National Water-Quality Assessment Program

Nutrient Trends in Streams and Rivers of the United States, 1993–2003

Scientific Investigations Report 2008–5202

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

FRONT COVER

Yocum Creek near Oak Grove, Arkansas. Photograph courtesy of Reed Green, U.S. Geological Survey.

BACK COVER

Left: Pheasant Branch at Middleton, Wisconsin. Photograph courtesy of Michelle Lutz, U.S. Geological Survey.

Top Right: Columbia River Gorge at sunrise, looking east. Photograph courtesy of Columbia River USGS Interdisciplinary Science Explorer (CRUISE) Web site.

Bottom Left: Colorado River near Colorado-Utah State Line. Photograph courtesy of Nancy Bauch, U.S. Geological Survey.

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Foreword

The U.S. Geological Survey (USGS) is committed to providing the Nation with credible scientific information that helps to enhance and protect the overall quality of life and that facilitates effective management of water, biological, energy, and mineral resources (*http://www.usgs.gov/*). Information on the Nation's water resources is critical to ensuring long-term availability of water that is safe for drinking and recreation and is suitable for industry, irrigation, and fish and wildlife. Population growth and increasing demands for water make the availability of that water, now measured in terms of quantity and quality, even more essential to the long-term sustainability of our communities and ecosystems.

The USGS implemented the National Water-Quality Assessment (NAWQA) Program in 1991 to support national, regional, State, and local information needs and decisions related to water-quality management and policy (*http://water.usgs.gov/nawqa*). The NAWQA Program is designed to answer: What is the condition of our Nation's streams and ground water? How are conditions changing over time? How do natural features and human activities affect the quality of streams and ground water, and where are those effects most pronounced? By combining information on water chemistry, physical characteristics, stream habitat, and aquatic life, the NAWQA Program aims to provide science-based insights for current and emerging water issues and priorities. From 1991–2001, the NAWQA Program completed interdisciplinary assessments and established a baseline understanding of water-quality conditions in 51 of the Nation's river basins and aquifers, referred to as Study Units (*http://water.usgs.gov/nawqa/studyu.html*).

Multiple national and regional assessments are ongoing in the second decade (2001–2012) of the NAWQA Program as 42 of the 51 Study Units are reassessed. These assessments extend the findings in the Study Units by determining status and trends at sites that have been consistently monitored for more than a decade, and filling critical gaps in characterizing the quality of surface water and ground water. For example, increased emphasis has been placed on assessing the quality of source water and finished water associated with many of the Nation's largest community water systems. During the second decade, NAWQA is addressing five national priority topics that build an understanding of how natural features and human activities affect water quality, and establish links between sources of contaminants, the transport of those contaminants through the hydrologic system, and the potential effects of contaminants on humans and aquatic ecosystems. Included are topics on the fate of agricultural chemicals, effects of urbanization on stream ecosystems, bioaccumulation of mercury in stream ecosystems, effects of nutrient enrichment on aquatic ecosystems, and transport of contaminants to public-supply wells. These topical studies are conducted in those Study Units most affected by these issues; they comprise a set of multi-Study-Unit designs for systematic national assessment. In addition, national syntheses of information on pesticides, volatile organic compounds (VOCs), nutrients, selected trace elements, and aquatic ecology are continuing.

The USGS aims to disseminate credible, timely, and relevant science information to address practical and effective water-resource management and strategies that protect and restore water quality. We hope this NAWQA publication will provide you with insights and information to meet your needs, and will foster increased citizen awareness and involvement in the protection and restoration of our Nation's waters.

The USGS recognizes that a national assessment by a single program cannot address all water-resource issues of interest. External coordination at all levels is critical for cost-effective management, regulation, and conservation of our Nation's water resources. The NAWQA Program, therefore, depends on advice and information from other agencies—Federal, State, regional, interstate, Tribal, and local—as well as nongovernmental organizations, industry, academia, and other stakeholder groups. Your assistance and suggestions are greatly appreciated.

Matthew C. Larsen
Associate Director for Water

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Conversion Factors

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
meter (m)	3.281	foot (ft)
kilometer (km)	0.6214	mile (mi)
	Area	
square kilometer (km^2)	247.1	acre
square meter (m^2)	10.76	square foot (ft^2)
square kilometer (km^2)	0.3861	square mile (mi^2)
	Volume	
cubic meter (m^3)	0.0008107	acre-foot (acre-ft)
	Flow rate	
cubic meter per second (m^3/s)	70.07	acre-foot per day (acre-ft/d)
cubic meter per second (m^3/s)	35.31	cubic foot per second (ft^3/s)
	Mass	
kilogram (kg)	2.205	pound avoirdupois (lb)
	Yield	
kilogram per square kilometer (kg/km^2)	5.710	pound avoirdupois per square mile (lb/mi^2)

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

°F=(1.8×°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 North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

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

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

Abbreviations

AR(30)	autoregressive process of order 30
FA	flow adjusted
GIS	geographic information system
LOWESS	locally weighted scatterplot smooth
NAWQA	National Water-Quality Assessment Program
NFA	non flow adjusted
NWIS	U.S. Geological Survey National Water Information System database
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey

Nutrient Trends in Streams and Rivers of the United States, 1993–2003

By Lori A. Sprague, David K. Mueller, Gregory E. Schwarz, and David L. Lorenz

Abstract

Trends in streamflow and concentrations and loads of total phosphorus, total nitrogen, and nitrate were determined for the period from 1993 to 2003 in selected streams and rivers of the United States. Flow-adjusted trends in concentration (the trends that would have occurred in the absence of natural changes in streamflow), non-flow-adjusted trends in concentration (the trends resulting from both natural and human factors), and trends in load (trends in the nutrient mass transported downstream) were determined, and the results were examined spatially to determine whether a consistent pattern of trends occurred across groups of sites at multiple locations. Relations between the trends and changes in nutrient sources and streamflow were examined.

At the majority of sites nationwide, concentrations and loads of total phosphorus, total nitrogen, and nitrate did not change significantly from 1993 to 2003. Where significant changes did occur, there were more upward and fewer downward flow-adjusted trends in total phosphorus and total nitrogen concentrations as compared to nitrate concentrations. Increases in nutrient sources and(or) transport contributed to net upward flow-adjusted trends at 33 percent of sites for total phosphorus, 21 percent for total nitrogen, and 12 percent for nitrate; whereas decreases in nutrient sources, implementation of pollution-control strategies, or other anthropogenic activities contributed to net downward flow-adjusted trends at 16 percent of sites for total phosphorus and total nitrogen, and 25 percent of sites for nitrate.

There were fewer upward non-flow-adjusted trends than upward flow-adjusted trends in total phosphorus (24 and 33 percent of sites, respectively), total nitrogen (11 and 21 percent, respectively), and nitrate (6 and 12 percent, respectively) concentrations. This was particularly evident at sites in the Central and Southwestern United States, where most of the downward trends in streamflow occurred as a result of drought conditions in the latter part of the study period. At these sites, the increase in source indicated by the upward flow-adjusted trend likely was offset by the effects of decreasing precipitation and surface runoff indicated by the downward streamflow trend. Without the decrease in surface runoff, in-stream concentrations at these sites probably would have been higher.

Changes in population density were related to total phosphorus trends at sites in undeveloped areas and total phosphorus and nitrate trends at sites in the Western United States. Changes in nonpoint-source loads were related to total phosphorus trends (fertilizer and manure) at sites in some agricultural areas, as well as nitrate trends (manure) at sites in the Central United States.

The more frequent increases in total phosphorus concentrations as compared to total nitrogen and nitrate concentrations cannot be explained easily by changes in nonpoint-source loads; there were slightly more sites with increases in nitrogen loading from fertilizer and(or) manure than with increases in phosphorus loading from fertilizer and(or) manure. Instead, the differences may have been due in part to phosphorus saturation of soils in areas that have been subject to long-term manure or fertilizer application and(or) lag time between anthropogenic changes on the land surface and changes in nitrogen concentration in streams caused by the transport of nitrogen in ground water.

At nearly 20 percent of sites with nutrient enrichment over natural background conditions, anthropogenic activities contributed to net decreases in nutrient concentrations from 1993 to 2003, and overall nutrient quality in the streams improved. At sites minimally affected by human activities, downward trends occurred at fewer than 10 percent of sites, and there were over three times more upward trends than downward trends in total phosphorus concentrations and over eight times more upward trends than downward trends in total nitrogen concentrations.

Introduction

Nutrients are essential for plant and animal life, but in high concentrations they can act as contaminants in water. Over-enrichment of streams and rivers with nutrients contributes to the formation of algal blooms, which can interfere with recreational activities, lead to taste and odor problems in drinking water supplies, deprive deeper waters of sunlight needed by aquatic organisms, and reduce available habitat. During drinking-water treatment, chlorination of algal metabolites and decomposition products may lead to the production of carcinogenic trihalomethanes and haloacetic acids (Nguyen and others, 2005; Scully and others, 1988; Oliver and Shindler, 1980). In addition, algal toxins harmful to animal and human health can be produced from blooms of selected cyanobacteria species (Falconer, 1999; Rinehart and others, 1994; Repavich and others, 1990). High algal biomass also is associated with hypoxia (low dissolved-oxygen concentrations), which can contribute to the release of toxic metals from bed sediments, increased availability of toxic substances like ammonia and hydrogen sulfide, and fish kills (U.S. Environmental Protection Agency, 2000). In recent years, nitrate and other nutrients discharged from the Mississippi River Basin have been linked to a large zone of hypoxia in the Gulf of Mexico along the Louisiana-Texas coast (Turner and others, 2008; Donner and Scavia, 2007; Justic and others, 1993).

According to the most recent U.S. Environmental Protection Agency (USEPA) compilation of States' water-quality reports under Section 305(b) of the Clean Water Act, nutrients were the fifth leading pollutant in rivers and streams nationally, affecting over 15 percent of impaired river miles (U.S. Environmental Protection Agency, 2007). The USEPA report also lists nutrients as the leading pollutant in lakes and reservoirs and the second leading cause of degradation in wetlands and estuaries. Another USEPA report, covering its Wadeable Streams Assessment, identifies nitrogen and phosphorus as the two most widespread stressors contributing to diminished biological quality in flowing waters across the Nation (U.S. Environmental Protection Agency, 2006).

Understanding how and why nutrient concentrations are changing over time in streams and rivers is essential for effectively managing and protecting these water resources. In 1987, the U.S. Geological Survey (USGS) began a study of more than 50 river basins and aquifers across the Nation as part of the National Water-Quality Assessment (NAWQA) Program. One of the major goals of the NAWQA Program is to determine how water-quality conditions, including concentrations of nutrients, are changing over time. Outside of the NAWQA Program, USGS (in cooperation with other Federal, State, Tribal, and local agencies), state environmental agencies, USEPA and other Federal agencies, universities, and many others have collected nutrient data throughout the Nation. Collectively, these data can provide insight into how nutrient concentrations have changed over time in the Nation's streams and rivers and how natural features and human activities have contributed to those changes.

Purpose and Scope

This report describes the methods used to determine trends in total phosphorus, total nitrogen, and nitrate concentrations and loads for the period from 1993 to 2003 in streams and rivers of the United States. Flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load are presented, and the results are examined spatially to determine whether a consistent pattern of trends occurred across groups of sites at multiple locations. Relations between the trends and changes in nutrient sources, streamflow, and other factors are examined.

Acknowledgments

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Approach

The approach for selecting sites, calculating trends, and evaluating factors affecting the trends is presented in this section. The national trends included in this report are, to a large degree, taken from seven recent regional trend analyses conducted within the NAWQA program (these regions are referred to as "major river basins" in the NAWQA program; see figure 1). There were some differences in approach between these regional analyses. To the extent possible, these differences have been minimized in the national-level analysis; as a result, some sites included in the regional analyses have been removed and some new sites have been added for this report. More detail on the regional analyses is available in Lorenz and others (2008; Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy region), Sprague and others (2006; Missouri region), Rebich and Demcheck (2007; Lower Mississippi, Arkansas-White-Red, and Texas-Gulf region), and Wise and others (2007; Pacific Northwest region). In addition, new results for the New England and Mid-Atlantic region (E.C.T. Trench, U.S. Geological Survey, written commun., 2007); South Atlantic-Gulf and Tennessee region (D.A. Harned, U.S. Geological Survey, written commun., 2007); Rio Grande, Colorado, and Great Basin region (N.J. Bauch, U.S. Geological Survey, written commun., 2007); and the California region (C.R. Kratzer, U.S. Geological Survey, written commun., 2007) are presented in this report.

Site Selection

Nutrient data publicly accessible through the online USGS National Water Information System (NWIS) database at *http://waterdata.usgs.gov/usa/nwis/qw* initially were surveyed for this study. The majority of data contained in the NWIS database are from water samples collected using standard methods described in U.S. Geological Survey (variously dated). In order to fill in spatial gaps in site coverage, additional data from the online USEPA STORET database at *http://www.epa.gov/storet/dbtop.html* also were surveyed in some regions. Sites were screened separately for total phosphorus as P, total nitrogen as N, and nitrite plus nitrate as N (hereinafter referred to as nitrate).

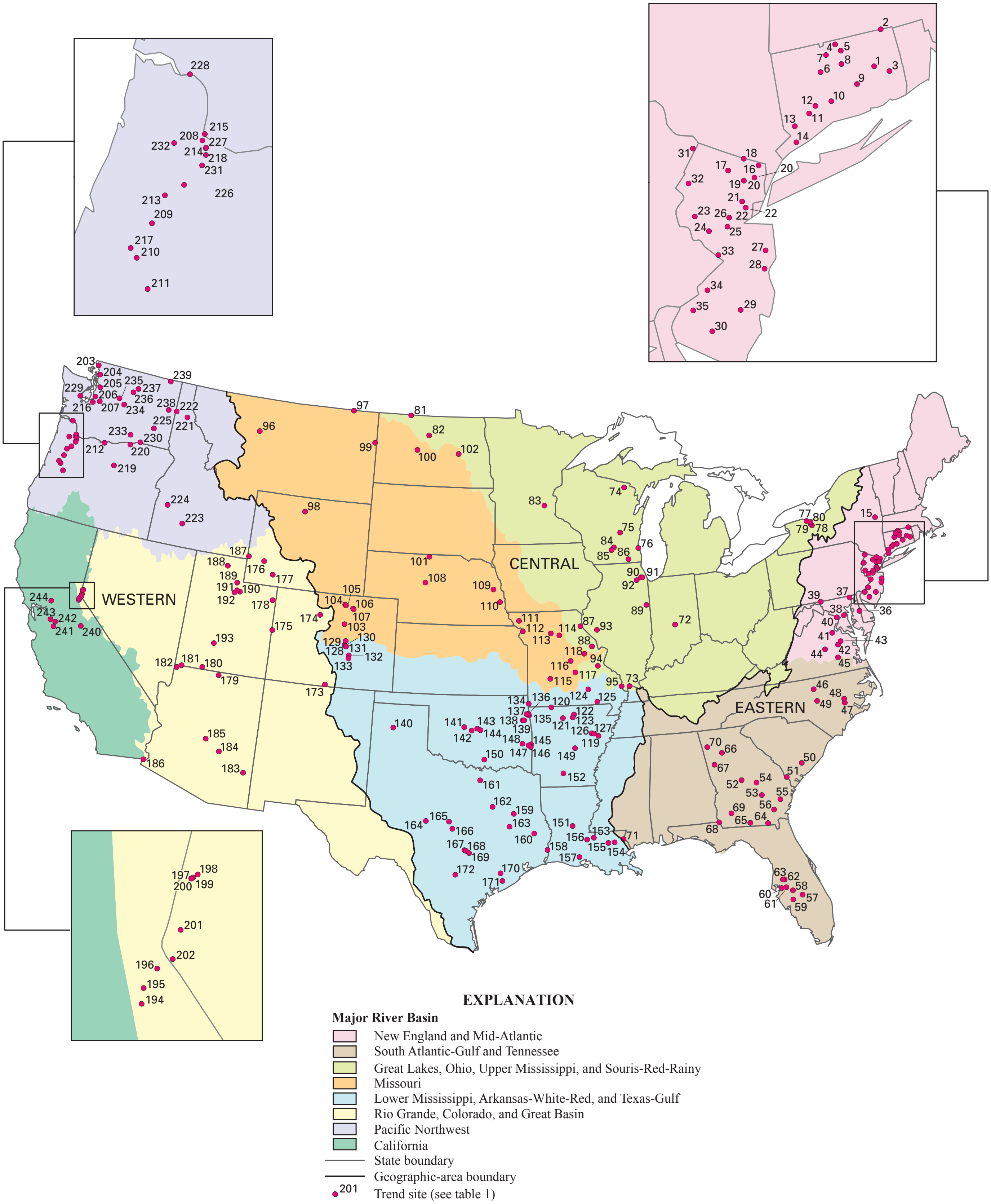

Figure 1. Location of study sites and major river basins (as designated for regional assessments in the National Water-Quality Assessment program).

Sites were selected for analysis of trends between water year (October 1 through September 30) 1993 and water year 2003 on the basis of the following minimum criteria:

- period of water-quality record with a beginning year of 1993 or earlier and an ending year of 2003 or later;
- approximately quarterly sampling each year;
- continuous daily mean discharge between 1993 and 2003 at that site or a nearby representative site;
- data gaps no longer than 2 years and only during the middle 6 years of record;
- representative coverage of samples over the site's hydrograph to avoid bias toward low or high streamflows;
- representative coverage over all seasons to avoid bias toward certain times of year.

In some regions, the data record for additional sites contained two time periods separated by a gap longer than 2 years. These sites were included for step-trend analysis on the basis of the following minimum criteria:

- 3 years of sampling at the beginning and end of the period (1993–95 and 2001–03);
- approximately quarterly sampling during 1993–95 and 2001–03;
- continuous daily mean discharge during 1993–95 and 2001–03 at that site or a nearby representative site;
- representative coverage of samples over the site's hydrograph to avoid bias toward low or high streamflows;
- representative coverage over all seasons to avoid bias toward certain times of year.

The final 244 sites are shown in figure 1 and listed in table 1 along with a list of constituents used in the trend analyses for each site. The number of sites used in the trend analyses for each constituent varied depending on data availability—244 sites were used for streamflow, 171 sites for total phosphorus, 137 sites for total nitrogen, and 166 for nitrate.

Trend Analysis

Many factors affect the concentration and load (mass) of nutrients in a stream. When these factors vary over time, concentration and load will change over time as well. These changes can be short in duration, such as those caused by seasonal variability or individual precipitation events, or longer in duration, such as those caused by changes in nutrient sources in the watershed (for example, a decrease in fertilizer application over many years). Trends, as used in this report, refer to the longer duration, low-frequency changes detectable over many years, irrespective of the shorter duration, high-frequency changes that may occur each day, month, or year.

In the following sections, the conceptual basis for the four different types of trend presented in this report is first described in a nonmathematical way in the "Concepts" section. This non-technical description is followed by a discussion of the statistical methods used in the analysis of each type of trend in the "Methods" section. Finally, the limitations of trend analysis in general are discussed in the "Limitations" section.

Concepts

Trends in Streamflow

Changes in streamflow are an important influence on nutrient concentrations in streams. Depending on the particular nutrient sources in a watershed and how these nutrients are transported to the stream, increases or decreases in streamflow can lead to increases or decreases in concentrations. For example, if a point source such as discharge from a wastewater-treatment plant is the predominant source of nutrients to a stream, an increase in streamflow likely will lead to a decrease in concentrations as a result of dilution of the plant discharge. However, if a nonpoint source such as runoff from fertilized land area is the predominant source of nutrients to a stream, an increase in streamflow may lead to an increase in concentration as a result of the associated increase in precipitation and surface runoff. As a result, understanding how streamflow changes over time is critical in an assessment of how and why nutrient concentrations change over time.

Trends in streamflow often result from natural variability in climatological conditions such as precipitation and evapotranspiration. In some streams, particularly in the arid west, trends in streamflow also can result from variability in water-regulation operations such as diversions and reservoir storage and release.

Flow-Adjusted Trends in Concentration

Streamflow is not always the only influence on nutrient concentrations in streams. Changes in the watershed, such as implementation of management practices like conservation tillage or an increase or decrease in nutrient sources like manure, can influence nutrient transport to streams. In the analysis of flow-adjusted (FA) trends in concentration, the effects of streamflow on concentration are removed, allowing trends caused by other factors to be identified and the effects of management practices to be more directly assessed.

A FA trend in concentration implies that the streamflow-concentration relation is shifting over time. If the FA trend is downward, the concentration at a particular streamflow will be lower at the end of the time period than it was in the beginning. If streamflow is different at the end of the time period than at the beginning, actual concentration might be greater, even though the FA trend is downward. In this case, the actual concentration at the end of the period is less than it would have been in the absence of the changes in source and transport within the watershed that led to the FA trend in concentration. Over enough years, the annual pattern of concentration in the stream will shift to generally lower values.

FA trends in concentration can be complex, as there often are multiple and possibly counteracting anthropogenic factors influencing nutrient source and transport in a watershed. For example, population growth initially may lead to an increase in the nutrient load discharged from wastewater-treatment plants, but after several years, upgrades at the plant may lead to a relative decrease in the nutrient load discharged. Or, a decrease in fertilizer use in agricultural areas of a watershed may lead to decreasing nutrient loads in surface runoff, but population growth in other areas of the watershed may lead to an increase in the nutrient load discharged from wastewater-treatment plants. These multiple changes are not always counteracting; they also may supplement each other. For example, a decrease in fertilizer use and concurrent upgrades at wastewater-treatment plants may both contribute to decreasing nutrient concentrations in streams. Without detailed knowledge of all important factors in each watershed, it may be difficult to discern the specific cause(s) of a FA trend in concentration.

Non-Flow-Adjusted Trends in Concentration

Non-flow-adjusted (NFA) trends in concentration are influenced by the same anthropogenic changes in the watershed that can lead to FA trends in concentration, but they are also influenced by changes in streamflow. Anthropogenic changes in the watershed and natural changes in streamflow often occur concurrently and can therefore counteract or supplement each other. For example, if nonpoint sources are the predominant source of nutrients to a stream, a decrease in concentration resulting from the implementation of management practices may be offset by an increase in concentration resulting from natural increases in surface runoff and streamflow. If point sources are the predominant source of nutrients to a stream, a decrease in concentration resulting from treatment upgrades may be offset by the decreased in-stream dilution capacity resulting from a natural decrease in streamflow. In both of these examples, although climate and streamflow variability may be counteracting the effects of management practices, the strategies are still having a positive effect; in-stream concentrations would have been even higher in the absence of these management practices or treatment upgrades.

To consider the effects of both streamflow variability and changes in the watershed, trends in concentrations that are not flow adjusted are determined. These NFA trends reflect any and all influences on nutrient concentrations in streams, allowing for the assessment of the status of streams relative to water-quality standards and their suitability for supporting aquatic communities.

Some “raw” (unaltered) nutrient data sets are inappropriate for analysis of NFA trends in concentration. Monitoring programs often are implemented to meet multiple objectives, such as trend analysis, illicit-discharge detection, stormwater-runoff evaluation, and targeted seasonal assessment (such as during peak fertilizer-application periods). These objectives can change at a site over the time period used in the trend analysis, resulting in changes in the timing and frequency of sample collection. The resulting data sets may exhibit bias that interferes with trend analysis. For example, an increase in sampling at high streamflows in support of stormwater-runoff evaluation during the latter half of the study period may induce a trend that likely would be an artifact of the change in sampling design rather than a true change in concentration. To deal with these limitations in the determination of NFA trends in concentration, a coupled statistical modeling approach that simultaneously accounted for changes in streamflow and concentration was used in this study.

Trends in Load

Trends in load represent changes in the nutrient mass that is transported downstream from the site. An increase or decrease in the nutrient mass moving downstream can affect the quality of receiving water bodies such as lakes, reservoirs, or estuaries. Because loads are the product of concentration and streamflow, changes in either or both can lead to changes in load. The same sampling complications that limit the assessment of trend in raw concentration measurements also limit the assessment of trend in raw load measurements. Consequently, the coupled statistical modeling approach used to assess trend in concentration is also used to assess trend in load.

Methods

Trends in Streamflow

To determine the trend in daily mean streamflow, a model relating streamflow and time was defined as:

$$\tilde{q}_t = \bar{q} + a\left(T_t - \bar{T}\right), \tag{1}$$

where

$\tilde{q}$ is the natural logarithm of streamflow at time t;

$\bar{q}$ is the mean of the natural logarithm of streamflow during the analysis period;

a is the coefficient to be estimated;

T_t is decimal time at time t;

and

$\bar{T}$ is the mean of decimal time during the analysis period.

If streamflow was upward trending, then a was positive, and the trend in the logarithm of streamflow was less than the mean value of the logarithm of streamflow for the first half of the analysis period and greater than the mean value thereafter. Note that the mean of the natural logarithm of streamflow, $\bar{q}$, implicitly accounted for the intercept and average of the seasonal terms that are included in the streamflow model but not otherwise apparent in the formulation of equation 1.

Table 1. Characteristics and trend coverage of study sites.

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to]

Site number (figure 1)	Station number	Station name	Major river basin
1	01122610	Shetucket River at South Windham, Conn.	New England and Mid-Atlantic
2	01124000	Quinebaug River at Quinebaug, Conn.	New England and Mid-Atlantic
3	01127000	Quinebaug River at Jewett City, Conn.	New England and Mid-Atlantic
4	01184000	Connecticut River at Thompsonville, Conn.	New England and Mid-Atlantic
5	01184490	Broad Brook at Broad Brook, Conn.	New England and Mid-Atlantic
6	01188090	Farmington River at Unionville, Conn.	New England and Mid-Atlantic
7	01189995	Farmington River at Tariffville, Conn.	New England and Mid-Atlantic
8	01192500	Hockanum River near East Hartford, Conn.	New England and Mid-Atlantic
9	01193500	Salmon River near East Hampton, Conn.	New England and Mid-Atlantic
10	01196500	Quinnipiac River at Wallingford, Conn.	New England and Mid-Atlantic
11	01205500	Housatonic River at Stevenson, Conn.	New England and Mid-Atlantic
12	01208500	Naugatuck River at Beacon Falls, Conn.	New England and Mid-Atlantic
13	01208990	Saugatuck River near Redding, Conn.	New England and Mid-Atlantic
14	01209710	Norwalk River at Winnipauk, Conn.	New England and Mid-Atlantic
15	01357500	Mohawk River at Cohoes, N.Y.	New England and Mid-Atlantic
16	01377000	Hackensack River at Rivervale, N.J.	New England and Mid-Atlantic
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	New England and Mid-Atlantic
18	01387500	Ramapo River near Mahwah, N.J.	New England and Mid-Atlantic
19	01389500	Passaic River at Little Falls, N.J.	New England and Mid-Atlantic
20	01391500	Saddle River at Lodi, N.J.	New England and Mid-Atlantic
21	01394500	Rahway River near Springfield, N.J.	New England and Mid-Atlantic
22	01395000	Rahway River at Rahway, N.J.	New England and Mid-Atlantic
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	New England and Mid-Atlantic
24	01398000	Neshanic River at Reaville, N.J.	New England and Mid-Atlantic
25	01402000	Millstone River at Blackwells Mills, N.J.	New England and Mid-Atlantic
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	New England and Mid-Atlantic
27	01408000	Manasquan River at Squankum, N.J.	New England and Mid-Atlantic
28	01408500	Toms River near Toms River, N.J.	New England and Mid-Atlantic
29	01409500	Batsto River at Batsto, N.J.	New England and Mid-Atlantic
30	01411500	Maurice River at Norma, N.J.	New England and Mid-Atlantic
31	01438500	Delaware River at Montague, N.J.	New England and Mid-Atlantic
32	01443500	Paulins Kill at Blairstown, N.J.	New England and Mid-Atlantic
33	01463500	Delaware River at Trenton, N.J.	New England and Mid-Atlantic
34	01467150	Cooper River at Haddonfield, N.J.	New England and Mid-Atlantic
35	01477120	Raccoon Creek near Swedesboro, N.J.	New England and Mid-Atlantic
36	01491000	Choptank River near Greensboro, Md.	New England and Mid-Atlantic
37	01578310	Susquehanna River at Conowingo, Md.	New England and Mid-Atlantic
38	01594440	Patuxent River near Bowie, Md.	New England and Mid-Atlantic
39	01614500	Conococheague Creek at Fairview, Md.	New England and Mid-Atlantic
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	New England and Mid-Atlantic
41	01668000	Rappahannock River near Fredericksburg, Va.	New England and Mid-Atlantic
42	01673000	Pamunkey River near Hanover, Va.	New England and Mid-Atlantic
43	01674500	Mattaponi River near Beulahville, Va.	New England and Mid-Atlantic
44	02035000	James River at Cartersville, Va.	New England and Mid-Atlantic
45	02041650	Appomattox River at Matoaca, Va.	New England and Mid-Atlantic
46	02085000	Eno River at Hillsborough, N.C.	South Atlantic-Gulf and Tennessee
47	02089500	Neuse River at Kinston, N.C.	South Atlantic-Gulf and Tennessee
48	02091500	Contentnea Creek at Hookerton, N.C.	South Atlantic-Gulf and Tennessee
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	South Atlantic-Gulf and Tennessee
50	02175000	Edisto River near Givhans, S.C.	South Atlantic-Gulf and Tennessee
51	02198500	Savannah River near Clyo, Ga.	South Atlantic-Gulf and Tennessee
52	02213700	Ocmulgee River near Warner Robins, Ga.	South Atlantic-Gulf and Tennessee

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to.]

Site number (figure 1)	Data source	Drainage area, in square kilometers	Percent of drainage area in the United States	Land cover in the basin, in percent[1]					Land-use classification[3]	Constituent included for trend analysis		
				Urban	Agriculture	Rangeland	Forest	Other[2]		Total phosphorus	Total nitrogen	Nitrate
1	USGS	1,065	100.0	10.3	10.9	0.0	73.6	5.2	Mixed	X	X	X
2	USGS	392	100.0	11.0	7.4	0.1	75.5	6.1	Mixed	X	X	X
3	USGS	1,839	100.0	9.4	11.3	0.1	73.3	5.9	Mixed	X	X	X
4	USGS	25,049	98.8	5.0	8.3	0.2	81.0	4.3	Mixed	X	X	X
5	USGS	38	100.0	13.1	39.0	0.0	45.9	2.0	Mixed	X	X	X
6	USGS	978	100.0	5.2	4.8	0.0	84.0	6.0	Mixed	--	X	X
7	USGS	1,493	100.0	13.4	6.7	0.0	74.8	5.1	Mixed	X	X	X
8	USGS	191	100.0	44.5	11.1	0.0	40.5	3.9	Urban	X	X	X
9	USGS	271	100.0	11.1	12.4	0.1	71.7	4.8	Mixed	--	X	X
10	USGS	286	100.0	56.6	1.0	0.0	38.8	3.6	Urban	X	X	X
11	USGS	3,993	100.0	12.2	13.5	0.0	69.9	4.3	Mixed	X	X	X
12	USGS	674	100.0	26.5	9.9	0.0	58.9	4.6	Urban	X	X	X
13	USGS	54	100.0	21.4	4.4	0.0	70.7	3.4	Mixed	X	X	X
14	USGS	85	100.0	50.7	2.8	0.0	44.2	2.3	Urban	X	X	X
15	USGS	9,113	100.0	5.9	27.2	0.0	65.1	1.9	Mixed	X	X	X
16	USGS	145	100.0	78.5	0.3	0.0	13.6	7.6	Urban	X	X	X
17	USGS	164	100.0	5.7	0.8	0.0	87.7	5.8	Mixed	X	X	X
18	USGS	312	100.0	25.4	0.9	0.0	70.2	3.6	Urban	X	X	X
19	USGS	1,998	100.0	39.3	2.2	0.0	53.9	4.6	Urban	X	X	X
20	USGS	146	100.0	93.2	0.5	0.0	5.7	0.5	Urban	X	X	X
21	USGS	67	100.0	80.5	0.4	0.0	18.4	0.6	Urban	--	X	X
22	USGS	107	100.0	89.9	0.2	0.0	9.3	0.6	Urban	X	X	X
23	USGS	30	100.0	3.1	25.4	0.0	71.2	0.2	Mixed	--	X	X
24	USGS	66	100.0	8.5	59.8	0.0	31.5	0.2	Mixed	X	X	X
25	USGS	664	100.0	25.1	33.0	0.0	40.6	1.3	Mixed	X	X	X
26	USGS	2,074	100.0	19.4	33.3	0.0	45.6	1.7	Mixed	X	X	X
27	USGS	114	100.0	27.7	24.3	0.0	44.9	3.1	Urban	X	--	--
28	USGS	320	100.0	21.0	4.7	0.0	68.8	5.5	Mixed	X	--	--
29	USGS	176	100.0	2.3	12.1	0.0	82.8	2.8	Undeveloped	--	X	X
30	USGS	270	100.0	23.4	27.6	0.0	47.7	1.3	Mixed	X	--	--
31	USGS	9,016	100.0	2.4	9.8	0.0	85.0	2.8	Undeveloped	X	X	X
32	USGS	327	100.0	9.1	25.4	0.0	61.2	4.4	Mixed	X	X	X
33	USGS	17,580	100.0	5.6	16.2	0.0	75.1	3.1	Mixed	X	X	X
34	USGS	47	100.0	69.9	6.4	0.0	20.1	3.6	Urban	X	X	X
35	USGS	67	100.0	9.2	64.3	0.0	26.1	0.4	Mixed	X	X	X
36	USGS	295	100.0	2.8	48.5	0.0	48.0	0.6	Mixed	X	X	X
37	USGS	70,103	100.0	3.5	28.0	0.0	66.5	2.1	Mixed	X	X	X
38	USGS	907	100.0	32.4	32.8	0.0	31.3	3.5	Mixed	X	X	X
39	USGS	1,309	100.0	3.6	56.8	0.0	38.3	1.3	Agricultural	X	X	X
40	USGS	29,999	100.0	5.1	33.4	0.0	59.8	1.6	Mixed	X	X	X
41	USGS	4,135	100.0	4.7	34.7	0.0	59.4	1.2	Mixed	X	X	X
42	USGS	2,795	100.0	2.7	23.0	0.0	69.1	5.2	Undeveloped	X	X	X
43	USGS	1,560	100.0	2.2	18.6	0.0	73.8	5.4	Undeveloped	X	X	X
44	USGS	16,201	100.0	3.9	15.0	0.0	79.3	1.9	Undeveloped	X	X	X
45	USGS	3,478	100.0	2.0	19.8	0.0	74.3	3.8	Undeveloped	X	X	X
46	USGS	171	100.0	8.7	23.5	0.0	66.6	1.2	Mixed	X	X	--
47	USGS	7,022	100.0	12.1	28.7	0.0	56.8	2.4	Mixed	--	X	--
48	USGS	1,909	100.0	4.3	41.9	0.0	52.7	1.2	Mixed	--	X	--
49	USGS	--	--	--	--	--	--	--	--	--	X	--
50	USGS	7,077	100.0	2.0	31.8	0.0	60.0	6.2	Mixed	--	--	X
51	USGS	25,510	100.0	4.3	18.1	0.0	69.5	8.1	Undeveloped	X	--	--
52	USGS	6,891	100.0	20.8	12.8	0.0	63.3	3.1	Mixed	X	X	--

Table 1. Characteristics and trend coverage of study sites.—Continued

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Site number (figure 1)	Station number	Station name	Major river basin
53	02215500	Ocmulgee River at Lumber City, Ga.	South Atlantic-Gulf and Tennessee
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	South Atlantic-Gulf and Tennessee
55	02226010	Altamaha River near Gardi, Ga.	South Atlantic-Gulf and Tennessee
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	South Atlantic-Gulf and Tennessee
57	02271500	Josephine Creek near De Soto City, Fla.	South Atlantic-Gulf and Tennessee
58	02295420	Payne Creek near Bowling Green, Fla.	South Atlantic-Gulf and Tennessee
59	02296750	Peace River at Arcadia, Fla.	South Atlantic-Gulf and Tennessee
60	02300700	Bullfrog Creek near Wimauma, Fla.	South Atlantic-Gulf and Tennessee
61	02301300	South Prong Alafia River near Lithia, Fla.	South Atlantic-Gulf and Tennessee
62	02302500	Blackwater Creek near Knights, Fla.	South Atlantic-Gulf and Tennessee
63	02303000	Hillsborough River near Zephyrhills, Fla.	South Atlantic-Gulf and Tennessee
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	South Atlantic-Gulf and Tennessee
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	South Atlantic-Gulf and Tennessee
66	02335870	Sope Creek near Marietta, Ga.	South Atlantic-Gulf and Tennessee
67	02338000	Chattahoochee River near Whitesburg, Ga.	South Atlantic-Gulf and Tennessee
68	02344040	Chattahoochee River near Steam Mill, Ga.	South Atlantic-Gulf and Tennessee
69	02353000	Flint River at Newton, Ga.	South Atlantic-Gulf and Tennessee
70	02388520	Oostanaula River at Rome, Ga.	South Atlantic-Gulf and Tennessee
71	02492000	Bogue Chitto River near Bush, La.	South Atlantic-Gulf and Tennessee
72	03353637	Little Buck Creek near Indianapolis, Ind.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
74	04063700	Popple River near Fence, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
76	04087000	Milwaukee River at Milwaukee, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
77	0422026250	Northrup Creek at North Greece, N.Y.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
81	05114000	Souris River near Sherwood, N. Dak.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
82	05120000	Souris River near Verendrye, N. Dak.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
83	05287890	Elm Creek near Champlin, Minn.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
84	05427718	Yahara River at Windsor, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
85	05427948	Pheasant Branch at Middleton, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
87	05500000	South Fabius River near Taylor, Mo.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
88	05514500	Cuivre River near Troy, Mo.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
89	05525500	Sugar Creek at Milford, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
90	05531500	Salt Creek at Western Springs, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
91	05532500	Des Plaines River at Riverside, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
93	05586100	Illinois River at Valley City, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
94	07018100	Big River near Richwoods, Mo.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
95	07022000	Mississippi River at Thebes, Ill.	Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy
96	06088500	Muddy Creek at Vaughn, Mont.	Missouri
97	06178000	Poplar River at International Boundary, Mont.	Missouri
98	06274300	Bighorn River at Basin, Wyo.	Missouri
99	06329500	Yellowstone River near Sidney, Mont.	Missouri
100	06338490	Missouri River at Garrison Dam, N. Dak.	Missouri
101	06461500	Niobrara River near Sparks, Nebr.	Missouri
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	Missouri
103	06713500	Cherry Creek at Denver, Colo.	Missouri

Table 1. Characteristics and trend coverage of study sites.—Continued

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Site number (figure 1)	Data source	Drainage area, in square kilometers	Percent of drainage area in the United States	Land cover in the basin, in percent[1]					Land-use classification[3]	Constituent included for trend analysis		
				Urban	Agriculture	Rangeland	Forest	Other[2]		Total phosphorus	Total nitrogen	Nitrate
53	USGS	13,582	100.0	12.0	22.7	0.0	59.4	5.9	Mixed	X	X	--
54	USGS	11,517	100.0	3.1	18.9	0.0	72.0	5.9	Undeveloped	X	--	--
55	USGS	35,220	100.0	6.0	24.3	0.0	62.9	6.8	Mixed	X	--	--
56	USGS	3,487	100.0	1.9	32.0	0.0	56.2	10.0	Mixed	X	--	--
57	USGS	301	100.0	30.0	13.8	14.7	20.1	21.4	Urban	--	X	--
58	USGS	317	100.0	3.0	21.9	25.0	18.5	31.6	Undeveloped	X	X	--
59	USGS	3,436	100.0	10.9	26.7	26.1	21.4	14.9	Mixed	X	X	--
60	USGS	74	100.0	10.4	42.7	23.1	19.7	4.2	Mixed	X	X	--
61	USGS	277	100.0	3.7	19.4	25.7	18.1	33.1	Undeveloped	X	X	--
62	USGS	226	100.0	35.4	14.4	24.4	17.4	8.4	Urban	X	X	--
63	USGS	546	100.0	28.0	12.8	21.1	26.6	11.6	Urban	X	--	--
64	USGS	3,322	100.0	0.3	1.0	0.2	86.2	12.2	Undeveloped	X	--	--
65	USGS	3,864	100.0	3.1	49.7	0.3	39.8	7.1	Mixed	X	X	X
66	USGS	80	100.0	62.3	0.0	0.0	37.4	0.3	Urban	X	--	X
67	USGS	6,251	100.0	23.0	9.7	0.0	63.5	3.8	Mixed	--	X	--
68	USGS	21,974	100.0	10.4	13.3	0.0	70.2	6.1	Mixed	X	--	--
69	USGS	14,899	100.0	4.0	30.7	0.0	59.6	5.7	Mixed	X	--	--
70	USGS	20	100.0	61.5	7.7	0.0	26.0	4.8	Urban	X	--	--
71	USGS and LADEQ	3,071	100.0	1.8	34.2	0.0	62.1	1.9	Mixed	X	X	X
72	USGS	45	100.0	78.8	19.3	0.0	1.8	0.1	Urban	X	X	X
73	USGS	527,229	100.0	5.4	37.7	0.1	54.7	2.1	Mixed	X	X	X
74	USGS	363	100.0	0.1	3.4	0.6	92.6	3.3	Undeveloped	X	X	X
75	USGS	122	100.0	9.0	76.8	1.2	9.1	4.0	Mixed	X	--	--
76	USGS	1,805	100.0	11.3	64.9	0.7	21.0	2.1	Mixed	X	X	X
77	USGS	23	100.0	26.3	49.0	0.0	24.5	0.2	Mixed	X	--	--
78	USGS	98	100.0	5.8	58.3	0.0	34.6	1.3	Mixed	X	--	--
79	USGS	23	100.0	43.6	44.4	0.0	11.5	0.5	Mixed	X	--	--
80	USGS	391	100.0	47.8	32.3	0.0	19.0	0.9	Mixed	X	--	--
81	USGS	22,759	14.2	0.0	9.9	3.6	0.0	0.7	--	X	X	X
82	USGS	28,840	31.9	0.3	21.2	8.8	0.1	1.4	--	X	X	X
83	USGS	222	100.0	13.7	52.1	0.0	14.6	19.6	Mixed	X	--	--
84	USGS	185	100.0	8.3	87.2	0.5	3.5	0.4	Mixed	X	--	--
85	USGS	47	100.0	12.3	82.8	0.5	4.2	0.2	Mixed	X	--	--
86	USGS	11	100.0	42.9	53.8	0.3	1.4	1.6	Mixed	X	--	--
87	USGS	1,560	100.0	1.6	67.9	4.1	25.4	1.1	Agricultural	X	--	--
88	USGS	2,439	100.0	1.0	72.7	2.6	23.3	0.4	Agricultural	X	--	X
89	USGS	1,159	100.0	0.8	97.3	0.3	1.5	0.1	Agricultural	X	--	--
90	USGS	291	100.0	82.3	2.2	3.2	9.6	2.7	Urban	X	--	--
91	USGS	1,634	100.0	54.4	28.9	1.9	11.9	2.9	Mixed	X	--	--
92	USGS	25	100.0	97.9	0.0	0.0	0.2	1.9	Urban	X	X	X
93	USGS	69,165	100.0	8.6	77.9	0.8	10.8	2.0	Mixed	X	--	--
94	USGS	1,909	100.0	2.3	21.2	1.0	73.9	1.7	Undeveloped	X	--	--
95	USGS	1,839,670	98.5	1.8	43.5	36.4	13.2	3.7	Mixed	X	X	X
96	USGS	662	100.0	0.4	72.4	27.0	0.1	0.1	Agricultural	--	--	X
97	USGS	929	2.0	0.0	0.8	0.8	0.0	0.5	--	X	X	--
98	USGS	34,249	100.0	0.2	3.6	81.5	9.1	5.7	Undeveloped	--	--	X
99	USGS	177,139	100.0	0.2	8.4	72.4	14.3	4.7	Undeveloped	X	X	X
100	USGS	468,774	94.1	0.2	19.7	58.7	12.0	3.5	Undeveloped	--	X	X
101	USGS	21,667	100.0	0.2	11.9	83.7	0.5	3.6	Undeveloped	X	X	X
102	USGS	3,019	100.0	0.3	68.0	26.0	0.9	4.7	Agricultural	--	X	X
103	USGS	1,063	100.0	15.2	8.7	70.9	4.6	0.7	Mixed	--	X	X

Table 1. Characteristics and trend coverage of study sites.—Continued

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Site number (figure 1)	Station number	Station name	Major river basin
104	06752260	Cache La Poudre River at Fort Collins, Colo.	Missouri
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	Missouri
106	06753990	Lonetree Creek near Greeley, Colo.	Missouri
107	06754000	South Platte River near Kersey, Colo.	Missouri
108	06775900	Dismal River near Thedford, Nebr.	Missouri
109	06800000	Maple Creek near Nickerson, Nebr.	Missouri
110	06805500	Platte River at Louisville, Nebr.	Missouri
111	06817700	Nodaway River near Graham, Mo.	Missouri
112	06818000	Missouri River at St. Joseph, Mo.	Missouri
113	06902000	Grand River near Sumner, Mo.	Missouri
114	06905500	Chariton River near Prairie Hill, Mo.	Missouri
115	06921070	Pomme De Terre River near Polk, Mo.	Missouri
116	06926510	Osage River below St. Thomas, Mo.	Missouri
117	06930800	Gasconade River above Jerome, Mo.	Missouri
118	06934500	Missouri River at Hermann, Mo.	Missouri
119	07047942	L'Anguille River near Colt, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
120	07053250	Yocum Creek near Oak Grove, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
121	07056000	Buffalo River near St Joe, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
122	07060500	White River at Calico Rock, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
123	07060710	North Sylamore Creek near Fifty Six, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
124	07066110	Jacks Fork above Two River, Mo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
125	07068000	Current River at Doniphan, Mo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
126	07077500	Cache River at Patterson, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
127	07077700	Bayou DeView near Morton, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
128	07103700	Fountain Creek near Colorado Springs, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
130	07105500	Fountain Creek at Colorado Springs, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
132	07106300	Fountain Creek near Pinon, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
133	07106500	Fountain Creek at Pueblo, Colo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
134	07189000	Elk River near Tiff City, Mo.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
135	07195500	Illinois River near Watts, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
136	07195865	Sager Creek near West Siloam Springs, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
137	07196000	Flint Creek near Kansas, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
138	07196500	Illinois River near Tahlequah, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
139	07197000	Baron Fork at Eldon, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
140	07227500	Canadian River near Amarillo, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
141	07239450	North Canadian River near Calumet, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
144	07241550	North Canadian River near Harrah, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
145	07247015	Poteau River at Loving, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
146	07247250	Black Fork below Big Creek near Page, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
147	07247345	Black Fork at Hodgen, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
148	07247650	Fourche Maline near Leflore, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
150	07331000	Washita River near Dickson, Okla.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
151	07355500	Red River at Alexandria, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
152	07362000	Ouachita River at Camden, Ark.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
153	07373420	Mississippi River near St Francisville, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to.]

Site number (figure 1)	Data source	Drainage area, in square kilometers	Percent of drainage area in the United States	Land cover in the basin, in percent[1]					Land-use classification[3]	Constituent included for trend analysis		
				Urban	Agriculture	Rangeland	Forest	Other[2]		Total phosphorus	Total nitrogen	Nitrate
104	USGS	2,921	100.0	1.0	1.8	32.3	59.3	5.7	Undeveloped	--	--	X
105	USGS	3,223	100.0	2.9	2.8	34.2	54.1	6.1	Undeveloped	--	--	X
106	USGS	1,478	100.0	0.9	23.1	74.7	0.4	1.0	Undeveloped	X	X	X
107	USGS	25,016	100.0	8.1	13.3	38.5	34.5	5.7	Mixed	X	X	X
108	USGS	72	100.0	0.0	1.1	72.0	12.8	14.2	Undeveloped	--	X	X
109	USGS	954	100.0	0.4	96.7	1.4	1.1	0.5	Agricultural	X	X	X
110	USGS	220,908	100.0	1.5	25.5	61.5	8.1	3.6	Mixed	X	X	X
111	USGS	3,927	100.0	1.5	86.6	5.5	5.4	0.9	Agricultural	X	X	X
112	USGS	1,081,420	97.5	0.7	30.8	54.4	8.1	3.5	Mixed	X	X	X
113	USGS	17,950	100.0	1.7	73.9	6.2	16.9	1.2	Agricultural	X	X	X
114	USGS	4,897	100.0	1.9	68.0	5.4	22.1	2.6	Agricultural	X	X	X
115	USGS	713	100.0	1.0	65.1	2.0	31.4	0.7	Agricultural	X	X	X
116	USGS	37,908	100.0	1.3	55.6	7.9	31.5	3.7	Agricultural	--	X	X
117	USGS	6,649	100.0	1.1	36.7	1.1	60.3	0.8	Mixed	--	--	X
118	USGS	1,344,910	98.0	0.9	35.8	49.2	9.0	3.1	Mixed	X	X	X
119	USGS	1,375	100.0	1.1	82.0	0.0	15.8	1.1	Agricultural	--	--	X
120	USGS	134	100.0	1.8	71.3	0.3	25.8	0.7	Agricultural	X	X	X
121	USGS and ARDEQ	2,149	100.0	0.3	10.8	0.6	87.5	0.8	Undeveloped	--	--	X
122	USGS	25,815	100.0	2.1	30.6	0.8	63.2	3.3	Mixed	--	--	X
123	USGS	150	100.0	0.0	2.0	0.1	97.8	0.2	Undeveloped	--	--	X
124	USGS	1,121	100.0	0.5	19.2	0.4	79.6	0.4	Undeveloped	--	X	X
125	USGS	5,317	100.0	0.2	13.5	0.3	85.5	0.4	Undeveloped	--	X	X
126	USGS	6,678	100.0	1.2	49.3	1.2	47.0	1.2	Mixed	--	--	X
127	USGS	1,079	100.0	2.8	77.1	0.0	18.4	1.8	Agricultural	--	--	X
128	USGS	268	100.0	6.8	0.3	16.6	71.6	4.7	Mixed	--	--	X
129	USGS	214	100.0	9.8	1.3	31.0	57.1	0.8	Mixed	--	--	X
130	USGS	961	100.0	21.1	0.7	26.6	49.5	2.1	Mixed	--	--	X
131	USGS	1,072	100.0	23.8	0.6	24.6	49.0	2.0	Mixed	--	--	X
132	USGS	2,209	100.0	18.6	2.6	50.4	27.1	1.4	Mixed	--	--	X
133	USGS	2,414	100.0	17.9	2.6	53.3	24.9	1.4	Mixed	--	--	X
134	USGS	2,201	100.0	2.8	43.3	2.1	51.0	0.8	Mixed	X	X	X
135	USGS	1,635	100.0	10.7	61.7	0.2	26.3	1.1	Mixed	X	X	X
136	USGS	50	100.0	24.5	65.6	0.1	9.3	0.4	Mixed	X	X	X
137	USGS	300	100.0	6.2	66.9	0.5	25.4	1.1	Mixed	X	X	X
138	USGS	2,454	100.0	7.4	56.2	0.9	34.3	1.2	Mixed	X	X	X
139	USGS	808	100.0	1.4	46.0	0.7	51.3	0.6	Mixed	X	X	X
140	USGS	49,290	100.0	0.3	5.2	83.5	10.6	0.4	Undeveloped	--	--	X
141	USGS	34,298	100.0	0.5	43.4	54.7	1.0	0.5	Mixed	--	--	X
142	USGS	34,968	100.0	0.7	43.8	53.9	1.0	0.6	Mixed	--	--	X
143	USGS	35,447	100.0	1.4	43.5	53.4	1.1	0.6	Mixed	--	--	X
144	USGS	35,713	100.0	1.5	43.4	53.3	1.2	0.6	Mixed	--	--	X
145	USGS	697	100.0	0.8	25.1	0.0	71.5	2.6	Mixed	X	X	X
146	USGS	245	100.0	0.1	6.2	0.0	93.0	0.8	Undeveloped	--	X	X
147	USGS	511	100.0	0.2	5.7	0.0	92.4	1.7	Undeveloped	--	X	X
148	USGS	633	100.0	1.4	19.0	0.0	79.1	0.5	Undeveloped	X	X	X
149	USGS	408,729	100.0	1.7	31.1	50.7	14.5	2.0	Mixed	X	X	X
150	USGS	18,590	100.0	1.0	36.4	51.5	9.3	1.8	Mixed	X	X	X
151	USGS	560	100.0	12.3	68.3	0.0	16.8	2.5	Mixed	X	X	X
152	USGS	13,943	100.0	1.4	13.8	0.0	80.7	4.1	Undeveloped	X	X	X
153	USGS	2,965,463	99.1	2.4	41.0	29.6	22.9	3.2	Mixed	X	X	X

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to]

Site number (figure 1)	Station number	Station name	Major river basin
154	07375500	Tangipahoa River at Robert, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
155	07376000	Tickfaw River at Holden, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
156	07381495	Atchafalaya River at Melville, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
157	07386980	Vermilion River at Perry, La.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
158	08030500	Sabine River near Ruliff, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
159	08032000	Neches River near Neches, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
160	08033500	Neches River near Rockland, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
161	08051500	Clear Creek near Sanger, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
162	08064100	Chambers Creek near Rice, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
163	08065350	Trinity River near Crockett, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
164	08136500	Concho River at Paint Rock, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
165	08143600	Pecan Bayou near Mullin, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
166	08147000	Colorado River near San Saba, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
170	08162000	Colorado River at Wharton, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
171	08162500	Colorado River near Bay City, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
172	08181800	San Antonio River near Elmendorf, Tex.	Lower Mississippi, Arkansas-White-Red, and Texas-Gulf
173	08251500	Rio Grande near Lobatos, Colo.	Rio Grande, Colorado, and Great Basin
174	09058000	Colorado River near Kremmling, Colo.	Rio Grande, Colorado, and Great Basin
175	09163500	Colorado River near Colorado-Utah State Line	Rio Grande, Colorado, and Great Basin
176	09211200	Green River below Fontenelle Reservoir, Wyo.	Rio Grande, Colorado, and Great Basin
177	09217010	Green River below Green River, Wyo.	Rio Grande, Colorado, and Great Basin
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	Rio Grande, Colorado, and Great Basin
179	09380000	Colorado River at Lees Ferry, Ariz.	Rio Grande, Colorado, and Great Basin
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	Rio Grande, Colorado, and Great Basin
181	09413500	Virgin River below First Narrows, Utah	Rio Grande, Colorado, and Great Basin
182	09415000	Virgin River at Littlefield, Ariz.	Rio Grande, Colorado, and Great Basin
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	Rio Grande, Colorado, and Great Basin
184	09498500	Salt River near Roosevelt, Ariz.	Rio Grande, Colorado, and Great Basin
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	Rio Grande, Colorado, and Great Basin
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	Rio Grande, Colorado, and Great Basin
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	Rio Grande, Colorado, and Great Basin
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	Rio Grande, Colorado, and Great Basin
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	Rio Grande, Colorado, and Great Basin
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	Rio Grande, Colorado, and Great Basin
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	Rio Grande, Colorado, and Great Basin
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	Rio Grande, Colorado, and Great Basin
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	Rio Grande, Colorado, and Great Basin
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	Rio Grande, Colorado, and Great Basin
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	Rio Grande, Colorado, and Great Basin
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	Rio Grande, Colorado, and Great Basin
197	10336698	Third Creek near Crystal Bay, Nev.	Rio Grande, Colorado, and Great Basin
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	Rio Grande, Colorado, and Great Basin
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	Rio Grande, Colorado, and Great Basin
200	10336700	Incline Creek near Crystal Bay, Nev.	Rio Grande, Colorado, and Great Basin

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to.]

Site number (figure 1)	Data source	Drainage area, in square kilometers	Percent of drainage area in the United States	Land cover in the basin, in percent[1]					Land-use classification[3]	Constituent included for trend analysis		
				Urban	Agriculture	Rangeland	Forest	Other[2]		Total phosphorus	Total nitrogen	Nitrate
154	USGS and LADEQ	1,675	100.0	3.4	33.4	0.0	61.3	1.9	Mixed	X	X	X
155	LADEQ	1,028	100.0	1.6	18.5	0.0	76.6	3.3	Undeveloped	X	X	X
156	USGS	240,628	100.0	1.6	34.9	22.0	37.9	3.5	Mixed	X	X	X
157	USGS and LADEQ	1,129	100.0	16.6	69.2	0.2	10.0	4.0	Mixed	X	X	X
158	TXCEQ	24,171	100.0	2.9	26.7	0.1	61.8	8.5	Mixed	--	--	X
159	USGS	2,991	100.0	4.5	45.9	0.0	44.1	5.5	Mixed	--	--	X
160	USGS	9,425	100.0	2.9	28.9	0.0	62.6	5.7	Mixed	--	--	X
161	USGS	763	100.0	0.3	37.9	45.8	15.2	0.9	Mixed	--	--	X
162	USGS	2,136	100.0	2.7	77.0	5.5	12.3	2.5	Agricultural	--	--	X
163	USGS	35,967	100.0	9.6	49.6	16.0	19.8	5.1	Mixed	--	--	X
164	USGS	16,698	100.0	1.2	11.6	85.4	0.9	0.9	Undeveloped	--	--	X
165	TXCEQ	5,387	100.0	1.7	13.8	75.0	7.4	2.1	Undeveloped	X	--	--
166	TXCEQ	74,658	100.0	1.2	19.0	75.4	3.0	1.4	Undeveloped	X	--	--
167	USGS	232	100.0	4.1	1.6	42.7	50.5	1.0	Undeveloped	--	--	X
168	USGS	279	100.0	6.5	1.4	40.0	50.9	1.2	Mixed	--	--	X
169	TXCEQ	839	100.0	17.3	6.2	34.9	40.5	1.0	Mixed	X	--	--
170	TXCEQ	102,705	100.0	1.7	17.0	68.3	11.4	1.6	Undeveloped	X	--	--
171	TXCEQ	103,310	100.0	1.8	17.3	68.0	11.4	1.6	Undeveloped	X	--	--
172	USGS	4,528	100.0	19.1	16.2	21.1	41.6	2.0	Mixed	--	--	X
173	USGS	11,876	100.0	0.3	8.4	50.9	34.3	6.1	Undeveloped	X	X	--
174	USGS	46,230	100.0	0.8	4.2	33.5	54.8	6.7	Undeveloped	--	--	X
175	USGS	46,274	100.0	0.7	4.2	33.6	54.8	6.7	Undeveloped	--	--	X
176	USGS	10,862	100.0	0.1	4.2	66.6	17.7	11.4	Undeveloped	--	X	--
177	USGS	25,220	100.0	0.2	2.1	83.4	8.3	5.9	Undeveloped	X	--	X
178	UDEQ	66,056	100.0	0.2	2.6	74.1	19.4	3.8	Undeveloped	X	--	--
179	USGS	280,074	100.0	0.3	2.2	63.8	27.5	6.2	Undeveloped	--	X	--
180	UDEQ	503	100.0	0.1	0.6	69.0	29.4	0.9	Undeveloped	X	--	--
181	UDEQ	10,304	100.0	0.7	0.7	69.4	23.2	5.9	Undeveloped	--	--	X
182	USGS	12,571	100.0	0.6	0.7	69.5	22.4	6.8	Undeveloped	X	X	--
183	USGS	20,424	100.0	0.1	0.3	56.2	42.8	0.6	Undeveloped	X	--	--
184	USGS	11,103	100.0	0.3	0.0	31.1	67.8	0.8	Undeveloped	X	--	--
185	USGS	14,243	100.0	1.1	0.3	50.7	47.2	0.6	Undeveloped	X	--	--
186	USGS	624,016	99.5	0.9	2.0	68.7	22.9	5.0	Undeveloped	X	--	--
187	USGS	6,336	100.0	0.2	6.8	74.3	16.3	2.4	Undeveloped	--	--	X
188	UDEQ	18,312	100.0	0.7	18.3	60.6	16.2	4.2	Undeveloped	X	--	--
189	UDEQ	661	100.0	0.1	1.2	48.9	49.4	0.4	Undeveloped	--	--	X
190	UDEQ	420	100.0	0.0	0.0	18.8	79.9	1.3	Undeveloped	--	--	X
191	UDEQ	568	100.0	0.0	2.3	22.5	74.2	1.0	Undeveloped	--	--	X
192	UDEQ	726	100.0	1.4	4.3	24.9	68.4	0.9	Undeveloped	--	--	X
193	UDEQ	3,119	100.0	0.2	0.8	51.4	44.7	2.9	Undeveloped	X	--	--
194	USGS	37	100.0	0.0	0.0	26.7	67.0	6.3	Undeveloped	--	--	X
195	USGS	102	100.0	1.9	0.0	22.1	71.9	4.1	Undeveloped	--	--	X
196	USGS	140	100.0	7.8	0.0	20.1	68.8	3.2	Mixed	--	X	--
197	USGS	16	100.0	17.7	0.0	29.5	45.1	7.7	Mixed	--	--	X
198	USGS	7	100.0	0.0	0.0	33.9	65.7	0.4	Undeveloped	--	--	X
199	USGS	12	100.0	4.8	0.0	27.0	67.7	0.4	Undeveloped	--	X	X
200	USGS	17	100.0	13.0	0.0	19.9	66.7	0.3	Mixed	--	--	X

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to]

Site number (figure 1)	Station number	Station name	Major river basin
201	10336740	Logan House Creek near Glenbrook, Nev.	Rio Grande, Colorado, and Great Basin
202	10336760	Edgewood Creek at Stateline, Nev.	Rio Grande, Colorado, and Great Basin
203	01A050	Nooksack River at Brennan, Wash.	Pacific Northwest
204	03A060	Skagit River near Mount Vernon, Wash.	Pacific Northwest
205	07A090	Snohomish River at Snohomish, Wash.	Pacific Northwest
206	09A080	Green River at Tukwila, Wash.	Pacific Northwest
207	09A190	Green River at Kanaskat, Wash.	Pacific Northwest
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	Pacific Northwest
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	Pacific Northwest
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	Pacific Northwest
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	Pacific Northwest
212	10411	Deschutes River at Deschutes River Park, Oreg.	Pacific Northwest
213	10555	Willamette River at Marion Street at Salem, Oreg.	Pacific Northwest
214	10611	Willamette River at Hawthorne Bridge, Oreg.	Pacific Northwest
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	Pacific Northwest
216	10A070	Puyallup River at Meridian Street, Wash.	Pacific Northwest
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	Pacific Northwest
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	Pacific Northwest
219	11478	John Day River at Service Creek, Oreg.	Pacific Northwest
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	Pacific Northwest
221	12413470	South Fork Coeur D‘Alene River near Pinehurst, Idaho	Pacific Northwest
222	12419000	Spokane River near Post Falls, Idaho	Pacific Northwest
223	13154500	Snake River at King Hill, Idaho	Pacific Northwest
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	Pacific Northwest
225	13351000	Palouse River at Hooper, Wash.	Pacific Northwest
226	14201300	Zollner Creek near Mt. Angel, Oreg.	Pacific Northwest
227	14211720	Willamette River at Portland, Oreg.	Pacific Northwest
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	Pacific Northwest
229	16A070	Skokomish River near Potlatch, Wash.	Pacific Northwest
230	32A070	Walla Walla River near Touchet, Wash.	Pacific Northwest
231	3701002	Tualatin River at Weiss Bridge, Oreg.	Pacific Northwest
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	Pacific Northwest
233	37A090	Yakima River at Kiona, Wash.	Pacific Northwest
234	45A070	Wenatchee River at Wenatchee, Wash.	Pacific Northwest
235	45A110	Wenatchee River near Leavenworth, Wash.	Pacific Northwest
236	48A070	Methow River near Pateros, Wash.	Pacific Northwest
237	49A070	Okanogan River at Malott, Wash.	Pacific Northwest
238	54A120	Spokane River at Riverside State Park, Wash.	Pacific Northwest
239	61A070	Columbia River at Northport, Wash.	Pacific Northwest
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	California
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	California
242	11290000	Tuolumne River at Modesto, Calif.	California
243	11303500	San Joaquin River near Vernalis, Calif.	California
244	11447650	Sacramento River at Freeport, Calif.	California

[1] Land-use characteristics for the drainage area in the United States. Data are from an enhanced version of the U.S. Geological Survey 1992 National Land Cover Dataset (Nakagaki and Wolock, 2005).

