0.452	22	0.855	9	0.656	13
Ammonia, as N, in mg/L	0.606	22	0.692	9	0.690	13
Nitrite + nitrate, as N, in mg/L	0.798	22	0.803	9	0.696	13
Ammonia + organic N, in mg/L	0.952	22	0.924	9	0.753	13
Phosphorus, as P, in mg/L	0.743	22	0.972	9	0.732	13
Orthophosphate, as P, in mg/L	0.276	22	0.587	9	0.617	13
Dissolved copper, in µg/L	0.403	22	0.765	9	0.584	13
Dissolved lead, in µg/L	0.524	22	0.820	9	0.618	13
Dissolved zinc, in µg/L	0.729	22	0.777	9	0.689	13

A summary of results from composite samples and bacteriological samples that did not meet or had exceptions when compared to standards is presented in table 9 for individual stations. For cases with several exceptions, exception frequency and magnitude are described in absolute numbers and also as a fraction of the total number of samples with analyses. Exceptions also are characterized as multiples of the actual standard, for magnitude.

Results from composite samples indicate very few exceptions to standards. Two samples at Tollgate had values for pH that were equal to the lower limit of numeric standards (6.5 standard pH units). In addition there were three exceptions to standards for metals; one each for dissolved copper and manganese at Union and one for dissolved zinc at Sand Creek. Bacteriological indicators in all samples however, consistently exceeded numeric standards.

Evaluation of Stormwater Quality

Results from laboratory analyses of composite samples are evaluated in this section by using a preliminary examination of annual means and two statistical methods. The goal of the evaluations is to establish criteria that may be compared with results from past or future sampling.

Annual Means

Composite samples collected as part of this study describe the quality of stormwater runoff during a 4-year period, and annual means from these data can be used to determine if temporal trends are present. In this report the term "temporal trends" is used to indicate simple one-directional trends in which values tend to show upward or downward

Table 9. Summary of composite and bacteriological sample results not meeting Colorado Department of Public Health and Environment numeric standards for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ indicates statistics for: std, numeric standard; dif, difference between composite-stormwater results and numeric standard; pdf, dif divided by numeric standard. n, number of samples; M, number of missing values; Pctc, percentage of determinations with concentrations below reporting level; E, number of samples that did not meet numeric standard; Pcte, percentage of determinations with values greater than minimum reporting level that did not meet numeric standard; Stddev, standard deviation; Min, minimum, Max, maximum; col, colonies per 100 milliliters; N, nitrogen; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pctc	E	Pcte	Mean	Median	Stddev	Skewness	Min	Max
All stations													
pH, in standard pH units	W	std	176	0	0	2	1.14	6.5	6.5	0.0	0.0	6.5	6.5
		dif						--	--	--	--	--	--
		pdf						--	--	--	--	--	--
Escherichia coli, in col	W	std	22	0	0	22	100	126	--	--	--	--	--
		dif						16,376	12,874	19,971	2.81	334	91874
		pdf						130	102.17	158	2.81	2.65	729
Fecal coliform, in col	W	std	22	0	0	22	100	200	--	--	--	--	--
		dif						20,141	13,000	18,215	0.76	310	54,000
		pdf						100	64	91	0.76	0.55	269
Chloride, in mg/L	D	std						No exceptions to chloride standards.					
		dif						The chloride standards specify that chloride should not exceed 250.					
		pdf											
Nitrite + nitrate, as N, in mg/L	D	std	22					No exceptions to nitrite and nitrate standards.					
		dif						The nitrite plus nitrate standards specify that nitrite plus nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	173	3	0	1	0.60	25.8	25.8	--	--	25.8	25.8
		dif						2.2	2.2	--	--	2.2	2.2
		pdf						0.08	0.08	--	--	0.08	0.08
Lead, in µg/L	D	std	173	3	47.4	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	132	44	0	1	0.76	190	190	--	--	190	190
		dif						50.9	50.9	--	--	50.93	50.93
		pdf						0.26	0.26	--	--	0.26	0.26
Manganese, in µg/L	T	std						No exceptions to manganese standards.					
		dif						The manganese standard is specified as a table-value standard calculated for each sample.					
		pdf											
Zinc, in µg/L	D	std	172	4	9.88	1	0.64	273	273	--	--	273	273
		dif						26.8	26.8	--	--	26.8	26.8
		pdf						0.09	0.09	--	--	0.09	0.09
South Platte River below Union Avenue at Englewood (06710247)													
pH, in standard pH units	W	std	37	0	0		0	No exceptions to pH standard.					
		dif						The pH standard specifies pH should be in the range of 6.5 to 9.0.					
		pdf											
Escherichia coli, in col	W	std	5	0	0	5	100	126	--	--	--	--	--
		dif						26,414	12,874	36,918	2.13	1,574	91,874
		pdf						209	102	293	2.13	12.49	729
Fecal coliform, in col	W	std	5	0	0	5	100	200	--	--	--	--	--
		dif						12,620	12,800	9,584	1.03	2,000	27.800
		pdf						63	64	48	1.03	10	139
Nitrite + nitrate, as N, in mg/L	D	std	28	9	0	0	0	No exceptions to nitrite and nitrate standards.					
		dif						The nitrite and nitrate standards specify that nitrite + nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	37	0	0	1	2.70	25.8	25.8	--	--	25.8	25.8
		dif						2.2	2.2	--	--	2.2	2.2
		pdf						0.08	0.08	--	--	0.08	0.08
Lead, in µg/L	D	std	37	0	81.1	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	28	9	0	1	3.57	190	190	--	--	190	190
		dif						50.9	50.9	--	--	50.93	50.93
		pdf						0.26	0.26	--	--	0.26	0.26
Zinc, in µg/L	D	std	37	0	16.2	0	0.00	No exceptions to dissolved zinc standard.					
		dif						The dissolved zinc standard is specified as a table-value standard calculated for individual samples.					
		pdf											

Table 9. Summary of composite and bacteriological sample results not meeting Colorado Department of Public Health and Environment numeric standards for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ indicates statistics for: std, numeric standard; dif, difference between composite-stormwater results and numeric standard; pdf, dif divided by numeric standard. n, number of samples; M, number of missing values; Pctc, percentage of determinations with concentrations below reporting level; E, number of samples that did not meet numeric standard; Pcte, percentage of determinations with values greater than minimum reporting level that did not meet numeric standard; Stddev, standard deviation; Min, minimum, Max, maximum; col, colonies per 100 milliliters; N, nitrogen; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pctc	E	Pcte	Mean	Median	Stddev	Skewness	Min	Max
South Platte River at Denver (0671400)													
pH, in standard pH units	W	std	46	0	0	0	0.00	No exceptions to pH standard.					
		dif						The pH standard specifies pH should be in the range of 6.5 to 9.0.					
		pdf											
Escherichia coli, in col	W	std	5	0	0	5	100	126	--	--	--	--	--
		dif						12,834	12,874	6,866	0.19	4,774	21,874
		pdf						102	102	54	0.19	38	174
Fecal coliform, in col	W	std	5	0	0	5	100	200	--	--	--	--	--
		dif						20,760	21,800	14,351	–0.117	4,700	34,800
		pdf						103	109	72	–0.017	23.5	174
Nitrite + nitrate, as N, in mg/L	D	std	35	11	0	0	0.00	No exceptions to nitrite and nitrate standards.					
		dif						The nitrite and nitrate standards specify that nitrite + nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	35	11	0	0	0.00	No exceptions to dissolved copper standard.					
		dif						The dissolved copper standard as 2.8 * table-value standard calculated for individual samples.					
		pdf											
Lead, in µg/L	D	std	45	1	26.7	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	35	11	0	0	0.00	No exceptions to dissolved manganese standard.					
		dif						The dissolved manganese standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Zinc, in µg/L	D	std	35	11	0	0	0.00	No exceptions to dissolved zinc standard.					
		dif						The dissolved zinc standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Tollgate Creek above 6th Avenue at Aurora (394329104490l1)													
pH, in standard pH units	W	std	24	0	0	2	8.33	6.5	6.5	0.0	0.0	6.5	6.5
		dif						--	--	--	--	--	--
		pdf						--	--	--	--	--	--
Escherichia coli, in col	W	std	3	0	0	3	100	126	--	--	--	--	--
		dif						25,540	34,874	--	--	6,874	38,874
		pdf						203	277	--	--	55	277
Fecal coliform, in col	W	std	3	0	0	3	100	200	--	--	--	--	--
		dif						31,800	34,800	--	--	6,800	53,800
		pdf						159	174	--	--	104	269
Nitrite + nitrate, as N, in mg/L	D	std	21	3	14.3	0	0.00	No exceptions to nitrite and nitrate standards.					
		dif						The nitrite and nitrate standards specify that nitrite + nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	24	0	0	0	0.00	No exceptions to dissolved copper standard.					
		dif						The dissolved copper standard is specified as 2.8 * table-value standard calculated for individual samples.					
		pdf											
Lead, in µg/L	D	std	24	0	70.8	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	21	3	0	0	0.00	No exceptions to dissolved manganese standard.					
		dif						The dissolved manganese standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Zinc, in µg/L	D	std	24	0	8.33			No exceptions to dissolved zinc standard.					
		dif						The dissolved zinc standard is specified as a table-value standard calculated for individual samples.					
		pdf											

Table 9. Summary of composite and bacteriological sample results not meeting Colorado Department of Public Health and Environment numeric standards for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[Phase: W, determination made using whole water; T, total; D, dissolved. Typ indicates statistics for: std, numeric standard; dif, difference between composite-stormwater results and numeric standard; pdf, dif divided by numeric standard. n, number of samples; M, number of missing values; Pctc, percentage of determinations with concentrations below reporting level; E, number of samples that did not meet numeric standard; Pcte, percentage of determinations with values greater than minimum reporting level that did not meet numeric standard; Stddev, standard deviation; Min, minimum, Max, maximum; col, colonies per 100 milliliters; N, nitrogen; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pctc	E	Pcte	Mean	Median	Stddev	Skewness	Min	Max
Sand Creek at mouth near Commerce City (394839104570300)													
pH, in standard pH units	W	std	34	0	0	0	0.00	No exceptions to pH standard.					
		dif						The pH standard specifies pH should be in the range of 6.5 to 9.0.					
		pdf											
Escherichia coli, in col	W	std	4	0	0	4	100	126	--	--	--	--	--
		dif						13,324	9,024	--	--	374	38874
		pdf						106	72	--	--	2.97	277
Fecal coliform, in col	W	std	4	0	0	4	100	200	--	--	--	--	--
		dif						13,300	8,950	--	--	500	34,800
		pdf						66.5	44.8	--	--	2.6	174
Nitrite + nitrate, as N, in mg/L	D	std	25	9	0	0	0.00	No exceptions to nitrite and nitrate standards.					
		dif						The nitrite and nitrate standards specify that nitrite + nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	33	1	0	0	0.00	No exceptions to dissolved copper standard.					
		dif						The dissolved copper standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Lead, in µg/L	D	std	33	1	39.4	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	25	9	0	0	0.00	No exceptions to dissolved manganese standard.					
		dif						The dissolved manganese standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Zinc, in µg/L	D	std	32	2	0	1	3.12	273	273	0.00	0.00	273	273
		dif						26.8	26.8	0.00	0.00	26.8	26.8
		pdf						0.09	0.09	0.00	0.00	0.09	0.09
South Platte River at Henderson (06720500)													
pH, in standard pH units	W	std	35	0	0	0	0.00	No exceptions to pH standard.					
		dif						The pH standard specifies pH should be in the range of 6.5 to 9.0.					
		pdf											
Escherichia coli, in col	W	std	5	0	0	5	100	126	--	--	--	--	--
		dif						3,174	6,826	5,206	–0.102	334	12,874
		pdf						54.2	54.6	41.3	–0.102	2.65	102
Fecal coliform, in col	W	std	5	0	0	5	100	200	--	--	--	--	--
		dif						24,642	10,800	26,886	0.520	110	53,800
		pdf						123	54.0	134	0.520	0.55	269
Nitrite + nitrate, as N, in mg/L	D	std	23	12	0	0	0.00	No exceptions to nitrite and nitrate standards.					
		dif						The nitrite and nitrate standards specify that nitrite + nitrate should not exceed 11.					
		pdf											
Copper, in µg/L	D	std	34	1	0	0	0.00	No exceptions to dissolved copper standard.					
		dif						The dissolved copper standard is specified as 2.3 * table-value standard calculated for individual samples.					
		pdf											
Lead, in µg/L	D	std	34	1	29.4	0	0.00	No exceptions to dissolved lead standard.					
		dif						The dissolved lead standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Manganese, in µg/L	D	std	23	12	0	0	0.00	No exceptions to dissolved manganese standard.					
		dif						The dissolved manganese standard is specified as a table-value standard calculated for individual samples.					
		pdf											
Zinc, in µg/L	D	std	34	1	8.82	0	0.00	No exceptions to dissolved zinc standard.					
		dif						The dissolved zinc standard is specified as a table-value standard calculated for individual samples.					
		pdf											

changes through time. The composite-sample data were found to have considerable variability through a given year (table A2), and this variability was interpreted as seasonal variation that cannot be readily explained by data collected as part of this study; the data were aggregated into annual means for further evaluation.

A visual inspection of the annual means, which are shown in figure 3 and listed in table A2, can be used to qualitatively identify trends for water-quality properties and constituents. In general, that is for all data pooled together (fig. 3*A*), hardness, ammonia plus organic nitrogen, total phosphorus, most dissolved metals (lead, manganese, and zinc), and all total metals (copper, lead, manganese, and zinc) all indicate annual means that decrease each year, or downward trends. A downward trend also is generally evident for most individual stations as well, although departure from downward trends does exist; for example, Tollgate, Sand Creek, and Henderson in particular show some departure for the total metals, indicating that conditions are not always the same at all stations. Some trends were indicated only at individual stations in the network rather than at all stations. Ammonia as nitrogen at Union, Denver, and Henderson, orthophosphate at Sand Creek, and nitrite plus nitrate at Denver and Henderson all indicate decreasing annual means, or downward trends. Only nitrite plus nitrate at Union and total copper and lead at Sand Creek showed consistently increasing annual means, or upward trends.

Tolerance Intervals

Tolerance intervals specifying lower and upper bounds that contain a specified portion of a given distribution, referred to as "coverage," can be defined on the basis of samples from the distribution. Typically, tolerance intervals are reported for a specified coverage with an associated confidence. For example, a symmetrical, or two-sided, 99-percent coverage tolerance interval with 95-percent confidence is a 95-percent confident estimate of an interval that contains 99-percent, from the 0.5 percentile to the 99.5 percentile, of the entire population. Two-sided tolerance intervals for a specified percent coverage at 95-percent confidence were computed in this study for comparison to similar data, such as the tolerance intervals computed in period 1 (Bossong and others, 2005). For all cases, except those using nonparametric computations, the specified coverage was 99 percent.

A brief description of the methods used to compute tolerance intervals in this study is presented here. Computations for tolerance intervals were complicated by the presence of censored data, multiple censoring levels, and data that did not meet normality criteria. More detailed descriptions of the methods used in this study are in publications by Hahn and Meeker (1991), Gibbons (1994), and the U.S. Environmental Protection Agency (1989, 1992).

For trend-free data that have no censored values (values reported as less than the reporting level) and that are normally distributed, conventional parametric statistical methods can be used to compute a tolerance interval on the basis of the number of samples, mean, and standard deviation. Tolerance intervals were not calculated for water-quality properties and constituents that indicated trends as discussed in the *"*Annual Means*"* section of this report. In addition, some data from this study have censored values, and the percentage of values reported as below the laboratory reporting level (table 7) was used to determine tolerance-interval computation methods. If less than 40 percent of the data were censored, then maximum likelihood estimation (MLE) methods utilizing Cohen's adjustment (Hahn and Meeker, 1991; Gibbons, 1994) were used to compute tolerance intervals. If 40 percent or more of the data were censored, then parametric methods were deemed as inappropriate and nonparametric methods were used to compute tolerance intervals. Nonparametric methods used in this study set the lower and upper tolerance-interval bounds to minima and maxima.

Data were evaluated for normality on the basis of skewness and the number of samples using methods described by Fisher and Potter (1989). Data that did not meet normality criteria were modified with a natural log transform and then compared to normality criteria again. Tolerance intervals for transformed data that did not meet normality criteria were calculated using nonparametric methods. The results of tolerance-interval computations are listed in table 10 and included in figure 3. The vast majority of the computations, 84.9 percent, were made by using conventional methods with no adjustments; 13.3 percent of the computations were made using Cohen's adjustment, and the remaining 1.8 percent were made using nonparametric methods.

Regressions

Regressions among water-quality properties and constituents were evaluated to identify network patterns in linear regression and linear regressions that may be useful in quantifying future intradistribution changes. Linear regressions (table 11) and Pearson correlation coefficients (table A3) were calculated for all possible pairs of water-quality properties and constituents. For regressions, each pair was evaluated using three different transform scenarios: (1) no transform, (2) a natural-log transform on one variable, and (3) a natural-log transform on both variables. Regressions were screened on the basis of 95-percent significance and the magnitude of the coefficient of determination, a statistic commonly referred to as "r squared (r^2)." In this report the term "strong" is generally used for all regressions that had an r^2 value equal to or greater than 0.65, and the term "very strong" is used to indicate regressions that had an r^2 value equal to or greater than 0.80. When a strong regression was identified for any station in the

Table 10. Tolerance intervals computed for physical properties and constituents at 99-percent coverage with 95-percent confidence at South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.

[I, transform indicator: 1, natural log transform; 2, no transform. Type indicates amount of censored values and method used to calculate tolerance intervals: 1, no censored values and regular computation; 2, less than 40-percent censored values and computed using Cohen's adjustment for censored values; 5, greater than 40-percent censored values or normal distribution assumptions not met or both, nonparametric computation. n, number of samples; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; col, colonies per 100 milliliters; µg/L, micrograms per liter; --, not applicable, includes properties or constituents for which annual means indicated temporal patterns]

Property or constituent	I	Type	n	Maximum	Upper bound tolerance interval	Minimum	Lower bound tolerance interval	Non-parametric coverage
South Platte River below Union Avenue at Englewood (06710247)								
Mean streamflow, in ft^3/s	1	1	37	686	2,004.02	37	13.34	--
Streamflow volume, in acre-feet	1	1	37	623	2,303.19	16	8.55	--
pH, in standard units	2	1	37	8.35	8.54	6.82	6.48	--
Specific conductance, in µS/cm	1	1	31	917	1,396.73	212	155.73	--
Hardness, as $CaCO_3$, in mg/L	1	1	37	365	--	69.7	--	--
Calcium, dissolved, in mg/L	2	1	28	66.07	76.37	21.96	10.69	--
Magnesium, dissolved, in mg/L	1	1	28	19.55	30.19	3.61	2.5	--
Potassium, dissolved, in mg/L	1	1	15	5.46	9.13	2.67	1.51	--
Sodium, dissolved, in mg/L	1	1	15	64.61	150.13	13.91	6.95	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	2	1	15	124.4	167.15	48.58	1.59	--
Chloride, dissolved, in mg/L	1	1	15	77.61	210.6	10.97	5.62	--
Fluoride, dissolved, in mg/L	2	1	15	1.08	1.78	0.29	0	--
Sulfate, dissolved, in mg/L	1	1	15	155.15	337.54	30.88	13.91	--
Residue at 105°C, in mg/L	1	2	37	1,532	47,011.56	13	0.42	--
Ammonia + organic N, in mg/L	1	1	37	7	--	0.47	--	--
Ammonia, as N, in mg/L	1	2	28	0.34	--	0.05	--	--
Nitrite + nitrate, as N, in mg/L	1	1	28	1.65	--	0.4	--	--
Orthophosphate, as P, in mg/L	1	1	37	0.45	0.78	0.01	0.01	--
Phosphorus, as P, in mg/L	1	1	37	1.75	--	0.07	--	--
Organic carbon, dissolved, in mg/L	1	1	25	16.19	24.77	3.55	1.9	--
Copper, dissolved, in µg/L	1	1	37	28	29.26	1.14	0.27	--
Copper, total, in µg/L	1	1	28	48.78	--	2.82	--	--
Lead, dissolved, in µg/L	1	5	37	60	60	0.09	0.09	69
Lead, total, in µg/L	1	1	28	51.95	--	0.63	--	--
Manganese, dissolved, in µg/L	1	1	28	240.93	866.51	1.07	0.22	--
Manganese, total, in µg/L	1	1	28	1,274.73	3,212.10	62.78	24.22	--
Zinc, dissolved, in µg/L	1	2	37	30	92.14	1.99	0.15	--
Zinc, total, in µg/L	1	1	28	230	--	7	--	--

network, additional 95-percent significant regressions, using the transform with the highest r^2 value, for all remaining stations are highlighted in table 11. The correlation coefficient, which may be used as a surrogate for r^2 (r^2 is the square of the correlation coefficient) is shown for all possible pairs of water-quality properties and constituents in table A3.

The strong regressions (r^2 equal to or greater than 0.65) include about one-third of all possible pairs (133 out of 378) of water-quality properties and constituents. For convenience, the regressions are discussed in terms of two groups; the first group, referred to as "majors," includes the major ions (calcium, magnesium, sodium, potassium, alkalinity, chloride, fluoride, and sulfate) as well as mean streamflow, specific conductance, and hardness. The second group, referred to as "nonmajors," includes the total and dissolved metals (copper, lead, manganese, and zinc), nutrients (ammonia plus organic nitrogen, ammonia, nitrite plus nitrate, orthophosphate, and total phosphorus), and residue on evaporation at 105 degrees Celsius. The nonmajors include seven properties and constituents that have a particulate component, such as residue on evaporation at 105 degrees Celsius, organic nitrogen plus ammonia, total phosphorus, and the total metals.

About one-half of the strong regressions are for the majors, and many of these strong regressions are widespread, occurring at several stations rather than locally at just one or two stations. For example, regressions between calcium and magnesium are consistently strong at all stations. The widespread occurrence of many strong regressions involving

Table 10. Tolerance intervals computed for physical properties and constituents at 99-percent coverage with 95-percent confidence at South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[I, transform indicator: 1, natural log transform; 2, no transform. Type indicates amount of censored values and method used to calculate tolerance intervals: 1, no censored values and regular computation; 2, less than 40-percent censored values and computed using Cohen's adjustment for censored values; 5, greater than 40-percent censored values or normal distribution assumptions not met or both, nonparametric computation. n, number of samples; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; col, colonies per 100 milliliters; µg/L, micrograms per liter; --, not applicable, includes properties or constituents for which annual means indicated temporal patterns]

Property or constituent	I	Type	n	Maximum	Upper bound tolerance interval	Minimum	Lower bound tolerance interval	Non-parametric coverage
South Platte River at Denver (0671400)								
Mean streamflow, in ft^3/s	1	1	46	4,446	7,675.74	166	52.26	--
Streamflow volume, in acre-feet	1	1	46	4,038	7,665.11	69	38.77	--
pH, in standard units	2	1	46	7.9	8.26	6.72	6.57	--
Specific conductance, in µS/cm	1	1	41	1,060	1,495.58	247	177.28	--
Hardness, as $CaCO_3$, in mg/L	2	1	45	255	--	69.1	--	--
Calcium, dissolved, in mg/L	2	1	35	63.27	78.35	21.4	5.7	--
Magnesium, dissolved, in mg/L	2	1	35	16.54	18.63	3.81	0	--
Potassium, dissolved, in mg/L	1	1	15	7.03	12.45	3.23	1.64	--
Sodium, dissolved, in mg/L	2	1	15	84.84	113.98	18.2	0	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	2	1	15	116.9	174.17	51.04	0.43	--
Chloride, dissolved, in mg/L	1	1	15	122.01	270.75	15.9	7.34	--
Fluoride, dissolved, in mg/L	2	1	15	0.83	1.33	0.25	0	--
Sulfate, dissolved, in mg/L	2	1	15	135.87	197.87	34.02	0	--
Residue at 105°C, in mg/L	1	1	45	1,240	3483.98	28	9.64	--
Ammonia + organic N, in mg/L	1	1	45	10.23	12.61	0.87	0.39	--
Ammonia, as N, in mg/L	1	2	35	1.8	--	0.06	--	--
Nitrite + nitrate, as N, in mg/L	1	1	35	4.7	--	0.7	--	--
Orthophosphate, as P, in mg/L	1	1	45	0.86	1.46	0.09	0.04	--
Phosphorus, as P, in mg/L	1	1	45	2.68	3.89	0.28	0.12	--
Organic carbon, dissolved, in mg/L	1	1	31	29.78	35.82	4.46	1.96	--
Copper, dissolved, in µg/L	1	1	45	6.16	8.8	1.44	0.94	--
Copper, total, in µg/L	1	1	35	74.55	--	5.89	--	--
Lead, dissolved, in µg/L	1	2	45	0.52	13.96	0.08	0.01	--
Lead, total, in µg/L	1	1	35	66.04	--	2.79	--	--
Manganese, dissolved, in µg/L	1	1	35	150.4	786.69	1.29	0.25	--
Manganese, total, in µg/L	1	1	35	998.56	--	109.37	--	--
Zinc, dissolved, in µg/L	1	2	45	40	288.29	2.69	0.19	--
Zinc, total, in µg/L	1	1	35	348	--	24	--	--

major ions indicates that the major ions are readily available within the network; the strong regressions between them are largely a result of equilibrium dynamics that describe reactions between, especially dissolved, laboratory constituents as a function of availability and prevailing physical conditions (Hem, 1985).

For regression pairs that involve the nonmajors, a little more than one-half of the strong regressions have r^2 values greater than 0.8 and are considered very strong. In general, regressions are either strong or very strong for 12 of 21 possible combinations involving constituents that are known to have a particulate component and are widespread, because they were found at all or most stations. These widespread regressions include organic nitrogen plus ammonia with total phosphorus, total copper, and total zinc; total phosphorus with total copper, total lead, and total zinc; residue on evaporation at 105 degrees Celsius with total copper and total lead; and several additional regressions involving the metals (total copper with total lead, total manganese, and total zinc; and total lead with total zinc) are all strong or very strong for all stations. Local strong or very strong regressions that include three or four stations and are somewhat widespread include total manganese with total phosphorus, total lead, and total zinc at four of the five stations; residue on evaporation at 105 degrees Celsius with total phosphorus, total manganese, and total zinc at three of the five stations; and total manganese with organic nitrogen plus ammonia and total phosphorus with total zinc at three of the five stations. The only remaining pair

Table 10. Tolerance intervals computed for physical properties and constituents at 99-percent coverage with 95-percent confidence at South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[I, transform indicator: 1, natural log transform; 2, no transform. Type indicates amount of censored values and method used to calculate tolerance intervals: 1, no censored values and regular computation; 2, less than 40-percent censored values and computed using Cohen's adjustment for censored values; 5, greater than 40-percent censored values or normal distribution assumptions not met or both, nonparametric computation. n, number of samples; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; col, colonies per 100 milliliters; µg/L, micrograms per liter; --, not applicable, includes properties or constituents for which annual means indicated temporal patterns]

Property or constituent	I	Type	n	Maximum	Upper bound tolerance interval	Minimum	Lower bound tolerance interval	Non-parametric coverage
Tollgate Creek above 6th Avenue at Aurora (394329104490 11)								
Mean streamflow, in ft^3/s	1	1	20	405	17,159.72	1	0.06	--
Streamflow volume, in acre-feet	2	1	20	335	451.94	0	0	--
pH, in standard units	2	1	24	7.8	8.65	6.1	5.67	--
Specific conductance, in µS/cm	1	1	20	2,630	3956.99	350	150.02	--
Hardness, as $CaCO_3$, in mg/L	1	1	24	594	1066.74	107	52.75	--
Calcium, dissolved, in mg/L	1	1	21	169.05	319.95	35.6	15.7	--
Magnesium, dissolved, in mg/L	1	1	21	41.75	84.29	4.33	1.92	--
Potassium, dissolved, in mg/L	1	1	13	5.68	7.79	2.89	1.96	--
Sodium, dissolved, in mg/L	1	1	13	141.9	350.81	42.75	16.15	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	1	1	13	118.3	235.8	51.81	25.56	--
Chloride, dissolved, in mg/L	1	1	13	111.72	272.99	29.9	12.07	--
Fluoride, dissolved, in mg/L	2	1	13	0.37	0.56	0.2	0.05	--
Sulfate, dissolved, in mg/L	1	1	13	386.14	1,368.08	116.04	28.53	--
Residue at 105°C, in mg/L	1	1	22	7,360	25,368.91	40	2.9	--
Ammonia + organic N, in mg/L	1	1	24	6.32	--	0.59	--	--
Ammonia, as N, in mg/L	1	2	21	0.54	4.26	0.05	0.01	--
Nitrite + nitrate, as N, in mg/L	2	2	21	0.99	1.63	0.1	0	--
Orthophosphate, as P, in mg/L	2	2	23	0.11	0.18	0.01	0	--
Phosphorus, as P, in mg/L	1	2	24	2.44	9.99	0.18	0.04	--
Organic carbon, dissolved, in mg/L	1	1	21	18.39	38.73	5.89	2.39	--
Copper, dissolved, in µg/L	1	1	24	5	8.88	1.25	0.8	--
Copper, total, in µg/L	1	1	21	66.87	205.1	5.41	1.43	--
Lead, dissolved, in µg/L	1	5	24	0.18	0.18	0.09	0.09	79
Lead, total, in µg/L	1	1	21	53.23	296.83	1.8	0.33	--
Manganese, dissolved, in µg/L	1	1	21	1,569.81	22,613.45	2.11	0.13	--
Manganese, total, in µg/L	1	1	21	1,950.6	--	89.52	--	--
Zinc, dissolved, in µg/L	1	2	24	50.61	202.3	2.69	0.21	--
Zinc, total, in µg/L	1	1	21	293	1,024.62	18	5.66	--

of constituents with a particulate component that have strong or very strong regressions, organic nitrogen plus ammonia and total lead, were from Union and Denver.

For the remainder of nonmajors, which involve very soluble compounds that have a very small or even no particulate component, strong and very strong regressions are not often widespread and occur mostly locally at individual stations. The regression between nitrite plus nitrate and orthophosphate is the only regression that is strong for the nonmajor soluble compounds at all stations. Locally strong or very strong regressions include hardness with nitrite plus nitrate and dissolved lead (at Denver and Henderson) and dissolved lead (at Union and Tollgate); dissolved manganese with hardness, ammonia, nitrite plus nitrate, orthophosphate, and dissolved lead (all at Henderson); and dissolved lead with ammonia (at Union) and nitrite plus nitrate (at Henderson).