[2] “Other” includes open water, wetlands, tundra, bare rock/sand/clay, perennial ice/snow, quarries/strip mines/gravel pits, and transitional.

[3] Agricultural: >50 percent agricultural land and ≤5 percent urban land; Urban: >25 percent urban land and ≤25 percent agricultural land; Undeveloped: ≤5 percent urban land and ≤25 percent agricultural land; Mixed - all other combinations of urban, agricultural, and undeveloped land (Gilliom and others, 2006).

Table 1. Characteristics and trend coverage of study sites.—Continued

[ARDEQ, Arkansas Department of Environmental Quality; CADWR, California Department of Water Resources; CWS, Clean Water Services (Tualatin River Basin, Oregon); LADEQ, Louisiana Department of Environmental Quality; ODEQ, Oregon Department of Environmental Quality; TXCEQ, Texas Commission on Environmental Quality; UCD, University of California, Davis; USGS, U.S. Geological Survey; WECY, Washington State Department of Ecology; UDEQ, Utah Department of Environmental Quality; --, not determined or not applicable; >, greater than; ≤, less than or equal to.]

Site number (figure 1)	Data source	Drainage area, in square kilometers	Percent of drainage area in the United States	Land cover in the basin, in percent[1]					Land-use classification[3]	Constituent included for trend analysis		
				Urban	Agriculture	Rangeland	Forest	Other[2]		Total phosphorus	Total nitrogen	Nitrate
201	USGS	5	100.0	0.0	0.0	6.5	93.5	0.0	Undeveloped	--	X	X
202	USGS	15	100.0	19.6	0.0	11.9	68.3	0.2	Mixed	--	X	--
203	WECY	1,908	100.0	3.0	11.7	3.5	69.3	12.4	Undeveloped	X	--	--
204	WECY	6,024	100.0	1.3	1.4	9.2	71.2	17.0	Undeveloped	X	--	--
205	WECY	4,438	100.0	4.0	2.5	6.5	77.3	9.7	Undeveloped	X	--	X
206	WECY	1,236	100.0	22.6	4.4	3.2	57.2	12.6	Mixed	X	--	--
207	WECY	616	100.0	0.2	0.0	3.4	77.2	19.2	Undeveloped	X	--	X
208	ODEQ	--	--	--	--	--	--	--	--	X	X	X
209	ODEQ	12,567	100.0	3.8	16.2	4.4	71.8	3.9	Undeveloped	X	X	X
210	ODEQ	8,886	100.0	2.6	3.9	4.8	84.0	4.7	Undeveloped	X	X	X
211	ODEQ	3,487	100.0	1.0	1.2	4.1	89.1	4.7	Undeveloped	X	--	--
212	ODEQ	27,768	100.0	0.7	5.2	47.9	43.5	2.6	Undeveloped	X	X	--
213	ODEQ	19,112	100.0	3.8	18.2	4.3	69.9	3.7	Undeveloped	X	X	X
214	ODEQ	28,937	100.0	5.5	23.1	3.7	64.5	3.3	Mixed	X	X	--
215	ODEQ	--	--	--	--	--	--	--	--	X	X	X
216	WECY	2,381	100.0	6.2	2.9	3.5	70.2	17.2	Mixed	X	--	--
217	ODEQ	1,078	100.0	10.4	34.2	4.5	46.6	4.4	Mixed	X	X	X
218	ODEQ	139	100.0	75.6	13.9	0.7	9.6	0.2	Urban	X	X	X
219	ODEQ	13,289	100.0	0.1	1.8	37.6	59.7	0.8	Undeveloped	X	X	--
220	ODEQ	--	--	--	--	--	--	--	--	X	X	--
221	USGS	738	100.0	2.5	0.1	12.7	83.3	1.4	Undeveloped	X	X	--
222	USGS	10,162	100.0	1.4	4.1	6.2	80.4	7.9	Undeveloped	X	X	--
223	USGS	92,942	100.0	0.5	17.4	59.2	16.6	6.3	Undeveloped	X	X	--
224	USGS	7,184	100.0	0.8	0.5	48.8	43.2	6.7	Undeveloped	X	X	X
225	USGS	6,379	100.0	1.5	72.5	14.9	9.6	1.5	Agricultural	X	X	X
226	USGS	39	100.0	1.1	95.2	0.8	2.6	0.3	Agricultural	--	--	X
227	USGS	28,937	100.0	5.5	23.1	3.7	64.5	3.3	Mixed	X	X	--
228	USGS	582,736	100.0	0.9	12.0	45.6	36.4	5.0	Undeveloped	X	X	X
229	WECY	339	100.0	0.4	1.3	1.8	80.6	16.0	Undeveloped	X	--	X
230	WECY	4,365	100.0	2.0	56.1	23.6	17.8	0.4	Agricultural	X	--	--
231	CWS	1,838	100.0	19.8	33.9	0.8	43.3	2.1	Mixed	X	X	--
232	CWS	327	100.0	1.2	22.2	0.5	73.3	2.7	Undeveloped	X	X	--
233	WECY	14,536	100.0	2.1	15.0	41.9	36.3	4.7	Undeveloped	X	--	--
234	WECY	3,440	100.0	0.6	1.4	18.7	70.1	9.3	Undeveloped	X	--	X
235	WECY	1,721	100.0	0.1	0.2	12.0	75.1	12.6	Undeveloped	X	--	X
236	WECY	4,657	100.0	0.4	0.8	28.0	65.6	5.2	Undeveloped	X	--	--
237	WECY	4,500	100.0	1.0	5.0	48.8	41.2	4.1	Undeveloped	X	--	X
238	WECY	12,951	100.0	3.5	13.3	7.8	68.6	6.8	Undeveloped	X	--	X
239	WECY	--	--	--	--	--	--	--	--	X	--	X
240	USGS	468	100.0	0.0	0.0	43.7	40.0	16.4	Undeveloped	--	--	X
241	USGS, UCD, CADWR	28	100.0	0.3	95.3	3.5	0.0	1.0	Agricultural	X	X	X
242	USGS, UCD, CADWR	4,760	100.0	2.8	4.3	33.9	48.5	10.7	Undeveloped	X	X	X
243	USGS, CADWR	19,030	100.0	3.1	22.1	34.8	33.8	6.3	Undeveloped	X	X	X
244	USGS, UCD	61,693	100.0	2.4	13.0	29.5	52.2	2.8	Undeveloped	X	X	X

The streamflow residual was assumed to follow an autoregressive process of order 30 [AR(30)] (Fuller, 1996). The streamflow model was estimated using maximum-likelihood estimation methods as used by the *AUTOREG* procedure in SAS 9, version 1, release 2 (SAS Institute Inc., 2004). For some sites, serial correlation in the residuals was not fully removed by the AR(30) model. Significant residual serial correlation could invalidate the standard error of the streamflow trend coefficient, although the practical importance of this effect for the statistical significance of the trend was likely to be small.

The trend in streamflow over the analysis period (between t_1, 1993, and t_2, 2003), τ_q, was defined as:

$$\tau_q = \tilde{q}_{t_2} - \tilde{q}_{t_1} = a\left(T_{t_2} - T_{t_1}\right). \qquad (2)$$

The trend in streamflow (expressed as the percentage change from 1993 to 2003), $\%\Delta q$, was defined as:

$$\%\Delta q = 100\left(e^{\tau_q} - 1\right), \qquad (3)$$

where

e is Euler's number (the base of the natural logarithm).

The 95-percent confidence interval of the trend was calculated by use of the standard deviation of τ_q (given by the product of $(T_{t_2} - T_{t_1})$ and the standard error of a); trend results were considered significant if the p-value was less than or equal to 0.05.

Flow-Adjusted Trends in Concentration

To determine the FA trend in concentration, a concentration model relating the logarithm of nutrient concentrations to various functions of streamflow, decimal time, and season was used. An abstract representation of the model is given by:

$$c_t = b_0 + m(q_t)b_q + h(T_t)b_T + x_t b_x + E_t, \qquad (4)$$

where

c_t is the natural logarithm of constituent concentration at time t;

b_0 is the intercept;

$m(\cdot)$ and $h(\cdot)$ are multi-element vector functions of q and T;

q_t is natural logarithm of streamflow at time t;

b_q, b_T and b_x are vector-valued coefficients to be estimated;

T_t is decimal time at time t;

x_t is a vector of ancillary predictors of season, such as the sine and cosine functions of decimal time;

and

E_t is an independent and identically normally distributed random error.

Depending on the form of a given concentration model, the multi-element vector function of the logarithm of streamflow, $m(\cdot)$, consisted of the logarithm of streamflow and(or) the square of the logarithm of streamflow, and the multi-element vector function of decimal time, $h(\cdot)$, consisted of first- and(or) second-order polynomial terms and(or) step functions of decimal time. Because of the inclusion of the streamflow function in equation 4, the resulting trend in concentration was inherently flow adjusted.

The concentration model was fit separately for each constituent at each site. The dependent variable was always the logarithm of concentration, and the independent variables were various functions of daily mean streamflow, decimal time, and season. All possible combinations of these variables were examined, and the best model was selected on the basis of the Akaike Information Criteria (Akaike, 1981). Step trends were evaluated with an additional binary variable designating samples as residing in either the "early" or the "late" period. Residuals from the best-fit model were examined for homoscedasticity and normality, two fundamental assumptions of linear models; if either assumption was violated, the model was rejected. The final models always included, at a minimum, log of streamflow (to ensure that the resulting time trend was flow adjusted) and decimal time (to ensure that a trend over time could be calculated). In addition, sine of time and cosine of time (to account for seasonality) always were present together if either were selected. The concentration model was estimated using either ordinary least squares if the concentration data contained no censored observations or the maximum-likelihood estimation method if censored observations were present. The maximum-likelihood estimation bias adjustment required estimates of the detection level even for uncensored observations; the detection level was set equal to either the maximum of the median detection level for all censored observations across all study sites or to a minimum reported uncensored value.

The FA trend in concentration over the analysis period (between t_1, 1993, and t_2, 2003), τ_{FA}, was defined as the change in the trend component of equation 4:

$$\tau_{FA} = \left[h(T_{t_2}) - h(T_{t_1})\right]\hat{b}_T, \qquad (5)$$

where

$\hat{b}_T$ is the sample estimate for the trend coefficient, b_T.

The FA trend in concentration (expressed as the percentage change from 1993 to 2003), $\%\Delta FAC$, was defined as:

$$\%\Delta FAC = 100(e^{\tau_{FA}} - 1)\,. \qquad (6)$$

The standard error of τ_{FA}, denoted $S(\tau_{FA})$, is given by

$$S\left(\tau_{FA}\right) = \sqrt{\left[h\left(T_{t_2}\right) - h\left(T_{t_1}\right)\right] V\left(\hat{b}_T\right) \left[h\left(T_{t_2}\right) - h\left(T_{t_1}\right)\right]'}, \qquad (7)$$

where

$V(\hat{b}_T)$ is the covariance matrix for $\hat{b}_T$.

The 95-percent confidence interval of the trend was calculated using the Student's *t* distribution (Helsel and Hirsch, 2002),

$$\text{95 percent confidence interval} = \tau_{FA} \pm \alpha(0.975, DF)S(\tau_{FA}), \tag{8}$$

where

$\alpha(0.975, DF)$ is the 0.975 quantile of the Student's *t* distribution with *DF* degrees of freedom (*DF* equals the number of observations minus the number of estimated coefficients in equation 4).

Trend results were considered significant if the two-tailed p-value, also based on the Student's *t* distribution, was less than or equal to 0.05.

Non-Flow-Adjusted Trends in Concentration

NFA trends in concentration were derived from the decimal time and streamflow coefficients from the concentration model (b_T and b_q) in equation 4 and the decimal time coefficient from the streamflow model (*a*) in equation 1. The NFA trend in concentration during a given period *t*, $\tilde{c}_t$, was defined as:

$$\tilde{c}_t = b_0 + m(\tilde{q}_t)b_q + h(T_t)b_T + \bar{x}b_x, \tag{9}$$

where

$\bar{x}$ is an average, over period *t*, of the non-streamflow/non-trend variables in the concentration model.

The average of the error term is absent because it is set to its expected value of zero. Note that in forming the estimate of $\tilde{c}_t$, the trend in the logarithm of streamflow ($\tilde{q}_t$) was substituted for the actual logarithm of streamflow in the function $m(\cdot)$. This implied that variations in streamflow not reflected in the trend did not determine the proposed measure of the trend in concentration. Because of the nonlinearity of the function $m(\cdot)$, this might have led to a bias in the evaluation of the trend in concentration if streamflows were becoming more or less variable over time.

The NFA trend in concentration over the analysis period (between t_1, 1993, and t_2, 2003), τ_{NFA}, was defined as:

$$\begin{aligned}\tau_{NFA} = \tilde{c}_{t_2} - \tilde{c}_{t_1} &= \left\{\left[m(\tilde{q}_{t_2}) - m(\tilde{q}_{t_1})\right]\hat{b}_q\right\} \\ &+ \left\{\left[h(T_{t_2}) - h(T_{t_1})\right]\hat{b}_T\right\}, \\ &= \left\{\begin{bmatrix} m\left(\bar{q} + \hat{a}\left(T_{t_2} - \bar{T}\right)\right) \\ -m\left(\bar{q} + \hat{a}\left(T_{t_1} - \bar{T}\right)\right)\end{bmatrix}\hat{b}_q\right\} \\ &+ \left\{\left[h(T_{t_2}) - h(T_{t_1})\right]\hat{b}_T\right\},\end{aligned} \tag{10}$$

where

$\hat{b}_q$, $\hat{b}_T$, and $\hat{a}$ are sample estimates of the b_q, b_T and *a* coefficients in equations 1 and 4.

The NFA trend in concentration (expressed as the percentage change from 1993 to 2003), %ΔNFAC, was defined as:

$$\%\Delta NFAC = 100\left(e^{\tau_{NFA}} - 1\right). \tag{11}$$

The estimate of the NFA trend in concentration was obtained by substituting sample estimates for the population values of *a*, b_q, and b_T in equation 10. In general, the transformation of the estimated values of τ_{NFA} into real space, through the exponential function appearing in equation 11, induces a small degree of bias. No correction of this bias was applied here in order to ensure agreement between the sign of %ΔNFAC and the sign of the test statistic used to evaluate the statistical significance of the trend.

A statistical test of the null hypothesis that trend is zero can be undertaken by forming t-statistics from the estimates of τ_{NFA} and dividing by the standard error. The standard error of τ_{NFA} was complicated to derive owing to the nonlinear manner in which the streamflow trend coefficient and the concentration and streamflow coefficients interact in the determination of the trend in concentration. An approximation to the standard error suitable for large samples (30 or more) was obtained by taking a first-order Taylor approximation of the trend estimate from equation 10 with respect to the streamflow and concentration model coefficients. The vector of combined streamflow and trend coefficients from the concentration model was represented by $b = \left\{b'_q \;\; b'_T\right\}'$, and the covariance matrix of this vector was represented by V_b. Under the plausible assumption that streamflow was exogenous with respect to concentration, meaning that changes in streamflow caused changes in concentration but changes in concentration did not cause changes in streamflow, the covariance between the estimated values of *a* and *b* was zero. Consequently, the standard error of τ_{NFA}, denoted as σ_{NFA}, was defined as:

$$\sigma_{NFA} = \sqrt{V_a\left(\frac{\partial \Delta m}{\partial a}b_q\right)^2 + AV_bA'}, \tag{12}$$

where

V_a is the variance of the estimated streamflow trend coefficient, *a*;

$$\frac{\partial \Delta m}{\partial a} = \frac{\partial m(\bar{q} + a(T_{t_2} - \bar{T}))}{\partial a} - \frac{\partial m(\bar{q} + a(T_{t_1} - \bar{T}))}{\partial a}; \tag{13}$$

and

$$\begin{aligned}A &= \left\{m\left(\bar{q} + a\left(T_{t_2} - \bar{T}\right)\right)h\left(T_{t_2}\right)\right\} \\ &\quad - \left\{m\left(\bar{q} + a\left(T_{t_1} - \bar{T}\right)\right)h\left(T_{t_1}\right)\right\};\end{aligned} \tag{14}$$

and

A' is the transposition of *A*.

In large samples, the t-statistic $\tau_{NFA} / \sigma_{NFA}$ follows standard normal distribution. Therefore, the two-sided p-value for significance of the trend was calculated as:

$$p = 2\left[1 - \Phi\left(\left|\tau_{NFA} / \sigma_{NFA}\right|\right)\right], \tag{15}$$

where

p is the two-sided p-value for significance of the trend;

and

$\Phi(\cdot)$ is the standard-normal cumulative distribution.

NFA trend results were considered significant if p was less than or equal to 0.05. The 95-percent confidence interval of the trend was calculated by use of σ_{NFA}.

Trends in Load

The non-flow-adjusted trend in concentration depended on the decimal time and streamflow coefficients from the concentration model and the decimal time coefficient from the streamflow model. The trend in load during a given period t, $\tilde{L}_t$, was similarly defined, but included an additional term to reflect the direct effect streamflow had on the determination of load.

$$\begin{aligned}\tilde{L}_t &= \bar{q} + a\left(T_t - \bar{T}\right) + b_0 + m\left(\bar{q} + a\left(T_t - \bar{T}\right)\right)b_q \\ &+ h\left(T_t\right)b_T + \bar{x}b_x,\end{aligned} \tag{16}$$

The trend in load over the analysis period (between t_1, 1993, and t_2, 2003), τ_L, was defined as the change in the trend in load, $\tilde{L}_t$, evaluated using sample estimates of the coefficients:

$$\begin{aligned}\tau_L &= \hat{a}\left(T_{t_2} - T_{t_1}\right) \\ &+ \left[m\left(\bar{q} + \hat{a}\left(T_{t_2} - \bar{T}\right)\right) - m\left(\bar{q} + \hat{a}\left(T_{t_1} - \bar{T}\right)\right)\right]\hat{b}_q \\ &+ \left[h\left(T_{t_2}\right) - h\left(T_{t_1}\right)\right]\hat{b}_T.\end{aligned} \tag{17}$$

The trend in load (expressed as the percentage change from 1993 to 2003), $\%\Delta L$, was defined as:

$$\%\Delta L = 100\left(e^{\tau_L} - 1\right). \tag{18}$$

The standard error of τ_L, denoted as σ_L, was defined as:

$$\sigma_L = \sqrt{V_a\left(\frac{\partial \Delta m}{\partial a} b_q + \left(T_{t_2} - T_{t_1}\right)\right)^2 + AV_bA'}. \tag{19}$$

In large samples, the t-statistic τ_L/σ_L is distributed standard normal. Therefore, the two-sided p-value for significance of the trend was calculated as:

$$p = 2\left[1 - \Phi\left(\left|\tau_L / \sigma_L\right|\right)\right]. \tag{20}$$

The 95-percent confidence interval of the trend was calculated by use of σ_L; trend results were considered significant if p was less than or equal to 0.05.

Reference Values

Ambient streamflows, concentrations, and loads vary throughout the Nation, and a given percentage increase or decrease may be more notable in one stream location than another. For example, a 100-percent increase in nitrate concentrations in a stream with an ambient concentration of 0.001 mg/L may have less of an environmental impact than a 100-percent increase in a stream with an ambient concentration of 5 mg/L. As a result, reference values for streamflow, concentration, and load representing the ambient initial conditions at each site are presented with the trend results. Because the season and flow conditions at the time of the first sample in the record differed among sites, the concentration and streamflow values from these initial samples were not used as reference values. Instead, the reference values were modeled as the streamflow, concentration, or load that would have been observed on the first day of the period of record under average hydrologic and seasonal conditions. The reference values for concentration (C_r) in mg/L, load (L_r) in kg/day, and streamflow (q_r) in m^3/s were defined as:

$$C_r = e^{\tilde{c}_{t_1}}, \tag{21}$$

$$L_r = e^{\tilde{L}_{t_1}}, \tag{22}$$

and

$$q_r = \frac{L_r}{C_r} \times 0.011574. \tag{23}$$

The estimated reference concentration and load are based on sample estimates of the coefficients used to evaluate $\tilde{c}_{t_1}$ and $\tilde{L}_{t_1}$. Due to the nonlinearity of the exponential function appearing in equations 21 and 22, and because the sample estimates of the estimates of $\tilde{c}_{t_1}$ and $\tilde{L}_{t_1}$ are approximately normally distributed, C_r and L_r and will be biased upward by the factors $e^{\left(\mathrm{var}\left(\tilde{c}_{t_1}\right)/2\right)}$ and $e^{\left(\mathrm{var}\left(\tilde{L}_{t_1}\right)/2\right)}$. To correct this bias, equations 21 and 22 were multiplied by retransformation factors equal to $e^{\left(-\mathrm{var}\left(\tilde{c}_{t_1}\right)/2\right)}$ and $e^{\left(-\mathrm{var}\left(\tilde{L}_{t_1}\right)/2\right)}$, respectively, where var($\tilde{c}_{t_1}$) and var($\tilde{L}_{t_1}$) are the variances of $\tilde{c}_{t_1}$ and $\tilde{L}_{t_1}$, computed from terms that are similar in form to the terms appearing inside the radicals of equations 12 and 19.

Limitations

The statistical procedures used in this report to evaluate trends assume that the trend is monotonic–that is, the population of observations increases or decreases over time, with no substantial reversals in direction. Major changes in the factors affecting in-stream concentrations could lead to nonmonotonic trends that would not be detected. For example, the effects of decreases in fertilizer use over many years may eventually be offset by the effects of increases in population density and concomitant increases in loading from wastewater-treatment plants. Typically, the longer the period of record, the more likely it is that different factors will be contributing to large changes in in-stream concentrations and the more likely it is that nonmonotonic trends will be present. A nonmonotonic trend in FA total nitrogen concentrations occurred at Site 99 (Yellowstone River near Sidney, Mont.) between 1985 and 2003; concentrations decreased from 1985 to 1992, then increased between 1993 and 2003 (fig. 2). The latter trend will be the only change reflected in the trend results in this report. Similar longer term, nonmonotonic trends likely occurred at other sites as well.

For a valid comparison of trends at multiple sites, the data record at all sites must be concurrent (Hirsch and others, 1991). To maximize the number and coverage of sites nationally and to include data from a long enough period to detect changes in concentration but not so long as to encounter numerous nonmonotonic trends, a period of record from 1993 to 2003 was used in this report. Trend results are reported here not as the year-to-year variation during the period of record, but as the overall change between the start date and the end date based on modeled load, concentration, or streamflow. As a result, the magnitude and significance of each individual trend is sensitive to conditions at the start and end of the record; the trend from 1993 to 2003 might be different from a trend during a different period, such as 1985 to 2003 or 1993 to 2001. For example, the record of total phosphorus concentrations at site 184 (Salt River near Roosevelt, Ariz.) shows large increases in 2002 and 2003 (fig. 3*A*). These increases likely were due in large part to runoff after the Rodeo-Chediski fire, which burned 1,890 km^2 of the White Mountain Apache Indian Reservation, Apache-Sitgreaves National Forest, and Tonto National Forest in June and July of 2002; over 1,170 km^2 of the burned area was in the Salt River drainage (Arizona Game and Fish Department, 2006). The FA total phosphorus trend from 1993 to 2003 at site 184 was upward approximately 4,680 percent. The record of total phosphorus concentrations between 1993 and early 2002 (pre-burn) shows no evidence of an increase of similar magnitude (fig. 3*B*). The FA trend from 1993 to 2001 also was upward, but smaller in magnitude. The total phosphorus data for site 184 demonstrate how the use of different periods of record can lead to different, yet equally valid, trend results. Therefore, it is important to always consider the period of record when using and comparing any trend results.

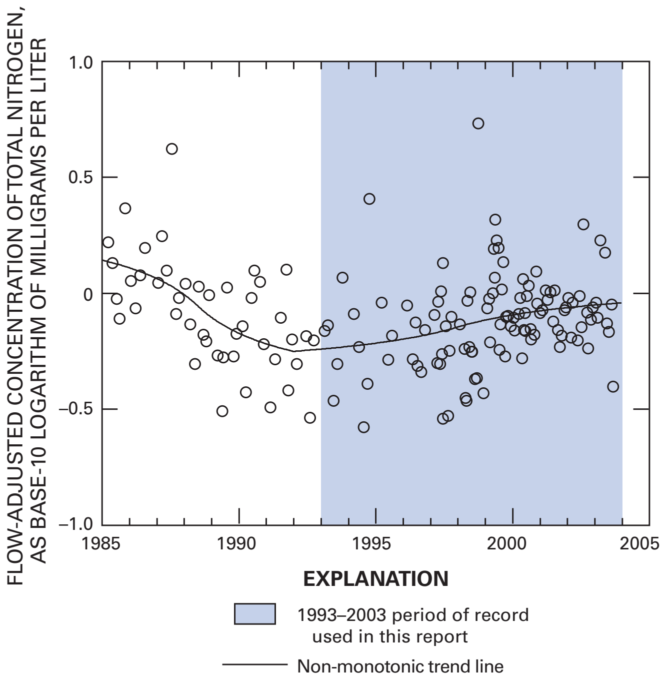

Figure 2. Flow-adjusted total nitrogen concentrations from 1985 to 2003 at site 99. Modified from Sprague and others, 2006.

In addition, during any period of record, there may be periods of shorter duration (for example, a day, season, or year) when relative extremes in concentration or load occur. Because the trend in this report represents the overall change from 1993 to 2003 and not the variability within that period, extremes in concentration or load between 1993 and 2003 may not be reflected in the trend result. However, these extremes may have contributed to important changes in water quality or ecosystem function during some shorter period between 1993 and 2003. For example, mean annual load of total nitrogen at site 153 (Mississippi River near St. Francisville, La.) was substantially lower during 2000 than during any other year from 1993 to 2003 (fig. 4); this low load corresponded to the relatively smaller extent of the hypoxic zone in the Gulf of Mexico in 2000 (Rabalais and others, 2002). To relate nutrient concentrations or loads to changes in certain water-quality or ecosystem end points, it may be necessary to look not only at the overall trends, but at changes occurring during periods of shorter duration.

Factors Affecting the Trends

Nutrient concentrations and loads can be affected by temporal and spatial changes in nutrient sources and landscape characteristics. To aid in interpreting the nutrient trends, important nutrient sources and landscape characteristics were determined for each site.

Data Sources

Geographic information system (GIS) software (ESRI, 2005) was used for spatial overlay analyses of the drainage-area polygons (or equivalent raster representation thereof) with digital thematic maps of nutrient sources and landscape characteristics. The spatial resolution of the thematic characteristics varied according to the scale or resolution of the source data. For many of the thematic characteristics, a time series of digital maps was available that was analyzed by a corresponding series of spatial overlays to produce a temporal series of basin characteristics. When drainage basins only partially extended into one or more counties, county-level data were apportioned according to the amount of agricultural or urban land contained within the drainage basin, as described by Nakagaki and Wolock (2005). The nutrient sources and landscape characteristics included

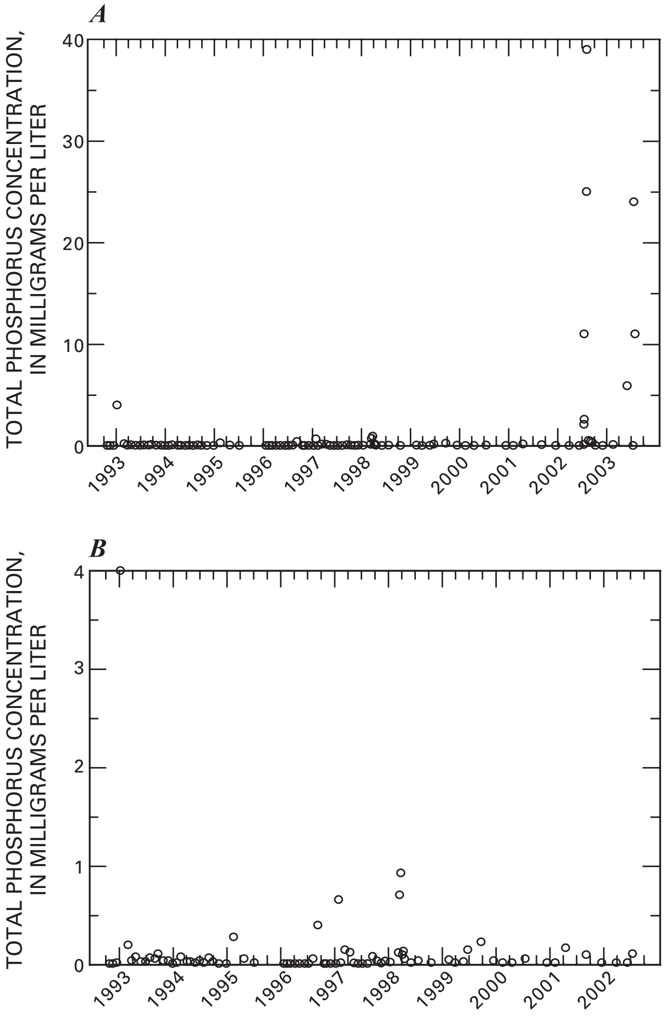

Figure 3. Total phosphorus concentrations from (*A*) 1993 to 2003 and (*B*) 1993 to early 2002 at site 184. Note different y-axis scales.

atmospheric deposition for nitrogen, fertilizer source loads for nitrogen and phosphorus, manure source loads for nitrogen and phosphorus, population density, land use, the base-flow index (estimated percentage base flow of total flow), presence of subsurface (tile) drains, mean basin slope, and mean annual precipitation.

Data for nitrogen in atmospheric deposition were derived from 1-km resolution grids of atmospheric deposition that were based on data from the National Atmospheric Deposition Program. Fertilizer and manure data were based on county-level estimates assigned to specified land uses within each county and then summed for the area within each drainage basin; data included nitrogen and phosphorus in commercial fertilizers used on farms and in urban settings and nitrogen and phosphorus in livestock manure. More detail on atmospheric deposition, fertilizer, and manure data generation can be found in Ruddy and others (2006). In addition, the fertilizer data used in this report (version date October 21, 2008) contain a correction for a processing error in the non-farm versus farm allocation in Ruddy and others (2006) (J.M. Gronberg and N.E. Spahr, U.S. Geological Survey, written commun., 2008). The population data were derived from a 30-m resolution grid of census block groups and population counts that were based on the 1990 and 2000 census of population and housing (U.S. Census Bureau, 1991, 2000). The source for land cover information was an enhanced version of the USGS 1992 National Land Cover Dataset (Nakagaki and Wolock, 2005). The 30-m resolution satellite-imagery-based land-cover data were used to compile basin percentages by land classification. The base-flow index, mean basin slope, and mean annual precipitation were characterized by the average of the grid-cell data values in the drainage basin. Base flow, the component of streamflow that can be attributed to ground-water discharge into streams, was estimated from the national base-flow index 1-km resolution dataset developed by Wolock (2003). Mean basin slope was derived from the USGS National Elevation Dataset (U.S. Geological Survey, 2003) gridded at 100-m resolution. The source for precipitation data was the 1-km resolution gridded data from the Daymet conterminous United States database (Thorton and Running, 1999); these data only were available through 1997. The basin area with subsurface (tile) drains was derived from 30-m resolution grids of 1992 National Resources Inventory parameters compiled by the Natural Resources Conservation Service (U.S. Department of Agriculture, 1995, 2001).

Point-source discharge likely is an important source of nutrients to some streams. However, consistent and comprehensive national estimates of annual nitrogen and phosphorus loading from point sources were not available for the period of record. Therefore, point sources were not evaluated directly in this study. Urban point sources were evaluated indirectly using population density as a surrogate; non-urban point sources such as pulp and paper mills had no available surrogate. Selected data on the implementation of management practices are available in the 1992 and 1997 National Resources Inventory (U.S. Department of Agriculture, 1995, 2001); however, similar data are not available after 1997. In addition, several potentially influential conservation practices that had been present in the 1992 National Resources Inventory, including conservation tillage systems, irrigation land management, irrigation land leveling, and subsurface drains, were no longer present in the 1997 National Resources Inventory. Therefore, changes in the implementation of management practices were not evaluated directly in this study. More comprehensive data on point-source loading and the implementation of management practices likely would have improved the interpretation of trends in this report.

Analysis of Factors Affecting Trends

To help explain the factors affecting the trends over time, FA trends in concentration were compared to changes in nutrient sources during the same period. FA trends were used in this analysis because the effects of streamflow on concentration had been removed, allowing the effects of changes in nutrient sources over time to be more directly assessed.

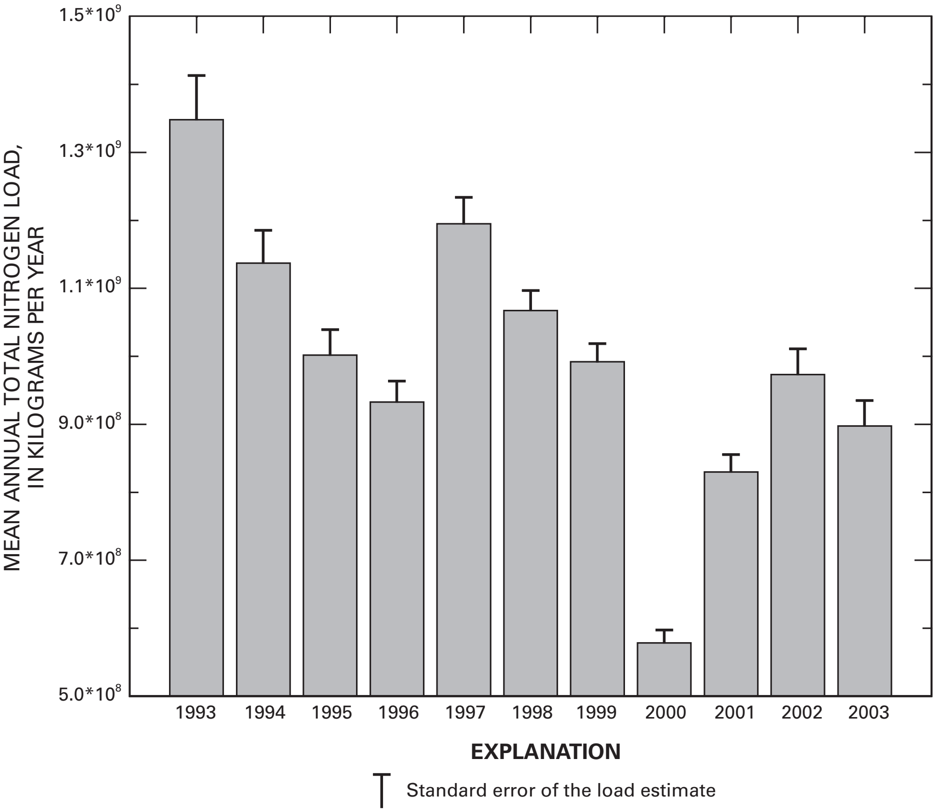

Figure 4. Mean annual loads of total nitrogen from 1993 to 2003 at site 153.

Nutrient sources included atmospheric deposition of nitrogen annually from 1993 to 2003; fertilizer inputs of phosphorus and nitrogen annually from 1993 to 2003; manure inputs of phosphorus and nitrogen in 1992, 1997, and 2002; and population density (a surrogate for urban sources of nutrients) in 1990 and 2000. The effects of changes in streamflow were assessed separately through a comparison of FA and NFA trends in the general discussion of trend results.

The goal of this analysis was not to explain all factors affecting each trend at individual sites—that was beyond the scope of this study. Rather, the goal was to identify on a broader scale those individual factors potentially affecting trends at a group of related sites. Groups of approximately 30 or more related sites were selected so as to minimize within group variability. These site groups were:

1. Eastern United States, including
    - New England and Mid-Atlantic NAWQA major river basin and
    - South Atlantic-Gulf and Tennessee NAWQA major river basin;
2. Central United States, including
    - Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy NAWQA major river basin,
    - Missouri NAWQA major river basin, and
    - Lower Mississippi, Arkansas-White-Red, and Texas-Gulf NAWQA major river basin;
3. Western United States, including
    - Rio Grande, Colorado, and Great Basin NAWQA major river basin,
    - Pacific Northwest NAWQA major river basin, and
    - California NAWQA major river basin;
4. undeveloped land-use classification (table 1);
5. greater than 40 percent agricultural land use in the basin;
6. greater than 10 percent urban land use in the basin;
7. base-flow index (estimated percentage base flow of total flow) greater than 50;
8. basin area with subsurface (tile) drains greater than 10 km^2;
9. mean basin slope greater than 10 percent;
10. mean annual precipitation greater than 130 cm;
11. mean annual precipitation less than 80 cm;
12. reference streamflow greater than 100 m^3/s;
13. reference streamflow less than 3 m^3/s;
14. high source loading from atmospheric deposition (median annual yield from 1993 to 2003 greater than 500 kg/km^2 for nitrogen);
15. high source loading from fertilizer (median annual yield from 1993 to 2003 greater than 2,000 kg/km^2 for nitrogen and greater than 300 kg/km^2 for phosphorus); and
16. high source loading from manure (median annual load from 1992 to 2002 greater than 1,200 kg/km^2 for nitrogen and greater than 300 kg/km^2 for phosphorus).

Ancillary data used in grouping sites are presented in Appendix 1.

To use the nutrient source data in these comparisons, a single number representing the percentage change in a given source over the study period (or the portion of the study period with available source data) was generated for each site (Appendix 1). When a source data series had annual observations (for example, the annual data series for fertilizer), the Sen slope estimate—calculated as the median of all possible pairwise slopes (Helsel and Hirsch, 1992)—was determined for that series at each site, divided by the initial value in the time series for that site to obtain a percentage, and then multiplied by 11 (the number of years in the study period). When an explanatory data series had only two or three observations (for example, 1990 and 2000 estimates of population density), the percentage change between the first year and the last year was determined for each site. When the value for the first year was zero, the percentage change value was treated as missing, because a meaningful percentage change could not be determined.

At sites with more than 50 percent of their drainage areas extending into Canada or Mexico, computed basin characteristics were based on the land area contained within the conterminous United States and thus were not representative of the characteristics of the full drainage areas. These sites—81 (Souris River near Sherwood, N. Dak.; 14.2 percent of drainage area in the United States), 82 (Souris River near Verendrye, N. Dak.; 31.9 percent of drainage area in the United States), and 97 (Poplar River at International Boundary, Mont.; 2.0 percent of drainage area in the United States)—were excluded from the comparison of FA trends and changes in nutrient sources, though they are included in the maps and discussion of general trend results. In addition, drainage areas were not delineated for sites 49 (Cape Fear River at State Highway 42 near Brickhaven, N.C.), 208 (Willamette River at SP&S Railroad Bridge, Oreg.), 215 (Columbia River at Marker number 47 upstream of Willamette River, Oreg.), 220 (Umatilla River at Westland Road at Hermiston, Oreg.), and 239 (Columbia River at Northport, Wash.). These sites also were excluded from the comparison of FA trends and changes in nutrient sources, though they are included in the maps and general discussion of trend results. Finally, the FA trend in total phosphorus concentrations at site 184 (Salt River near Roosevelt, Ariz.) was an order of magnitude higher than any other FA trend in total phosphorus concentrations. As discussed earlier, in June and July of 2002, the Rodeo-Chediski fire burned over 1,170 km^2 in the Salt River drainage (Arizona Game and Fish Department, 2006); runoff from the burned area likely was a primary factor in the large increase in total phosphorus concentrations. Because a probable contributor to this outlier trend value could be determined and was different from other explanatory variables being examined, this site was excluded from the comparison of FA trends and changes in nutrient sources; however, it is included in the maps and general discussion of trend results.

Three methods were used to compare FA trends and changes in nutrient sources—weighted-least squares (bivariate) regression, the Kruskal-Wallis test, and multiple linear regression. Each of the three methods offers relative benefits and drawbacks; none are entirely suited to this application.

With weighted least-squares regression, each trend value can be weighted so that values known with more confidence (those with less variance) have a greater weight in the regression than values that are known with less confidence (those with greater variance) (Helsel and Hirsch, 1992). In this way, trends with less variance have a stronger effect on the regression. For this study, weights in the weighted least-squares regression were based on the inverse of the variance of the FA trend estimates and the mean squared error of the regression model for each constituent at each site:

$$w_i = \frac{1}{s_i^2 + \sigma_{e_i}^2}, \tag{24}$$

where

w_i is the weight for each site-constituent combination i;

s_i^2 is the variance of the FA trend estimate;

and

$\sigma_{e_i}^2$ is the mean squared error of the regression model.

Relations were considered significant if the p-value was less than or equal to 0.05.

The weighted least-squares regression models were verified for normality and homoscedasticity of the residuals; results from models exhibiting heteroscedasticity or departure from a normal distribution were excluded. In addition, Cook's distance was used to screen for the presence of influential observations. When Cook's distance was greater than 2.4 (Helsel and Hirsch, 1992), and(or) when extreme outliers were identified through visual inspection of the scatterplots, the results were excluded. Both untransformed data and transformed data initially were examined in the weighted-least squares procedure. Because of the large number of zero and negative values in both the response and explanatory data sets, an inverse hyperbolic sine transform was employed (Burbidge and others, 1988). Residuals from the models with transformed variables often were substantially less normal and(or) homoscedastic than the residuals from corresponding models using untransformed variables; as a result, untransformed variables were used exclusively in the final regression analyses reported here.

One disadvantage of the weighted least-squares regression (and the multiple linear regression described later in this section) is that it requires a linear distribution in the data used to fit the model and normality and homoscedasticity in the residuals. In addition, all trends are assumed equal with respect to their probability of being different from zero—that is, non-significant trends are not distinguished from significant trends. The alpha-level of 0.05 used for statistical significance in this study is somewhat arbitrary and without specific theoretical basis; it is one of several alpha-levels conventionally used in hypothesis testing. Some have argued that fixed alpha-levels are unnecessarily restrictive and provide results that are relatively uninformative (for example, Anderson and others, 2000).

The non-parametric Kruskal-Wallis test can discriminate between non-significant and significant trends. For the Kruskal-Wallis test, the FA trends in each of the 16 site groups were classified into three categories: significantly upward, significantly downward, and non-significant. The corresponding changes in nutrient sources at the sites within each of those classifications were then compared using the Kruskal-Wallis test to determine whether the changes in source differed among the three trend classifications. If a significant (p-value less than or equal to 0.05, based on the chi-square distribution) difference was detected using the Kruskal-Wallis test, a post-hoc Tukey's multiple comparison test was used on the ranks of the data to evaluate pairwise differences in medians. The Kruskal-Wallis test does not require a specific data distribution and is not sensitive to outliers; therefore, it can be used with data sets that might not be appropriate for use in parametric tests such as linear regression (Helsel and Hirsch, 1992). However, if the assumptions of these parametric tests can be met, non-parametric tests like Kruskal-Wallis may have less power to detect real effects. In addition, the Kruskal-Wallis test cannot incorporate the errors in the trend estimates, giving equal weight to all estimates.

For the groups that included sites in the Eastern, Central, and Western United States and sites in the undeveloped land-use classification, sample sizes were large enough to permit the evaluation of multiple explanatory variables using multiple linear regression. FA trends in total phosphorus were evaluated in relation to changes in population density and phosphorus loading from fertilizer and manure. FA trends in total nitrogen and nitrate were evaluated in relation to changes in population density and nitrogen loading from atmospheric deposition, fertilizer, and manure. The most parsimonious model based on Akaike's Information Criterion was identified in a stepwise manner using the *stepAIC* function implemented in the MASS library (Venables and Ripley, 2002) of S-plus (Insightful Corporation, 2005). The final best-fit models were verified for normality and homoscedasticity of the residuals; results from models exhibiting heteroscedasticity or departure from a normal distribution were excluded. As with the weighted-least squares bivariate regression, both untransformed and transformed (using an inverse hyperbolic sine transform) response and explanatory variables were evaluated initially, but because residuals from the models with transformed variables often were substantially less normal and(or) homoscedastic than the residuals from corresponding models using untransformed variables, untransformed variables were used exclusively in the final multiple linear regression analyses reported here.

Although the explanatory factors identified through these three methods have a significant relation to the FA nutrient trends, the specific cause-and-effect relations responsible for the observed relations are not always clear, and inferences regarding causes should be considered as hypotheses.

Regional Trends

Consistent trends in nutrient concentrations may be present across a given area of the Nation. These areas may be defined in various ways, including geographically (for example, Eastern, Central, or Western United States), by major landscape features (for example, agricultural or urban land area), or by site characteristic (for example, mean annual streamflow). The areas may be spatially contiguous or related by some physical characteristic, though spatially disjointed. Regional FA and NFA trends in concentration were examined using the Regional Seasonal Kendall test—the Regional Kendall test (Helsel and Frans, 2006) modified to account for seasonality. The Regional Kendall test computes a test for trend for all sites within a region by computing a score for each site and adding the scores to compute the total for the region (Helsel and Frans, 2006). The Regional Seasonal Kendall test takes this procedure one step further by computing a score for each season at each site and totaling those scores for the region. The Regional Seasonal Kendall test was built into the statistical program ESTREND (Schertz and others, 1991) recoded in S-plus version 7.0 (Insightful Corporation, 2005).

The Mann-Kendall test statistic S is calculated for a site by comparing each (t, y) data pair, where t is time and y is the response variable of interest, to all other (t, y) data pairs in a pairwise fashion, and subtracting the number of data pairs where y decreases as t increases (M) from the number of data pairs where y increases as t increases (P), with ties not counted (Helsel and Hirsch, 1992).

$$S = P - M. \tag{25}$$

With n data pairs, the variance of S is

$$Var\left(S\right) = \frac{n(n-1)(2n+5)}{18}, \tag{26}$$

If there are ties, an adjustment is made to the computation of variance (Helsel and Hirsch, 1992).

The Seasonal Kendall test accounts for seasonality by calculating S within each of m seasons separately (Helsel and Hirsch, 1992).

$$\mathrm{S_k} = \sum_{S=1}^{m} S_S, \tag{27}$$

where

S_k is the Seasonal Kendall test statistic;

m is the number of seasons;

and

S_S is the Mann-Kendall test statistic for each of the S=1 to m seasons.

S_k is asymptotically normal with mean of 0 and variance, $Var(S_K)$, of

$$Var\left(S_K\right) = \sum_{S=1}^{m} Var\left(S_S\right) + 2\sum_{S=1}^{m-1}\sum_{Q=1+S}^{m} Cov(S_S, S_Q), \tag{28}$$

where

$Var(S_S)$ is the variance of S_S;

and

$Cov(S_S, S_Q)$ is the covariance between seasons S and Q.

The covariance is computed as described in Hirsch and Slack (1984), building on work by Dietz and Killeen (1981), and accounts for serial dependence. When serial dependence exists, the null hypothesis of no trend will tend to be more frequently rejected than it should be unless serial dependence is accounted for by computing the covariance between seasons.

The Regional Kendall test substitutes location for season in the Seasonal Kendall test and computes the Mann-Kendall test statistic, S_L, for each of *n* locations (Helsel and Frans, 2006). The overall regional test statistic S_R is computed following equation 27, with S_L substituted for S_S, and the variance of S_R is computed following equation 28, again with S_L substituted for S_S (Douglas and others, 2000). When the product of the number of sites and the number of years is more than about 25, the distribution of S_R will be approximately normal (Helsel and Frans, 2006). Calculating the variance following equation 28 accounts for spatial correlation among the sites (Douglas and others, 2000), which may occur when closely spaced sites repeatedly sample one portion of a defined region. Just as with serial dependence, when spatial correlation exists, the null hypothesis of no regional trend will tend to be more frequently rejected than it should be unless the spatial correlation is accounted for by computing the covariance between sites.

The Regional Seasonal Kendall test incorporates the features of both the Seasonal Kendall test and the Regional Kendall Test. The overall regional and seasonal test statistic, S_T, is the sum of the individual Mann-Kendall test statistics, S_{SL}, from each of the *m* seasons at each of the *n* locations.

$$S_T = \sum_{S=1}^{m} \sum_{L=1}^{n} S_{SL} \tag{29}$$

The variance of S_T, $Var(S_T)$, is computed from the covariance between each season at each site, as with the Seasonal Kendall test, and between each site for each season.

$$\begin{aligned} Var(S_T) &= \sum_{S=1}^{m} \sum_{L=1}^{n} Var(S_{SL}) \\ &+ 2\sum_{S=1}^{m-1} \sum_{Q=1+S}^{m} \sum_{L=1}^{n} Cov(S_{SL}, S_{QL}), \\ &+ 2\sum_{S=1}^{m} \sum_{L=1}^{n-1} \sum_{K=1+L}^{n} Cov(S_{SL}, S_{SK}) \end{aligned} \tag{30}$$

where

$Var(S_{SL})$ is the variance of S_{SL};

$Cov(S_{SL}, S_{QL})$ is the covariance between seasons *S* and *Q* at location *L*;

and

$Cov(S_{SL}, S_{SK})$ is the covariance between locations *L* and *K* in season *S*.

The remaining covariance is assumed to be equal to zero.

The variance of S_T can be used to compute the test statistic Z_T and p-value of the normal approximation for the Regional Seasonal Kendall test, with a continuity correction for S_T.

$$Z_T = \begin{cases} \dfrac{S_T - 1}{\sqrt{Var(S_T)}} & \text{if } S_T \text{ is greater than 0} \\ 0 & \text{if } S_T \text{ is equal to 0} \\ \dfrac{S_T + 1}{\sqrt{Var(S_T)}} & \text{if } S_T \text{ is less than 0} \end{cases} \tag{31}$$

The null hypothesis of the Regional Seasonal Kendall test is that there is no regional trend. Rejection of the null hypothesis will occur when a trend in the same direction occurs at many of the individual locations. Failure to reject the null hypothesis may result from a lack of trend at most locations or from trends in opposite directions at different locations cancelling one another out. A general increase or decrease at an individual location occurring in the same direction as the regional pattern provides support for a significant regional trend, even if the trend at that individual location is not significant on its own (Helsel and Frans, 2006). Regional trend results were considered significant if the p-value was less than or equal to 0.10. The higher alpha value (as compared to the 0.05 value used in other statistical analyses herein) was used because of the potential loss of power resulting from the recensoring process described in the following paragraph.

For the Regional Seasonal Kendall test, FA concentrations were calculated as residuals from a locally weighted scatterplot smooth (LOWESS) of log-transformed concentrations on log-transformed streamflow with a span of 0.75. A maximum of 5 percent censoring was accepted in the LOWESS flow-adjustment. For the NFA analysis, concentrations were recensored to the highest detection limit for each constituent among all sites, and a maximum of 50 percent censoring was accepted. This involved some loss of information and possibly loss of power to detect true trends (Helsel and Hirsch, 1992).

For both NFA and FA concentrations, the number of seasons was set to four (October–December, January–March, April–June, July–September), the highest annual sampling frequency inclusive of the largest number of sites. A small number of sites had an average annual sampling frequency less than four and were excluded from the Regional Seasonal Kendall analysis, including sites 61 (South Prong Alafia River near Lithia, Fla.), 97 (Poplar River at International Boundary, Mont.), 106 (Lonetree Creek near Greeley, Colo.), and 169 (Onion Creek at U.S. Highway 183, Austin, Tex.) for total phosphorus; sites 61, 97, 106, and 179 (Colorado River at Lees Ferry, Ariz.) for total nitrogen; and sites 106, 159 (Neches River near Neches, Tex.), 160 (Neches River near Rockland, Tex.), 163 (Trinity River near Crockett, Tex.), and 174 (Colorado River near Kremmling, Colo.) for nitrate. When multiple observations occurred in a single season at a site, the observation closest to the midpoint of that season was used. The same 16 site groups that were used in the analysis of factors affecting the trends over time were used in the Regional Seasonal Kendall analysis.

A similar regional analysis also could have been done for streamflow and nutrient loads. In this study, trends in streamflow were determined only at sites used in the analysis of trends in concentration and load. The main goal of the analysis was to determine changes in streamflow at sites where changes in nutrient concentrations and loads also would be determined, so that the effects of changes in streamflow on changes in nutrient concentrations and loads could be evaluated. A more complete regional and national analysis of streamflow trends would include additional sites with long-term streamflow records that may not have appropriate long-term records of nutrient concentrations. In addition, to use the Regional Seasonal Kendall test on nutrient loads, monthly or annual load estimates for each site and constituent would be required. However, in this study, the trends in load were determined using sample estimates of the coefficients in equation 17; they were not determined through a two-stage process involving estimation of monthly or annual loads followed by some independent test for trend. Therefore, load estimates were not needed and were not generated. Even if they had been, such a two-stage process would not account for the fact that loads are estimated with sampling error; as a result, hypothesis tests based on the estimated covariance matrix of the second-stage trend test would be biased.

Nutrient Trends in Streams and Rivers of the United States, 1993–2003

FA trends in concentration (the trends that would have occurred in the absence of natural changes in streamflow), NFA trends in concentration (the trends resulting from both natural and anthropogenic factors), and trends in load (trends in the nutrient mass transported downstream) from 1993 to 2003 are presented in the following sections for total phosphorus, total nitrogen, and nitrate. Because the interpretation of these trends can be improved by understanding how streamflow has changed during the same period, trends in streamflow are presented first. The nutrient trends follow, and they are evaluated spatially to determine whether a consistent pattern of trends occurred across groups of sites at multiple locations. Relations between the trends and temporal changes in streamflow and nutrient sources then are examined.

General geographic areas are used periodically in the following sections to group results; these geographic areas (table 1, fig. 1, appendix 1) are categorized as follows:

- Eastern—the New England and Mid-Atlantic (Northeast) and South Atlantic-Gulf and Tennessee (Southeast) NAWQA major river basins.
- Central—the Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy; Missouri; and Lower Mississippi, Arkansas-White-Red, and Texas-Gulf NAWQA major river basins.
- Western—the Rio Grande, Colorado, and Great Basin (Southwest); Pacific Northwest; and California (Southwest) NAWQA major river basins.

The site coverage in some portions of these geographic areas was sparse. Results are discussed below in terms of the sites included in the analysis; care should be taken with spatial extrapolation of these results to unrepresented areas.

Streamflow Trends

Significant (p-value less than or equal to 0.05) trends in streamflow occurred at 56 (23 percent) of the 244 sites from 1993 to 2003 (fig. 5, table 2, Appendix 2). At all but two sites, these trends were downward. These downward trends primarily occurred at sites in the Central and Southwestern United States and parts of the Southeastern United States. At sites in these three areas, trends overall were either downward or nonsignificant. Trends at sites in the Northeastern and Northwestern United States were almost entirely nonsignificant.

Drought conditions in the latter part of the study period likely were the predominant influence contributing to the widespread downward trends in streamflow at sites in the Southeastern, Central, and Southwestern United States. The Southeastern United States experienced unusually dry conditions each year between 1998 and 2002 (National Oceanic and Atmospheric Administration, 2002). Snowpack in the Rocky Mountains, a large source of water to rivers on both sides of the continental divide, was less than the long-term average between 2000 and 2003 (U.S. Army Corps of Engineers, 2006; U.S. Department of Agriculture, 2007). Statewide precipitation levels in Colorado between July 2001 and June 2002 and in Nebraska between December 2001 and July 2002 were at the lowest level of any single year since 1895 (National Oceanic and Atmospheric Administration, 2002). From 2000 to 2003, moderate to severe drought conditions were observed in parts of Missouri (National Oceanic and Atmospheric Administration, 2003). Prolonged below-average precipitation in the Southwestern United States from 1998 to 2002 resulted in values of the Palmer Drought Index—an index of the scope, severity, and frequency of protracted periods of abnormally dry or wet weather—during 2002 that were at the lowest level observed in 100 years (National Oceanic and Atmospheric Administration, 2002). In 2002, Colorado, Arizona, and Nevada experienced the driest September through August on record and Utah experienced the driest January through August on record (National Oceanic and Atmospheric Administration, 2002). In 2003, below-average precipitation and above-average temperatures contributed to persistent or worsening drought conditions in the Central and Southwestern United Sates (National Oceanic and Atmospheric Administration, 2003). In addition, above-average precipitation occurred early in the trend period in the Central United States—the worst floods on record in southern Wisconsin, Iowa, Missouri, and Illinois occurred between June and August of 1993, and January through July 1993 was the wettest period in the upper Mississippi River Basin and the second wettest in the Missouri River Basin since 1895 (Bell and Janowiak, 1995). Precipitation in 2003 was near average in the Northwestern United States and above average in most states east of the Mississippi River, where North Carolina, Virginia, and Maryland experienced the wettest year on record (National Oceanic and Atmospheric Administration, 2003).

This analysis of streamflow trends included only sites used in the analysis of trends in one or more nutrient constituents. The main goal of the analysis was to determine changes in

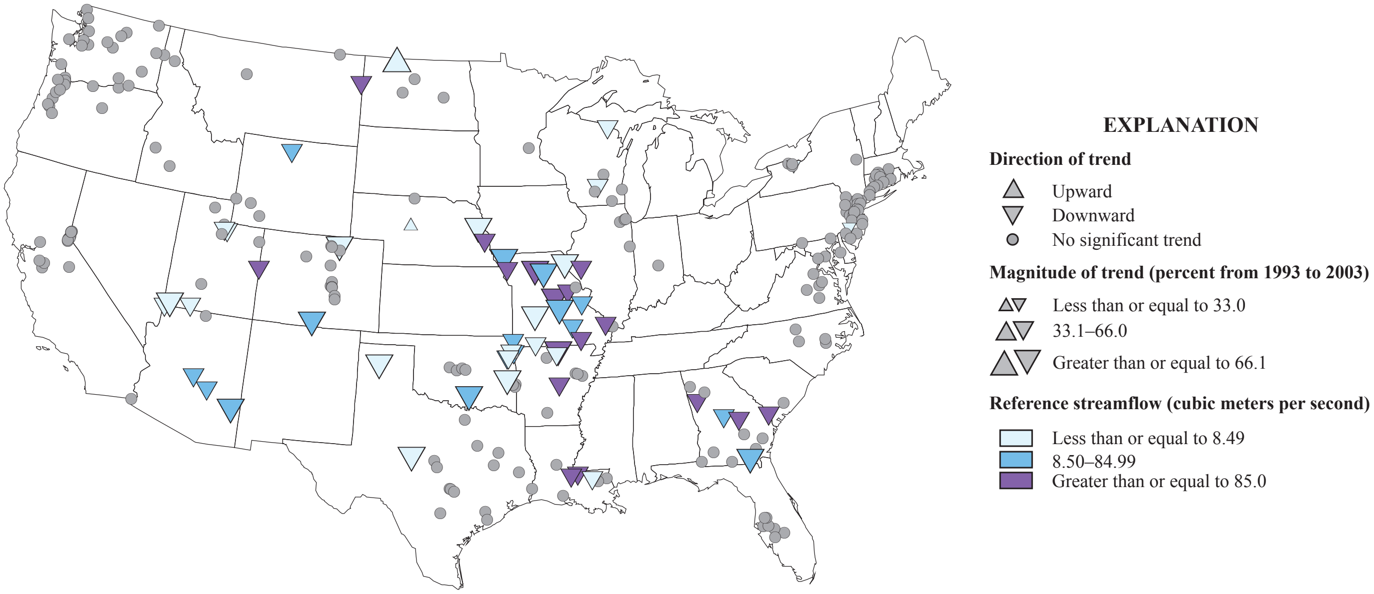

Figure 5. Trends in streamflow at selected sites in the United States.

streamflow at sites where changes in nutrient concentrations and loads also would be determined, so that the effects of changes in streamflow on changes in nutrient concentrations and loads could be evaluated. A comprehensive national analysis of streamflow trends would include additional sites with long-term streamflow records that may not have appropriate long-term records of nutrient concentrations. Because not all sites shown in figure 5 were included in the trend analyses for each constituent (see table 1), maps showing trends in concentration and load for each constituent are presented together in the following sections with maps showing trends in streamflow from figure 5 at only those sites included in the analyses for that constituent.

Total Phosphorus

Trends from 1993 to 2003

Significant (p-value less than or equal to 0.05) FA trends in total phosphorus concentrations occurred at 84 (49 percent) of 171 sites from 1993 to 2003 (fig. 6*B*, tables 3 and 4, Appendix 3). Downward FA trends only occurred at 27 (16 percent) of the sites, indicating that at the majority of sites, changes in phosphorus use, implementation of pollution-control strategies, or other anthropogenic activities were not contributing to significant decreases in total phosphorus concentrations in streams, or any reductions that occurred were offset by other anthropogenic activities in the watershed that increased concentrations. Upward FA trends occurred at 57 (33 percent) of the sites, indicating increases in phosphorus sources and(or) transport at one-third of the sites. At sites in the Northeastern, Central, and Southwestern United States, FA trends in total phosphorus concentrations were generally upward or nonsignificant (fig. 6*B*). At sites in the Southeastern and Northwestern United States, FA trends were a mixture of upward, downward, and nonsignificant.

There were fewer significant NFA trends than FA trends in total phosphorus concentrations; NFA trends were significant at 69 (40 percent) of 171 sites from 1993 to 2003 (fig. 6*C*, tables 3 and 5, Appendix 3). Downward NFA trends only occurred at 28 (16 percent) of the sites, indicating that at the majority of sites, total phosphorus concentrations in streams were not decreasing significantly. However, total phosphorus concentrations in streams were increasing at only about one-quarter of the sites—upward NFA trends occurred at 41 (24 percent) of the 171 sites. At the majority of sites (60 percent) nationwide, total phosphorus concentrations in streams were not changing significantly. At sites in the Northeastern and Central United States, NFA trends in total phosphorus concentrations were generally upward or nonsignificant (fig. 6*C*). At sites in the Southeastern and Western United States, NFA trends were a mixture of upward, downward, and nonsignificant.

The primary difference between the number of significant FA and NFA trends was a smaller number of upward NFA trends. In particular, relatively fewer upward NFA trends than upward FA trends occurred at sites in the Central and Southwestern United States, where most of the significant (downward) trends in streamflow occurred (fig. 6*A*). The upward FA trends at these sites (fig. 6*B*) indicate that phosphorus sources may have been increasing between 1993 and 2003. The downward trends in streamflow at many of these sites likely resulted from a decrease in precipitation during drought conditions in the latter part of the study period, which would have contributed to a decrease in surface runoff. The increase in source indicated by the upward FA trend likely was offset by the effects of decreasing surface runoff indicated by the downward streamflow trend, resulting in fewer upward NFA trends. Without the decrease in streamflow and associated surface runoff at these sites, in-stream concentrations probably would have been higher.

Table 2. Trends in daily mean streamflow from 1993 to 2003.

[See Appendix 2 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic meters per second[1]	Trend, in percent from 1993 to 2003			p-value
					Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
1	01122610	Shetucket River at South Windham, Conn.	01122610	13.70	–20.09	35.75	–52.96	0.407
2	01124000	Quinebaug River at Quinebaug, Conn.	01124000	5.00	–24.00	36.50	–57.68	0.358
3	01127000	Quinebaug River at Jewett City, Conn.	01127000	22.25	–3.74	63.17	–43.21	0.887
4	01184000	Connecticut River at Thompsonville, Conn.	01184000	379.66	–10.12	25.25	–35.51	0.529
5	01184490	Broad Brook at Broad Brook, Conn.	01184490	0.63	–18.36	15.06	–42.07	0.247
6	01188090	Farmington River at Unionville, Conn.	01188090	16.17	–24.01	16.08	–50.25	0.204
7	01189995	Farmington River at Tariffville, Conn.	01189995	27.44	–25.45	13.76	–51.15	0.173
8	01192500	Hockanum River near East Hartford, Conn.	01192500	3.15	–21.67	12.63	–45.52	0.188
9	01193500	Salmon River near East Hampton, Conn.	01193500	2.95	–11.31	56.45	–49.72	0.679
10	01196500	Quinnipiac River at Wallingford, Conn.	01196500	4.80	–7.19	39.65	–38.32	0.720
11	01205500	Housatonic River at Stevenson, Conn.	01205500	43.66	–4.82	86.90	–51.53	0.886
12	01208500	Naugatuck River at Beacon Falls, Conn.	01208500	10.84	–13.16	35.79	–44.46	0.536
13	01208990	Saugatuck River near Redding, Conn.	01208990	0.47	17.58	164.94	–47.82	0.696
14	01209710	Norwalk River at Winnipauk, Conn.	01209710	0.87	–0.88	93.23	–49.16	0.979
15	01357500	Mohawk River at Cohoes, N.Y.	01357500	91.16	23.29	89.21	–19.66	0.338
16	01377000	Hackensack River at Rivervale, N.J.	01377000	1.72	–23.87	20.21	–51.78	0.242
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	01382500	0.42	–46.63	100.42	–85.79	0.352
18	01387500	Ramapo River near Mahwah, N.J.	01387500	2.80	14.67	151.39	–47.69	0.732
19	01389500	Passaic River at Little Falls, N.J.	01389500	14.48	–18.58	139.20	–72.29	0.708
20	01391500	Saddle River at Lodi, N.J.	01391500	1.90	4.46	81.35	–39.83	0.877
21	01394500	Rahway River near Springfield, N.J.	01394500	0.47	17.68	78.33	–22.34	0.443
22	01395000	Rahway River at Rahway, N.J.	01395000	0.65	10.34	89.87	–35.87	0.722
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	01396660	0.32	4.20	93.78	–43.97	0.897
24	01398000	Neshanic River at Reaville, N.J.	01398000	0.33	3.03	175.69	–61.50	0.953
25	01402000	Millstone River at Blackwells Mills, N.J.	01402000	6.82	–14.34	37.97	–46.82	0.524
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	01403300	18.39	–17.31	43.06	–52.20	0.497
27	01408000	Manasquan River at Squankum, N.J.	01408000	1.54	–16.44	25.75	–44.48	0.389
28	01408500	Toms River near Toms River, N.J.	01408500	5.09	–10.02	31.26	–38.31	0.584
29	01409500	Batsto River at Batsto, N.J.	01409500	2.99	–23.58	13.30	–48.46	0.181
30	01411500	Maurice River at Norma, N.J.	01411500	3.47	1.18	76.11	–41.87	0.967
31	01438500	Delaware River at Montague, N.J.	01438500	108.40	6.27	63.49	–30.92	0.782
32	01443500	Paulins Kill at Blairstown, N.J.	01443500	3.94	–20.60	65.47	–61.90	0.538
33	01463500	Delaware River at Trenton, N.J.	01463500	240.81	0.93	63.68	–37.76	0.970
34	01467150	Cooper River at Haddonfield, N.J.	01467150	0.59	–28.62	–3.38	–47.26	**0.029**
35	01477120	Raccoon Creek near Swedesboro, N.J.	01477120	0.82	–12.68	38.60	–44.98	0.565
36	01491000	Choptank River near Greensboro, Md.	01491000	1.89	43.84	332.25	–52.13	0.517
37	01578310	Susquehanna River at Conowingo, Md.	01578310	764.53	–21.03	32.07	–52.78	0.368
38	01594440	Patuxent River near Bowie, Md.	01594440	7.69	1.20	92.75	–46.87	0.971
39	01614500	Conococheague Creek at Fairview, Md.	01614500	13.51	–38.33	33.36	–71.48	0.219
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	01646580	213.18	–25.99	108.51	–73.73	0.569
41	01668000	Rappahannock River near Fredericksburg, Va.	01668000	32.46	–42.69	73.75	–81.09	0.325
42	01673000	Pamunkey River near Hanover, Va.	01673000	17.17	–46.94	59.54	–82.35	0.259
43	01674500	Mattaponi River near Beulahville, Va.	01674500	9.31	–53.89	96.74	–89.19	0.296
44	02035000	James River at Cartersville, Va.	02035000	147.16	–34.78	38.64	–69.32	0.267
45	02041650	Appomattox River at Matoaca, Va.	02041650	18.95	–36.08	99.23	–79.49	0.440
46	02085000	Eno River at Hillsborough, N.C.	02085000	0.54	0.82	201.95	–66.34	0.988
47	02089500	Neuse River at Kinston, N.C.	02089500	48.43	23.45	172.20	–44.01	0.602
48	02091500	Contentnea Creek at Hookerton, N.C.	02091500	10.21	52.67	283.87	–39.28	0.368
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	02102500	49.27	–6.35	101.73	–56.52	0.867
50	02175000	Edisto River near Givhans, S.C.	02175000	67.39	–51.00	18.36	–79.71	0.113
51	02198500	Savannah River near Clyo, Ga.	02198500	384.30	–51.95	–5.97	–75.45	**0.032**
52	02213700	Ocmulgee River near Warner Robins, Ga.	02213700	49.94	–40.36	–4.21	–62.87	**0.033**
53	02215500	Ocmulgee River at Lumber City, Ga.	02215500	147.53	–47.60	14.40	–76.00	0.105
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	02223500	113.18	–59.99	–9.57	–82.30	**0.028**
55	02226010	Altamaha River near Gardi, Ga.	02226000	336.17	–51.45	23.90	–80.98	0.131
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	02226500	10.70	–68.11	73.46	–94.14	0.186
57	02271500	Josephine Creek near De Soto City, Fla.	02271500	0.86	–3.83	270.94	–75.07	0.955

Table 2. Trends in daily mean streamflow from 1993 to 2003.—Continued

[See Appendix 2 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic meters per second[1]	Trend, in percent from 1993 to 2003			p-value
					Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
58	02295420	Payne Creek near Bowling Green, Fla.	02295420	2.34	–41.53	119.85	–84.45	0.427
59	02296750	Peace River at Arcadia, Fla.	02296750	14.38	–35.78	183.72	–85.46	0.559
60	02300700	Bullfrog Creek near Wimauma, Fla.	02300700	0.61	–25.78	42.03	–61.22	0.368
61	02301300	South Prong Alafia River near Lithia, Fla.	02301300	1.60	–41.87	211.34	–89.15	0.526
62	02302500	Blackwater Creek near Knights, Fla.	02302500	0.95	–59.09	112.22	–92.11	0.287
63	02303000	Hillsborough River near Zephyrhills, Fla.	02303000	3.68	–14.21	127.43	–67.64	0.758
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	02314500	17.03	–83.56	–22.23	–96.52	**0.023**
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	02318500	8.10	–18.20	339.98	–84.79	0.815
66	02335870	Sope Creek near Marietta, Ga.	02335870	0.92	–37.34	7.60	–63.51	0.090
67	02338000	Chattahoochee River near Whitesburg, Ga.	02338000	115.56	–48.48	–10.88	–70.22	**0.018**
68	02344040	Chattahoochee River near Steam Mill, Ga.	02343801	260.33	–28.21	21.34	–57.53	0.216
69	02353000	Flint River at Newton, Ga.	02353000	168.15	–46.12	4.10	–72.11	0.066
70	02388520	Oostanaula River at Rome, Ga.	02388500	67.45	–11.15	55.96	–49.38	0.681
71	02492000	Bogue Chitto River near Bush, La.	02492000	47.14	–31.18	5.95	–55.29	0.090
72	03353637	Little Buck Creek near Indianapolis, Ind.	03353637	0.30	–47.86	28.18	–78.79	0.156
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	03611500	6,996.15	–18.06	20.92	–44.47	0.316
74	04063700	Popple River near Fence, Wis.	04063700	2.66	–35.22	–9.96	–53.39	**0.010**
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	04073468	0.95	–44.81	7.95	–71.79	0.083
76	04087000	Milwaukee River at Milwaukee, Wis.	04087000	10.89	–29.12	6.87	–52.99	0.100
77	0422026250	Northrup Creek at North Greece, N.Y.	0422026250	0.21	58.64	165.31	–5.14	0.079
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	04232034	0.90	–26.71	–1.44	–45.51	**0.040**
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	0423204920	0.15	–20.40	19.78	–47.10	0.274
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	0423205025	3.07	–20.92	9.11	–42.69	0.153
81	05114000	Souris River near Sherwood, N. Dak.	05114000	0.15	935.99	9,496.68	11.84	**0.040**
82	05120000	Souris River near Verendrye, N. Dak.	05120000	1.22	84.53	678.32	–56.25	0.404
83	05287890	Elm Creek near Champlin, Minn.	05287890	0.72	–60.06	8.68	–85.32	0.072
84	05427718	Yahara River at Windsor, Wis.	05427718	0.75	–36.21	–19.03	–49.74	**<0.001**
85	05427948	Pheasant Branch at Middleton, Wis.	05427948	0.09	–9.68	23.68	–34.05	0.525
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	054310157	0.04	–8.53	67.45	–50.03	0.773
87	05500000	South Fabius River near Taylor, Mo.	05500000	5.14	–85.60	–55.45	–95.34	**0.001**
88	05514500	Cuivre River near Troy, Mo.	05514500	5.06	–61.49	23.05	–87.95	0.107
89	05525500	Sugar Creek at Milford, Ill.	05525500	5.13	–56.05	39.65	–86.17	0.163
90	05531500	Salt Creek at Western Springs, Ill.	05531500	3.85	–3.42	30.52	–28.54	0.821
91	05532500	Des Plaines River at Riverside, Ill.	05532500	16.79	–21.88	14.94	–46.91	0.210
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	05540275	0.18	–40.47	22.19	–71.00	0.158
93	05586100	Illinois River at Valley City, Ill.	05586100	824.87	–59.42	–31.58	–75.93	**0.001**
94	07018100	Big River near Richwoods, Mo.	07018100	15.97	–61.09	–33.55	–77.21	**0.001**
95	07022000	Mississippi River at Thebes, Ill.	07022000	8,873.13	–54.17	–35.15	–67.62	**0.000**
96	06088500	Muddy Creek at Vaughn, Mont.	06088500	2.26	–8.24	10.67	–23.92	0.369
97	06178000	Poplar River at International Boundary, Mont.	06178000	0.11	–17.28	140.85	–71.59	0.728
98	06274300	Bighorn River at Basin, Wyo.	06274300	55.72	–54.76	–9.76	–77.32	**0.024**
99	06329500	Yellowstone River near Sidney, Mont.	06329500	338.31	–49.57	–21.70	–67.52	**0.002**
100	06338490	Missouri River at Garrison Dam, N. Dak.	06338490	510.45	10.16	102.10	–39.96	0.755
101	06461500	Niobrara River near Sparks, Nebr.	06461500	22.26	–5.33	6.04	–15.49	0.344
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	06468250	0.33	127.28	1,477.31	–67.25	0.406
103	06713500	Cherry Creek at Denver, Colo.	06713500	0.61	40.29	158.97	–24.00	0.279
104	06752260	Cache La Poudre River at Fort Collins, Colo.	06752260	1.29	–43.47	70.82	–81.29	0.312
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	06752280	0.85	–62.36	74.41	–91.88	0.212
106	06753990	Lonetree Creek near Greeley, Colo.	06753990	0.41	–93.30	–80.20	–97.74	**<0.001**
107	06754000	South Platte River near Kersey, Colo.	06754000	26.64	–46.40	10.26	–73.95	0.090
108	06775900	Dismal River near Thedford, Nebr.	06775900	6.03	6.81	12.00	1.85	**0.007**
109	06800000	Maple Creek near Nickerson, Nebr.	06800000	3.44	–71.28	–42.92	–85.55	**<0.001**
110	06805500	Platte River at Louisville, Nebr.	06805500	324.79	–61.40	–44.36	–73.23	**<0.001**
111	06817700	Nodaway River near Graham, Mo.	06817700	28.76	–90.02	–74.40	–96.11	**<0.001**
112	06818000	Missouri River at St. Joseph, Mo.	06818000	1,821.07	–43.38	–20.12	–59.87	**0.001**

Table 2. Trends in daily mean streamflow from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic meters per second[1]	Trend, in percent from 1993 to 2003			p-value
					Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
113	06902000	Grand River near Sumner, Mo.	06902000	100.76	–89.05	–63.62	–96.71	**<0.001**
114	06905500	Chariton River near Prairie Hill, Mo.	06905500	38.02	–88.81	–61.04	–96.79	**0.001**
115	06921070	Pomme De Terre River near Polk, Mo.	06921070	4.02	–72.43	–30.84	–89.01	**0.006**
116	06926510	Osage River below St. Thomas, Mo.	06926510	387.34	–84.61	–56.94	–94.50	**<0.001**
117	06930800	Gasconade River above Jerome, Mo.	06930800	62.90	–67.50	–44.51	–80.97	**<0.001**
118	06934500	Missouri River at Hermann, Mo.	06934500	3,945.46	–63.20	–43.52	–76.02	**<0.001**
119	07047942	L'Anguille River near Colt, Ark.	07047942	6.03	52.18	217.98	–27.17	0.264
120	07053250	Yocum Creek near Oak Grove, Ark.	07053250	1.09	–58.98	–36.26	–73.60	**<0.001**
121	07056000	Buffalo River near St Joe, Ark.	07056000	12.99	–49.76	0.41	–74.86	0.051
122	07060500	White River at Calico Rock, Ark.	07060500	363.03	–68.03	–42.08	–82.35	**<0.001**
123	07060710	North Sylamore Creek near Fifty Six, Ark.	07060710	0.63	–55.02	–24.15	–73.33	**0.003**
124	07066110	Jacks Fork above Two River, Mo.	07066000	13.93	–53.92	–32.31	–68.64	**<0.001**
125	07068000	Current River at Doniphan, Mo.	07068000	91.97	–48.45	–29.10	–62.52	**<0.001**
126	07077500	Cache River at Patterson, Ark.	07077500	15.65	–19.39	81.46	–64.19	0.603
127	07077700	Bayou DeView near Morton, Ark.	07077700	2.02	189.77	832.53	–9.96	0.075
128	07103700	Fountain Creek near Colorado Springs, Colo.	07103700	0.52	–46.90	37.19	–79.44	0.191
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	07103780	0.22	–14.33	116.13	–66.04	0.743
130	07105500	Fountain Creek at Colorado Springs, Colo.	07105500	1.64	–30.06	86.76	–73.81	0.476
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	07105530	3.31	–10.10	62.13	–50.15	0.723
132	07106300	Fountain Creek near Pinon, Colo.	07106300	3.42	4.53	134.55	–53.41	0.914
133	07106500	Fountain Creek at Pueblo, Colo.	07106500	3.70	–2.33	120.06	–56.65	0.955
134	07189000	Elk River near Tiff City, Mo.	07189000	20.69	–64.28	–35.45	–80.23	**0.001**
135	07195500	Illinois River near Watts, Okla.	07195500	16.58	–48.67	–18.72	–67.59	**0.004**
136	07195865	Sager Creek near West Siloam Springs, Okla.	07195865	0.41	–20.34	40.30	–54.78	0.431
137	07196000	Flint Creek near Kansas, Okla.	07196000	2.78	–51.59	–18.07	–71.40	**0.007**
138	07196500	Illinois River near Tahlequah, Okla.	07196500	24.71	–50.46	–18.63	–69.83	**0.006**
139	07197000	Baron Fork at Eldon, Okla.	07197000	8.15	–62.23	–33.05	–78.69	**0.001**
140	07227500	Canadian River near Amarillo, Tex.	07227500	2.21	–82.32	–27.94	–95.66	**0.016**
141	07239450	North Canadian River near Calumet, Okla.	07239450	4.42	–35.88	129.54	–82.09	0.495
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	07241000	6.65	–78.87	21.32	–96.32	0.081
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	07241520	10.47	–55.77	19.54	–83.64	0.108
144	07241550	North Canadian River near Harrah, Okla.	07241550	15.39	–47.86	2.36	–73.44	0.059
145	07247015	Poteau River at Loving, Okla.	07247015	1.86	–33.36	67.93	–73.55	0.389
146	07247250	Black Fork below Big Creek near Page, Okla.	07247250	1.60	–59.00	41.80	–88.15	0.159
147	07247345	Black Fork at Hodgen, Okla.	07247250	1.60	–59.00	41.80	–88.15	0.159
148	07247650	Fourche Maline near Leflore, Okla.	07247500	1.32	–68.28	–12.35	–88.52	**0.027**
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	07263450	1,188.45	–61.89	–16.38	–82.63	**0.016**
150	07331000	Washita River near Dickson, Okla.	07331000	66.07	–72.26	–45.80	–85.80	**<0.001**
151	07355500	Red River at Alexandria, La.	07355500	793.30	–16.56	64.45	–57.66	0.601
152	07362000	Ouachita River at Camden, Ark.	07362000	132.49	–15.66	57.59	–54.86	0.593
153	07373420	Mississippi River near St Francisville, La.	07373420	16,338.57	–33.22	–9.58	–50.67	**0.009**
154	07375500	Tangipahoa River at Robert, La.	07375500	26.72	–29.02	13.68	–55.68	0.154
155	07376000	Tickfaw River at Holden, La.	07376000	7.73	–37.56	–0.96	–60.64	**0.045**
156	07381495	Atchafalaya River at Melville, La.	07381495	6,980.76	–34.21	–11.91	–50.86	**0.005**
157	07386980	Vermilion River at Perry, La.	07386980	22.17	4.35	100.34	–45.65	0.898
158	08030500	Sabine River near Ruliff, Tex.	08030500	167.84	–9.30	114.59	–61.66	0.824
159	08032000	Neches River near Neches, Tex.	08032000	11.64	–20.75	91.41	–67.19	0.605
160	08033500	Neches River near Rockland, Tex.	08033500	35.28	–8.84	155.19	–67.44	0.860
161	08051500	Clear Creek near Sanger, Tex.	08051500	1.26	–90.37	9.92	–99.16	0.060
162	08064100	Chambers Creek near Rice, Tex.	08064100	0.99	–17.89	596.90	–90.33	0.857
163	08065350	Trinity River near Crockett, Tex.	08065350	141.53	–43.85	22.10	–74.18	0.145
164	08136500	Concho River at Paint Rock, Tex.	08136500	2.11	–98.97	–96.44	–99.70	**<0.001**

Table 2. Trends in daily mean streamflow from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic meters per second[1]	Trend, in percent from 1993 to 2003			p-value
					Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
165	08143600	Pecan Bayou near Mullin, Tex.	08143600	0.76	–45.27	80.44	–83.40	0.322
166	08147000	Colorado River near San Saba, Tex.	08147000	6.88	–53.55	5.81	–79.61	0.068
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	08155200	0.05	453.02	11365.96	–73.33	0.269
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	08155240	0.08	279.80	4489.77	–68.57	0.294
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	08159000	0.11	455.32	3367.86	–11.07	0.067
170	08162000	Colorado River at Wharton, Tex.	08162000	35.53	35.94	224.70	–43.09	0.490
171	08162500	Colorado River near Bay City, Tex.	08162500	31.98	12.32	211.47	–59.50	0.823
172	08181800	San Antonio River near Elmendorf, Tex.	08181800	7.94	67.48	218.94	–12.06	0.117
173	08251500	Rio Grande near Lobatos, Colo.	08251500	12.90	–81.28	–29.61	–95.02	**0.013**
174	09058000	Colorado River near Kremmling, Colo.	09058000	27.37	–35.18	7.93	–61.07	0.096
175	09163500	Colorado River near Colorado-Utah State Line	09163500	200.30	–55.41	–26.99	–72.77	**0.001**
176	09211200	Green River below Fontenelle Reservoir, Wyo.	09211200	40.17	–34.67	18.22	–63.89	0.160
177	09217010	Green River below Green River, Wyo.	09217000	40.91	–37.33	23.63	–68.23	0.178
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	09261000	106.68	–40.94	2.99	–66.13	0.064
179	09380000	Colorado River at Lees Ferry, Ariz.	09380000	389.40	–7.28	40.07	–38.62	0.719
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	09403600	0.29	–37.81	–17.94	–52.86	**0.001**
181	09413500	Virgin River below First Narrows, Utah	09413500	6.09	–74.85	–43.69	–88.76	**0.001**
182	09415000	Virgin River at Littlefield, Ariz.	09415000	7.54	–63.34	–35.27	–79.23	**0.001**
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	09448500	9.82	–66.40	–18.62	–86.13	**0.016**
184	09498500	Salt River near Roosevelt, Ariz.	09498500	15.01	–63.86	–11.16	–85.30	**0.027**
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	09508500	10.51	–54.20	–26.76	–71.36	**0.001**
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	09522000	82.21	–23.84	46.47	–60.40	0.414
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	10038000	9.04	–47.38	50.22	–81.57	0.230
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	10126000	25.37	–29.35	250.61	–85.76	0.671
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	10131000	1.55	–53.57	4.23	–79.32	0.063
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	10154200	4.03	–37.45	–9.13	–56.95	**0.014**
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	10155000	5.33	–46.37	–12.59	–67.10	**0.012**
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	10155500	3.78	84.10	242.36	–1.00	0.054
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	10189000	1.38	–21.32	18.71	–47.85	0.253
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	10336580	0.45	–36.45	60.70	–74.87	0.338
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	103366092	1.09	–29.28	90.85	–73.80	0.494
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	10336610	1.40	–37.31	121.64	–82.27	0.469
197	10336698	Third Creek near Crystal Bay, Nev.	10336698	0.20	–45.98	34.05	–78.23	0.184
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	103366993	0.08	4.75	291.76	–71.99	0.945
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	103366995	0.12	–13.03	235.54	–77.46	0.839
200	10336700	Incline Creek near Crystal Bay, Nev.	10336700	0.22	–37.05	50.64	–73.69	0.299
201	10336740	Logan House Creek near Glenbrook, Nev.	10336740	0.01	108.69	1442.99	–71.77	0.471
202	10336760	Edgewood Creek at Stateline, Nev.	10336760	0.09	23.04	240.54	–55.54	0.690
203	01A050	Nooksack River at Brennan, Wash.	01A050	84.12	5.89	51.03	–25.76	0.752
204	03A060	Skagit River near Mount Vernon, Wash.	03A060	404.73	0.62	42.81	–29.11	0.972
205	07A090	Snohomish River at Snohomish, Wash.	07A090	199.53	–0.96	49.78	–34.50	0.964
206	09A080	Green River at Tukwila, Wash.	09A080	26.82	–11.36	41.13	–44.32	0.611
207	09A190	Green River at Kanaskat, Wash.	09A190	17.07	–12.83	42.44	–46.65	0.584
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	10332	763.65	–15.07	32.23	–45.45	0.470
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	10350	328.47	–15.28	33.55	–46.26	0.475
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	10355	264.32	–11.27	36.57	–42.35	0.587

Table 2. Trends in daily mean streamflow from 1993 to 2003.—Continued

[See Appendix 2 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic meters per second[1]	Trend, in percent from 1993 to 2003			p-value
					Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	10386	99.38	–8.72	40.64	–40.75	0.679
212	10411	Deschutes River at Deschutes River Park, Oreg.	10411	158.52	0.20	35.51	–25.91	0.990
213	10555	Willamette River at Marion Street at Salem, Oreg.	10555	529.99	–15.02	32.63	–45.55	0.474
214	10611	Willamette River at Hawthorne Bridge, Oreg.	10611	762.85	–15.07	32.23	–45.45	0.470
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	10616	4,894.24	–7.19	43.70	–40.06	0.738
216	10A070	Puyallup River at Meridian Street, Wash.	10A070	72.70	10.27	55.78	–21.94	0.579
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	11140	9.18	–26.08	35.80	–59.77	0.330
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	11321	1.56	–22.97	23.38	–51.91	0.278
219	11478	John Day River at Service Creek, Oreg.	11478	34.15	–45.76	5.22	–72.04	0.070
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	11489	5.84	21.56	115.88	–31.55	0.505
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	12413470	9.21	–2.39	81.63	–47.54	0.939
222	12419000	Spokane River near Post Falls, Idaho	12419000	110.76	–12.79	70.84	–55.48	0.690
223	13154500	Snake River at King Hill, Idaho	13154500	301.51	–20.44	33.54	–52.60	0.387
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	13206000	19.48	–0.64	166.07	–62.90	0.990
225	13351000	Palouse River at Hooper, Wash.	13351000	6.06	24.77	259.47	–56.69	0.682
226	14201300	Zollner Creek near Mt. Angel, Oreg.	14201300	0.19	–45.62	20.68	–75.50	0.134
227	14211720	Willamette River at Portland, Oreg.	14211720	757.47	–15.07	32.23	–45.45	0.470
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	14246900	6,587.22	–12.72	31.75	–42.18	0.517
229	16A070	Skokomish River near Potlatch, Wash.	16A070	19.57	11.40	66.53	–25.49	0.599
230	32A070	Walla Walla River near Touchet, Wash.	32A070	7.37	–4.11	60.90	–42.85	0.874
231	3701002	Tualatin River at Weiss Bridge, Oreg.	3701002	21.27	2.58	97.90	–46.83	0.940
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	3701612	6.88	14.16	110.47	–38.08	0.671
233	37A090	Yakima River at Kiona, Wash.	37A090	73.14	11.07	141.37	–48.89	0.791
234	45A070	Wenatchee River at Wenatchee, Wash.	45A070	54.59	–4.41	89.86	–51.88	0.897
235	45A110	Wenatchee River near Leavenworth, Wash.	45A110	52.97	–4.41	89.86	–51.88	0.897
236	48A070	Methow River near Pateros, Wash.	48A070	23.48	–16.02	51.52	–53.46	0.562
237	49A070	Okanogan River at Malott, Wash.	49A070	68.39	–37.95	19.28	–67.72	0.152
238	54A120	Spokane River at Riverside State Park, Wash.	54A120	122.44	–6.57	77.83	–50.91	0.836
239	61A070	Columbia River at Northport, Wash.	61A070	2,582.28	2.06	39.37	–25.26	0.898
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	11264500	4.81	–45.22	40.19	–78.60	0.209
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	11274538	0.60	–20.65	103.40	–69.04	0.630
242	11290000	Tuolumne River at Modesto, Calif.	11290000	24.03	–21.12	184.87	–78.16	0.717
243	11303500	San Joaquin River near Vernalis, Calif.	11303500	97.35	–17.66	141.06	–71.88	0.723
244	11447650	Sacramento River at Freeport, Calif.	11447650	627.66	–5.87	65.43	–46.44	0.833

[1] Reference value is the streamflow that would have been observed on the first day of the period of record under average hydrologic and seasonal conditions.

At sites in the Northeastern, Southeastern, and Northwestern United States, where there were few trends in streamflow from 1993 to 2003, FA and NFA trends generally were similar. Sites with upward FA trends may have experienced an increase in phosphorus sources between 1993 and 2003; sites with downward FA trends may have experienced a decrease in phosphorus sources and(or) reductions due to the implementation of pollution control strategies. With no trend in streamflow at these sites, and thus no trend in surface runoff or in-stream dilution capacity, NFA trends generally were similar and a product of these same influences.

Trends in loads of total phosphorus from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (81 percent) nationwide, there was no significant trend in the load of total phosphorus being transported to downstream locations (fig. 6*D*, tables 3 and 6, Appendix 3). Upward trends in load occurred at only 7 (4 percent) of the 171 sites; these few sites primarily were in the Northeastern and Northwestern United States. Downward trends in load occurred at 25 (15 percent) of the sites, primarily in the Central and Southeastern United States. In the Northeast, Southeast, and Northwest, trends in load were similar to trends in streamflow at the majority of sites. However, the change in concentration was large enough to be the primary influence at several sites, and load changed correspondingly. In the Central and Southwestern United States, there were more frequent differences between the streamflow and load trends; at these sites, changes in concentration likely were the primary influence on changes in load. At some of these sites, the trend

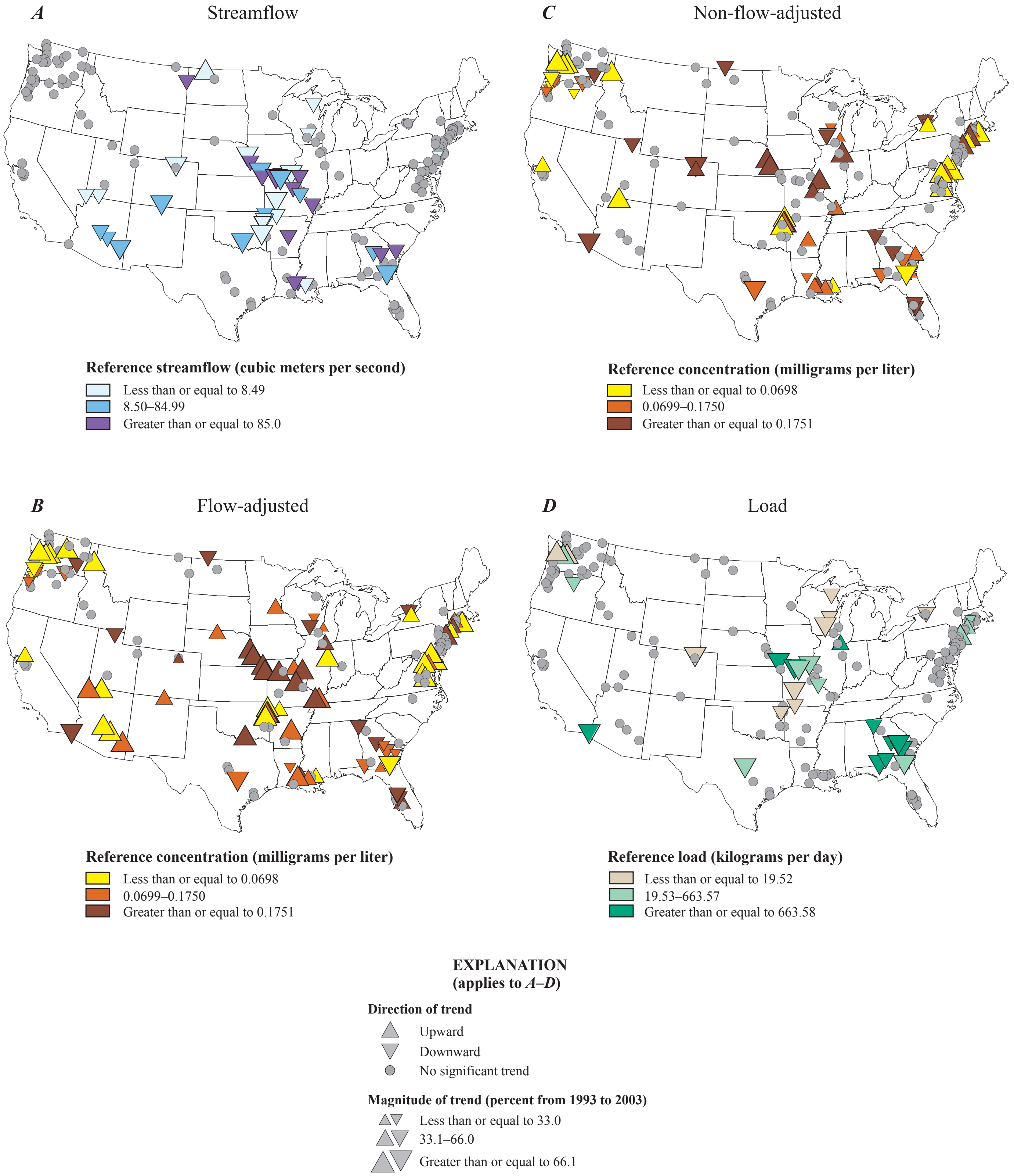

Figure 6. Trends in (*A*) streamflow, (*B*) flow-adjusted and (*C*) non-flow-adjusted trends in total phosphorus concentrations, and (*D*) trends in total phosphorus loads at selected sites in the United States.

in concentration was greater in magnitude than the trend in streamflow. At other sites, particularly those with agricultural or urban influences, the reference concentration was relatively large and the reference streamflow was relatively small.

Factors Affecting the Trends

Land use and phosphorus budgets for each site in the Eastern, Central, and Western United States are shown in figures 7, 8, and 9, respectively. Land use is shown as a percentage of the basin area in part *A* of each figure. Median phosphorus loads from manure and fertilizer between 1993 and 2003 are shown as percentages of their combined total load in part *B* of each figure and as absolute loads, normalized to the basin area, in part *D* of each figure. There likely were additional sources of phosphorus in these basins that are not shown in the phosphorus budgets; currently (2008), national-scale, consistently derived phosphorus source data that cover the period from 1993 to 2003 are available only for manure and fertilizer.

At sites in the Eastern United States, fertilizer often was a larger source of phosphorus than manure, particularly at more urbanized sites (fig. 7). At sites with relatively high percentages of agricultural land use, manure often was a larger or comparable source of phosphorus. The total source loads of phosphorus, including both manure and fertilizer, were highest at sites with relatively high percentages of agricultural land use. At sites in the Central United States, fertilizer generally was a larger source of phosphorus than manure in the Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy NAWQA major river basin; manure generally was a larger source in the Missouri and Lower Mississippi, Arkansas-White-Red, and Texas-Gulf NAWQA major river basins (figs. 1 and 8). Across the Central United States, the total source loads of phosphorus were highest at sites with relatively high percentages of agricultural land use. At sites in the Western United States, manure generally was a larger source of phosphorus than fertilizer in the Southwest, particularly the Rio Grande, Colorado, and Great Basin NAWQA major river basin, where the percentage of rangeland in the basins was high (figs. 1 and 9). Total source loads of phosphorus at these sites, however, were relatively low. Total source loads of phosphorus were higher at sites in the Pacific Northwest and California, where fertilizer and manure loads generally were comparable. As in the Eastern and Central United States, the total source loads of phosphorus in the West were highest at sites with relatively high percentages of agricultural land use.

Nutrients in fertilizer typically are more mobile than the organically complexed nutrients in manure (Withers and others, 2001; Nichols and others, 1994; Edwards and Daniel, 1994). As a result, changes in source loads of fertilizer may have a greater or more immediate effect on in-stream nutrient concentrations than changes in source loads of manure, even in areas where source loads of manure are greater. In addition, it is not uncommon for urban land use to be concentrated closer to monitoring sites than agricultural land use. At these sites, changes in urban loads may have a greater or more immediate effect on in-stream nutrient concentrations than changes in agricultural loads.

Changes in phosphorus loading from manure and fertilizer and changes in population density during the study period are shown on a county-level basis in figure 10, parts *A*–*C*. Decreases in phosphorus loading from manure were widespread throughout the nation (fig. 10*A*). Small increases also were common, particularly in the Eastern and Central United States. Large increases in phosphorus loading from fertilizer were more widespread in the Central (particularly west of the Mississippi River) and Western United States (fig. 10*B*). In the Eastern United States, decreases in phosphorus loading from fertilizer were more widespread and often greater in magnitude than decreases in phosphorus loading from manure. Population density increases were widespread in the Southeastern and Western United States (fig. 10*C*).

Table 3. Summary of trend results for streamflow, total phosphorus, total nitrogen, and nitrate.

Trend type	Number of sites	Number (and percentage) of sites with trends		
		Upward	Downward	Nonsignificant
Streamflow	244	2 (1)	54 (22)	188 (77)
		Total phosphorus		
Concentration, flow-adjusted	171	57 (33)	27 (16)	87 (51)
Concentration, non-flow-adjusted	171	41 (24)	28 (16)	102 (60)
Load	171	7 (4)	25 (15)	139 (81)
		Total nitrogen		
Concentration, flow-adjusted	137	29 (21)	22 (16)	86 (63)
Concentration, non-flow-adjusted	137	15 (11)	22 (16)	100 (73)
Load	137	2 (1)	34 (25)	101 (74)
		Nitrate		
Concentration, flow-adjusted	166	20 (12)	42 (25)	104 (63)
Concentration, non-flow-adjusted	166	10 (6)	45 (27)	111 (67)
Load	166	5 (3)	51 (31)	110 (66)

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus					
1	01122610	Shetucket River at South Windham, Conn.	0.021	61.1	154.4	2.0	**0.044**
2	01124000	Quinebaug River at Quinebaug, Conn.	0.036	20.4	88.0	–22.9	0.418
3	01127000	Quinebaug River at Jewett City, Conn.	0.046	81.3	168.8	22.3	**0.004**
4	01184000	Connecticut River at Thompsonville, Conn.	0.033	26.9	90.0	–15.3	0.250
5	01184490	Broad Brook at Broad Brook, Conn.	0.092	–6.5	26.3	–30.8	**0.662**
7	01189995	Farmington River at Tariffville, Conn.	0.087	38.5	78.2	7.7	0.013
8	01192500	Hockanum River near East Hartford, Conn.	0.364	–19.9	0.6	–36.2	0.059
10	01196500	Quinnipiac River at Wallingford, Conn.	0.241	–20.3	1.6	–37.6	0.071
11	01205500	Housatonic River at Stevenson, Conn.	0.021	10.6	189.5	–57.8	0.839
12	01208500	Naugatuck River at Beacon Falls, Conn.	0.227	61.1	121.3	17.3	**0.004**
13	01208990	Saugatuck River near Redding, Conn.	0.012	25.2	326.5	–63.2	0.720
14	01209710	Norwalk River at Winnipauk, Conn.	0.030	44.0	94.3	6.7	**0.018**
15	01357500	Mohawk River at Cohoes, N.Y.	0.034	7.9	64.9	–29.4	0.727
16	01377000	Hackensack River at Rivervale, N.J.	0.065	14.8	93.3	–31.8	0.607
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.025	–54.1	67.6	–87.4	0.245
18	01387500	Ramapo River near Mahwah, N.J.	0.120	–0.9	34.0	–26.8	0.951
19	01389500	Passaic River at Little Falls, N.J.	0.372	8.8	32.8	–10.9	0.413
20	01391500	Saddle River at Lodi, N.J.	0.369	120.1	216.1	53.2	**<0.001**
22	01395000	Rahway River at Rahway, N.J.	0.071	34.1	83.5	–2.0	0.074
24	01398000	Neshanic River at Reaville, N.J.	0.042	23.2	177.4	–45.3	0.616
25	01402000	Millstone River at Blackwells Mills, N.J.	0.195	25.9	66.4	–4.8	0.114
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	0.160	10.8	41.1	–13.0	0.407
27	01408000	Manasquan River at Squankum, N.J.	0.099	9.8	78.4	–32.5	0.709
28	01408500	Toms River near Toms River, N.J.	0.024	32.2	271.5	–53.0	0.599
30	01411500	Maurice River at Norma, N.J.	0.014	–14.4	217.9	–76.9	0.818
31	01438500	Delaware River at Montague, N.J.	0.041	–45.3	52.7	–80.4	0.256
32	01443500	Paulins Kill at Blairstown, N.J.	0.025	7.7	124.2	–48.2	0.843
33	01463500	Delaware River at Trenton, N.J.	0.057	–10.8	26.2	–36.9	0.521
34	01467150	Cooper River at Haddonfield, N.J.	0.198	0.1	42.8	–29.9	0.996
35	01477120	Raccoon Creek near Swedesboro, N.J.	0.117	29.8	83.2	–8.0	0.142
36	01491000	Choptank River near Greensboro, Md.	0.045	91.1	157.7	41.6	**<0.001**
37	01578310	Susquehanna River at Conowingo, Md.	0.021	78.6	134.7	35.9	**<0.001**
38	01594440	Patuxent River near Bowie, Md.	0.116	40.7	78.9	10.6	**0.006**
39	01614500	Conococheague Creek at Fairview, Md.	0.114	26.3	73.4	–8.0	0.150
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	0.030	95.6	186.3	33.6	**0.001**
41	01668000	Rappahannock River near Fredericksburg, Va.	0.033	51.2	102.2	13.0	**0.006**
42	01673000	Pamunkey River near Hanover, Va.	0.066	80.4	112.0	53.5	**<0.001**
43	01674500	Mattaponi River near Beulahville, Va.	0.059	0.3	14.1	–11.9	0.968
44	02035000	James River at Cartersville, Va.	0.100	–2.9	20.1	–21.5	0.789
45	02041650	Appomattox River at Matoaca, Va.	0.047	–6.7	8.3	–19.6	0.362
46	02085000	Eno River at Hillsborough, N.C.	0.025	42.2	134.8	–13.9	0.173
51	02198500	Savannah River near Clyo, Ga.	0.093	14.3	47.9	–11.7	0.311
52	02213700	Ocmulgee River near Warner Robins, Ga.	0.177	–47.9	–27.8	–62.4	**<0.001**
53	02215500	Ocmulgee River at Lumber City, Ga.	0.117	–34.9	–16.0	–49.5	**0.001**
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	0.135	–26.4	–7.4	–41.5	**0.010**
55	02226010	Altamaha River near Gardi, Ga.	0.106	–17.0	–2.1	–29.7	**0.029**
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	0.140	19.4	49.2	–4.4	0.121
58	02295420	Payne Creek near Bowling Green, Fla.	0.620	37.6	69.2	11.8	**0.004**
59	02296750	Peace River at Arcadia, Fla.	0.940	–6.0	10.9	–20.3	0.464
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.227	14.4	34.3	–2.6	0.104
61	02301300	South Prong Alafia River near Lithia, Fla.	0.954	–36.0	–13.8	–52.5	**0.005**

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
62	02302500	Blackwater Creek near Knights, Fla.	0.807	–36.5	–19.2	–50.0	**<0.001**
63	02303000	Hillsborough River near Zephyrhills, Fla.	0.323	–44.5	–23.9	–59.5	**0.001**
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	0.066	–73.9	–61.7	–82.2	**<0.001**
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.150	21.1	45.6	0.7	**0.044**
66	02335870	Sope Creek near Marietta, Ga.	0.017	–2.9	64.3	–42.6	0.913
68	02344040	Chattahoochee River near Steam Mill, Ga.	0.085	–55.7	–31.6	–71.3	**<0.001**
69	02353000	Flint River at Newton, Ga.	0.049	–9.9	20.6	–32.7	0.487
70	02388520	Oostanaula River at Rome, Ga.	0.217	–55.8	–42.8	–65.8	**<0.001**
71	02492000	Bogue Chitto River near Bush, La.	0.070	49.2	99.8	11.4	**0.009**
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.024	29.8	87.3	–10.0	0.165
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	0.082	82.2	124.0	48.1	**<0.001**
74	04063700	Popple River near Fence, Wis.	0.027	–18.3	40.3	–52.5	0.465
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	0.134	–24.4	–15.7	–32.3	**<0.001**
76	04087000	Milwaukee River at Milwaukee, Wis.	0.083	26.9	54.9	3.9	**0.021**
77	0422026250	Northrup Creek at North Greece, N.Y.	0.402	–35.5	–23.3	–45.7	**<0.001**
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	0.070	–19.9	5.2	–39.0	0.111
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	0.090	–15.5	0.1	–28.6	0.052
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	0.068	52.6	68.6	38.1	**<0.001**
81	05114000	Souris River near Sherwood, N. Dak.	0.424	–35.8	–8.0	–55.1	**0.018**
82	05120000	Souris River near Verendrye, N. Dak.	0.264	–15.2	18.7	–39.4	0.341
83	05287890	Elm Creek near Champlin, Minn.	0.139	42.0	77.2	13.7	**0.002**
84	05427718	Yahara River at Windsor, Wis.	0.149	8.2	28.2	–8.7	0.364
85	05427948	Pheasant Branch at Middleton, Wis.	0.390	–62.6	–56.2	–68.1	**<0.001**
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	0.129	–12.2	9.2	–29.4	0.242
87	05500000	South Fabius River near Taylor, Mo.	0.102	63.7	134.3	14.4	**0.008**
88	05514500	Cuivre River near Troy, Mo.	0.136	15.7	77.9	–24.7	0.508
89	05525500	Sugar Creek at Milford, Ill.	0.060	66.0	165.1	4.0	**0.037**
90	05531500	Salt Creek at Western Springs, Ill.	1.019	46.2	81.8	17.6	**0.001**
91	05532500	Des Plaines River at Riverside, Ill.	0.517	62.0	96.6	33.4	**<0.001**
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.079	–11.5	26.8	–38.2	0.508
93	05586100	Illinois River at Valley City, Ill.	0.264	110.3	172.5	62.3	**<0.001**
94	07018100	Big River near Richwoods, Mo.	0.032	2.0	64.7	–36.8	0.936
95	07022000	Mississippi River at Thebes, Ill.	0.230	102.1	159.4	57.4	**<0.001**
97	06178000	Poplar River at International Boundary, Mont.	0.029	–17.5	53.8	–55.7	0.548
99	06329500	Yellowstone River near Sidney, Mont.	0.075	60.8	229.4	–21.5	0.197
101	06461500	Niobrara River near Sparks, Nebr.	0.121	38.8	85.8	3.7	**0.031**
106	06753990	Lonetree Creek near Greeley, Colo.	0.325	–16.9	89.5	–63.5	0.662
107	06754000	South Platte River near Kersey, Colo.	0.636	26.7	49.0	7.6	**0.005**
109	06800000	Maple Creek near Nickerson, Nebr.	0.207	290.4	473.1	165.9	**<0.001**
110	06805500	Platte River at Louisville, Nebr.	0.313	188.4	294.6	110.7	**<0.001**
111	06817700	Nodaway River near Graham, Mo.	0.327	102.5	250.2	17.1	**0.013**
112	06818000	Missouri River at St. Joseph, Mo.	0.216	68.3	146.9	14.7	**0.009**
113	06902000	Grand River near Sumner, Mo.	0.202	193.7	383.1	78.5	**<0.001**
114	06905500	Chariton River near Prairie Hill, Mo.	0.207	36.4	129.6	–19.0	0.246
115	06921070	Pomme De Terre River near Polk, Mo.	0.047	9.3	64.4	–27.3	0.669
118	06934500	Missouri River at Hermann, Mo.	0.187	233.3	422.7	112.5	**<0.001**
120	07053250	Yocum Creek near Oak Grove, Ark.	0.039	47.9	90.4	14.9	**0.003**
134	07189000	Elk River near Tiff City, Mo.	0.041	231.1	374.1	131.2	**<0.001**
135	07195500	Illinois River near Watts, Okla.	0.112	117.4	211.0	51.9	**<0.001**
136	07195865	Sager Creek near West Siloam Springs, Okla.	0.495	66.3	158.7	6.8	**0.029**

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
137	07196000	Flint Creek near Kansas, Okla.	0.092	111.2	160.4	71.3	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	0.063	135.6	190.3	91.1	**<0.001**
139	07197000	Baron Fork at Eldon, Okla.	0.028	67.4	140.2	16.6	**0.006**
145	07247015	Poteau River at Loving, Okla.	0.106	–9.5	34.3	–39.0	0.622
148	07247650	Fourche Maline near Leflore, Okla.	0.051	17.9	60.0	–13.1	0.293
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.081	78.7	121.7	43.9	**<0.001**
150	07331000	Washita River near Dickson, Okla.	0.201	140.7	277.7	53.4	**<0.001**
151	07355500	Red River at Alexandria, La.	0.095	–25.1	–5.4	–40.6	**0.017**
152	07362000	Ouachita River at Camden, Ark.	0.041	–26.6	27.8	–57.9	0.279
153	07373420	Mississippi River near St Francisville, La.	0.175	50.4	87.9	20.3	**<0.001**
154	07375500	Tangipahoa River at Robert, La.	0.112	16.0	56.6	–14.1	0.335
155	07376000	Tickfaw River at Holden, La.	0.074	57.1	117.3	13.6	**0.008**
156	07381495	Atchafalaya River at Melville, La.	0.146	71.8	105.6	43.6	**<0.001**
157	07386980	Vermilion River at Perry, La.	0.297	1.2	26.0	–18.8	0.918
165	08143600	Pecan Bayou near Mullin, Tex.	0.205	0.0	88.4	–47.0	0.999
166	08147000	Colorado River near San Saba, Tex.	0.077	–68.0	8.1	–90.5	0.072
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	0.076	–93.9	–71.3	–98.7	**0.001**
170	08162000	Colorado River at Wharton, Tex.	0.269	–5.9	47.1	–39.8	0.791
171	08162500	Colorado River near Bay City, Tex.	0.291	–26.1	26.3	–56.7	0.274
173	08251500	Rio Grande near Lobatos, Colo.	0.079	52.9	96.9	18.6	**0.002**
177	09217010	Green River below Green River, Wyo.	0.026	51.1	186.1	–20.2	0.210
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	0.062	–34.8	55.5	–72.6	0.338
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	0.035	232.7	656.8	46.2	**0.005**
182	09415000	Virgin River at Littlefield, Ariz.	0.106	463.4	1200.6	144.0	**<0.001**
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	0.122	216.0	730.0	20.3	**0.024**
184	09498500	Salt River near Roosevelt, Ariz.	0.013	4678.5	14832.1	1428.8	**<0.001**
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	0.023	166.7	493.8	19.8	**0.019**
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	0.280	–85.9	–65.2	–94.3	**<0.001**
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	0.188	–50.7	–29.9	–65.3	**<0.001**
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	0.085	–3.4	37.7	–32.2	0.849
203	01A050	Nooksack River at Brennan, Wash.	0.021	37.9	104.2	–6.9	0.112
204	03A060	Skagit River near Mount Vernon, Wash.	0.015	5.5	112.6	–47.6	0.880
205	07A090	Snohomish River at Snohomish, Wash.	0.009	26.3	123.2	–28.5	0.423
206	09A080	Green River at Tukwila, Wash.	0.025	19.2	59.3	–10.8	0.238
207	09A190	Green River at Kanaskat, Wash.	0.005	254.0	606.4	77.4	**<0.001**
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.070	–7.6	9.1	–21.7	0.355
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.075	–18.8	–3.0	–32.1	**0.023**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.046	–2.6	18.5	–20.0	0.790
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	0.028	–13.8	3.5	–28.1	0.117
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.080	–8.9	29.5	–35.9	0.606
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.064	–18.6	–4.1	–30.9	**0.015**
214	10611	Willamette River at Hawthorne Bridge, Oreg.	0.082	–22.9	–13.6	–31.2	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.040	–21.9	–1.9	–37.9	**0.039**

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
216	10A070	Puyallup River at Meridian Street, Wash.	0.036	79.6	176.1	16.8	**0.009**
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.081	–21.7	–2.0	–37.4	**0.037**
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	0.090	–7.8	11.1	–23.6	0.397
219	11478	John Day River at Service Creek, Oreg.	0.041	–19.2	10.5	–40.9	0.187
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	0.104	–36.8	–13.8	–53.7	**0.005**
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	0.011	93.0	235.6	11.0	**0.022**
222	12419000	Spokane River near Post Falls, Idaho	0.011	–37.3	87.4	–79.0	0.405
223	13154500	Snake River at King Hill, Idaho	0.068	–13.2	7.2	–29.8	0.191
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.083	36.3	98.7	–6.4	0.110
225	13351000	Palouse River at Hooper, Wash.	0.195	–54.4	–37.0	–67.0	**<0.001**
227	14211720	Willamette River at Portland, Oreg.	0.061	13.5	37.0	–6.1	0.192
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.031	14.8	75.2	–24.8	0.523
229	16A070	Skokomish River near Potlatch, Wash.	0.009	104.8	265.9	14.6	**0.017**
230	32A070	Walla Walla River near Touchet, Wash.	0.112	–4.2	21.3	–24.3	0.724
231	3701002	Tualatin River at Weiss Bridge, Oreg.	0.175	–32.0	–24.2	–39.1	**<0.001**
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.039	–41.9	–29.4	–52.2	**<0.001**
233	37A090	Yakima River at Kiona, Wash.	0.102	3.1	23.1	–13.7	0.740
234	45A070	Wenatchee River at Wenatchee, Wash.	0.004	53.4	274.4	–37.2	0.349
235	45A110	Wenatchee River near Leavenworth, Wash.	0.004	13.5	154.5	–49.4	0.759
236	48A070	Methow River near Pateros, Wash.	0.003	99.5	292.6	1.3	**0.048**
237	49A070	Okanogan River at Malott, Wash.	0.017	16.2	111.7	–36.3	0.626
238	54A120	Spokane River at Riverside State Park, Wash.	0.019	39.9	123.2	–12.4	0.162
239	61A070	Columbia River at Northport, Wash.	0.011	–33.5	24.5	–64.5	0.205
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	0.183	16.2	55.8	–13.4	0.319
242	11290000	Tuolumne River at Modesto, Calif.	0.074	–4.9	26.0	–28.3	0.726
243	11303500	San Joaquin River near Vernalis, Calif.	0.274	–3.2	11.8	–16.2	0.660
244	11447650	Sacramento River at Freeport, Calif.	0.039	59.6	121.8	14.9	**0.006**
		Total nitrogen					
1	01122610	Shetucket River at South Windham, Conn.	0.603	6.2	31.2	–14.1	0.581
2	01124000	Quinebaug River at Quinebaug, Conn.	0.530	34.8	60.2	13.4	**0.001**
3	01127000	Quinebaug River at Jewett City, Conn.	0.913	–4.3	12.3	–18.4	0.590
4	01184000	Connecticut River at Thompsonville, Conn.	0.624	2.6	21.1	–13.1	0.766
5	01184490	Broad Brook at Broad Brook, Conn.	4.259	–2.2	5.9	–9.7	0.585
6	01188090	Farmington River at Unionville, Conn.	0.270	37.6	103.3	–6.9	0.115
7	01189995	Farmington River at Tariffville, Conn.	1.018	10.4	29.7	–5.9	0.229
8	01192500	Hockanum River near East Hartford, Conn.	3.480	–4.5	10.2	–17.3	0.526
9	01193500	Salmon River near East Hampton, Conn.	0.436	16.4	58.7	–14.6	0.341
10	01196500	Quinnipiac River at Wallingford, Conn.	3.208	–4.2	7.4	–14.5	0.462
11	01205500	Housatonic River at Stevenson, Conn.	0.661	12.1	41.3	–11.0	0.338
12	01208500	Naugatuck River at Beacon Falls, Conn.	2.492	–52.9	–43.6	–60.7	**<0.001**
13	01208990	Saugatuck River near Redding, Conn.	0.307	40.1	106.2	–4.8	0.094
14	01209710	Norwalk River at Winnipauk, Conn.	0.642	24.3	46.3	5.7	**0.009**
15	01357500	Mohawk River at Cohoes, N.Y.	1.048	–10.1	1.1	–20.1	0.078
16	01377000	Hackensack River at Rivervale, N.J.	1.032	10.4	37.0	–11.0	0.372
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.500	23.2	73.4	–12.5	0.239
18	01387500	Ramapo River near Mahwah, N.J.	1.537	0.4	20.9	–16.6	0.965
19	01389500	Passaic River at Little Falls, N.J.	3.357	–19.1	–4.7	–31.3	**0.013**
20	01391500	Saddle River at Lodi, N.J.	5.794	26.4	56.6	2.1	**0.037**