An important characteristic of the reported regressions is that for regressions such as mean streamflow with specific conductance, which intuitively would be expected to have a very strong inverse (negative slope) regression due to the addition of large amounts of dilute (low specific conductance) precipitation, the Pearson correlation coefficient is not very strong (table A3). One possible explanation for this is that the regression of mean streamflow with specific conductance in a receiving stream such as the South Platte River is dependent on conditions in several contributing tributaries. Consequently, rather than a simple model in which an inverse relation between mean streamflow and specific conductance is based largely on a uniform source of relatively dilute precipitation, the model becomes more complex due to mixing of heterogeneous waters received from different tributaries with unique mean streamflow and specific conductances.

Table 10. Tolerance intervals computed for physical properties and constituents at 99-percent coverage with 95-percent confidence at South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[I, transform indicator: 1, natural log transform; 2, no transform. Type indicates amount of censored values and method used to calculate tolerance intervals: 1, no censored values and regular computation; 2, less than 40-percent censored values and computed using Cohen's adjustment for censored values; 5, greater than 40-percent censored values or normal distribution assumptions not met or both, nonparametric computation. n, number of samples; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; col, colonies per 100 milliliters; µg/L, micrograms per liter; --, not applicable, includes properties or constituents for which annual means indicated temporal patterns]

Property or constituent	I	Type	n	Maximum	Upper bound tolerance interval	Minimum	Lower bound tolerance interval	Non-parametric coverage
Sand Creek at mouth near Commerce City (394839104570300)								
Mean streamflow, in ft^3/s	1	1	34	1813	3,515.24	18	4.2	--
Streamflow volume, in acre-feet	1	1	34	2,545	3,970.87	17	3.07	--
pH, in standard units	2	1	34	7.94	8.31	6.88	6.55	--
Specific conductance, in µS/cm	1	1	30	1,600	2,779.84	342	234.59	--
Hardness, as $CaCO_3$, in mg/L	2	1	33	360	--	87	--	--
Calcium, dissolved, in mg/L	2	1	25	95.79	139.25	27.7	0	--
Magnesium, dissolved, in mg/L	2	1	25	21.53	29.59	4.33	0	--
Potassium, dissolved, in mg/L	2	1	12	6.35	8.99	2.81	0	--
Sodium, dissolved, in mg/L	1	1	12	138.4	489.53	42.93	12.39	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	2	1	12	139.1	215.17	53.49	0	--
Chloride, dissolved, in mg/L	2	1	12	110.34	187.21	33.66	0	--
Fluoride, dissolved, in mg/L	2	1	12	0.67	1.02	0.26	0	--
Sulfate, dissolved, in mg/L	1	1	12	346.52	1,358.18	78.88	17.25	--
Residue at 105°C, in mg/L	1	1	34	1925	10,153.77	13	7.36	--
Ammonia + organic N, in mg/L	1	1	33	8.61	18.6	0.88	0.42	--
Ammonia, as N, in mg/L	1	2	25	1.15	15.87	0.05	0.01	--
Nitrite + nitrate, as N, in mg/L	1	1	25	2.29	5.14	0.36	0.18	--
Orthophosphate, as P, in mg/L	1	1	33	0.44	--	0.04	--	--
Phosphorus, as P, in mg/L	1	1	33	2.76	6.1	0.24	0.09	--
Organic carbon, dissolved, in mg/L	1	1	24	30.09	53.91	5.86	2.7	--
Copper, dissolved, in µg/L	1	1	33	25	20.37	1.25	0.46	--
Copper, total, in µg/L	1	1	25	87.27	--	5.36	--	--
Lead, dissolved, in µg/L	1	2	33	0.48	--	0.08	--	--
Lead, total, in µg/L	1	1	25	114.41	--	1.45	--	--
Manganese, dissolved, in µg/L	1	1	25	549.6	6,856.14	2.69	0.14	--
Manganese, total, in µg/L	1	1	25	2,092.15	10,665.19	84.01	26.08	--
Zinc, dissolved, in µg/L	1	1	32	335.63	2360.7	3.01	0.36	--
Zinc, total, in µg/L	1	1	24	1152	--	18	--	--

Comparison to Previous Results

As mentioned in the "Previous Investigations" section, the study described in this report has the same programmatic goals and used the same sample-collection protocols that were used in a similar study by Bossong and others (2005). This section presents a comparison of results from the two studies presented in terms of period 1, the 2005 study that covers water years 1998–2001, and period 2, this study that covers water years 2002–2005. The comparisons address streamflow conditions, univariate statistics, spatial patterns, trends, and regressions observed in the two periods.

There were fewer samples collected during period 2 (176) than during period 1 (255), due mostly to the relatively storm-free conditions during 2002, which was a very dry year. The mean streamflows associated with composite samples are the best indicator of hydrologic conditions for the sampled storms available from this study. The boxplot for mean streamflow in figure 3*A* shows that distribution of mean streamflow for samples collected in period 2 is very similar to the distribution for period 1. In addition, the general distribution of composite samples among the various hydrograph classifications (most samples were classified as events, followed by falling and then rising classifications) was also similar for both periods. Although there were fewer samples collected in period 2, the statistical distribution of mean streamflows and the distribution of samples among the various hydrograph classifications indicate similar conditions were sampled in both periods.

The distributions for composite sample results from periods 1 and 2 are shown in figure 3 and many details for period 2 results are listed in table 7. The boxplots in figure 3*A* provide a comparison of the entire distribution for all water-quality properties and constituents from both periods and

Table 10. Tolerance intervals computed for physical properties and constituents at 99-percent coverage with 95-percent confidence at South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson, water years 2002–2005.—Continued

[I, transform indicator: 1, natural log transform; 2, no transform. Type indicates amount of censored values and method used to calculate tolerance intervals: 1, no censored values and regular computation; 2, less than 40-percent censored values and computed using Cohen's adjustment for censored values; 5, greater than 40-percent censored values or normal distribution assumptions not met or both, nonparametric computation. n, number of samples; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; $CaCO_3$, calcium carbonate; mg/L, milligrams per liter; C, Celsius; N, nitrogen; P, phosphorus; col, colonies per 100 milliliters; µg/L, micrograms per liter; --, not applicable, includes properties or constituents for which annual means indicated temporal patterns]

Property or constituent	I	Type	n	Maximum	Upper bound tolerance interval	Minimum	Lower bound tolerance interval	Non-parametric coverage
South Platte River at Henderson (06720500)								
Mean streamflow, in ft^3/s	1	1	35	7,566	13,761.09	280	83.8	--
Streamflow volume, in acre-feet	1	1	35	6,879	12,499.09	208	74.63	--
pH, in standard units	2	1	35	8	8.24	6.72	6.52	--
Specific conductance, in µS/cm	1	1	30	1,090	1,888.15	316	219.79	--
Hardness, as $CaCO_3$, in mg/L	1	1	34	380	--	84.5	--	--
Calcium, dissolved, in mg/L	2	1	23	62.7	76.43	26.22	12.24	--
Magnesium, dissolved, in mg/L	2	1	23	16.02	19.59	4.62	0.16	--
Potassium, dissolved, in mg/L	1	1	8	8.37	25.07	4.26	1.41	--
Sodium, dissolved, in mg/L	1	1	8	142.1	946.05	27.08	3.59	--
Alkalinity, as $CaCO_3$, fixed endpoint, in mg/L	2	1	8	121.2	194.93	57.66	0	--
Chloride, dissolved, in mg/L	1	1	8	197.07	2,184.54	23.32	1.51	--
Fluoride, dissolved, in mg/L	1	1	8	0.84	2.87	0.35	0.1	--
Sulfate, dissolved, in mg/L	2	1	8	116.9	210.07	47.42	0	--
Residue at 105°C, in mg/L	1	1	34	6,040	9,072.56	76	10.08	--
Ammonia + organic N, in mg/L	1	1	34	12.15	19.88	1.98	1.27	--
Ammonia, as N, in mg/L	1	1	23	3.55	--	0.32	--	--
Nitrite + nitrate, as N, in mg/L	2	1	23	4.1	--	1.14	--	--
Orthophosphate, as P, in mg/L	1	1	34	1.4	2.69	0.2	0.12	--
Phosphorus, as P, in mg/L	1	1	34	8.3	7.84	0.73	0.33	--
Organic carbon, dissolved, in mg/L	1	1	19	16.56	32.74	5.39	2.68	--
Copper, dissolved, in µg/L	1	1	34	9	12.42	1.56	0.76	--
Copper, total, in µg/L	1	1	23	71.86	176.78	11.61	5.67	--
Lead, dissolved, in µg/L	1	2	34	10	--	0.13	--	--
Lead, total, in µg/L	2	1	23	68.23	95.87	6.92	0	--
Manganese, dissolved, in µg/L	2	1	23	241.81	--	7.21	--	--
Manganese, total, in µg/L	2	1	23	1,011.8	1398.54	235.74	0	--
Zinc, dissolved, in µg/L	1	2	34	50	--	7.86	--	--
Zinc, total, in µg/L	1	1	23	299	862.43	45	21.63	--

indicate that concentrations for many are shifted to lower levels in period 2. A more formal characterization of these shifts can be made by comparing 95-percent confidence intervals on the mean concentrations from each period (table 12). The 95-percent confidence intervals on the mean concentrations from periods 1 and 2 are independent (have no overlap) for four constituents (dissolved copper, manganese, and zinc, and total zinc) indicating a significant difference in these mean concentrations at the 95-percent confidence level (lower in period 2). There were also significant differences in mean concentrations for dissolved lead and ammonia; however, because the values reported in period 1 commonly (about 80- and 60-percent, respectively) were censored at much higher levels than in period 2; the decreases in mean concentrations are an artifact of changes in censoring levels. The spatial patterns noted in period 1, in which mean concentrations for many constituents increased in the downstream direction in the South Platte River, were observed again in period 2. There also are increases in mean concentration in the downstream direction, from Tollgate to Sand Creek, in the tributary streams during period 2. Although downstream increases in mean concentrations for the tributaries were not reported for period 1, they were present, and spatial patterns for the two periods are similar.

Exceptions to CDPHE numeric standards for bacteriological indicators were observed consistently at all stations in periods 1 and 2. In period 1, additional exceptions to numeric standards were noted for metals, and the percentage of samples that had exceptions was 20 or more for some metals (dissolved manganese and dissolved zinc) at some stations. In period 2, exceptions to numeric standards also were noted; however, there were only three instances of exceptions to metal numeric standards, and the percentage of exceptions was markedly lower in period 2.

Table 11. Results of linear regression analyses, water years 2002–2005.

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	2	Alkalinity	Dissolved chloride	62	113	0.292	3.325	0.282
Union	3	Alkalinity	Dissolved chloride	14	22	0.407	3.132	0.359
Denver	3	Alkalinity	Dissolved chloride	14	31	0.275	3.247	0.313
Sand Creek	**1**	**Alkalinity**	**Dissolved chloride**	**11**	**22**	**0.729**	**28.220**	**0.905**
Henderson	3	Alkalinity	Dissolved chloride	7	27	0.444	3.465	0.237
ALL	3	Alkalinity	Dissolved fluoride	62	113	0.502	4.758	0.443
Union	**3**	**Alkalinity**	**Dissolved fluoride**	**14**	**22**	**0.669**	**4.629**	**0.445**
Denver	**3**	**Alkalinity**	**Dissolved fluoride**	**14**	**31**	**0.865**	**4.856**	**0.701**
Tollgate	3	Alkalinity	Dissolved fluoride	12	11	0.627	5.537	0.972
Sand Creek	**3**	**Alkalinity**	**Dissolved fluoride**	**11**	**22**	**0.894**	**5.282**	**0.924**
Henderson	**2**	**Alkalinity**	**Dissolved fluoride**	**7**	**27**	**0.869**	**124.110**	**59.996**
ALL	3	Alkalinity	Dissolved manganese	62	113	0.281	4.120	0.101
Union	3	Alkalinity	Dissolved manganese	14	22	0.365	4.103	0.125
Denver	2	Alkalinity	Dissolved manganese	14	31	0.579	54.917	13.206
Sand Creek	3	Alkalinity	Dissolved manganese	11	22	0.410	4.089	0.128
Henderson	**1**	**Alkalinity**	**Dissolved manganese**	**7**	**27**	**0.968**	**57.878**	**0.450**
ALL	3	Alkalinity	Ammonia	56	119	0.101	4.558	0.101
Sand Creek	3	Alkalinity	Ammonia	11	22	0.403	4.977	0.503
Henderson	**3**	**Alkalinity**	**Ammonia**	**7**	**27**	**0.822**	**4.428**	**0.311**
ALL	3	Alkalinity	Nitrite + nitrate	62	113	0.309	4.417	0.236
Union	1	Alkalinity	Nitrite + nitrate	14	22	0.619	47.935	40.849
Denver	**2**	**Alkalinity**	**Nitrite + nitrate**	**14**	**31**	**0.762**	**71.823**	**30.879**
Tollgate	3	Alkalinity	Nitrite + nitrate	12	11	0.331	4.601	0.454
Sand Creek	3	Alkalinity	Nitrite + nitrate	11	22	0.477	4.610	0.735
Henderson	**3**	**Alkalinity**	**Nitrite + nitrate**	**7**	**27**	**0.850**	**4.046**	**0.491**
ALL	1	Alkalinity	Orthophosphate	62	113	0.069	81.041	31.841
Denver	2	Alkalinity	Orthophosphate	14	31	0.577	129.340	26.649
Henderson	**2**	**Alkalinity**	**Orthophosphate**	**7**	**27**	**0.864**	**117.493**	**34.228**
ALL	2	Alkalinity		62	113	0.375	3.151	0.275
Union	**2**	**Alkalinity**	**Dissolved sulfate**	**14**	**22**	**0.854**	**–118.399**	**47.973**
Denver	**3**	**Alkalinity**	**Dissolved sulfate**	**14**	**31**	**0.950**	**1.606**	**0.658**
Tollgate	**3**	**Alkalinity**	**Dissolved sulfate**	**12**	**11**	**0.861**	**1.533**	**0.533**
Sand Creek	**3**	**Alkalinity**	**Dissolved sulfate**	**11**	**22**	**0.746**	**1.881**	**0.522**
Henderson	**3**	**Alkalinity**	**Dissolved sulfate**	**7**	**27**	**0.918**	**1.114**	**0.760**
ALL	2	Alkalinity	Dissolved zinc	61	114	0.305	48.383	18.776
Union	3	Alkalinity	Dissolved zinc	14	22	0.388	3.824	0.392
Denver	2	Alkalinity	Dissolved zinc	14	31	0.381	3.783	0.285
Tollgate	2	Alkalinity	Dissolved zinc	12	11	0.491	42.727	18.338
Sand Creek	2	Alkalinity	Dissolved zinc	10	23	0.317	74.651	2.285
Henderson	**3**	**Alkalinity**	**Dissolved zinc**	**7**	**27**	**0.764**	**2.880**	**0.608**
ALL	3	Dissolved calcium	Alkalinity	62	113	0.467	–187.640	54.084
Union	**1**	**Dissolved calcium**	**Alkalinity**	**14**	**22**	**0.924**	**–0.880**	**1.044**
Denver	**3**	**Dissolved calcium**	**Alkalinity**	**14**	**31**	**0.959**	**–1.106**	**1.087**
Tollgate	**3**	**Dissolved calcium**	**Alkalinity**	**12**	**11**	**0.888**	**–1.731**	**1.359**
Sand Creek	**3**	**Dissolved calcium**	**Alkalinity**	**11**	**22**	**0.749**	**–221.940**	**62.551**
Henderson	**3**	**Dissolved calcium**	**Alkalinity**	**7**	**27**	**0.894**	**–123.319**	**37.138**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Dissolved calcium	Dissolved chloride	62	113	0.415	2.048	0.466
Union	3	Dissolved calcium	Dissolved chloride	14	22	0.481	2.215	0.424
Denver	3	Dissolved calcium	Dissolved chloride	14	31	0.368	2.188	0.402
Sand Creek	**1**	**Dissolved calcium**	**Dissolved chloride**	**11**	**22**	**0.727**	**–148.408**	**49.264**
Henderson	3	Dissolved calcium	Dissolved chloride	7	27	0.412	2.745	0.232
Union	3	Dissolved calcium	Dissolved fluoride	14	22	0.412	3.909	0.379
Denver	**1**	**Dissolved calcium**	**Dissolved fluoride**	**14**	**31**	**0.762**	**4.151**	**0.730**
Tollgate	3	Dissolved calcium	Dissolved fluoride	12	11	0.441	5.619	1.176
Sand Creek	**3**	**Dissolved calcium**	**Dissolved fluoride**	**11**	**22**	**0.672**	**4.850**	**0.983**
Henderson	**2**	**Dissolved calcium**	**Dissolved fluoride**	**7**	**27**	**0.914**	**59.298**	**28.847**
ALL	3	Dissolved calcium	Dissolved potassium	62	113	0.151	3.078	0.541
Union	1	Dissolved calcium	Dissolved potassium	14	22	0.430	2.656	0.809
Denver	**2**	**Dissolved calcium**	**Dissolved potassium**	**14**	**31**	**0.724**	**2.202**	**1.002**
Sand Creek	**3**	**Dissolved calcium**	**Dissolved potassium**	**11**	**22**	**0.785**	**2.007**	**1.376**
Henderson	**2**	**Dissolved calcium**	**Dissolved potassium**	**7**	**27**	**0.945**	**–20.412**	**34.485**
ALL	**3**	**Dissolved calcium**	**Dissolved magnesium**	**131**	**44**	**0.894**	**2.023**	**0.820**
Union	**2**	**Dissolved calcium**	**Dissolved magnesium**	**27**	**9**	**0.847**	**–8.931**	**24.268**
Denver	**3**	**Dissolved calcium**	**Dissolved magnesium**	**34**	**11**	**0.927**	**2.152**	**0.737**
Tollgate	**3**	**Dissolved calcium**	**Dissolved magnesium**	**20**	**3**	**0.972**	**2.260**	**0.787**
Sand Creek	**3**	**Dissolved calcium**	**Dissolved magnesium**	**24**	**9**	**0.961**	**2.102**	**0.819**
Henderson	**3**	**Dissolved calcium**	**Dissolved magnesium**	**22**	**12**	**0.952**	**2.233**	**0.684**
ALL	3	Dissolved calcium	Dissolved manganese	131	44	0.311	3.429	0.142
Union	3	Dissolved calcium	Dissolved manganese	27	9	0.299	3.474	0.105
Denver	3	Dissolved calcium	Dissolved manganese	34	11	0.356	3.337	0.138
Sand Creek	2	Dissolved calcium	Dissolved manganese	24	9	0.441	34.754	9.031
Henderson	**3**	**Dissolved calcium**	**Dissolved manganese**	**22**	**12**	**0.712**	**3.027**	**0.181**
ALL	**3**	**Dissolved calcium**	**Dissolved sodium**	**62**	**113**	**0.682**	**1.557**	**0.583**
Union	**3**	**Dissolved calcium**	**Dissolved sodium**	**14**	**22**	**0.681**	**1.645**	**0.596**
Denver	3	Dissolved calcium	Dissolved sodium	14	31	0.618	1.432	0.604
Tollgate	**1**	**Dissolved calcium**	**Dissolved sodium**	**12**	**11**	**0.897**	**–240.357**	**71.999**
Sand Creek	**1**	**Dissolved calcium**	**Dissolved sodium**	**11**	**22**	**0.969**	**7.133**	**0.622**
Henderson	3	Dissolved calcium	Dissolved sodium	7	27	0.562	2.246	0.354
Tollgate	3	Dissolved calcium	Ammonia	18	5	0.228	4.829	0.336
Sand Creek	1	Dissolved calcium	Ammonia	21	12	0.257	49.705	32.929
Henderson	**3**	**Dissolved calcium**	**Ammonia**	**22**	**12**	**0.751**	**3.695**	**0.275**
Union	1	Dissolved calcium	Nitrite + nitrate	27	9	0.305	31.010	14.586
Denver	**3**	**Dissolved calcium**	**Nitrite + nitrate**	**34**	**11**	**0.668**	**3.445**	**0.426**
Tollgate	3	Dissolved calcium	Nitrite + nitrate	17	6	0.228	4.510	0.388
Sand Creek	3	Dissolved calcium	Nitrite + nitrate	24	9	0.404	4.138	0.483
Henderson	**3**	**Dissolved calcium**	**Nitrite + nitrate**	**22**	**12**	**0.778**	**3.292**	**0.511**
ALL	2	Dissolved calcium	Orthophosphate	126	49	0.06	41.162	–5.330
Denver	2	Dissolved calcium	Orthophosphate	34	11	0.456	64.931	14.698
Tollgate	3	Dissolved calcium	Orthophosphate	15	8	0.238	3.361	–0.274
Henderson	**3**	**Dissolved calcium**	**Orthophosphate**	**22**	**12**	**0.661**	**4.044**	**0.382**
Tollgate	**1**	**Dissolved calcium**	**Dissolved lead**	**6**	**17**	**0.680**	**415.356**	**152.395**
Henderson	2	Dissolved calcium	Dissolved lead	22	12	0.334	62.727	13.831