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

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				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
21	01394500	Rahway River near Springfield, N.J.	1.727	–0.3	23.4	–19.5	0.978
22	01395000	Rahway River at Rahway, N.J.	1.407	–0.1	25.0	–20.2	0.993
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	1.090	–13.5	7.2	–30.2	0.193
24	01398000	Neshanic River at Reaville, N.J.	1.753	–14.9	26.0	–42.5	0.423
25	01402000	Millstone River at Blackwells Mills, N.J.	2.902	8.1	34.4	–13.1	0.490
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	2.316	11.0	26.6	–2.7	0.125
29	01409500	Batsto River at Batsto, N.J.	0.386	–10.3	23.9	–35.1	0.513
31	01438500	Delaware River at Montague, N.J.	0.487	–23.2	–1.2	–40.3	**0.046**
32	01443500	Paulins Kill at Blairstown, N.J.	0.958	7.7	36.1	–14.8	0.540
33	01463500	Delaware River at Trenton, N.J.	1.277	–18.3	–3.7	–30.6	**0.018**
34	01467150	Cooper River at Haddonfield, N.J.	0.921	5.1	29.4	–14.7	0.644
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.658	6.9	30.0	–12.1	0.507
36	01491000	Choptank River near Greensboro, Md.	1.457	23.5	36.6	11.7	**<0.001**
37	01578310	Susquehanna River at Conowingo, Md.	1.526	–8.5	0.6	–16.8	0.067
38	01594440	Patuxent River near Bowie, Md.	2.078	0.6	9.1	–7.2	0.883
39	01614500	Conococheague Creek at Fairview, Md.	5.429	1.3	10.4	–7.0	0.763
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	2.010	–12.0	1.2	–23.5	0.075
41	01668000	Rappahannock River near Fredericksburg, Va.	0.577	44.3	69.3	23.0	**<0.001**
42	01673000	Pamunkey River near Hanover, Va.	0.653	31.9	45.5	19.5	**<0.001**
43	01674500	Mattaponi River near Beulahville, Va.	0.623	16.2	26.3	7.0	**<0.001**
44	02035000	James River at Cartersville, Va.	0.478	21.5	38.4	6.7	**0.004**
45	02041650	Appomattox River at Matoaca, Va.	0.587	14.1	24.6	4.5	**0.004**
46	02085000	Eno River at Hillsborough, N.C.	0.664	17.9	40.0	–0.7	0.064
47	02089500	Neuse River at Kinston, N.C.	1.493	–36.1	–26.9	–44.2	**<0.001**
48	02091500	Contentnea Creek at Hookerton, N.C.	1.242	–11.1	–2.9	–18.5	**0.010**
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	1.363	1.2	37.4	–25.4	0.939
52	02213700	Ocmulgee River near Warner Robins, Ga.	1.350	–5.5	27.2	–29.8	0.710
53	02215500	Ocmulgee River at Lumber City, Ga.	0.965	–16.4	1.1	–30.8	0.068
57	02271500	Josephine Creek near De Soto City, Fla.	0.889	36.4	61.5	15.1	**0.001**
58	02295420	Payne Creek near Bowling Green, Fla.	1.696	–10.3	15.3	–30.2	0.401
59	02296750	Peace River at Arcadia, Fla.	1.780	–2.1	13.1	–15.3	0.771
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.782	22.1	49.5	–0.3	0.056
61	02301300	South Prong Alafia River near Lithia, Fla.	1.056	2.6	29.7	–18.9	0.832
62	02302500	Blackwater Creek near Knights, Fla.	1.693	–16.5	6.5	–34.6	0.152
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	1.005	36.0	57.5	17.4	**<0.001**
67	02338000	Chattahoochee River near Whitesburg, Ga.	1.386	11.8	37.7	–9.2	0.297
71	02492000	Bogue Chitto River near Bush, La.	0.819	16.5	103.3	–33.2	0.592
72	03353637	Little Buck Creek near Indianapolis, Ind.	1.079	–2.8	15.9	–18.6	0.749
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.344	20.4	44.1	0.7	**0.044**
74	04063700	Popple River near Fence, Wis.	0.453	26.3	47.2	8.4	**0.003**
76	04087000	Milwaukee River at Milwaukee, Wis.	1.724	31.9	48.4	17.2	**<0.001**
81	05114000	Souris River near Sherwood, N. Dak.	2.076	–18.0	10.9	–39.4	0.201
82	05120000	Souris River near Verendrye, N. Dak.	1.507	0.6	39.0	–27.2	0.970
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	1.615	–32.2	–12.4	–47.5	**0.004**
95	07022000	Mississippi River at Thebes, Ill.	3.227	13.7	36.7	–5.5	0.176
97	06178000	Poplar River at International Boundary, Mont.	0.613	7.6	44.1	–19.6	0.625
99	06329500	Yellowstone River near Sidney, Mont.	0.606	51.2	114.0	6.8	**0.022**
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.193	39.8	131.3	–15.5	0.197
101	06461500	Niobrara River near Sparks, Nebr.	0.441	67.8	138.6	18.0	**0.005**
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	1.518	5.4	36.7	–18.7	0.692
103	06713500	Cherry Creek at Denver, Colo.	3.828	–44.3	–30.7	–55.3	**<0.001**

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
106	06753990	Lonetree Creek near Greeley, Colo.	9.761	–42.3	–22.1	–57.3	**0.001**
107	06754000	South Platte River near Kersey, Colo.	6.215	7.6	16.6	–0.6	0.074
108	06775900	Dismal River near Thedford, Nebr.	0.717	–5.5	10.1	–18.8	0.473
109	06800000	Maple Creek near Nickerson, Nebr.	6.015	34.2	71.4	5.0	**0.020**
110	06805500	Platte River at Louisville, Nebr.	2.642	60.2	105.0	25.2	**<0.001**
111	06817700	Nodaway River near Graham, Mo.	5.273	–4.4	48.8	–38.6	0.841
112	06818000	Missouri River at St. Joseph, Mo.	3.257	–43.7	–27.5	–56.2	**<0.001**
113	06902000	Grand River near Sumner, Mo.	1.723	21.4	83.2	–19.6	0.358
114	06905500	Chariton River near Prairie Hill, Mo.	1.607	–17.0	24.5	–44.7	0.369
115	06921070	Pomme De Terre River near Polk, Mo.	0.544	36.1	116.2	–14.4	0.196
116	06926510	Osage River below St. Thomas, Mo.	0.752	–7.3	24.9	–31.2	0.620
118	06934500	Missouri River at Hermann, Mo.	2.025	22.5	58.4	–5.2	0.124
120	07053250	Yocum Creek near Oak Grove, Ark.	2.529	89.9	138.3	51.3	**<0.001**
124	07066110	Jacks Fork above Two River, Mo.	0.448	6.6	31.5	–13.5	0.549
125	07068000	Current River at Doniphan, Mo.	0.426	–20.8	–3.9	–34.7	**0.020**
134	07189000	Elk River near Tiff City, Mo.	1.721	36.6	63.2	14.3	**0.001**
135	07195500	Illinois River near Watts, Okla.	2.523	5.8	32.4	–15.4	0.621
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.666	11.3	46.3	–15.4	0.448
137	07196000	Flint Creek near Kansas, Okla.	1.882	63.1	83.2	45.1	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	1.723	20.5	41.2	2.8	**0.023**
139	07197000	Baron Fork at Eldon, Okla.	1.033	40.7	83.1	8.2	**0.012**
145	07247015	Poteau River at Loving, Okla.	0.439	16.8	53.8	–11.3	0.271
146	07247250	Black Fork below Big Creek near Page, Okla.	0.315	–5.0	41.4	–36.1	0.802
147	07247345	Black Fork at Hodgen, Okla.	0.322	5.9	49.0	–24.7	0.744
148	07247650	Fourche Maline near Leflore, Okla.	0.610	9.4	36.6	–12.4	0.430
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.842	8.5	29.9	–9.3	0.373
150	07331000	Washita River near Dickson, Okla.	0.988	72.5	124.8	32.3	**<0.001**
151	07355500	Red River at Alexandria, La.	0.715	7.7	23.5	–6.1	0.292
152	07362000	Ouachita River at Camden, Ark.	0.312	52.9	127.0	2.9	**0.040**
153	07373420	Mississippi River near St Francisville, La.	2.096	–5.0	11.7	–19.2	0.534
154	07375500	Tangipahoa River at Robert, La.	0.909	–10.2	15.4	–30.1	0.402
155	07376000	Tickfaw River at Holden, La.	0.873	–3.0	26.3	–25.5	0.820
156	07381495	Atchafalaya River at Melville, La.	1.776	–5.6	8.6	–17.9	0.424
157	07386980	Vermilion River at Perry, La.	1.888	–16.8	1.3	–31.7	0.070
173	08251500	Rio Grande near Lobatos, Colo.	0.440	14.3	46.8	–11.0	0.298
176	09211200	Green River below Fontenelle Reservoir, Wyo.	0.230	28.9	76.9	–6.1	0.119
179	09380000	Colorado River at Lees Ferry, Ariz.	0.368	5.6	40.6	–20.8	0.713
182	09415000	Virgin River at Littlefield, Ariz.	0.841	194.4	382.6	79.6	**<0.001**
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	0.210	8.0	30.0	–10.3	0.418
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.304	–4.8	23.6	–26.7	0.713
201	10336740	Logan House Creek near Glenbrook, Nev.	0.313	–21.3	–1.5	–37.2	**0.038**
202	10336760	Edgewood Creek at Stateline, Nev.	0.328	–34.6	–20.9	–46.0	**<0.001**
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.967	–22.0	6.0	–42.6	0.118
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.791	–50.0	–35.8	–61.0	**<0.001**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.430	–49.5	–33.9	–61.3	**<0.001**
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.316	–24.4	1.1	–43.5	0.064
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.912	–51.9	–41.3	–60.6	**<0.001**
214	10611	Willamette River at Hawthorne Bridge, Oreg.	1.171	–39.1	–24.9	–50.5	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.459	–28.4	6.0	–51.6	0.101

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	1.009	–45.0	–27.8	–58.1	**<0.001**
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.554	–30.4	–23.5	–36.6	**<0.001**
219	11478	John Day River at Service Creek, Oreg.	0.293	–36.8	–9.1	–56.1	**0.016**
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	2.665	–38.5	–18.8	–53.4	**0.001**
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	0.230	16.7	53.7	–11.4	0.276
222	12419000	Spokane River near Post Falls, Idaho	0.138	14.0	61.6	–19.5	0.462
223	13154500	Snake River at King Hill, Idaho	1.480	–5.4	4.1	–14.1	0.259
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.565	22.7	47.5	2.1	**0.032**
225	13351000	Palouse River at Hooper, Wash.	1.724	2.3	21.9	–14.2	0.800
227	14211720	Willamette River at Portland, Oreg.	0.781	–2.4	14.3	–16.7	0.760
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.473	–7.2	10.6	–22.1	0.406
231	3701002	Tualatin River at Weiss Bridge, Oreg.	2.701	6.4	13.5	–0.3	0.064
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.553	–33.8	–24.1	–42.2	**<0.001**
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.839	2.5	31.7	–20.3	0.849
242	11290000	Tuolumne River at Modesto, Calif.	0.378	128.5	170.8	92.8	<0.001
243	11303500	San Joaquin River near Vernalis, Calif.	2.012	1.9	13.5	–8.6	0.737
244	11447650	Sacramento River at Freeport, Calif.	0.238	48.8	95.5	13.2	**0.005**
		Nitrate					
1	01122610	Shetucket River at South Windham, Conn.	0.393	–18.2	3.2	–35.2	0.093
2	01124000	Quinebaug River at Quinebaug, Conn.	0.260	10.3	34.2	–9.4	0.331
3	01127000	Quinebaug River at Jewett City, Conn.	0.481	–19.5	14.1	–43.3	0.226
4	01184000	Connecticut River at Thompsonville, Conn.	0.327	5.1	24.5	–11.2	0.562
5	01184490	Broad Brook at Broad Brook, Conn.	3.743	–0.9	8.2	–9.2	0.838
6	01188090	Farmington River at Unionville, Conn.	0.183	–28.6	–8.1	–44.6	**0.012**
7	01189995	Farmington River at Tariffville, Conn.	0.641	1.9	15.3	–9.9	0.767
8	01192500	Hockanum River near East Hartford, Conn.	2.545	–3.3	17.5	–20.4	0.735
9	01193500	Salmon River near East Hampton, Conn.	0.297	–25.6	20.8	–54.2	0.237
10	01196500	Quinnipiac River at Wallingford, Conn.	2.625	–14.9	–4.3	–24.3	**0.008**
11	01205500	Housatonic River at Stevenson, Conn.	0.342	13.0	51.7	–15.9	0.421
12	01208500	Naugatuck River at Beacon Falls, Conn.	1.055	–19.4	–2.8	–33.1	**0.027**
13	01208990	Saugatuck River near Redding, Conn.	0.120	–5.1	82.3	–50.6	0.876
14	01209710	Norwalk River at Winnipauk, Conn.	0.392	–1.2	28.3	–23.9	0.928
15	01357500	Mohawk River at Cohoes, N.Y.	0.689	–11.8	3.5	–24.9	0.127
16	01377000	Hackensack River at Rivervale, N.J.	0.461	–26.3	8.8	–50.0	0.132
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.184	21.2	124.5	–34.5	0.544
18	01387500	Ramapo River near Mahwah, N.J.	1.292	0.2	25.6	–20.0	0.986
19	01389500	Passaic River at Little Falls, N.J.	2.719	–28.0	–12.0	–41.0	**0.002**
20	01391500	Saddle River at Lodi, N.J.	4.463	31.1	61.2	6.7	**0.013**
21	01394500	Rahway River near Springfield, N.J.	1.356	1.8	34.4	–22.9	0.900
22	01395000	Rahway River at Rahway, N.J.	0.867	10.1	55.6	–22.1	0.588
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	0.931	–20.5	0.3	–37.0	0.059
24	01398000	Neshanic River at Reaville, N.J.	1.430	–16.8	58.3	–56.3	0.577
25	01402000	Millstone River at Blackwells Mills, N.J.	2.410	–2.0	20.6	–20.3	0.851
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	1.878	9.0	27.4	–6.7	0.280
29	01409500	Batsto River at Batsto, N.J.	0.168	–60.9	–36.3	–76.1	**0.001**
31	01438500	Delaware River at Montague, N.J.	0.295	–43.7	–18.9	–60.9	**0.004**
32	01443500	Paulins Kill at Blairstown, N.J.	0.795	4.6	67.9	–34.9	0.854
33	01463500	Delaware River at Trenton, N.J.	1.003	–24.2	–10.1	–36.1	**0.002**
34	01467150	Cooper River at Haddonfield, N.J.	0.349	–26.5	3.8	–48.0	0.084
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.398	–27.9	2.3	–49.2	0.070

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
36	01491000	Choptank River near Greensboro, Md.	1.291	8.4	24.6	–5.8	0.262
37	01578310	Susquehanna River at Conowingo, Md.	1.299	–22.5	–13.1	–30.9	**<0.001**
38	01594440	Patuxent River near Bowie, Md.	1.434	–10.1	–1.9	–17.7	**0.018**
39	01614500	Conococheague Creek at Fairview, Md.	4.995	–7.8	0.2	–15.2	0.057
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	1.807	–34.0	–18.8	–46.4	**<0.001**
41	01668000	Rappahannock River near Fredericksburg, Va.	0.312	24.6	73.0	–10.2	0.189
42	01673000	Pamunkey River near Hanover, Va.	0.282	0.6	15.8	–12.6	0.932
43	01674500	Mattaponi River near Beulahville, Va.	0.155	14.6	38.1	–4.9	0.153
44	02035000	James River at Cartersville, Va.	0.219	–18.1	5.3	–36.3	0.121
45	02041650	Appomattox River at Matoaca, Va.	0.142	–18.8	–0.4	–33.8	**0.046**
50	02175000	Edisto River near Givhans, S.C.	0.099	–25.9	11.4	–50.7	0.153
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.374	34.3	64.1	9.9	**0.005**
66	02335870	Sope Creek near Marietta, Ga.	0.523	–6.3	9.8	–20.1	0.422
71	02492000	Bogue Chitto River near Bush, La.	0.243	139.0	343.6	28.7	**0.007**
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.862	–36.2	–19.8	–49.3	**<0.001**
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.030	–8.0	16.9	–27.6	0.495
74	04063700	Popple River near Fence, Wis.	0.045	12.4	71.6	–26.5	0.591
76	04087000	Milwaukee River at Milwaukee, Wis.	0.673	92.2	181.0	31.4	**0.001**
81	05114000	Souris River near Sherwood, N. Dak.	0.047	–14.7	104.8	–64.4	0.724
82	05120000	Souris River near Verendrye, N. Dak.	0.147	–61.7	24.9	–88.3	0.116
88	05514500	Cuivre River near Troy, Mo.	0.329	37.6	305.4	–53.3	0.565
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.842	–51.7	–30.1	–66.7	**<0.001**
95	07022000	Mississippi River at Thebes, Ill.	2.367	0.7	31.2	–22.6	0.956
96	06088500	Muddy Creek at Vaughn, Mont.	2.327	–49.8	–27.9	–65.1	**<0.001**
98	06274300	Bighorn River at Basin, Wyo.	0.288	–47.7	–19.3	–66.1	**0.006**
99	06329500	Yellowstone River near Sidney, Mont.	0.171	–10.0	123.1	–63.7	0.820
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.135	–73.2	–55.6	–83.8	**<0.001**
101	06461500	Niobrara River near Sparks, Nebr.	0.262	51.9	131.0	–0.1	0.055
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	0.071	–74.2	–14.7	–92.2	**0.029**
103	06713500	Cherry Creek at Denver, Colo.	2.735	–46.6	–35.0	–56.2	**<0.001**
104	06752260	Cache La Poudre River at Fort Collins, Colo.	0.293	–73.6	–56.5	–84.0	**<0.001**
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	0.576	–13.4	30.9	–42.7	0.497
106	06753990	Lonetree Creek near Greeley, Colo.	6.915	–56.3	–40.4	–68.0	**<0.001**
107	06754000	South Platte River near Kersey, Colo.	4.974	2.7	11.4	–5.4	0.533
108	06775900	Dismal River near Thedford, Nebr.	0.458	7.7	25.1	–7.3	0.335
109	06800000	Maple Creek near Nickerson, Nebr.	6.192	–29.7	5.2	–53.0	0.089
110	06805500	Platte River at Louisville, Nebr.	1.487	9.7	108.4	–42.3	0.779
111	06817700	Nodaway River near Graham, Mo.	3.433	52.4	407.1	–54.2	0.494
112	06818000	Missouri River at St. Joseph, Mo.	1.951	–62.9	–37.1	–78.1	**<0.001**
113	06902000	Grand River near Sumner, Mo.	0.431	51.2	297.9	–42.6	0.404
114	06905500	Chariton River near Prairie Hill, Mo.	0.420	80.7	286.0	–15.4	0.130
115	06921070	Pomme De Terre River near Polk, Mo.	0.215	126.1	470.8	–10.5	0.088
116	06926510	Osage River below St. Thomas, Mo.	0.352	–59.5	–18.1	–80.0	**0.015**
117	06930800	Gasconade River above Jerome, Mo.	0.416	–0.7	49.1	–33.8	0.974
118	06934500	Missouri River at Hermann, Mo.	1.399	–29.6	11.6	–55.6	0.138
119	07047942	L'Anguille River near Colt, Ark.	0.451	–46.1	–6.6	–68.9	**0.032**
120	07053250	Yocum Creek near Oak Grove, Ark.	2.245	109.0	195.9	47.6	**<0.001**
121	07056000	Buffalo River near St Joe, Ark.	0.067	67.3	151.7	11.3	**0.015**
122	07060500	White River at Calico Rock, Ark.	0.241	28.2	81.9	–9.6	0.169
123	07060710	North Sylamore Creek near Fifty Six, Ark.	0.064	–2.3	30.5	–26.9	0.873

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
124	07066110	Jacks Fork above Two River, Mo.	0.290	22.7	53.9	–2.2	0.081
125	07068000	Current River at Doniphan, Mo.	0.282	–13.2	5.1	–28.3	0.150
126	07077500	Cache River at Patterson, Ark.	0.256	–17.5	39.7	–51.3	0.479
127	07077700	Bayou DeView near Morton, Ark.	0.153	69.9	222.4	–10.5	0.117
128	07103700	Fountain Creek near Colorado Springs, Colo.	0.750	–5.8	14.7	–22.6	0.555
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	0.127	282.0	708.1	80.5	**0.001**
130	07105500	Fountain Creek at Colorado Springs, Colo.	1.563	8.6	25.1	–5.7	0.254
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	1.665	45.2	68.9	24.8	**<0.001**
132	07106300	Fountain Creek near Pinon, Colo.	5.192	–48.4	–35.0	–59.0	**<0.001**
133	07106500	Fountain Creek at Pueblo, Colo.	5.306	–55.1	–50.0	–59.7	**<0.001**
134	07189000	Elk River near Tiff City, Mo.	1.572	46.4	76.1	21.7	**<0.001**
135	07195500	Illinois River near Watts, Okla.	2.450	–17.7	13.4	–40.3	0.236
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.241	11.5	49.4	–16.8	0.469
137	07196000	Flint Creek near Kansas, Okla.	1.871	59.6	79.5	42.0	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	1.684	2.6	24.0	–15.1	0.791
139	07197000	Baron Fork at Eldon, Okla.	1.033	35.0	78.2	2.2	**0.037**
140	07227500	Canadian River near Amarillo, Tex.	0.173	515.1	1605.0	121.9	**0.001**
141	07239450	North Canadian River near Calumet, Okla.	0.084	–32.6	58.2	–71.3	0.366
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	0.249	–47.1	–1.6	–71.6	**0.046**
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	0.601	–28.4	19.1	–56.9	0.201
144	07241550	North Canadian River near Harrah, Okla.	1.176	0.0	44.8	–31.0	0.998
145	07247015	Poteau River at Loving, Okla.	0.088	45.8	161.3	–18.6	0.209
146	07247250	Black Fork below Big Creek near Page, Okla.	0.063	124.0	263.5	38.0	**0.002**
147	07247345	Black Fork at Hodgen, Okla.	0.033	109.8	281.3	15.5	**0.018**
148	07247650	Fourche Maline near Leflore, Okla.	0.093	8.4	76.4	–33.3	0.745
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.382	–50.8	–12.6	–72.3	**0.018**
150	07331000	Washita River near Dickson, Okla.	0.366	17.6	178.9	–50.4	0.714
151	07355500	Red River at Alexandria, La.	0.155	–43.1	–9.9	–64.1	**0.018**
152	07362000	Ouachita River at Camden, Ark.	0.126	2.9	62.8	–35.0	0.903
153	07373420	Mississippi River near St Francisville, La.	1.562	–15.4	3.1	–30.6	0.100
154	07375500	Tangipahoa River at Robert, La.	0.366	–13.6	6.2	–29.6	0.168
155	07376000	Tickfaw River at Holden, La.	0.301	–13.9	6.7	–30.4	0.175
156	07381495	Atchafalaya River at Melville, La.	1.123	–16.0	5.1	–32.9	0.129
157	07386980	Vermilion River at Perry, La.	0.376	27.9	91.3	–14.4	0.233
158	08030500	Sabine River near Ruliff, Tex.	0.078	–31.8	–0.9	–53.1	**0.047**
159	08032000	Neches River near Neches, Tex.	0.135	–9.4	57.1	–47.7	0.727
160	08033500	Neches River near Rockland, Tex.	0.184	8.9	74.3	–31.9	0.722
161	08051500	Clear Creek near Sanger, Tex.	0.122	67.4	219.6	–12.4	0.122
162	08064100	Chambers Creek near Rice, Tex.	0.254	–16.4	57.9	–55.7	0.582
163	08065350	Trinity River near Crockett, Tex.	1.673	–2.3	66.3	–42.6	0.932
164	08136500	Concho River at Paint Rock, Tex.	11.897	–93.4	–76.6	–98.1	**<0.001**
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	0.042	5.0	83.9	–40.0	0.864
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	0.063	54.9	132.9	2.9	**0.039**
172	08181800	San Antonio River near Elmendorf, Tex.	8.417	13.3	51.2	–15.0	0.396

Table 4. Flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
174	09058000	Colorado River near Kremmling, Colo.	0.121	–0.2	49.5	–33.3	0.994
175	09163500	Colorado River near Colorado-Utah State Line	0.579	–9.2	10.7	–25.5	0.343
177	09217010	Green River below Green River, Wyo.	0.070	–10.1	32.5	–38.9	0.594
181	09413500	Virgin River below First Narrows, Utah	0.901	29.8	84.3	–8.6	0.148
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	0.089	–39.3	–10.9	–58.7	**0.013**
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	0.253	–17.9	19.3	–43.5	0.303
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	0.112	98.6	207.9	28.1	**0.003**
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	0.039	301.6	649.6	115.1	**<0.001**
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	0.463	–54.8	–36.5	–67.8	**<0.001**
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	0.009	2.1	39.2	–25.1	0.894
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	0.014	–21.3	–2.2	–36.7	**0.032**
197	10336698	Third Creek near Crystal Bay, Nev.	0.017	–67.9	–56.7	–76.2	**<0.001**
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	0.013	10.3	45.9	–16.6	0.491
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.019	2.4	26.6	–17.2	0.829
200	10336700	Incline Creek near Crystal Bay, Nev.	0.021	–0.7	21.7	–18.9	0.949
201	10336740	Logan House Creek near Glenbrook, Nev.	0.004	70.7	396.2	–41.3	0.328
205	07A090	Snohomish River at Snohomish, Wash.	0.236	–7.0	10.2	–21.6	0.401
207	09A190	Green River at Kanaskat, Wash.	0.084	–4.0	32.2	–30.2	0.805
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.587	–24.1	6.9	–46.1	0.121
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.348	–39.8	–20.0	–54.6	**0.001**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.153	–27.0	–10.3	–40.7	**0.003**
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.473	–44.2	–30.8	–54.9	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.152	30.3	94.9	–12.9	0.203
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.161	–22.9	54.5	–61.6	0.467
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.288	–29.6	–20.8	–37.5	**<0.001**
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.446	–11.8	17.2	–33.6	0.390
225	13351000	Palouse River at Hooper, Wash.	1.113	–12.2	27.8	–39.7	0.499
226	14201300	Zollner Creek near Mt. Angel, Oreg.	8.370	25.0	54.2	1.3	**0.039**
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.289	–33.2	–11.5	–49.5	**0.006**
229	16A070	Skokomish River near Potlatch, Wash.	0.105	–59.7	–47.4	–69.1	**<0.001**
234	45A070	Wenatchee River at Wenatchee, Wash.	0.064	1.2	25.8	–18.6	0.916
235	45A110	Wenatchee River near Leavenworth, Wash.	0.026	7.6	57.9	–26.7	0.709
237	49A070	Okanogan River at Malott, Wash.	0.023	7.6	87.5	–38.3	0.796
238	54A120	Spokane River at Riverside State Park, Wash.	0.346	47.9	86.7	17.2	**0.001**
239	61A070	Columbia River at Northport, Wash.	0.056	0.5	19.1	–15.2	0.956
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	0.053	–50.6	–16.3	–70.8	**0.010**
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.006	5.3	36.8	–18.9	0.698
242	11290000	Tuolumne River at Modesto, Calif.	0.254	125.8	173.3	86.5	**<0.001**
243	11303500	San Joaquin River near Vernalis, Calif.	0.987	4.8	15.4	–4.8	0.335
244	11447650	Sacramento River at Freeport, Calif.	0.147	–32.4	–10.0	–49.2	**0.008**

[1] Reference value is the concentration that would have been observed on the first day of the period of record under average hydrologic and seasonal conditions.

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus					
1	01122610	Shetucket River at South Windham, Conn.	0.021	66.7	166.4	4.3	**0.033**
2	01124000	Quinebaug River at Quinebaug, Conn.	0.036	24.2	94.9	–20.9	0.347
3	01127000	Quinebaug River at Jewett City, Conn.	0.046	81.6	169.9	22.2	**0.003**
4	01184000	Connecticut River at Thompsonville, Conn.	0.033	28.0	91.3	–14.3	0.228
5	01184490	Broad Brook at Broad Brook, Conn.	0.092	–17.0	19.2	–42.3	0.312
7	01189995	Farmington River at Tariffville, Conn.	0.087	55.8	110.8	15.1	**0.004**
8	01192500	Hockanum River near East Hartford, Conn.	0.364	–8.1	24.8	–32.3	0.590
10	01196500	Quinnipiac River at Wallingford, Conn.	0.241	–18.1	9.1	–38.5	0.173
11	01205500	Housatonic River at Stevenson, Conn.	0.021	10.3	188.7	–57.8	0.841
12	01208500	Naugatuck River at Beacon Falls, Conn.	0.227	74.8	163.2	16.1	**0.007**
13	01208990	Saugatuck River near Redding, Conn.	0.012	26.6	326.9	–62.5	0.704
14	01209710	Norwalk River at Winnipauk, Conn.	0.030	43.9	95.6	5.8	**0.020**
15	01357500	Mohawk River at Cohoes, N.Y.	0.034	13.9	76.5	–26.5	0.559
16	01377000	Hackensack River at Rivervale, N.J.	0.065	20.7	104.4	–28.7	0.484
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.025	–53.1	67.0	–86.8	0.242
18	01387500	Ramapo River near Mahwah, N.J.	0.120	–6.9	48.7	–41.7	0.763
19	01389500	Passaic River at Little Falls, N.J.	0.372	19.3	101.4	–29.3	0.509
20	01391500	Saddle River at Lodi, N.J.	0.369	115.1	241.7	35.4	**0.001**
22	01395000	Rahway River at Rahway, N.J.	0.071	35.7	87.2	–1.7	0.063
24	01398000	Neshanic River at Reaville, N.J.	0.042	23.8	184.0	–46.0	0.614
25	01402000	Millstone River at Blackwells Mills, N.J.	0.195	34.3	89.1	–4.7	0.092
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	0.160	21.4	73.2	–14.9	0.285
27	01408000	Manasquan River at Squankum, N.J.	0.099	–4.7	71.7	–47.1	0.872
28	01408500	Toms River near Toms River, N.J.	0.024	29.1	269.6	–54.9	0.634
30	01411500	Maurice River at Norma, N.J.	0.014	–14.1	221.7	–77.1	0.821
31	01438500	Delaware River at Montague, N.J.	0.041	–43.9	57.1	–80.0	0.271
32	01443500	Paulins Kill at Blairstown, N.J.	0.025	4.5	116.1	–49.4	0.905
33	01463500	Delaware River at Trenton, N.J.	0.057	–10.7	26.2	–36.9	0.520
34	01467150	Cooper River at Haddonfield, N.J.	0.198	–3.7	37.1	–32.3	0.835
35	01477120	Raccoon Creek near Swedesboro, N.J.	0.117	27.9	80.9	–9.6	0.164
36	01491000	Choptank River near Greensboro, Md.	0.045	113.6	235.0	36.1	**0.001**
37	01578310	Susquehanna River at Conowingo, Md.	0.021	64.5	127.5	18.9	**0.003**
38	01594440	Patuxent River near Bowie, Md.	0.116	41.0	84.2	7.9	**0.012**
39	01614500	Conococheague Creek at Fairview, Md.	0.114	14.5	63.0	–19.6	0.454
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	0.030	76.4	196.4	5.0	**0.032**
41	01668000	Rappahannock River near Fredericksburg, Va.	0.033	6.7	125.6	–49.6	0.866
42	01673000	Pamunkey River near Hanover, Va.	0.066	82.3	113.6	55.5	**<0.001**
43	01674500	Mattaponi River near Beulahville, Va.	0.059	–6.9	12.2	–22.8	0.451
44	02035000	James River at Cartersville, Va.	0.100	–11.0	15.1	–31.2	0.375
45	02041650	Appomattox River at Matoaca, Va.	0.047	–13.5	10.1	–32.0	0.238
46	02085000	Eno River at Hillsborough, N.C.	0.025	42.4	144.6	–17.1	0.200
51	02198500	Savannah River near Clyo, Ga.	0.093	42.2	91.4	5.6	**0.020**
52	02213700	Ocmulgee River near Warner Robins, Ga.	0.177	–38.3	–11.8	–56.9	**0.008**
53	02215500	Ocmulgee River at Lumber City, Ga.	0.117	–40.4	–23.2	–53.8	**<0.001**
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	0.135	–20.3	0.4	–36.7	0.054
55	02226010	Altamaha River near Gardi, Ga.	0.106	–9.2	11.0	–25.7	0.347
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	0.140	48.0	118.5	0.3	**0.049**
58	02295420	Payne Creek near Bowling Green, Fla.	0.620	31.4	66.8	3.5	**0.025**
59	02296750	Peace River at Arcadia, Fla.	0.940	–3.8	15.4	–19.8	0.676
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.227	7.9	32.4	–12.1	0.469

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
61	02301300	South Prong Alafia River near Lithia, Fla.	0.954	–39.2	–14.7	–56.7	**0.004**
62	02302500	Blackwater Creek near Knights, Fla.	0.807	–40.3	–22.1	–54.3	**<0.001**
63	02303000	Hillsborough River near Zephyrhills, Fla.	0.323	–49.8	2.7	–75.5	0.059
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	0.066	–71.0	–57.7	–80.0	**<0.001**
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.150	29.9	140.8	–30.0	0.407
66	02335870	Sope Creek near Marietta, Ga.	0.017	–26.2	38.8	–60.7	0.346
68	02344040	Chattahoochee River near Steam Mill, Ga.	0.085	–54.8	–31.0	–70.3	**<0.001**
69	02353000	Flint River at Newton, Ga.	0.049	–20.7	8.0	–41.7	0.141
70	02388520	Oostanaula River at Rome, Ga.	0.217	–55.1	–41.0	–65.7	**<0.001**
71	02492000	Bogue Chitto River near Bush, La.	0.070	38.2	86.6	2.3	**0.035**
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.024	0.0	66.7	–40.0	0.999
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	0.082	60.9	121.2	17.0	**0.003**
74	04063700	Popple River near Fence, Wis.	0.027	–26.0	33.5	–58.9	0.318
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	0.134	–27.3	–18.0	–35.5	**<0.001**
76	04087000	Milwaukee River at Milwaukee, Wis.	0.083	23.3	50.2	1.2	**0.038**
77	0422026250	Northrup Creek at North Greece, N.Y.	0.402	–41.3	–28.5	–51.9	**<0.001**
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	0.070	–31.8	–6.9	–50.1	**0.016**
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	0.090	–19.2	–2.4	–33.1	**0.027**
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	0.068	41.6	63.3	22.8	**<0.001**
81	05114000	Souris River near Sherwood, N. Dak.	0.424	–42.8	–9.8	–63.7	**0.016**
82	05120000	Souris River near Verendrye, N. Dak.	0.264	–13.7	21.5	–38.7	0.399
83	05287890	Elm Creek near Champlin, Minn.	0.139	16.5	58.1	–14.2	0.327
84	05427718	Yahara River at Windsor, Wis.	0.149	–37.9	–12.3	–56.0	**0.007**
85	05427948	Pheasant Branch at Middleton, Wis.	0.390	–64.7	–55.3	–72.1	**<0.001**
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	0.129	–15.5	18.3	–39.6	0.327
87	05500000	South Fabius River near Taylor, Mo.	0.102	–15.8	39.0	–49.0	0.501
88	05514500	Cuivre River near Troy, Mo.	0.136	–23.0	46.5	–59.5	0.426
89	05525500	Sugar Creek at Milford, Ill.	0.060	23.0	128.5	–33.8	0.513
90	05531500	Salt Creek at Western Springs, Ill.	1.019	49.4	99.1	12.1	**0.006**
91	05532500	Des Plaines River at Riverside, Ill.	0.517	84.0	143.4	39.1	**<0.001**
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.079	–19.2	17.5	–44.5	0.265
93	05586100	Illinois River at Valley City, Ill.	0.264	112.3	171.1	66.3	**<0.001**
94	07018100	Big River near Richwoods, Mo.	0.032	–11.7	37.5	–43.3	0.581
95	07022000	Mississippi River at Thebes, Ill.	0.230	26.2	73.1	–7.9	0.148
97	06178000	Poplar River at International Boundary, Mont.	0.029	–20.6	55.0	–59.4	0.499
99	06329500	Yellowstone River near Sidney, Mont.	0.075	6.3	118.5	–48.3	0.868
101	06461500	Niobrara River near Sparks, Nebr.	0.121	33.5	80.4	–1.3	0.061
106	06753990	Lonetree Creek near Greeley, Colo.	0.325	–73.0	–35.5	–88.7	**0.003**
107	06754000	South Platte River near Kersey, Colo.	0.636	34.6	59.6	13.5	**0.001**
109	06800000	Maple Creek near Nickerson, Nebr.	0.207	105.8	237.0	25.7	**0.004**
110	06805500	Platte River at Louisville, Nebr.	0.313	89.4	161.3	37.2	**<0.001**
111	06817700	Nodaway River near Graham, Mo.	0.327	–36.2	27.3	–68.0	0.203
112	06818000	Missouri River at St. Joseph, Mo.	0.216	23.4	81.2	–16.0	0.284
113	06902000	Grand River near Sumner, Mo.	0.202	12.9	119.5	–41.9	0.720
114	06905500	Chariton River near Prairie Hill, Mo.	0.207	–42.8	13.8	–71.2	0.112
115	06921070	Pomme De Terre River near Polk, Mo.	0.047	–22.8	20.9	–50.7	0.258
118	06934500	Missouri River at Hermann, Mo.	0.187	64.5	169.3	0.5	**0.048**
120	07053250	Yocum Creek near Oak Grove, Ark.	0.039	18.9	52.9	–7.5	0.176
134	07189000	Elk River near Tiff City, Mo.	0.041	280.3	433.1	171.2	**<0.001**

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
135	07195500	Illinois River near Watts, Okla.	0.112	110.3	206.8	44.1	**<0.001**
136	07195865	Sager Creek near West Siloam Springs, Okla.	0.495	94.5	250.7	7.9	**0.027**
137	07196000	Flint Creek near Kansas, Okla.	0.092	79.7	130.6	40.1	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	0.063	80.4	139.7	35.7	**<0.001**
139	07197000	Baron Fork at Eldon, Okla.	0.028	6.5	64.0	–30.9	0.777
145	07247015	Poteau River at Loving, Okla.	0.106	–13.6	29.7	–42.4	0.481
148	07247650	Fourche Maline near Leflore, Okla.	0.051	–0.6	39.0	–28.9	0.971
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.081	47.4	91.5	13.4	**0.004**
150	07331000	Washita River near Dickson, Okla.	0.201	19.8	109.7	–31.5	0.526
151	07355500	Red River at Alexandria, La.	0.095	–30.4	–0.1	–51.5	**0.050**
152	07362000	Ouachita River at Camden, Ark.	0.041	–27.2	26.5	–58.1	0.260
153	07373420	Mississippi River near St Francisville, La.	0.175	45.7	82.0	16.6	**0.001**
154	07375500	Tangipahoa River at Robert, La.	0.112	1.6	43.7	–28.2	0.929
155	07376000	Tickfaw River at Holden, La.	0.074	46.0	103.3	4.9	**0.025**
156	07381495	Atchafalaya River at Melville, La.	0.146	52.7	85.9	25.4	**<0.001**
157	07386980	Vermilion River at Perry, La.	0.297	1.9	30.1	–20.3	0.882
165	08143600	Pecan Bayou near Mullin, Tex.	0.205	–3.2	81.1	–48.2	0.920
166	08147000	Colorado River near San Saba, Tex.	0.077	–69.1	2.4	–90.7	0.055
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	0.076	–91.7	–61.7	–98.2	**0.001**
170	08162000	Colorado River at Wharton, Tex.	0.269	–3.1	52.1	–38.3	0.890
171	08162500	Colorado River near Bay City, Tex.	0.291	–24.9	30.6	–56.8	0.310
173	08251500	Rio Grande near Lobatos, Colo.	0.079	25.8	66.8	–5.2	0.111
177	09217010	Green River below Green River, Wyo.	0.026	90.3	281.9	–5.2	0.070
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	0.062	–43.8	33.1	–76.2	0.190
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	0.035	135.1	451.5	0.2	**0.049**
182	09415000	Virgin River at Littlefield, Ariz.	0.106	58.4	336.2	–42.5	0.373
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	0.122	–26.9	230.6	–83.8	0.684
184	09498500	Salt River near Roosevelt, Ariz.	0.013	514.5	5184.4	–28.6	0.098
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	0.023	35.8	234.2	–44.9	0.506
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	0.280	–88.7	–67.6	–96.1	**<0.001**
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	0.188	–48.3	–22.2	–65.6	**0.002**
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	0.085	–8.5	32.7	–36.9	0.639
203	01A050	Nooksack River at Brennan, Wash.	0.021	43.5	129.1	–10.1	0.130
204	03A060	Skagit River near Mount Vernon, Wash.	0.015	6.0	123.6	–49.7	0.878
205	07A090	Snohomish River at Snohomish, Wash.	0.009	26.0	125.1	–29.5	0.435
206	09A080	Green River at Tukwila, Wash.	0.025	18.6	58.5	–11.3	0.250
207	09A190	Green River at Kanaskat, Wash.	0.005	244.0	597.2	69.7	**0.001**
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.070	–7.3	9.6	–21.6	0.372
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.075	–20.1	–4.4	–33.2	**0.014**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.046	–4.9	17.6	–23.2	0.641
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	0.028	–15.3	3.7	–30.8	0.107
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.080	–8.9	29.5	–35.9	0.604
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.064	–20.6	–5.4	–33.3	**0.010**
214	10611	Willamette River at Hawthorne Bridge, Oreg.	0.082	–21.7	–11.6	–30.5	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.040	–24.8	3.1	–45.1	0.077

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
216	10A070	Puyallup River at Meridian Street, Wash.	0.036	87.4	196.4	18.5	**0.007**
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.081	–21.5	–2.2	–36.9	**0.031**
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	0.090	–10.3	8.5	–25.9	0.261
219	11478	John Day River at Service Creek, Oreg.	0.041	–32.8	–2.8	–53.5	**0.035**
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	0.104	–33.7	–6.6	–52.9	**0.019**
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	0.011	94.5	250.1	8.1	**0.027**
222	12419000	Spokane River near Post Falls, Idaho	0.011	–36.0	93.6	–78.8	0.430
223	13154500	Snake River at King Hill, Idaho	0.068	–8.9	14.4	–27.5	0.422
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.083	37.0	199.8	–37.4	0.431
225	13351000	Palouse River at Hooper, Wash.	0.195	–51.7	–26.2	–68.4	**0.001**
227	14211720	Willamette River at Portland, Oreg.	0.061	13.8	37.2	–5.5	0.173
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.031	7.8	70.6	–31.9	0.748
229	16A070	Skokomish River near Potlatch, Wash.	0.009	112.2	282.8	17.7	**0.012**
230	32A070	Walla Walla River near Touchet, Wash.	0.112	–4.5	21.2	–24.7	0.707
231	3701002	Tualatin River at Weiss Bridge, Oreg.	0.175	–31.9	–23.6	–39.4	**<0.001**
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.039	–40.9	–27.2	–52.0	**<0.001**
233	37A090	Yakima River at Kiona, Wash.	0.102	3.8	24.8	–13.7	0.693
234	45A070	Wenatchee River at Wenatchee, Wash.	0.004	52.5	272.8	–37.6	0.354
235	45A110	Wenatchee River near Leavenworth, Wash.	0.004	12.3	156.4	–50.8	0.783
236	48A070	Methow River near Pateros, Wash.	0.003	95.3	280.8	0.1	**0.050**
237	49A070	Okanogan River at Malott, Wash.	0.017	–2.1	89.8	–49.6	0.949
238	54A120	Spokane River at Riverside State Park, Wash.	0.019	42.1	131.9	–13.0	0.160
239	61A070	Columbia River at Northport, Wash.	0.011	–33.2	25.4	–64.5	0.209
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	0.183	15.8	54.8	–13.4	0.324
242	11290000	Tuolumne River at Modesto, Calif.	0.074	2.0	63.7	–36.4	0.934
243	11303500	San Joaquin River near Vernalis, Calif.	0.274	–2.4	13.2	–15.9	0.748
244	11447650	Sacramento River at Freeport, Calif.	0.039	57.9	122.4	12.1	**0.009**
		Total nitrogen					
1	01122610	Shetucket River at South Windham, Conn.	0.603	10.4	39.2	–12.4	0.403
2	01124000	Quinebaug River at Quinebaug, Conn.	0.530	44.3	81.0	15.0	**0.002**
3	01127000	Quinebaug River at Jewett City, Conn.	0.913	–4.0	13.6	–18.8	0.638
4	01184000	Connecticut River at Thompsonville, Conn.	0.624	4.9	25.4	–12.4	0.604
5	01184490	Broad Brook at Broad Brook, Conn.	4.259	0.1	9.4	–8.5	0.988
6	01188090	Farmington River at Unionville, Conn.	0.270	41.6	109.4	–4.2	0.081
7	01189995	Farmington River at Tariffville, Conn.	1.018	23.0	53.8	–1.6	0.069
8	01192500	Hockanum River near East Hartford, Conn.	3.480	5.5	29.7	–14.2	0.614
9	01193500	Salmon River near East Hampton, Conn.	0.436	13.8	58.4	–18.3	0.445
10	01196500	Quinnipiac River at Wallingford, Conn.	3.208	–1.3	20.4	–19.1	0.895
11	01205500	Housatonic River at Stevenson, Conn.	0.661	12.1	41.2	–11.0	0.333
12	01208500	Naugatuck River at Beacon Falls, Conn.	2.492	–49.3	–31.7	–62.3	**<0.001**
13	01208990	Saugatuck River near Redding, Conn.	0.307	40.3	106.5	–4.6	0.085
14	01209710	Norwalk River at Winnipauk, Conn.	0.642	24.3	47.0	5.1	**0.011**
15	01357500	Mohawk River at Cohoes, N.Y.	1.048	–9.1	2.5	–19.4	0.120
16	01377000	Hackensack River at Rivervale, N.J.	1.032	13.5	41.5	–9.0	0.261
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.500	21.5	69.4	–12.8	0.250
18	01387500	Ramapo River near Mahwah, N.J.	1.537	–5.3	39.2	–35.6	0.781
19	01389500	Passaic River at Little Falls, N.J.	3.357	–12.2	39.4	–44.7	0.582
20	01391500	Saddle River at Lodi, N.J.	5.794	24.5	66.9	–7.2	0.144

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
21	01394500	Rahway River near Springfield, N.J.	1.727	0.9	25.5	–18.8	0.934
22	01395000	Rahway River at Rahway, N.J.	1.407	–0.1	25.2	–20.3	0.993
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	1.090	–13.6	7.2	–30.3	0.184
24	01398000	Neshanic River at Reaville, N.J.	1.753	–14.2	39.0	–47.0	0.534
25	01402000	Millstone River at Blackwells Mills, N.J.	2.902	11.7	42.0	–12.2	0.368
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	2.316	16.4	40.5	–3.7	0.116
29	01409500	Batsto River at Batsto, N.J.	0.386	–22.1	12.0	–45.9	0.178
31	01438500	Delaware River at Montague, N.J.	0.487	–23.2	–1.2	–40.2	**0.040**
32	01443500	Paulins Kill at Blairstown, N.J.	0.958	4.7	34.2	–18.4	0.720
33	01463500	Delaware River at Trenton, N.J.	1.277	–18.3	–3.7	–30.6	**0.016**
34	01467150	Cooper River at Haddonfield, N.J.	0.921	0.9	24.3	–18.2	0.936
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.658	8.9	33.6	–11.3	0.415
36	01491000	Choptank River near Greensboro, Md.	1.457	22.4	35.8	10.2	**<0.001**
37	01578310	Susquehanna River at Conowingo, Md.	1.526	–9.4	–0.3	–17.6	**0.042**
38	01594440	Patuxent River near Bowie, Md.	2.078	0.5	11.0	–9.0	0.921
39	01614500	Conococheague Creek at Fairview, Md.	5.429	–3.7	8.3	–14.3	0.530
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	2.010	–18.7	10.5	–40.2	0.186
41	01668000	Rappahannock River near Fredericksburg, Va.	0.577	17.5	82.1	–24.2	0.471
42	01673000	Pamunkey River near Hanover, Va.	0.653	27.0	42.6	13.1	**<0.001**
43	01674500	Mattaponi River near Beulahville, Va.	0.623	10.1	25.2	–3.1	0.140
44	02035000	James River at Cartersville, Va.	0.478	1.8	42.5	–27.3	0.918
45	02041650	Appomattox River at Matoaca, Va.	0.587	11.9	23.6	1.3	**0.027**
46	02085000	Eno River at Hillsborough, N.C.	0.664	18.0	48.3	–6.1	0.155
47	02089500	Neuse River at Kinston, N.C.	1.493	–36.8	–27.3	–45.1	**<0.001**
48	02091500	Contentnea Creek at Hookerton, N.C.	1.242	–11.5	–3.4	–18.9	**0.006**
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	1.363	0.8	37.2	–26.0	0.961
52	02213700	Ocmulgee River near Warner Robins, Ga.	1.350	6.7	44.8	–21.4	0.679
53	02215500	Ocmulgee River at Lumber City, Ga.	0.965	–7.5	14.8	–25.4	0.481
57	02271500	Josephine Creek near De Soto City, Fla.	0.889	37.2	78.2	5.6	**0.018**
58	02295420	Payne Creek near Bowling Green, Fla.	1.696	–5.1	26.9	–29.0	0.726
59	02296750	Peace River at Arcadia, Fla.	1.780	–3.7	12.4	–17.4	0.635
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.782	19.0	46.8	–3.6	0.106
61	02301300	South Prong Alafia River near Lithia, Fla.	1.056	7.2	40.6	–18.4	0.618
62	02302500	Blackwater Creek near Knights, Fla.	1.693	–20.7	2.8	–38.7	0.080
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	1.005	41.4	103.0	–1.5	0.060
67	02338000	Chattahoochee River near Whitesburg, Ga.	1.386	43.6	89.8	8.5	**0.011**
71	02492000	Bogue Chitto River near Bush, La.	0.819	–10.9	67.8	–52.7	0.720
72	03353637	Little Buck Creek near Indianapolis, Ind.	1.079	–15.5	9.7	–35.0	0.205
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.344	17.4	41.3	–2.4	0.089
74	04063700	Popple River near Fence, Wis.	0.453	12.3	33.5	–5.4	0.185
76	04087000	Milwaukee River at Milwaukee, Wis.	1.724	28.9	45.0	14.5	**<0.001**
81	05114000	Souris River near Sherwood, N. Dak.	2.076	–24.5	7.4	–46.9	0.118
82	05120000	Souris River near Verendrye, N. Dak.	1.507	4.0	45.5	–25.7	0.821
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	1.615	–38.8	–18.2	–54.3	**0.001**
95	07022000	Mississippi River at Thebes, Ill.	3.227	–13.0	6.0	–28.6	0.166
97	06178000	Poplar River at International Boundary, Mont.	0.613	4.6	46.3	–25.2	0.791
99	06329500	Yellowstone River near Sidney, Mont.	0.606	25.7	77.5	–11.0	0.194
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.193	40.7	133.3	–15.1	0.185
101	06461500	Niobrara River near Sparks, Nebr.	0.441	61.9	132.0	13.0	**0.009**
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	1.518	4.8	36.6	–19.6	0.728
103	06713500	Cherry Creek at Denver, Colo.	3.828	–49.8	–32.8	–62.5	**<0.001**

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
106	06753990	Lonetree Creek near Greeley, Colo.	9.761	–10.6	23.2	–35.1	0.493
107	06754000	South Platte River near Kersey, Colo.	6.215	27.4	57.1	3.3	**0.023**
108	06775900	Dismal River near Thedford, Nebr.	0.717	4.8	24.4	–11.6	0.588
109	06800000	Maple Creek near Nickerson, Nebr.	6.015	–11.3	21.3	–35.1	0.454
110	06805500	Platte River at Louisville, Nebr.	2.642	11.2	44.6	–14.5	0.428
111	06817700	Nodaway River near Graham, Mo.	5.273	–72.1	–46.9	–85.3	**<0.001**
112	06818000	Missouri River at St. Joseph, Mo.	3.257	–47.7	–34.4	–58.3	**<0.001**
113	06902000	Grand River near Sumner, Mo.	1.723	–39.8	2.1	–64.5	0.060
114	06905500	Chariton River near Prairie Hill, Mo.	1.607	–42.1	–12.0	–61.9	**0.011**
115	06921070	Pomme De Terre River near Polk, Mo.	0.544	–6.2	57.9	–44.3	0.810
116	06926510	Osage River below St. Thomas, Mo.	0.752	–30.8	–5.6	–49.3	**0.020**
118	06934500	Missouri River at Hermann, Mo.	2.025	–12.3	13.0	–32.0	0.311
120	07053250	Yocum Creek near Oak Grove, Ark.	2.529	69.2	111.8	35.2	**<0.001**
124	07066110	Jacks Fork above Two River, Mo.	0.448	1.3	23.4	–16.8	0.897
125	07068000	Current River at Doniphan, Mo.	0.426	–29.7	–15.6	–41.5	**<0.001**
134	07189000	Elk River near Tiff City, Mo.	1.721	0.1	27.2	–21.2	0.993
135	07195500	Illinois River near Watts, Okla.	2.523	–4.0	22.2	–24.5	0.742
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.666	18.3	61.5	–13.3	0.289
137	07196000	Flint Creek near Kansas, Okla.	1.882	51.6	73.1	32.7	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	1.723	–9.2	17.4	–29.8	0.459
139	07197000	Baron Fork at Eldon, Okla.	1.033	2.8	41.9	–25.5	0.865
145	07247015	Poteau River at Loving, Okla.	0.439	13.4	50.3	–14.4	0.380
146	07247250	Black Fork below Big Creek near Page, Okla.	0.315	–10.6	33.7	–40.2	0.585
147	07247345	Black Fork at Hodgen, Okla.	0.322	–2.9	38.9	–32.1	0.874
148	07247650	Fourche Maline near Leflore, Okla.	0.610	2.1	28.0	–18.5	0.856
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.842	1.7	22.0	–15.2	0.852
150	07331000	Washita River near Dickson, Okla.	0.988	27.3	71.2	–5.4	0.111
151	07355500	Red River at Alexandria, La.	0.715	4.7	24.4	–11.8	0.599
152	07362000	Ouachita River at Camden, Ark.	0.312	52.9	127.0	3.0	**0.035**
153	07373420	Mississippi River near St Francisville, La.	2.096	–7.9	7.4	–21.1	0.295
154	07375500	Tangipahoa River at Robert, La.	0.909	–29.0	6.3	–52.6	0.097
155	07376000	Tickfaw River at Holden, La.	0.873	–26.1	7.3	–49.1	0.112
156	07381495	Atchafalaya River at Melville, La.	1.776	–9.6	3.8	–21.3	0.153
157	07386980	Vermilion River at Perry, La.	1.888	–16.9	1.3	–31.8	0.066
173	08251500	Rio Grande near Lobatos, Colo.	0.440	26.3	61.2	–1.0	0.060
176	09211200	Green River below Fontenelle Reservoir, Wyo.	0.230	23.6	70.6	–10.4	0.197
179	09380000	Colorado River at Lees Ferry, Ariz.	0.368	5.8	40.9	–20.6	0.701
182	09415000	Virgin River at Littlefield, Ariz.	0.841	34.0	150.6	–28.4	0.360
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	0.210	4.6	28.1	–14.6	0.666
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.304	–8.9	50.0	–44.7	0.714
201	10336740	Logan House Creek near Glenbrook, Nev.	0.313	–2.6	81.2	–47.6	0.934
202	10336760	Edgewood Creek at Stateline, Nev.	0.328	–28.8	12.8	–55.1	0.148
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.967	–21.7	6.8	–42.6	0.122
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.791	–48.9	–34.5	–60.2	**<0.001**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.430	–49.0	–33.3	–61.0	**<0.001**
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.316	–24.4	1.1	–43.5	0.059
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.912	–51.3	–40.7	–60.0	**<0.001**
214	10611	Willamette River at Hawthorne Bridge, Oreg.	1.171	–38.6	–24.5	–50.0	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.459	–28.4	6.2	–51.7	0.097