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	**1**	**Dissolved calcium**	**Dissolved sulfate**	**62**	**113**	**0.934**	**21.829**	**0.237**
Union	**2**	**Dissolved calcium**	**Dissolved sulfate**	**14**	**22**	**0.933**	**–73.199**	**27.415**
Denver	**3**	**Dissolved calcium**	**Dissolved sulfate**	**14**	**31**	**0.985**	**0.519**	**0.743**
Tollgate	**3**	**Dissolved calcium**	**Dissolved sulfate**	**12**	**11**	**0.984**	**11.977**	**0.267**
Sand Creek	**3**	**Dissolved calcium**	**Dissolved sulfate**	**11**	**22**	**0.970**	**–156.519**	**43.033**
Henderson	**2**	**Dissolved calcium**	**Dissolved sulfate**	**7**	**27**	**0.974**	**–92.987**	**30.749**
Sand Creek	**1**	**Dissolved chloride**	**Dissolved copper**	**11**	**22**	**0.674**	**25.667**	**55.067**
ALL	3	Dissolved chloride	Dissolved sulfate	62	113	0.390	1.413	0.537
Tollgate	1	Dissolved chloride	Dissolved sulfate	12	11	0.364	32.625	0.131
Sand Creek	**2**	**Dissolved chloride**	**Dissolved sulfate**	**11**	**22**	**0.724**	**–149.137**	**44.279**
Tollgate	**3**	**Dissolved chloride**	**Total phosphorus**	**12**	**11**	**0.652**	**3.759**	**–0.390**
Sand Creek	2	Dissolved chloride	Total phosphorus	11	22	0.452	65.867	–29.984
ALL	2	Dissolved copper	Dissolved lead	90	85	0.366	5.413	1.435
Denver	2	Dissolved copper	Dissolved lead	32	13	0.280	5.095	1.181
Henderson	**1**	**Dissolved copper**	**Dissolved lead**	**23**	**11**	**0.829**	**2.563**	**0.650**
ALL	3	Dissolved copper	Dissolved zinc	154	21	0.340	0.378	0.256
Union	**1**	**Dissolved copper**	**Dissolved zinc**	**30**	**6**	**0.839**	**0.869**	**0.245**
Denver	**1**	**Dissolved copper**	**Dissolved zinc**	**38**	**7**	**0.643**	**1.670**	**0.104**
Tollgate	3	Dissolved copper	Dissolved zinc	21	2	0.265	0.477	0.222
Henderson	1	Dissolved copper	Dissolved zinc	30	4	0.572	–0.880	0.689
ALL	**3**	**Total copper**	**Total manganese**	**131**	**44**	**0.666**	**–1.819**	**0.790**
Union	**1**	**Total copper**	**Total manganese**	**27**	**9**	**0.835**	**–3.071**	**0.975**
Denver	**1**	**Total copper**	**Total manganese**	**34**	**11**	**0.816**	**–2.436**	**0.942**
Tollgate	1	Total copper	Total manganese	20	3	0.455	–57.318	12.410
Sand Creek	**3**	**Total copper**	**Total manganese**	**24**	**9**	**0.819**	**–1.717**	**0.755**
Henderson	**3**	**Total copper**	**Total manganese**	**22**	**12**	**0.855**	**–2.757**	**0.995**
ALL	**3**	**Total copper**	**Total lead**	**131**	**44**	**0.956**	**1.135**	**0.683**
Union	**1**	**Total copper**	**Total lead**	**27**	**9**	**0.979**	**3.811**	**0.934**
Denver	**3**	**Total copper**	**Total lead**	**34**	**11**	**0.945**	**0.982**	**0.717**
Tollgate	**1**	**Total copper**	**Total lead**	**20**	**3**	**0.985**	**4.773**	**1.138**
Sand Creek	**1**	**Total copper**	**Total lead**	**24**	**9**	**0.980**	**6.868**	**0.719**
Henderson	**3**	**Total copper**	**Total lead**	**22**	**12**	**0.884**	**0.980**	**0.742**
ALL	3	Total copper	Total zinc	130	45	0.556	–34.746	13.206
Union	**3**	**Total copper**	**Total zinc**	**27**	**9**	**0.965**	**–0.652**	**0.850**
Denver	**1**	**Total copper**	**Total zinc**	**34**	**11**	**0.980**	**1.737**	**0.209**
Tollgate	**1**	**Total copper**	**Total zinc**	**20**	**3**	**0.679**	**–53.591**	**17.311**
Henderson	**3**	**Total copper**	**Total zinc**	**22**	**12**	**0.942**	**–1.000**	**0.906**
ALL	1	Dissolved organic C	Dissolved lead	77	98	0.204	6.787	20.563
Union	**3**	**Dissolved organic C**	**Dissolved lead**	**3**	**33**	**0.831**	**–22.499**	**–15.041**
Denver	1	Dissolved organic C	Dissolved lead	28	17	0.538	2.808	37.262
Tollgate	**2**	**Dissolved organic C**	**Dissolved lead**	**6**	**17**	**0.729**	**50.234**	**17.470**
Sand Creek	1	Dissolved organic C	Dissolved lead	18	15	0.424	6.960	37.261
Henderson	3	Dissolved organic C	Dissolved lead	18	16	0.446	2.974	0.558
ALL	3	Dissolved fluoride	Dissolved manganese	62	113	0.066	–0.991	0.078
Union	2	Dissolved fluoride	Dissolved manganese	14	22	0.452	0.300	0.152
Denver	2	Dissolved fluoride	Dissolved manganese	14	31	0.458	0.336	0.101
Sand Creek	2	Dissolved fluoride	Dissolved manganese	11	22	0.490	0.256	0.060
Henderson	**1**	**Dissolved fluoride**	**Dissolved manganese**	**7**	**27**	**0.845**	**0.329**	**0.004**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Dissolved fluoride	Nitrite + nitrate	62	113	0.474	–0.768	0.468
Union	3	Dissolved fluoride	Nitrite + nitrate	14	22	0.511	–0.347	0.754
Denver	**2**	**Dissolved fluoride**	**Nitrite + nitrate**	**14**	**31**	**0.824**	**0.444**	**0.275**
Tollgate	2	Dissolved fluoride	Nitrite + nitrate	12	11	0.597	0.378	0.139
Sand Creek	3	Dissolved fluoride	Nitrite + nitrate	11	22	0.391	–0.744	0.681
Henderson	**1**	**Dissolved fluoride**	**Nitrite + nitrate**	**7**	**27**	**0.995**	**0.159**	**0.166**
ALL	1	Dissolved fluoride	Orthophosphate	62	113	0.119	0.447	0.411
Union	2	Dissolved fluoride	Orthophosphate	14	22	0.247	0.925	–3.600
Denver	**2**	**Dissolved fluoride**	**Orthophosphate**	**14**	**31**	**0.654**	**0.965**	**0.243**
Tollgate	1	Dissolved fluoride	Orthophosphate	12	11	0.333	0.361	–1.152
Sand Creek	3	Dissolved fluoride	Orthophosphate	11	22	0.378	–1.666	–0.376
Henderson	**2**	**Dissolved fluoride**	**Orthophosphate**	**7**	**27**	**0.949**	**0.847**	**0.313**
ALL	1	Dissolved fluoride	Dissolved lead	38	137	0.232	0.324	0.973
Union	**1**	**Dissolved fluoride**	**Dissolved lead**	**2**	**34**	**0.957**	**0.902**	**–3.648**
Henderson	**1**	**Dissolved fluoride**	**Dissolved lead**	**7**	**27**	**0.717**	**1.367**	**0.545**
Union	3	Dissolved fluoride	Dissolved sulfate	14	22	0.358	–3.490	0.706
Denver	**2**	**Dissolved fluoride**	**Dissolved sulfate**	**14**	**31**	**0.803**	**–1.214**	**0.418**
Tollgate	2	Dissolved fluoride	Dissolved sulfate	12	11	0.458	–2.893	0.317
Sand Creek	3	Dissolved fluoride	Dissolved sulfate	11	22	0.598	–3.247	0.479
Henderson	**1**	**Dissolved fluoride**	**Dissolved sulfate**	**7**	**27**	**0.919**	**–4.948**	**0.990**
Union	2	Dissolved fluoride	Dissolved zinc	14	22	0.302	–1.448	0.636
Denver	2	Dissolved fluoride	Dissolved zinc	14	31	0.290	0.424	0.014
Henderson	**3**	**Dissolved fluoride**	**Dissolved zinc**	**7**	**27**	**0.927**	**–2.850**	**0.872**
ALL	3	Hardness	Alkalinity	62	113	0.508	–658.557	187.397
Union	**3**	**Hardness**	**Alkalinity**	**14**	**22**	**0.939**	**–28.933**	**2.038**
Denver	**3**	**Hardness**	**Alkalinity**	**14**	**31**	**0.922**	**–510.569**	**147.172**
Tollgate	**3**	**Hardness**	**Alkalinity**	**12**	**11**	**0.872**	**–91.699**	**4.004**
Sand Creek	**3**	**Hardness**	**Alkalinity**	**11**	**22**	**0.760**	**–744.175**	**208.504**
Henderson	**3**	**Hardness**	**Alkalinity**	**7**	**27**	**0.907**	**–469.397**	**137.428**
ALL	**1**	**Hardness**	**Dissolved calcium**	**131**	**44**	**0.991**	**1.115**	**1.022**
Union	**3**	**Hardness**	**Dissolved calcium**	**27**	**9**	**0.979**	**0.770**	**1.117**
Denver	**3**	**Hardness**	**Dissolved calcium**	**34**	**11**	**0.992**	**0.960**	**1.066**
Tollgate	**3**	**Hardness**	**Dissolved calcium**	**20**	**3**	**0.998**	**0.951**	**1.053**
Sand Creek	**3**	**Hardness**	**Dissolved calcium**	**24**	**9**	**0.997**	**1.018**	**1.042**
Henderson	**3**	**Hardness**	**Dissolved calcium**	**22**	**12**	**0.994**	**0.838**	**1.102**
ALL	3	Hardness	Dissolved chloride	62	113	0.439	3.146	0.490
Union	3	Hardness	Dissolved chloride	14	22	0.494	3.228	0.477
Denver	3	Hardness	Dissolved chloride	14	31	0.404	3.247	0.438
Tollgate	1	Hardness	Dissolved chloride	12	11	0.402	2.626	0.675
Sand Creek	**1**	**Hardness**	**Dissolved chloride**	**11**	**22**	**0.732**	**–496.344**	**163.571**
Henderson	3	Hardness	Dissolved chloride	7	27	0.476	3.781	0.276
Union	3	Hardness	Dissolved fluoride	14	22	0.472	5.145	0.450
Denver	**1**	**Hardness**	**Dissolved fluoride**	**14**	**31**	**0.753**	**5.365**	**0.757**
Tollgate	3	Hardness	Dissolved fluoride	12	11	0.439	6.843	1.216
Sand Creek	**3**	**Hardness**	**Dissolved fluoride**	**11**	**22**	**0.689**	**6.059**	**1.018**
Henderson	**2**	**Hardness**	**Dissolved fluoride**	**7**	**27**	**0.884**	**204.777**	**104.222**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Hardness	Dissolved potassium	62	113	0.174	4.192	0.595
Union	1	Hardness	Dissolved potassium	14	22	0.462	3.697	0.930
Denver	**2**	**Hardness**	**Dissolved potassium**	**14**	**31**	**0.702**	**3.360**	**1.028**
Sand Creek	**3**	**Hardness**	**Dissolved potassium**	**11**	**22**	**0.794**	**3.127**	**1.416**
Henderson	**2**	**Hardness**	**Dissolved potassium**	**7**	**27**	**0.915**	**–83.264**	**124.622**
ALL	**3**	**Hardness**	**Dissolved magnesium**	**131**	**44**	**0.944**	**3.121**	**0.865**
Union	**3**	**Hardness**	**Dissolved magnesium**	**27**	**9**	**0.934**	**3.454**	**0.695**
Denver	**3**	**Hardness**	**Dissolved magnesium**	**34**	**11**	**0.967**	**3.212**	**0.806**
Tollgate	**3**	**Hardness**	**Dissolved magnesium**	**20**	**3**	**0.984**	**3.314**	**0.835**
Sand Creek	**3**	**Hardness**	**Dissolved magnesium**	**24**	**9**	**0.980**	**3.183**	**0.863**
Henderson	**3**	**Hardness**	**Dissolved magnesium**	**22**	**12**	**0.979**	**3.271**	**0.766**
ALL	3	Hardness	Dissolved manganese	131	44	0.331	4.603	0.151
Union	3	Hardness	Dissolved manganese	27	9	0.294	4.651	0.117
Denver	3	Hardness	Dissolved manganese	34	11	0.385	4.500	0.153
Sand Creek	2	Hardness	Dissolved manganese	24	9	0.477	107.346	31.998
Henderson	**3**	**Hardness**	**Dissolved manganese**	**22**	**12**	**0.724**	**4.166**	**0.201**
ALL	**3**	**Hardness**	**Dissolved sodium**	**62**	**113**	**0.693**	**2.677**	**0.601**
Union	**3**	**Hardness**	**Dissolved sodium**	**14**	**22**	**0.717**	**2.557**	**0.679**
Denver	**3**	**Hardness**	**Dissolved sodium**	**14**	**31**	**0.654**	**2.465**	**0.648**
Tollgate	**1**	**Hardness**	**Dissolved sodium**	**12**	**11**	**0.914**	**0.894**	**1.034**
Sand Creek	**1**	**Hardness**	**Dissolved sodium**	**11**	**22**	**0.972**	**20.353**	**2.061**
Henderson	3	Hardness	Dissolved sodium	7	27	0.625	3.221	0.412
Tollgate	3	Hardness	Ammonia	18	5	0.220	6.023	0.345
Sand Creek	1	Hardness	Ammonia	21	12	0.292	159.552	120.555
Henderson	**3**	**Hardness**	**Ammonia**	**22**	**12**	**0.779**	**4.909**	**0.309**
Union	1	Hardness	Nitrite + nitrate	27	9	0.293	99.146	55.713
Denver	**3**	**Hardness**	**Nitrite + nitrate**	**34**	**11**	**0.654**	**4.634**	**0.452**
Tollgate	3	Hardness	Nitrite + nitrate	17	6	0.236	5.708	0.419
Sand Creek	3	Hardness	Nitrite + nitrate	24	9	0.403	5.329	0.503
Henderson	**3**	**Hardness**	**Nitrite + nitrate**	**22**	**12**	**0.756**	**4.472**	**0.557**
ALL	3	Hardness	Dissolved lead	90	85	0.093	5.286	0.119
Union	**2**	**Hardness**	**Dissolved lead**	**6**	**30**	**0.818**	**197.363**	**30.795**
Tollgate	**1**	**Hardness**	**Dissolved lead**	**6**	**17**	**0.704**	**1,484.309**	**553.945**
Henderson	2	Hardness	Dissolved lead	23	11	0.407	188.638	28.737
ALL	**1**	**Hardness**	**Dissolved sulfate**	**62**	**113**	**0.914**	**72.513**	**0.780**
Union	**3**	**Hardness**	**Dissolved sulfate**	**14**	**22**	**0.950**	**1.737**	**0.752**
Denver	**3**	**Hardness**	**Dissolved sulfate**	**14**	**31**	**0.981**	**1.587**	**0.773**
Tollgate	**3**	**Hardness**	**Dissolved sulfate**	**12**	**11**	**0.990**	**0.845**	**0.854**
Sand Creek	**3**	**Hardness**	**Dissolved sulfate**	**11**	**22**	**0.979**	**1.426**	**0.751**
Henderson	**2**	**Hardness**	**Dissolved sulfate**	**7**	**27**	**0.965**	**–351.315**	**112.446**
ALL	3	Dissolved potassium	Alkalinity	62	113	0.419	–1.396	0.645
Union	1	Dissolved potassium	Alkalinity	14	22	0.490	–6.998	2.454
Denver	**3**	**Dissolved potassium**	**Alkalinity**	**14**	**31**	**0.723**	**–2.044**	**0.801**
Sand Creek	**3**	**Dissolved potassium**	**Alkalinity**	**11**	**22**	**0.939**	**–1.987**	**0.766**
Henderson	**3**	**Dissolved potassium**	**Alkalinity**	**7**	**27**	**0.831**	**–2.684**	**1.009**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Dissolved potassium	Dissolved chloride	62	113	0.134	0.717	0.190
Sand Creek	**1**	**Dissolved potassium**	**Dissolved chloride**	**11**	**22**	**0.685**	**2.030**	**0.033**
ALL	3	Dissolved potassium	Dissolved copper	62	113	0.263	1.104	0.397
Union	**1**	**Dissolved potassium**	**Dissolved copper**	**14**	**22**	**0.669**	**0.699**	**0.841**
Denver	1	Dissolved potassium	Dissolved copper	14	31	0.372	2.733	0.611
Sand Creek	1	Dissolved potassium	Dissolved copper	11	22	0.580	2.413	0.794
ALL	3	Dissolved potassium	Dissolved fluoride	62	113	0.315	1.722	0.350
Union	3	Dissolved potassium	Dissolved fluoride	14	22	0.327	1.450	0.274
Denver	**1**	**Dissolved potassium**	**Dissolved fluoride**	**14**	**31**	**0.747**	**1.367**	**5.677**
Sand Creek	**3**	**Dissolved potassium**	**Dissolved fluoride**	**11**	**22**	**0.889**	**2.077**	**0.728**
Henderson	**3**	**Dissolved potassium**	**Dissolved fluoride**	**7**	**27**	**0.969**	**2.312**	**0.837**
ALL	3	Dissolved potassium	Dissolved manganese	62	113	0.266	1.164	0.098
Denver	3	Dissolved potassium	Dissolved manganese	14	31	0.603	1.123	0.157
Sand Creek	2	Dissolved potassium	Dissolved manganese	11	22	0.432	2.987	0.450
Henderson	**1**	**Dissolved potassium**	**Dissolved manganese**	**7**	**27**	**0.822**	**4.046**	**0.034**
ALL	3	Dissolved potassium	Dissolved sodium	62	113	0.186	0.593	0.218
Union	1	Dissolved potassium	Dissolved sodium	14	22	0.276	2.573	0.036
Denver	3	Dissolved potassium	Dissolved sodium	14	31	0.253	2.961	0.036
Sand Creek	**2**	**Dissolved potassium**	**Dissolved sodium**	**11**	**22**	**0.763**	**–4.917**	**2.153**
ALL	1	Dissolved potassium	Ammonia	56	119	0.466	3.711	2.007
Sand Creek	3	Dissolved potassium	Ammonia	11	22	0.327	1.801	0.358
Henderson	**3**	**Dissolved potassium**	**Ammonia**	**7**	**27**	**0.702**	**1.785**	**0.318**
ALL	**1**	**Dissolved potassium**	**Nitrite + nitrate**	**62**	**113**	**0.685**	**3.089**	**1.067**
Union	**1**	**Dissolved potassium**	**Nitrite + nitrate**	**14**	**22**	**0.734**	**2.090**	**1.926**
Denver	**2**	**Dissolved potassium**	**Nitrite + nitrate**	**14**	**31**	**0.948**	**3.702**	**1.935**
Sand Creek	3	Dissolved potassium	Nitrite + nitrate	11	22	0.437	1.544	0.556
Henderson	**1**	**Dissolved potassium**	**Nitrite + nitrate**	**7**	**27**	**0.979**	**2.458**	**1.540**
ALL	1	Dissolved potassium	Orthophosphate	62	113	0.608	3.544	5.406
Denver	**2**	**Dissolved potassium**	**Orthophosphate**	**14**	**31**	**0.907**	**7.631**	**1.876**
Henderson	**2**	**Dissolved potassium**	**Orthophosphate**	**7**	**27**	**0.947**	**8.851**	**2.926**
ALL	1	Dissolved potassium	Dissolved lead	38	137	0.398	3.091	9.837
Union	**1**	**Dissolved potassium**	**Dissolved lead**	**2**	**34**	**0.929**	**6.261**	**–20.524**
Denver	2	Dissolved potassium	Dissolved lead	13	32	0.326	7.658	1.563
Henderson	**1**	**Dissolved potassium**	**Dissolved lead**	**7**	**27**	**0.711**	**13.689**	**5.076**
ALL	3	Dissolved potassium	Dissolved sulfate	62	113	0.110	0.773	0.148
Union	1	Dissolved potassium	Dissolved sulfate	14	22	0.621	2.110	0.023
Denver	**3**	**Dissolved potassium**	**Dissolved sulfate**	**14**	**31**	**0.763**	**–0.880**	**0.556**
Sand Creek	**3**	**Dissolved potassium**	**Dissolved sulfate**	**11**	**22**	**0.690**	**–4.213**	**1.724**
Henderson	**1**	**Dissolved potassium**	**Dissolved sulfate**	**7**	**27**	**0.947**	**–1.945**	**0.855**
ALL	2	Dissolved potassium	Dissolved zinc	61	114	0.325	2.222	1.108
Denver	1	Dissolved potassium	Dissolved zinc	14	31	0.639	3.129	0.131
Sand Creek	1	Dissolved potassium	Dissolved zinc	10	23	0.394	3.591	0.096
Henderson	**1**	**Dissolved potassium**	**Dissolved zinc**	**7**	**27**	**0.879**	**1.666**	**0.332**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	**3**	**Dissolved magnesium**	**Alkalinity**	**62**	**113**	**0.715**	**–3.612**	**1.318**
Union	**3**	**Dissolved magnesium**	**Alkalinity**	**14**	**22**	**0.921**	**–4.651**	**1.532**
Denver	**3**	**Dissolved magnesium**	**Alkalinity**	**14**	**31**	**0.927**	**–3.537**	**1.269**
Tollgate	**3**	**Dissolved magnesium**	**Alkalinity**	**12**	**11**	**0.877**	**–4.339**	**1.564**
Sand Creek	**3**	**Dissolved magnesium**	**Alkalinity**	**11**	**22**	**0.840**	**–3.263**	**1.241**
Henderson	**2**	**Dissolved magnesium**	**Alkalinity**	**7**	**27**	**0.900**	**–39.002**	**10.812**
ALL	3	Dissolved magnesium	Dissolved chloride	62	113	0.391	–10.753	5.339
Sand Creek	**1**	**Dissolved magnesium**	**Dissolved chloride**	**11**	**22**	**0.743**	**–30.670**	**9.883**
ALL	3	Dissolved magnesium	Dissolved fluoride	62	113	0.127	2.481	0.347
Union	3	Dissolved magnesium	Dissolved fluoride	14	22	0.575	2.428	0.658
Denver	**1**	**Dissolved magnesium**	**Dissolved fluoride**	**14**	**31**	**0.707**	**2.591**	**0.836**
Tollgate	3	Dissolved magnesium	Dissolved fluoride	12	11	0.428	4.106	1.342
Sand Creek	**3**	**Dissolved magnesium**	**Dissolved fluoride**	**11**	**22**	**0.729**	**3.275**	**1.128**
Henderson	**2**	**Dissolved magnesium**	**Dissolved fluoride**	**7**	**27**	**0.786**	**13.762**	**7.759**
ALL	3	Dissolved magnesium	Dissolved potassium	62	113	0.232	1.120	0.753
Sand Creek	**3**	**Dissolved magnesium**	**Dissolved potassium**	**11**	**22**	**0.768**	**–12.192**	**15.907**
Henderson	**2**	**Dissolved magnesium**	**Dissolved potassium**	**7**	**27**	**0.810**	**–7.651**	**9.260**
ALL	3	Dissolved magnesium	Dissolved manganese	131	44	0.357	1.708	0.176
Union	3	Dissolved magnesium	Dissolved manganese	27	9	0.268	1.755	0.155
Denver	3	Dissolved magnesium	Dissolved manganese	34	11	0.428	1.579	0.197
Sand Creek	2	Dissolved magnesium	Dissolved manganese	24	9	0.543	5.068	2.276
Henderson	**3**	**Dissolved magnesium**	**Dissolved manganese**	**22**	**12**	**0.721**	**1.181**	**0.259**
ALL	**3**	**Dissolved magnesium**	**Dissolved sodium**	**62**	**113**	**0.650**	**3.442**	**0.109**
Union	**3**	**Dissolved magnesium**	**Dissolved sodium**	**14**	**22**	**0.738**	**–1.077**	**0.912**
Denver	**3**	**Dissolved magnesium**	**Dissolved sodium**	**14**	**31**	**0.664**	**–13.130**	**5.745**
Tollgate	**1**	**Dissolved magnesium**	**Dissolved sodium**	**12**	**11**	**0.926**	**–2.559**	**1.164**
Sand Creek	**1**	**Dissolved magnesium**	**Dissolved sodium**	**11**	**22**	**0.966**	**–32.953**	**10.124**
Henderson	3	Dissolved magnesium	Dissolved sodium	7	27	0.523	5.059	0.057
ALL	3	Dissolved magnesium	Ammonia	116	59	0.053	2.398	0.094
Tollgate	3	Dissolved magnesium	Ammonia	18	5	0.198	3.190	0.373
Sand Creek	1	Dissolved magnesium	Ammonia	21	12	0.377	8.622	9.297
Henderson	**3**	**Dissolved magnesium**	**Ammonia**	**22**	**12**	**0.805**	**2.138**	**0.406**
ALL	3	Dissolved magnesium	Nitrite + nitrate	128	47	0.045	2.248	0.125
Union	1	Dissolved magnesium	Nitrite + nitrate	27	9	0.239	5.237	4.698
Denver	3	Dissolved magnesium	Nitrite + nitrate	34	11	0.589	1.787	0.523
Tollgate	3	Dissolved magnesium	Nitrite + nitrate	17	6	0.274	2.903	0.543
Sand Creek	3	Dissolved magnesium	Nitrite + nitrate	24	9	0.388	2.487	0.567
Henderson	**3**	**Dissolved magnesium**	**Nitrite + nitrate**	**22**	**12**	**0.691**	**1.605**	**0.687**
ALL	3	Dissolved magnesium	Dissolved lead	87	88	0.079	2.711	0.252
Denver	2	Dissolved magnesium	Dissolved lead	32	13	0.159	13.566	2.673
Tollgate	**1**	**Dissolved magnesium**	**Dissolved lead**	**6**	**17**	**0.787**	**–23.427**	**344.115**
Henderson	1	Dissolved magnesium	Dissolved lead	22	12	0.306	6.158	13.081

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	**1**	**Dissolved magnesium**	**Dissolved sulfate**	**62**	**113**	**0.798**	**4.384**	**0.045**
Union	**1**	**Dissolved magnesium**	**Dissolved sulfate**	**14**	**22**	**0.901**	**–2.010**	**0.971**
Denver	**3**	**Dissolved magnesium**	**Dissolved sulfate**	**14**	**31**	**0.945**	**–1.629**	**0.865**
Tollgate	**1**	**Dissolved magnesium**	**Dissolved sulfate**	**12**	**11**	**0.988**	**–2.575**	**0.954**
Sand Creek	**2**	**Dissolved magnesium**	**Dissolved sulfate**	**11**	**22**	**0.974**	**–31.920**	**8.558**
Henderson	**2**	**Dissolved magnesium**	**Dissolved sulfate**	**7**	**27**	**0.907**	**–28.673**	**8.609**
ALL	3	Total manganese	Total zinc	130	45	0.626	3.194	0.631
Union	**1**	**Total manganese**	**Total zinc**	**27**	**9**	**0.914**	**73.566**	**5.370**
Denver	**1**	**Total manganese**	**Total zinc**	**34**	**11**	**0.817**	**85.960**	**2.669**
Tollgate	**3**	**Total manganese**	**Total zinc**	**20**	**3**	**0.708**	**2.182**	**0.961**
Sand Creek	3	Total manganese	Total zinc	23	10	0.449	3.662	0.515
Henderson	**3**	**Total manganese**	**Total zinc**	**22**	**12**	**0.856**	**2.296**	**0.803**
ALL	3	Mean streamflow	Alkalinity	58	117	0.164	17.274	–2.657
Union	2	Mean streamflow	Alkalinity	14	22	0.616	2,478.522	–509.488
Denver	**2**	**Mean streamflow**	**Alkalinity**	**14**	**31**	**0.758**	**10,557.627**	**–2,177.453**
Tollgate	**2**	**Mean streamflow**	**Alkalinity**	**8**	**15**	**0.733**	**1,667.329**	**–361.251**
Sand Creek	3	Mean streamflow	Alkalinity	11	22	0.556	16.978	–2.636
Henderson	**2**	**Mean streamflow**	**Alkalinity**	**7**	**27**	**0.888**	**25,433.410**	**–5,204.953**
ALL	3	Mean streamflow	Dissolved chloride	58	117	0.075	9.038	–0.914
Union	2	Mean streamflow	Dissolved chloride	14	22	0.402	1,055.511	–231.939
Denver	2	Mean streamflow	Dissolved chloride	14	31	0.455	4,721.985	–1,006.529
Tollgate	2	Mean streamflow	Dissolved chloride	8	15	0.446	812.788	–185.621
Sand Creek	**3**	**Mean streamflow**	**Dissolved chloride**	**11**	**22**	**0.684**	**14.979**	**–2.336**
Henderson	2	Mean streamflow	Dissolved chloride	7	27	0.490	7,968.377	–1,377.489
Union	3	Mean streamflow	Dissolved fluoride	14	22	0.333	4.722	–0.939
Denver	3	Mean streamflow	Dissolved fluoride	14	31	0.593	5.429	–1.781
Tollgate	**2**	**Mean streamflow**	**Dissolved fluoride**	**8**	**15**	**0.672**	**–519.873**	**–531.096**
Sand Creek	3	Mean streamflow	Dissolved fluoride	11	22	0.331	3.432	–1.984
Henderson	**3**	**Mean streamflow**	**Dissolved fluoride**	**7**	**27**	**0.854**	**6.497**	**–1.751**
Union	3	Mean streamflow	Dissolved potassium	14	22	0.431	8.127	–2.233
Denver	**3**	**Mean streamflow**	**Dissolved potassium**	**14**	**31**	**0.759**	**10.775**	**–2.835**
Sand Creek	3	Mean streamflow	Dissolved potassium	11	22	0.615	10.238	–3.505
Henderson	**3**	**Mean streamflow**	**Dissolved potassium**	**7**	**27**	**0.847**	**11.259**	**–2.050**
ALL	3	Mean streamflow	Dissolved magnesium	127	48	0.317	10.341	–2.061
Union	3	Mean streamflow	Dissolved magnesium	27	9	0.281	7.603	–1.085
Denver	3	Mean streamflow	Dissolved magnesium	34	11	0.525	9.631	–1.474
Sand Creek	3	Mean streamflow	Dissolved magnesium	24	9	0.544	9.572	–1.924
Henderson	**3**	**Mean streamflow**	**Dissolved magnesium**	**22**	**12**	**0.664**	**11.293**	**–1.795**
ALL	3	Mean streamflow	Dissolved sodium	58	117	0.204	11.309	–1.476
Union	2	Mean streamflow	Dissolved sodium	14	22	0.480	1,274.618	–299.197
Denver	2	Mean streamflow	Dissolved sodium	14	31	0.632	6,103.122	–1,377.721
Tollgate	2	Mean streamflow	Dissolved sodium	8	15	0.602	962.258	–203.851
Sand Creek	**3**	**Mean streamflow**	**Dissolved sodium**	**11**	**22**	**0.661**	**14.084**	**–2.064**
Henderson	2	Mean streamflow	Dissolved sodium	7	27	0.627	10,656.621	–2,033.731
ALL	**3**	**Mean streamflow**	**Streamflow volume**	**171**	**4**	**0.972**	**0.232**	**0.979**
Union	**1**	**Mean streamflow**	**Streamflow volume**	**36**	**0**	**0.959**	**0.763**	**0.877**
Denver	**1**	**Mean streamflow**	**Streamflow volume**	**45**	**0**	**0.945**	**0.667**	**0.918**
Sand Creek	**3**	**Mean streamflow**	**Streamflow volume**	**33**	**0**	**0.976**	**0.435**	**0.928**
Henderson	**3**	**Mean streamflow**	**Streamflow volume**	**34**	**0**	**0.694**	**–9,223.888**	**1,557.344**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Mean streamflow	Dissolved sulfate	58	117	0.509	15.169	–2.105
Union	2	Mean streamflow	Dissolved sulfate	14	22	0.619	1,618.282	–327.318
Denver	**3**	**Mean streamflow**	**Dissolved sulfate**	**14**	**31**	**0.818**	**14.550**	**–1.873**
Tollgate	2	Mean streamflow	Dissolved sulfate	8	15	0.634	1083.251	–187.379
Sand Creek	3	Mean streamflow	Dissolved sulfate	11	22	0.549	13.060	–1.583
Henderson	**2**	**Mean streamflow**	**Dissolved sulfate**	**7**	**27**	**0.924**	**20,756.254**	**–4211.833**
ALL	3	Dissolved sodium	Alkalinity	62	113	0.330	–246.208	69.393
Union	3	Dissolved sodium	Alkalinity	14	22	0.538	–132.400	37.945
Tollgate	**1**	**Dissolved sodium**	**Alkalinity**	**12**	**11**	**0.703**	**–332.051**	**94.793**
Sand Creek	**3**	**Dissolved sodium**	**Alkalinity**	**11**	**22**	**0.736**	**–357.669**	**98.222**
ALL	**3**	**Dissolved sodium**	**Dissolved chloride**	**62**	**113**	**0.747**	**–151.567**	**54.404**
Union	**3**	**Dissolved sodium**	**Dissolved chloride**	**14**	**22**	**0.889**	**0.650**	**0.799**
Denver	**3**	**Dissolved sodium**	**Dissolved chloride**	**14**	**31**	**0.919**	**0.640**	**0.826**
Tollgate	3	Dissolved sodium	Dissolved chloride	12	11	0.617	–175.783	63.283
Sand Creek	**3**	**Dissolved sodium**	**Dissolved chloride**	**11**	**22**	**0.833**	**–268.017**	**83.460**
Henderson	**3**	**Dissolved sodium**	**Dissolved chloride**	**7**	**27**	**0.974**	**1.002**	**0.756**
ALL	3	Dissolved sodium	Dissolved manganese	62	113	0.403	3.247	0.238
Union	3	Dissolved sodium	Dissolved manganese	14	22	0.247	3.103	0.154
Denver	3	Dissolved sodium	Dissolved manganese	14	31	0.631	3.172	0.247
Sand Creek	3	Dissolved sodium	Dissolved manganese	11	22	0.494	3.717	0.195
Henderson	**3**	**Dissolved sodium**	**Dissolved manganese**	**7**	**27**	**0.656**	**2.651**	**0.384**
ALL	3	Dissolved sodium	Ammonia	56	119	0.248	4.444	0.302
Sand Creek	3	Dissolved sodium	Ammonia	11	22	0.541	5.114	0.812
Henderson	**3**	**Dissolved sodium**	**Ammonia**	**7**	**27**	**0.700**	**4.067**	**0.617**
Denver	2	Dissolved sodium	Dissolved lead	13	32	0.303	86.659	21.001
ALL	**3**	**Dissolved sodium**	**Dissolved sulfate**	**62**	**113**	**0.681**	**21.934**	**0.309**
Union	3	Dissolved sodium	Dissolved sulfate	14	22	0.582	–72.167	25.285
Tollgate	**1**	**Dissolved sodium**	**Dissolved sulfate**	**12**	**11**	**0.922**	**19.271**	**0.278**
Sand Creek	**2**	**Dissolved sodium**	**Dissolved sulfate**	**11**	**22**	**0.947**	**–253.699**	**67.327**
ALL	3	Dissolved sodium	Dissolved zinc	61	114	0.344	3.015	0.463
Union	3	Dissolved sodium	Dissolved zinc	14	22	0.312	2.694	0.529
Denver	3	Dissolved sodium	Dissolved zinc	14	31	0.478	2.721	0.461
Tollgate	**3**	**Dissolved sodium**	**Dissolved zinc**	**12**	**11**	**0.710**	**3.560**	**0.370**
Sand Creek	3	Dissolved sodium	Dissolved zinc	10	23	0.357	3.434	0.449
ALL	3	Ammonia	Dissolved manganese	116	59	0.339	–2.600	0.420
Union	1	Ammonia	Dissolved manganese	19	17	0.599	0.095	0.001
Denver	3	Ammonia	Dissolved manganese	32	13	0.338	–2.394	0.368
Tollgate	1	Ammonia	Dissolved manganese	18	5	0.424	0.188	0.000
Sand Creek	2	Ammonia	Dissolved manganese	21	12	0.312	–2.331	0.326
Henderson	**1**	**Ammonia**	**Dissolved manganese**	**22**	**12**	**0.810**	**0.462**	**0.013**
ALL	1	Ammonia	Dissolved lead	81	94	0.567	–0.374	5.443
Union	**1**	**Ammonia**	**Dissolved lead**	**3**	**33**	**0.984**	**0.744**	**–3.992**
Denver	1	Ammonia	Dissolved lead	30	15	0.399	1.383	0.545
Sand Creek	1	Ammonia	Dissolved lead	17	16	0.267	1.120	0.359
Henderson	1	Ammonia	Dissolved lead	22	12	0.521	3.930	1.758