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	1.009	–43.3	–25.6	–56.9	**<0.001**
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.554	–26.6	–16.2	–35.7	**<0.001**
219	11478	John Day River at Service Creek, Oreg.	0.293	–37.9	–10.9	–56.7	**0.010**
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	2.665	–43.1	–18.4	–60.3	**0.002**
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	0.230	17.7	67.3	–17.2	0.365
222	12419000	Spokane River near Post Falls, Idaho	0.138	15.7	65.2	–19.0	0.423
223	13154500	Snake River at King Hill, Idaho	1.480	2.0	23.9	–16.0	0.842
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.565	23.1	95.7	–22.6	0.381
225	13351000	Palouse River at Hooper, Wash.	1.724	6.8	39.7	–18.5	0.634
227	14211720	Willamette River at Portland, Oreg.	0.781	–3.6	13.1	–17.7	0.654
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.473	–9.0	8.9	–24.0	0.305
231	3701002	Tualatin River at Weiss Bridge, Oreg.	2.701	6.0	17.9	–4.6	0.277
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.553	–32.0	–18.4	–43.4	**<0.001**
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.839	6.0	40.6	–20.2	0.688
242	11290000	Tuolumne River at Modesto, Calif.	0.378	171.5	600.0	5.3	**0.039**
243	11303500	San Joaquin River near Vernalis, Calif.	2.012	9.0	60.5	–26.0	0.664
244	11447650	Sacramento River at Freeport, Calif.	0.238	49.3	96.3	13.5	**0.004**
		Nitrate					
1	01122610	Shetucket River at South Windham, Conn.	0.393	–12.4	16.6	–34.1	0.365
2	01124000	Quinebaug River at Quinebaug, Conn.	0.260	20.0	56.4	–8.0	0.179
3	01127000	Quinebaug River at Jewett City, Conn.	0.481	–19.3	14.8	–43.3	0.233
4	01184000	Connecticut River at Thompsonville, Conn.	0.327	8.5	31.7	–10.7	0.412
5	01184490	Broad Brook at Broad Brook, Conn.	3.743	3.9	17.1	–7.8	0.528
6	01188090	Farmington River at Unionville, Conn.	0.183	–22.8	2.1	–41.6	0.070
7	01189995	Farmington River at Tariffville, Conn.	0.641	18.1	50.9	–7.6	0.184
8	01192500	Hockanum River near East Hartford, Conn.	2.545	9.9	44.4	–16.3	0.497
9	01193500	Salmon River near East Hampton, Conn.	0.297	–26.1	20.4	–54.6	0.224
10	01196500	Quinnipiac River at Wallingford, Conn.	2.625	–11.7	11.5	–30.1	0.296
11	01205500	Housatonic River at Stevenson, Conn.	0.342	12.7	51.5	–16.2	0.430
12	01208500	Naugatuck River at Beacon Falls, Conn.	1.055	–13.4	16.3	–35.5	0.340
13	01208990	Saugatuck River near Redding, Conn.	0.120	–6.3	80.4	–51.3	0.845
14	01209710	Norwalk River at Winnipauk, Conn.	0.392	–1.3	30.6	–25.5	0.926
15	01357500	Mohawk River at Cohoes, N.Y.	0.689	–10.1	6.0	–23.8	0.206
16	01377000	Hackensack River at Rivervale, N.J.	0.461	–20.9	18.9	–47.4	0.260
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.184	30.1	139.2	–29.2	0.397
18	01387500	Ramapo River near Mahwah, N.J.	1.292	–6.4	46.7	–40.3	0.774
19	01389500	Passaic River at Little Falls, N.J.	2.719	–20.1	42.6	–55.2	0.448
20	01391500	Saddle River at Lodi, N.J.	4.463	28.7	76.6	–6.2	0.118
21	01394500	Rahway River near Springfield, N.J.	1.356	3.0	36.5	–22.3	0.838
22	01395000	Rahway River at Rahway, N.J.	0.867	9.7	55.3	–22.6	0.604
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	0.931	–20.8	0.7	–37.7	0.057
24	01398000	Neshanic River at Reaville, N.J.	1.430	–15.2	107.3	–65.3	0.717
25	01402000	Millstone River at Blackwells Mills, N.J.	2.410	3.1	33.6	–20.5	0.817
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	1.878	15.6	45.5	–8.1	0.214
29	01409500	Batsto River at Batsto, N.J.	0.168	–60.7	–36.6	–75.6	**<0.001**
31	01438500	Delaware River at Montague, N.J.	0.295	–44.0	–19.3	–61.2	**0.002**
32	01443500	Paulins Kill at Blairstown, N.J.	0.795	–1.1	62.3	–39.7	0.965
33	01463500	Delaware River at Trenton, N.J.	1.003	–24.2	–9.9	–36.3	**0.002**
34	01467150	Cooper River at Haddonfield, N.J.	0.349	–32.2	–3.7	–52.3	**0.030**
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.398	–26.1	6.0	–48.4	0.100

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
36	01491000	Choptank River near Greensboro, Md.	1.291	3.2	26.4	–15.8	0.763
37	01578310	Susquehanna River at Conowingo, Md.	1.299	–23.4	–14.0	–31.8	**<0.001**
38	01594440	Patuxent River near Bowie, Md.	1.434	–10.3	5.2	–23.6	0.181
39	01614500	Conococheague Creek at Fairview, Md.	4.995	–9.5	–1.2	–17.1	**0.026**
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	1.807	–41.7	–6.5	–63.7	**0.025**
41	01668000	Rappahannock River near Fredericksburg, Va.	0.312	–29.6	130.1	–78.5	0.561
42	01673000	Pamunkey River near Hanover, Va.	0.282	6.7	26.6	–10.1	0.457
43	01674500	Mattaponi River near Beulahville, Va.	0.155	23.2	54.0	–1.5	0.068
44	02035000	James River at Cartersville, Va.	0.219	–43.6	14.0	–72.1	0.111
45	02041650	Appomattox River at Matoaca, Va.	0.142	–13.9	10.5	–32.8	0.240
50	02175000	Edisto River near Givhans, S.C.	0.099	14.7	122.3	–40.8	0.685
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.374	49.4	274.1	–40.3	0.391
66	02335870	Sope Creek near Marietta, Ga.	0.523	–11.3	4.9	–25.0	0.162
71	02492000	Bogue Chitto River near Bush, La.	0.243	85.4	262.6	–5.3	0.071
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.862	–41.7	–24.4	–54.9	**<0.001**
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.030	–8.9	15.9	–28.5	0.447
74	04063700	Popple River near Fence, Wis.	0.045	14.0	72.5	–24.7	0.535
76	04087000	Milwaukee River at Milwaukee, Wis.	0.673	49.8	141.6	–7.2	0.098
81	05114000	Souris River near Sherwood, N. Dak.	0.047	41.2	313.1	–51.7	0.528
82	05120000	Souris River near Verendrye, N. Dak.	0.147	–56.3	52.0	–87.4	0.193
88	05514500	Cuivre River near Troy, Mo.	0.329	–30.4	162.4	–81.5	0.593
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.842	–59.4	–36.8	–73.9	**<0.001**
95	07022000	Mississippi River at Thebes, Ill.	2.367	–24.5	–1.7	–42.0	**0.037**
96	06088500	Muddy Creek at Vaughn, Mont.	2.327	–49.1	–26.8	–64.7	**<0.001**
98	06274300	Bighorn River at Basin, Wyo.	0.288	–5.9	80.3	–50.8	0.856
99	06329500	Yellowstone River near Sidney, Mont.	0.171	–47.7	29.8	–78.9	0.162
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.135	–72.6	–53.5	–83.8	**<0.001**
101	06461500	Niobrara River near Sparks, Nebr.	0.262	51.4	130.8	–0.7	0.054
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	0.071	–67.1	25.7	–91.4	0.104
103	06713500	Cherry Creek at Denver, Colo.	2.735	–56.4	–33.7	–71.3	**<0.001**
104	06752260	Cache La Poudre River at Fort Collins, Colo.	0.293	–65.4	–28.5	–83.3	**0.004**
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	0.576	15.1	111.6	–37.4	0.651
106	06753990	Lonetree Creek near Greeley, Colo.	6.915	–1.9	50.4	–36.0	0.931
107	06754000	South Platte River near Kersey, Colo.	4.974	24.5	57.8	–1.7	0.069
108	06775900	Dismal River near Thedford, Nebr.	0.458	8.2	25.8	–7.0	0.308
109	06800000	Maple Creek near Nickerson, Nebr.	6.192	–47.0	–22.1	–63.9	**0.001**
110	06805500	Platte River at Louisville, Nebr.	1.487	–62.0	–22.5	–81.4	**0.008**
111	06817700	Nodaway River near Graham, Mo.	3.433	–92.8	–62.2	–98.6	**0.002**
112	06818000	Missouri River at St. Joseph, Mo.	1.951	–66.8	–47.0	–79.2	**<0.001**
113	06902000	Grand River near Sumner, Mo.	0.431	–74.7	–10.7	–92.8	**0.033**
114	06905500	Chariton River near Prairie Hill, Mo.	0.420	–62.0	19.1	–87.9	0.097
115	06921070	Pomme De Terre River near Polk, Mo.	0.215	–21.4	151.1	–75.4	0.685
116	06926510	Osage River below St. Thomas, Mo.	0.352	–79.9	–58.2	–90.3	**<0.001**
117	06930800	Gasconade River above Jerome, Mo.	0.416	–50.0	–19.0	–69.1	**0.005**
118	06934500	Missouri River at Hermann, Mo.	1.399	–49.0	–23.7	–65.9	**0.001**
119	07047942	L'Anguille River near Colt, Ark.	0.451	–51.3	–11.8	–73.1	**0.018**
120	07053250	Yocum Creek near Oak Grove, Ark.	2.245	86.8	158.1	35.1	**<0.001**
121	07056000	Buffalo River near St Joe, Ark.	0.067	23.4	105.1	–25.8	0.418
122	07060500	White River at Calico Rock, Ark.	0.241	–20.0	20.8	–47.0	0.289
123	07060710	North Sylamore Creek near Fifty Six, Ark.	0.064	–12.5	16.5	–34.3	0.360
124	07066110	Jacks Fork above Two River, Mo.	0.290	17.0	42.6	–3.9	0.118

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
125	07068000	Current River at Doniphan, Mo.	0.282	–27.3	–12.5	–39.6	**0.001**
126	07077500	Cache River at Patterson, Ark.	0.256	–15.4	45.2	–50.7	0.545
127	07077700	Bayou DeView near Morton, Ark.	0.153	63.4	201.1	–11.4	0.116
128	07103700	Fountain Creek near Colorado Springs, Colo.	0.750	5.6	36.9	–18.5	0.681
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	0.127	303.8	813.7	78.5	**0.001**
130	07105500	Fountain Creek at Colorado Springs, Colo.	1.563	22.3	74.9	–14.4	0.269
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	1.665	50.7	95.1	16.4	**0.002**
132	07106300	Fountain Creek near Pinon, Colo.	5.192	–48.5	–34.7	–59.4	**<0.001**
133	07106500	Fountain Creek at Pueblo, Colo.	5.306	–55.0	–46.9	–61.8	**<0.001**
134	07189000	Elk River near Tiff City, Mo.	1.572	2.9	33.9	–20.9	0.829
135	07195500	Illinois River near Watts, Okla.	2.450	–20.0	12.1	–42.8	0.195
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.241	20.1	69.5	–14.8	0.296
137	07196000	Flint Creek near Kansas, Okla.	1.871	51.9	72.6	33.7	**<0.001**
138	07196500	Illinois River near Tahlequah, Okla.	1.684	–23.2	1.7	–42.0	0.065
139	07197000	Baron Fork at Eldon, Okla.	1.033	0.3	39.3	–27.8	0.988
140	07227500	Canadian River near Amarillo, Tex.	0.173	264.3	960.6	25.1	**0.018**
141	07239450	North Canadian River near Calumet, Okla.	0.084	–44.1	53.4	–79.6	0.259
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	0.249	–45.7	2.5	–71.3	0.059
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	0.601	4.1	99.5	–45.7	0.904
144	07241550	North Canadian River near Harrah, Okla.	1.176	56.4	180.7	–12.8	0.134
145	07247015	Poteau River at Loving, Okla.	0.088	35.4	147.2	–25.9	0.324
146	07247250	Black Fork below Big Creek near Page, Okla.	0.063	80.8	220.3	2.0	**0.043**
147	07247345	Black Fork at Hodgen, Okla.	0.033	76.7	233.4	–6.4	0.079
148	07247650	Fourche Maline near Leflore, Okla.	0.093	–24.2	33.8	–57.0	0.340
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.382	–56.3	–20.6	–75.9	**0.007**
150	07331000	Washita River near Dickson, Okla.	0.366	–56.9	14.2	–83.7	0.090
151	07355500	Red River at Alexandria, La.	0.155	–46.2	–10.8	–67.5	**0.016**
152	07362000	Ouachita River at Camden, Ark.	0.126	0.9	60.6	–36.6	0.969
153	07373420	Mississippi River near St Francisville, La.	1.562	–20.8	–4.1	–34.6	**0.017**
154	07375500	Tangipahoa River at Robert, La.	0.366	–30.8	–0.2	–52.0	**0.049**
155	07376000	Tickfaw River at Holden, La.	0.301	–32.3	–6.8	–50.8	**0.017**
156	07381495	Atchafalaya River at Melville, La.	1.123	–20.2	–0.9	–35.7	**0.041**
157	07386980	Vermilion River at Perry, La.	0.376	26.6	95.2	–17.9	0.286
158	08030500	Sabine River near Ruliff, Tex.	0.078	–30.0	8.5	–54.9	0.110
159	08032000	Neches River near Neches, Tex.	0.135	–6.8	63.7	–46.9	0.807
160	08033500	Neches River near Rockland, Tex.	0.184	11.6	92.1	–35.1	0.691
161	08051500	Clear Creek near Sanger, Tex.	0.122	–44.5	106.6	–85.1	0.380
162	08064100	Chambers Creek near Rice, Tex.	0.254	–22.1	110.3	–71.1	0.622
163	08065350	Trinity River near Crockett, Tex.	1.673	23.8	126.4	–32.3	0.489
164	08136500	Concho River at Paint Rock, Tex.	11.897	–99.5	–97.9	–99.9	**<0.001**
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	0.042	52.2	263.0	–36.2	0.344
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	0.063	99.2	272.1	6.6	**0.031**
172	08181800	San Antonio River near Elmendorf, Tex.	8.417	–17.0	34.5	–48.8	0.449
174	09058000	Colorado River near Kremmling, Colo.	0.121	–31.6	23.4	–62.1	0.207

Table 5. Non-flow-adjusted trends in concentration from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
			Nitrate—Continued				
175	09163500	Colorado River near Colorado-Utah State Line	0.579	20.5	54.5	–6.1	0.143
177	09217010	Green River below Green River, Wyo.	0.070	6.2	67.0	–32.5	0.796
181	09413500	Virgin River below First Narrows, Utah	0.901	165.0	347.3	56.9	**<0.001**
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	0.089	–40.1	–15.2	–57.7	**0.004**
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	0.253	14.4	88.1	–30.4	0.596
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	0.112	116.0	239.6	37.4	**0.001**
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	0.039	337.2	700.0	138.9	**<0.001**
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	0.463	–65.2	–46.2	–77.6	**<0.001**
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	0.009	11.0	57.4	–21.8	0.560
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	0.014	–21.6	–2.5	–36.9	**0.029**
197	10336698	Third Creek near Crystal Bay, Nev.	0.017	–67.8	–56.9	–75.9	**<0.001**
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	0.013	10.1	46.8	–17.5	0.514
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.019	4.0	34.8	–19.8	0.767
200	10336700	Incline Creek near Crystal Bay, Nev.	0.021	–1.3	20.5	–19.1	0.901
201	10336740	Logan House Creek near Glenbrook, Nev.	0.004	38.4	323.3	–54.8	0.569
205	07A090	Snohomish River at Snohomish, Wash.	0.236	–7.0	10.8	–21.9	0.419
207	09A190	Green River at Kanaskat, Wash.	0.084	–2.7	34.4	–29.5	0.870
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.587	–24.1	7.3	–46.3	0.118
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.348	–38.2	–17.6	–53.6	**0.001**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.153	–25.8	–8.1	–40.1	**0.006**
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.473	–42.9	–28.9	–54.1	**<0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.152	28.4	93.8	–14.9	0.234
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.161	–13.4	77.7	–57.8	0.694
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.288	–25.6	–13.2	–36.2	**<0.001**
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.446	–11.5	48.2	–47.2	0.642
225	13351000	Palouse River at Hooper, Wash.	1.113	–5.8	56.8	–43.4	0.820
226	14201300	Zollner Creek near Mt. Angel, Oreg.	8.370	12.2	44.0	–12.6	0.368
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.289	–35.2	–13.3	–51.5	**0.003**
229	16A070	Skokomish River near Potlatch, Wash.	0.105	–59.6	–47.4	–69.0	**<0.001**
234	45A070	Wenatchee River at Wenatchee, Wash.	0.064	3.4	53.4	–30.3	0.868
235	45A110	Wenatchee River near Leavenworth, Wash.	0.026	5.1	77.7	–37.8	0.853
237	49A070	Okanogan River at Malott, Wash.	0.023	8.5	87.0	–37.1	0.769
238	54A120	Spokane River at Riverside State Park, Wash.	0.346	56.4	178.1	–12.1	0.128
239	61A070	Columbia River at Northport, Wash.	0.056	0.7	19.7	–15.3	0.938
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	0.053	–50.6	–17.7	–70.4	**0.007**
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.006	10.9	54.5	–20.5	0.543
242	11290000	Tuolumne River at Modesto, Calif.	0.254	170.7	635.3	–0.4	0.051
243	11303500	San Joaquin River near Vernalis, Calif.	0.987	17.1	117.4	–36.9	0.617
244	11447650	Sacramento River at Freeport, Calif.	0.147	–31.7	–7.7	–49.5	**0.013**

[1] Reference value is the concentration that would have been observed on the first day of the period of record under average hydrologic and seasonal conditions.

Table 6. Trends in load from 1993 to 2003.

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus					
1	01122610	Shetucket River at South Windham, Conn.	24.7	33.7	152.9	–29.3	0.372
2	01124000	Quinebaug River at Quinebaug, Conn.	15.4	–5.3	86.7	–52.0	0.874
3	01127000	Quinebaug River at Jewett City, Conn.	87.8	75.0	228.8	–6.9	0.082
4	01184000	Connecticut River at Thompsonville, Conn.	1,067.5	15.2	90.0	–30.1	0.578
5	01184490	Broad Brook at Broad Brook, Conn.	5.0	–31.6	25.7	–62.8	0.221
7	01189995	Farmington River at Tariffville, Conn.	207.1	16.6	65.9	–18.1	0.394
8	01192500	Hockanum River near East Hartford, Conn.	99.4	–27.7	–5.0	–45.0	**0.020**
10	01196500	Quinnipiac River at Wallingford, Conn.	99.8	–24.0	8.1	–46.5	0.127
11	01205500	Housatonic River at Stevenson, Conn.	78.3	5.2	242.2	–67.7	0.933
12	01208500	Naugatuck River at Beacon Falls, Conn.	212.5	52.2	119.1	5.7	**0.024**
13	01208990	Saugatuck River near Redding, Conn.	0.5	48.3	553.1	–66.3	0.602
14	01209710	Norwalk River at Winnipauk, Conn.	2.3	42.6	214.6	–35.4	0.379
15	01357500	Mohawk River at Cohoes, N.Y.	270.9	38.7	169.9	–28.7	0.336
16	01377000	Hackensack River at Rivervale, N.J.	9.7	–7.6	74.3	–51.0	0.806
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.9	–74.7	50.9	–95.8	0.131
18	01387500	Ramapo River near Mahwah, N.J.	28.9	6.5	77.8	–36.2	0.811
19	01389500	Passaic River at Little Falls, N.J.	467.2	–2.5	78.7	–46.8	0.935
20	01391500	Saddle River at Lodi, N.J.	60.4	124.3	246.3	45.2	**<0.001**
22	01395000	Rahway River at Rahway, N.J.	4.0	49.4	193.2	–23.9	0.243
24	01398000	Neshanic River at Reaville, N.J.	1.2	27.5	416.9	–68.5	0.734
25	01402000	Millstone River at Blackwells Mills, N.J.	113.9	15.9	69.0	–20.6	0.444
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	255.1	0.7	44.9	–30.0	0.969
27	01408000	Manasquan River at Squankum, N.J.	13.1	–20.2	91.9	–66.8	0.614
28	01408500	Toms River near Toms River, N.J.	10.5	16.4	265.1	–62.9	0.794
30	01411500	Maurice River at Norma, N.J.	4.3	–13.1	282.5	–80.3	0.852
31	01438500	Delaware River at Montague, N.J.	379.5	–40.4	94.0	–81.7	0.390
32	01443500	Paulins Kill at Blairstown, N.J.	8.6	–16.8	148.0	–72.1	0.742
33	01463500	Delaware River at Trenton, N.J.	1,193.6	–9.9	63.5	–50.4	0.731
34	01467150	Cooper River at Haddonfield, N.J.	10.1	–30.7	12.2	–57.2	0.136
35	01477120	Raccoon Creek near Swedesboro, N.J.	8.3	12.1	105.5	–38.9	0.712
36	01491000	Choptank River near Greensboro, Md.	7.1	205.9	1,211.1	–28.6	0.132
37	01578310	Susquehanna River at Conowingo, Md.	1,396.0	30.3	172.5	–37.7	0.482
38	01594440	Patuxent River near Bowie, Md.	76.5	42.7	214.3	–35.2	0.378
39	01614500	Conococheague Creek at Fairview, Md.	132.9	–27.5	85.7	–71.7	0.503
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	549.2	31.1	445.9	–68.5	0.709
41	01668000	Rappahannock River near Fredericksburg, Va.	89.8	–38.7	278.1	–90.0	0.599
42	01673000	Pamunkey River near Hanover, Va.	98.5	–3.0	188.3	–67.4	0.956
43	01674500	Mattaponi River near Beulahville, Va.	46.9	–56.9	110.9	–91.2	0.299
44	02035000	James River at Cartersville, Va.	1,282.6	–41.8	46.9	–76.9	0.252
45	02041650	Appomattox River at Matoaca, Va.	75.7	–44.6	110.0	–85.4	0.385
46	02085000	Eno River at Hillsborough, N.C.	1.2	43.6	471.3	–63.9	0.608
51	02198500	Savannah River near Clyo, Ga.	3,076.5	–30.5	15.3	–58.1	0.159
52	02213700	Ocmulgee River near Warner Robins, Ga.	765.1	–63.1	–42.1	–76.4	**<0.001**
53	02215500	Ocmulgee River at Lumber City, Ga.	1,473.5	–68.6	–21.9	–87.4	**0.013**
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	1,321.5	–67.8	–30.6	–85.0	**0.004**
55	02226010	Altamaha River near Gardi, Ga.	3,075.5	–55.7	1.5	–80.6	0.054
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	129.0	–52.3	89.4	–88.0	0.293
58	02295420	Payne Creek near Bowling Green, Fla.	122.8	–22.7	225.4	–81.6	0.726
59	02296750	Peace River at Arcadia, Fla.	1,179.6	–38.0	152.9	–84.8	0.505
60	02300700	Bullfrog Creek near Wimauma, Fla.	11.9	–19.7	76.3	–63.4	0.584

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
61	02301300	South Prong Alafia River near Lithia, Fla.	127.3	–64.5	124.6	–94.4	0.271
62	02302500	Blackwater Creek near Knights, Fla.	66.1	–75.3	43.3	–95.8	0.119
63	02303000	Hillsborough River near Zephyrhills, Fla.	102.8	–56.9	122.0	–91.6	0.314
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	97.3	–95.2	–78.4	–98.9	**<0.001**
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	107.9	6.4	218.3	–64.4	0.912
66	02335870	Sope Creek near Marietta, Ga.	1.3	–52.8	27.9	–82.5	0.140
68	02344040	Chattahoochee River near Steam Mill, Ga.	1,917.0	–67.4	–38.0	–82.9	**0.001**
69	02353000	Flint River at Newton, Ga.	714.8	–56.9	–0.9	–81.3	**0.048**
70	02388520	Oostanaula River at Rome, Ga.	1,266.1	–60.0	–31.3	–76.7	**0.001**
71	02492000	Bogue Chitto River near Bush, La.	286.0	–4.7	72.2	–47.3	0.872
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.6	–46.7	92.0	–85.2	0.336
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	49,089.7	32.1	155.8	–31.8	0.409
74	04063700	Popple River near Fence, Wis.	6.1	–51.2	–1.4	–75.8	**0.046**
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	11.0	–59.0	–17.5	–79.6	**0.012**
76	04087000	Milwaukee River at Milwaukee, Wis.	77.8	–11.1	41.8	–44.3	0.621
77	0422026250	Northrup Creek at North Greece, N.Y.	7.2	–8.7	39.1	–40.1	0.672
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	5.4	–49.4	–15.3	–69.8	**0.010**
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	1.2	–35.3	7.5	–61.0	0.093
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	18.0	12.7	72.8	–26.5	0.585
81	05114000	Souris River near Sherwood, N. Dak.	5.5	439.6	4,189.7	–32.1	0.111
82	05120000	Souris River near Verendrye, N. Dak.	28.1	55.5	571.7	–64.0	0.554
83	05287890	Elm Creek near Champlin, Minn.	8.7	–52.2	59.8	–85.7	0.230
84	05427718	Yahara River at Windsor, Wis.	9.7	–59.9	–30.1	–77.0	**0.001**
85	05427948	Pheasant Branch at Middleton, Wis.	3.1	–68.1	–46.9	–80.8	**<0.001**
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	0.5	–22.5	85.3	–67.6	0.567
87	05500000	South Fabius River near Taylor, Mo.	45.1	–87.1	–41.4	–97.2	**0.008**
88	05514500	Cuivre River near Troy, Mo.	60.8	–69.5	62.7	–94.3	0.165
89	05525500	Sugar Creek at Milford, Ill.	26.4	–44.3	176.3	–88.8	0.474
90	05531500	Salt Creek at Western Springs, Ill.	338.8	44.5	83.9	13.5	**0.003**
91	05532500	Des Plaines River at Riverside, Ill.	749.7	45.0	88.3	11.7	**0.005**
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	1.2	–51.3	19.8	–80.2	0.117
93	05586100	Illinois River at Valley City, Ill.	18,788.7	–10.9	55.1	–48.8	0.682
94	07018100	Big River near Richwoods, Mo.	43.6	–64.5	–25.6	–83.1	**0.006**
95	07022000	Mississippi River at Thebes, Ill.	176,092.9	–41.5	6.6	–67.9	0.080
97	06178000	Poplar River at International Boundary, Mont.	0.3	–34.2	172.2	–84.1	0.564
99	06329500	Yellowstone River near Sidney, Mont.	2,177.1	–46.1	42.2	–79.6	0.212
101	06461500	Niobrara River near Sparks, Nebr.	232.7	26.4	79.2	–10.9	0.189
106	06753990	Lonetree Creek near Greeley, Colo.	11.3	–98.2	–89.8	–99.7	**<0.001**
107	06754000	South Platte River near Kersey, Colo.	1,454.4	–25.7	40.4	–60.6	0.361
109	06800000	Maple Creek near Nickerson, Nebr.	61.0	–36.9	82.3	–78.2	0.395
110	06805500	Platte River at Louisville, Nebr.	8,767.3	–26.0	33.8	–59.0	0.320
111	06817700	Nodaway River near Graham, Mo.	806.1	–93.2	–70.3	–98.5	**<0.001**
112	06818000	Missouri River at St. Joseph, Mo.	33,847.8	–29.7	31.4	–62.4	0.270
113	06902000	Grand River near Sumner, Mo.	1,754.8	–87.2	–26.3	–97.8	**0.021**
114	06905500	Chariton River near Prairie Hill, Mo.	663.6	–93.4	–60.4	–98.9	**0.003**
115	06921070	Pomme De Terre River near Polk, Mo.	16.3	–78.2	–26.9	–93.5	**0.014**
118	06934500	Missouri River at Hermann, Mo.	63,637.4	–38.3	40.2	–72.9	0.249
120	07053250	Yocum Creek near Oak Grove, Ark.	3.7	–50.8	–11.3	–72.7	**0.018**
134	07189000	Elk River near Tiff City, Mo.	73.3	38.2	151.9	–24.1	0.290
135	07195500	Illinois River near Watts, Okla.	160.9	8.5	99.6	–41.0	0.792

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
136	07195865	Sager Creek near West Siloam Springs, Okla.	17.7	55.9	149.2	–2.5	0.064
137	07196000	Flint Creek near Kansas, Okla.	22.1	–12.4	72.0	–55.4	0.700
138	07196500	Illinois River near Tahlequah, Okla.	133.8	–10.0	83.5	–55.9	0.772
139	07197000	Baron Fork at Eldon, Okla.	19.5	–59.4	–0.2	–83.5	**0.049**
145	07247015	Poteau River at Loving, Okla.	17.2	–41.8	71.2	–80.2	0.326
148	07247650	Fourche Maline near Leflore, Okla.	5.7	–67.9	5.5	–90.2	0.061
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	8,280.0	–42.4	48.3	–77.6	0.253
150	07331000	Washita River near Dickson, Okla.	1,137.5	–66.3	2.5	–88.9	0.055
151	07355500	Red River at Alexandria, La.	6,494.3	–41.9	54.7	–78.1	0.277
152	07362000	Ouachita River at Camden, Ark.	464.8	–38.4	43.7	–73.6	0.262
153	07373420	Mississippi River near St Francisville, La.	247,836.4	–2.5	44.5	–34.2	0.899
154	07375500	Tangipahoa River at Robert, La.	258.7	–27.8	47.6	–64.7	0.372
155	07376000	Tickfaw River at Holden, La.	49.4	–8.3	70.2	–50.6	0.784
156	07381495	Atchafalaya River at Melville, La.	89,521.1	1.0	52.4	–33.0	0.961
157	07386980	Vermilion River at Perry, La.	565.1	6.2	132.2	–51.4	0.879
165	08143600	Pecan Bayou near Mullin, Tex.	13.5	–45.3	110.1	–85.7	0.380
166	08147000	Colorado River near San Saba, Tex.	45.6	–85.0	–36.3	–96.5	**0.010**
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	0.7	–56.9	4,58.4	–96.7	0.519
170	08162000	Colorado River at Wharton, Tex.	826.8	29.7	257.2	–52.9	0.614
171	08162500	Colorado River near Bay City, Tex.	803.2	–16.1	187.6	–75.5	0.780
173	08251500	Rio Grande near Lobatos, Colo.	86.6	–75.8	5.9	–94.5	0.060
177	09217010	Green River below Green River, Wyo.	90.0	20.3	140.9	–39.9	0.602
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	571.6	–66.3	1.0	–88.7	0.052
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	0.9	50.3	288.2	–41.8	0.401
182	09415000	Virgin River at Littlefield, Ariz.	68.0	–41.2	154.6	–86.4	0.477
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	103.9	–75.3	138.6	–97.4	0.227
184	09498500	Salt River near Roosevelt, Ariz.	16.9	127.0	4,158.2	–87.9	0.584
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	20.6	–36.8	106.1	–80.6	0.447
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	1,985.5	–91.4	–61.7	–98.1	**0.001**
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	411.5	–63.4	50.4	–91.1	0.163
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	10.1	–27.9	33.7	–61.1	0.299
203	01A050	Nooksack River at Brennan, Wash.	152.5	51.9	212.6	–26.2	0.256
204	03A060	Skagit River near Mount Vernon, Wash.	517.6	6.7	169.4	–57.8	0.891
205	07A090	Snohomish River at Snohomish, Wash.	152.9	24.8	170.1	–42.3	0.574
206	09A080	Green River at Tukwila, Wash.	58.5	5.2	84.7	–40.1	0.860
207	09A190	Green River at Kanaskat, Wash.	7.4	200.1	649.7	20.1	**0.019**
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	4,604.1	–21.1	24.9	–50.1	0.312
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	2,126.5	–32.1	14.2	–59.6	0.144
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	1,037.8	–15.5	45.9	–51.0	0.546
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	238.6	–22.6	33.4	–55.1	0.356
212	10411	Deschutes River at Deschutes River Park, Oreg.	1,096.0	–8.7	44.9	–42.5	0.699
213	10555	Willamette River at Marion Street at Salem, Oreg.	2,912.6	–32.3	15.0	–60.1	0.149
214	10611	Willamette River at Hawthorne Bridge, Oreg.	5,385.0	–33.3	0.2	–55.6	0.051
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	16,869.6	–30.1	38.8	–64.8	0.306

Table 6. Trends in load from 1993 to 2003.—Continued

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Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total phosphorus—Continued					
216	10A070	Puyallup River at Meridian Street, Wash.	228.7	106.5	298.1	7.1	**0.030**
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	63.9	–41.7	9.7	–69.0	0.095
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	12.0	–30.6	19.6	–59.7	0.188
219	11478	John Day River at Service Creek, Oreg.	118.8	–63.3	–8.9	–85.2	**0.031**
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	51.7	–19.7	73.9	–62.9	0.578
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	8.6	89.9	278.2	–4.6	0.068
222	12419000	Spokane River near Post Falls, Idaho	107.9	–44.1	92.7	–83.8	0.357
223	13154500	Snake River at King Hill, Idaho	1,759.9	–27.4	13.8	–53.6	0.163
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	141.8	36.1	118.5	–15.2	0.202
225	13351000	Palouse River at Hooper, Wash.	101.6	–40.1	129.4	–84.3	0.455
227	14211720	Willamette River at Portland, Oreg.	3,996.4	–3.1	54.4	–39.1	0.896
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	17,761.9	–5.7	95.1	–54.4	0.875
229	16A070	Skokomish River near Potlatch, Wash.	15.9	136.2	416.5	8.0	**0.031**
230	32A070	Walla Walla River near Touchet, Wash.	71.2	–8.4	67.1	–49.8	0.776
231	3701002	Tualatin River at Weiss Bridge, Oreg.	319.9	–30.2	41.1	–65.4	0.317
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	23.3	–32.5	38.3	–67.1	0.283
233	37A090	Yakima River at Kiona, Wash.	645.6	15.2	167.0	–50.3	0.742
234	45A070	Wenatchee River at Wenatchee, Wash.	17.7	45.9	371.6	–54.9	0.528
235	45A110	Wenatchee River near Leavenworth, Wash.	20.5	7.4	246.0	–66.7	0.905
236	48A070	Methow River near Pateros, Wash.	6.3	64.2	317.9	–35.5	0.298
237	49A070	Okanogan River at Malott, Wash.	98.8	–39.1	79.3	–79.3	0.368
238	54A120	Spokane River at Riverside State Park, Wash.	195.0	32.8	161.6	–32.6	0.412
239	61A070	Columbia River at Northport, Wash.	2,516.8	–31.9	41.3	–67.1	0.303
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	9.5	–7.7	145.6	–65.3	0.873
242	11290000	Tuolumne River at Modesto, Calif.	146.6	–18.9	101.1	–67.3	0.651
243	11303500	San Joaquin River near Vernalis, Calif.	2,217.1	–19.6	126.3	–71.4	0.680
244	11447650	Sacramento River at Freeport, Calif.	2,100.3	48.8	208.8	–28.3	0.286
		Total nitrogen					
1	01122610	Shetucket River at South Windham, Conn.	713.2	–11.5	42.9	–45.2	0.618
2	01124000	Quinebaug River at Quinebaug, Conn.	228.7	10.0	75.4	–31.0	0.689
3	01127000	Quinebaug River at Jewett City, Conn.	1,755.0	–7.5	51.7	–43.6	0.758
4	01184000	Connecticut River at Thompsonville, Conn.	20,452.8	–5.6	28.3	–30.6	0.712
5	01184490	Broad Brook at Broad Brook, Conn.	233.2	–17.5	11.2	–38.8	0.206
6	01188090	Farmington River at Unionville, Conn.	377.6	8.6	85.1	–36.2	0.761
7	01189995	Farmington River at Tariffville, Conn.	2,412.9	–7.9	25.2	–32.2	0.598
8	01192500	Hockanum River near East Hartford, Conn.	947.7	–17.1	6.9	–35.7	0.149
9	01193500	Salmon River near East Hampton, Conn.	111.0	1.2	110.3	–51.3	0.974
10	01196500	Quinnipiac River at Wallingford, Conn.	1,328.9	–8.4	19.9	–30.0	0.524
11	01205500	Housatonic River at Stevenson, Conn.	2,492.3	6.8	114.3	–46.7	0.852
12	01208500	Naugatuck River at Beacon Falls, Conn.	2,334.6	–55.9	–42.0	–66.4	**<0.001**
13	01208990	Saugatuck River near Redding, Conn.	12.6	64.5	301.9	–32.7	0.275
14	01209710	Norwalk River at Winnipauk, Conn.	48.4	23.2	154.1	–40.3	0.572
15	01357500	Mohawk River at Cohoes, N.Y.	8,255.2	10.7	72.1	–28.8	0.652
16	01377000	Hackensack River at Rivervale, N.J.	153.1	–13.1	37.1	–45.0	0.545
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	18.3	–34.4	157.8	–83.3	0.546
18	01387500	Ramapo River near Mahwah, N.J.	371.2	8.3	73.7	–32.4	0.740
19	01389500	Passaic River at Little Falls, N.J.	4,200.5	–28.2	36.9	–62.4	0.314
20	01391500	Saddle River at Lodi, N.J.	953.1	29.9	94.0	–13.1	0.202
21	01394500	Rahway River near Springfield, N.J.	70.7	18.4	92.9	–27.4	0.499
22	01395000	Rahway River at Rahway, N.J.	79.3	10.0	96.1	–38.3	0.746

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	30.5	–10.0	68.2	–51.9	0.741
24	01398000	Neshanic River at Reaville, N.J.	50.7	–11.6	227.3	–76.1	0.853
25	01402000	Millstone River at Blackwells Mills, N.J.	1,709.8	–3.9	46.6	–37.1	0.852
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	3,680.5	–3.5	47.2	–36.7	0.870
29	01409500	Batsto River at Batsto, N.J.	99.8	–40.1	16.2	–69.1	0.129
31	01438500	Delaware River at Montague, N.J.	4,559.0	–18.4	34.3	–50.4	0.423
32	01443500	Paulins Kill at Blairstown, N.J.	325.7	–16.7	94.6	–64.3	0.673
33	01463500	Delaware River at Trenton, N.J.	26,572.9	–17.5	36.2	–50.0	0.452
34	01467150	Cooper River at Haddonfield, N.J.	47.0	–27.4	7.3	–50.8	0.108
35	01477120	Raccoon Creek near Swedesboro, N.J.	117.8	–4.6	47.0	–38.0	0.832
36	01491000	Choptank River near Greensboro, Md.	237.3	75.3	407.3	–39.5	0.301
37	01578310	Susquehanna River at Conowingo, Md.	100,777.9	–28.2	22.7	–58.0	0.226
38	01594440	Patuxent River near Bowie, Md.	1,380.1	1.7	82.3	–43.3	0.955
39	01614500	Conococheague Creek at Fairview, Md.	6,336.5	–39.0	37.7	–73.0	0.234
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	37,023.5	–39.6	122.2	–83.6	0.448
41	01668000	Rappahannock River near Fredericksburg, Va.	1,618.4	–32.4	208.8	–85.2	0.613
42	01673000	Pamunkey River near Hanover, Va.	968.7	–32.4	116.5	–78.9	0.510
43	01674500	Mattaponi River near Beulahville, Va.	501.5	–49.0	139.4	–89.1	0.393
44	02035000	James River at Cartersville, Va.	6,074.1	–33.4	93.8	–77.1	0.456
45	02041650	Appomattox River at Matoaca, Va.	961.9	–28.4	134.5	–78.1	0.581
46	02085000	Eno River at Hillsborough, N.C.	30.8	19.0	314.0	–65.8	0.785
47	02089500	Neuse River at Kinston, N.C.	6,248.6	–22.4	63.1	–63.1	0.503
48	02091500	Contentnea Creek at Hookerton, N.C.	1,095.9	33.7	226.2	–45.2	0.524
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	5,800.4	–5.5	122.4	–59.8	0.897
52	02213700	Ocmulgee River near Warner Robins, Ga.	5,825.2	–36.2	0.8	–59.5	0.054
53	02215500	Ocmulgee River at Lumber City, Ga.	12,295.7	–51.3	–4.1	–75.2	**0.037**
57	02271500	Josephine Creek near De Soto City, Fla.	66.0	32.0	314.5	–58.0	0.635
58	02295420	Payne Creek near Bowling Green, Fla.	343.5	–44.1	84.8	–83.1	0.340
59	02296750	Peace River at Arcadia, Fla.	2,210.8	–37.9	187.6	–86.6	0.542
60	02300700	Bullfrog Creek near Wimauma, Fla.	41.0	–11.5	83.4	–57.2	0.743
61	02301300	South Prong Alafia River near Lithia, Fla.	146.0	–37.4	193.5	–86.6	0.553
62	02302500	Blackwater Creek near Knights, Fla.	139.6	–67.2	86.4	–94.2	0.209
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	703.5	15.9	345.8	–69.9	0.830
67	02338000	Chattahoochee River near Whitesburg, Ga.	13,838.9	–23.8	10.2	–47.3	0.148
71	02492000	Bogue Chitto River near Bush, La.	3,334.4	–38.6	54.5	–75.6	0.300
72	03353637	Little Buck Creek near Indianapolis, Ind.	27.7	–55.0	32.2	–84.7	0.146
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	812,588.8	–3.6	54.3	–39.7	0.879
74	04063700	Popple River near Fence, Wis.	104.0	–25.9	14.0	–51.8	0.173
76	04087000	Milwaukee River at Milwaukee, Wis.	1,621.8	–7.1	43.3	–39.8	0.740
81	05114000	Souris River near Sherwood, N. Dak.	26.3	612.1	5,638.1	–11.6	0.065
82	05120000	Souris River near Verendrye, N. Dak.	159.0	87.3	735.8	–58.0	0.411
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	25.2	–63.1	–11.0	–84.7	**0.027**
95	07022000	Mississippi River at Thebes, Ill.	2,473,864.5	–59.7	–34.3	–75.2	**<0.001**
97	06178000	Poplar River at International Boundary, Mont.	5.7	–13.2	201.6	–75.0	0.824
99	06329500	Yellowstone River near Sidney, Mont.	17,700.9	–36.3	21.1	–66.5	0.169
100	06338490	Missouri River at Garrison Dam, N. Dak.	8,511.6	54.9	250.1	–31.5	0.293
101	06461500	Niobrara River near Sparks, Nebr.	848.9	53.4	128.4	3.0	**0.035**
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	43.5	135.9	1,506.8	–65.4	0.381
103	06713500	Cherry Creek at Denver, Colo.	203.1	–30.8	9.0	–56.0	0.113
106	06753990	Lonetree Creek near Greeley, Colo.	347.6	–93.9	–84.3	–97.6	**<0.001**

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
107	06754000	South Platte River near Kersey, Colo.	14,303.8	–29.6	15.7	–57.2	0.166
108	06775900	Dismal River near Thedford, Nebr.	373.4	11.9	36.1	–8.0	0.262
109	06800000	Maple Creek near Nickerson, Nebr.	1,789.4	–72.8	–32.8	–89.0	**0.005**
110	06805500	Platte River at Louisville, Nebr.	74,129.1	–56.5	–24.8	–74.9	**0.003**
111	06817700	Nodaway River near Graham, Mo.	13,102.7	–97.0	–87.0	–99.3	**<0.001**
112	06818000	Missouri River at St. Joseph, Mo.	512,446.0	–70.2	–53.5	–80.9	**<0.001**
113	06902000	Grand River near Sumner, Mo.	15,003.1	–93.2	–66.0	–98.6	**0.001**
114	06905500	Chariton River near Prairie Hill, Mo.	5,279.4	–93.3	–70.6	–98.5	**<0.001**
115	06921070	Pomme De Terre River near Polk, Mo.	188.8	–73.6	–7.5	–92.4	**0.037**
116	06926510	Osage River below St. Thomas, Mo.	25,153.3	–89.0	–63.4	–96.7	**<0.001**
118	06934500	Missouri River at Hermann, Mo.	690,237.8	–67.1	–40.0	–82.0	**<0.001**
120	07053250	Yocum Creek near Oak Grove, Ark.	239.0	–30.0	20.0	–59.1	0.195
124	07066110	Jacks Fork above Two River, Mo.	539.4	–52.7	–25.9	–69.8	**0.001**
125	07068000	Current River at Doniphan, Mo.	3,386.9	–63.4	–44.9	–75.7	**<0.001**
134	07189000	Elk River near Tiff City, Mo.	3,076.2	–63.6	–20.9	–83.3	**0.011**
135	07195500	Illinois River near Watts, Okla.	3,615.6	–50.4	–12.2	–72.0	**0.016**
136	07195865	Sager Creek near West Siloam Springs, Okla.	236.8	–5.2	53.5	–41.4	0.829
137	07196000	Flint Creek near Kansas, Okla.	452.7	–26.2	32.8	–59.0	0.311
138	07196500	Illinois River near Tahlequah, Okla.	3,678.5	–54.7	–7.9	–77.7	**0.029**
139	07197000	Baron Fork at Eldon, Okla.	727.1	–60.8	–13.1	–82.3	**0.021**
145	07247015	Poteau River at Loving, Okla.	70.8	–23.9	109.7	–72.4	0.598
146	07247250	Black Fork below Big Creek near Page, Okla.	43.7	–62.8	45.4	–90.5	0.155
147	07247345	Black Fork at Hodgen, Okla.	44.5	–59.6	60.9	–89.8	0.199
148	07247650	Fourche Maline near Leflore, Okla.	69.4	–67.0	–2.5	–88.8	**0.045**
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	86,502.2	–60.2	–8.2	–82.8	**0.031**
150	07331000	Washita River near Dickson, Okla.	5,642.1	–64.2	–15.5	–84.8	**0.019**
151	07355500	Red River at Alexandria, La.	49,016.7	–12.5	92.7	–60.3	0.740
152	07362000	Ouachita River at Camden, Ark.	3,570.6	29.4	167.7	–37.4	0.487
153	07373420	Mississippi River near St Francisville, La.	2,958,811.0	–38.4	–11.8	–57.0	**0.008**
154	07375500	Tangipahoa River at Robert, La.	2,098.0	–49.5	15.5	–78.0	0.106
155	07376000	Tickfaw River at Holden, La.	582.4	–53.6	0.0	–78.5	**0.050**
156	07381495	Atchafalaya River at Melville, La.	1,071,142.5	–39.6	–15.2	–57.0	**0.004**
157	07386980	Vermilion River at Perry, La.	3,615.4	–13.4	66.5	–54.9	0.667
173	08251500	Rio Grande near Lobatos, Colo.	489.8	–75.7	–15.6	–93.0	**0.026**
176	09211200	Green River below Fontenelle Reservoir, Wyo.	797.3	–18.7	66.4	–60.3	0.571
179	09380000	Colorado River at Lees Ferry, Ariz.	12,388.6	–1.6	58.8	–39.0	0.947
182	09415000	Virgin River at Littlefield, Ariz.	547.7	–50.3	49.2	–83.4	0.213
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	25.4	–33.7	150.8	–82.4	0.545
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	3.1	–20.7	370.9	–86.6	0.799
201	10336740	Logan House Creek near Glenbrook, Nev.	0.2	101.6	2,527.9	–84.5	0.593
202	10336760	Edgewood Creek at Stateline, Nev.	2.7	–12.6	267.9	–79.2	0.854
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	63,781.1	–33.3	12.7	–60.5	0.131
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	22,459.5	–56.6	–31.3	–72.6	**<0.001**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	9,822.5	–54.7	–27.1	–71.8	**0.001**
212	10411	Deschutes River at Deschutes River Park, Oreg.	4,325.5	–24.3	15.3	–50.3	0.195
213	10555	Willamette River at Marion Street at Salem, Oreg.	41,756.6	–58.5	–35.2	–73.4	**<0.001**
214	10611	Willamette River at Hawthorne Bridge, Oreg.	77,155.4	–47.7	–16.9	–67.1	**0.006**

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Total nitrogen—Continued					
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	193,915.3	–33.4	19.2	–62.8	0.171
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	800.3	–57.9	–23.2	–76.9	**0.005**
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	613.9	–43.2	–17.0	–61.1	**0.003**
219	11478	John Day River at Service Creek, Oreg.	865.5	–66.1	–27.2	–84.2	**0.006**
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	1,344.9	–31.0	6.7	–55.4	0.095
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	183.1	14.9	85.4	–28.8	0.570
222	12419000	Spokane River near Post Falls, Idaho	1,320.8	1.0	101.7	–49.4	0.978
223	13154500	Snake River at King Hill, Idaho	38,562.4	–18.7	16.0	–43.0	0.254
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	951.1	22.3	117.9	–31.4	0.495
225	13351000	Palouse River at Hooper, Wash.	903.2	32.4	360.3	–61.9	0.659
227	14211720	Willamette River at Portland, Oreg.	51,090.1	–17.9	34.4	–49.8	0.433
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	269,349.9	–20.4	30.5	–51.4	0.366
231	3701002	Tualatin River at Weiss Bridge, Oreg.	4,963.9	8.8	93.6	–38.9	0.775
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	328.8	–22.4	63.7	–63.2	0.506
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	148.3	–15.5	92.3	–62.9	0.688
242	11290000	Tuolumne River at Modesto, Calif.	784.8	115.7	207.6	51.3	**<0.001**
243	11303500	San Joaquin River near Vernalis, Calif.	16,922.7	–10.0	80.0	–55.0	0.766
244	11447650	Sacramento River at Freeport, Calif.	12,908.4	40.7	153.7	–22.0	0.257
		Nitrate					
1	01122610	Shetucket River at South Windham, Conn.	466.0	–29.7	7.8	–54.2	0.106
2	01124000	Quinebaug River at Quinebaug, Conn.	109.8	–7.8	41.7	–40.1	0.710
3	01127000	Quinebaug River at Jewett City, Conn.	907.9	–22.2	39.7	–56.7	0.400
4	01184000	Connecticut River at Thompsonville, Conn.	10,733.3	–2.4	29.8	–26.6	0.868
5	01184490	Broad Brook at Broad Brook, Conn.	205.1	–14.3	11.3	–34.1	0.246
6	01188090	Farmington River at Unionville, Conn.	255.1	–40.5	–13.3	–59.2	**0.007**
7	01189995	Farmington River at Tariffville, Conn.	1,508.4	–11.2	12.1	–29.6	0.318
8	01192500	Hockanum River near East Hartford, Conn.	687.6	–13.3	11.7	–32.7	0.271
9	01193500	Salmon River near East Hampton, Conn.	74.5	–34.1	39.7	–68.9	0.277
10	01196500	Quinnipiac River at Wallingford, Conn.	1,078.3	–17.8	2.8	–34.3	0.086
11	01205500	Housatonic River at Stevenson, Conn.	1,289.9	7.4	127.4	–49.3	0.852
12	01208500	Naugatuck River at Beacon Falls, Conn.	973.7	–24.4	–0.3	–42.7	**0.048**
13	01208990	Saugatuck River near Redding, Conn.	4.8	9.3	186.4	–58.3	0.856
14	01209710	Norwalk River at Winnipauk, Conn.	28.9	–2.2	116.2	–55.7	0.957
15	01357500	Mohawk River at Cohoes, N.Y.	5,427.1	9.4	74.9	–31.6	0.707
16	01377000	Hackensack River at Rivervale, N.J.	68.6	–39.5	1.0	–63.7	0.054
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	6.8	–29.8	155.8	–80.7	0.592
18	01387500	Ramapo River near Mahwah, N.J.	312.8	7.1	67.0	–31.3	0.761
19	01389500	Passaic River at Little Falls, N.J.	3,429.6	–34.7	13.3	–62.3	0.130
20	01391500	Saddle River at Lodi, N.J.	735.0	34.3	93.4	–6.7	0.113
21	01394500	Rahway River near Springfield, N.J.	55.5	20.8	102.9	–28.1	0.476
22	01395000	Rahway River at Rahway, N.J.	48.9	20.8	123.6	–34.8	0.548
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	26.1	–17.5	49.6	–54.5	0.526
24	01398000	Neshanic River at Reaville, N.J.	40.5	–12.7	385.2	–84.3	0.877
25	01402000	Millstone River at Blackwells Mills, N.J.	1,404.9	–11.0	27.9	–38.1	0.528
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	2,988.1	–4.1	43.0	–35.7	0.839
29	01409500	Batsto River at Batsto, N.J.	43.6	–69.8	–44.5	–83.5	**<0.001**
31	01438500	Delaware River at Montague, N.J.	2,761.8	–40.6	1.0	–65.0	0.055
32	01443500	Paulins Kill at Blairstown, N.J.	269.5	–21.3	117.2	–71.4	0.644
33	01463500	Delaware River at Trenton, N.J.	20,884.3	–23.5	23.1	–52.5	0.269

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
34	01467150	Cooper River at Haddonfield, N.J.	17.8	–51.2	–19.3	–70.5	**0.005**
35	01477120	Raccoon Creek near Swedesboro, N.J.	99.3	–35.2	7.3	–60.8	0.092
36	01491000	Choptank River near Greensboro, Md.	211.9	47.8	281.9	–42.8	0.420
37	01578310	Susquehanna River at Conowingo, Md.	85,810.9	–39.3	4.6	–64.8	0.072
38	01594440	Patuxent River near Bowie, Md.	955.5	–9.3	50.9	–45.5	0.708
39	01614500	Conococheague Creek at Fairview, Md.	5,844.6	–42.7	22.8	–73.2	0.152
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	33,032.7	–56.7	86.7	–89.9	0.262
41	01668000	Rappahannock River near Fredericksburg, Va.	842.3	–59.5	289.6	–95.8	0.434
42	01673000	Pamunkey River near Hanover, Va.	426.2	–43.2	54.8	–79.2	0.269
43	01674500	Mattaponi River near Beulahville, Va.	127.2	–43.0	113.5	–84.8	0.405
44	02035000	James River at Cartersville, Va.	2,747.3	–63.1	54.0	–91.1	0.172
45	02041650	Appomattox River at Matoaca, Va.	235.0	–44.9	50.4	–79.8	0.245
50	02175000	Edisto River near Givhans, S.C.	576.7	–43.0	–5.9	–65.5	**0.028**
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	278.3	22.4	172.6	–45.0	0.620
66	02335870	Sope Creek near Marietta, Ga.	41.7	–43.2	3.4	–68.8	0.064
71	02492000	Bogue Chitto River near Bush, La.	993.5	27.8	227.6	–50.2	0.610
72	03353637	Little Buck Creek near Indianapolis, Ind.	22.2	–68.9	–13.9	–88.8	**0.025**
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	623,006.8	–25.2	19.7	–53.3	0.226
74	04063700	Popple River near Fence, Wis.	10.4	–24.8	25.8	–55.0	0.277
76	04087000	Milwaukee River at Milwaukee, Wis.	629.2	8.0	136.3	–50.6	0.847
81	05114000	Souris River near Sherwood, N. Dak.	0.6	1,219.4	21,128.4	–18.0	0.069
82	05120000	Souris River near Verendrye, N. Dak.	15.2	–21.2	530.1	–90.2	0.822
88	05514500	Cuivre River near Troy, Mo.	143.6	–72.4	152.3	–97.0	0.254
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	13.1	–75.5	–32.7	–91.1	**0.006**
95	07022000	Mississippi River at Thebes, Ill.	1,815,610.3	–65.0	–40.9	–79.3	**<0.001**
96	06088500	Muddy Creek at Vaughn, Mont.	455.3	–53.3	–30.7	–68.5	**<0.001**
98	06274300	Bighorn River at Basin, Wyo.	1,385.5	–56.3	–32.8	–71.5	**<0.001**
99	06329500	Yellowstone River near Sidney, Mont.	4,962.6	–73.5	–16.4	–91.6	**0.024**
100	06338490	Missouri River at Garrison Dam, N. Dak.	5,929.0	–69.8	–25.0	–87.8	**0.010**
101	06461500	Niobrara River near Sparks, Nebr.	504.1	43.4	122.2	–7.5	0.107
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	1.9	–25.9	1081.4	–95.4	0.832
103	06713500	Cherry Creek at Denver, Colo.	146.0	–39.9	–19.1	–55.3	**0.001**
104	06752260	Cache La Poudre River at Fort Collins, Colo.	32.7	–80.4	–58.0	–90.8	**<0.001**
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	42.3	–56.2	38.1	–86.1	0.159
106	06753990	Lonetree Creek near Greeley, Colo.	248.1	–93.3	–85.0	–97.0	**<0.001**
107	06754000	South Platte River near Kersey, Colo.	11,468.1	–31.2	10.0	–57.0	0.118
108	06775900	Dismal River near Thedford, Nebr.	238.9	15.4	35.4	–1.6	0.077
109	06800000	Maple Creek near Nickerson, Nebr.	1,851.1	–83.8	–60.8	–93.3	**<0.001**
110	06805500	Platte River at Louisville, Nebr.	41,578.2	–85.2	–61.0	–94.3	**<0.001**
111	06817700	Nodaway River near Graham, Mo.	8,367.0	–99.3	–91.4	–99.9	**<0.001**
112	06818000	Missouri River at St. Joseph, Mo.	306,902.8	–81.1	–65.0	–89.8	**<0.001**
113	06902000	Grand River near Sumner, Mo.	3,650.1	–97.1	–71.5	–99.7	**0.002**
114	06905500	Chariton River near Prairie Hill, Mo.	1,363.0	–95.6	–58.9	–99.5	**0.006**
115	06921070	Pomme De Terre River near Polk, Mo.	73.3	–77.9	45.0	–96.6	0.116
116	06926510	Osage River below St. Thomas, Mo.	11,602.8	–96.8	–85.2	–99.3	**<0.001**
117	06930800	Gasconade River above Jerome, Mo.	2,262.0	–83.4	–58.3	–93.4	**<0.001**
118	06934500	Missouri River at Hermann, Mo.	477,034.2	–80.9	–62.4	–90.2	**<0.001**
119	07047942	L'Anguille River near Colt, Ark.	234.9	–26.5	61.7	–66.5	0.445
120	07053250	Yocum Creek near Oak Grove, Ark.	212.2	–22.7	38.9	–57.0	0.389

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
121	07056000	Buffalo River near St Joe, Ark.	75.2	–37.4	82.3	–78.5	0.390
122	07060500	White River at Calico Rock, Ark.	7,572.9	–73.8	–36.1	–89.2	**0.003**
123	07060710	North Sylamore Creek near Fifty Six, Ark.	3.5	–60.1	–23.7	–79.1	**0.005**
124	07066110	Jacks Fork above Two River, Mo.	349.2	–45.4	–14.6	–65.1	**0.008**
125	07068000	Current River at Doniphan, Mo.	2,237.4	–62.2	–41.7	–75.4	**<0.001**
126	07077500	Cache River at Patterson, Ark.	346.6	–29.3	55.5	–67.9	0.388
127	07077700	Bayou DeView near Morton, Ark.	26.7	353.1	1,463.1	31.3	**0.017**
128	07103700	Fountain Creek near Colorado Springs, Colo.	33.8	–43.6	24.7	–74.5	0.157
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	2.4	246.7	791.7	34.8	**0.010**
130	07105500	Fountain Creek at Colorado Springs, Colo.	221.8	–13.8	65.4	–55.1	0.654
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	476.5	35.8	103.0	–9.2	0.136
132	07106300	Fountain Creek near Pinon, Colo.	1,533.4	–46.3	14.8	–74.8	0.109
133	07106500	Fountain Creek at Pueblo, Colo.	1,698.0	–56.0	–13.1	–77.7	**0.018**
134	07189000	Elk River near Tiff City, Mo.	2,808.9	–62.6	–16.6	–83.2	**0.016**
135	07195500	Illinois River near Watts, Okla.	3,516.5	–58.7	–26.1	–76.9	**0.003**
136	07195865	Sager Creek near West Siloam Springs, Okla.	222.0	–3.7	53.5	–39.6	0.873
137	07196000	Flint Creek near Kansas, Okla.	450.8	–26.0	31.0	–58.2	0.301
138	07196500	Illinois River near Tahlequah, Okla.	3,597.3	–61.7	–21.1	–81.4	**0.009**
139	07197000	Baron Fork at Eldon, Okla.	728.8	–61.8	–15.6	–82.7	**0.017**
140	07227500	Canadian River near Amarillo, Tex.	33.1	–33.7	417.8	–91.5	0.695
141	07239450	North Canadian River near Calumet, Okla.	31.9	–63.9	162.5	–95.0	0.314
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	143.1	–88.4	–28.4	–98.1	**0.020**
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	543.7	–53.6	–6.2	–77.1	**0.032**
144	07241550	North Canadian River near Harrah, Okla.	1,563.3	–18.0	23.6	–45.6	0.344
145	07247015	Poteau River at Loving, Okla.	14.1	–9.2	208.6	–73.3	0.878
146	07247250	Black Fork below Big Creek near Page, Okla.	8.6	–24.7	270.7	–84.7	0.727
147	07247345	Black Fork at Hodgen, Okla.	4.6	–26.5	254.6	–84.7	0.702
148	07247650	Fourche Maline near Leflore, Okla.	10.4	–75.5	–0.7	–93.9	**0.049**
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	39,163.4	–82.9	–51.5	–94.0	**0.001**
150	07331000	Washita River near Dickson, Okla.	2,068.8	–87.9	–48.6	–97.1	**0.004**
151	07355500	Red River at Alexandria, La.	10,592.5	–55.1	21.7	–83.4	0.115
152	07362000	Ouachita River at Camden, Ark.	1,444.2	–14.6	94.7	–62.5	0.708
153	07373420	Mississippi River near St Francisville, La.	2,204,310.2	–47.0	–21.2	–64.4	**0.002**
154	07375500	Tangipahoa River at Robert, La.	846.8	–50.8	9.5	–77.9	0.082
155	07376000	Tickfaw River at Holden, La.	201.3	–57.4	–12.2	–79.4	**0.021**
156	07381495	Atchafalaya River at Melville, La.	687,594.0	–47.2	–22.2	–64.2	**0.001**
157	07386980	Vermilion River at Perry, La.	724.2	32.0	147.4	–29.5	0.386
158	08030500	Sabine River near Ruliff, Tex.	1,136.0	–36.3	28.4	–68.3	0.207
159	08032000	Neches River near Neches, Tex.	135.7	–25.4	87.6	–70.3	0.534
160	08033500	Neches River near Rockland, Tex.	561.9	2.2	140.3	–56.6	0.961
161	08051500	Clear Creek near Sanger, Tex.	13.2	–94.3	101.9	–99.8	0.115
162	08064100	Chambers Creek near Rice, Tex.	21.8	–35.8	1,108.6	–96.6	0.767
163	08065350	Trinity River near Crockett, Tex.	20,455.8	–28.8	38.7	–63.5	0.318
164	08136500	Concho River at Paint Rock, Tex.	2,164.9	–100.0	–99.9	–100.0	**<0.001**
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	0.2	693.9	29,857.9	–79.0	0.263

Table 6. Trends in load from 1993 to 2003.—Continued

[See Appendix 3 for more detail on the trend model. CI, confidence interval; <, less than. Bold p-values indicate statistical significance at the α=0.05 level.]