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	2	Nitrite + nitrate	Dissolved manganese	128	47	0.154	0.567	0.299
Union	3	Nitrite + nitrate	Dissolved manganese	27	9	0.226	–0.664	0.163
Denver	3	Nitrite + nitrate	Dissolved manganese	34	11	0.420	1.482	0.023
Sand Creek	3	Nitrite + nitrate	Dissolved manganese	24	9	0.233	–0.534	0.148
Henderson	**3**	**Nitrite + nitrate**	**Dissolved manganese**	**22**	**12**	**0.785**	**–0.410**	**0.327**
ALL	**1**	**Nitrite + nitrate**	**Orthophosphate**	**126**	**49**	**0.720**	**0.622**	**4.381**
Denver	**2**	**Nitrite + nitrate**	**Orthophosphate**	**34**	**11**	**0.876**	**5.260**	**2.032**
Tollgate	2	Nitrite + nitrate	Orthophosphate	15	8	0.229	0.746	–3.502
Henderson	**3**	**Nitrite + nitrate**	**Orthophosphate**	**22**	**12**	**0.765**	**1.446**	**0.710**
ALL	2	Nitrite + nitrate	Dissolved lead	87	88	0.394	4.385	1.443
Denver	2	Nitrite + nitrate	Dissolved lead	32	13	0.288	4.612	1.333
Henderson	**2**	**Nitrite + nitrate**	**Dissolved lead**	**22**	**12**	**0.656**	**5.301**	**1.945**
ALL	3	Nitrite + nitrate	Dissolved zinc	127	48	0.226	–0.699	0.377
Union	2	Nitrite + nitrate	Dissolved zinc	27	9	0.278	–1.048	0.537
Denver	3	Nitrite + nitrate	Dissolved zinc	34	11	0.571	–1.068	0.732
Sand Creek	3	Nitrite + nitrate	Dissolved zinc	23	10	0.206	–0.543	0.167
Henderson	**3**	**Nitrite + nitrate**	**Dissolved zinc**	**22**	**12**	**0.684**	**–1.146**	**0.745**
Union	2	Orthophosphate	Dissolved manganese	27	9	0.258	0.107	–0.015
Denver	1	Orthophosphate	Dissolved manganese	34	11	0.460	0.161	0.003
Henderson	**3**	**Orthophosphate**	**Dissolved manganese**	**22**	**12**	**0.678**	**–2.261**	**0.375**
ALL	3	Dissolved lead	Dissolved manganese	87	88	0.312	–2.392	0.191
Denver	1	Dissolved lead	Dissolved manganese	32	13	0.495	0.114	0.002
Sand Creek	3	Dissolved lead	Dissolved manganese	19	14	0.358	–2.486	0.189
Henderson	**1**	**Dissolved lead**	**Dissolved manganese**	**22**	**12**	**0.743**	**0.148**	**0.002**
ALL	3	Dissolved lead	Dissolved zinc	87	88	0.275	–2.739	0.393
Denver	1	Dissolved lead	Dissolved zinc	32	13	0.558	–3.318	0.628
Sand Creek	3	Dissolved lead	Dissolved zinc	18	15	0.386	–2.616	0.243
Henderson	3	Dissolved lead	Dissolved zinc	23	11	0.570	–5.026	1.354
ALL	3	Total lead	Total manganese	131	44	0.611	–3.881	1.082
Union	**1**	**Total lead**	**Total manganese**	**27**	**9**	**0.899**	**–3.116**	**0.041**
Denver	**1**	**Total lead**	**Total manganese**	**34**	**11**	**0.783**	**–4.412**	**1.251**
Tollgate	1	Total lead	Total manganese	20	3	0.524	–2.992	0.832
Sand Creek	3	Total lead	Total manganese	24	9	0.843	–4.398	1.148
Henderson	**3**	**Total lead**	**Total manganese**	**22**	**12**	**0.652**	**–3.540**	**1.101**
ALL	**3**	**Total lead**	**Total zinc**	**130**	**45**	**0.720**	**–1.541**	**0.934**
Union	**1**	**Total lead**	**Total zinc**	**27**	**9**	**0.977**	**–1.135**	**0.242**
Denver	**3**	**Total lead**	**Total zinc**	**34**	**11**	**0.944**	**–2.472**	**1.186**
Tollgate	**1**	**Total lead**	**Total zinc**	**20**	**3**	**0.809**	**–2.829**	**1.180**
Henderson	**3**	**Total lead**	**Total zinc**	**22**	**12**	**0.817**	**–1.922**	**1.069**
ALL	3	Streamflow volume	Alkalinity	58	117	0.191	18.343	–2.939
Union	2	Streamflow volume	Alkalinity	14	22	0.622	2,309.927	–476.806
Denver	**2**	**Streamflow volume**	**Alkalinity**	**14**	**31**	**0.764**	**9,818.997**	**–2,032.055**
Tollgate	2	Streamflow volume	Alkalinity	8	15	0.619	1,587.981	–344.285
Sand Creek	3	Streamflow volume	Alkalinity	11	22	0.554	17.850	–2.861
Henderson	**3**	**Streamflow volume**	**Alkalinity**	**7**	**27**	**0.734**	**15.931**	**–1.925**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Streamflow volume	Dissolved chloride	58	117	0.076	8.984	–0.947
Union	2	Streamflow volume	Dissolved chloride	14	22	0.402	974.679	–216.066
Denver	2	Streamflow volume	Dissolved chloride	14	31	0.449	4,333.135	–928.814
Sand Creek	**3**	**Streamflow volume**	**Dissolved chloride**	**11**	**22**	**0.714**	**15.935**	**–2.595**
Union	2	Streamflow volume	Dissolved fluoride	14	22	0.319	116.035	–185.626
Denver	1	Streamflow volume	Dissolved fluoride	14	31	0.572	2,286.662	–2,543.802
Tollgate	3	Streamflow volume	Dissolved fluoride	8	15	0.398	555.146	–1,466.386
Sand Creek	3	Streamflow volume	Dissolved fluoride	11	22	0.350	3.093	–2.220
Henderson	**3**	**Streamflow volume**	**Dissolved fluoride**	**7**	**27**	**0.750**	**6.464**	**–1.495**
Union	3	Streamflow volume	Dissolved potassium	14	22	0.471	8.866	–2.949
Denver	**3**	**Streamflow volume**	**Dissolved potassium**	**14**	**31**	**0.673**	**11.256**	**–3.287**
Sand Creek	3	Streamflow volume	Dissolved potassium	11	22	0.609	10.524	–3.796
Henderson	**3**	**Streamflow volume**	**Dissolved potassium**	**7**	**27**	**0.667**	**10.365**	**–1.658**
ALL	3	Streamflow volume	Dissolved sodium	58	117	0.207	11.317	–1.524
Union	2	Streamflow volume	Dissolved sodium	14	22	0.487	1,185.034	–280.518
Denver	2	Streamflow volume	Dissolved sodium	14	31	0.629	5,627.323	–1,276.56
Tollgate	2	Streamflow volume	Dissolved sodium	8	15	0.474	887.587	–187.675
Sand Creek	**3**	**Streamflow volume**	**Dissolved sodium**	**11**	**22**	**0.696**	**14.983**	**–2.302**
Henderson	2	Streamflow volume	Dissolved sodium	7	27	0.425	7,582.725	–1,390.661
ALL	3	Streamflow volume	Dissolved sulfate	58	117	0.515	15.288	–2.170
Union	**2**	**Streamflow volume**	**Dissolved sulfate**	**14**	**22**	**0.628**	**1,507.371**	**–306.914**
Denver	**2**	**Streamflow volume**	**Dissolved sulfate**	**14**	**31**	**0.823**	**6,923.504**	**–1,422.584**
Tollgate	2	Streamflow volume	Dissolved sulfate	8	15	0.551	1,045.490	–181.234
Sand Creek	3	Streamflow volume	Dissolved sulfate	11	22	0.577	13.835	–1.765
Henderson	**3**	**Streamflow volume**	**Dissolved sulfate**	**7**	**27**	**0.738**	**14.087**	**–1.532**
ALL	3	Specific conductance	Alkalinity	54	121	0.369	2.297	0.910
Union	1	Specific conductance	Alkalinity	11	25	0.586	–1,194.733	367.662
Denver	3	Specific conductance	Alkalinity	14	31	0.612	2.065	0.928
Tollgate	**3**	**Specific conductance**	**Alkalinity**	**10**	**13**	**0.786**	**–3,350.682**	**953.958**
Sand Creek	3	Specific conductance	Alkalinity	10	23	0.619	2.819	0.837
ALL	**1**	**Specific conductance**	**Dissolved calcium**	**110**	**65**	**0.788**	**2.358**	**1.038**
Union	**3**	**Specific conductance**	**Dissolved calcium**	**21**	**15**	**0.705**	**2.009**	**1.092**
Denver	**3**	**Specific conductance**	**Dissolved calcium**	**30**	**15**	**0.696**	**2.480**	**1.009**
Tollgate	**3**	**Specific conductance**	**Dissolved calcium**	**16**	**7**	**0.903**	**2.321**	**1.027**
Sand Creek	**3**	**Specific conductance**	**Dissolved calcium**	**21**	**12**	**0.858**	**2.533**	**1.015**
Henderson	3	Specific conductance	Dissolved calcium	18	16	0.498	–2,025.506	706.634
ALL	**3**	**Specific conductance**	**Dissolved chloride**	**54**	**121**	**0.691**	**3.794**	**0.646**
Union	**3**	**Specific conductance**	**Dissolved chloride**	**11**	**25**	**0.655**	**4.074**	**0.545**
Denver	**3**	**Specific conductance**	**Dissolved chloride**	**14**	**31**	**0.709**	**3.916**	**0.596**
Tollgate	1	Specific conductance	Dissolved chloride	10	13	0.586	3.867	0.686
Sand Creek	**3**	**Specific conductance**	**Dissolved chloride**	**10**	**23**	**0.696**	**3.011**	**0.838**
Henderson	**1**	**Specific conductance**	**Dissolved chloride**	**5**	**29**	**0.903**	**275.134**	**3.839**
ALL	3	Specific conductance	Hardness as calcium carbonate	151	24	0.628	2.061	0.839
Union	3	Specific conductance	Hardness as calcium carbonate	30	6	0.430	3.056	0.605
Denver	3	Specific conductance	Hardness as calcium carbonate	40	5	0.639	2.052	0.838
Tollgate	**1**	**Specific conductance**	**Hardness as calcium carbonate**	**19**	**4**	**0.829**	**1.744**	**0.901**
Sand Creek	3	Specific conductance	Hardness as calcium carbonate	29	4	0.628	2.357	0.805
Henderson	3	Specific conductance	Hardness as calcium carbonate	29	5	0.421	3.116	0.650

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	**1**	**Specific conductance**	**Dissolved magnesium**	**110**	**65**	**0.796**	**4.344**	**0.900**
Union	3	Specific conductance	Dissolved magnesium	21	15	0.601	4.641	0.672
Denver	**3**	**Specific conductance**	**Dissolved magnesium**	**30**	**15**	**0.812**	**4.465**	**0.830**
Tollgate	**1**	**Specific conductance**	**Dissolved magnesium**	**16**	**7**	**0.949**	**4.577**	**0.835**
Sand Creek	**3**	**Specific conductance**	**Dissolved magnesium**	**21**	**12**	**0.908**	**4.562**	**0.871**
Henderson	**3**	**Specific conductance**	**Dissolved magnesium**	**18**	**16**	**0.680**	**4.478**	**0.857**
ALL	**3**	**Specific conductance**	**Dissolved sodium**	**54**	**121**	**0.881**	**3.451**	**0.723**
Union	**2**	**Specific conductance**	**Dissolved sodium**	**11**	**25**	**0.765**	**–540.615**	**277.712**
Denver	**3**	**Specific conductance**	**Dissolved sodium**	**14**	**31**	**0.829**	**3.354**	**0.748**
Tollgate	**1**	**Specific conductance**	**Dissolved sodium**	**10**	**13**	**0.984**	**95.487**	**8.884**
Sand Creek	**3**	**Specific conductance**	**Dissolved sodium**	**10**	**23**	**0.866**	**3.239**	**0.765**
Henderson	**1**	**Specific conductance**	**Dissolved sodium**	**5**	**29**	**0.892**	**3.441**	**0.692**
Denver	2	Specific conductance	Dissolved lead	28	17	0.336	961.722	238.445
Tollgate	**1**	**Specific conductance**	**Dissolved lead**	**6**	**17**	**0.777**	**–1,296.216**	**20,249.705**
ALL	**1**	**Specific conductance**	**Dissolved sulfate**	**54**	**121**	**0.754**	**286.059**	**2.600**
Union	2	Specific conductance	Dissolved sulfate	11	25	0.567	–551.779	233.593
Denver	3	Specific conductance	Dissolved sulfate	14	31	0.619	3.471	0.630
Tollgate	**1**	**Specific conductance**	**Dissolved sulfate**	**10**	**13**	**0.967**	**216.692**	**2.697**
Sand Creek	**3**	**Specific conductance**	**Dissolved sulfate**	**10**	**23**	**0.844**	**3.553**	**0.602**
ALL	3	Dissolved sulfate	Dissolved manganese	62	113	0.336	3.892	0.246
Denver	3	Dissolved sulfate	Dissolved manganese	14	31	0.578	3.707	0.242
Sand Creek	3	Dissolved sulfate	Dissolved manganese	11	22	0.491	4.275	0.231
Henderson	**1**	**Dissolved sulfate**	**Dissolved manganese**	**7**	**27**	**0.918**	**49.561**	**0.516**
Sand Creek	**3**	**Dissolved sulfate**	**Ammonia**	**11**	**22**	**0.672**	**6.036**	**1.074**
Henderson	**3**	**Dissolved sulfate**	**Ammonia**	**7**	**27**	**0.803**	**4.362**	**0.387**
Union	1	Dissolved sulfate	Nitrite + nitrate	14	22	0.540	4.367	0.658
Denver	**2**	**Dissolved sulfate**	**Nitrite + nitrate**	**14**	**31**	**0.794**	**57.886**	**42.992**
Tollgate	3	Dissolved sulfate	Nitrite + nitrate	12	11	0.411	5.769	0.881
Henderson	**1**	**Dissolved sulfate**	**Nitrite + nitrate**	**7**	**27**	**0.937**	**29.588**	**21.721**
ALL	2	Dissolved sulfate	Orthophosphate	62	113	0.136	53.598	–31.946
Denver	2	Dissolved sulfate	Orthophosphate	14	31	0.642	139.860	38.305
Tollgate	2	Dissolved sulfate	Orthophosphate	12	11	0.392	4.140	–0.354
Henderson	**2**	**Dissolved sulfate**	**Orthophosphate**	**7**	**27**	**0.964**	**120.954**	**42.577**
ALL	1	Dissolved sulfate	Dissolved zinc	61	114	0.203	77.169	4.833
Union	3	Dissolved sulfate	Dissolved zinc	14	22	0.327	3.396	0.562
Denver	3	Dissolved sulfate	Dissolved zinc	14	31	0.440	3.261	0.454
Tollgate	2	Dissolved sulfate	Dissolved zinc	12	11	0.627	4.384	0.438
Henderson	**2**	**Dissolved sulfate**	**Dissolved zinc**	**7**	**27**	**0.872**	**–81.086**	**64.098**
ALL	**3**	**Ammonia + organic N**	**Total copper**	**131**	**44**	**0.705**	**–1.375**	**0.756**
Union	**3**	**Ammonia + organic N**	**Total copper**	**27**	**9**	**0.858**	**–1.376**	**0.697**
Denver	**1**	**Ammonia + organic N**	**Total copper**	**34**	**11**	**0.802**	**–1.496**	**0.774**
Tollgate	1	Ammonia + organic N	Total copper	20	3	0.564	–2.238	1.639
Sand Creek	3	Ammonia + organic N	Total copper	24	9	0.541	–0.866	0.625
ALL	2	Ammonia + organic N	Dissolved manganese	131	44	0.062	2.614	0.003
Union	1	Ammonia + organic N	Dissolved manganese	27	9	0.495	1.131	0.017
Denver	1	Ammonia + organic N	Dissolved manganese	34	11	0.337	1.580	0.037
Sand Creek	2	Ammonia + organic N	Dissolved manganese	24	9	0.226	2.659	0.008
Henderson	**1**	**Ammonia + organic N**	**Dissolved manganese**	**22**	**12**	**0.686**	**2.158**	**0.029**

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	3	Ammonia + organic N	Total manganese	131	44	0.555	–3.059	0.649
Union	**1**	**Ammonia + organic N**	**Total manganese**	**27**	**9**	**0.865**	**–3.896**	**0.747**
Denver	**3**	**Ammonia + organic N**	**Total manganese**	**34**	**11**	**0.801**	**–3.819**	**0.806**
Tollgate	1	Ammonia + organic N	Total manganese	20	3	0.399	1.031	0.002
Sand Creek	**1**	**Ammonia + organic N**	**Total manganese**	**24**	**9**	**0.700**	**1.085**	**0.003**
ALL	1	Ammonia + organic N	Ammonia	116	59	0.550	1.769	2.210
Union	1	Ammonia + organic N	Ammonia	19	17	0.321	1.638	0.529
Denver	**1**	**Ammonia + organic N**	**Ammonia**	**32**	**13**	**0.755**	**0.832**	**5.172**
Sand Creek	1	Ammonia + organic N	Ammonia	21	12	0.552	1.520	4.403
Henderson	**1**	**Ammonia + organic N**	**Ammonia**	**22**	**12**	**0.716**	**1.408**	**2.063**
ALL	**3**	**Ammonia + organic N**	**Total lead**	**131**	**44**	**0.650**	**–0.492**	**0.507**
Union	**1**	**Ammonia + organic N**	**Total lead**	**27**	**9**	**0.868**	**0.571**	**0.090**
Denver	**3**	**Ammonia + organic N**	**Total lead**	**34**	**11**	**0.724**	**–0.702**	**0.542**
Tollgate	1	Ammonia + organic N	Total lead	20	3	0.640	1.085	0.091
Sand Creek	3	Ammonia + organic N	Total lead	24	9	0.364	2.103	0.045
ALL	**3**	**Ammonia + organic N**	**Total phosphorus**	**171**	**4**	**0.825**	**1.189**	**0.752**
Union	**1**	**Ammonia + organic N**	**Total phosphorus**	**36**	**0**	**0.869**	**0.289**	**3.213**
Denver	**1**	**Ammonia + organic N**	**Total phosphorus**	**44**	**1**	**0.865**	**1.154**	**0.925**
Tollgate	3	Ammonia + organic N	Total phosphorus	22	1	0.615	1.116	0.567
Sand Creek	**3**	**Ammonia + organic N**	**Total phosphorus**	**32**	**1**	**0.738**	**1.248**	**0.779**
Henderson	3	Ammonia + organic N	Total phosphorus	33	1	0.597	1.294	0.671
ALL	**3**	**Ammonia + organic N**	**Total zinc**	**130**	**45**	**0.654**	**–1.657**	**0.560**
Union	**1**	**Ammonia + organic N**	**Total zinc**	**27**	**9**	**0.915**	**0.424**	**0.023**
Denver	**1**	**Ammonia + organic N**	**Total zinc**	**34**	**11**	**0.848**	**–2.359**	**0.716**
Tollgate	1	Ammonia + organic N	Total zinc	20	3	0.488	–3.895	1.457
Sand Creek	1	Ammonia + organic N	Total zinc	23	10	0.551	1.891	0.005
Henderson	3	Ammonia + organic N	Total zinc	22	12	0.310	2.053	0.017
ALL	**1**	**Total phosphorus**	**Total copper**	**130**	**45**	**0.846**	**–3.218**	**0.961**
Union	**1**	**Total phosphorus**	**Total copper**	**27**	**9**	**0.967**	**–3.570**	**1.028**
Denver	**1**	**Total phosphorus**	**Total copper**	**34**	**11**	**0.704**	**–2.452**	**0.696**
Tollgate	**1**	**Total phosphorus**	**Total copper**	**19**	**4**	**0.869**	**–3.503**	**1.033**
Sand Creek	**3**	**Total phosphorus**	**Total copper**	**24**	**9**	**0.860**	**–2.711**	**0.813**
Henderson	**1**	**Total phosphorus**	**Total copper**	**22**	**12**	**0.706**	**0.391**	**0.032**
ALL	3	Total phosphorus	Total manganese	130	45	0.623	–5.227	0.803
Union	**1**	**Total phosphorus**	**Total manganese**	**27**	**9**	**0.829**	**–6.801**	**1.015**
Denver	**3**	**Total phosphorus**	**Total manganese**	**34**	**11**	**0.863**	**–4.982**	**0.802**
Tollgate	1	Total phosphorus	Total manganese	19	4	0.563	–5.029	0.704
Sand Creek	**3**	**Total phosphorus**	**Total manganese**	**24**	**9**	**0.842**	**–4.469**	**0.672**
Henderson	**3**	**Total phosphorus**	**Total manganese**	**22**	**12**	**0.716**	**–4.087**	**0.709**
ALL	**3**	**Total phosphorus**	**Total lead**	**130**	**45**	**0.809**	**–2.129**	**0.657**
Union	**1**	**Total phosphorus**	**Total lead**	**27**	**9**	**0.958**	**0.110**	**0.029**
Denver	**1**	**Total phosphorus**	**Total lead**	**34**	**11**	**0.683**	**0.268**	**0.023**
Tollgate	**1**	**Total phosphorus**	**Total lead**	**19**	**4**	**0.958**	**0.118**	**0.043**
Sand Creek	**3**	**Total phosphorus**	**Total lead**	**24**	**9**	**0.845**	**–1.764**	**0.538**
Henderson	3	Total phosphorus	Total lead	22	12	0.404	–0.962	0.391

Table 11. Results of linear regression analyses, water years 2002–2005.—Continued

[Group indicates that data represent results from all stations (ALL), South Platte River below Union Avenue at Englewood (Union), South Platte River at Denver (Denver), Tollgate Creek above 6th Avenue at Aurora (Tollgate), Sand Creek at mouth near Commerce City (Sand Creek), or South Platte River at Henderson (Henderson); T indicates transform: 1, no transform; 2 natural log transform for dependent variable; 3, natural log transform for both variables; Dependent and Independent describe regression variables. n, number of values used in regression; M, number of missing values; r^2, coefficient of determination (commonly referred to as r-squared). Intercept, y-axis intercept of the linear regression line; Slope, slope of the linear regression line. Regressions with r^2 values greater than 0.65 are shown in bold print]

Station	T	Water-quality properties or constituents		n	M	r^2	Intercept	Slope
		Dependent	Independent					
ALL	**3**	**Total phosphorus**	**Total zinc**	**129**	**46**	**0.691**	**–3.389**	**0.670**
Union	**3**	**Total phosphorus**	**Total zinc**	**27**	**9**	**0.939**	**–4.250**	**0.877**
Denver	**1**	**Total phosphorus**	**Total zinc**	**34**	**11**	**0.859**	**0.144**	**0.006**
Tollgate	**1**	**Total phosphorus**	**Total zinc**	**19**	**4**	**0.656**	**–4.298**	**0.861**
Sand Creek	3	Total phosphorus	Total zinc	23	10	0.491	–2.262	0.394
Henderson	3	Total phosphorus	Total zinc	22	12	0.634	–2.505	0.579
ALL	**3**	**Residue at 105°C**	**Total copper**	**125**	**50**	**0.751**	**1.760**	**1.200**
Union	**3**	**Residue at 105°C**	**Total copper**	**25**	**11**	**0.905**	**1.403**	**1.495**
Denver	**3**	**Residue at 105°C**	**Total copper**	**33**	**12**	**0.828**	**1.479**	**1.250**
Tollgate	**3**	**Residue at 105°C**	**Total copper**	**18**	**5**	**0.937**	**1.350**	**1.427**
Sand Creek	**3**	**Residue at 105°C**	**Total copper**	**24**	**9**	**0.875**	**0.779**	**1.552**
Henderson	**1**	**Residue at 105°C**	**Total copper**	**21**	**13**	**0.704**	**1.241**	**1.195**
ALL	3	Residue at 105°C	Total manganese	125	50	0.624	–1.058	1.057
Union	**1**	**Residue at 105°C**	**Total manganese**	**25**	**11**	**0.897**	**–143.611**	**1.162**
Denver	**3**	**Residue at 105°C**	**Total manganese**	**33**	**12**	**0.750**	**–1.940**	**1.244**
Tollgate	1	Residue at 105°C	Total manganese	18	5	0.358	–1,756.927	338.760
Sand Creek	**3**	**Residue at 105°C**	**Total manganese**	**24**	**9**	**0.766**	**–2.137**	**1.212**
Henderson	3	Residue at 105°C	Total manganese	21	13	0.472	–1,403.339	267.747
ALL	2	Residue at 105°C	Dissolved lead	87	88	0.109	530.578	134.118
Henderson	**1**	**Residue at 105°C**	**Dissolved lead**	**22**	**12**	**0.935**	**182.790**	**319.447**
ALL	**3**	**Residue at 105°C**	**Total lead**	**125**	**50**	**0.739**	**3.055**	**0.844**
Union	**1**	**Residue at 105°C**	**Total lead**	**25**	**11**	**0.900**	**3.044**	**1.013**
Denver	**3**	**Residue at 105°C**	**Total lead**	**33**	**12**	**0.861**	**2.589**	**0.942**
Tollgate	**3**	**Residue at 105°C**	**Total lead**	**18**	**5**	**0.915**	**3.052**	**1.030**
Sand Creek	**3**	**Residue at 105°C**	**Total lead**	**24**	**9**	**0.892**	**2.533**	**1.046**
Henderson	1	Residue at 105°C	Total lead	21	13	0.528	2.695	0.805
ALL	3	Residue at 105°C	Ammonia + organic N	166	9	0.396	4.432	1.061
Union	**1**	**Residue at 105°C**	**Ammonia + organic N**	**34**	**2**	**0.847**	**–137.831**	**256.262**
Denver	3	Residue at 105°C	Ammonia + organic N	43	2	0.569	4.191	1.242
Tollgate	3	Residue at 105°C	Ammonia + organic N	21	2	0.522	4.283	1.659
Sand Creek	3	Residue at 105°C	Ammonia + organic N	32	1	0.391	4.340	1.207
Henderson	3	Residue at 105°C	Ammonia + organic N	32	2	0.254	3.478	1.344
ALL	3	Residue at 105°C	Total phosphorus	166	9	0.480	5.752	0.981
Union	**1**	**Residue at 105°C**	**Total phosphorus**	**34**	**2**	**0.856**	**–99.591**	**892.699**
Denver	2	Residue at 105°C	Total phosphorus	43	2	0.462	376.397	295.045
Tollgate	**3**	**Residue at 105°C**	**Total phosphorus**	**21**	**2**	**0.809**	**6.374**	**1.452**
Sand Creek	3	Residue at 105°C	Total phosphorus	32	1	0.583	5.957	1.335
Henderson	**1**	**Residue at 105°C**	**Total phosphorus**	**32**	**2**	**0.762**	**–857.620**	**781.536**
ALL	3	Residue at 105°C	Total zinc	124	51	0.470	2.017	0.731
Union	**1**	**Residue at 105°C**	**Total zinc**	**25**	**11**	**0.903**	**–71.066**	**6.514**
Denver	3	Residue at 105°C	Total zinc	33	12	0.557	–817.903	245.747
Tollgate	**1**	**Residue at 105°C**	**Total zinc**	**18**	**5**	**0.808**	**–220.809**	**6.341**
Sand Creek	3	Residue at 105°C	Total zinc	23	10	0.268	2.654	0.549
Henderson	1	Residue at 105°C	Total zinc	21	13	0.598	–1,040.420	265.738
ALL	**1**	**Dissolved zinc**	**Total zinc**	**130**	**45**	**0.685**	**–6.709**	**0.188**
Sand Creek	1	Dissolved zinc	Total zinc	23	10	0.443	–182.832	46.270

Table 12. Ninety-five percent confidence bounds for means of selected water-quality properties and constituents period 1 (water years 1998–2001) and period 2 (water years 2002–2005).

[ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter at 25 degrees Celsius; C, Celsius; mg/L, milligrams per liter; N, nitrogen; P, phosphorus; µg/L, micrograms per liter]

Water-quality property or constituent	95-percent confidence bounds on mean value			
	Period 1		Period 2	
	Lower	Upper	Lower	Upper
Mean streamflow, in ft^3/s	758	1,030	492	780
Streamflow volume, in acre-feet	684	928	441	695
Specific conductance, in µS/cm	593	653	614	713
Hardness, as calcium carbonate, in mg/L	190	206	180	203
Residue at 105°C, in mg/L	471	620	325	573
Ammonia, as N, in mg/L	0.75	1.04	0.42	0.68
Nitrite + nitrate, as N, in mg/L	1.21	1.50	1.34	1.71
Ammonia + organic nitrogen, as N, in mg/L	2.37	2.81	2.00	2.46
Orthophosphate, as P, in mg/L	0.22	0.27	0.22	0.30
Total phosphorus, as P, in mg/L	0.63	0.75	0.83	1.09
Dissolved organic carbon, in mg/L	7.88	10.4	9.08	10.8
Dissolved copper, in µg/L	6.88	8.7	3.04	4.24
Total copper, in µg/L	21.1	26.0	20.5	26.4
Total lead, in µg/L	29.3	36.8	17.7	24.5
Dissolved manganese, in µg/L	162	236	49.1	107
Total manganese, in µg/L	406	571	450	590
Dissolved zinc, in µg/L	62.5	94.3	17.3	31.5
Total zinc, in µg/L	169	214	103	162

Annual means used to identify simple upward or downward temporal trends for period 2 are shown in figure 3. Relatively few trends were identified in period 1 (Bossong and others, 2005) and most trends in period 1 were local, occurring at only one or two stations. Some of the period 1 trends indicated decreases in concentrations. Trends for total organic carbon, ammonia plus organic nitrogen, and total phosphorus all indicated a consistent decrease at some stations during period 1, and about the same number indicated increases in values for specific conductance, or concentrations of hardness, orthophosphate, and ammonia at some stations. Annual means indicate more trends in period 2 than were indicated in period 1, and many of the period 2 trends are widespread. Two of the period 2 trends are for properties and constituents that indicated trends in period 1. Hardness indicated an upward trend at some stations in period 1 and a widespread downward trend in period 2; total phosphorus indicated a downward trend at some stations in period 1 and a widespread downward trend in period 2. Overall, more trends were observed in period 2 than in period 1, and most of the period 2 trends indicated decreases.

In period 1 there were relatively few strong or very strong regressions, and only one pair, total manganese with total lead, was widespread, occurring at all stations. In period 2 there were more strong and very strong regressions than in period 1, and many of them were widespread (table 11). For instance, total manganese was strongly or very strongly related to total lead, total copper, and residue on evaporation at 105 degrees Celsius at many stations in period 2.

Summary

The quality of stormwater runoff is of interest to many management and regulatory agencies as well as academia, scientists, recreational stream users, and the general public. The basic character of stormwater runoff is of general interest to all, whereas more detailed information concerning spatial and temporal variations may be of interest to management and regulatory agencies. In response to these interests, the U.S. Geological Survey, in cooperation with the Urban Drainage and Flood Control District, systematically collected stormwater samples during wet weather from a network of five monitoring stations in and around metropolitan Denver, Colorado. This report describes the quality of stormwater sampled from October 1, 2001, to October 11, 2005. The network includes three stations known as Union, Denver, and Henderson on the principal, or receiving, stream draining the area, the South Platte River. The network also includes stations on two tributary streams: Sand Creek, which is tributary to the South Platte River, and Tollgate Creek, which is tributary to Sand Creek. Sampling was facilitated using refrigerated or, in one case, iced automatic pumping samplers that were used to collect composite and discrete samples. Time-weighted composite stormwater samples were collected by compositing individual aliquots of stormwater that were obtained at fixed-time increments typically during 12-hour intervals; bacteriological samples were collected manually from streams during some storms. Discrete samples of stormwater also were collected during two storms; the discrete samples were submitted for laboratory analyses individually and were not physically composited. Various types of quality-assurance and quality-control samples also were collected to help evaluate laboratory performance, to evaluate relations between fixed-point and cross-section depth-integrated samples, and to document field and equipment conditions that could potentially affect results.

Composite samples for analysis of physical properties, major ions (in 2005), organic carbon, nutrients, and dissolved and total copper, lead, manganese, and zinc were submitted to the Metro Wastewater Reclamation District Laboratory (in water year 2002) and the U.S. Geological Survey National Water Quality Laboratory (in water years 2003–2005). Bacteriological samples were submitted to the Metro Wastewater Reclamation District Laboratory for determination of the bacteriological indicators *Escherichia coli* and fecal coliform. Discrete samples were submitted to the U.S. Geological Survey National Water Quality Laboratory for analysis of a suite of water-quality properties and constituents similar to those analyzed for in the composite samples; however, the discrete samples were not analyzed for total metals. Quality-control and quality-assurance results for laboratory performance indicate that results from both the National Water Quality Laboratory and the Metro Wastewater Reclamation District laboratory are consistently close to most probable values determined on the basis of results from as many as 100 laboratories across the country. Other quality-control and

quality-assurance results indicate no substantial contribution to concentrations from ambient field conditions or sampling equipment, and that samples collected from the fixed-point locations by pumping samplers are similar to, but not always the same as, samples collected using methods that vertically and horizontally integrate flow in the channel cross section.

Streamflow characteristics associated with 176 composite stormwater samples indicate that most samples were collected from falling or event hydrographs and that only a few samples were collected from rising hydrographs. Results from laboratory analyses of the composite samples indicate spatial patterns in which concentrations for some constituents increase with contributing drainage area in the South Platte River and Sand Creek, but no well-defined relation was identified between concentration and the amount of urban land cover identified using the U.S. Geological Survey National Land Cover data.

Results from 22 discrete samples, collected during two storms used to obtain composited results with various weighting methods, indicate that correlation coefficients between time-weighted and volume-weighted concentrations were generally at least 0.65, indicating a strong direct correlation between the two weighting methods for the stations involved in this study. In addition, the central tendency for relative percent differences between the time- and volume-weighting methods typically has a value of about 10, indicating good agreement for these weighting methods for data collected as part of this study.

Comparison of analytical results from stormwater samples to numeric standards developed by the Colorado Department of Public Health and Environment on the basis of use classifications indicates that, for water-quality properties and constituents other than bacteriological indicators, there were very few exceptions to numeric standards. Bacteriological indicators, however, such as *Escherichia coli* and fecal coliform consistently exceeded numeric standards in all bacteriological samples.

An evaluation of annual means of analytical results from composite stormwater samples indicates the presence of some simple upward and downward trends in concentrations. In general, for annual means of results for all stations, hardness, ammonia plus organic nitrogen, total phosphorus, most dissolved metals (lead, manganese, and zinc), and all total metals (copper, lead, manganese, and zinc) indicate annual means that decrease each year, or downward trends. In addition, some trends were indicated only at individual stations in the network rather than at all. Ammonia as nitrogen at Union, Denver, and Henderson; orthophosphate at Sand Creek; and nitrite plus nitrate at Denver and Henderson all indicate decreasing annual means, or downward trends. Only nitrite plus nitrate at Union and total copper and lead at Sand Creek showed consistently increasing annual means, or upward trends.

Linear regressions of analytical results from composite stormwater samples indicate widespread strong regressions (coefficient of determination or r^2 equal or greater than 0.65) among major ions. In addition, many widespread and strong regressions were noted among constituents known to have a particulate component; these include organic nitrogen plus ammonia with total phosphorus, total copper, and total zinc; total phosphorus with total copper, total lead, and total zinc; residue on evaporation at 105 degrees Celsius with total copper and total lead; and several additional regressions involving the metals (total copper with total lead, total manganese, and total zinc; and total lead with total zinc). Strong regressions generally are not widespread and occur mostly locally at individual stations for very soluble nonmajor constituents that have a very small or even no particulate component. The regression between nitrite plus nitrate and orthophosphate is the only strong regression for soluble constituents that are not major ions, at all stations. Together, relatively weak correlation coefficients between water-quality properties and constituents, with mean streamflow, indicate a heterogeneous and mixed system.

Results from this study were compared to results from an earlier U.S. Geological Survey study for water years 1998–2001 that collected data from the same network of stations using the same programmatic goals and sample-collection protocols. Samples from the two periods, based on the distribution of mean streamflow associated with composite samples, appear to represent similar conditions. There were many more exceptions to numeric standards in the earlier period than in this study. In addition, pooled means for all stations from this study are numerically lower and the 95-percent confidence intervals do not overlap with those from the earlier study for some metals (dissolved copper, manganese, and zinc; and total zinc) and indicate statistically significant decreases in concentrations. Simple downward trends in annual means were widespread for many constituents in this study and in general were more prevalent than in the earlier study.

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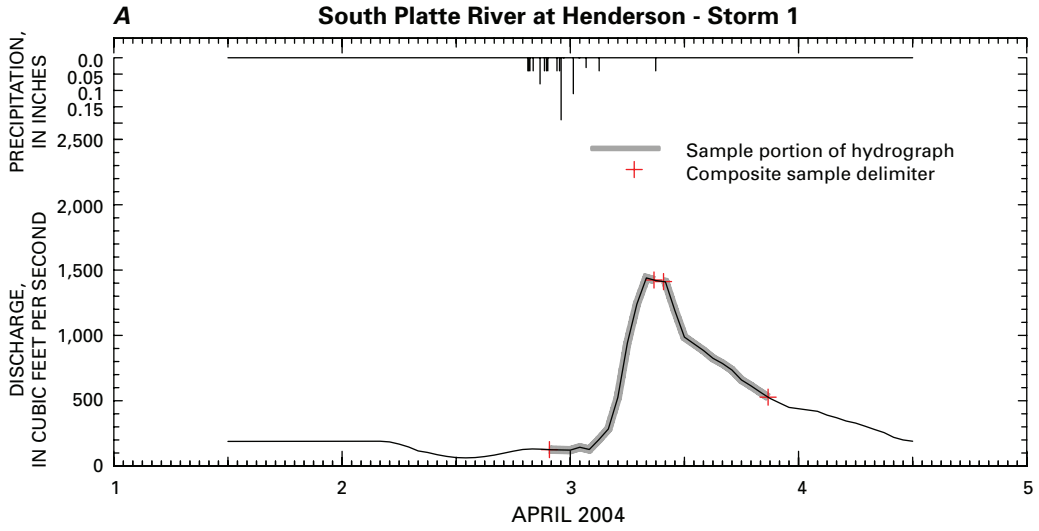
Appendix. Hydrograph Classification

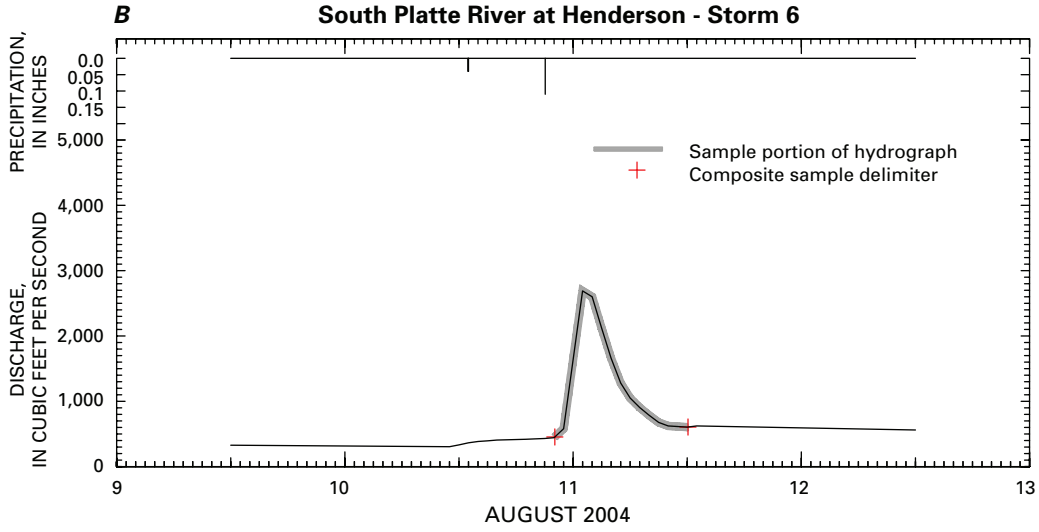
The portion of the storm hydrograph associated with each composite sample was classified as "rising," "falling," "event," or "unclassified." Examples for rising, falling, and event classifications are in figure A1. Samples classified as rising or falling are associated with the rising or falling limb of a storm hydrograph. Samples classified as event are associated with both a rising and falling portion of a storm hydrograph. In some cases, mostly at Tollgate, streamflow data were not available and samples were categorized as unclassified.

The hydrographs in figure A1 indicate examples of each classification and provide readers with a sense for storm hydrographs and the different classifications. Additional information that characterizes storm hydrographs sampled as part of this study in terms of peak streamflow and runoff volumes are in table 6. Summer storm hydrographs commonly originate from convective storm cells and have very steep rising limbs, steep falling limbs, and a duration that may be 12 hours or less in which case samples are classified as "event" (fig. A1*B*). Some summer storm hydrographs are longer and may have samples from the rising and falling limbs (fig. A1*A*). Spring storm hydrographs sometimes originate from snowfall that accumulates as wet snow over a period of hours and then melts over a period of a day or more. Spring storm hydrographs may have multiple peaks and a duration of days.



	Times				Precipitation depth	Computed mean runoff	Computed volume	Sample
	Beginning		Ending					
	(YYYYMMDD)	(HHMM)	(MMDD)	(HHMM)	(inches)	(cubic feet per second)	(acre-feet)	classification
Hydrograph	20040401	1200	0404	1200	0.85	372	2211	na
Sample 1	20040402	2148	0403	0848	na	515	468	rising
Sample 2	20040403	0948	0403	2048	na	847	770	falling

Discharge record from Colorado Division of Water Resources
Precipitation record from Urban Drainage and Flood Control District gage at Henderson
Beginning time in year (YYYY), month (MM), day (DD), hour (HH), and minute (MN)
na indicates not applicable



	Times				Precipitation depth	Computed mean runoff	Computed volume	Sample
	Beginning		Ending					
	(YYYYMMDD)	(HHMM)	(MMDD)	(HHMM)	(inches)	(cubic feet per second)	(acre-feet)	classification
Hydrograph	20040809	1200	0812	1200	0.19	611	3632	na
Sample 1	20040810	2205	0811	1205	na	1293	1496	event

Discharge record from Colorado Division of Water Resources
Precipitation record from Urban Drainage and Flood Control District gage at Henderson
Beginning time in year (YYYY), month (MM), day (DD), hour (HH), and minute (MN)
na indicates not applicable

Figure A1. Example storm hydrographs showing (*A*) rising, falling, and (*B*) event sample classifications.

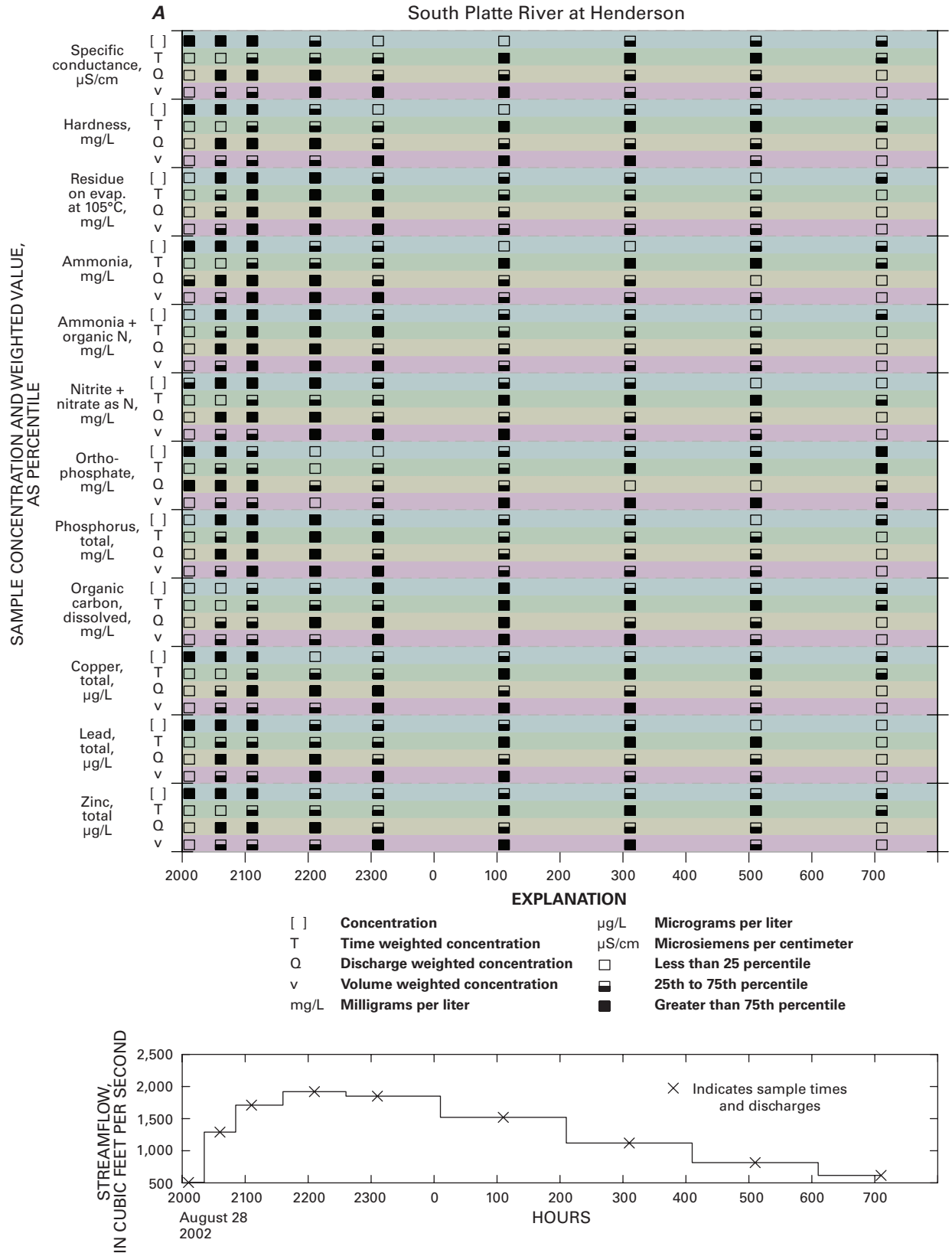


Figure A2. Graphs showing results from discrete sampling events (*A*) August 28, 2002, at South Platte River at Henderson, (*B*) August 18, 2004, at South Platte River at Denver.

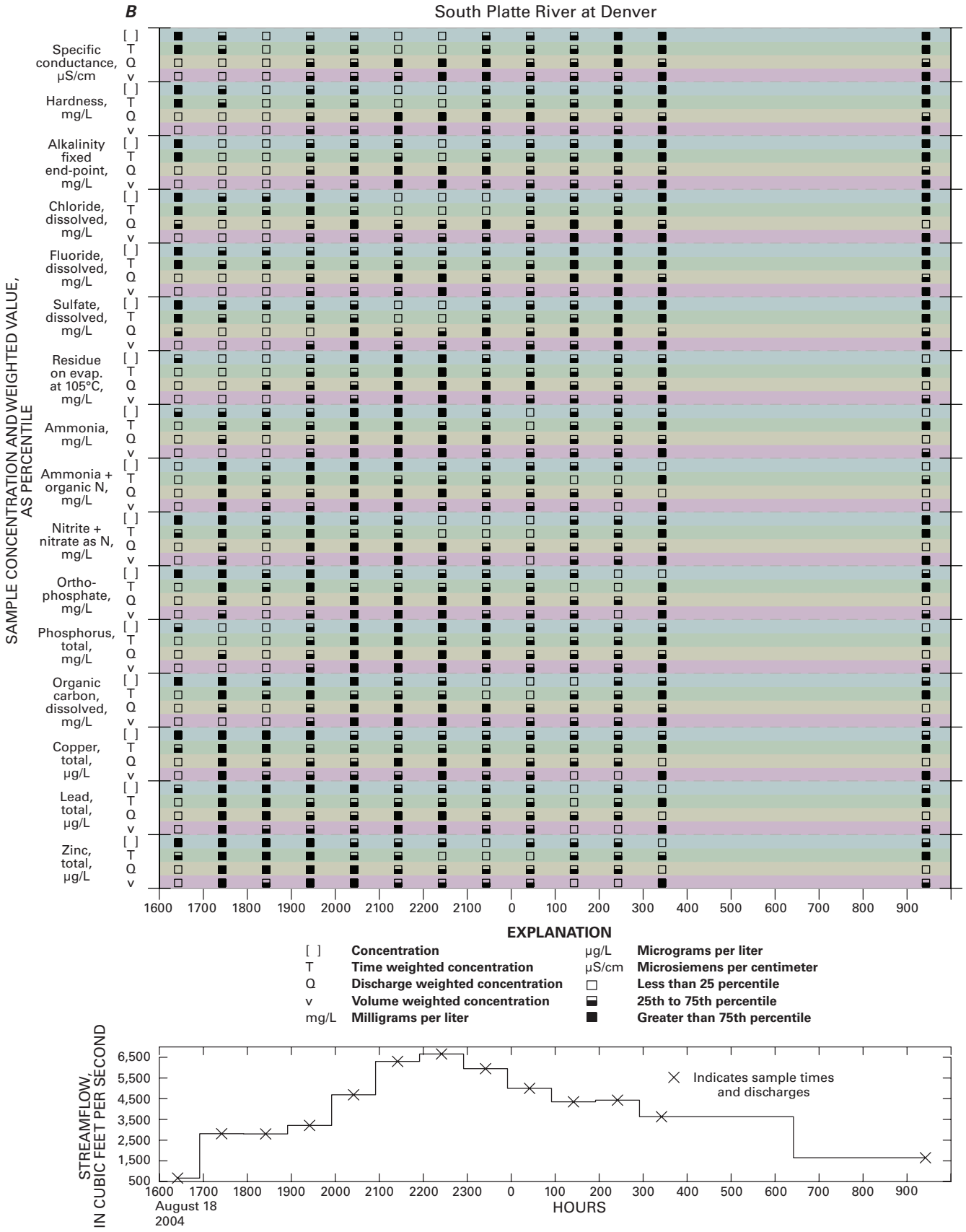


Figure A2. Graphs showing results from discrete sampling events (*A*) August 28, 2002, at South Platte River at Henderson, (*B*) August 18, 2004, at South Platte River at Denver.—Continued

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Table A1. Results from discrete samples collected during storms and computed time, discharge, and volume-weighted concentrations, with relative percent differences.

[Samples collected with pumping samplers. Analytical determination made at USGS National Water Quality Laboratory; –999, missing value (isolated missing values were replaced with an average of the preceding and following values for weighting computations); values greater than –999 and less than 0 are censored. Laboratory estimated values included in weighting computations; Weighting method—Time: (summation of interval × concentration) / sampling period time, where interval is the sum of the midpoint between sample time preceding and following sample times—Discharge: (summation of discharge × concentration) / summation of discharge—Volume: (summation of interval × discharge × concentration) / (summation of interval × discharge); RPD, relative percent difference: 1, time and discharge; 2, time and volume; 3, discharge and volume; wh, whole water unfiltered; wf, whole water filtered; fxdEP, fixed endpoint. ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; la, laboratory; NO_2, nitrite; NO_3, nitrate; N, nitrogen; P, phosphorus; µg/L, micrograms per liter]

	Weighting method			RPD1	RPD2	RPD3
	Time	Discharge	Volume			
Storm 1						
Station number 06720500 (Henderson)						
Date (yyyymmdd)	--	--	--	--	--	--
Time (hhmm)	--	--	--	--	--	--
Decimal julian day	--	--	--	--	--	--
00065 Gage height (feet)	5.702	5.839	5.850	–2.380	–2.571	–0.190
00061 Discharge (ft^3/s)	1,297.708	1,459.559	1,453.353	–11.740	–11.315	0.426
00403 pH, wh, laboratory (standard units)	6.814	6.848	6.766	–0.499	0.708	1.208
Field conductivity (µS/cm)	657.141	716.197	652.017	–8.600	0.783	9.381
90095 Specific conductance (µS/cm)	652.823	712.070	648.919	–8.682	0.600	9.280
00900 Hardness, wh (mg/L as $CaCO_3$)	157.956	167.942	155.456	–6.129	1.595	7.722
00915 Calcium, wf (mg/L)	47.237	50.202	46.492	–6.086	1.589	7.673
00925 Magnesium, wf (mg/L)	9.665	10.420	9.577	–7.522	0.914	8.434
00530 Residue, wh (mg/L)	411.039	558.048	479.436	–30.340	–15.362	15.154
00608 Nitrogen ammonia (mg/L as N)	2.253	2.674	2.297	–17.074	–1.900	15.186
00625 Nitrogen ammonia + organic (mg/L as N)	9.102	12.074	10.169	–28.071	–11.067	17.137
00631 NO_2 + NO_3 wf (mg/L as N)	3.395	3.752	3.495	–10.002	–2.911	7.096
00671 Orthophosphate, wf (mg/L as P)	0.390	0.411	0.348	–5.043	11.470	16.489
00665 Phosphorus, wh (mg/L)	3.002	4.425	3.487	–38.303	–14.944	23.698
00681 Carbon, organic, wf (mg/L)	11.002	10.958	11.274	0.406	–2.439	–2.845
01040 Copper, wf (µg/L)	2.195	2.268	2.164	–3.243	1.430	4.672
01049 Lead, wf (µg/L)	0.405	0.456	0.417	–11.900	–3.072	8.836
01090 Zinc, wf (µg/L)	16.977	17.800	16.877	–4.733	0.593	5.325
Storm 2						
Station number 06714000 (Denver)						
Date (yyyymmdd)	--	--	--	--	--	--
Time (hhmm)	--	--	--	--	--	--
Decimal julian day	--	--	--	--	--	--
00065 Gage height feet	7.218	7.845	7.679	–8.317	–6.186	2.134
00061 Discharge (ft^3/s)	3,775.782	4,743.822	4,448.460	–22.725	–16.358	6.426
00403 pH, wh, laboratory (standard units)	7.338	7.408	7.354	–0.941	–0.218	0.723
90095 Specific conductance, wh (µS/cm)	241.267	199.072	209.432	19.164	14.127	–5.072
00900 Hardness, wh (mg/L as $CaCO_3$)	63.706	50.426	53.575	23.272	17.277	–6.056
00915 Calcium, wf (mg/L)	19.730	15.762	16.737	22.360	16.414	–6.000
00925 Magnesium, wf (mg/L)	3.491	2.685	2.844	26.097	20.417	–5.757
00935 Potassium, wf (mg/L)	3.197	2.931	2.983	8.679	6.930	–1.752
90410 Alkalinity, wh, fxdEP, la (mg/L as $CaCO_3$)	60.618	54.620	56.450	10.409	7.120	–3.295
00940 Chloride, wf (mg/L)	16.191	12.284	13.003	27.440	21.841	–5.684
00950 Fluoride, wf (mg/L)	0.279	0.235	0.251	17.165	10.724	–6.471
00945 Sulfate, wf (mg/L)	34.515	26.416	27.931	26.586	21.086	–5.578
00530 Residue, wh (mg/L)	416.646	465.550	456.594	–11.087	–9.149	1.942
00625 NH_3 + org N, wu (mg/L as N)	2.397	2.599	2.502	–8.074	–4.277	3.801
00608 Ammonia, wf (mg/L as N)	0.214	0.253	0.230	–16.376	–6.908	9.495
00631 NO_2 + NO_3, wf (mg/L as N)	0.659	0.578	0.589	13.199	11.262	–1.944
00671 Orthophosphate, wf (mg/L as P)	0.129	0.128	0.125	0.841	3.045	2.205
00665 Phosphorus, wh (mg/L)	0.863	0.956	0.922	–10.254	–6.589	3.671
00681 Organic carbon, wf (mg/L)	6.068	5.931	5.858	2.274	3.518	1.245
01040 Copper, wf (µg/L)	1.779	1.663	1.628	6.754	8.915	2.164
01049 Lead, wf (µg/L)	0.136	0.141	0.132	–3.619	3.231	6.848
01090 Zinc, wf (µg/L)	3.918	3.894	3.549	0.615	9.886	9.273

Table A1. Results from discrete samples collected during storms and computed time, discharge, and volume-weighted concentrations, with relative percent differences.—Continued

[Samples collected with pumping samplers. Analytical determination made at USGS National Water Quality Laboratory; –999, missing value (isolated missing values were replaced with an average of the preceding and following values for weighting computations); values greater than –999 and less than 0 are censored. Laboratory estimated values included in weighting computations; Weighting method—Time: (summation of interval × concentration) / sampling period time, where interval is the sum of the midpoint between sample time preceding and following sample times—Discharge: (summation of discharge × concentration) / summation of discharge—Volume: (summation of interval × discharge × concentration) / (summation of interval × discharge); RPD, relative percent difference: 1, time and discharge; 2, time and volume; 3, discharge and volume; wh, whole water unfiltered; wf, whole water filtered; fxdEP, fixed endpoint. ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; la, laboratory; NO_2, nitrite; NO_3, nitrate; N, nitrogen; P, phosphorus; µg/L, micrograms per liter]

Discrete measurements												
Storm 1												
20020828	20020828	20020828	20020828	20020828	20020829	20020829	20020829	20020829				
2006	2036	2106	2206	2306	106	306	506	706				
241.8375	241.8583	241.8792	241.9208	241.9625	242.0458	242.1292	242.2125	242.2958				
4.650	5.730	6.070	6.250	6.200	5.940	5.590	5.260	5.010				
506.000	1,290.000	1,710.000	1,920.000	1,850.000	1,520.000	1,120.000	815.000	616.000				
7.400	7.000	7.000	7.000	6.500	6.600	6.500	7.200	7.000				
960.000	940.000	896.000	740.000	549.000	548.000	595.000	647.000	703.000				
950.000	931.000	886.000	741.000	551.000	546.000	594.000	636.000	694.000				
220.000	210.000	210.000	170.000	120.000	140.000	150.000	160.000	170.000				
66.200	63.400	61.400	50.900	37.000	41.100	45.000	48.100	50.500				
13.800	13.200	12.900	10.900	7.740	8.430	8.920	9.540	10.300				
16.000	776.000	1,070.000	712.000	566.000	334.000	266.000	180.000	206.000				
3.180	3.640	4.330	2.870	1.910	1.630	1.820	1.920	2.450				
4.300	17.000	23.000	--	9.200	6.800	6.400	5.600	5.800				
3.990	4.850	4.680	4.070	3.140	3.270	3.300	2.930	2.630				
0.874	0.828	0.438	0.211	0.221	0.282	0.344	0.422	0.695				
1.110	6.740	9.790	--	2.830	1.940	1.610	1.420	1.540				
9.500	9.700	10.000	11.000	13.000	12.000	11.000	10.000	9.800				
3.500	2.800	2.300	2.000	2.100	2.100	2.100	2.200	2.200				
0.530	0.670	0.590	0.410	0.400	0.420	0.350	0.330	0.330				
25.000	24.000	18.000	16.000	16.000	17.000	16.000	16.000	17.000				
Storm 2												
20040818	20040818	20040818	20040818	20040818	20040818	20040818	20040818	20040820	20040820	20040820	20040820	20040820
1625	1725	1825	1925	2025	2125	2225	2325	25	125	225	325	925
231.6840	231.7257	231.7674	231.8090	231.8507	231.8924	231.9340	231.9757	232.0174	232.0590	232.1007	232.1424	232.3924
4.220	6.720	6.710	7.050	7.950	8.680	8.830	8.530	8.000	7.780	7.820	7.360	5.590
667.000	2,810.000	2,800.000	3,210.000	4,690.000	6,300.000	6,660.000	5,950.000	5,000.000	4,350.000	4,430.000	3,630.000	1,650.000
7.500	7.400	6.800	7.500	7.400	7.500	7.500	7.600	7.500	7.500	7.300	7.000	7.500
763.000	176.000	165.000	192.000	209.000	156.000	160.000	172.000	175.000	218.000	222.000	240.000	345.000
230.000	44.000	38.000	49.000	48.000	40.000	38.000	41.000	49.000	55.000	55.000	62.000	98.000
68.000	13.800	12.000	15.300	14.900	12.600	12.100	13.000	15.300	17.200	17.300	19.400	30.000
14.900	2.430	2.050	2.700	2.590	1.980	1.940	2.120	2.510	2.880	2.890	3.240	5.490
6.870	2.740	2.750	3.090	3.160	2.930	2.660	2.570	2.780	2.860	2.860	3.090	3.900
142.000	43.000	37.000	51.000	57.000	55.000	49.000	50.000	52.000	58.000	59.000	63.000	76.000
70.500	12.700	10.200	13.800	11.900	8.060	7.980	9.600	11.100	13.300	13.400	14.700	25.500
0.600	0.200	–0.200	0.200	0.200	0.200	0.200	0.200	0.200	0.300	0.300	0.300	0.400
149.000	25.800	20.800	27.500	27.100	19.100	17.300	20.800	23.700	28.200	28.800	31.500	54.300
370.000	254.000	280.000	356.000	542.000	597.000	640.000	490.000	520.000	398.000	320.000	460.000	297.000
2.500	2.700	2.600	2.700	3.600	3.200	2.900	2.300	2.000	2.200	2.200	2.200	1.800
0.060	0.580	0.300	0.350	0.370	0.310	0.210	0.220	0.190	0.180	0.170	0.150	0.070
1.570	0.900	0.560	0.790	0.670	0.520	0.400	0.420	0.480	0.560	0.560	0.610	0.810
0.199	0.178	0.143	0.171	0.146	0.122	0.116	0.114	0.123	0.114	0.108	0.113	0.123
0.830	0.810	0.690	0.930	1.250	1.180	1.070	0.960	0.870	0.850	0.880	0.830	0.620
9.000	7.800	6.900	7.800	7.600	6.300	5.200	4.700	4.800	5.100	5.200	5.500	6.000
3.700	3.200	2.400	2.200	1.600	1.400	1.400	1.400	1.400	1.400	1.400	1.400	1.900
0.140	0.320	0.280	0.210	0.160	0.140	0.120	0.110	0.100	0.090	0.100	0.090	0.100
8.700	10.600	8.400	7.900	5.300	3.400	2.300	2.100	2.300	2.400	2.400	2.100	2.600