Site number (figure 1)	Station number	Station name	Reference load, in kilograms per day[1]	Trend, in percent from 1993 to 2003			p-value
				Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	
		Nitrate—Continued					
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	0.4	637.6	13,902.3	–61.2	0.183
172	08181800	San Antonio River near Elmendorf, Tex.	5,777.2	38.2	101.8	–5.3	0.094
174	09058000	Colorado River near Kremmling, Colo.	284.9	–55.5	24.2	–84.0	0.122
175	09163500	Colorado River near Colorado-Utah State Line	10,028.4	–45.9	–22.2	–62.4	**0.001**
177	09217010	Green River below Green River, Wyo.	248.9	–32.9	19.0	–62.2	0.173
181	09413500	Virgin River below First Narrows, Utah	473.6	–32.8	10.7	–59.1	0.119
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	69.8	–68.1	–3.6	–89.4	**0.043**
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	34.0	–46.4	–5.1	–69.7	**0.032**
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	39.0	35.6	132.9	–21.0	0.269
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	18.0	137.0	391.4	14.3	**0.020**
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	151.3	–36.3	4.4	–61.1	0.073
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	0.4	–29.1	58.9	–68.3	0.404
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	1.3	–44.3	53.3	–79.8	0.258
197	10336698	Third Creek near Crystal Bay, Nev.	0.3	–82.5	–55.2	–93.1	**<0.001**
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	0.1	15.2	309.7	–67.6	0.827
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.2	–9.4	201.1	–72.7	0.872
200	10336700	Incline Creek near Crystal Bay, Nev.	0.4	–37.5	53.1	–74.5	0.304
201	10336740	Logan House Creek near Glenbrook, Nev.	0.0	186.3	1,474.1	–47.9	0.226
205	07A090	Snohomish River at Snohomish, Wash.	4,071.6	–7.8	38.5	–38.6	0.694
207	09A190	Green River at Kanaskat, Wash.	123.5	–15.1	46.3	–50.7	0.556
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	38,708.1	–35.4	12.7	–62.9	0.124
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	9,869.7	–47.5	–16.2	–67.0	**0.007**
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	3,494.3	–34.0	0.1	–56.5	0.051
213	10555	Willamette River at Marion Street at Salem, Oreg.	21,656.5	–51.3	–25.2	–68.3	**0.001**
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	63,995.8	19.3	129.4	–37.9	0.596
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	128.5	–35.7	39.1	–70.3	0.262
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	578.3	–42.4	–15.8	–60.6	**0.004**
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	750.9	–12.1	62.2	–52.4	0.680
225	13351000	Palouse River at Hooper, Wash.	577.5	16.9	383.5	–71.7	0.829
226	14201300	Zollner Creek near Mt. Angel, Oreg.	134.4	–38.7	59.3	–76.4	0.315
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	164,026.5	–43.3	0.1	–67.9	0.050
229	16A070	Skokomish River near Potlatch, Wash.	177.0	–55.1	–27.3	–72.2	**0.001**
234	45A070	Wenatchee River at Wenatchee, Wash.	302.1	–1.1	49.5	–34.6	0.957
235	45A110	Wenatchee River near Leavenworth, Wash.	117.0	0.5	204.1	–66.8	0.993
237	49A070	Okanogan River at Malott, Wash.	138.1	–32.4	56.2	–70.8	0.359
238	54A120	Spokane River at Riverside State Park, Wash.	3,664.7	46.2	89.3	12.9	**0.004**
239	61A070	Columbia River at Northport, Wash.	12,434.4	2.7	50.4	–29.8	0.889
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	21.9	–72.7	–21.4	–90.5	**0.016**
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	105.3	–11.6	88.6	–58.6	0.750
242	11290000	Tuolumne River at Modesto, Calif.	529.0	115.1	197.6	55.4	**<0.001**
243	11303500	San Joaquin River near Vernalis, Calif.	8,323.0	–3.5	54.0	–39.5	0.881
244	11447650	Sacramento River at Freeport, Calif.	7,982.7	–35.7	10.2	–62.4	0.108

[1] Reference value is the load that would have been observed on the first day of the period of record under average hydrologic and seasonal conditions.

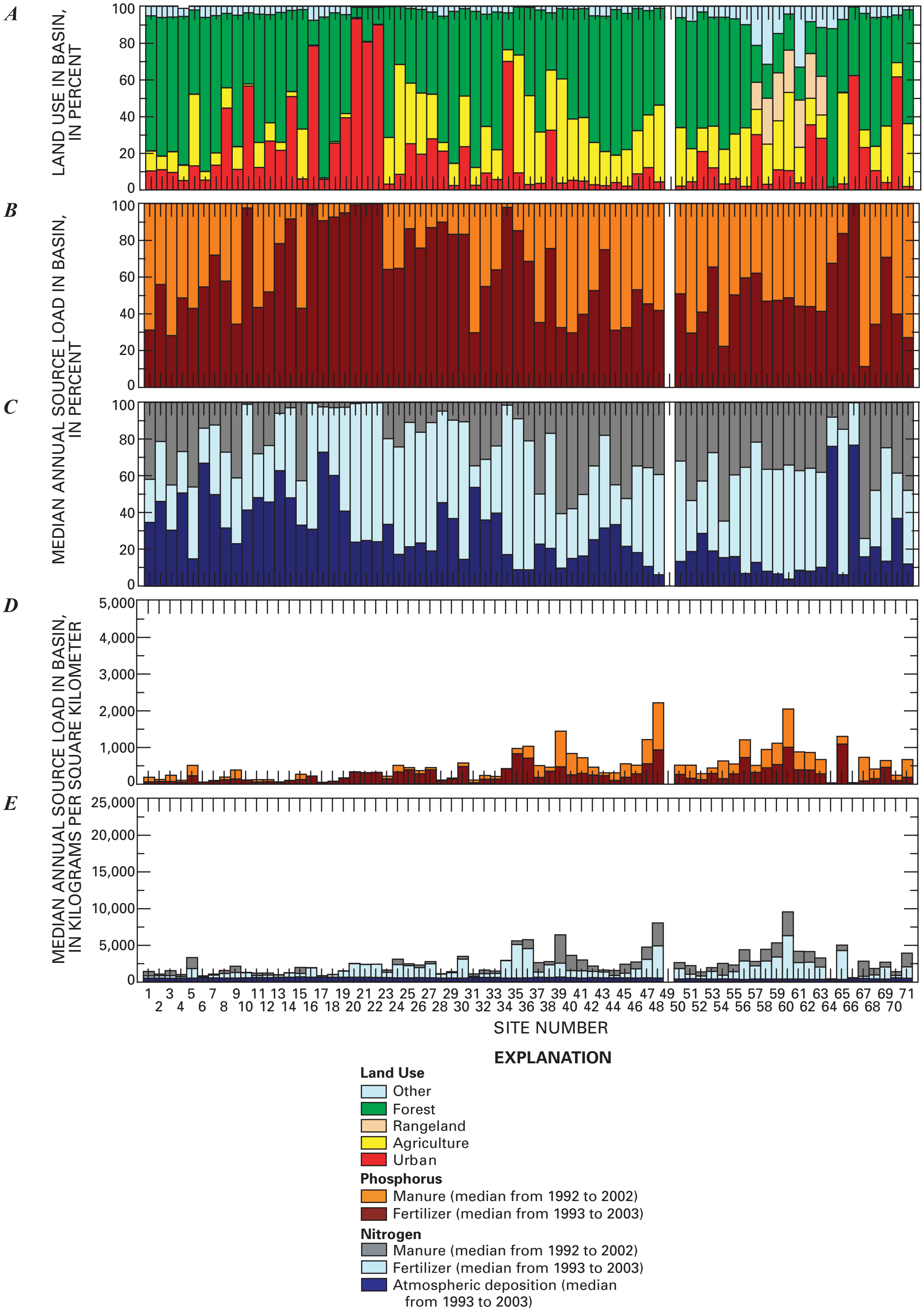

Figure 7. Land use and nutrient budgets at sites in the Eastern United States. Note there likely were additional nutrient sources that are not shown here; currently (2008), national-scale, consistently derived source data for the period from 1993 to 2003 are available only for manure, fertilizer, and atmospheric deposition.

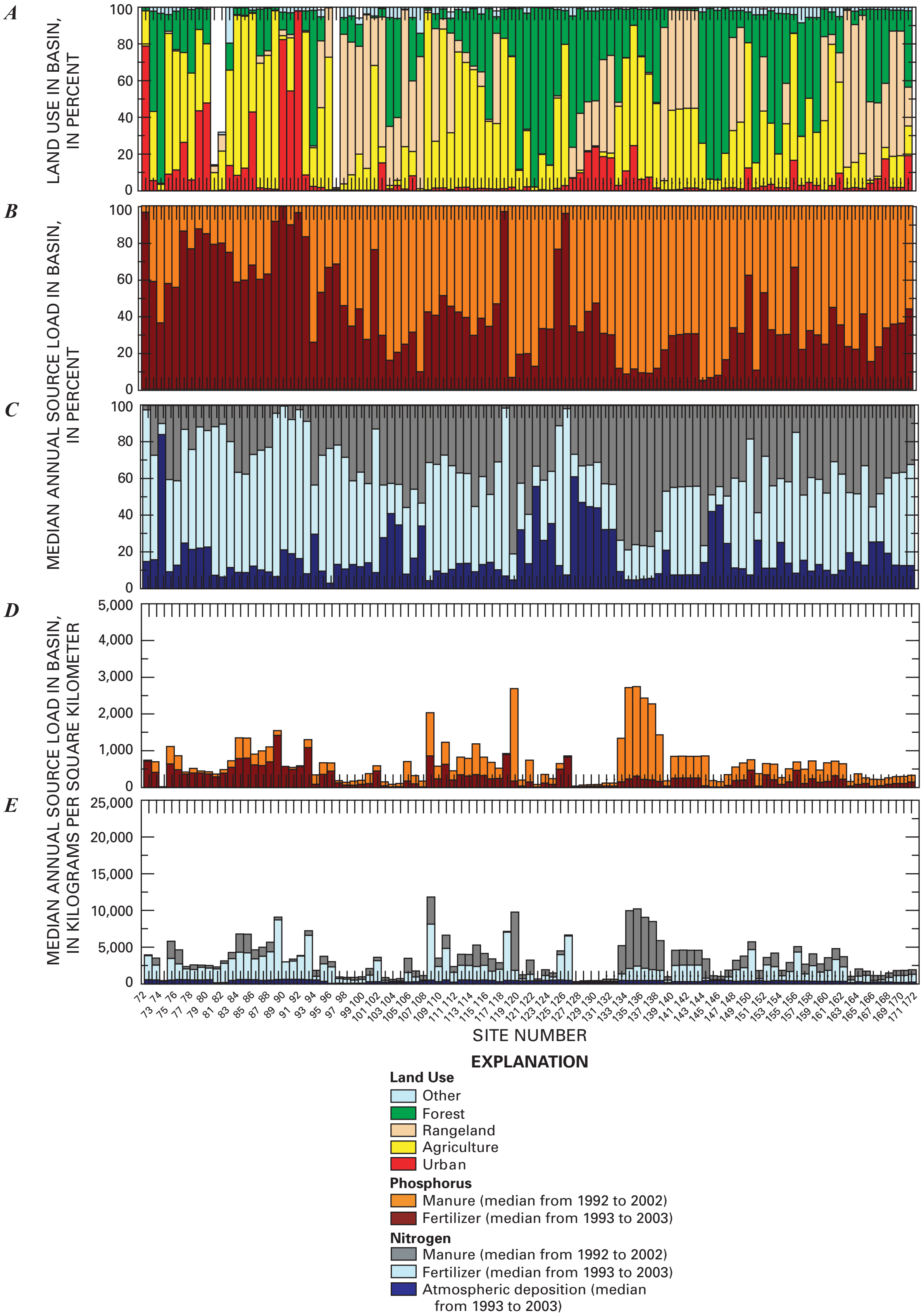

Figure 8. Land use and nutrient budgets at sites in the Central United States. Note there likely were additional nutrient sources that are not shown here; currently (2008), national-scale, consistently derived source data for the period from 1993 to 2003 are available only for manure, fertilizer, and atmospheric deposition.

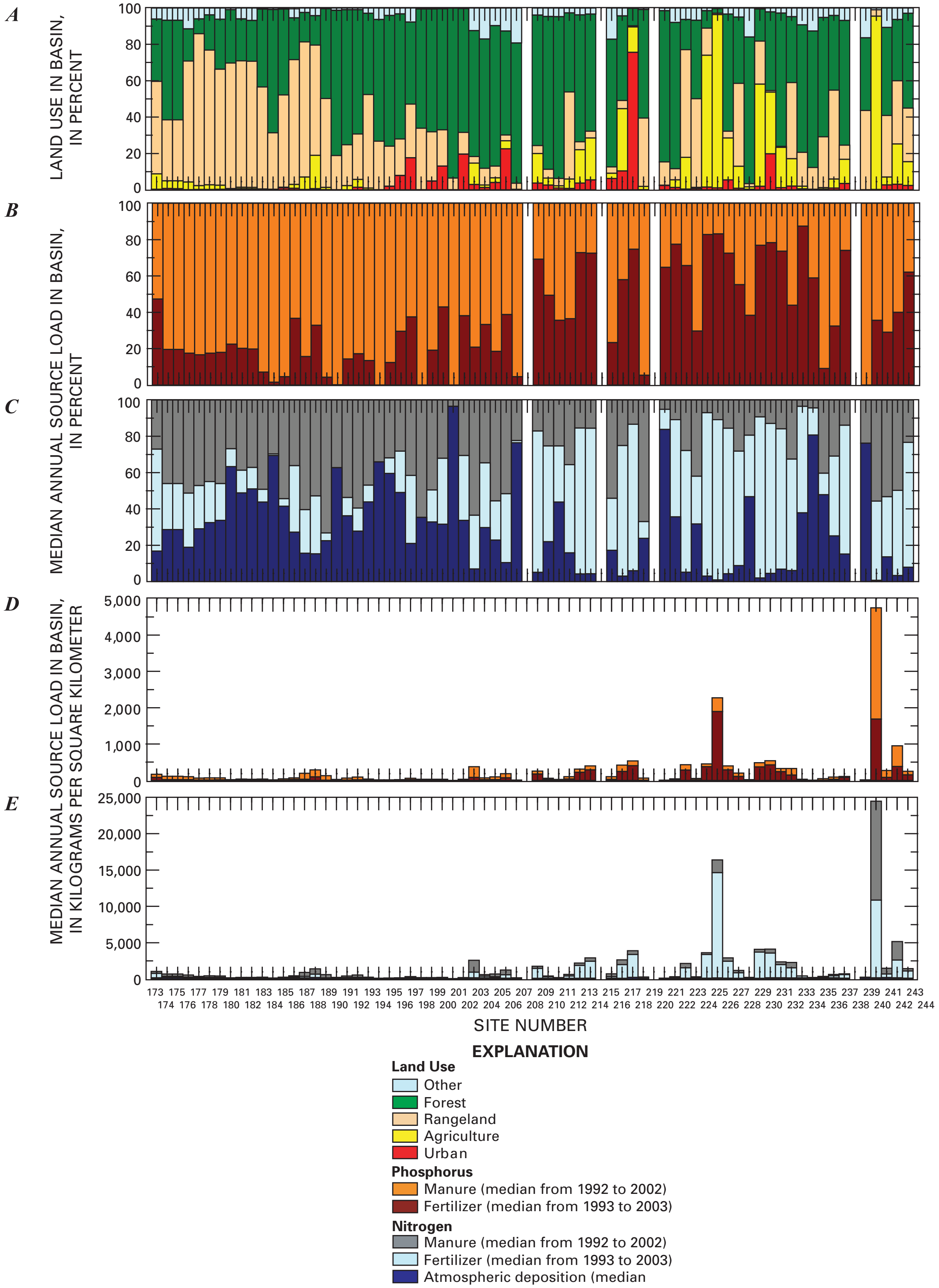

Figure 9. Land use and nutrient budgets at sites in the Western United States. Note there likely were additional nutrient sources that are not shown here; currently (2008), national-scale, consistently derived source data for the period from 1993 to 2003 are available only for manure, fertilizer, and atmospheric deposition.

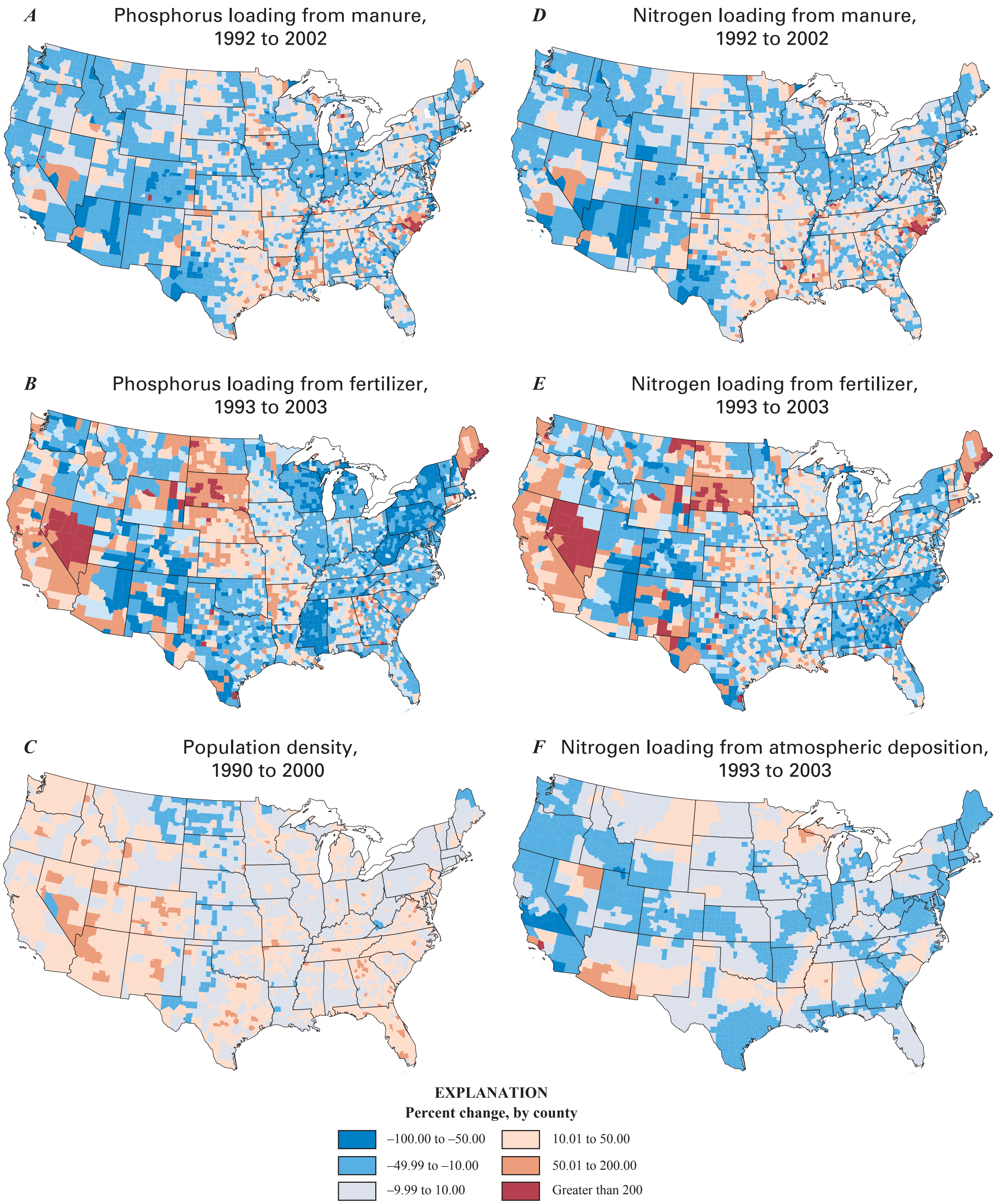

Figure 10. Changes in (*A*) phosphorus loading from manure, (*B*) phosphorus loading from fertilizer, (*C*) population density, (*D*) nitrogen loading from manure, (*E*) nitrogen loading from fertilizer, and (*F*) nitrogen loading from atmospheric deposition in the United States during the study period.

Several significant (p-value less than or equal to 0.05) relations were identified through the weighted-least squares regression analysis relating FA trends in total phosphorus concentrations to changes in nutrient sources (table 7 and fig. 11). Note the R^2 value for these relations was low, indicating that a substantial portion of the variability in FA trends in total phosphorus concentration was not explained by the changes in the source data. At undeveloped sites, total phosphorus trends were positively related to changes in population density (fig. 11*D*). This relation indicates that increases in population density may be a factor contributing to increasing total phosphorus concentrations in streams in undeveloped areas, possibly as a result of increased loading from septic systems and point sources and(or) runoff from construction sites and fertilized lawns. Relations between total phosphorus trends and changes in population density were not as strong for sites with greater agricultural or urban influences (fig. 11*E* and *F*); the effects of increasing population may be greater or more discernable at sites less subject to loading from other nutrient sources such as fertilizer or manure. Similar positive relations between total phosphorus trends and changes in population density occurred at sites in the Western United States, at sites with mean basin slope greater than 10 percent, and at semi-arid/arid sites with mean annual precipitation less than 80 cm (fig. 11*C*, *I*, and *K*); many of the sites in these groups also were classified as undeveloped. In the case of the Western and semi-arid/arid sites, the effects of increases in population density also may be greater or more discernable because of lower in-stream dilution capacity.

At sites with greater than 40 percent agricultural land use in the basin, total phosphorus trends were positively related to changes in phosphorus loading from fertilizer and manure (fig. 11*E*). These relations indicate that increases in the land application of fertilizer and manure may be factors contributing to increasing total phosphorus concentrations in streams in some agricultural areas. Likewise, decreases in the land application of fertilizer and manure may be contributing to decreases (or smaller increases) in total phosphorus concentrations in streams in other agricultural areas. A similar relation between total phosphorus trends and changes in phosphorus loading from fertilizer occurred at sites in the Central United States (fig. 11*B*) and at sites with high loading from atmospheric deposition (fig. 11*N*)—many of these sites had substantial agricultural land use in the basin.

At sites with greater than 10 km^2 of the basin area containing subsurface (tile) drains, total phosphorus trends were negatively related to changes in population density (fig. 11*H*). This relation indicates that increases in population density may be a factor contributing to decreases (or smaller increases) in total phosphorus concentrations in streams in areas where phosphorus transport may be influenced by subsurface tile drains. In general, phosphorus is transported through the subsurface in much smaller amounts than nitrogen owing to phosphorus sorption on soils and subsoils. However, phosphorus sorption in the subsurface can be reduced when tile drains are present; tile drains accelerate water movement to streams and therefore can decrease the contact time between the water and the subsoil (Gentry and others, 2007; Heathwaite and Dils, 2000; Sims and others, 1998). The sites in this group were located throughout the United States, but many had more than 20 percent agricultural land use in the basin. It is possible that conversion of agricultural land to urban land, and a concomitant reduction in fertilizer and(or) manure application, may have contributed to a net reduction in phosphorus transport to streams, thereby decreasing in-stream total phosphorus concentrations. However, fertilizer and manure loads did not decrease consistently at these sites (fig. 11*H*); in addition, land-use/land-cover data for the United States for the early 1990's period and the early 2000s period currently (2008) are not comparably derived and, as a result, land-use change cannot be evaluated directly.

The Kruskal-Wallis and Tukey's analyses identified several additional site groups where changes in nutrient sources were different between sites with upward, downward, and nonsignificant FA trends in total phosphorus concentrations (tables 8 and 9). At sites in the Eastern United States, changes in phosphorus loading from fertilizer differed between sites with upward, downward, and nonsignificant FA trends, but these differences were no longer significant in the post-hoc Tukey's analysis. At sites with greater than 10 percent urban land cover in the basin, the decrease in phosphorus loading from manure was greater at sites with nonsignificant trends than at sites with downward trends, indicating that other factors likely were more important in affecting the downward trends. At sites with high source loading from atmospheric deposition, the increase in population density was greater at sites with nonsignificant trends than at sites with upward trends, indicating that other factors likely were more important in affecting the upward trends.

The results from the weighted-least squares regression and Kruskal-Wallis analyses largely were consistent with results from multiple linear regression when FA trends in total phosphorus concentrations were related to changes in population density and source loading from fertilizer and manure at sites in the Eastern, Central, and Western United States and at sites classified as having undeveloped land use (table 10*A*). The one exception was the model for sites in the Eastern United States—the variation in trends at these sites was best described by changes in source loading from manure, though the overall model was not significant (table 10*A*). The variation in trends in the Central United States was best described by changes in source loading from fertilizer alone; additional source variables did not improve the model (table 10*A*). The fertilizer coefficient was positive, indicating that total phosphorus trends at sites in the Central United States generally increased as source loading from fertilizer increased and decreased as source loading from fertilizer decreased. The variation in trends in the Western United States was best described by changes in population density alone; additional source variables did not improve the model (table 10*A*). The population-density coefficient was positive, indicating that total phosphorus trends at sites in the Western United

States generally increased as population density increased and decreased as population density decreased. The variation in trends at undeveloped sites was best explained by changes in population density and source loading from manure. The manure coefficient, however, was not significant; changes in source loading from manure did not account for a significant amount of variation in total phosphorus trends at undeveloped sites. The population-density coefficient was significant and positive, indicating that total phosphorus trends at undeveloped sites generally increased as population density increased and decreased as population density decreased. The multiple R^2 value for each model was low—a substantial portion of the variability in FA trends in total phosphorus concentration at these sites was not explained by changes in the available source data.

Regional Trends

Upward regional trends in FA total phosphorus concentrations occurred at sites in the Central United States, sites with greater than 40 percent agricultural land use in the basin, and sites with high source loading from manure (table 11). There were, however, no significant regional trends in NFA total phosphorus concentrations at these sites, likely reflecting the effects of decreasing streamflow at many of the sites. For the other site groups, a combination of a lack of trend at many locations and trends in opposite directions at other locations cancelling one another out resulted in nonsignificant regional trends.

Total Nitrogen

Trends from 1993 to 2003

Significant (p-value less than or equal to 0.05) FA trends in total nitrogen concentrations only occurred at 51 (37 percent) of 137 sites from 1993 to 2003 (fig. 12*B*, tables 3 and 4, Appendix 3). Downward FA trends occurred at 22 (16 percent) of the sites, indicating that changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities contributed to significant decreases in total nitrogen concentrations in some streams. In many other streams, any such changes that occurred were offset by other anthropogenic activities in the watershed that increased concentrations. Upward FA trends occurred at 29 (21 percent) of the sites, indicating that increases in nitrogen sources and(or) transport at these sites may have been contributing to increased total nitrogen concentrations in streams. FA trends in total nitrogen concentrations generally were downward or nonsignificant at sites in the Northwestern United States (fig. 12*B*). At sites in the Eastern, Central, and Southwestern United States, FA trends were a mixture of upward, downward, and nonsignificant.

There were fewer significant NFA trends than FA trends in total nitrogen concentrations; NFA trends were significant at 37 (27 percent) of 137 sites from 1993 to 2003 (fig. 12*C*, tables 3 and 5, Appendix 3). At the majority of sites (73 percent) nationwide, total nitrogen concentrations in streams were not changing significantly. At sites where concentrations were changing significantly, more NFA trends were downward than upward. Downward NFA trends occurred at 22 (16 percent) of the sites, and upward NFA trends occurred at 15 (11 percent) of the sites. NFA trends in total nitrogen concentrations generally were downward or nonsignificant at sites in the Northwestern United States (fig. 12*C*). At sites in others areas of the United States, NFA trends were a mixture of upward, downward, and nonsignificant.

The primary difference between the number of significant FA and NFA trends was a smaller number of upward NFA trends. In particular, relatively fewer upward NFA trends than upward FA trends occurred at sites in the Central United States, where many of the significant (downward) trends in streamflow occurred (fig. 12*A*). At these sites, the upward FA trends indicate that nitrogen sources may have been increasing between 1993 and 2003, while the downward trends in streamflow indicate that precipitation and surface runoff were decreasing, likely as a result of drought conditions in the latter part of the study period. The increase in source indicated by the upward FA trend likely was offset by the effects of decreasing surface runoff indicated by the downward streamflow trend, resulting in fewer upward NFA trends. In this case, in-stream concentrations probably would have been higher without the decrease in streamflow and associated surface runoff. At other sites, a downward FA trend in total nitrogen concentrations occurred along with a downward trend in streamflow; in this case, the decrease in source indicated by the downward FA trend likely was supplemented by the effects of decreasing surface runoff.

At sites in other parts of the United States, where there were few trends in streamflow from 1993 to 2003, FA and NFA trends generally were similar. Sites with upward FA trends may have experienced an increase in nitrogen sources between 1993 and 2003; sites with downward FA trends may have experienced a decrease in nitrogen sources and(or) reductions due to the implementation of pollution-control strategies. With no trend in streamflow at these sites, NFA trends generally were similar and a product of the same influences.

Trends in loads of total nitrogen from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (74 percent) nationwide, there was no significant trend in the load of total nitrogen being transported to downstream locations (fig. 12*D*, tables 3 and 6, Appendix 3). Upward trends in load occurred at only 2 (1 percent) of the 137 sites. Downward trends in load occurred at 34 (25 percent) of the sites, primarily in the Central United States. Throughout the United States, trends in load were similar to trends in streamflow at the majority of sites. However, the change in concentration was large enough to be the primary influence at numerous sites, and load changed correspondingly.

There were fewer upward FA and NFA trends in total nitrogen concentrations (21 and 11 percent, respectively) than in total phosphorus concentrations (33 and 24 percent, respectively). In contrast, the percentage of downward FA and NFA

Table 7. Results of weighted least-squares regression relating flow-adjusted trends to changes in nutrient sources.

[--, not applicable; NN, model exhibited heteroscedasticity, departure from a normal distribution, or outliers were present; <, less than; R^2, coefficient of determination. Bold p-values indicate statistical significance at the α=0.05 level.]

Site group	Loading from atmospheric deposition					Loading from fertilizer				
	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient
Total phosphorus										
Eastern United States	--	--	--	--	--	60	0.020	0.284	–0.166	0.154
Central United States	--	--	--	--	--	57	0.160	**0.002**	0.207	0.064
Western United States	--	--	--	--	--	46	0.000	0.900	–0.008	0.065
Undeveloped land-use classification	--	--	--	--	--	58	0.000	0.894	0.008	0.060
Greater than 40 percent agricultural land use in the basin	--	--	--	--	--	38	0.213	**0.004**	0.252	0.081
Greater than 10 percent urban land use in the basin	--	--	--	--	--	51	0.001	0.821	–0.043	0.186
Base-flow index greater than 50	--	--	--	--	--	67	0.007	0.512	0.054	0.081
Basin area with subsurface drains greater than 10 square kilometers	--	--	--	--	--	46	0.042	0.172	0.081	0.058
Mean basin slope greater than 10 percent	--	--	--	--	--	50	0.000	0.889	–0.009	0.062
Mean annual precipitation greater than 130 centimeters	--	--	--	--	--	51	0.004	0.677	–0.050	0.119
Mean annual precipitation less than 80 centimeters	--	--	--	--	--	34	0.081	0.103	0.097	0.058
Reference streamflow greater than 100 cubic meters per second	--	--	--	--	--	40	0.003	0.726	0.025	0.070
Reference streamflow less than 3 cubic meters per second	--	--	--	--	--	42	0.007	0.592	0.089	0.165
High source loading from atmospheric deposition	--	--	--	--	--	54	0.084	**0.034**	0.193	0.089
High source loading from fertilizer	--	--	--	--	--	54	0.005	0.595	0.051	0.095
High source loading from manure	--	--	--	--	--	46	0.068	0.081	0.120	0.067
Total nitrogen										
Eastern United States	56	0.066	0.056	–0.180	0.092	56	0.000	0.891	0.073	0.531
Central United States	45	0.083	0.055	–0.120	0.061	45	0.001	0.875	–0.031	0.195
Western United States	29	0.125	0.060	0.105	0.054	28	0.008	0.651	0.065	0.141
Undeveloped land-use classification	41	0.036	0.233	0.083	0.068	40	0.008	0.583	0.086	0.155
Greater than 40 percent agricultural land use in the basin	28	0.241	**0.008**	–0.240	0.084	28	0.005	0.711	0.097	0.259
Greater than 10 percent urban land use in the basin	41	0.034	0.251	–0.103	0.088	41	0.007	0.616	0.287	0.568
Base-flow index greater than 50	42	NN	NN	NN	NN	41	0.002	0.804	–0.090	0.361
Basin area with subsurface drains greater than 10 square kilometers	38	0.047	0.191	0.095	0.072	38	0.000	0.908	–0.023	0.193
Mean basin slope greater than 10 percent	38	0.132	**0.025**	0.129	0.055	37	0.002	0.769	0.052	0.176
Mean annual precipitation greater than 130 centimeters	41	0.057	0.134	0.105	0.069	41	0.011	0.512	0.213	0.322
Mean annual precipitation less than 80 centimeters	27	0.037	0.334	0.059	0.060	26	0.000	0.984	0.005	0.233
Reference streamflow greater than 100 cubic meters per second	35	0.142	**0.025**	0.198	0.085	35	0.007	0.625	–0.097	0.196
Reference streamflow less than 3 cubic meters per second	41	0.017	0.413	–0.067	0.081	40	0.000	0.911	0.052	0.458
High source loading from atmospheric deposition	43	0.064	0.101	–0.142	0.085	43	0.027	0.292	0.267	0.250
High source loading from fertilizer	32	0.032	0.330	–0.097	0.098	32	0.000	0.961	–0.016	0.315
High source loading from manure	37	0.126	**0.031**	–0.175	0.078	37	NN	NN	NN	NN
Nitrate										
Eastern United States	46	0.002	0.775	–0.023	0.078	46	0.001	0.817	–0.129	0.554
Central United States	78	0.049	0.051	–0.046	0.023	78	0.027	0.151	0.099	0.068
Western United States	37	0.007	0.623	0.020	0.041	33	0.010	0.576	–0.082	0.145
Undeveloped land-use classification	57	0.006	0.572	0.019	0.033	53	0.003	0.722	0.036	0.101
Greater than 40 percent agricultural land use in the basin	39	0.124	**0.028**	–0.118	0.052	39	0.028	0.309	0.108	0.105

Table 7. Results of weighted least-squares regression relating flow-adjusted trends to changes in nutrient sources.—Continued

[--, not applicable; NN, model exhibited heteroscedasticity, departure from a normal distribution, or outliers were present; <, less than; R^2, coefficient of determination. Bold p-values indicate statistical significance at the $\alpha=0.05$ level.]

Site group	Loading from manure					Population density				
	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient
Total phosphorus										
Eastern United States	60	NN	NN	NN	NN	60	0.002	0.718	–0.015	0.042
Central United States	57	0.062	0.061	0.090	0.047	57	0.006	0.566	0.020	0.034
Western United States	46	0.009	0.527	–0.021	0.033	46	0.315	**<0.001**	0.170	0.038
Undeveloped land-use classification	58	0.026	0.228	–0.043	0.035	58	0.357	**<0.001**	0.182	0.033
Greater than 40 percent agricultural land use in the basin	38	0.140	**0.021**	0.100	0.042	38	0.031	0.289	0.049	0.046
Greater than 10 percent urban land use in the basin	51	NN	NN	NN	NN	51	0.018	0.353	–0.052	0.056
Base-flow index greater than 50	67	0.014	0.340	–0.033	0.034	67	NN	NN	NN	NN
Basin area with subsurface drains greater than 10 square kilometers	46	0.004	0.668	0.017	0.039	46	0.157	**0.006**	–0.070	0.024
Mean basin slope greater than 10 percent	50	0.005	0.616	–0.016	0.032	50	0.315	**<0.001**	0.161	0.034
Mean annual precipitation greater than 130 centimeters	51	0.008	0.534	–0.050	0.081	51	NN	NN	NN	NN
Mean annual precipitation less than 80 centimeters	34	0.000	0.933	–0.002	0.026	34	0.124	**0.041**	0.083	0.039
Reference streamflow greater than 100 cubic meters per second	40	0.003	0.745	0.015	0.045	40	0.060	0.129	–0.050	0.032
Reference streamflow less than 3 cubic meters per second	42	NN	NN	NN	NN	42	0.077	0.075	0.126	0.069
High source loading from atmospheric deposition	54	NN	NN	NN	NN	54	NN	NN	NN	NN
High source loading from fertilizer	54	0.001	0.816	–0.016	0.070	54	0.039	0.155	–0.064	0.044
High source loading from manure	46	0.017	0.392	0.035	0.040	46	0.016	0.396	0.030	0.035
Total nitrogen										
Eastern United States	56	NN	NN	NN	NN	56	0.002	0.774	0.026	0.091
Central United States	45	NN	NN	NN	NN	45	0.000	0.899	–0.013	0.105
Western United States	29	0.028	0.384	0.069	0.078	29	NN	NN	NN	NN
Undeveloped land-use classification	41	0.000	0.929	–0.007	0.081	41	NN	NN	NN	NN
Greater than 40 percent agricultural land use in the basin	28	0.010	0.609	0.067	0.130	28	0.066	0.186	0.232	0.171
Greater than 10 percent urban land use in the basin	41	NN	NN	NN	NN	41	0.094	0.052	–0.236	0.117
Base-flow index greater than 50	42	0.009	0.558	0.050	0.085	42	NN	NN	NN	NN
Basin area with subsurface drains greater than 10 square kilometers	38	0.019	0.407	–0.094	0.112	38	0.049	0.180	–0.103	0.075
Mean basin slope greater than 10 percent	38	0.001	0.845	0.018	0.091	38	NN	NN	NN	NN
Mean annual precipitation greater than 130 centimeters	41	0.006	0.640	0.086	0.183	41	0.004	0.694	–0.032	0.081
Mean annual precipitation less than 80 centimeters	27	0.000	0.924	–0.009	0.093	27	NN	NN	NN	NN
Reference streamflow greater than 100 cubic meters per second	35	0.029	0.330	0.086	0.087	35	0.022	0.397	–0.079	0.092
Reference streamflow less than 3 cubic meters per second	41	NN	NN	NN	NN	41	0.032	0.263	–0.169	0.149
High source loading from atmospheric deposition	43	NN	NN	NN	NN	43	0.019	0.377	–0.095	0.107
High source loading from fertilizer	32	0.001	0.846	0.047	0.237	32	0.088	0.098	–0.296	0.174
High source loading from manure	37	0.004	0.703	–0.044	0.115	37	NN	NN	NN	NN
Nitrate										
Eastern United States	46	NN	NN	NN	NN	46	0.000	0.938	0.006	0.072
Central United States	78	0.059	0.033	0.108	0.050	78	0.024	0.172	0.054	0.039
Western United States	37	0.009	0.572	0.029	0.050	37	NN	NN	NN	NN
Undeveloped land-use classification	57	0.040	0.135	0.060	0.040	57	NN	NN	NN	NN
Greater than 40 percent agricultural land use in the basin	39	0.017	0.427	0.047	0.059	39	NN	NN	NN	NN

Table 7. Results of weighted least-squares regression relating flow-adjusted trends to changes in nutrient sources.—Continued

[--, not applicable; NN, model exhibited heteroscedasticity, departure from a normal distribution, or outliers were present; <, less than; R^2, coefficient of determination. Bold p-values indicate statistical significance at the α=0.05 level.]

Site group	Loading from atmospheric deposition					Loading from fertilizer				
	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient
				Nitrate—Continued						
Greater than 10 percent urban land use in the basin	39	0.028	0.309	–0.073	0.070	39	0.001	0.850	0.097	0.508
Base-flow index greater than 50	58	0.008	0.492	0.030	0.043	54	0.001	0.831	–0.053	0.247
Basin area with subsurface drains greater than 10 square kilometers	33	0.050	0.213	0.082	0.064	33	0.031	0.327	–0.137	0.138
Mean basin slope greater than 10 percent	54	0.007	0.554	0.020	0.033	50	0.000	0.891	0.017	0.122
Mean annual precipitation greater than 130 centimeters	38	0.002	0.768	0.016	0.055	37	0.031	0.294	–0.294	0.276
Mean annual precipitation less than 80 centimeters	43	0.003	0.708	0.011	0.030	42	0.021	0.361	0.104	0.113
Reference streamflow greater than 100 cubic meters per second	30	0.010	0.608	0.054	0.104	30	0.088	0.112	–0.312	0.190
Reference streamflow less than 3 cubic meters per second	54	0.002	0.761	–0.010	0.033	51	0.000	0.886	0.027	0.184
High source loading from atmospheric deposition	44	0.000	0.982	0.002	0.070	44	0.002	0.781	0.061	0.216
High source loading from fertilizer	34	0.017	0.459	–0.050	0.066	34	0.016	0.472	0.129	0.178
High source loading from manure	42	0.088	0.057	–0.111	0.057	42	NN	NN	NN	NN

trends was similar for total nitrogen concentrations and total phosphorus concentrations (16 percent for all). The greater number of upward total phosphorus trends at these sites cannot be explained easily by changes in nonpoint-source loading of nitrogen and phosphorus from 1993 to 2003; during this period, there were slightly more sites with increases in nitrogen loading from fertilizer and(or) manure than there were sites with increases in phosphorus loading from these two sources (appendix 1). One alternate possibility is that soils are at or approaching phosphorus saturation in areas that have been subject to long-term manure or fertilizer application (Sharpley and others, 1996). Because the amount of phosphorus in surface runoff can increase with the phosphorus content of soils (Davis and others, 2005; Pote and others, 1996), over time, a greater proportion of the phosphorus load applied to the land surface may be reaching streams, particularly in agricultural areas. Another possibility is that a substantial source of nitrate in some streams is ground water (Sprague and others, 2006; Bachman and others, 1998). Because of the time required for ground water to travel to streams, there may be a lag between changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities on the land surface and changes in total nitrogen concentration in streams. As a result, trends in total nitrogen concentrations from 1993 to 2003 may have been influenced by changes that took place on the land surface prior to 1993.

Factors Affecting the Trends

Land use and nitrogen budgets for each site in the Eastern, Central, and Western United States are shown in figures 7, 8, and 9, respectively. Land use is shown as a percentage of the basin area in part *A* of each figure. Median nitrogen loads from manure, fertilizer, and atmospheric deposition between 1993 and 2003 are shown as percentages of their combined total load in part *C* of each figure and as absolute loads, normalized to the basin area, in part *E* of each figure. There likely were additional sources of nitrogen in these basins that are not shown in the nitrogen budgets; currently (2008), national-scale, consistently derived nitrogen source data that cover the period from 1993 to 2003 are available only for manure, fertilizer, and atmospheric deposition.

At sites in the Eastern United States, fertilizer often was a larger source of nitrogen than manure (fig. 7). In the Northeast (New England and Mid-Atlantic NAWQA major river basin in fig. 1), atmospheric deposition often was the largest source of nitrogen, particularly at sites with minimal urban or agricultural development and small total loads. The total source loads of nitrogen, including manure, fertilizer, and atmospheric deposition, were highest at sites with relatively high percentages of agricultural land use. At sites in the Central United States, fertilizer generally was a larger source of nitrogen than manure in the Great Lakes, Ohio, Upper Mississippi, and Souris-Red-Rainy NAWQA major river basin; manure generally was a comparable or larger source in the Missouri and Lower Mississippi, Arkansas-White-Red, and Texas-Gulf NAWQA major river basins (figs. 1 and 8). Atmospheric deposition was a large source of nitrogen at sites with minimal urban or agricultural development and small total loads. Across the Central United States, the total source loads of nitrogen were highest at sites with relatively high percentages of agricultural land use. At sites in the Western United States, manure generally was a larger source of nitrogen than fertilizer in the Southwest, particularly the Rio Grande, Colorado, and Great Basin NAWQA major river basin, where the percentage of rangeland in the basins was high (figs. 1 and

Table 7. Results of weighted least-squares regression relating flow-adjusted trends to changes in nutrient sources.—Continued

[--, not applicable; NN, model exhibited heteroscedasticity, departure from a normal distribution, or outliers were present; <, less than; R^2, coefficient of determination. Bold p-values indicate statistical significance at the α=0.05 level.]

Site group	Loading from manure					Population density				
	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient	Number of samples	R^2	p-value	Slope coefficient	Standard error of slope coefficient
				Nitrate—Continued						
Greater than 10 percent urban land use in the basin	39	NN	NN	NN	NN	39	0.071	0.102	–0.151	0.090
Base-flow index greater than 50	58	0.002	0.739	–0.017	0.051	58	NN	NN	NN	NN
Basin area with subsurface drains greater than 10 square kilometers	33	0.005	0.709	–0.026	0.070	33	0.000	0.909	0.007	0.062
Mean basin slope greater than 10 percent	54	0.009	0.484	0.039	0.056	54	NN	NN	NN	NN
Mean annual precipitation greater than 130 centimeters	38	NN	NN	NN	NN	38	0.006	0.644	0.046	0.099
Mean annual precipitation less than 80 centimeters	43	0.000	0.978	–0.002	0.058	43	0.018	0.387	0.060	0.068
Reference streamflow greater than 100 cubic meters per second	30	0.023	0.423	–0.090	0.111	30	0.066	0.169	0.139	0.098
Reference streamflow less than 3 cubic meters per second	54	NN	NN	NN	NN	54	0.011	0.450	0.049	0.064
High source loading from atmospheric deposition	44	NN	NN	NN	NN	44	NN	NN	NN	NN
High source loading from fertilizer	34	0.097	0.073	0.266	0.143	34	0.010	0.569	–0.066	0.114
High source loading from manure	42	0.027	0.295	0.061	0.058	42	NN	NN	NN	NN

9). Total source loads of nitrogen at these sites, however, were relatively low. Total source loads of nitrogen were higher at sites in the Pacific Northwest and California, where fertilizer was a comparable or larger source of nitrogen than manure. As in the Eastern and Central United States, atmospheric deposition often was a large source of nitrogen at sites with minimal urban or agricultural development and small total loads in the West, and the total source loads of nitrogen were highest at sites with relatively high percentages of agricultural land use.

Changes in nitrogen loading from manure, fertilizer, and atmospheric deposition during the study period are shown on a county-level basis in figure 10, parts *D*–*F*. Decreases in nitrogen loading from manure were widespread throughout the nation (fig. 10*D*). Small increases also were common, particularly in the Eastern and Central United States. Large increases in nitrogen loading from fertilizer were more widespread in the Central (particularly west of the Mississippi River) and Western United States (fig. 10*E*). In the Eastern United States, decreases in nitrogen loading from fertilizer were more widespread and often greater in magnitude than decreases in nitrogen loading from manure. Nitrogen loading from atmospheric deposition decreased or increased only slightly in many parts of the United States (fig. 10*F*). Larger increases in nitrogen loading from atmospheric deposition occurred in parts of the Southeast, the Southwest, and northern parts of the Central United States.

Several significant (p-value less than or equal to 0.05) relations were identified through the weighted-least squares regression analysis relating FA trends in total nitrogen concentration to changes in nutrient sources (table 7 and fig. 13). Note the R^2 value for these relations was low, indicating that a substantial portion of the variability in FA trends in total nitrogen concentration was not explained by the changes in the source data. Changes in nitrogen loading from atmospheric deposition were significantly related to FA trends in total nitrogen concentrations at sites with greater than 40 percent agricultural land use in the basin (fig. 13*E*), at sites with mean basin slope greater than 10 percent (fig. 13*I*), at sites with reference streamflow values greater than 100 m^3/s (fig. 13*L*), and at sites with high loading from manure (fig. 13*P*). Although a negative relation was observed at sites with greater than 40 percent agricultural land use in the basin and at sites with high loading from manure, changes in loading from atmospheric deposition likely had little impact on trends in total nitrogen at these sites because nitrogen loading from atmospheric deposition was small compared to that from fertilizer and(or) manure (figs. 7–9).

The Kruskal-Wallis and Tukey's analyses identified several additional site groups where changes in nutrient sources were different between sites with upward, downward, and nonsignificant FA trends in total nitrogen concentrations (tables 8 and 9). At sites in the Eastern United States, changes in nitrogen loading from atmospheric deposition differed between sites with upward, downward, and nonsignificant FA trends, but these differences were no longer significant in the post-hoc Tukey's analysis. At sites with high source loading from fertilizer, changes in nitrogen loading from fertilizer differed between sites with upward, downward, and nonsignificant FA trends, but these differences were no longer significant in the post-hoc Tukey's analysis. At sites with high source loading from manure, nitrogen loading from fertilizer generally decreased at sites with downward trends and generally increased at sites with upward and nonsignificant trends. At sites with reference streamflow values greater than 100 m^3/s, the decrease in loading from manure was greater at sites with downward trends than at sites with nonsignificant trends.

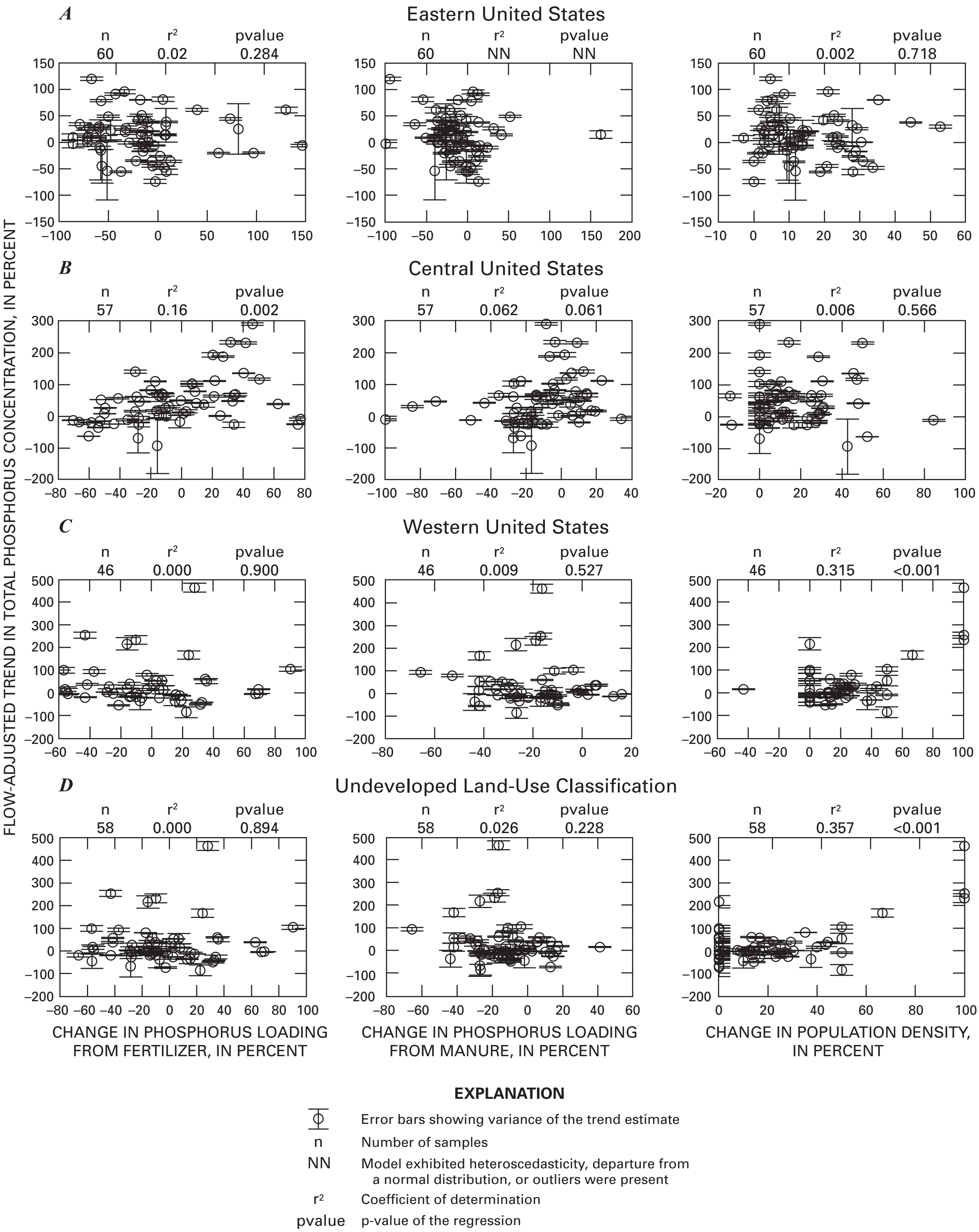

Figure 11. Relations between flow-adjusted trends in total phosphorus concentrations and changes in phosphorus sources from 1993 to 2003 for selected site subsets.

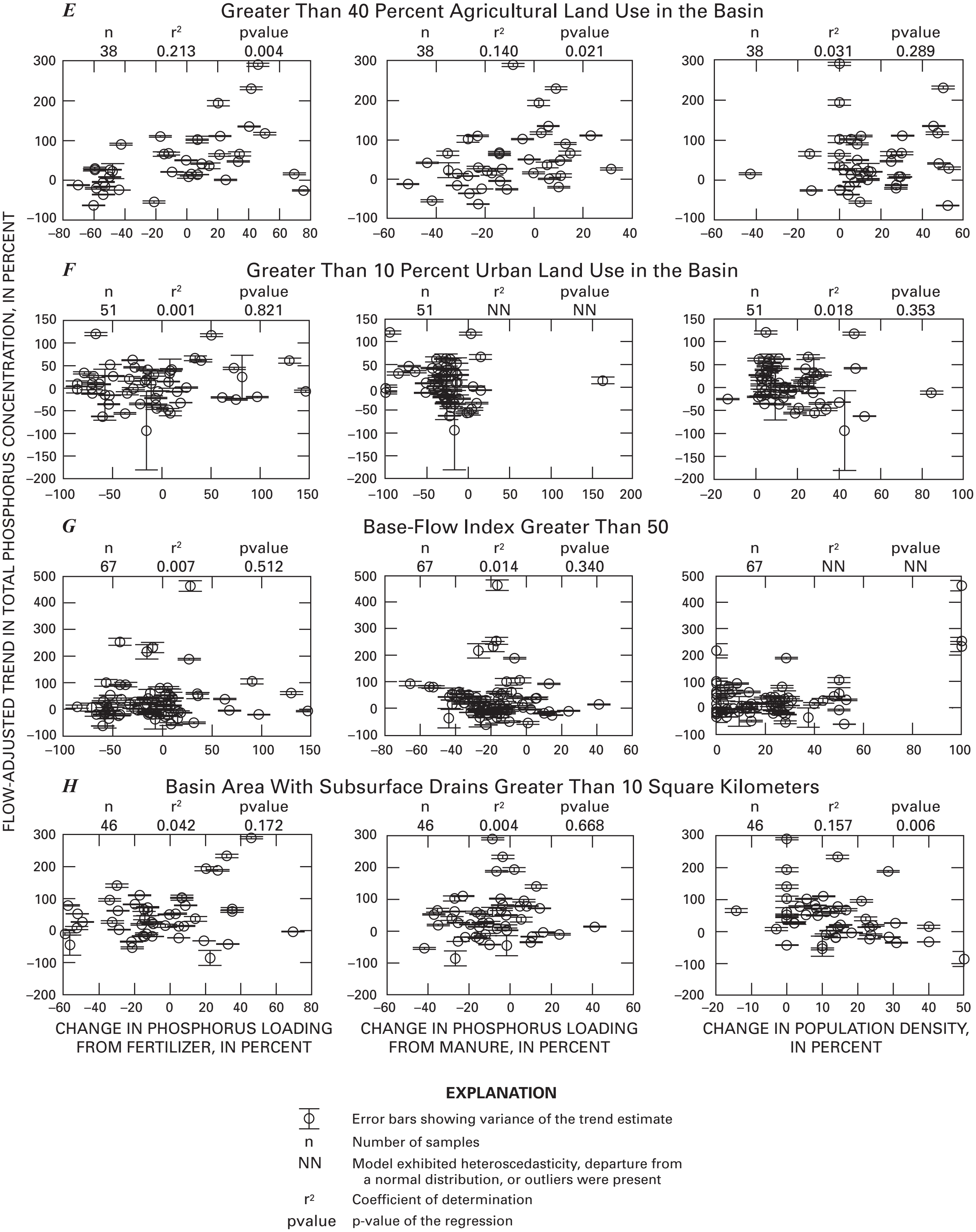

Figure 11—Continued. Relations between flow-adjusted trends in total phosphorus concentrations and changes in phosphorus sources from 1993 to 2003 for selected site subsets.

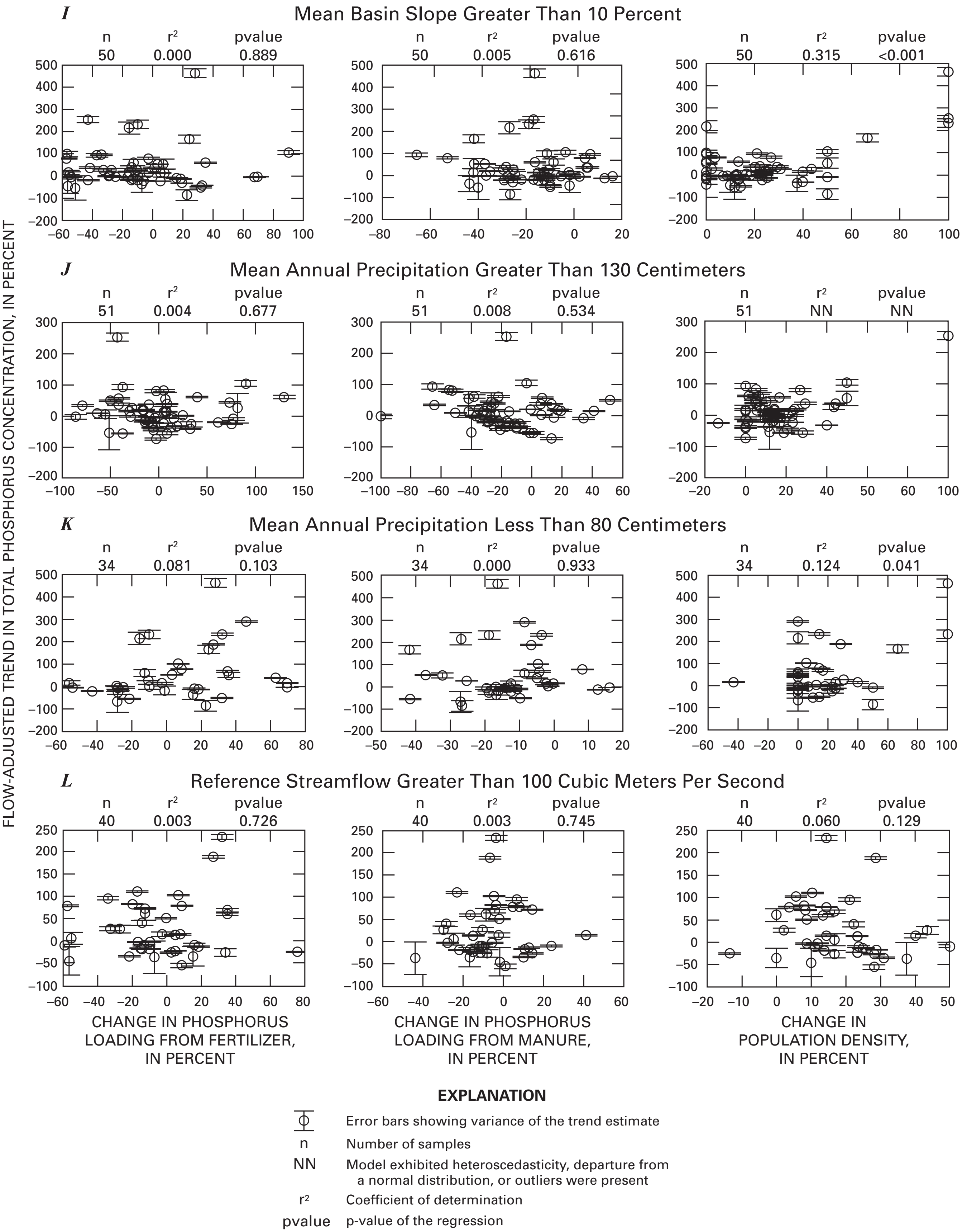

Figure 11—Continued. Relations between flow-adjusted trends in total phosphorus concentrations and changes in phosphorus sources from 1993 to 2003 for selected site subsets.