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
All stations													
Mean streamflow, in ft^3/s	--	2002	44	0	0	460	258	631	2.47	14	2,780	--	--
		2003	19	0	0	302	154	313	1.31	20	1,060	--	--
		2004	50	0	0	864	557	1,240	3.87	7	7,570	--	--
		2005	59	4	0	682	288	978	2.5	1	4,830	--	--
Streamflow volume, in acre-feet	--	2002	44	0	0	410	216	554	2.4	16	2,290	--	--
		2003	19	0	0	287	140	317	1.79	18	1,230	--	--
		2004	50	0	0	794	506	1,140	3.75	6	6,880	--	--
		2005	59	4	0	584	271	813	2.59	0	4,390	--	--
pH, in standard pH units	W	2002	44	0	0	7.43	7.4	0.32	1.29	6.1	8	--	--
		2003	19	0	0	7.36	7.25	0.36	1.12	6.8	8.35	--	--
		2004	50	0	0	7.39	7.4	0.22	0.05	6.88	7.94	--	--
		2005	63	0	0	7.38	7.5	0.37	0.85	6.3	7.99	--	--
Specific conductance, in µS/cm	W	2002	41	3	0	673	613	214	0.4	342	1,130	--	--
		2003	14	5	0	997	875	604	1.68	423	2,630	--	--
		2004	42	8	0	614	555	240	1.02	259	1,280	--	--
		2005	55	8	0	609	581	259	0.95	212	1,330	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	41	3	0	240	235	62.2	1.1	150	415	--	--
		2003	19	0	0	218	204	108	2.46	91	594	--	--
		2004	50	0	0	167	152	62.3	1.27	69.1	375	--	--
		2005	63	0	0	170	154	72.5	1.3	69.7	394	--	--
Calcium, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	63.8	55.9	30.9	2.36	28.3	169	--	--
		2004	50	0	0	50.2	46.6	18.9	1.47	21.4	117	--	--
		2005	63	0	0	51.6	47.1	21.8	1.38	22	121	--	--
Magnesium, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	14.3	13.1	7.8	2.54	4.9	41.8	--	--
		2004	50	0	0	10.2	9.38	3.88	0.67	3.81	20.2	--	--
		2005	63	0	0	10.1	8.89	4.52	1.06	3.61	22.8	--	--
Potassium, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	4.47	4.12	1.33	1.2	2.67	8.37	--	--
Sodium, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	60.7	52.4	33.3	1	13.9	142	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	86.5	85.6	23.3	0.25	48.6	139	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
All stations—Continued													
Chloride, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	56.8	50.7	32.2	1.79	11	197	--	--
Fluoride, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	0.52	0.45	0.23	0.68	0.2	1.08	--	--
Sulfate, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	0	19	0	--	--	--	--	--	--	--	--
		2004	0	50	0	--	--	--	--	--	--	--	--
		2005	63	0	0	125	93.5	88.9	1.62	30.9	386	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	44	0	0	831	460	1,430	3.58	19	7,360	--	--
		2003	17	2	0	408	404	429	1.56	26	1,530	--	--
		2004	49	1	0	239	178	190	1.08	13	760	--	--
		2005	62	1	3.23	352	204	429	2.78	28	2,090	10	10
E. coli, colonies per 100 mL	W	2002	10	0	0	17,100	13,000	10,700	0.86	3,300	35,000	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	8	0	0	4,600	3,300	4,480	0.94	460	13,000	--	--
		2005	4	0	0	38,800	26,000	36,900	1.58	11,000	92,000	--	--
Fecal coliform, colonies per 100 mL	W	2002	10	0	0	25,000	19,500	18,600	0.64	4,900	54,000	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	8	0	0	5,160	3,550	4,930	0.66	310	13,000	--	--
		2005	4	0	0	38,000	35,000	11,200	1.46	28,000	54,000	--	--
Ammonia + organic N, in mg/L	T	2002	41	3	0	4.03	3.3	2.37	0.64	1.3	9.2	--	--
		2003	19	0	0	3.83	3.52	2.77	0.64	0.59	9.63	--	--
		2004	50	0	0	3.08	2.78	2.29	2.2	0.61	12.2	--	--
		2005	63	0	0	2.37	1.98	1.44	1.12	0.47	6.56	--	--
Ammonia, as N, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	10.5	0.59	0.25	0.84	3.03	0.05	3.55	0.04	0.04
		2004	50	0	14	0.76	0.34	0.86	1.58	0.05	3.46	0.04	0.04
		2005	63	0	9.52	0.37	0.22	0.46	2.6	0.05	2.2	0.04	0.04
Nitrite + nitrate, as N, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	1.41	0.87	1.11	1.38	0.34	4.19	--	--
		2004	50	0	6	1.88	1.98	1.07	0.28	0.11	4.1	0.06	0.06
		2005	63	0	0	1.3	0.94	1.03	1.86	0.33	4.7	--	--
Orthophosphate, as P, in mg/L	D	2002	41	3	0	0.42	0.34	0.32	1.14	0.03	1.4	--	--
		2003	18	1	0	0.21	0.18	0.23	2.33	0.03	0.95	--	--
		2004	50	0	8	0.26	0.17	0.22	1.05	0.02	0.81	0.01	0.01
		2005	63	0	0	0.17	0.11	0.19	2.37	0.01	1	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
All stations—Continued													
Phosphorus, as P, in mg/L	T	2002	41	3	0	1.28	0.99	1.33	3.82	0.18	8.3	--	--
		2003	19	0	5.26	1.1	1.03	0.78	0.85	0.1	2.77	0.04	0.04
		2004	50	0	0	0.9	0.84	0.6	1.41	0.1	3.12	--	--
		2005	63	0	0	0.75	0.61	0.59	1.56	0.07	2.76	--	--
Organic carbon, in mg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	10.7	8.78	4.63	0.68	4.71	20.8	--	--
		2004	38	12	0	8.89	7.95	3.59	1.25	3.55	19.4	--	--
		2005	63	0	0	10.4	8.12	5.51	1.65	4.3	30.1	--	--
Copper, in µg/L	D	2002	41	3	0	6.22	5	6.03	2.65	2	28	--	--
		2003	19	0	0	2.61	2.57	0.55	0.44	1.74	3.6	--	--
		2004	50	0	0	2.63	2.5	0.75	0.46	1.31	4.59	--	--
		2005	63	0	0	2.6	2.28	0.97	1.11	1.14	6.16	--	--
Copper, in µg/L	T	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	26.8	24.4	18.9	0.86	3.78	72.8	--	--
		2004	50	0	0	24.4	19.5	16.7	1.21	3.02	74.5	--	--
		2005	63	0	0	22.1	17.3	17	1.66	2.82	87.3	--	--
Lead, in µg/L	D	2002	41	3	92.7	33.3	30	25.2	0.59	10	60	10	10
		2003	19	0	31.6	0.23	0.18	0.14	1.12	0.1	0.5	0.08	0.08
		2004	50	0	28	0.21	0.19	0.12	1.52	0.09	0.64	0.08	0.08
		2005	63	0	38.1	0.17	0.15	0.1	1.94	0.08	0.52	0.08	0.08
Lead, in µg/L	T	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	24.7	19.1	20.1	0.85	1.44	66	--	--
		2004	50	0	0	22.8	14.3	19.4	1.04	0.63	70.7	--	--
		2005	63	0	0	19.1	13	20.2	2.38	0.67	114	--	--
Manganese, in µg/L	D	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	102	52.2	109	0.72	2.95	303	--	--
		2004	50	0	0	86.6	33.7	226	6.07	1.29	1,570	--	--
		2005	63	0	0	55.3	20.9	101	3.59	1.07	550	--	--
Manganese, in µg/L	T	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	668	693	451	0.32	79.3	1,550	--	--
		2004	50	0	0	511	404	391	1.94	84	2,090	--	--
		2005	63	0	0	490	413	399	2.04	62.8	2,090	--	--
Zinc, in µg/L	D	2002	41	3	41.5	52.1	35	59.7	3.5	20	300	20	20
		2003	19	0	0	44.6	10.4	85.2	2.86	2.55	336	--	--
		2004	50	0	0	18.9	12.4	27.2	3.96	2.52	165	--	--
		2005	62	1	0	9.85	7.73	8.34	2.66	1.99	50.6	--	--
Zinc, in µg/L	T	2002	0	44	0	--	--	--	--	--	--	--	--
		2003	19	0	0	272	165	333	2	8	1,150	--	--
		2004	50	0	0	136	93.5	132	2.35	12	708	--	--
		2005	62	1	0	89.1	67	74	1.63	7	348	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte below Union Avenue at Englewood (06710247)													
Mean streamflow, in ft^3/s	--	2002	9	0	0	116	122	59.9	0.02	37	212	--	--
		2003	4	0	0	152	149	84.3	0.26	53	259	--	--
		2004	9	0	0	311	215	216	0.77	120	679	--	--
		2005	15	0	0	235	202	171	1.37	38	686	--	--
Streamflow volume, in acre-feet	--	2002	9	0	0	105	111	56.1	0.09	25	193	--	--
		2003	4	0	0	139	135	77	0.27	48	236	--	--
		2004	9	0	0	271	195	192	1.03	109	617	--	--
		2005	15	0	0	210	184	159	1.24	16	623	--	--
pH, in standard pH units	W	2002	9	0	0	7.43	7.4	0.24	0.16	7	7.8	--	--
		2003	4	0	0	7.69	7.54	0.48	1.3	7.32	8.35	--	--
		2004	9	0	0	7.52	7.49	0.15	0.25	7.29	7.77	--	--
		2005	15	0	0	7.51	7.64	0.39	0.9	6.82	7.99	--	--
Specific conductance, in µS/cm	W	2002	9	0	0	550	478	196	1.32	342	917	--	--
		2003	4	0	0	614	598	203	0.17	423	835	--	--
		2004	6	3	0	448	436	98.6	0.19	323	583	--	--
		2005	12	3	0	428	451	130	0.27	212	620	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	9	0	0	242	220	66.1	0.78	167	365	--	--
		2003	4	0	0	165	157	31.4	1.31	136	209	--	--
		2004	9	0	0	146	150	26.8	0.34	103	195	--	--
		2005	15	0	0	143	136	44.9	0.67	69.7	246	--	--
Calcium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	48.4	46.5	8.41	1.17	40.6	60.1	--	--
		2004	9	0	0	42.8	42.3	6.08	0.3	32.1	52.2	--	--
		2005	15	0	0	42.7	41.4	11.7	0.24	22	66.1	--	--
Magnesium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	10.6	9.84	2.57	1.57	8.41	14.3	--	--
		2004	9	0	0	9.39	8.14	3.13	1.06	5.48	15.7	--	--
		2005	15	0	0	8.84	8.04	4.02	1.5	3.61	19.6	--	--
Potassium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	3.81	3.39	0.92	0.78	2.67	5.46	--	--
Sodium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	34.7	32	13.6	0.78	13.9	64.6	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	84.4	81.7	21.3	0.14	48.6	124	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte below Union Avenue at Englewood (06710247)—Continued													
Chloride, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	37.8	36.8	16.4	0.87	11	77.6	--	--
Fluoride, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	0.67	0.63	0.29	0.04	0.29	1.08	--	--
Sulfate, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	4	0	--	--	--	--	--	--	--	--
		2004	0	9	0	--	--	--	--	--	--	--	--
		2005	15	0	0	74.1	74.4	31.8	1.25	30.9	155	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	9	0	0	532	574	488	0.71	19	1,460	--	--
		2003	4	0	0	433	86	734	1.99	26	1,530	--	--
		2004	9	0	0	232	178	206	1.42	13	680	--	--
		2005	15	0	13.3	292	242	219	0.98	54	782	10	10
E. coli, colonies per 100 mL	W	2002	2	0	0	13,000	13,000	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	7,350	7,350	--	--	--	--	--	--
		2005	1	0	0	92,000	92,000	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	2002	2	0	0	10,500	10,500	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	7,600	7,600	--	--	--	--	--	--
		2005	1	0	0	28,000	28,000	--	--	--	--	--	--
Ammonia + organic N as N, in mg/L	T	2002	9	0	0	2.57	1.9	1.83	2.09	1.3	7	--	--
		2003	4	0	0	2.41	1.43	2.56	1.82	0.59	6.19	--	--
		2004	9	0	0	1.48	1.38	0.71	1.43	0.61	3.07	--	--
		2005	15	0	0	1.48	1.21	0.73	0.23	0.47	2.72	--	--
Ammonia, as N, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	25	0.2	0.22	0.15	0.56	0.05	0.34	0.04	0.04
		2004	9	0	22.2	0.12	0.11	0.06	0.05	0.05	0.18	0.04	0.04
		2005	15	0	33.3	0.1	0.1	0.03	0.31	0.06	0.16	0.04	0.04
Nitrite + nitrate, as N, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	0.79	0.78	0.28	0.3	0.48	1.14	--	--
		2004	9	0	0	0.83	0.79	0.35	0.97	0.4	1.53	--	--
		2005	15	0	0	0.89	0.76	0.41	0.63	0.41	1.65	--	--
Orthophosphate, as P, in mg/L	D	2002	9	0	0	0.19	0.16	0.12	1.59	0.08	0.45	--	--
		2003	4	0	0	0.04	0.04	0.01	0.16	0.03	0.06	--	--
		2004	9	0	0	0.07	0.07	0.04	0.86	0.03	0.14	--	--
		2005	15	0	0	0.07	0.08	0.04	0.41	0.01	0.16	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte below Union Avenue at Englewood (06710247)—Continued													
Phosphorus, as P, in mg/L	T	2002	9	0	0	0.6	0.29	0.53	1.44	0.18	1.75	--	--
		2003	4	0	0	0.56	0.3	0.65	1.85	0.1	1.52	--	--
		2004	9	0	0	0.45	0.37	0.31	1.81	0.1	1.18	--	--
		2005	15	0	0	0.42	0.42	0.28	0.67	0.07	1.02	--	--
Organic carbon, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	6.83	6.59	2.11	0.44	4.71	9.41	--	--
		2004	6	3	0	5.75	6.08	1.31	0.76	3.55	7.47	--	--
		2005	15	0	0	8.16	6.91	3.69	1.23	4.3	16.2	--	--
Copper, in µg/L	D	2002	9	0	0	10.6	5	9.33	1.25	2	28	--	--
		2003	4	0	0	1.96	1.95	0.19	0.26	1.74	2.2	--	--
		2004	9	0	0	2.01	2.04	0.34	0.25	1.38	2.58	--	--
		2005	15	0	0	2.12	2.08	0.44	0.16	1.14	2.84	--	--
Copper, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	18.5	10.8	20.5	1.81	3.78	48.8	--	--
		2004	9	0	0	14.5	13	9.81	1.72	3.02	37.4	--	--
		2005	15	0	0	13.6	13.5	8.92	0.53	2.82	32.1	--	--
Lead, in µg/L	D	2002	9	0	77.8	45	45	21.2		30	60	10	10
		2003	4	0	75	0.1	0.1			0.1	0.1	0.08	0.08
		2004	9	0	88.9	0.14	0.14			0.14	0.14	0.08	0.08
		2005	15	0	80	0.13	0.15	0.04	1.66	0.09	0.16	0.08	0.08
Lead, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	16.9	7.16	23.5	1.91	1.44	51.9	--	--
		2004	9	0	0	11.4	10.9	10.3	1.98	0.63	36.2	--	--
		2005	15	0	0	10.2	9.44	8.34	0.66	0.67	27.6	--	--
Manganese, in µg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	79.6	32.7	109	1.83	12.3	241	--	--
		2004	9	0	0	17.2	12.5	14.8	1.19	2.75	46.9	--	--
		2005	15	0	0	22.1	9.54	26.4	1.65	1.07	82.6	--	--
Manganese, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	455	234	551	1.89	79.3	1,270	--	--
		2004	9	0	0	312	272	200	1.94	123	786	--	--
		2005	15	0	0	355	337	210	0.27	62.8	716	--	--
Zinc, in µg/L	D	2002	9	0	66.7	23.3	20	5.77	1.73	20	30	20	20
		2003	4	0	0	4.85	5.31	1.59	1.53	2.55	6.24	--	--
		2004	9	0	0	5.16	4.41	2.42	0.94	2.52	9.63	--	--
		2005	15	0	0	4.73	4.64	1.76	0.02	1.99	7.61	--	--
Zinc, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	4	0	0	77	35	103	1.9	8	230	--	--
		2004	9	0	0	50.4	48	36.1	1.63	12	134	--	--
		2005	15	0	0	47.1	45	33.2	0.5	7	112	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Denver (06714000)													
Mean streamflow, in ft^3/s	--	2002	11	0	0	749	427	862	1.94	188	2,780	--	--
		2003	6	0	0	563	569	238	0.07	263	847	--	--
		2004	14	0	0	1,090	753	1,100	2.56	338	4,450	--	--
		2005	15	0	0	900	821	694	1.07	166	2,460	--	--
Streamflow volume, in acre-feet	--	2002	11	0	0	661	388	730	1.84	171	2,290	--	--
		2003	6	0	0	501	513	200	0.12	239	754	--	--
		2004	14	0	0	909	685	945	3.17	307	4,040	--	--
		2005	15	0	0	806	746	644	0.98	69	2,240	--	--
pH, in standard pH units	W	2002	11	0	0	7.4	7.3	0.25	0.5	7	7.9	--	--
		2003	6	0	0	7.28	7.23	0.33	0.07	6.8	7.71	--	--
		2004	14	0	0	7.4	7.47	0.21	0.58	6.99	7.72	--	--
		2005	15	0	0	7.49	7.6	0.3	1.56	6.72	7.8	--	--
Specific conductance, in µS/cm	W	2002	10	1	0	586	540	194	1.28	361	972	--	--
		2003	4	2	0	740	720	304	0.12	461	1,060	--	--
		2004	12	2	0	488	496	129	0.3	259	717	--	--
		2005	15	0	0	506	509	153	0.15	247	711	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	10	1	0	199	193	30.3	0.61	150	255	--	--
		2003	6	0	0	153	160	40.1	0.36	91	208	--	--
		2004	14	0	0	134	129	37.8	0.03	69.1	191	--	--
		2005	15	0	0	142	141	42.5	0.01	74.4	211	--	--
Calcium, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	44.1	45.4	9.76	0.67	28.3	55.9	--	--
		2004	14	0	0	40.3	38.9	10.7	0.1	21.4	56.6	--	--
		2005	15	0	0	42.8	42.9	12.4	0.02	23.5	63.3	--	--
Magnesium, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	10.4	9.97	4.02	0.29	4.9	16.5	--	--
		2004	14	0	0	8.11	7.8	2.74	0.27	3.81	12.9	--	--
		2005	15	0	0	8.57	8.2	2.82	0.09	3.81	12.9	--	--
Potassium, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	4.67	4.46	1.26	0.61	3.23	7.03	--	--
Sodium, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	46.8	50.7	17.3	0.39	18.2	84.8	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	87.3	85.4	22.4	0.25	51	117	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Denver (06714000)—Continued													
Chloride, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	49.2	50.7	24.1	1.9	15.9	122	--	--
Fluoride, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	0.58	0.55	0.19	0.18	0.25	0.83	--	--
Sulfate, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	0	6	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	15	0	0	79.4	75.2	30.5	0.28	34	136	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	11	0	0	343	237	250	0.64	54	758	--	--
		2003	6	0	0	407	234	473	1.3	51	1,240	--	--
		2004	13	1	0	254	204	179	0.89	45	604	--	--
		2005	15	0	0	181	159	158	2.04	28	652	--	--
E. coli, colonies per 100 mL	W	2002	2	0	0	17,500	17,500	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	6,400	6,400	--	--	--	--	--	--
		2005	1	0	0	17,000	17,000	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	2002	2	0	0	28,500	28,500	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	6,400	6,400	--	--	--	--	--	--
		2005	1	0	0	35,000	35,000	--	--	--	--	--	--
Ammonia + organic N, as N, in mg/L	T	2002	10	1	0	2.73	2.35	1.12	0.67	1.4	4.7	--	--
		2003	6	0	0	3.57	2.81	2.91	1.38	1.05	8.8	--	--
		2004	14	0	0	2.9	2.23	2.28	2.85	1.08	10.2	--	--
		2005	15	0	0	1.85	1.64	0.82	0.75	0.87	3.53	--	--
Ammonia, as N, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	0.45	0.39	0.33	0.41	0.1	0.91	--	--
		2004	14	0	7.14	0.42	0.25	0.47	2.5	0.09	1.8	0.04	0.04
		2005	15	0	6.67	0.19	0.17	0.1	0.9	0.06	0.42	0.04	0.04
Nitrite + nitrate, as N, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	2.43	2.09	0.99	1.28	1.39	4.19	--	--
		2004	14	0	0	2.04	2.06	0.91	0.42	0.71	3.67	--	--
		2005	15	0	0	2.01	1.28	1.34	0.95	0.76	4.7	--	--
Orthophosphate, as P, in mg/L	D	2002	10	1	0	0.45	0.43	0.18	1.36	0.25	0.86	--	--
		2003	6	0	0	0.3	0.25	0.14	1.72	0.2	0.55	--	--
		2004	14	0	0	0.2	0.18	0.08	0.76	0.11	0.37	--	--
		2005	15	0	0	0.25	0.16	0.18	1.05	0.09	0.59	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Denver (06714000)—Continued													
Phosphorus, as P, in mg/L	T	2002	10	1	0	0.88	0.78	0.43	0.44	0.33	1.62	--	--
		2003	6	0	0	1.11	0.86	0.87	1.42	0.34	2.68	--	--
		2004	14	0	0	0.81	0.69	0.52	2.39	0.37	2.39	--	--
		2005	15	0	0	0.59	0.54	0.27	0.46	0.28	1.03	--	--
Organic carbon, in mg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	9.72	7.84	4.05	0.89	5.54	15.9	--	--
		2004	10	4	0	8.3	7.4	3.64	2	5.29	17.5	--	--
		2005	15	0	0	9.79	7.53	6.33	2.45	4.46	29.8	--	--
Copper, in µg/L	D	2002	10	1	0	3.8	4	1.23	0.43	2	5	--	--
		2003	6	0	0	2.73	2.63	0.48	1.17	2.26	3.56	--	--
		2004	14	0	0	2.57	2.37	0.79	1.3	1.63	4.59	--	--
		2005	15	0	0	3.17	3.31	1.26	0.82	1.44	6.16	--	--
Copper, in µg/L	T	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	29.6	24.5	25.5	1.02	6.21	72.8	--	--
		2004	14	0	0	26.3	21.5	18	1.63	7.07	74.5	--	--
		2005	15	0	0	16.9	13.7	9.37	1.45	5.89	41.9	--	--
Lead, in µg/L	D	2002	10	1	100	--	--	--	--	--	--	10	10
		2003	6	0	0	0.21	0.18	0.11	1.22	0.1	0.41	--	--
		2004	14	0	7.14	0.16	0.13	0.08	1.71	0.09	0.36	0.08	0.08
		2005	15	0	6.67	0.17	0.14	0.11	2.68	0.08	0.52	0.08	0.08
Lead, in µg/L	T	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	29.9	20.6	28.4	0.65	3.81	66	--	--
		2004	14	0	0	25.2	20.1	18.8	0.79	3.77	62.5	--	--
		2005	15	0	0	14.4	11	12.1	2.13	2.79	50.8	--	--
Manganese, in µg/L	D	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	53.3	37.7	52.5	1.57	12.9	150	--	--
		2004	14	0	0	19.6	10.4	19.3	1.33	1.29	66.8	--	--
		2005	15	0	0	22.7	14.2	26.2	1.61	1.32	81.5	--	--
Manganese, in µg/L	T	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	429	389	294	0.28	128	815	--	--
		2004	14	0	0	417	371	271	1.3	113	999	--	--
		2005	15	0	0	269	205	147	0.54	109	560	--	--
Zinc, in µg/L	D	2002	10	1	60	30	30	8.16	0	20	40	20	20
		2003	6	0	0	11.9	10.6	5.24	1.48	6.94	21.5	--	--
		2004	14	0	0	10.6	9.12	5.49	0.36	2.69	20.3	--	--
		2005	15	0	0	11.7	11.7	7.65	1.86	4.21	34.3	--	--
Zinc, in µg/L	T	2002	0	11	0	--	--	--	--	--	--	--	--
		2003	6	0	0	134	113	118	0.98	24	333	--	--
		2004	14	0	0	118	97.5	85	1.59	27	348	--	--
		2005	15	0	0	71.7	56	45.3	1.32	27	183	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Tollgate Creek above 6th Avenue at Aurora (394329104490101)													
Mean streamflow, in ft^3/s	--	2002	3	0	0	24.7	18	15.1	1.6	14	42	--	--
		2003	3	0	0	61.7	56	44.8	0.56	20	109	--	--
		2004	5	0	0	145	62	160	1.41	7	405	--	--
		2005	9	4	0	84.2	32	111	1.31	1	310	--	--
Streamflow volume, in acre-feet	--	2002	3	0	0	46.3	38	35.2	1	16	85	--	--
		2003	3	0	0	56	51	40.7	0.54	18	99	--	--
		2004	5	0	0	125	57	132	1.26	6	335	--	--
		2005	9	4	0	79.1	13	116	1.4	0	282	--	--
pH, in standard pH units	W	2002	3	0	0	6.93	7.3	0.72	1.69	6.1	7.4	--	--
		2003	3	0	0	7.3	7.25	0.35	0.63	6.98	7.67	--	--
		2004	5	0	0	7.28	7.3	0.18	0.7	7.01	7.49	--	--
		2005	13	0	0	7.13	7.31	0.46	0.22	6.3	7.8	--	--
Specific conductance, in µS/cm	W	2002	3	0	0	753	747	201	0.13	555	957	--	--
		2003	1	2	0	2,630	2,630	--	--	2,630	2,630	--	--
		2004	5	0	0	746	784	322	0.12	350	1,130	--	--
		2005	11	2	0	779	676	285	0.86	494	1,330	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	3	0	0	306	263	95.1	1.62	240	415	--	--
		2003	3	0	0	381	287	185	1.7	262	594	--	--
		2004	5	0	0	234	219	98.2	0.34	107	375	--	--
		2005	13	0	0	231	194	97.2	0.64	127	394	--	--
Calcium, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	112	89.4	49.4	1.64	78.6	169	--	--
		2004	5	0	0	72.9	67.4	29.8	0.52	35.6	117	--	--
		2005	13	0	0	70.8	60	28.9	0.66	39.8	121	--	--
Magnesium, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	24.4	16	15	1.73	15.6	41.8	--	--
		2004	5	0	0	12.5	12.4	5.9	0.17	4.33	20.2	--	--
		2005	13	0	0	13	11.1	6.06	0.59	6.68	22.8	--	--
Potassium, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	3.96	3.88	0.71	1.04	2.89	5.68	--	--
Sodium, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	80.5	68	31.1	0.68	42.8	142	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	80.5	69.8	22.7	0.56	51.8	118	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Tollgate Creek above 6th Avenue at Aurora (394329104490101)—Continued													
Chloride, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	61.4	62	23.3	0.63	29.9	112	--	--
Fluoride, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	0.3	0.34	0.06	0.59	0.2	0.37	--	--
Sulfate, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	0	3	0	--	--	--	--	--	--	--	--
		2004	0	5	0	--	--	--	--	--	--	--	--
		2005	13	0	0	220	180	107	0.62	116	386	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	3	0	0	2,940	1,150	3,850	1.64	314	7,360	--	--
		2003	1	2	0	698	698	--	--	698	698	--	--
		2004	5	0	0	263	141	234	0.51	40	529	--	--
		2005	13	0	0	381	153	552	2.84	54	2,090	--	--
E. coli, colonies per 100 mL	W	2002	2	0	0	21,000	21,000	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	0	0	0	--	--	--	--	--	--	--	--
		2005	1	0	0	35,000	35,000	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	2002	2	0	0	30,500	30,500	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	0	0	0	--	--	--	--	--	--	--	--
		2005	1	0	0	35,000	35,000	--	--	--	--	--	--
Ammonia + organic N as N, in mg/L	T	2002	3	0	0	3.67	2.8	1.59	1.72	2.7	5.5	--	--
		2003	3	0	0	3.31	4.52	2.36	1.7	0.59	4.82	--	--
		2004	5	0	0	2.29	2.26	0.98	1.03	1.32	3.82	--	--
		2005	13	0	0	2.26	1.92	1.53	1.87	0.81	6.32	--	--
Ammonia, as N, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	0.28	0.23	0.14	1.37	0.17	0.44	--	--
		2004	5	0	40	0.33	0.26	0.19	1.42	0.19	0.54	0.04	0.04
		2005	13	0	0	0.2	0.19	0.09	0.03	0.05	0.35	--	--
Nitrite + nitrate, as N, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	0.49	0.46	0.16	0.88	0.34	0.67	--	--
		2004	5	0	60	0.17	0.17	0.09		0.11	0.24	0.06	0.06
		2005	13	0	0	0.61	0.59	0.21	0.62	0.33	0.99	--	--
Orthophosphate, as P, in mg/L	D	2002	3	0	0	0.07	0.09	0.04	1.6	0.03	0.1	--	--
		2003	2	1	0	0.03	0.03	0	--	0.03	0.04	--	--
		2004	5	0	80	0.02	0.02	--	--	0.02	0.02	0.01	0.01
		2005	13	0	0	0.05	0.05	0.03	0.32	0.01	0.11	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Tollgate Creek above 6th Avenue at Aurora (394329104490101)—Continued													
Phosphorus, as P, in mg/L	T	2002	3	0	0	1.17	1.17	0.66	0.02	0.51	1.82	--	--
		2003	3	0	33.3	1.37	1.37	0.59		0.96	1.79	0.04	0.04
		2004	5	0	0	0.71	0.57	0.45	0.74	0.23	1.37	--	--
		2005	13	0	0	0.65	0.38	0.63	2.14	0.18	2.44	--	--
Organic carbon, in mg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	12.1	12	4.61	0.1	7.53	16.8	--	--
		2004	5	0	0	7.42	7.67	0.88	0.82	6.09	8.41	--	--
		2005	13	0	0	11.1	9.68	4.71	0.52	5.89	18.4	--	--
Copper, in µg/L	D	2002	3	0	0	4	4	1	0	3	5	--	--
		2003	3	0	0	3.25	3.51	0.54	1.68	2.63	3.6	--	--
		2004	5	0	0	2.33	2.11	0.73	1.97	1.78	3.6	--	--
		2005	13	0	0	2.65	2.58	0.87	0.09	1.25	4.16	--	--
Copper, in µg/L	T	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	32.1	24.7	12.9	1.73	24.5	46.9	--	--
		2004	5	0	0	18.4	11.8	13.2	0.48	5.51	32.6	--	--
		2005	13	0	0	20.1	13.1	16.4	2.15	5.41	66.9	--	--
Lead, in µg/L	D	2002	3	0	100	--	--	--	--	--	--	10	10
		2003	3	0	66.7	0.18	0.18	--	--	0.18	0.18	0.08	0.08
		2004	5	0	80	0.09	0.09	--	--	0.09	0.09	0.08	0.08
		2005	13	0	61.5	0.11	0.1	0.02	0.26	0.09	0.13	0.08	0.08
Lead, in µg/L	T	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	24.9	17.5	13.8	1.72	16.3	40.8	--	--
		2004	5	0	0	12.6	6.34	11.2	0.56	2.47	25.9	--	--
		2005	13	0	0	13	6.79	13.8	2.29	1.8	53.2	--	--
Manganese, in µg/L	D	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	182	241	158	1.43	2.95	303	--	--
		2004	5	0	0	403	41.8	667	2.01	17.4	1,570	--	--
		2005	13	0	0	98.4	35.7	144	2.13	2.11	474	--	--
Manganese, in µg/L	T	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	1,290	1,170	229	1.69	1,140	1,550	--	--
		2004	5	0	0	840	769	521	0.82	223	1,650	--	--
		2005	13	0	0	593	558	497	1.79	89.5	1,950	--	--
Zinc, in µg/L	D	2002	3	0	66.7	20	20			20	20	20	20
		2003	3	0	0	7.72	7.45	2.5	0.49	5.38	10.4	--	--
		2004	5	0	0	8.18	5.52	4.88	0.84	4.2	15.1	--	--
		2005	13	0	0	11.6	7.88	13.1	2.56	2.69	50.6	--	--
Zinc, in µg/L	T	2002	0	3	0	--	--	--	--	--	--	--	--
		2003	3	0	0	137	124	24.3	1.72	122	165	--	--
		2004	5	0	0	86.2	61	54.7	0.68	33	161	--	--
		2005	13	0	0	89.6	84	72.9	1.9	18	293	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Sand Creek at mouth near Commerce City (394839104570300)													
Mean streamflow, in ft^3/s	--	2002	9	0	0	137	124	80.7	0.63	40	258	--	--
		2003	5	0	0	101	82	44.5	1.89	67	178	--	--
		2004	8	0	0	305	75	614	2.75	18	1,810	--	--
		2005	12	0	0	278	205	303	1.98	30	1,100	--	--
Streamflow volume, in acre-feet	--	2002	9	0	0	121	104	70.7	0.59	36	226	--	--
		2003	5	0	0	98.2	85	40.2	1.04	60	160	--	--
		2004	8	0	0	389	68.5	874	2.8	17	2,550	--	--
		2005	12	0	0	256	187	278	1.86	24	995	--	--
pH, in standard pH units	W	2002	9	0	0	7.53	7.5	0.25	0.5	7.2	7.9	--	--
		2003	5	0	0	7.26	7.22	0.26	1.58	7.03	7.7	--	--
		2004	8	0	0	7.45	7.42	0.36	0.09	6.88	7.94	--	--
		2005	12	0	0	7.4	7.42	0.2	0.38	7.08	7.65	--	--
Specific conductance, in µS/cm	W	2002	8	1	0	766	750	205	0.71	521	1,130	--	--
		2003	4	1	0	1,200	1,260	465	0.18	703	1,600	--	--
		2004	7	1	0	897	1,020	309	0.88	342	1,280	--	--
		2005	11	1	0	783	715	270	0.41	482	1,190	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	8	1	0	266	263	64.1	0.15	183	360	--	--
		2003	5	0	0	242	231	56.6	0.62	180	323	--	--
		2004	8	0	0	233	245	74.8	1.06	87	311	--	--
		2005	12	0	0	196	177	76	0.3	108	314	--	--
Calcium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	71.1	68.9	15.4	0.63	53.3	93.8	--	--
		2004	8	0	0	70.6	73.7	22	1.07	27.7	91.2	--	--
		2005	12	0	0	60	53.5	23	0.33	33.9	95.8	--	--
Magnesium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	15.6	14.4	4.48	0.52	11.5	21.5	--	--
		2004	8	0	0	13.7	14.8	4.98	0.84	4.33	20.2	--	--
		2005	12	0	0	11.1	10.4	4.56	0.2	5.81	18.1	--	--
Potassium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	4.46	4.2	1.09	0.17	2.81	6.35	--	--
Sodium, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	85	73.2	36.4	0.26	42.9	138	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	94.8	90.9	29	0.17	53.5	139	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Sand Creek at mouth near Commerce City (394839104570300)—Continued													
Chloride, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	73.6	66.3	27.4	0.1	33.7	110	--	--
Fluoride, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	0.45	0.49	0.14	0.1	0.26	0.67	--	--
Sulfate, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	0	5	0	--	--	--	--	--	--	--	--
		2004	0	8	0	--	--	--	--	--	--	--	--
		2005	12	0	0	174	150	90	0.64	78.9	347	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	9	0	0	478	566	219	0.5	120	732	--	--
		2003	5	0	0	328	404	151	2.02	64	416	--	--
		2004	8	0	0	253	220	244	1.38	13	760	--	--
		2005	12	0	0	584	278	672	1.39	44	1,930	--	--
E. coli, colonies per 100 mL	W	2002	2	0	0	26,000	26,000	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	900	900	--	--	--	--	--	--
		2005	0	0	0	--	--	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	2002	2	0	0	26,000	26,000	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	1,000	1,000	--	--	--	--	--	--
		2005	0	0	0	--	--	--	--	--	--	--	--
Ammonia + organic N as N, in mg/L	T	2002	8	1	0	3.2	2.75	1.53	1.13	1.9	6.1	--	--
		2003	5	0	0	4.42	4.89	2.24	0.48	1.41	6.78	--	--
		2004	8	0	0	2.99	2.29	2.52	1.87	0.88	8.61	--	--
		2005	12	0	0	3.04	2.67	1.51	1.05	1.21	6.56	--	--
Ammonia, as N, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	20	0.57	0.53	0.59	0.05	0.05	1.15	0.04	0.04
		2004	8	0	25	0.38	0.13	0.44	1.15	0.07	1.08	0.04	0.04
		2005	12	0	0	0.42	0.38	0.16	0.28	0.21	0.71	--	--
Nitrite + nitrate, as N, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	0.81	0.77	0.2	0.92	0.59	1.12	--	--
		2004	8	0	0	1.54	1.86	0.77	0.6	0.36	2.29	--	--
		2005	12	0	0	0.9	0.87	0.27	0.59	0.48	1.46	--	--
Orthophosphate, as P, in mg/L	D	2002	8	1	0	0.24	0.21	0.1	1.31	0.15	0.44	--	--
		2003	5	0	0	0.16	0.16	0.03	0.75	0.11	0.2	--	--
		2004	8	0	0	0.13	0.12	0.07	0.9	0.04	0.27	--	--
		2005	12	0	0	0.12	0.13	0.06	0.22	0.04	0.22	--	--

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[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft^3/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
Sand Creek at mouth near Commerce City (394839104570300)—Continued													
Phosphorus, as P, in mg/L	T	2002	8	1	0	0.84	0.85	0.48	0.24	0.29	1.49	--	--
		2003	5	0	0	1.08	1.17	0.45	0.68	0.44	1.53	--	--
		2004	8	0	0	0.85	0.68	0.6	0.68	0.24	1.83	--	--
		2005	12	0	0	0.93	0.76	0.68	1.97	0.34	2.76	--	--
Organic carbon, in mg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	13.8	15.9	5.64	0.1	7.21	20.8	--	--
		2004	7	1	0	12.1	11	4.5	0.59	7.8	19.4	--	--
		2005	12	0	0	13.6	12.9	6.99	1.31	5.86	30.1	--	--
Copper, in µg/L	D	2002	8	1	0	7.25	4.5	7.59	2.29	2	25	--	--
		2003	5	0	0	2.6	2.46	0.41	0.03	2.08	3.06	--	--
		2004	8	0	0	3.1	3.34	0.88	1.26	1.31	4.04	--	--
		2005	12	0	0	2.58	2.25	1.05	0.66	1.25	4.6	--	--
Copper, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	21.6	22.2	9.32	0.23	8.28	34.1	--	--
		2004	8	0	0	22.9	15.5	18.6	1.04	5.36	51.7	--	--
		2005	12	0	0	30.3	22.3	23.8	1.42	7.3	87.3	--	--
Lead, in µg/L	D	2002	8	1	100	--	--	--	--	--	--	10	10
		2003	5	0	20	0.24	0.18	0.17	1.64	0.11	0.48	0.08	0.08
		2004	8	0	12.5	0.19	0.17	0.08	1.09	0.1	0.33	0.08	0.08
		2005	12	0	25	0.17	0.13	0.1	1.97	0.08	0.41	0.08	0.08
Lead, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	21.3	22.4	11.2	0.15	5.29	36.7	--	--
		2004	8	0	0	22.9	11.2	25.9	1.34	1.45	70.7	--	--
		2005	12	0	0	32	20.2	33.2	1.65	2.7	114	--	--
Manganese, in µg/L	D	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	106	33.3	127	0.69	4.49	271	--	--
		2004	8	0	0	71.3	46.4	74.5	1.04	3.69	190	--	--
		2005	12	0	0	85.8	28.9	159	2.71	2.69	550	--	--
Manganese, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	746	718	359	0.4	235	1,170	--	--
		2004	8	0	0	703	579	663	1.43	84	2,090	--	--
		2005	12	0	0	721	531	573	1.37	113	2,090	--	--
Zinc, in µg/L	D	2002	8	1	0	98.8	70	88.2	2.09	40	300	--	--
		2003	5	0	0	141	79.5	130	1	22.2	336	--	--
		2004	8	0	0	55.1	32.1	54.9	1.27	6.78	165	--	--
		2005	11	1	0	9.45	8.06	7.38	2.37	3.01	29.7	--	--
Zinc, in µg/L	T	2002	0	9	0	--	--	--	--	--	--	--	--
		2003	5	0	0	689	545	418	0.29	227	1,150	--	--
		2004	8	0	0	279	243	240	0.72	40	708	--	--
		2005	11	1	0	114	80	103	1.59	18	348	--	--

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Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Henderson (06720500)													
Mean streamflow, in ft³/s	--	2002	12	0	0	805	572	653	1.68	280	2,390	--	--
		2003	1	0	0	1,060	1,060	--	--	1,060	1,060	--	--
		2004	14	0	0	1,570	1,230	1,770	3.43	515	7,570	--	--
		2005	8	0	0	2,390	1,780	1,460	0.67	752	4,830	--	--
Streamflow volume, in acre-feet	--	2002	12	0	0	717	480	603	1.66	208	2,170	--	--
		2003	1	0	0	1,230	1,230	--	--	1,230	1,230	--	--
		2004	14	0	0	1,490	1,150	1,600	3.35	468	6,880	--	--
		2005	8	0	0	1,930	1,590	1,220	1.39	683	4,390	--	--
pH, in standard pH units	W	2002	12	0	0	7.51	7.4	0.29	0.75	7.1	8	--	--
		2003	1	0	0	7.2	7.2	--	--	7.2	7.2	--	--
		2004	14	0	0	7.32	7.32	0.17	0.3	7.05	7.63	--	--
		2005	8	0	0	7.32	7.48	0.33	1.09	6.72	7.64	--	--
Specific conductance, in µS/cm	W	2002	11	1	0	763	737	206	0.26	418	1,020	--	--
		2003	1	0	0	1,090	1,090	--	--	1,090	1,090	--	--
		2004	12	2	0	603	602	107	0.24	439	800	--	--
		2005	6	2	0	596	547	273	0.66	316	1,020	--	--
Hardness, as calcium carbonate, in mg/L	T	2002	11	1	0	240	240	53.9	1.73	175	380	--	--
		2003	1	0	0	219	219	--	--	219	219	--	--
		2004	14	0	0	153	148	26.8	0.62	109	213	--	--
		2005	8	0	0	139	150	38.3	0.39	84.5	178	--	--
Calcium, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	61.2	61.2	--	--	61.2	61.2	--	--
		2004	14	0	0	45	43.3	7.38	0.92	33.4	62.7	--	--
		2005	8	0	0	41.1	42.9	10.4	0.3	26.2	52.4	--	--
Magnesium, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	16	16	--	--	16	16	--	--
		2004	14	0	0	10	9.57	2.12	0.11	6.19	13.8	--	--
		2005	8	0	0	8.87	10.1	3.02	0.48	4.62	11.7	--	--
Potassium, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	6.18	5.73	1.81	0.32	4.26	8.37	--	--
Sodium, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	67.1	65.3	38.5	1.06	27.1	142	--	--
Alkalinity, as calcium carbonate, fixed endpoint, in mg/L	W	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	86.3	90.7	22.2	0.11	57.7	121	--	--

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Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Henderson (06720500)—Continued													
Chloride, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	74	58.1	60.2	1.51	23.3	197	--	--
Fluoride, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	0.56	0.51	0.19	0.43	0.35	0.84	--	--
Sulfate, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	0	1	0	--	--	--	--	--	--	--	--
		2004	0	14	0	--	--	--	--	--	--	--	--
		2005	8	0	0	82.1	80.4	26.2	0.05	47.4	117	--	--
Residue on evaporation at 105°C, in mg/L	T	2002	12	0	0	1,240	420	1,800	2.11	138	6,040	--	--
		2003	1	0	0	416	416	--	--	416	416	--	--
		2004	14	0	0	213	120	166	1.51	76	580	--	--
		2005	7	1	0	378	346	157	0.33	138	564	--	--
E. coli, colonies per 100 mL	W	2002	2	0	0	8,150	8,150	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	3,730	3,730	--	--	--	--	--	--
		2005	1	0	0	11,000	11,000	--	--	--	--	--	--
Fecal coliform, colonies per 100 mL	W	2002	2	0	0	29,500	29,500	--	--	--	--	--	--
		2003	0	0	0	--	--	--	--	--	--	--	--
		2004	2	0	0	5,660	5,660	--	--	--	--	--	--
		2005	1	0	0	54,000	54,000	--	--	--	--	--	--
Ammonia + organic N as N, in mg/L	T	2002	11	1	0	7.1	7.2	1.37	0.9	3.9	9.2	--	--
		2003	1	0	0	9.63	9.63	--	--	9.63	9.63	--	--
		2004	14	0	0	4.62	3.85	2.44	2.55	2.66	12.2	--	--
		2005	8	0	0	4.19	4.39	1.18	0.84	1.98	5.72	--	--
Ammonia, as N, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	3.55	3.55	--	--	3.55	3.55	--	--
		2004	14	0	0	1.65	1.45	0.9	0.73	0.51	3.46	--	--
		2005	8	0	0	1.24	1.48	0.71	0.3	0.32	2.2	--	--
Nitrite + nitrate, as N, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	3.56	3.56	--	--	3.56	3.56	--	--
		2004	14	0	0	2.82	2.59	0.76	0.56	1.77	4.1	--	--
		2005	8	0	0	2.42	2.08	1.17	0.39	1.14	4	--	--
Orthophosphate, as P, in mg/L	D	2002	11	1	0	0.81	0.76	0.29	0.58	0.39	1.4	--	--
		2003	1	0	0	0.95	0.95	--	--	0.95	0.95	--	--
		2004	14	0	0	0.54	0.55	0.16	0.19	0.28	0.81	--	--
		2005	8	0	0	0.47	0.35	0.29	0.94	0.2	1	--	--

Table A2. Summary statistics for water-quality properties and constituents by water year for all stations, South Platte River below Union Avenue at Englewood, South Platte River at Denver, Tollgate Creek above 6th Avenue at Aurora, Sand Creek at mouth near Commerce City, and South Platte River at Henderson.—Continued

[n, number of samples; M, number of samples with missing values; N, nitrogen; P, phosphorus; Pct, percentage of samples below minimum reporting level; Stddev, standard deviation; Skew, skewness; ft³/s, cubic feet per second; µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Property or constituent	Phase	Typ	n	M	Pct	Mean	Median	StdDev	Skew	Minimum	Maximum	Reporting level	
												Mean	Median
South Platte River at Henderson (06720500)—Continued													
Phosphorus, as P, in mg/L	T	2002	11	1	0	2.55	2.14	1.98	2.85	0.87	8.3	--	--
		2003	1	0	0	2.77	2.77	--	--	2.77	2.77	--	--
		2004	14	0	0	1.38	1.25	0.6	2.01	0.83	3.12	--	--
		2005	8	0	0	1.58	1.59	0.5	0.31	0.73	2.52	--	--
Organic carbon, in mg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	11.7	11.7	--	--	11.7	11.7	--	--
		2004	10	4	0	9.81	10.1	2.79	0.07	5.98	14.4	--	--
		2005	8	0	0	9.74	8.94	4.08	0.61	5.39	16.6	--	--
Copper, in µg/L	D	2002	11	1	0	4.73	5	2.49	0.33	2	9	--	--
		2003	1	0	0	2.7	2.7	--	--	2.7	2.7	--	--
		2004	14	0	0	2.94	2.93	0.55	0.12	2.04	3.77	--	--
		2005	8	0	0	2.43	2.28	0.71	0.35	1.56	3.49	--	--
Copper, in µg/L	T	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	52.9	52.9	--	--	52.9	52.9	--	--
		2004	14	0	0	32.1	30.7	16.8	1.07	11.6	71.9	--	--
		2005	8	0	0	38.8	36	15.2	0.05	18.2	57.2	--	--
Lead, in µg/L	D	2002	11	1	90.9	10	10	--	--	10	10	10	10
		2003	1	0	0	0.5	0.5	--	--	0.5	0.5	--	--
		2004	14	0	0	0.3	0.28	0.12	1.55	0.13	0.64	--	--
		2005	8	0	0	0.24	0.21	0.07	0.4	0.16	0.34	--	--
Lead, in µg/L	T	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	40.9	40.9	--	--	40.9	40.9	--	--
		2004	14	0	0	31.3	31	19.6	0.61	6.92	68.2	--	--
		2005	8	0	0	35.3	31.4	16.4	0.49	16.7	61.2	--	--
Manganese, in µg/L	D	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	217	217	--	--	217	217	--	--
		2004	14	0	0	93.8	79.7	65.8	1.02	13.4	242	--	--
		2005	8	0	0	63.1	68.5	48.6	0.1	7.21	132	--	--
Manganese, in µg/L	T	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	713	713	--	--	713	713	--	--
		2004	14	0	0	507	495	239	0.58	236	966	--	--
		2005	8	0	0	649	592	230	0.27	306	1,010	--	--
Zinc, in µg/L	D	2002	11	1	27.3	31.3	30	11.3	0.49	20	50	20	20
		2003	1	0	0	29	29	--	--	29	29	--	--
		2004	14	0	0	19.3	17.6	7.76	1.54	9.71	40.3	--	--
		2005	8	0	0	13.6	12.6	5.12	0.39	7.86	21	--	--
Zinc, in µg/L	T	2002	0	12	0	--	--	--	--	--	--	--	--
		2003	1	0	0	209	209	--	--	209	209	--	--
		2004	14	0	0	144	123	78.4	0.68	45	299	--	--
		2005	8	0	0	166	155	70.7	0.2	66	265	--	--

Table A3. Correlation among water-quality properties and constituents, by station.

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Mean streamflow correlations												
Streamflow volume	0.975	172	0.993	37	0.974	46	0.974	46	0.906	20	0.965	35
pH	–0.043	172	0.122	37	0.158	46	0.158	46	–0.251	20	–0.230	35
Specific conductance	–0.321	150	–0.512	31	–0.569	41	–0.569	41	–0.260	18	–0.544	30
Hardness	–0.398	169	–0.488	37	–0.543	45	–0.543	45	–0.392	20	–0.557	34
Calcium, dissolved	–0.419	128	–0.599	28	–0.684	35	–0.684	35	–0.407	17	–0.682	23
Magnesium, dissolved	–0.377	128	–0.379	28	–0.614	35	–0.614	35	–0.370	17	–0.700	23
Potassium, dissolved	0.022	59	–0.461	15	–0.769	15	–0.769	15	–0.521	9	–0.872	8
Sodium, dissolved	–0.254	59	–0.568	15	–0.671	15	–0.671	15	–0.701	9	–0.630	8
Alkalinity, fixed endpoint	–0.383	59	–0.748	15	–0.863	15	–0.863	15	–0.797	9	–0.919	8
Chloride, dissolved	–0.117	59	–0.420	15	–0.422	15	–0.422	15	–0.574	9	–0.483	8
Flouride, dissolved	–0.193	59	–0.540	15	–0.747	15	–0.747	15	–0.816	9	–0.857	8
Sulfate, dissolved	–0.410	59	–0.679	15	–0.855	15	–0.855	15	–0.723	9	–0.934	8
Residue on evaporation at 105 degrees Celsius	0.063	166	0.214	35	0.299	45	0.299	45	–0.133	18	0.039	34
Ammonia + organic N, as N	0.151	169	0.049	37	0.017	45	0.017	45	–0.106	20	–0.302	34
Ammonia, as N	0.141	113	–0.409	20	–0.174	33	–0.174	33	–0.084	15	–0.529	23
Nitrite + nitrate, as N	0.121	125	–0.574	28	–0.578	35	–0.578	35	–0.163	14	–0.554	23
Orthophosphate, as P	0.151	164	–0.083	37	–0.413	45	–0.413	45	0.129	15	–0.554	34
Phosphorus, as P, total	0.234	168	0.334	37	0.069	45	0.069	45	0.232	19	–0.088	34
Organic carbon, dissolved	–0.130	116	–0.124	25	–0.244	31	–0.244	31	–0.265	17	–0.012	19
Copper, dissolved	–0.120	169	–0.126	37	–0.449	45	–0.449	45	–0.521	20	–0.242	34
Copper, total	0.364	128	0.460	28	0.206	35	0.206	35	0.133	17	0.340	23
Lead, dissolved	–0.077	89	–0.570	7	–0.287	33	–0.287	33	–0.377	5	0.053	24
Lead, total	0.443	128	0.411	28	0.372	35	0.372	35	0.198	17	0.532	23
Manganese, dissolved	–0.135	128	–0.327	28	–0.387	35	–0.387	35	–0.004	17	–0.503	23
Manganese, total	0.044	128	0.316	28	0.216	35	0.216	35	0.194	17	0.219	23
Zinc, dissolved	–0.134	151	–0.372	31	–0.478	39	–0.478	39	–0.286	18	–0.383	31
Zinc, total	0.066	127	0.321	28	0.208	35	0.208	35	0.111	17	0.321	23
Streamflow volume correlations												
pH	–0.067	172	0.103	37	0.137	46	0.137	46	–0.239	20	–0.306	35
Specific conductance	–0.312	150	–0.537	31	–0.548	41	–0.548	41	–0.294	18	–0.496	30
Hardness	–0.395	169	–0.504	37	–0.527	45	–0.527	45	–0.407	20	–0.531	34
Calcium, dissolved	–0.414	128	–0.637	28	–0.654	35	–0.654	35	–0.419	17	–0.621	23
Magnesium, dissolved	–0.370	128	–0.439	28	–0.584	35	–0.584	35	–0.375	17	–0.629	23
Potassium, dissolved	0.020	59	–0.485	15	–0.773	15	–0.773	15	–0.505	9	–0.733	8
Sodium, dissolved	–0.248	59	–0.575	15	–0.671	15	–0.671	15	–0.638	9	–0.494	8
Alkalinity, fixed endpoint	–0.390	59	–0.754	15	–0.869	15	–0.869	15	–0.743	9	–0.803	8
Chloride, dissolved	–0.095	59	–0.423	15	–0.419	15	–0.419	15	–0.523	9	–0.355	8
Flouride, dissolved	–0.196	59	–0.544	15	–0.756	15	–0.756	15	–0.631	9	–0.757	8
Sulfate, dissolved	–0.419	59	–0.687	15	–0.861	15	–0.861	15	–0.681	9	–0.799	8
Residue on evaporation at 105 degrees Celsius	0.070	166	0.236	35	0.297	45	0.297	45	0.105	18	0.030	34
Ammonia + organic N, as N	0.176	169	0.066	37	0.023	45	0.023	45	0.120	20	–0.250	34
Ammonia, as N	0.168	113	–0.377	20	–0.147	33	–0.147	33	0.074	15	–0.474	23
Nitrite + nitrate, as N	0.134	125	–0.566	28	–0.556	35	–0.556	35	–0.050	14	–0.487	23
Orthophosphate, as P	0.166	164	–0.069	37	–0.411	45	–0.411	45	0.071	15	–0.504	34
Phosphorus, as P, total	0.259	168	0.356	37	0.063	45	0.063	45	0.476	19	–0.055	34
Organic carbon, dissolved	–0.151	116	–0.114	25	–0.223	31	–0.223	31	–0.364	17	–0.145	19
Copper, dissolved	–0.123	169	–0.116	37	–0.421	45	–0.421	45	–0.566	20	–0.256	34
Copper, total	0.406	128	0.482	28	0.212	35	0.212	35	0.367	17	0.432	23
Lead, dissolved	–0.075	89	–0.565	7	–0.269	33	–0.269	33	–0.375	5	0.066	24
Lead, total	0.490	128	0.435	28	0.380	35	0.380	35	0.423	17	0.627	23

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Streamflow volume correlations—Continued												
Manganese, dissolved	–0.126	128	–0.318	28	–0.379	35	–0.379	35	0.053	17	–0.439	23
Manganese, total	0.076	128	0.338	28	0.210	35	0.210	35	0.391	17	0.312	23
Zinc, dissolved	–0.129	151	–0.364	31	–0.449	39	–0.449	39	–0.314	18	–0.325	31
Zinc, total	0.097	127	0.345	28	0.224	35	0.224	35	0.375	17	0.438	23
pH correlations												
Specific conductance	–0.137	152	0.012	31	–0.080	41	–0.080	41	–0.021	20	0.047	30
Hardness	–0.092	173	–0.038	37	–0.059	45	–0.059	45	–0.127	24	0.305	34
Calcium, dissolved	–0.117	132	0.137	28	–0.037	35	–0.037	35	0.038	21	–0.086	23
Magnesium, dissolved	–0.080	132	0.295	28	–0.103	35	–0.103	35	0.013	21	–0.009	23
Potassium, dissolved	0.114	63	0.453	15	0.018	15	0.018	15	0.509	13	–0.319	8
Sodium, dissolved	–0.116	63	0.361	15	0.092	15	0.092	15	–0.078	13	0.192	8
Alkalinity, fixed endpoint	0.224	63	0.386	15	0.103	15	0.103	15	0.209	13	–0.079	8
Chloride, dissolved	–0.063	63	0.238	15	0.028	15	0.028	15	–0.267	13	0.241	8
Flouride, dissolved	0.468	63	0.620	15	0.234	15	0.234	15	0.552	13	–0.185	8
Sulfate, dissolved	–0.186	63	0.248	15	0.109	15	0.109	15	–0.013	13	–0.264	8
Residue on evaporation at 105 degrees Celsius	0.052	170	–0.246	35	0.063	45	0.063	45	0.135	22	0.315	34
Ammonia + organic N, as N	–0.187	173	–0.274	37	–0.162	45	–0.162	45	–0.119	24	–0.058	34
Ammonia, as N	–0.146	117	–0.089	20	–0.266	33	–0.266	33	–0.035	19	–0.108	23
Nitrite + nitrate, as N	–0.051	129	0.066	28	–0.141	35	–0.141	35	–0.116	18	–0.163	23
Orthophosphate, as P	0.009	168	–0.138	37	–0.025	45	–0.025	45	0.070	19	0.055	34
Phosphorus, as P, total	–0.032	172	–0.244	37	–0.097	45	–0.097	45	0.124	23	0.221	34
Organic carbon, dissolved	–0.095	120	0.173	25	–0.139	31	–0.139	31	0.217	21	0.185	19
Copper, dissolved	0.037	173	–0.048	37	–0.474	45	–0.474	45	0.183	24	0.155	34
Copper, total	–0.140	132	–0.158	28	–0.197	35	–0.197	35	0.259	21	–0.270	23
Lead, dissolved	0.139	91	0.455	7	–0.394	33	–0.394	33	0.062	7	0.062	24
Lead, total	–0.093	132	–0.135	28	–0.118	35	–0.118	35	0.221	21	–0.226	23
Manganese, dissolved	–0.095	132	–0.077	28	–0.169	35	–0.169	35	0.168	21	–0.193	23
Manganese, total	–0.181	132	–0.136	28	–0.071	35	–0.071	35	0.209	21	–0.321	23
Zinc, dissolved	–0.092	155	–0.191	31	–0.283	39	–0.283	39	–0.301	22	0.164	31
Zinc, total	–0.173	131	–0.180	28	–0.208	35	–0.208	35	0.205	21	–0.203	23
Specific-conductance correlations												
Hardness	0.783	152	0.542	31	0.750	41	0.750	41	0.912	20	0.542	30
Calcium, dissolved	0.894	111	0.819	22	0.757	31	0.757	31	0.945	17	0.712	19
Magnesium, dissolved	0.920	111	0.717	22	0.885	31	0.885	31	0.988	17	0.802	19
Potassium, dissolved	0.316	55	0.499	12	0.632	15	0.632	15	0.150	11	0.202	6
Sodium, dissolved	0.937	55	0.855	12	0.872	15	0.872	15	0.992	11	0.959	6
Alkalinity, fixed endpoint	0.575	55	0.779	12	0.757	15	0.757	15	0.896	11	0.379	6
Chloride, dissolved	0.728	55	0.764	12	0.709	15	0.709	15	0.765	11	0.950	6
Flouride, dissolved	–0.079	55	0.321	12	0.634	15	0.634	15	0.590	11	0.111	6
Sulfate, dissolved	0.869	55	0.717	12	0.744	15	0.744	15	0.983	11	0.317	6
Residue on evaporation at 105 degrees Celsius	–0.073	147	–0.159	29	–0.054	40	–0.054	40	–0.248	19	–0.066	29
Ammonia + organic N, as N	0.270	152	0.048	31	0.303	41	0.303	41	0.169	20	0.462	30
Ammonia, as N	0.212	97	0.575	14	0.374	29	0.374	29	0.284	15	0.698	19
Nitrite + nitrate, as N	0.076	108	0.381	22	0.651	31	0.651	31	0.222	14	0.390	19
Orthophosphate, as P	0.119	148	0.020	31	0.620	41	0.620	41	–0.378	16	0.572	30
Phosphorus, as P, total	0.094	152	–0.145	31	0.375	41	0.375	41	–0.142	20	0.140	30
Organic carbon, dissolved	0.416	107	–0.016	22	0.185	29	0.185	29	0.367	17	–0.222	17
Copper, dissolved	–0.017	152	–0.082	31	0.295	41	0.295	41	0.247	20	0.162	30
Copper, total	0.014	111	–0.005	22	0.220	31	0.220	31	–0.113	17	0.190	19
Lead, dissolved	0.020	79	0.674	5	0.532	29	0.532	29	0.882	7	–0.109	20

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Specific-conductance correlations—Continued												
Lead, total	–0.050	111	0.019	22	0.042	31	0.042	31	–0.122	17	–0.025	19
Manganese, dissolved	0.404	111	0.467	22	0.707	31	0.707	31	0.215	17	0.612	19
Manganese, total	0.286	111	0.005	22	0.167	31	0.167	31	0.182	17	0.053	19
Zinc, dissolved	0.384	134	0.174	25	0.550	35	0.550	35	0.458	18	0.357	27
Zinc, total	0.379	110	0.069	22	0.213	31	0.213	31	0.005	17	0.114	19
Hardness correlations												
Calcium, dissolved	0.996	132	0.985	28	0.993	35	0.993	35	0.998	21	0.996	23
Magnesium, dissolved	0.969	132	0.957	28	0.965	35	0.965	35	0.988	21	0.985	23
Potassium, dissolved	0.279	63	0.755	15	0.810	15	0.810	15	0.059	13	0.934	8
Sodium, dissolved	0.822	63	0.823	15	0.685	15	0.685	15	0.966	13	0.606	8
Alkalinity, fixed endpoint	0.721	63	0.969	15	0.973	15	0.973	15	0.934	13	0.930	8
Chloride, dissolved	0.493	63	0.566	15	0.367	15	0.367	15	0.646	13	0.449	8
Flouride, dissolved	0.105	63	0.627	15	0.876	15	0.876	15	0.648	13	0.912	8
Sulfate, dissolved	0.956	63	0.967	15	0.985	15	0.985	15	0.994	13	0.967	8
Residue on evaporation at 105 degrees Celsius	0.169	167	0.160	35	–0.214	44	–0.214	44	0.006	22	0.644	33
Ammonia + organic N, as N	0.201	173	0.329	37	0.076	45	0.076	45	0.210	24	0.597	34
Ammonia, as N	0.049	117	0.195	20	0.077	33	0.077	33	0.382	19	0.817	23
Nitrite + nitrate, as N	0.007	129	0.541	28	0.762	35	0.762	35	0.325	18	0.848	23
Orthophosphate, as P	0.079	168	0.369	37	0.759	45	0.759	45	–0.436	19	0.710	34
Phosphorus, as P, total	0.154	172	0.149	37	0.174	45	0.174	45	–0.094	23	0.714	34
Organic carbon, dissolved	0.354	120	0.075	25	0.109	31	0.109	31	0.349	21	0.106	19
Copper, dissolved	0.322	173	0.511	37	0.455	45	0.455	45	0.397	24	0.679	34
Copper, total	–0.172	132	–0.372	28	–0.148	35	–0.148	35	–0.153	21	–0.089	23
Lead, dissolved	0.226	91	0.764	7	0.269	33	0.269	33	0.853	7	0.485	24
Lead, total	–0.241	132	–0.362	28	–0.315	35	–0.315	35	–0.156	21	–0.342	23
Manganese, dissolved	0.431	132	0.189	28	0.516	35	0.516	35	0.282	21	0.785	23
Manganese, total	0.213	132	–0.285	28	–0.114	35	–0.114	35	0.191	21	–0.038	23
Zinc, dissolved	0.315	155	0.668	31	0.636	39	0.636	39	0.528	22	0.718	31
Zinc, total	0.166	131	–0.318	28	–0.161	35	–0.161	35	0.017	21	–0.149	23
Calcium, dissolved, correlations												
Magnesium, dissolved	0.943	132	0.892	28	0.927	35	0.927	35	0.977	21	0.968	23
Potassium, dissolved	0.251	63	0.722	15	0.823	15	0.823	15	0.068	13	0.955	8
Sodium, dissolved	0.819	63	0.788	15	0.664	15	0.664	15	0.965	13	0.547	8
Alkalinity, fixed endpoint	0.692	63	0.967	15	0.972	15	0.972	15	0.934	13	0.925	8
Chloride, dissolved	0.478	63	0.550	15	0.340	15	0.340	15	0.648	13	0.382	8
Flouride, dissolved	0.058	63	0.592	15	0.880	15	0.880	15	0.646	13	0.932	8
Sulfate, dissolved	0.967	63	0.936	15	0.987	15	0.987	15	0.992	13	0.976	8
Residue on evaporation at 105 degrees Celsius	–0.190	126	–0.324	26	–0.378	34	–0.378	34	–0.314	19	–0.279	22
Ammonia + organic N, as N	0.06	132	–0.085	28	0.003	35	0.003	35	0.095	21	0.489	23
Ammonia, as N	0.019	117	0.249	20	0.040	33	0.040	33	0.413	19	0.794	23
Nitrite + nitrate, as N	–0.024	129	0.552	28	0.770	35	0.770	35	0.340	18	0.862	23
Orthophosphate, as P	–0.110	127	–0.238	28	0.641	35	0.641	35	–0.482	16	0.740	23
Phosphorus, as P, total	–0.089	131	–0.355	28	0.057	35	0.057	35	–0.173	20	0.335	23
Organic carbon, dissolved	0.358	120	0.103	25	0.123	31	0.123	31	0.340	21	0.123	19
Copper, dissolved	0.359	132	0.391	28	0.356	35	0.356	35	0.491	21	0.518	23
Copper, total	–0.182	132	–0.358	28	–0.202	35	–0.202	35	–0.163	21	–0.117	23
Lead, dissolved	0.047	88	–0.266	5	0.223	33	0.223	33	0.835	7	0.544	23
Lead, total	–0.248	132	–0.345	28	–0.358	35	–0.358	35	–0.163	21	–0.360	23
Manganese, dissolved	0.442	132	0.214	28	0.464	35	0.464	35	0.308	21	0.769	23