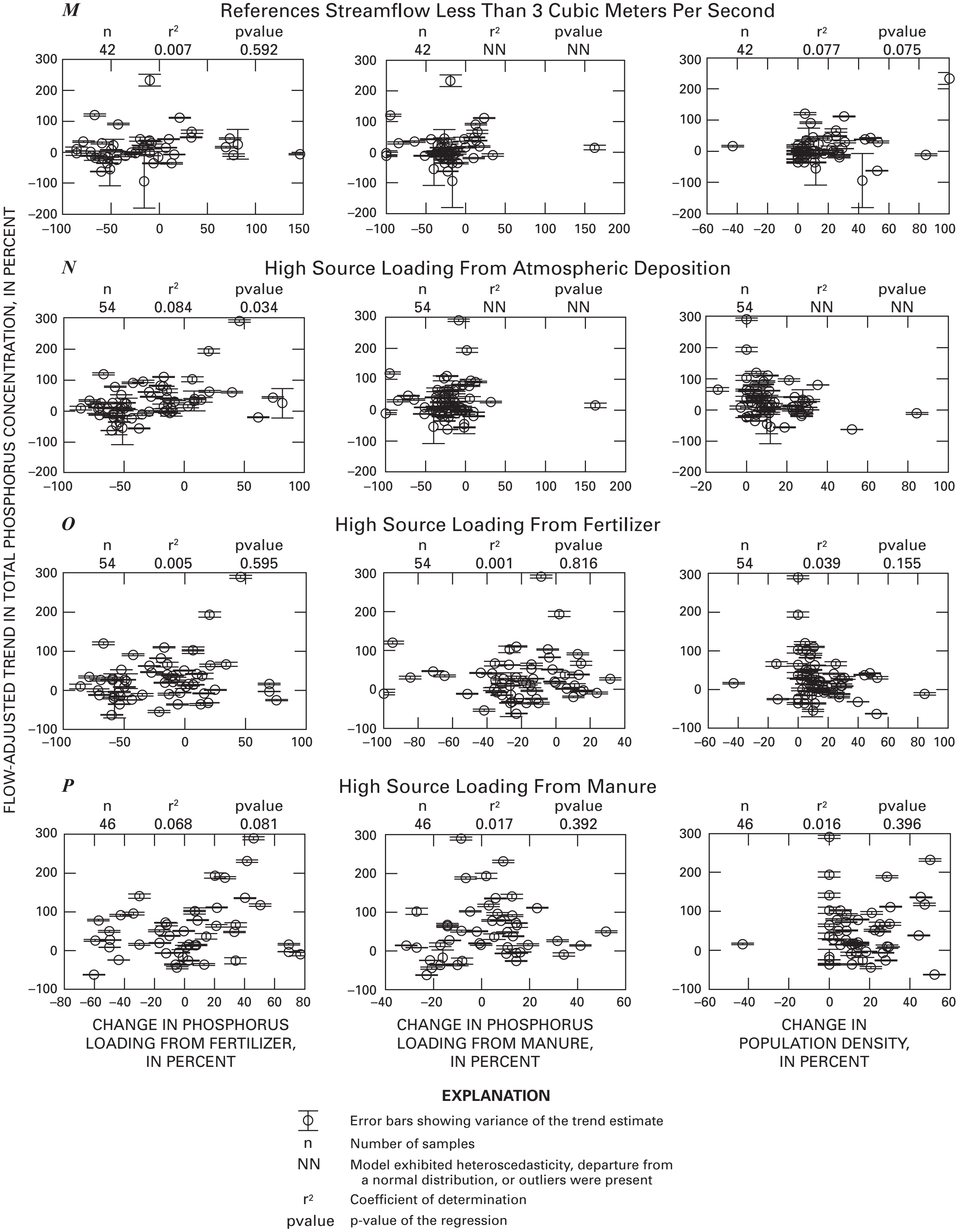

Figure 11—Continued. Relations between flow-adjusted trends in total phosphorus concentrations and changes in phosphorus sources from 1993 to 2003 for selected site subsets.

Table 8. Results of the Kruskal-Wallis test relating flow-adjusted trends to changes in nutrient sources.

[--, not applicable. Bold p-values indicate statistical significance at the α=0.05 level.]

Site group	Loading from atmospheric deposition		Loading from fertilizer		Loading from manure		Population density	
	Chi square	p-value	Chi square	p-value	Chi square	p-value	Chi square	p-value
Total phosphorus								
Eastern United States	--	--	6.40	**0.041**	5.72	0.057	2.46	0.293
Central United States	--	--	7.23	**0.027**	3.06	0.217	0.15	0.929
Western United States	--	--	0.94	0.625	2.54	0.281	1.11	0.574
Undeveloped land-use classification	--	--	3.40	0.182	1.05	0.590	1.92	0.382
Greater than 40 percent agricultural land use in the basin	--	--	7.29	**0.026**	3.19	0.203	0.83	0.662
Greater than 10 percent urban land use in the basin	--	--	2.80	0.246	7.50	**0.023**	3.50	0.173
Base-flow index greater than 50	--	--	2.26	0.324	2.61	0.271	0.51	0.774
Basin area with subsurface drains greater than 10 square kilometers	--	--	1.42	0.493	2.75	0.252	6.24	**0.044**
Mean basin slope greater than 10 percent	--	--	5.19	0.075	1.30	0.523	0.88	0.643
Mean annual precipitation greater than 130 centimeters	--	--	1.81	0.405	2.07	0.356	0.08	0.962
Mean annual precipitation less than 80 centimeters	--	--	4.84	0.089	2.00	0.368	2.36	0.307
Reference streamflow greater than 100 cubic meters per second	--	--	0.96	0.620	2.90	0.234	4.20	0.123
Reference streamflow less than 3 cubic meters per second	--	--	3.34	0.189	2.40	0.302	4.17	0.124
High source loading from atmospheric deposition	--	--	6.01	**0.049**	0.35	0.840	7.17	**0.028**
High source loading from fertilizer	--	--	2.86	0.239	0.22	0.898	4.63	0.099
High source loading from manure	--	--	1.80	0.407	5.00	0.082	0.31	0.857
Total nitrogen								
Eastern United States	6.32	**0.042**	2.30	0.317	2.13	0.345	1.72	0.422
Central United States	5.45	0.065	2.98	0.225	5.29	0.071	0.52	0.769
Western United States	4.17	0.124	0.49	0.782	2.51	0.285	1.09	0.581
Undeveloped land-use classification	2.38	0.305	0.11	0.946	1.35	0.508	3.24	0.198
Greater than 40 percent agricultural land use in the basin	6.73	**0.034**	2.91	0.233	3.42	0.181	2.92	0.232
Greater than 10 percent urban land use in the basin	0.87	0.648	1.61	0.448	0.61	0.736	4.92	0.085
Base-flow index greater than 50	1.72	0.423	0.34	0.844	5.48	0.065	0.78	0.677
Basin area with subsurface drains greater than 10 square kilometers	1.96	0.376	0.68	0.712	0.21	0.901	2.35	0.310
Mean basin slope greater than 10 percent	7.41	**0.025**	0.08	0.963	2.18	0.336	1.82	0.402
Mean annual precipitation greater than 130 centimeters	3.17	0.205	1.29	0.525	0.54	0.764	0.25	0.881
Mean annual precipitation less than 80 centimeters	0.45	0.800	0.47	0.790	2.41	0.299	0.40	0.818
Reference streamflow greater than 100 cubic meters per second	5.73	0.057	1.82	0.402	8.51	**0.014**	0.95	0.623
Reference streamflow less than 3 cubic meters per second	4.76	0.092	2.88	0.236	2.03	0.363	2.82	0.245
High source loading from atmospheric deposition	3.01	0.222	1.53	0.466	1.84	0.398	0.48	0.785
High source loading from fertilizer	2.25	0.325	6.09	**0.047**	0.34	0.845	5.78	0.056
High source loading from manure	10.96	**0.004**	8.36	**0.015**	1.37	0.503	2.22	0.330

Table 8. Results of the Kruskal-Wallis test relating flow-adjusted trends to changes in nutrient sources.—Continued

[--, not applicable. Bold p-values indicate statistical significance at the α=0.05 level.]

Site group	Loading from atmospheric deposition		Loading from fertilizer		Loading from manure		Population density	
	Chi square	p-value	Chi square	p-value	Chi square	p-value	Chi square	p-value
				Nitrate				
Eastern United States	1.20	0.548	1.61	0.448	1.05	0.591	0.67	0.716
Central United States	11.06	**0.004**	2.84	0.242	5.51	0.064	5.80	0.055
Western United States	3.00	0.223	0.88	0.644	2.72	0.257	0.51	0.776
Undeveloped land-use classification	1.59	0.451	0.98	0.614	4.42	0.109	1.70	0.427
Greater than 40 percent agricultural land use in the basin	6.24	**0.044**	1.07	0.587	0.34	0.842	5.43	0.066
Greater than 10 percent urban land use in the basin	7.19	**0.027**	0.79	0.672	2.09	0.352	1.50	0.472
Base-flow index greater than 50	1.41	0.493	0.01	0.997	1.33	0.514	3.43	0.180
Basin area with subsurface drains greater than 10 square kilometers	5.21	0.074	2.94	0.230	2.29	0.318	3.43	0.180
Mean basin slope greater than 10 percent	2.15	0.342	0.22	0.898	2.07	0.356	2.14	0.342
Mean annual precipitation greater than 130 centimeters	1.21	0.546	1.89	0.389	9.16	**0.010**	1.04	0.594
Mean annual precipitation less than 80 centimeters	0.01	0.993	1.07	0.585	2.92	0.232	0.56	0.755
Reference streamflow greater than 100 cubic meters per second	1.73	0.421	3.20	0.202	1.80	0.406	1.13	0.568
Reference streamflow less than 3 cubic meters per second	6.97	**0.031**	2.41	0.300	4.05	0.132	1.34	0.512
High source loading from atmospheric deposition	2.06	0.357	0.66	0.719	1.88	0.391	3.30	0.192
High source loading from fertilizer	1.46	0.483	0.08	0.962	2.51	0.285	0.06	0.970
High source loading from manure	5.63	0.060	3.75	0.153	0.03	0.984	1.55	0.460

The non-significant relations between FA trends in total nitrogen concentrations and changes in nutrient sources were informative as well. None of the relations that were significant in the weighted-least squares regression analysis for total phosphorus were found to be significant for total nitrogen. In addition, none of the additional differences between sites with upward, downward, and nonsignificant FA trends that were significant in the Kruskal-Wallis analysis for total phosphorus were found to be significant for total nitrogen. As discussed earlier, a substantial source of nitrate in some streams is ground water (Sprague and others, 2006; Bachman and others, 1998), and ground-water travel times of months, years, or decades can lead to a lag between changes in nitrogen use on the land surface and changes in total nitrogen concentration in streams. As a result, trends in total nitrogen concentrations from 1993 to 2003 may be influenced by changes that took place on the land surface prior to 1993; these changes would not be reflected in the contemporaneous ancillary data used here. Nitrogen typically is transported through ground water to a greater extent than phosphorus, which sorbs more readily to soil; therefore, nitrogen trends in streams are more likely to be affected by ground-water lag times than are phosphorus trends.

The multiple linear regression results provided limited additional insights when FA trends in total nitrogen concentrations were related to changes in population density and source loading from atmospheric deposition, fertilizer, and manure at sites in the Eastern, Central, and Western United States and at sites classified as having undeveloped land use (table 10*B*). The models for sites in the Eastern United States and for undeveloped sites were not significant, and the models for sites in the Central and Western United States violated assumptions of normality and(or) homoscedasticity (table 10*B*).

Regional Trends

There were no significant regional trends in FA or NFA total nitrogen concentrations (table 11). This likely resulted from a combination of a lack of trend at many locations and trends in opposite directions at other locations cancelling one another out.

Nitrate

Trends from 1993 to 2003

Significant (p-value less than or equal to 0.05) FA trends in nitrate concentrations occurred at 62 (37 percent) of 166 sites from 1993 to 2003 (fig. 14*B*, tables 3 and 4, Appendix 3). There were more downward FA trends in nitrate concentrations

Table 9. Results of the Tukey's multiple comparison test of changes in source loading at sites with upward, downward, and nonsignificant trends.

[Only those groups with significant differences in the Kruskal-Wallis test are shown (see table 8). Letters indicate significantly different group medians.]

Site group	Nutrient source	Median change in source, in percent over period of record		
		Sites with upward flow-adjusted trends in concentration	Sites with downward flow-adjusted trends in concentration	Sites with nonsignificant flow-adjusted trends in concentration
Total phosphorus				
Eastern United States	Loading from fertilizer	–14.5 a	–3.9 a	–32.5 a
Central United States	Loading from fertilizer	7.7 a	–43.9 ab	–15.4 b
Greater than 40 percent agricultural land use in the basin	Loading from fertilizer	9.6 a	–43.9 ab	–49.0 b
High source loading from atmospheric deposition	Loading from fertilizer	–17.3 a	–49.0 a	–49.0 a
Greater than 10 percent urban land use in the basin	Loading from manure	–26.9 ab	–17.0 a	–31.4 b
Basin area with subsurface drains greater than 10 square kilometers	Population density	8.3 a	23.2 b	13.4 ab
High source loading from atmospheric deposition	Population density	5.2 a	11.5 ab	11.5 b
Total nitrogen				
Eastern United States	Loading from atmospheric deposition	–26.9 a	–15.4 a	–20.6 a
Greater than 40 percent agricultural land use in the basin	Loading from atmospheric deposition	–21.5 a	9.6 a	–6.3 a
Mean basin slope greater than 10 percent	Loading from atmospheric deposition	–14.0 ab	–23.5 a	–14.2 b
High source loading from manure	Loading from atmospheric deposition	–21.6 a	9.6 b	–7.5 a
High source loading from fertilizer	Loading from fertilizer	–7.0 a	–10.2 a	10.9 a
High source loading from manure	Loading from fertilizer	2.8 a	–52.3 b	4.4 a
Reference streamflow greater than 100 cubic meters per second	Loading from manure	–3.5 ab	–13.9 a	–0.4 b
Nitrate				
Central United States	Loading from atmospheric deposition	–17.4 a	–1.5 b	–3.8 b
Greater than 40 percent agricultural land use in the basin	Loading from atmospheric deposition	–21.0 a	0.1 b	–2.8 ab
Greater than 10 percent urban land use in the basin	Loading from atmospheric deposition	–7.3 a	–7.2 a	–21.0 a
Reference streamflow less than 3 cubic meters per second	Loading from atmospheric deposition	–16.9 ab	–3.5 a	–16.3 b
Mean annual precipitation greater than 130 centimeters	Loading from manure	41.2 a	–23.8 ab	–29.5 b

than in total phosphorus or total nitrogen concentrations—42 (25 percent) of the sites had downward FA trends in nitrate concentrations, indicating that changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities likely were contributing to decreases in nitrate concentrations in one-quarter of the study streams. There were fewer upward FA trends in nitrate concentrations than in total phosphorus or total nitrogen concentrations—20 (12 percent) of the sites had upward FA trends in nitrate concentrations, indicating that increases in sources and(or) transport at these sites may have been contributing to increased nitrate concentrations in streams. FA trends in nitrate concentrations generally were downward or nonsignificant at sites in the Eastern and Western United States (fig. 14*B*). At sites in the Central United States, FA trends were a mixture of upward, downward, and nonsignificant.

There were fewer significant NFA trends than FA trends in nitrate concentrations; NFA trends were significant at 55 (33 percent) of 166 sites from 1993 to 2003 (fig. 14*C*, tables 3 and 5, Appendix 3). At the majority of sites (67 percent) nationwide, nitrate concentrations in streams were not changing significantly. At sites where concentrations were changing significantly, more NFA trends were downward than upward. Downward NFA trends occurred at 45 (27 percent) of the sites, and upward NFA trends occurred at 10 (6 percent) of the sites. NFA trends in nitrate concentrations generally were downward or nonsignificant at sites in the Eastern and Western United States (fig. 14*C*). At sites in the Central United States, NFA trends were a mixture of upward, downward, and nonsignificant.

The majority of the differences between the FA and NFA trends in nitrate concentrations occurred at sites in the Central United States, where many of the significant (downward) trends in streamflow occurred (fig. 14*A*). In particular, there were numerous sites with non-significant FA trends and downward NFA trends. At other sites, there were upward FA tends and upward, downward, or nonsignificant NFA trends. The downward trends in streamflow at many of these same sites likely resulted from a decrease in precipitation during drought conditions in the latter part of the study period. At sites with non-significant FA trends, there was little net change in inputs of nitrate from land application or loading from ground water between 1993 and 2003; a decrease in runoff at these sites probably contributed to downward NFA trends. At sites with upward FA trends, inputs of nitrate from land application or loading from ground water may have been increasing between 1993 and 2003. With a decrease in runoff, NFA trends were divided between non-significant (when the increase in source was offset by the effects of decreasing surface runoff), downward (when the increase in source was less than the effects of decreasing surface runoff), or upward (when the increase in source was greater than the effects of decreasing surface runoff). In all three cases, in-stream concentrations probably would have been higher without the decrease in streamflow and associated surface runoff.

Trends in loads of nitrate from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (66 percent) nationwide, there was no significant trend in the load of nitrate being transported to downstream locations (fig. 14*D*, tables 3 and 6, Appendix 3). Upward trends in load occurred at only 5 (3 percent) of the sites. Downward trends in load occurred at 51 (31 percent) of the sites; a large number were in the Central United States, although numerous downward trends occurred in other parts of the United States as well. Trends in load were similar to trends in streamflow at the majority of sites nationwide. However, the change in concentration was large enough to be the primary influence at many sites, and load changed correspondingly.

There were more downward and fewer upward trends in nitrate concentrations as compared to total phosphorus and total nitrogen. The discrepancy between trends in nitrate concentrations and trends in total phosphorus concentrations cannot be explained by changes in sources alone; from 1993 to 2003, there were slightly more sites with increases in nitrogen loading from fertilizer and(or) manure than there were sites with increases in phosphorus loading from these two sources (appendix 1). The discrepancy between trends in nitrate concentrations and trends in total nitrogen concentrations also cannot be explained easily by changes in sources, as the source data currently (2008) available do not distinguish between nitrate and other forms of nitrogen. Because inorganic nitrogen in fertilizer typically is more mobile than the organically complexed nitrogen in manure, it can be hypothesized that trends in nitrate concentrations were affected more by changes in source loads of fertilizer than manure, whereas trends in total nitrogen concentrations were affected by changes in source loads of both fertilizer and manure. However, from 1993 to 2003, there were more sites with increases in nitrogen loading from fertilizer than there were sites with increases in nitrogen loading from manure. The discrepancy between trends in nitrate concentrations and trends in total phosphorus and total nitrogen concentrations instead may be tied to the relatively greater transport of nitrate in ground water. Because nitrate is more soluble than phosphorus and other forms of nitrogen, it is more readily leached through the soil, and because it is more stable in ground water under aerobic conditions and less likely to sorb to aquifer materials than phosphorus and other forms of nitrogen, it is more mobile in ground water (Nolan and Stoner, 2000). Therefore, the lag time between changes in use, implementation of pollution-control strategies, or other anthropogenic activities on the land surface and changes in in-stream concentrations may have had the greatest impact on nitrate trends. As a result, trends in nitrate concentrations from 1993 to 2003 may have been influenced to a greater degree than trends in total phosphorus and total nitrogen by changes that took place on the land surface prior to 1993. Because ground-water residence times can vary substantially among river basins (Michel, 1992), it is difficult to link the trends in in-stream nitrate concentrations from 1993 to 2003 to changes on the land surface during any particular earlier year(s).

Table 10. Results of multiple linear regression relating flow-adjusted trends to changes in nutrient sources.

[Note model explanatory terms are in units of percent change from 1993 to 2003. --, explanatory term not in best fit model; NN, model exhibited heteroscedasticity or departure from a normal distribution; <, less than; R^2, coefficient of determination.]

(A) Total phosphorus

Site group	Model coefficients				Standardized model coefficients			Model coefficient standard error			
	Intercept	Population density	Phosphorus loading from fertilizer	Phosphorus loading from manure	Population density	Phosphorus loading from fertilizer	Phosphorus loading from manure	Intercept	Population density	Phosphorus loading from fertilizer	Phosphorus loading from manure
Eastern United States	7.693	--	--	–0.223	--	--	–0.194	5.290	--	--	0.148
Central United States	54.536	--	0.771	--	--	0.369	--	8.467	--	0.239	--
Western United States	–19.144	1.853	--	--	0.550	--	--	12.416	0.412	--	--
Undeveloped land-use classification	–26.857	1.997	--	–0.737	0.562	--	–0.152	10.721	0.345	--	0.397

Site group	Model coefficient p-value				Degrees of freedom	Residual standard error	Model p-value	Multiple R^2
	Intercept	Population density	Phosphorus loading from fertilizer	Phosphorus loading from manure				
Eastern United States	0.151	--	--	0.137	58	57.957	0.137	0.021
Central United States	<0.001	--	0.002	--	55	90.297	0.002	0.144
Western United States	0.130	<0.001	--	--	44	91.104	<0.001	0.299
Undeveloped land-use classification	0.015	<0.001	--	0.068	55	78.957	<0.001	0.373

(B) Total nitrogen

Site group	Model coefficients					Standardized model coefficients			
	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure
Eastern United States	–2.755	--	–0.366	--	--	--	–0.244	--	--
Central United States	NN	NN	NN	NN	NN	NN	NN	NN	NN
Western United States	NN	NN	NN	NN	NN	NN	NN	NN	NN
Undeveloped land-use classification	7.574	0.380	0.573	--	--	0.231	0.218	--	--

Site group	Model coefficient standard error					Model coefficient p-value					Degrees of freedom	Residual standard error	Model p-value	Multiple R^2
	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure				
Eastern United States	4.085	--	0.188	--	--	0.503	--	0.056	--	--	54	36.128	0.056	0.048
Central United States	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Western United States	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Undeveloped land-use classification	8.817	0.269	0.369	--	--	0.396	0.166	0.129	--	--	38	69.069	0.188	0.036

Factors Affecting the Trends

Fewer significant (p-value less than or equal to 0.05) relations were identified through the weighted-least squares regression and Kruskal-Wallis analyses relating FA trends in nitrate concentrations to changes in nutrient sources (tables 7–9; fig. 15) than were identified for total phosphorus or total nitrogen. At sites with greater than 40 percent agricultural land use in the basin, nitrate trends were negatively related to changes in nitrogen loading from atmospheric deposition (fig. 15*E*). However, changes in loading from atmospheric deposition likely had little impact on trends in nitrate at these sites because nitrogen loading from atmospheric deposition was small compared to that from fertilizer and manure (figs. 7–9). In the Central United States, where many sites had substantial agricultural land use in the basin,

Table 10. Results of multiple linear regression relating flow-adjusted trends to changes in nutrient sources.—Continued

[Note model explanatory terms are in units of percent change from 1993 to 2003. --, explanatory term not in best fit model; NN, model exhibited heteroscedasticity or departure from a normal distribution; <, less than; R^2, coefficient of determination.]

(C) Nitrate

Site group	Model coefficients					Standardized model coefficients			
	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure
Eastern United States	–6.224	--	--	--	--	--	--	--	--
Central United States	NN	NN	NN	NN	NN	NN	NN	NN	NN
Western United States	–15.603	0.597	0.682	--	--	0.589	0.136	--	--
Undeveloped land-use classification	NN	NN	NN	NN	NN	NN	NN	NN	NN

Site group	Model coefficient standard error					Model coefficient p-value					Degrees of freedom	Residual standard error	Model p-value	Multiple R^2
	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Intercept	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure				
Eastern United States	3.270	--	--	--	--	0.063	--	--	--	--	45	38.300	--	<0.001
Central United States	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN
Western United States	13.449	0.155	0.597	--	--	0.254	<0.001	0.261	--	--	34	66.635	0.002	0.268
Undeveloped land-use classification	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN

nitrate trends were positively related to changes in nitrogen loading from manure (fig. 15*B*). This relation indicates that increases in the land application of manure may be a factor contributing to increasing nitrate concentrations in streams in some areas of the Central United States. Likewise, decreases in the land application of manure may be contributing to decreases (or smaller increases) in nitrate concentrations in streams in other areas of the Central United States. A similar relation was not seen with changes in nitrogen loading from fertilizer (fig. 15*B*). Nitrate originating from manure sources may experience relatively more transport through surface runoff and less through ground water than nitrate originating from fertilizer sources; with less ground-water transport, there may have been less of a lag between changes in manure applications and changes in in-stream nitrate concentrations. Note the R^2 value for these significant relations was low, indicating that a substantial portion of the variability in FA trends in nitrate concentration was not explained by the changes in the source data.

The Kruskal-Wallis and Tukey's analyses identified several additional site groups where changes in nutrient sources were different between sites with upward, downward, and nonsignificant FA trends in nitrate concentration (tables 8 and 9). Changes in nitrogen loading from atmospheric deposition differed between sites with upward, downward, and nonsignificant FA trends in nitrate concentrations at sites in the Central United States (where decreases in loading from atmospheric deposition were greater at sites with upward trends than at sites with downward trends), sites with greater than 10 percent urban land use in the basin (where the differences were no longer significant in the post-hoc Tukey's analysis), and sites with reference streamflow less than 3 m^3/s (where decreases in loading from atmospheric deposition were smaller at sites with downward trends than at sites with nonsignificant trends). The counterintuitive results indicate that other factors likely were more important than changes in loading from atmospheric deposition in affecting the trends at these sites. In particular, changes in loading from atmospheric deposition probably had little impact on trends in nitrate at sites in the Central United States (where nitrate trends were found to be positively related to changes in nitrogen loading from manure in the weighted-least squares regression analysis), because nitrogen loading from atmospheric deposition was small compared to that from agricultural nonpoint sources (figs. 7–9). In addition, at sites with mean annual precipitation greater than 130 centimeters, increases in loading from manure were greater at sites with upward FA trends than at sites with nonsignificant FA trends.

Most of the relations that were significant for total nitrogen in the weighted least-squares regression analysis and the additional differences between sites with upward, downward, and nonsignificant FA trends that were significant for total nitrogen in the Kruskal-Wallis analysis were not found to be significant for nitrate. Many of these differences were in relations with changes in nitrogen loading from atmospheric deposition, which includes both nitrate and ammonium. Trends in total nitrogen concentrations may have been affected by changes in ammonium deposition as well as nitrate deposition, and the magnitude and direction of these changes were not always similar (Lehmann and others, 2005).

Table 11. Regional trends in flow-adjusted and non-flow-adjusted concentrations from 1993 to 2003.

[FA, flow adjusted; NFA, non flow adjusted; S_T, overall regional and seasonal test statistic. Bold p-values indicate statistical significance at the α=0.10 level.]

Site group	Concentration type	Number of sites	Number of seasons	S_T	Variance of S_T	Seasonal covariance of S_T	Regional covariance of S_T	p-value
Total phosphorus								
Eastern United States	FA	40	4	345	23,816	6,927	299,209	0.549
	NFA	58	4	–37	21,167	9,155	629,828	0.965
Central United States	FA	38	4	1099	20,607	9,855	325,905	**0.066**
	NFA	56	4	297	26,186	9,255	628,203	0.716
Western United States	FA	29	4	–444	18,150	3,738	164,610	0.305
	NFA	51	4	–493	16,809	2,615	491,884	0.491
Undeveloped land-use classification	FA	28	4	–118	16,485	719	147,139	0.773
	NFA	56	4	–304	17,625	2,896	553,277	0.689
Greater than 40 percent agricultural land use in the basin	FA	27	4	820	15,177	8,485	152,807	**0.051**
	NFA	37	4	346	18,430	8,117	279,017	0.533
Greater than 10 percent urban land use in the basin	FA	34	4	121	19,614	8,669	201,259	0.802
	NFA	49	4	–217	20,901	10,613	453,296	0.756
Base-flow index greater than 50	FA	34	4	153	20,798	4,682	209,725	0.754
	NFA	61	4	–288	20,205	4,329	659,967	0.729
Basin area with subsurface drains greater than 10 square kilometers	FA	32	4	749	18,666	5,754	225,047	0.134
	NFA	43	4	–12	18,175	5,065	351,002	0.986
Mean basin slope greater than 10 percent	FA	27	4	–60	16,638	2,046	134,340	0.880
	NFA	48	4	–357	15,150	2,847	428,014	0.594
Mean annual precipitation greater than 130 centimeters	FA	31	4	–130	18,745	4,329	168,778	0.768
	NFA	47	4	–333	16,258	5,305	412,681	0.614
Mean annual precipitation less than 80 centimeters	FA	23	4	71	12,814	2,971	93,821	0.833
	NFA	35	4	–237	16,128	3,282	215,329	0.626
Reference streamflow greater than 100 cubic meters per second	FA	28	4	178	17,426	5,173	173,993	0.690
	NFA	41	4	–195	15,279	3,079	325,233	0.741
Reference streamflow less than 3 cubic meters per second	FA	25	4	242	14,256	4,127	110,138	0.501
	NFA	40	4	13	16,745	4,125	285,692	0.983
High source loading from fertilizer	FA	35	4	462	19,865	7,076	225,367	0.359
	NFA	49	4	–1	24,192	6,039	446,539	1.000
High source loading from manure	FA	36	4	964	20,149	8,897	274,577	**0.081**
	NFA	43	4	424	20,310	8,630	360,341	0.498
Total nitrogen								
Eastern United States	FA	51	4	29	30,240	5,240	544,149	0.971
	NFA	56	4	–57	33,158	10,781	655,919	0.947
Central United States	FA	40	4	829	21,312	5,385	303,090	0.149
	NFA	46	4	–147	24,954	5,965	411,648	0.826
Western United States	FA	18	4	–162	10,777	4,637	66,762	0.574
	NFA	31	4	–616	16,542	6,157	207,000	0.199
Undeveloped land-use classification	FA	22	4	299	11,696	1,160	85,731	0.343
	NFA	40	4	–205	20,880	5,419	285,262	0.715
Greater than 40 percent agricultural land use in the basin	FA	28	4	606	15,837	4,743	148,510	0.141
	NFA	28	4	–4	16,091	5,769	144,224	0.994

Table 11. Regional trends in flow-adjusted and non-flow-adjusted concentrations from 1993 to 2003.—Continued

[FA, flow adjusted; NFA, non flow adjusted; S_T, overall regional and seasonal test statistic. Bold p-values indicate statistical significance at the α=0.10 level.]

Site group	Concentration type	Number of sites	Number of seasons	S_T	Variance of S_T	Seasonal covariance of S_T	Regional covariance of S_T	p-value
				Total nitrogen—Continued				
Greater than 10 percent urban land use in the basin	FA	38	4	–51	21,358	5,675	262,684	0.926
	NFA	41	4	–88	23,039	5,855	336,252	0.886
Base-flow index greater than 50	FA	26	4	623	14,483	2,300	138,549	0.115
	NFA	39	4	51	20,158	6,364	288,791	0.929
Basin area with subsurface drains greater than 10 square kilometers	FA	32	4	25	18,834	5,993	194,580	0.959
	NFA	37	4	–669	21,784	10,061	261,486	0.217
Mean basin slope greater than 10 percent	FA	22	4	194	12,939	3,627	100,910	0.573
	NFA	36	4	–325	19,144	7,211	269,299	0.551
Mean annual precipitation greater than 130 centimeters	FA	26	4	–250	15,299	2,649	131,131	0.519
	NFA	39	4	–471	23,239	7,043	305,073	0.417
Mean annual precipitation less than 80 centimeters	FA	23	4	328	12,257	1,836	93,030	0.318
	NFA	27	4	–201	13,648	2,625	120,199	0.588
Reference streamflow greater than 100 cubic meters per second	FA	25	4	35	15,416	3,345	128,925	0.930
	NFA	34	4	–738	20,314	6,472	237,378	0.152
Reference streamflow less than 3 cubic meters per second	FA	35	4	413	19,662	6,475	229,485	0.415
	NFA	41	4	192	21,811	6,355	309,551	0.742
High source loading from atmospheric deposition	FA	39	4	27	23,965	4,609	318,509	0.965
	NFA	43	4	–357	26,141	7,533	366,265	0.573
High source loading from fertilizer	FA	31	4	–17	17,839	6,074	168,901	0.971
	NFA	32	4	–516	18,723	6,139	187,973	0.264
High source loading from manure	FA	34	4	478	18,445	7,849	234,086	0.350
	NFA	35	4	–265	19,010	9,607	238,353	0.609
				Nitrate				
Eastern United States	FA	41	4	–608	25,341	3,294	369,081	0.336
	NFA	46	4	–512	26,593	5,622	450,335	0.462
Central United States	FA	40	4	–296	22,379	10,607	271,849	0.593
	NFA	74	4	–612	35,891	15,551	1,023,978	0.556
Western United States	FA	34	4	–461	20,811	7,541	225,189	0.361
	NFA	39	4	–211	13,030	4,307	286,969	0.703
Undeveloped land-use classification	FA	37	4	–635	22,482	8,041	250,719	0.232
	NFA	55	4	–344	19,857	7,266	548,688	0.651
Greater than 40 percent agricultural land use in the basin	FA	22	4	123	12,097	4,062	87,109	0.704
	NFA	37	4	–159	20,202	7,271	256,751	0.767
Greater than 10 percent urban land use in the basin	FA	35	4	–438	20,414	7,239	223,485	0.383
	NFA	39	4	–262	21,175	6,375	294,733	0.646
Base-flow index greater than 50	FA	44	4	–514	26,279	9,911	365,991	0.419
	NFA	55	4	–298	22,115	8,762	592,909	0.707
Basin area with subsurface drains greater than 10 square kilometers	FA	24	4	–452	14,525	6,283	109,703	0.212
	NFA	33	4	–657	18,199	9,121	219,918	0.187

Table 11. Regional trends in flow-adjusted and non-flow-adjusted concentrations from 1993 to 2003.—Continued

[FA, flow adjusted; NFA, non flow adjusted; S_T, overall regional and seasonal test statistic. Bold p-values indicate statistical significance at the $\alpha=0.10$ level.]

Site group	Concentration type	Number of sites	Number of seasons	S_T	Variance of S_T	Seasonal covariance of S_T	Regional covariance of S_T	p-value
				Nitrate—Continued				
Mean basin slope greater than 10 percent	FA	41	4	–565	24,784	9,381	309,693	0.336
	NFA	52	4	–222	20,504	9,405	521,462	0.766
Mean annual precipitation greater than 130 centimeters	FA	27	4	–543	16,856	3,278	143,265	0.180
	NFA	36	4	–357	17,577	4,715	250,209	0.495
Mean annual precipitation less than 80 centimeters	FA	29	4	–820	16,328	8,004	149,670	**0.050**
	NFA	42	4	–477	19,639	8,417	331,003	0.427
Reference streamflow greater than 100 cubic meters per second	FA	25	4	–507	15,961	6,663	132,804	0.199
	NFA	32	4	–793	17,010	8,449	217,745	0.108
Reference streamflow less than 3 cubic meters per second	FA	34	4	–350	20,345	6,675	217,435	0.480
	NFA	55	4	–112	22,334	6,155	543,341	0.883
High source loading from atmospheric deposition	FA	33	4	–413	20,345	3,801	222,603	0.407
	NFA	44	4	–522	25,643	6,455	381,911	0.418
High source loading from fertilizer	FA	19	4	–382	10,923	3,210	58,821	0.158
	NFA	34	4	–483	19,154	7,273	222,842	0.334
High source loading from manure	FA	24	4	128	13,414	4,310	116,792	0.729
	NFA	38	4	–370	20,162	8,396	284,541	0.510

None of the relations that were significant for total phosphorus in the weighted least-squares regression analysis were found to be significant for nitrate or total nitrogen, and none of the additional differences between sites with upward, downward, and nonsignificant FA trends that were significant for total phosphorus in the Kruskal-Wallis analysis were found to be significant for nitrate or total nitrogen. As with total nitrogen, with nitrate this may be due to the greater lag between changes in nutrient use on the land surface and changes in in-stream concentrations as compared to total phosphorus.

The multiple linear regression results provided limited additional insight when FA trends in nitrate concentrations were related to changes in population density and source loading from atmospheric deposition, fertilizer, and manure at sites in the Eastern, Central, and Western United States and at sites classified as having undeveloped land use (table 10*C*). The model for sites in the Eastern United States included only the intercept term, indicating that no combination of available source variables explained more variability in nitrate trends than random variation alone. The models for sites in the Central United States and for sites classified as having undeveloped land use violated assumptions of normality and(or) homoscedasticity (table 10*C*). The best-fit model for sites in the Western United States was significant and included changes in population density and source loading from atmospheric deposition (table 10*C*). The atmospheric-deposition coefficient, however, was not significant; changes in source loading form atmospheric deposition did not account for a significant amount of variation in nitrate trends at sites in the Western United States. The coefficient for population density was positive; nitrate trends at sites in the Western United States generally increased as population density increased, and decreased as population density and source loading from atmospheric deposition decreased. The multiple R^2 value for this model was low, however, indicating that much of the variability in FA trends in nitrate concentrations at sites in the Western United States was not explained by changes in the available source data.

Regional Trends

A downward regional trend in FA nitrate concentrations occurred at sites with mean annual precipitation less than 80 cm (table 11). For the other site groups, a combination of a lack of trend at many locations and trends in opposite directions at other locations cancelling one another out resulted in nonsignificant regional trends.

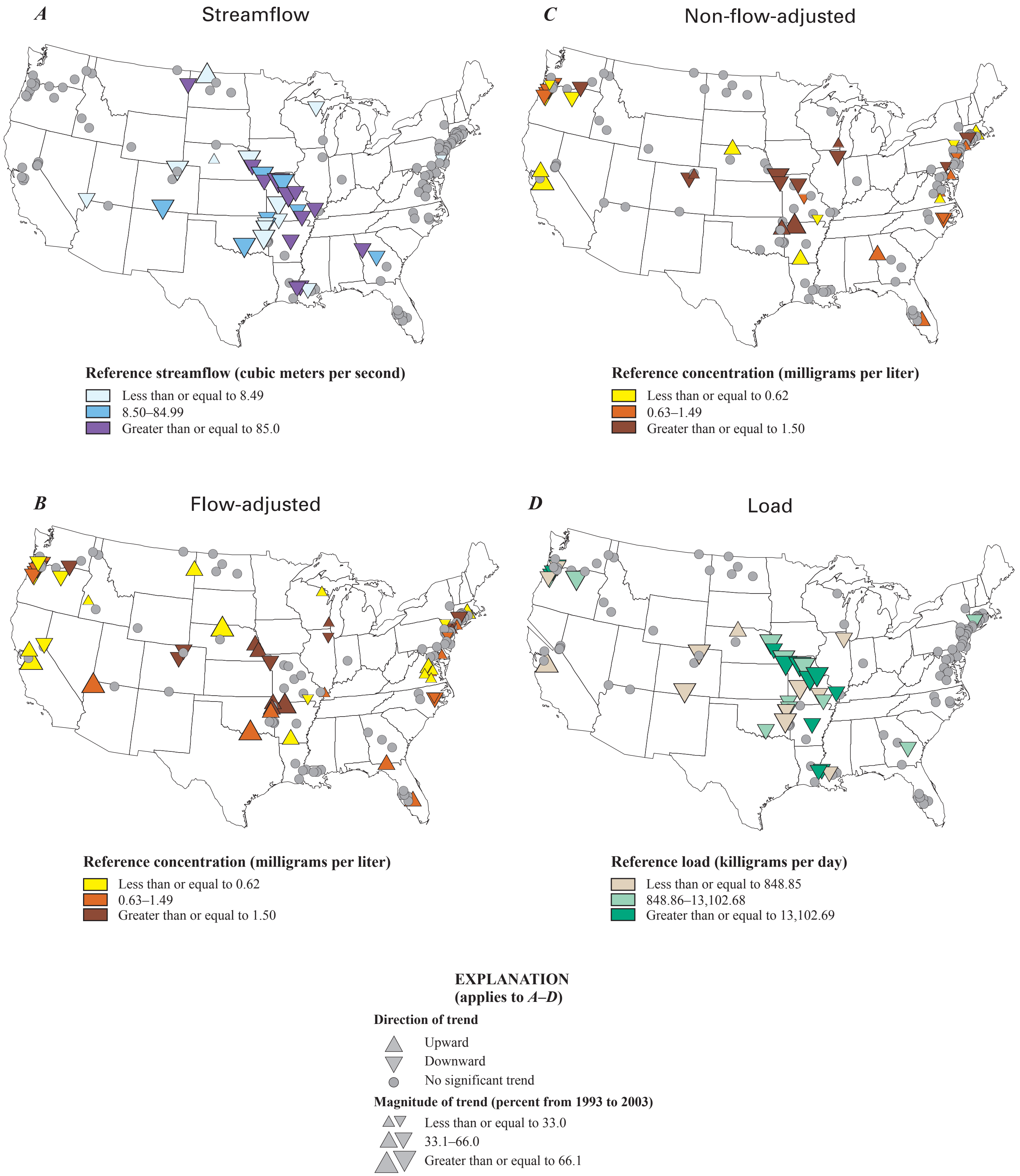

Figure 12. Trends in (*A*) streamflow, (*B*) flow-adjusted and (*C*) non-flow adjusted trends in total nitrogen concentrations, and (*D*) trends in total nitrogen loads at selected sites in the United States.

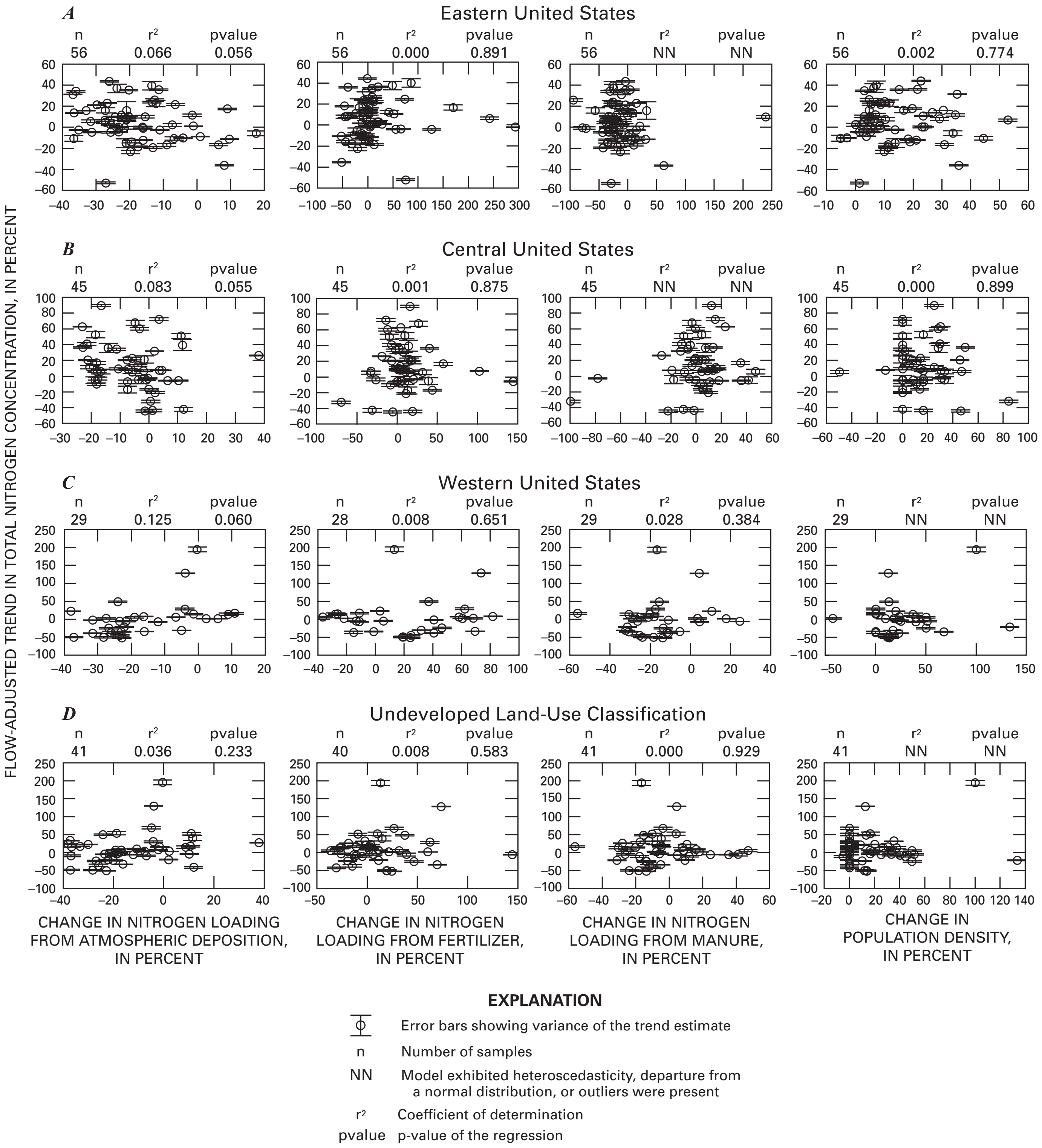

Figure 13. Relations between flow-adjusted trends in total nitrogen concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

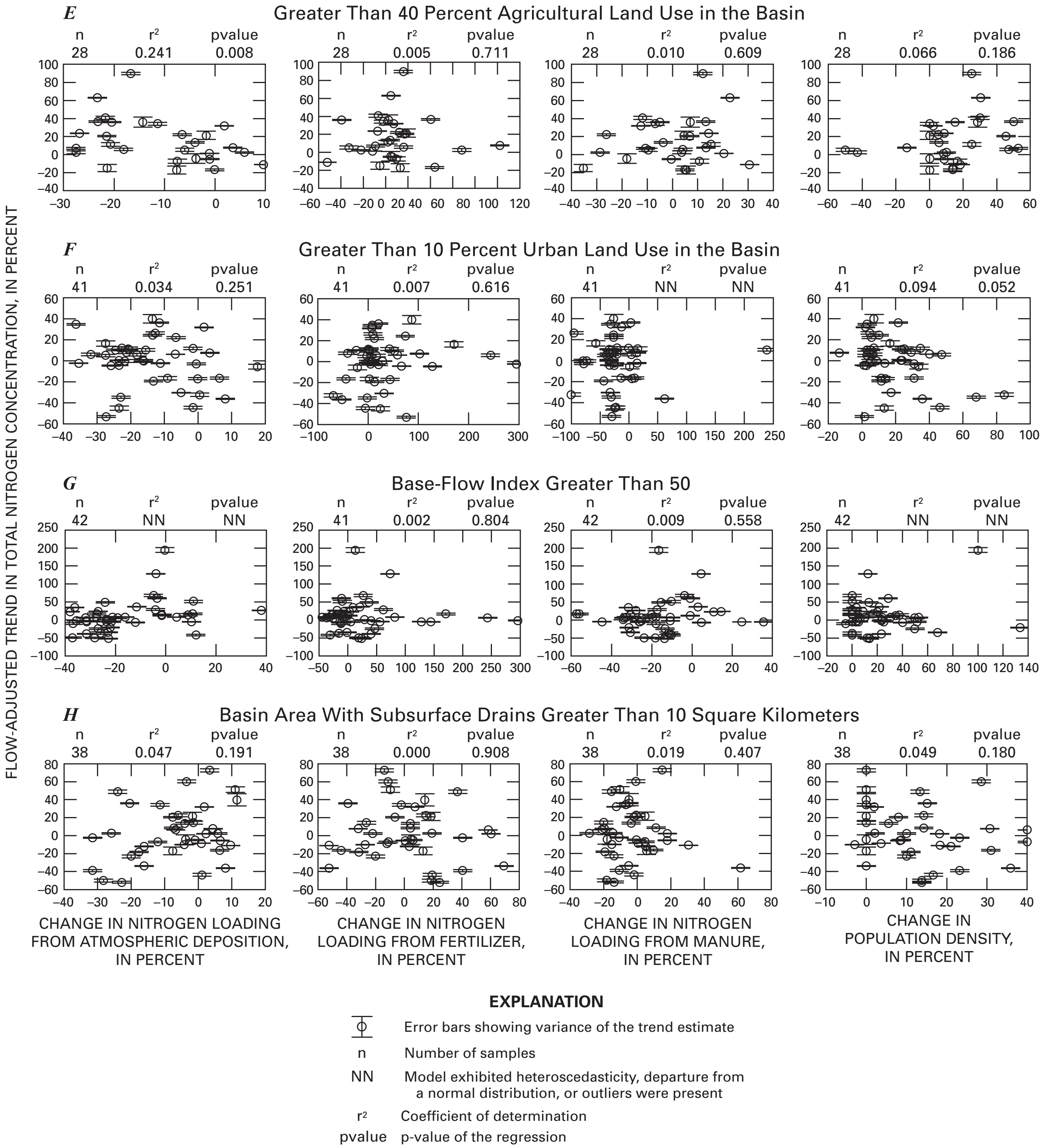

Figure 13 —Continued. Relations between flow-adjusted trends in total nitrogen concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

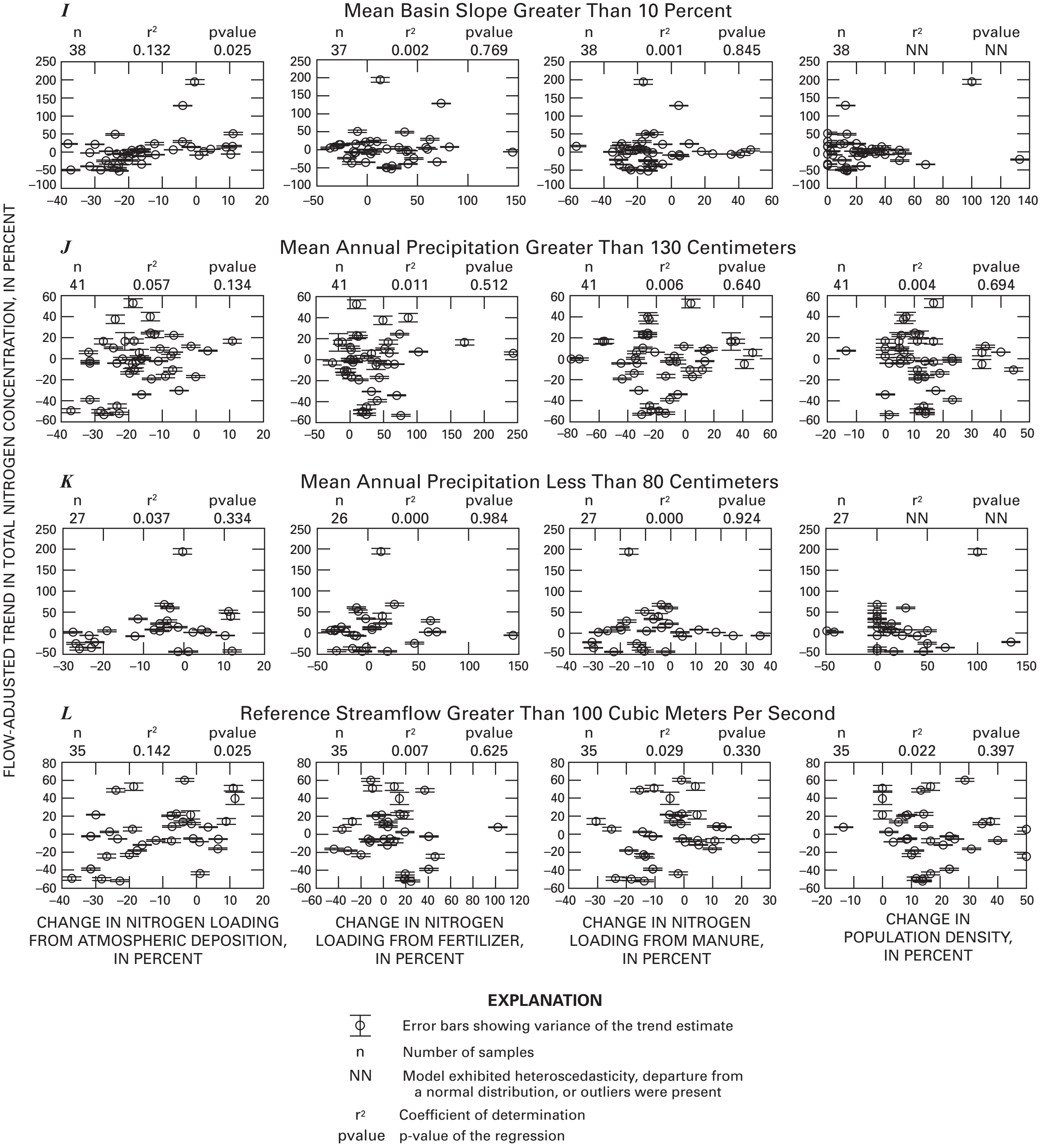

Figure 13 —Continued. Relations between flow-adjusted trends in total nitrogen concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

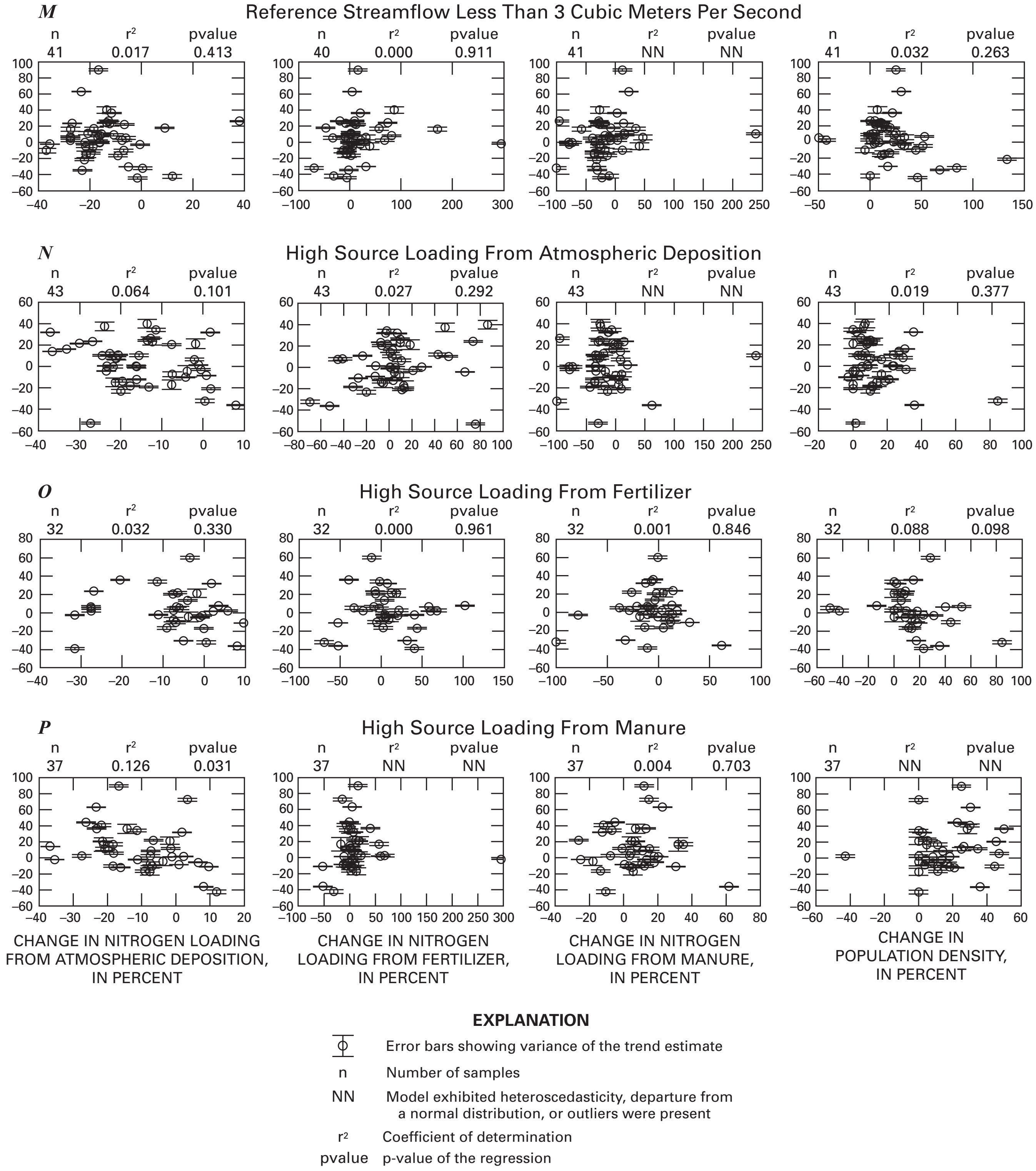

Figure 13 —Continued. Relations between flow-adjusted trends in total nitrogen concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

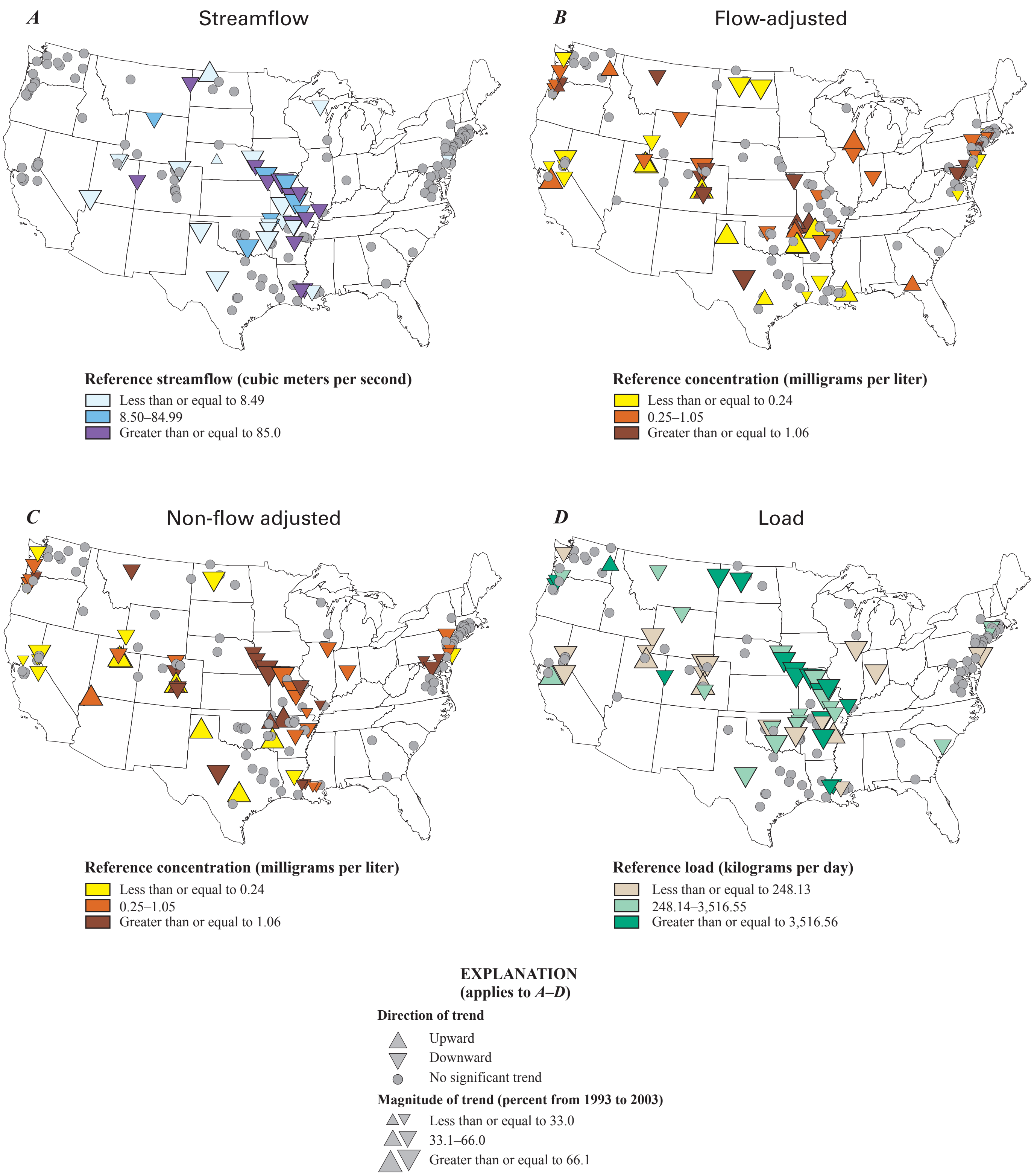

Figure 14. Trends in (*A*) streamflow, (*B*) flow-adjusted and (*C*) non-flow-adjusted trends in nitrate concentrations, and (*D*) trends in nitrate loads at selected sites in the United States.