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Calcium, dissolved, correlations—Continued												
Manganese, total	0.219	132	–0.267	28	–0.153	35	–0.153	35	0.195	21	–0.048	23
Zinc, dissolved	0.328	131	0.456	28	0.480	35	0.480	35	0.521	21	0.622	23
Zinc, total	0.148	131	–0.293	28	–0.214	35	–0.214	35	0.010	21	–0.173	23
Magnesium, dissolved, correlations												
Potassium, dissolved	0.353	63	0.775	15	0.760	15	0.760	15	0.031	13	0.868	8
Sodium, dissolved	0.806	63	0.839	15	0.735	15	0.735	15	0.967	13	0.723	8
Alkalinity, fixed endpoint	0.780	63	0.917	15	0.960	15	0.960	15	0.930	13	0.924	8
Chloride, dissolved	0.522	63	0.561	15	0.439	15	0.439	15	0.637	13	0.583	8
Flouride, dissolved	0.235	63	0.650	15	0.849	15	0.849	15	0.650	13	0.851	8
Sulfate, dissolved	0.893	63	0.966	15	0.966	15	0.966	15	0.996	13	0.928	8
Residue on evaporation at 105 degrees Celsius	–0.225	126	–0.335	26	–0.236	34	–0.236	34	–0.314	19	–0.179	22
Ammonia + organic N, as N	0.156	132	–0.127	28	0.166	35	0.166	35	0.134	21	0.579	23
Ammonia, as N	0.129	117	0.098	20	0.155	33	0.155	33	0.298	19	0.843	23
Nitrite + nitrate, as N	0.089	129	0.489	28	0.702	35	0.702	35	0.285	18	0.802	23
Orthophosphate, as P	0.002	127	–0.163	28	0.587	35	0.587	35	–0.429	16	0.703	23
Phosphorus, as P, total	–0.011	131	–0.348	28	0.222	35	0.222	35	–0.133	20	0.394	23
Organic carbon, dissolved	0.330	120	0.033	25	0.070	31	0.070	31	0.365	21	0.077	19
Copper, dissolved	0.347	132	0.444	28	0.237	35	0.237	35	0.478	21	0.440	23
Copper, total	–0.138	132	–0.369	28	–0.025	35	–0.025	35	–0.128	21	–0.045	23
Lead, dissolved	0.184	88	–0.224	5	0.353	33	0.353	33	0.887	7	0.554	23
Lead, total	–0.215	132	–0.367	28	–0.207	35	–0.207	35	–0.135	21	–0.310	23
Manganese, dissolved	0.384	132	0.134	28	0.603	35	0.603	35	0.219	21	0.801	23
Manganese, total	0.188	132	–0.295	28	–0.027	35	–0.027	35	0.182	21	–0.026	23
Zinc, dissolved	0.374	131	0.268	28	0.441	35	0.441	35	0.446	21	0.606	23
Zinc, total	0.205	131	–0.338	28	–0.037	35	–0.037	35	0.035	21	–0.106	23
Potassium, dissolved, correlations												
Sodium, dissolved	0.341	63	0.525	15	0.503	15	0.503	15	0.012	13	0.297	8
Alkalinity, fixed endpoint	0.615	63	0.748	15	0.824	15	0.824	15	0.052	13	0.886	8
Chloride, dissolved	0.311	63	0.178	15	0.193	15	0.193	15	–0.112	13	0.117	8
Flouride, dissolved	0.515	63	0.529	15	0.865	15	0.865	15	0.307	13	0.983	8
Sulfate, dissolved	0.152	63	0.788	15	0.846	15	0.846	15	0.044	13	0.978	8
Residue on evaporation at 105 degrees Celsius	–0.149	60	–0.245	13	–0.340	15	–0.340	15	–0.074	13	–0.524	7
Ammonia + organic N, as N	0.461	63	0.128	15	0.476	15	0.476	15	0.083	13	0.639	8
Ammonia, as N	0.683	57	0.283	10	0.105	14	0.105	14	–0.174	13	0.804	8
Nitrite + nitrate, as N	0.828	63	0.857	15	0.966	15	0.966	15	0.452	13	0.989	8
Orthophosphate, as P	0.780	63	0.283	15	0.948	15	0.948	15	0.009	13	0.934	8
Phosphorus, as P, total	0.382	63	–0.075	15	0.580	15	0.580	15	–0.087	13	0.624	8
Organic carbon, dissolved	0.423	63	0.549	15	0.638	15	0.638	15	0.558	13	0.017	8
Copper, dissolved	0.490	63	0.853	15	0.610	15	0.610	15	0.383	13	0.508	8
Copper, total	0.112	63	–0.201	15	–0.064	15	–0.064	15	–0.094	13	–0.029	8
Lead, dissolved	0.631	39	–0.964	3	0.550	14	0.550	14	0.562	5	0.865	8
Lead, total	0.041	63	–0.256	15	–0.165	15	–0.165	15	–0.137	13	–0.259	8
Manganese, dissolved	0.275	63	0.214	15	0.771	15	0.771	15	0.317	13	0.907	8
Manganese, total	0.053	63	–0.032	15	0.144	15	0.144	15	–0.146	13	0.253	8
Zinc, dissolved	0.452	62	0.444	15	0.799	15	0.799	15	–0.167	13	0.937	8
Zinc, total	0.113	62	–0.260	15	0.021	15	0.021	15	–0.209	13	–0.126	8
Sodium, dissolved, correlations												
Alkalinity, fixed endpoint	0.589	63	0.760	15	0.590	15	0.590	15	0.841	13	0.558	8
Chloride, dissolved	0.858	63	0.906	15	0.921	15	0.921	15	0.790	13	0.982	8
Flouride, dissolved	–0.067	63	0.411	15	0.454	15	0.454	15	0.506	13	0.289	8

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Sodium, dissolved, correlations—Continued												
Sulfate, dissolved	0.825	63	0.791	15	0.627	15	0.627	15	0.960	13	0.422	8
Residue on evaporation at 105 degrees Celsius	–0.123	60	–0.641	13	–0.347	15	–0.347	15	–0.387	13	0.248	7
Ammonia + organic N, as N	0.288	63	–0.106	15	0.214	15	0.214	15	–0.135	13	0.523	8
Ammonia, as N	0.357	57	–0.105	10	0.407	14	0.407	14	0.455	13	0.642	8
Nitrite + nitrate, as N	0.07	63	0.553	15	0.498	15	0.498	15	0.437	13	0.270	8
Orthophosphate, as P	0.024	63	–0.275	15	0.401	15	0.401	15	–0.552	13	0.175	8
Phosphorus, as P, total	0.026	63	–0.371	15	0.165	15	0.165	15	–0.487	13	0.267	8
Organic carbon, dissolved	0.335	63	–0.045	15	–0.010	15	–0.010	15	0.174	13	–0.417	8
Copper, dissolved	0.287	63	0.218	15	0.155	15	0.155	15	0.621	13	–0.273	8
Copper, total	–0.017	63	–0.384	15	–0.188	15	–0.188	15	–0.353	13	0.131	8
Lead, dissolved	0.075	39	0.849	3	0.389	14	0.389	14	0.364	5	–0.092	8
Lead, total	–0.051	63	–0.345	15	–0.259	15	–0.259	15	–0.379	13	0.056	8
Manganese, dissolved	0.369	63	0.102	15	0.431	15	0.431	15	–0.181	13	0.542	8
Manganese, total	0.089	63	–0.332	15	–0.045	15	–0.045	15	–0.306	13	–0.100	8
Zinc, dissolved	0.487	62	0.436	15	0.471	15	0.471	15	0.687	13	0.351	8
Zinc, total	0.05	62	–0.328	15	–0.127	15	–0.127	15	–0.097	13	0.147	8
Alkalinity, fixed endpoint, correlations												
Chloride, dissolved	0.443	63	0.515	15	0.265	15	0.265	15	0.467	13	0.411	8
Flouride, dissolved	0.631	63	0.766	15	0.928	15	0.928	15	0.762	13	0.917	8
Sulfate, dissolved	0.539	63	0.894	15	0.952	15	0.952	15	0.916	13	0.949	8
Residue on evaporation at 105 degrees Celsius	–0.246	60	–0.668	13	–0.578	15	–0.578	15	–0.246	13	–0.483	7
Ammonia + organic N, as N	0.102	63	–0.296	15	0.054	15	0.054	15	–0.047	13	0.610	8
Ammonia, as N	0.276	57	0.076	10	0.072	14	0.072	14	0.377	13	0.881	8
Nitrite + nitrate, as N	0.471	63	0.787	15	0.784	15	0.784	15	0.489	13	0.898	8
Orthophosphate, as P	0.263	63	–0.262	15	0.707	15	0.707	15	–0.496	13	0.903	8
Phosphorus, as P, total	–0.073	63	–0.588	15	0.150	15	0.150	15	–0.314	13	0.562	8
Organic carbon, dissolved	0.355	63	0.211	15	0.259	15	0.259	15	0.178	13	–0.008	8
Copper, dissolved	0.457	63	0.516	15	0.387	15	0.387	15	0.441	13	0.425	8
Copper, total	–0.216	63	–0.654	15	–0.429	15	–0.429	15	–0.186	13	–0.083	8
Lead, dissolved	0.313	39	–0.567	3	0.212	14	0.212	14	0.383	5	0.611	8
Lead, total	–0.208	63	–0.671	15	–0.459	15	–0.459	15	–0.217	13	–0.278	8
Manganese, dissolved	0.189	63	0.297	15	0.602	15	0.602	15	–0.100	13	0.984	8
Manganese, total	–0.119	63	–0.484	15	–0.254	15	–0.254	15	–0.169	13	0.095	8
Zinc, dissolved	0.496	62	0.618	15	0.532	15	0.532	15	0.676	13	0.843	8
Zinc, total	–0.169	62	–0.644	15	–0.364	15	–0.364	15	0.047	13	–0.154	8
Chloride, dissolved, correlations												
Flouride, dissolved	–0.025	63	0.225	15	0.104	15	0.104	15	–0.041	13	0.108	8
Sulfate, dissolved	0.444	63	0.488	15	0.285	15	0.285	15	0.604	13	0.249	8
Residue on evaporation at 105 degrees Celsius	–0.165	60	–0.568	13	–0.198	15	–0.198	15	–0.517	13	0.365	7
Ammonia + organic N, as N	0.245	63	–0.142	15	0.187	15	0.187	15	–0.421	13	0.447	8
Ammonia, as N	0.467	57	–0.282	10	0.478	14	0.478	14	0.305	13	0.527	8
Nitrite + nitrate, as N	0.121	63	0.232	15	0.181	15	0.181	15	–0.100	13	0.088	8
Orthophosphate, as P	0.112	63	–0.438	15	0.102	15	0.102	15	–0.112	13	0.003	8
Phosphorus, as P, total	0.038	63	–0.338	15	0.044	15	0.044	15	–0.657	13	0.190	8
Organic carbon, dissolved	0.098	63	–0.241	15	–0.111	15	–0.111	15	–0.225	13	–0.462	8
Copper, dissolved	0.155	63	–0.132	15	0.035	15	0.035	15	0.456	13	–0.405	8
Copper, total	–0.009	63	–0.300	15	–0.068	15	–0.068	15	–0.561	13	0.178	8
Lead, dissolved	0.143	39	0.724	3	0.388	14	0.388	14	–0.346	5	–0.261	8
Lead, total	–0.026	63	–0.223	15	–0.133	15	–0.133	15	–0.560	13	0.142	8

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Chloride, dissolved, correlations—Continued												
Manganese, dissolved	0.190	63	0.021	15	0.282	15	0.282	15	–0.315	13	0.394	8
Manganese, total	–0.053	63	–0.330	15	–0.028	15	–0.028	15	–0.550	13	–0.115	8
Zinc, dissolved	0.391	62	0.331	15	0.332	15	0.332	15	0.541	13	0.171	8
Zinc, total	0.050	62	–0.225	15	–0.017	15	–0.017	15	–0.358	13	0.211	8
Flouride, dissolved, correlations												
Sulfate, dissolved	–0.126	63	0.515	15	0.890	15	0.890	15	0.663	13	0.975	8
Residue on evaporation at 105 degrees Celsius	–0.200	60	–0.508	13	–0.446	15	–0.446	15	0.139	13	–0.551	7
Ammonia + organic N, as N	–0.036	63	–0.344	15	0.180	15	0.180	15	0.315	13	0.557	8
Ammonia, as N	0.265	57	0.200	10	–0.072	14	–0.072	14	0.378	13	0.761	8
Nitrite + nitrate, as N	0.572	63	0.639	15	0.850	15	0.850	15	0.725	13	0.997	8
Orthophosphate, as P	0.345	63	–0.497	15	0.785	15	0.785	15	–0.578	13	0.964	8
Phosphorus, as P, total	–0.064	63	–0.609	15	0.315	15	0.315	15	0.119	13	0.549	8
Organic carbon, dissolved	0.124	63	0.247	15	0.367	15	0.367	15	0.462	13	0.155	8
Copper, dissolved	0.194	63	0.328	15	0.313	15	0.313	15	0.340	13	0.611	8
Copper, total	–0.230	63	–0.671	15	–0.313	15	–0.313	15	0.208	13	–0.120	8
Lead, dissolved	0.481	39	–0.978	3	0.294	14	0.294	14	0.702	5	0.861	8
Lead, total	–0.198	63	–0.676	15	–0.327	15	–0.327	15	0.173	13	–0.327	8
Manganese, dissolved	0.019	63	0.594	15	0.624	15	0.624	15	0.118	13	0.919	8
Manganese, total	–0.205	63	–0.456	15	–0.102	15	–0.102	15	0.197	13	0.166	8
Zinc, dissolved	0.146	62	0.558	15	0.539	15	0.539	15	0.305	13	0.955	8
Zinc, total	–0.235	62	–0.671	15	–0.240	15	–0.240	15	0.319	13	–0.202	8
Sulfate, dissolved, correlations												
Residue on evaporation at 105 degrees Celsius	–0.117	60	–0.616	13	–0.544	15	–0.544	15	–0.313	13	–0.585	7
Ammonia + organic N, as N	0.109	63	–0.116	15	0.096	15	0.096	15	–0.033	13	0.607	8
Ammonia, as N	0.022	57	0.146	10	0.128	14	0.128	14	0.438	13	0.843	8
Nitrite + nitrate, as N	–0.099	63	0.741	15	0.828	15	0.828	15	0.579	13	0.968	8
Orthophosphate, as P	–0.179	63	0.030	15	0.749	15	0.749	15	–0.612	13	0.940	8
Phosphorus, as P, total	–0.131	63	–0.402	15	0.220	15	0.220	15	–0.374	13	0.570	8
Organic carbon, dissolved	0.398	63	0.187	15	0.217	15	0.217	15	0.307	13	–0.023	8
Copper, dissolved	0.325	63	0.650	15	0.379	15	0.379	15	0.614	13	0.482	8
Copper, total	–0.132	63	–0.474	15	–0.396	15	–0.396	15	–0.250	13	–0.116	8
Lead, dissolved	–0.110	39	–0.019	3	0.177	14	0.177	14	0.534	5	0.757	8
Lead, total	–0.167	63	–0.510	15	–0.440	15	–0.440	15	–0.283	13	–0.342	8
Manganese, dissolved	0.370	63	0.140	15	0.527	15	0.527	15	–0.140	13	0.958	8
Manganese, total	0.118	63	–0.313	15	–0.153	15	–0.153	15	–0.179	13	0.131	8
Zinc, dissolved	0.451	62	0.492	15	0.529	15	0.529	15	0.731	13	0.932	8
Zinc, total	–0.056	62	–0.461	15	–0.334	15	–0.334	15	0.017	13	–0.206	8
Residue on evaporation at 105 degrees Celsius correlations												
Ammonia + organic N, as N	0.335	167	0.921	35	0.670	44	0.670	44	0.299	22	0.341	33
Ammonia, as N	0.014	113	0.563	20	0.510	32	0.510	32	0.168	17	0.009	22
Nitrite + nitrate, as N	–0.173	123	–0.169	26	–0.097	34	–0.097	34	0.125	16	–0.198	22
Orthophosphate, as P	0.079	163	0.448	35	–0.014	44	–0.014	44	0.271	18	0.139	33
Phosphorus, as P, total	0.637	167	0.925	35	0.679	44	0.679	44	0.605	22	0.873	33
Organic carbon, dissolved	0.124	114	0.334	23	0.264	30	0.264	30	0.092	19	–0.021	18
Copper, dissolved	0.146	167	0.345	35	–0.243	44	–0.243	44	0.414	22	0.577	33
Copper, total	0.748	126	0.945	26	0.778	34	0.778	34	0.938	19	0.847	22
Lead, dissolved	0.101	88	–0.304	7	0.199	32	0.199	32	0.325	6	0.967	23
Lead, total	0.748	126	0.952	26	0.896	34	0.896	34	0.919	19	0.764	22
Manganese, dissolved	0.084	126	0.648	26	0.090	34	0.090	34	0.050	19	–0.015	22

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Residue on evaporation at 105 degrees Celsius correlations—Continued												
Manganese, total	0.711	126	0.947	26	0.793	34	0.793	34	0.711	19	0.694	22
Zinc, dissolved	0.022	149	0.241	29	–0.089	38	–0.089	38	–0.208	20	0.501	30
Zinc, total	0.321	125	0.950	26	0.761	34	0.761	34	0.899	19	0.802	22
Ammonia + organic nitrogen as N correlations												
Ammonia, as N	0.742	117	0.675	20	0.869	33	0.869	33	0.281	19	0.846	23
Nitrite + nitrate, as N	0.441	129	0.067	28	0.363	35	0.363	35	0.229	18	0.599	23
Orthophosphate, as P	0.562	168	0.444	37	0.284	45	0.284	45	–0.505	19	0.509	34
Phosphorus, as P, total	0.770	172	0.932	37	0.947	45	0.947	45	0.756	23	0.511	34
Organic carbon, dissolved	0.464	120	0.409	25	0.490	31	0.490	31	0.389	21	0.314	19
Copper, dissolved	0.116	173	0.265	37	0.016	45	0.016	45	–0.067	24	0.457	34
Copper, total	0.806	132	0.922	28	0.934	35	0.934	35	0.827	21	0.633	23
Lead, dissolved	–0.034	91	–0.162	7	0.640	33	0.640	33	0.667	7	0.429	24
Lead, total	0.705	132	0.932	28	0.811	35	0.811	35	0.800	21	0.390	23
Manganese, dissolved	0.249	132	0.703	28	0.581	35	0.581	35	0.112	21	0.828	23
Manganese, total	0.633	132	0.959	28	0.853	35	0.853	35	0.632	21	0.549	23
Zinc, dissolved	0.210	155	0.337	31	0.274	39	0.274	39	–0.047	22	0.594	31
Zinc, total	0.602	131	0.956	28	0.939	35	0.939	35	0.810	21	0.557	23
Ammonia as N correlations												
Nitrite + nitrate, as N	0.667	115	0.424	20	0.347	33	0.347	33	0.393	17	0.760	23
Orthophosphate, as p	0.788	114	0.046	20	0.228	33	0.228	33	–0.396	16	0.680	23
Phosphorus, as P, total	0.656	116	0.472	20	0.751	33	0.751	33	0.176	18	0.637	23
Organic carbon, dissolved	0.237	105	0.526	17	0.681	29	0.681	29	–0.164	19	0.233	19
Copper, dissolved	0.206	117	–0.027	20	0.133	33	0.133	33	–0.175	19	0.371	23
Copper, total	0.420	117	0.463	20	0.721	33	0.721	33	0.169	19	0.237	23
Lead, dissolved	0.753	82	–0.992	4	0.695	31	0.695	31	0.006	6	0.751	23
Lead, total	0.314	117	0.491	20	0.590	33	0.590	33	0.231	19	–0.022	23
Manganese, dissolved	0.197	117	0.774	20	0.533	33	0.533	33	0.651	19	0.900	23
Manganese, total	0.187	117	0.507	20	0.619	33	0.619	33	0.533	19	0.211	23
Zinc, dissolved	0.183	116	0.567	20	0.576	33	0.576	33	0.101	19	0.559	23
Zinc, total	0.254	116	0.553	20	0.743	33	0.743	33	0.251	19	0.159	23
Nitrite + nitrate as N correlations												
Orthophosphate, as P	0.848	127	0.186	28	0.930	35	0.930	35	–0.479	16	0.806	23
Phosphorus, as P, total	0.437	128	–0.118	28	0.430	35	0.430	35	0.089	17	0.484	23
Organic carbon, dissolved	0.202	117	0.498	25	0.479	31	0.479	31	0.554	18	0.413	19
Copper, dissolved	0.444	129	0.480	28	0.497	35	0.497	35	0.174	18	0.628	23
Copper, total	0.219	129	–0.154	28	0.158	35	0.158	35	0.107	18	0.045	23
Lead, dissolved	0.610	88	–0.094	5	0.535	33	0.535	33	0.421	7	0.761	23
Lead, total	0.149	129	–0.158	28	0.002	35	0.002	35	0.090	18	–0.166	23
Manganese, dissolved	0.160	129	0.186	28	0.648	35	0.648	35	0.306	18	0.849	23
Manganese, total	–0.039	129	–0.073	28	0.180	35	0.180	35	0.139	18	0.158	23
Zinc, dissolved	0.073	128	0.511	28	0.738	35	0.738	35	0.249	18	0.671	23
Zinc, total	0.051	128	–0.116	28	0.172	35	0.172	35	0.126	18	0.010	23
Orthophosphate as P correlations												
Phosphorus, as P, total	0.556	168	0.427	37	0.423	45	0.423	45	–0.116	19	0.372	34
Organic carbon, dissolved	0.129	115	0.414	25	0.568	31	0.568	31	–0.429	16	0.333	19
Copper, dissolved	0.122	168	0.615	37	0.511	45	0.511	45	0.037	19	0.399	34
Copper, total	0.288	127	0.225	28	0.167	35	0.167	35	–0.373	16	0.072	23
Lead, dissolved	–0.060	90	0.373	7	0.558	33	0.558	33	–0.551	6	0.094	24
Lead, total	0.214	127	0.171	28	0.056	35	0.056	35	–0.330	16	–0.119	23
Manganese, dissolved	0.158	127	–0.283	28	0.678	35	0.678	35	–0.412	16	0.668	23
Manganese, total	0.025	127	0.146	28	0.170	35	0.170	35	–0.390	16	0.228	23
Zinc, dissolved	0.072	150	0.617	31	0.704	39	0.704	39	–0.226	17	0.601	31
Zinc, total	0.100	126	0.123	28	0.189	35	0.189	35	–0.459	16	0.073	23

Table A3. Correlation among water-quality properties and constituents, by station.—Continued

[Mean streamflow is in cubic feet per second, streamflow volume is in acre-feet, pH is in standard pH units, specific conductance is in microsiemens per centimeter; and copper, lead, manganese, and zinc are in micrograms per liter; all other units are milligrams per liter. Corr, Pearson correlation coefficient; n, number of pairs used in calculation; N, nitrogen; P, phosphorus; --, not applicable]

Variables	All stations		Union		Denver		Henderson		Tollgate		Sand Creek	
	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n	Corr	n
Phosphorus as P, total correlations												
Organic carbon, dissolved	0.308	119	0.382	25	0.469	31	0.469	31	0.152	20	0.215	19
Copper, dissolved	0.108	172	0.263	37	–0.017	45	–0.017	45	–0.082	23	0.497	34
Copper, total	0.920	131	0.989	28	0.935	35	0.935	35	0.969	20	0.840	23
Lead, dissolved	–0.055	91	–0.314	7	0.612	33	0.612	33	0.518	7	0.450	24
Lead, total	0.830	131	0.979	28	0.826	35	0.826	35	0.979	20	0.601	23
Manganese, dissolved	0.158	131	0.430	28	0.606	35	0.606	35	0.007	20	0.631	23
Manganese, total	0.706	131	0.950	28	0.886	35	0.886	35	0.762	20	0.810	23
Zinc, dissolved	0.080	154	0.205	31	0.283	39	0.283	39	–0.309	21	0.518	31
Zinc, total	0.522	130	0.956	28	0.927	35	0.927	35	0.875	20	0.750	23
Organic carbon, dissolved, correlations												
Copper, dissolved	0.552	120	0.489	25	0.640	31	0.640	31	0.607	21	0.552	19
Copper, total	0.237	120	0.326	25	0.376	31	0.376	31	0.174	21	–0.012	19
Lead, dissolved	0.451	78	–0.896	4	0.733	29	0.733	29	0.798	7	0.571	19
Lead, total	0.201	120	0.281	25	0.314	31	0.314	31	0.113	21	–0.082	19
Manganese, dissolved	0.242	120	0.238	25	0.540	31	0.540	31	–0.016	21	0.435	19
Manganese, total	0.355	120	0.438	25	0.318	31	0.318	31	0.118	21	0.054	19
Zinc, dissolved	0.330	119	0.068	25	0.778	31	0.778	31	0.138	21	0.342	19
Zinc, total	0.362	119	0.276	25	0.416	31	0.416	31	0.163	21	–0.002	19
Copper, dissolved, correlations												
Copper, total	–0.168	132	–0.198	28	–0.089	35	–0.089	35	–0.290	21	–0.347	23
Lead, dissolved	0.396	91	0.313	7	0.529	33	0.529	33	0.561	7	0.911	24
Lead, total	–0.234	132	–0.244	28	–0.225	35	–0.225	35	–0.331	21	–0.421	23
Manganese, dissolved	0.020	132	–0.177	28	0.357	35	0.357	35	–0.199	21	0.447	23
Manganese, total	–0.166	132	–0.122	28	–0.148	35	–0.148	35	–0.266	21	–0.224	23
Zinc, dissolved	0.176	155	0.916	31	0.802	39	0.802	39	0.341	22	0.795	31
Zinc, total	–0.038	131	–0.261	28	–0.074	35	–0.074	35	–0.251	21	–0.313	23
Copper, total, correlations												
Lead, dissolved	0.495	88	–0.583	5	0.522	33	0.522	33	0.351	7	0.452	23
Lead, total	0.950	132	0.989	28	0.936	35	0.936	35	0.992	21	0.895	23
Manganese, dissolved	0.085	132	0.439	28	0.397	35	0.397	35	–0.034	21	0.204	23
Manganese, total	0.743	132	0.956	28	0.932	35	0.932	35	0.722	21	0.916	23
Zinc, dissolved	0.036	131	–0.196	28	0.246	35	0.246	35	–0.303	21	0.068	23
Zinc, total	0.490	131	0.977	28	0.990	35	0.990	35	0.929	21	0.953	23
Lead, dissolved, correlations												
Lead, total	0.381	88	–0.564	5	0.362	33	0.362	33	0.316	7	0.256	23
Manganese, dissolved	0.377	88	–0.435	5	0.704	33	0.704	33	0.596	7	0.862	23
Manganese, total	0.326	88	–0.545	5	0.388	33	0.388	33	0.770	7	0.442	23
Zinc, dissolved	0.087	88	0.593	5	0.838	33	0.838	33	0.175	7	0.693	24
Zinc, total	0.365	87	–0.476	5	0.560	33	0.560	33	0.408	7	0.426	23
Lead, total, correlations												
Manganese, dissolved	0.034	132	0.506	28	0.215	35	0.215	35	–0.015	21	–0.034	23
Manganese, total	0.693	132	0.948	28	0.891	35	0.891	35	0.742	21	0.741	23
Zinc, dissolved	0.038	131	–0.166	28	0.093	35	0.093	35	–0.323	21	–0.102	23
Zinc, total	0.496	131	0.988	28	0.940	35	0.940	35	0.912	21	0.866	23
Manganese, dissolved, correlations												
Manganese, total	0.489	132	0.568	28	0.259	35	0.259	35	0.560	21	0.203	23
Zinc, dissolved	0.162	131	0.340	28	0.706	35	0.706	35	0.065	21	0.637	23
Zinc, total	0.156	131	0.571	28	0.427	35	0.427	35	0.032	21	0.135	23
Manganese, total, correlations												
Zinc, dissolved	0.199	131	–0.064	28	0.132	35	0.132	35	–0.081	21	0.137	23
Zinc, total	0.558	131	0.956	28	0.904	35	0.904	35	0.764	21	0.900	23
Zinc, dissolved, correlations												
Zinc, total	0.828	131	–0.089	28	0.302	35	0.302	35	0	21	0.185	23

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