Trend Results Relative to Stream Nutrient Enrichment

The Federal Clean Water Act requires states and authorized tribes to adopt water-quality criteria that protect designated uses of their waters (U.S. Environmental Protection Agency, 2000). As a starting point for development of more refined nutrient criteria, USEPA has developed recommended criteria for total phosphorus and total nitrogen concentrations in streams in 14 nutrient ecoregions (U.S. Environmental Protection Agency, 2002). These recommended ecoregional nutrient criteria "represent stream conditions that have minimal impacts caused by human activities" (U.S. Environmental Protection Agency, 2000).

At each trend site, the reference concentrations of total phosphorus and total nitrogen divided by USEPA's recommended nutrient criteria in the respective ecoregion provide an *enrichment ratio*—an approximation of the degree of nutrient enrichment in 1993—for that site (Appendix 1). An enrichment ratio less than one indicates that the reference concentration was below USEPA's recommended nutrient criteria for that ecoregion. An enrichment ratio greater than one indicates that nutrient enrichment over natural background conditions may have been present, with increasing ratios indicating greater relative enrichment. Because of the small number of sites with an enrichment ratio less than one (potentially a key group of sites representing minimally affected conditions), these ratios were not used in the statistical analyses reported on previously. Rather, they are described qualitatively here to provide some perspective on changes in nutrient concentrations at minimally affected sites as compared to more enriched sites during the study period.

Generally, more downward trends (FA and NFA) occurred at sites with enrichment ratios greater than one as compared to sites with ratios less than one (fig. 16). At nearly 20 percent of the more enriched sites, anthropogenic activities contributed to net decreases in nutrient concentrations from 1993 to 2003, and overall nutrient quality in the stream improved. The number of downward trends did not increase consistently as the enrichment ratio increased, however, despite the nutrient management strategies that may have been targeted to the most enriched sites.

Downward trends occurred at fewer than 10 percent of sites with enrichment ratios less than one—those sites that were likely to be minimally affected by anthropogenic activities. At half or more of these sites, FA and NFA trends in total phosphorus and total nitrogen concentrations were nonsignificant (fig. 16), indicating that anthropogenic activities did not contribute to significant net changes in concentrations from 1993 to 2003, and overall nutrient quality in the stream was maintained. At the remaining sites with enrichment ratios less than one, there were over three times as many upward than downward trends (FA and NFA) in total phosphorus concentrations and over eight times as many upward than downward trends in total nitrogen concentrations (fig. 16).

Implications for Management of Stream Quality

Nationwide, anthropogenic increases in nutrient sources and(or) transport contributed to increasing concentrations at 33 percent of stream sites for total phosphorus, 21 percent for total nitrogen, and 12 percent for nitrate between 1993 and 2003. At sites in the Central and Southwestern United States, where drought conditions occurred in the latter part of the study period, these increases often were offset by the effects of naturally decreasing precipitation and surface runoff transporting nutrients to the stream. Without the decrease in precipitation and surface runoff, stream concentrations and loads at these sites probably would have been higher than were observed. The decrease in precipitation between 1993 and 2003, however, will not continue indefinitely—for example, precipitation levels in the Upper Mississippi River Basin from December 2007 through May 2008 were the second highest since 1895, and record precipitation during June 2008 caused widespread flooding in Iowa, Wisconsin, Indiana, Illinois, and Missouri and numerous flash floods in Missouri and Ohio (National Oceanic and Atmospheric Administration, 2008). Future water-quality conditions in the Nation's streams will depend on both natural and anthropogenic changes, and consideration of the full range of possible climatic conditions can inform future water-quality management decisions.

The more frequent increases in total phosphorus concentrations as compared to total nitrogen and nitrate concentrations may have been due in part to phosphorus saturation of soils in areas that have been subject to long-term manure or fertilizer application and(or) lag times between changes in nitrogen inputs on the land surface and changes in nitrogen concentrations in streams caused by the transport of nitrogen in ground water. In the case of ground-water lag times, the full effect of current changes in nitrogen inputs on the land surface may not be realized for years or decades (Stålnacke and others, 2003). Knowledge of ground-water travel times will contribute to the proper assessment of the potential and actual effects of management strategies aimed at reducing stream nitrogen concentrations.

While modest gains have been made in nutrient quality in some heavily impacted streams, nutrient enrichment has increased in many streams that were least impacted in 1993. The Nation's least-impacted streams are increasingly being affected by population growth, and new strategies designed to reduce these effects may need to be integrated with ongoing actions to improve nutrient quality in heavily impacted streams.

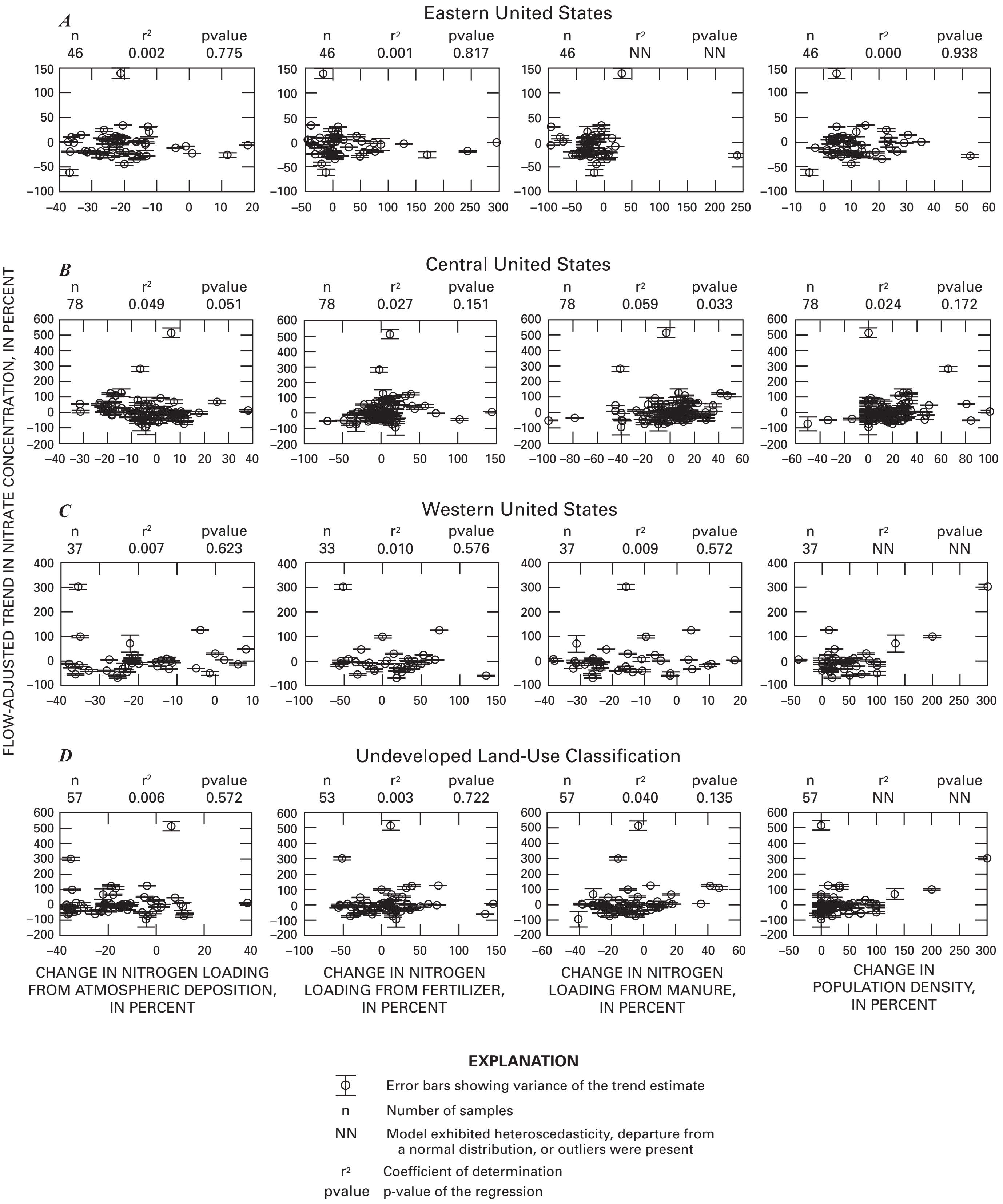

Figure 15. Relations between flow-adjusted trends in nitrate concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

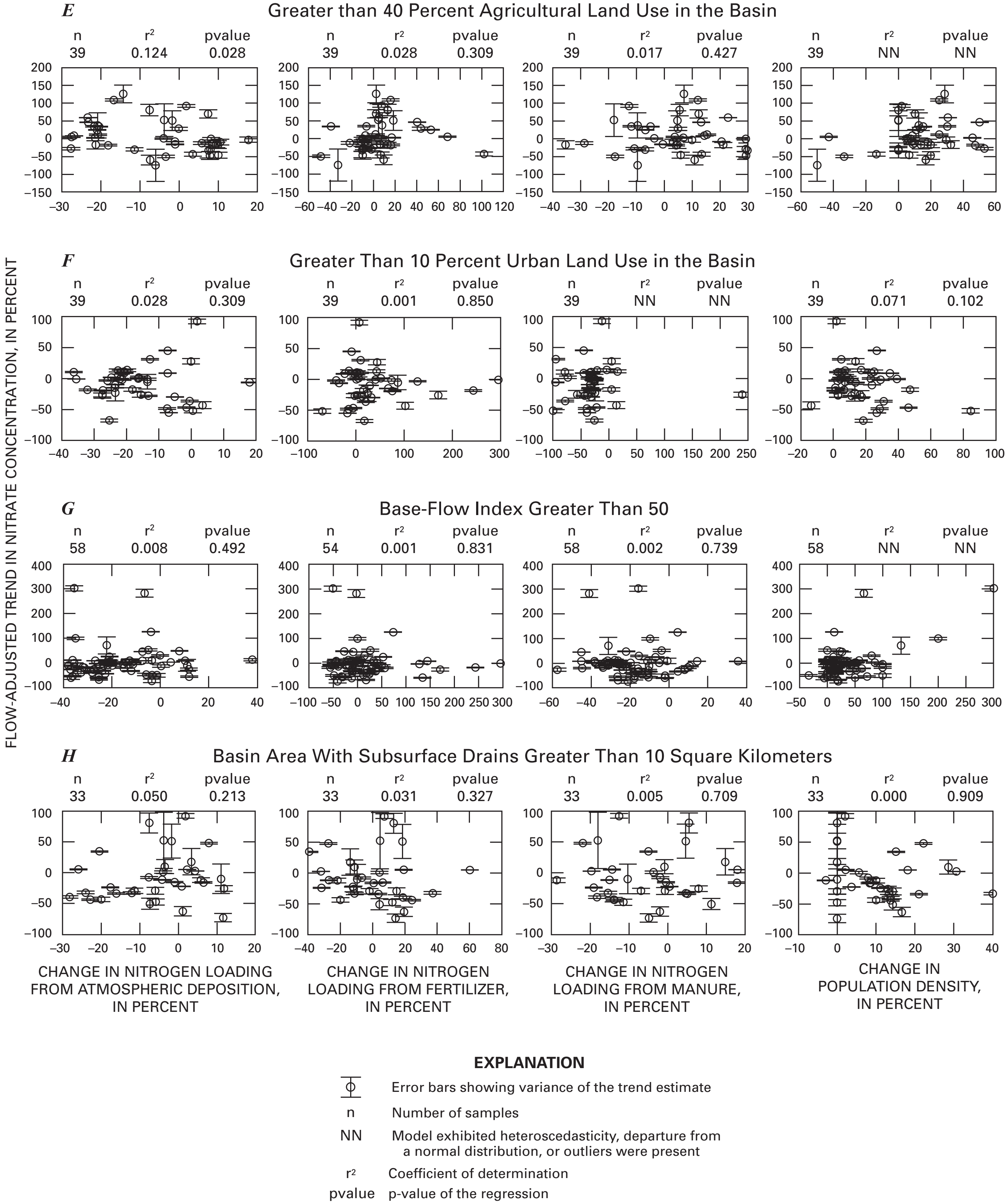

Figure 15—Continued. Relations between flow-adjusted trends in nitrate concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

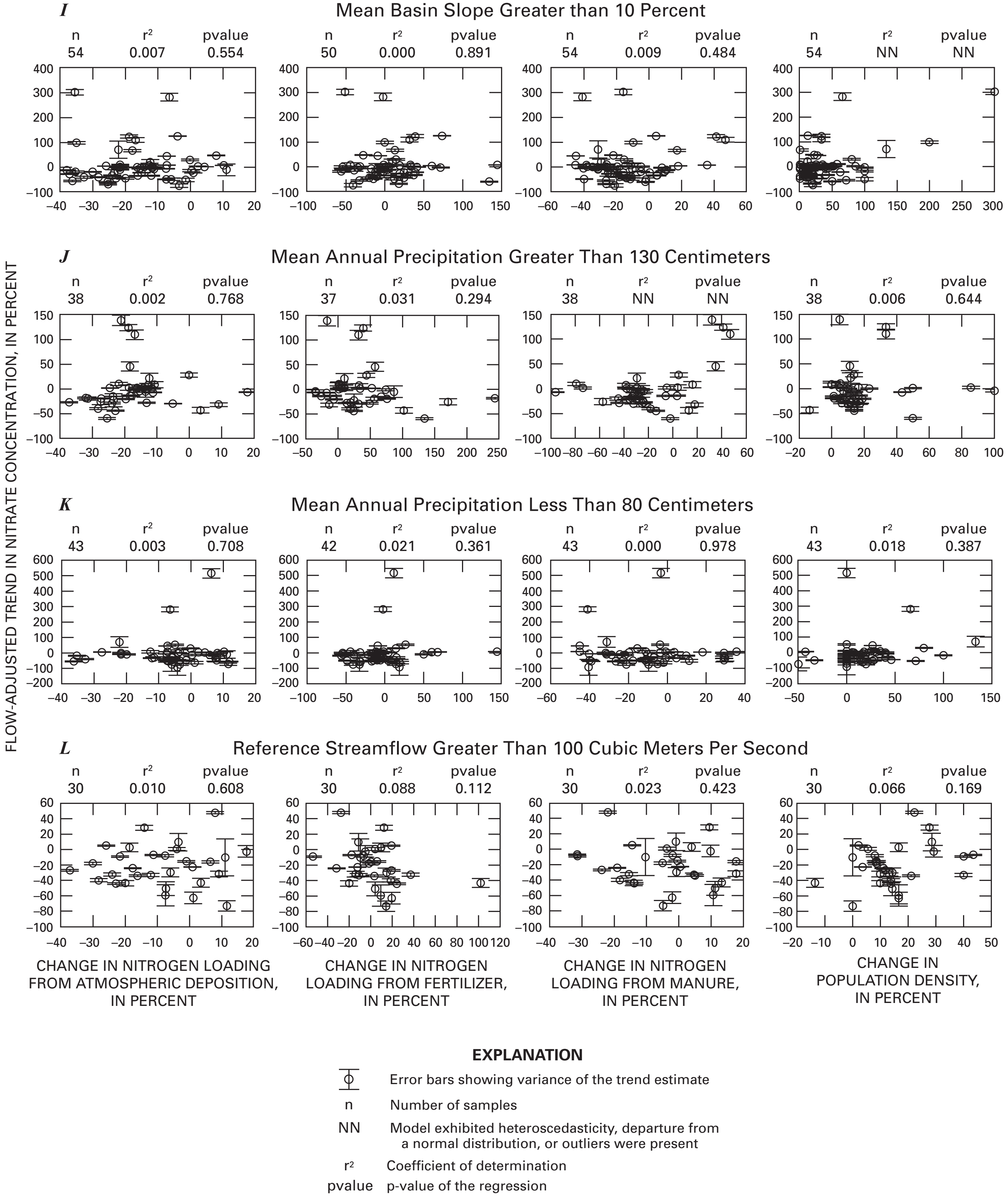

Figure 15—Continued. Relations between flow-adjusted trends in nitrate concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

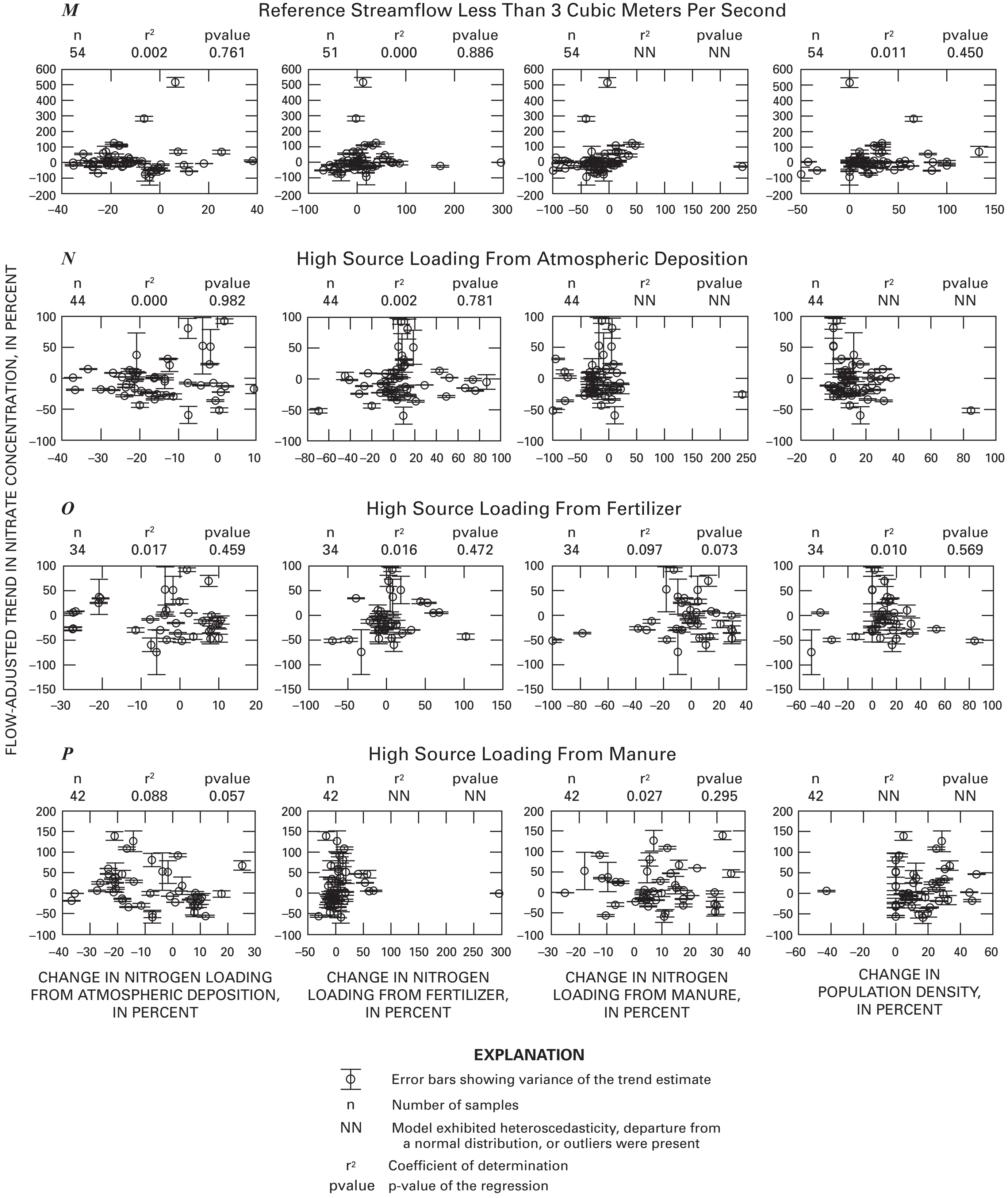

Figure 15—Continued. Relations between flow-adjusted trends in nitrate concentrations and changes in nitrogen sources from 1993 to 2003 for selected site subsets.

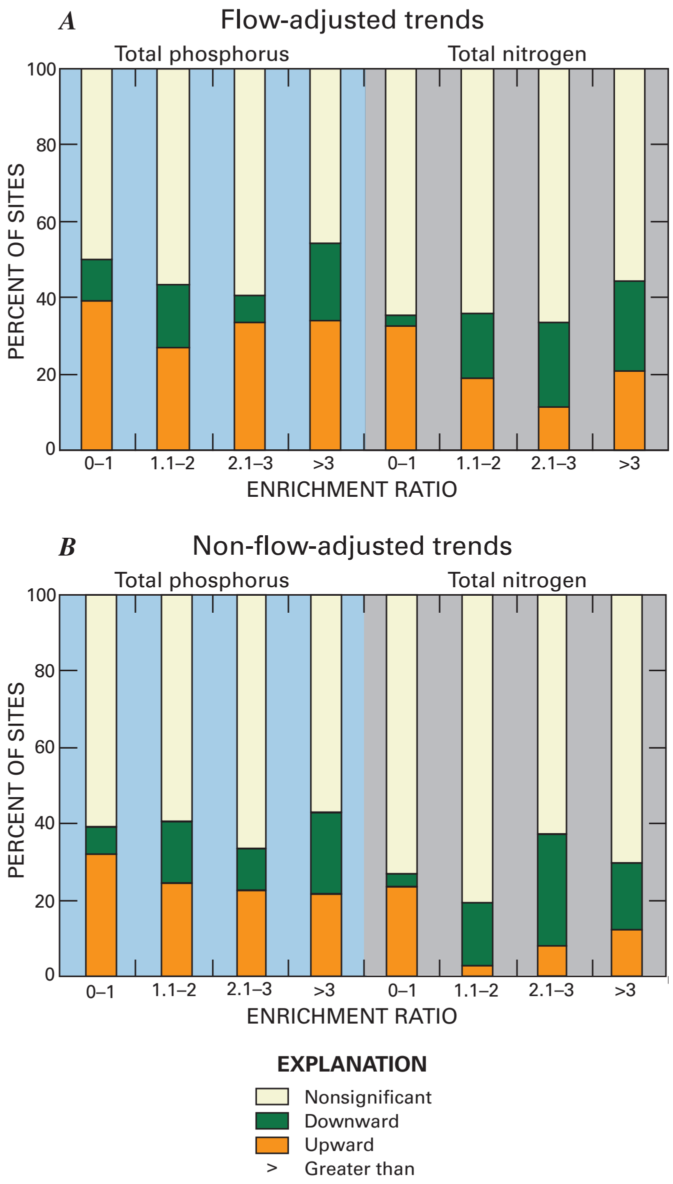

Figure 16. Distribution of (A) flow-adjusted and (B) non-flow-adjusted trends in total phosphorus and total nitrogen concentrations from 1993 to 2003 relative to the level of nutrient enrichment in the stream.

Summary and Conclusions

In 1987, the U.S. Geological Survey (USGS) began a study of more than 50 river basins and aquifers across the Nation as part of the National Water-Quality Assessment (NAWQA) Program. One of the major goals of the NAWQA Program is to determine how water-quality conditions, including concentrations and loads of nutrients, are changing over time. Outside of the NAWQA Program, USGS (in cooperation with other Federal, State, Tribal, and local agencies), state environmental agencies, the U.S. Environmental Protection Agency and other federal agencies, universities, and many others have collected nutrient data throughout the Nation. Collectively, these data can provide insight into how nutrient concentrations have changed over time in the Nation's streams and rivers and how natural features and human activities have contributed to those changes.

This report describes the methods and results of a study to determine trends in total phosphorus, total nitrogen, and nitrate concentrations and loads for the period from 1993 to 2003 in selected streams and rivers of the United States. Flow-adjusted (FA) trends in concentration (the trends that would have occurred in the absence of natural changes in streamflow), non-flow-adjusted (NFA) trends in concentration (the trends resulting from both natural and human factors), and trends in load (trends in the nutrient mass transported downstream) were determined, and the results were examined spatially to determine whether a consistent pattern of trends occurred across groups of sites at multiple locations. Relations between the trends and changes in nutrient sources, streamflow, and other factors were examined.

Streamflow

At the majority of sites nationwide, streamflow did not change significantly from 1993 to 2003. Significant trends in streamflow occurred at 23 percent of the sites; at all but two sites, the trends were downward. These downward trends primarily occurred at sites in Central and Southwestern United States and parts of the Southeastern United States, likely as a result of drought conditions in the latter part of the study period.

Total Phosphorus

Downward FA trends in total phosphorus concentrations occurred at 16 percent of the sites nationwide, indicating that at the majority of sites, changes in phosphorus use, implementation of pollution-control strategies, or other anthropogenic activities were not contributing to significant decreases in total phosphorus concentrations in streams, or any reductions that occurred were offset by other anthropogenic activities in the watershed that increased concentrations. Upward FA trends in total phosphorus concentrations were more numerous; increases in phosphorus sources and(or) transport at 33 percent of the sites may have been contributing to increased total phosphorus concentrations in streams. Upward NFA trends were fewer, with total phosphorus concentrations in streams increasing at 24 percent of sites. Downward NFA trends only occurred at 16 percent of the sites. At the majority of sites, total phosphorus concentrations in streams were not changing significantly. FA trends in total phosphorus concentrations were generally upward or nonsignificant at sites in the Northeastern, Central, and Southwestern United States, and NFA trends in total phosphorus concentrations were generally upward or nonsignificant at sites in the Northeastern and Central United States. Elsewhere, trends were upward, downward, and nonsignificant.

Relatively fewer upward NFA trends than upward FA trends occurred at sites in the Central and Southwestern United States, where most of the significant (downward) trends in streamflow occurred. In these areas, the increase in source indicated by the upward FA trend likely was offset by the effects of decreasing surface runoff indicated by the downward streamflow trend, leading to fewer upward NFA trends. Total phosphorus concentrations at sites in the Central and Southwestern United States were probably lower than they would have been without the decrease in streamflow and associated surface runoff. Trends in loads of total phosphorus from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (81 percent) nationwide, there was no significant trend in the load of total phosphorus being transported to downstream locations. Upward trends in load occurred at only 4 percent of sites; downward trends in load occurred at 15 percent of sites, primarily in the Central and Southeastern United States.

Several significant relations between FA trends in total phosphorus concentrations and changes in nutrient sources were identified, although these relations did not explain all of the variability in the trends. At undeveloped sites, total phosphorus trends were positively related to changes in population density, indicating that increases in population density may have been one factor contributing to increasing total phosphorus concentrations in streams in undeveloped areas, possibly as a result of increased loading from septic systems and point sources and(or) runoff from construction sites and fertilized lawns. At sites with greater than 40 percent agricultural land use in the basin, total phosphorus trends were positively related to changes in phosphorus loading from fertilizer and manure. These relations indicate that increases in the land application of fertilizer and manure may have been factors contributing to increasing total phosphorus concentrations in streams in some agricultural areas. Likewise, decreases in the land application of fertilizer and manure may have been contributing to decreases (or smaller increases) in total phosphorus concentrations in streams in other agricultural areas. A similar relation between total phosphorus trends and changes in phosphorus loading from fertilizer occurred at sites in the Central United States and at sites with high loading from atmospheric deposition—many of these sites had substantial agricultural land use in the basin. At sites with greater than 10 km^2 of the basin area containing subsurface (tile) drains, total phosphorus trends were negatively related to changes in population density.

Additional analyses comparing source changes at sites with upward, downward, and nonsignificant FA trends in total phosphorus concentrations indicated that at sites with greater than 10 percent urban land cover in the basin, the decrease in phosphorus loading from manure was greater at sites with nonsignificant trends than at sites with downward trends—at these sites, other factors likely were more important in affecting the downward trends. At sites with high source loading from atmospheric deposition, the increase in population density was greater at sites with nonsignificant trends than at sites with upward trends—at these sites, other factors likely were more important in affecting the upward trends.

Upward regional trends in FA total phosphorus concentrations occurred at sites in the Central United States, sites with greater than 40 percent agricultural land use in the basin, and sites with high source loading from manure. There were, however, no significant regional trends in NFA total phosphorus concentrations at these sites, likely reflecting the effects of decreasing streamflow at many of the sites.

Total Nitrogen

Downward FA trends in total nitrogen concentrations occurred at 16 percent of the sites, indicating that at the majority of sites, changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities were not contributing to significant decreases in total nitrogen concentrations in streams, or any reductions that occurred were offset by other anthropogenic activities in the watershed that increased concentrations. Upward FA trends in total nitrogen concentrations were more numerous; increases in nitrogen sources and(or) transport at 21 percent of the sites may have been contributing to increased total nitrogen concentrations in streams. In contrast, more NFA trends were downward than upward—downward NFA trends occurred at 16 percent of sites, whereas upward NFA trends occurred at 11 percent of sites. FA and NFA trends in total nitrogen concentrations generally were downward or nonsignificant at sites in the Northwestern United States. Elsewhere, trends were a mixture of upward, downward, and nonsignificant.

Relatively fewer upward NFA trends than upward FA trends occurred at sites in the Central United States, where many of the significant (downward) trends in streamflow occurred. At these sites, the increase in source indicated by the upward FA trend likely was offset by the effects of decreasing surface runoff indicated by the downward streamflow trend, resulting in fewer upward NFA trends. Total nitrogen concentrations at sites in the Central United States were probably lower than they would have been without the decrease in streamflow and associated surface runoff. Trends in loads of total nitrogen from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (74 percent) nationwide, there was no significant trend in the load of total nitrogen being transported to downstream locations. Upward trends in load occurred at only 1 percent of sites; downward trends in load occurred at 25 percent of sites, primarily in the Central United States.

There were fewer upward trends in total nitrogen concentrations than in total phosphorus concentrations. This difference cannot be explained easily by changes in nonpoint-source loading of nitrogen and phosphorus from 1993 to 2003—during this period, there were slightly more sites with increases in nitrogen loading from fertilizer and(or) manure than there were sites with increases in phosphorus loading from these two sources. One alternate possibility may be that soils are at or approaching phosphorus saturation in areas that have been subject to long-term manure or fertilizer application; over time, a greater proportion of the phosphorus load applied to the land surface may be reaching streams in these areas. Another possibility is that a substantial source of nitrogen in some streams is ground water. Because of the time required for ground water to travel to streams, there may be a lag between changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities on the land surface and changes in total nitrogen concentration in streams. As a result, trends in total nitrogen concentrations from 1993 to 2003 may be influenced to a greater degree than trends in total phosphorus concentrations by changes that took place on the land surface prior to 1993.

Several significant relations between FA trends in total nitrogen concentrations and changes in nutrient sources were identified, although these relations did not explain all of the variability in the trends. Changes in nitrogen loading from atmospheric deposition were significantly related to trends in total nitrogen concentrations at sites with greater than 40 percent agricultural land use in the basin, at sites with mean basin slope greater than 10 percent, at sites with high streamflows, and at sites with high loading from manure. Although a negative relation was observed at sites with greater than 40 percent agricultural land use in the basin and at sites with high loading from manure, changes in loading from atmospheric deposition likely had little impact on trends in total nitrogen at these sites because nitrogen loading from atmospheric deposition was small compared to that from fertilizer and(or) manure.

Additional analyses comparing source changes at sites with upward, downward, and nonsignificant FA trends in total nitrogen concentrations indicated that at sites with high source loading from manure, nitrogen loading from fertilizer generally decreased at sites with downward trends and generally increased at sites with upward and nonsignificant trends. At sites with high streamflows, the decrease in loading from manure was greater at sites with downward trends than at sites with nonsignificant trends.

There were no significant regional trends in FA or NFA total nitrogen concentrations. This likely resulted from a combination of a lack of trend at many locations and trends in opposite directions at other locations cancelling one another out.

Nitrate

There were more downward FA trends in nitrate concentrations than in total phosphorus or total nitrogen concentrations—25 percent of sites had downward FA trends in nitrate concentrations, indicating that changes in nitrogen use, implementation of pollution-control strategies, or other anthropogenic activities likely were contributing to decreases in nitrate concentrations in one-quarter of the study streams. There were fewer upward FA trends in nitrate concentrations than in total phosphorus or total nitrogen concentrations—12 percent of sites had upward FA trends in nitrate concentrations, indicating that increases in sources and(or) transport at these sites may have been contributing to increased nitrate concentrations in streams. More NFA trends in nitrate concentrations were downward than upward—downward NFA trends occurred at 27 percent of sites, whereas upward NFA trends occurred at 6 percent of sites. FA and NFA trends in nitrate concentrations generally were downward or nonsignificant at sites in the Eastern and Western United States and mixed at sites in the Central United States.

There were numerous sites with non-significant FA trends and downward NFA trends at sites in the Central United States, where many of the significant (downward) trends in streamflow occurred. At these sites, there likely was little net change in inputs of nitrate from land application or ground water between1993 and 2003; a decrease in runoff at these sites probably contributed to the downward NFA trends. As a result, nitrate concentrations at sites in the Central United States were probably lower than they would have been without the decrease in streamflow and associated surface runoff. Trends in loads of nitrate from 1993 to 2003 were a reflection of the combined influence of changes in streamflow and changes in concentration. At the majority of sites (66 percent) nationwide, there was no significant trend in the load of nitrate being transported to downstream locations. Upward trends in load occurred at only 3 percent of sites; downward trends in load occurred at 31 percent of sites, a large number of which were in the Central United States.

There were more downward and fewer upward trends in nitrate concentrations as compared to total phosphorus and total nitrogen. Nitrate is more readily leached through the soil and is more mobile in ground water than phosphorus and other forms of nitrogen. Therefore, the lag time between changes in use, implementation of pollution-control strategies, or other anthropogenic activities on the land surface and changes in in-stream concentrations may have had a greater impact on nitrate trends. As a result, trends in nitrate concentrations from 1993 to 2003 may have been influenced by changes that took place on the land surface prior to 1993 to a greater degree than trends in total phosphorus and total nitrogen.

Several significant relations between FA trends in nitrate concentrations and changes in nutrient sources were identified, although these relations did not explain all of the variability in the trends. Fewer significant relations between FA trends and changes in nutrient sources were identified for nitrate than for total phosphorus or total nitrogen. In the Central United States, where many sites had substantial agricultural land use in the basin, nitrate trends were positively related to changes in nitrogen loading from manure. This relation indicates that increases in the land application of manure may have been a factor contributing to increasing nitrate concentrations in streams in some areas of the Central United States. Likewise, decreases in the land application of manure may have been contributing to decreases (or smaller increases) in nitrate concentrations in streams in other areas of the Central United States. In addition, nitrate trends at sites in the Western United States generally increased as population density increased and decreased as population density decreased.

Additional analyses comparing source changes at sites with upward, downward, and nonsignificant FA trends in nitrate concentrations also found relations with changes in nitrogen loading from atmospheric deposition at sites in the Central United States (where decreases in loading from atmospheric deposition were greater at sites with upward trends than at sites with downward trends), and sites with low streamflows (where decreases in loading from atmospheric deposition were smaller at sites with downward trends than at sites with nonsignificant trends). The counterintuitive results indicate that other factors likely were more important than changes in loading from atmospheric deposition in affecting the trends at these sites. At sites with mean annual precipitation greater than 130 centimeters, increases in loading from manure were greater than at sites with upward FA trends than at sites with nonsignificant FA trends.

A downward regional trend in FA nitrate concentrations occurred at sites with mean annual precipitation less than 80 cm. The absence of additional regional trends in nitrate concentrations likely resulted from a combination of a lack of trend at many locations and trends in opposite directions at other locations cancelling one another out.

Trend Results Relative to Stream Nutrient Enrichment

Generally, more downward trends occurred at sites with nutrient enrichment above natural background conditions as compared to sites minimally affected by anthropogenic activities. At nearly 20 percent of sites with nutrient enrichment over natural background conditions, anthropogenic activities contributed to net decreases in nutrient concentrations from 1993 to 2003, and overall nutrient quality in the stream improved. At sites minimally affected by anthropogenic activities, downward trends occurred at fewer than 10 percent of sites, and there were over three times as many upward than downward trends in total phosphorus concentrations and over eight times as many upward than downward trends in total nitrogen concentrations.

Implications for Management of Stream Quality

While modest gains have been made in nutrient quality in some heavily impacted streams, nutrient enrichment has increased in many streams that were least impacted in 1993. The Nation's least-impacted streams are increasingly being affected by population growth, and new strategies designed to reduce these effects may need to be integrated with ongoing actions to improve nutrient quality in heavily impacted streams. In addition, future water-quality conditions will depend on both natural and anthropogenic changes, and consideration of the full range of possible climatic conditions can inform future water-quality management decisions.

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Appendixes

Appendix 1. Study-site characteristics.

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Station number	Station name	Drainage area, in square kilometers	Percent of drainage area in the United States	Area of United States
1	01122610	Shetucket River at South Windham, Conn.	1,065.4	100.0	Eastern
2	01124000	Quinebaug River at Quinebaug, Conn.	392.0	100.0	Eastern
3	01127000	Quinebaug River at Jewett City, Conn.	1,838.7	100.0	Eastern
4	01184000	Connecticut River at Thompsonville, Conn.	25,049.5	98.8	Eastern
5	01184490	Broad Brook at Broad Brook, Conn.	38.1	100.0	Eastern
6	01188090	Farmington River at Unionville, Conn.	977.8	100.0	Eastern
7	01189995	Farmington River at Tariffville, Conn.	1,493.0	100.0	Eastern
8	01192500	Hockanum River near East Hartford, Conn.	190.7	100.0	Eastern
9	01193500	Salmon River near East Hampton, Conn.	271.3	100.0	Eastern
10	01196500	Quinnipiac River at Wallingford, Conn.	285.8	100.0	Eastern
11	01205500	Housatonic River at Stevenson, Conn.	3,993.4	100.0	Eastern
12	01208500	Naugatuck River at Beacon Falls, Conn.	674.4	100.0	Eastern
13	01208990	Saugatuck River near Redding, Conn.	53.8	100.0	Eastern
14	01209710	Norwalk River at Winnipauk, Conn.	85.1	100.0	Eastern
15	01357500	Mohawk River at Cohoes, N.Y.	9,113.4	100.0	Eastern
16	01377000	Hackensack River at Rivervale, N.J.	145.3	100.0	Eastern
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	164.2	100.0	Eastern
18	01387500	Ramapo River near Mahwah, N.J.	312.1	100.0	Eastern
19	01389500	Passaic River at Little Falls, N.J.	1,997.6	100.0	Eastern
20	01391500	Saddle River at Lodi, N.J.	146.5	100.0	Eastern
21	01394500	Rahway River near Springfield, N.J.	67.1	100.0	Eastern
22	01395000	Rahway River at Rahway, N.J.	107.3	100.0	Eastern
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	30.4	100.0	Eastern
24	01398000	Neshanic River at Reaville, N.J.	66.0	100.0	Eastern
25	01402000	Millstone River at Blackwells Mills, N.J.	663.9	100.0	Eastern
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	2,074.2	100.0	Eastern
27	01408000	Manasquan River at Squankum, N.J.	114.1	100.0	Eastern
28	01408500	Toms River near Toms River, N.J.	319.9	100.0	Eastern
29	01409500	Batsto River at Batsto, N.J.	176.5	100.0	Eastern
30	01411500	Maurice River at Norma, N.J.	270.2	100.0	Eastern
31	01438500	Delaware River at Montague, N.J.	9,016.4	100.0	Eastern
32	01443500	Paulins Kill at Blairstown, N.J.	326.7	100.0	Eastern
33	01463500	Delaware River at Trenton, N.J.	17,579.8	100.0	Eastern
34	01467150	Cooper River at Haddonfield, N.J.	47.0	100.0	Eastern
35	01477120	Raccoon Creek near Swedesboro, N.J.	67.4	100.0	Eastern
36	01491000	Choptank River near Greensboro, Md.	295.0	100.0	Eastern
37	01578310	Susquehanna River at Conowingo, Md.	70,103.1	100.0	Eastern
38	01594440	Patuxent River near Bowie, Md.	906.6	100.0	Eastern
39	01614500	Conococheague Creek at Fairview, Md.	1,309.5	100.0	Eastern
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	29,998.8	100.0	Eastern
41	01668000	Rappahannock River near Fredericksburg, Va.	4,134.7	100.0	Eastern
42	01673000	Pamunkey River near Hanover, Va.	2,795.0	100.0	Eastern
43	01674500	Mattaponi River near Beulahville, Va.	1,560.2	100.0	Eastern
44	02035000	James River at Cartersville, Va.	16,200.6	100.0	Eastern
45	02041650	Appomattox River at Matoaca, Va.	3,477.7	100.0	Eastern
46	02085000	Eno River at Hillsborough, N.C.	171.4	100.0	Eastern
47	02089500	Neuse River at Kinston, N.C.	7,021.5	100.0	Eastern
48	02091500	Contentnea Creek at Hookerton, N.C.	1,908.6	100.0	Eastern
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	--	--	Eastern
50	02175000	Edisto River near Givhans, S.C.	7,077.1	100.0	Eastern
51	02198500	Savannah River near Clyo, Ga.	25,509.8	100.0	Eastern
52	02213700	Ocmulgee River near Warner Robins, Ga.	6,891.2	100.0	Eastern
53	02215500	Ocmulgee River at Lumber City, Ga.	13,581.9	100.0	Eastern
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	11,517.1	100.0	Eastern
55	02226010	Altamaha River near Gardi, Ga.	35,220.1	100.0	Eastern
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	3,486.9	100.0	Eastern
57	02271500	Josephine Creek near De Soto City, Fla.	301.1	100.0	Eastern
58	02295420	Payne Creek near Bowling Green, Fla.	316.8	100.0	Eastern
59	02296750	Peace River at Arcadia, Fla.	3,436.0	100.0	Eastern
60	02300700	Bullfrog Creek near Wimauma, Fla.	73.8	100.0	Eastern
61	02301300	South Prong Alafia River near Lithia, Fla.	277.3	100.0	Eastern

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Station number	Station name	Drainage area, in square kilometers	Percent of drainage area in the United States	Area of United States
62	02302500	Blackwater Creek near Knights, Fla.	226.4	100.0	Eastern
63	02303000	Hillsborough River near Zephyrhills, Fla.	546.1	100.0	Eastern
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	3,322.2	100.0	Eastern
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	3,863.7	100.0	Eastern
66	02335870	Sope Creek near Marietta, Ga.	79.5	100.0	Eastern
67	02338000	Chattahoochee River near Whitesburg, Ga.	6,250.6	100.0	Eastern
68	02344040	Chattahoochee River near Steam Mill, Ga.	21,974.1	100.0	Eastern
69	02353000	Flint River at Newton, Ga.	14,899.4	100.0	Eastern
70	02388520	Oostanaula River at Rome, Ga.	20.5	100.0	Eastern
71	02492000	Bogue Chitto River near Bush, La.	3,071.5	100.0	Eastern
72	03353637	Little Buck Creek near Indianapolis, Ind.	44.6	100.0	Central
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	527,228.9	100.0	Central
74	04063700	Popple River near Fence, Wis.	362.6	100.0	Central
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	122.3	100.0	Central
76	04087000	Milwaukee River at Milwaukee, Wis.	1,805.2	100.0	Central
77	0422026250	Northrup Creek at North Greece, N.Y.	22.6	100.0	Central
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	97.6	100.0	Central
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	22.9	100.0	Central
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	391.0	100.0	Central
81	05114000	Souris River near Sherwood, N. Dak.	22,758.7	14.2	Central
82	05120000	Souris River near Verendrye, N. Dak.	28,839.6	31.9	Central
83	05287890	Elm Creek near Champlin, Minn.	222.1	100.0	Central
84	05427718	Yahara River at Windsor, Wis.	184.7	100.0	Central
85	05427948	Pheasant Branch at Middleton, Wis.	47.0	100.0	Central
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	11.1	100.0	Central
87	05500000	South Fabius River near Taylor, Mo.	1,560.2	100.0	Central
88	05514500	Cuivre River near Troy, Mo.	2,439.3	100.0	Central
89	05525500	Sugar Creek at Milford, Ill.	1,158.8	100.0	Central
90	05531500	Salt Creek at Western Springs, Ill.	290.6	100.0	Central
91	05532500	Des Plaines River at Riverside, Ill.	1,634.2	100.0	Central
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	24.7	100.0	Central
93	05586100	Illinois River at Valley City, Ill.	69,164.6	100.0	Central
94	07018100	Big River near Richwoods, Mo.	1,909.5	100.0	Central
95	07022000	Mississippi River at Thebes, Ill.	1,839,670.0	98.5	Central
96	06088500	Muddy Creek at Vaughn, Mont.	661.9	100.0	Central
97	06178000	Poplar River at International Boundary, Mont.	929.1	2.0	Central
98	06274300	Bighorn River at Basin, Wyo.	34,249.0	100.0	Central
99	06329500	Yellowstone River near Sidney, Mont.	177,139.1	100.0	Central
100	06338490	Missouri River at Garrison Dam, N. Dak.	468,773.8	94.1	Central
101	06461500	Niobrara River near Sparks, Nebr.	21,666.8	100.0	Central
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	3,019.2	100.0	Central
103	06713500	Cherry Creek at Denver, Colo.	1,063.2	100.0	Central
104	06752260	Cache La Poudre River at Fort Collins, Colo.	2,920.8	100.0	Central
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	3,222.6	100.0	Central
106	06753990	Lonetree Creek near Greeley, Colo.	1,477.9	100.0	Central
107	06754000	South Platte River near Kersey, Colo.	25,015.6	100.0	Central
108	06775900	Dismal River near Thedford, Nebr.	71.6	100.0	Central
109	06800000	Maple Creek near Nickerson, Nebr.	953.9	100.0	Central
110	06805500	Platte River at Louisville, Nebr.	220,907.8	100.0	Central
111	06817700	Nodaway River near Graham, Mo.	3,927.0	100.0	Central
112	06818000	Missouri River at St. Joseph, Mo.	1,081,419.7	97.5	Central
113	06902000	Grand River near Sumner, Mo.	17,950.5	100.0	Central
114	06905500	Chariton River near Prairie Hill, Mo.	4,897.5	100.0	Central
115	06921070	Pomme De Terre River near Polk, Mo.	712.6	100.0	Central
116	06926510	Osage River below St. Thomas, Mo.	37,907.8	100.0	Central
117	06930800	Gasconade River above Jerome, Mo.	6,649.3	100.0	Central
118	06934500	Missouri River at Hermann, Mo.	1,344,910.2	98.0	Central
119	07047942	L'Anguille River near Colt, Ark.	1,374.9	100.0	Central
120	07053250	Yocum Creek near Oak Grove, Ark.	134.1	100.0	Central
121	07056000	Buffalo River near St Joe, Ark.	2,149.4	100.0	Central
122	07060500	White River at Calico Rock, Ark.	25,815.4	100.0	Central

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Station number	Station name	Drainage area, in square kilometers	Percent of drainage area in the United States	Area of United States
123	07060710	North Sylamore Creek near Fifty Six, Ark.	150.0	100.0	Central
124	07066110	Jacks Fork above Two River, Mo.	1,120.5	100.0	Central
125	07068000	Current River at Doniphan, Mo.	5,317.2	100.0	Central
126	07077500	Cache River at Patterson, Ark.	6,677.9	100.0	Central
127	07077700	Bayou DeView near Morton, Ark.	1,079.2	100.0	Central
128	07103700	Fountain Creek near Colorado Springs, Colo.	268.1	100.0	Central
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	214.2	100.0	Central
130	07105500	Fountain Creek at Colorado Springs, Colo.	961.4	100.0	Central
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	1,072.1	100.0	Central
132	07106300	Fountain Creek near Pinon, Colo.	2,208.9	100.0	Central
133	07106500	Fountain Creek at Pueblo, Colo.	2,414.2	100.0	Central
134	07189000	Elk River near Tiff City, Mo.	2,200.7	100.0	Central
135	07195500	Illinois River near Watts, Okla.	1,634.7	100.0	Central
136	07195865	Sager Creek near West Siloam Springs, Okla.	49.7	100.0	Central
137	07196000	Flint Creek near Kansas, Okla.	300.1	100.0	Central
138	07196500	Illinois River near Tahlequah, Okla.	2,454.3	100.0	Central
139	07197000	Baron Fork at Eldon, Okla.	808.5	100.0	Central
140	07227500	Canadian River near Amarillo, Tex.	49,289.7	100.0	Central
141	07239450	North Canadian River near Calumet, Okla.	34,298.2	100.0	Central
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	34,968.2	100.0	Central
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	35,447.1	100.0	Central
144	07241550	North Canadian River near Harrah, Okla.	35,712.9	100.0	Central
145	07247015	Poteau River at Loving, Okla.	696.6	100.0	Central
146	07247250	Black Fork below Big Creek near Page, Okla.	245.5	100.0	Central
147	07247345	Black Fork at Hodgen, Okla.	511.3	100.0	Central
148	07247650	Fourche Maline near Leflore, Okla.	633.2	100.0	Central
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	408,729.4	100.0	Central
150	07331000	Washita River near Dickson, Okla.	18,589.7	100.0	Central
151	07355500	Red River at Alexandria, La.	560.5	100.0	Central
152	07362000	Ouachita River at Camden, Ark.	13,943.0	100.0	Central
153	07373420	Mississippi River near St Francisville, La.	2,965,462.6	99.1	Central
154	07375500	Tangipahoa River at Robert, La.	1,674.8	100.0	Central
155	07376000	Tickfaw River at Holden, La.	1,028.0	100.0	Central
156	07381495	Atchafalaya River at Melville, La.	240,627.8	100.0	Central
157	07386980	Vermilion River at Perry, La.	1,128.9	100.0	Central
158	08030500	Sabine River near Ruliff, Tex.	24,171.0	100.0	Central
159	08032000	Neches River near Neches, Tex.	2,990.7	100.0	Central
160	08033500	Neches River near Rockland, Tex.	9,424.9	100.0	Central
161	08051500	Clear Creek near Sanger, Tex.	763.4	100.0	Central
162	08064100	Chambers Creek near Rice, Tex.	2,135.6	100.0	Central
163	08065350	Trinity River near Crockett, Tex.	35,967.2	100.0	Central
164	08136500	Concho River at Paint Rock, Tex.	16,698.0	100.0	Central
165	08143600	Pecan Bayou near Mullin, Tex.	5,387.3	100.0	Central
166	08147000	Colorado River near San Saba, Tex.	74,658.5	100.0	Central
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	232.4	100.0	Central
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	278.8	100.0	Central
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	839.4	100.0	Central
170	08162000	Colorado River at Wharton, Tex.	102,705.4	100.0	Central
171	08162500	Colorado River near Bay City, Tex.	103,310.5	100.0	Central
172	08181800	San Antonio River near Elmendorf, Tex.	4,528.5	100.0	Central
173	08251500	Rio Grande near Lobatos, Colo.	11,875.7	100.0	Western
174	09058000	Colorado River near Kremmling, Colo.	46,230.3	100.0	Western
175	09163500	Colorado River near Colorado-Utah State Line	46,274.0	100.0	Western
176	09211200	Green River below Fontenelle Reservoir, Wyo.	10,862.1	100.0	Western
177	09217010	Green River below Green River, Wyo.	25,220.0	100.0	Western
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	66,055.9	100.0	Western
179	09380000	Colorado River at Lees Ferry, Ariz.	280,073.6	100.0	Western
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	502.9	100.0	Western
181	09413500	Virgin River below First Narrows, Utah	10,303.6	100.0	Western
182	09415000	Virgin River at Littlefield, Ariz.	12,571.5	100.0	Western
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	20,424.0	100.0	Western

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Station number	Station name	Drainage area, in square kilometers	Percent of drainage area in the United States	Area of United States
184	09498500	Salt River near Roosevelt, Ariz.	11,102.9	100.0	Western
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	14,242.6	100.0	Western
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	624,015.9	99.5	Western
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	6,335.6	100.0	Western
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	18,311.9	100.0	Western
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	661.2	100.0	Western
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	419.8	100.0	Western
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	568.3	100.0	Western
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	726.2	100.0	Western
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	3,119.0	100.0	Western
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	36.8	100.0	Western
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	101.6	100.0	Western
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	139.7	100.0	Western
197	10336698	Third Creek near Crystal Bay, Nev.	15.6	100.0	Western
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	7.4	100.0	Western
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	11.7	100.0	Western
200	10336700	Incline Creek near Crystal Bay, Nev.	17.3	100.0	Western
201	10336740	Logan House Creek near Glenbrook, Nev.	5.4	100.0	Western
202	10336760	Edgewood Creek at Stateline, Nev.	14.5	100.0	Western
203	01A050	Nooksack River at Brennan, Wash.	1,907.8	100.0	Western
204	03A060	Skagit River near Mount Vernon, Wash.	6,024.1	100.0	Western
205	07A090	Snohomish River at Snohomish, Wash.	4,438.0	100.0	Western
206	09A080	Green River at Tukwila, Wash.	1,235.7	100.0	Western
207	09A190	Green River at Kanaskat, Wash.	615.6	100.0	Western
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	--	--	Western
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	12,567.2	100.0	Western
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	8,886.4	100.0	Western
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	3,487.2	100.0	Western
212	10411	Deschutes River at Deschutes River Park, Oreg.	27,768.3	100.0	Western
213	10555	Willamette River at Marion Street at Salem, Oreg.	19,112.2	100.0	Western
214	10611	Willamette River at Hawthorne Bridge, Oreg.	28,936.9	100.0	Western
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	--	--	Western
216	10A070	Puyallup River at Meridian Street, Wash.	2,381.1	100.0	Western
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	1,077.9	100.0	Western
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	138.8	100.0	Western
219	11478	John Day River at Service Creek, Oreg.	13,288.9	100.0	Western
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	--	--	Western
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	738.0	100.0	Western
222	12419000	Spokane River near Post Falls, Idaho	10,162.1	100.0	Western
223	13154500	Snake River at King Hill, Idaho	92,942.4	100.0	Western
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	7,184.4	100.0	Western
225	13351000	Palouse River at Hooper, Wash.	6,378.8	100.0	Western
226	14201300	Zollner Creek near Mt. Angel, Oreg.	38.9	100.0	Western
227	14211720	Willamette River at Portland, Oreg.	28,936.9	100.0	Western
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	582,735.9	100.0	Western
229	16A070	Skokomish River near Potlatch, Wash.	339.4	100.0	Western
230	32A070	Walla Walla River near Touchet, Wash.	4,365.4	100.0	Western
231	3701002	Tualatin River at Weiss Bridge, Oreg.	1,838.2	100.0	Western
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	326.6	100.0	Western
233	37A090	Yakima River at Kiona, Wash.	14,536.2	100.0	Western
234	45A070	Wenatchee River at Wenatchee, Wash.	3,440.5	100.0	Western
235	45A110	Wenatchee River near Leavenworth, Wash.	1,720.9	100.0	Western
236	48A070	Methow River near Pateros, Wash.	4,656.9	100.0	Western
237	49A070	Okanogan River at Malott, Wash.	4,499.6	100.0	Western
238	54A120	Spokane River at Riverside State Park, Wash.	12,950.9	100.0	Western
239	61A070	Columbia River at Northport, Wash.	--	--	Western
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	468.0	100.0	Western
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	27.9	100.0	Western
242	11290000	Tuolumne River at Modesto, Calif.	4,759.9	100.0	Western
243	11303500	San Joaquin River near Vernalis, Calif.	19,029.9	100.0	Western
244	11447650	Sacramento River at Freeport, Calif.	61,692.7	100.0	Western

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Land cover in the basin, in percent[1]					Land-use classification[3]	Base-flow index, in percent	Area with subsurface (tile) drains	Mean basin slope, in percent
	Urban	Agriculture	Rangeland	Forest	Other[2]				
1	10.3	10.9	0.0	73.6	5.2	Mixed	51.6	0.0	6.0
2	11.0	7.4	0.1	75.5	6.1	Mixed	52.9	0.7	6.8
3	9.4	11.3	0.1	73.3	5.9	Mixed	52.9	1.8	5.1
4	5.0	8.3	0.2	81.0	4.3	Mixed	47.6	14.7	11.6
5	13.1	39.0	0.0	45.9	2.0	Mixed	52.9	0.0	4.2
6	5.2	4.8	0.0	84.0	6.0	Mixed	47.6	0.0	9.0
7	13.4	6.7	0.0	74.8	5.1	Mixed	48.7	0.0	7.9
8	44.5	11.1	0.0	40.5	3.9	Urban	52.4	0.0	5.1
9	11.1	12.4	0.1	71.7	4.8	Mixed	52.6	0.0	6.0
10	56.6	1.0	0.0	38.8	3.6	Urban	49.8	0.0	5.3
11	12.2	13.5	0.0	69.9	4.3	Mixed	48.0	2.7	9.8
12	26.5	9.9	0.0	58.9	4.6	Urban	47.7	0.0	8.0
13	21.4	4.4	0.0	70.7	3.4	Mixed	48.1	0.2	8.1
14	50.7	2.8	0.0	44.2	2.3	Urban	47.1	0.2	5.5
15	5.9	27.2	0.0	65.1	1.9	Mixed	45.5	139.3	7.9
16	78.5	0.3	0.0	13.6	7.6	Urban	47.7	0.0	4.6
17	5.7	0.8	0.0	87.7	5.8	Mixed	44.6	0.0	11.2
18	25.4	0.9	0.0	70.2	3.6	Urban	44.8	0.1	10.8
19	39.3	2.2	0.0	53.9	4.6	Urban	43.9	0.1	7.4
20	93.2	0.5	0.0	5.7	0.5	Urban	47.5	0.0	4.3
21	80.5	0.4	0.0	18.4	0.6	Urban	30.4	0.0	5.2
22	89.9	0.2	0.0	9.3	0.6	Urban	28.8	0.0	3.8
23	3.1	25.4	0.0	71.2	0.2	Mixed	49.5	0.0	7.1
24	8.5	59.8	0.0	31.5	0.2	Mixed	30.8	0.0	3.3
25	25.1	33.0	0.0	40.6	1.3	Mixed	37.7	0.9	1.9
26	19.4	33.3	0.0	45.6	1.7	Mixed	40.5	0.9	4.2
27	27.7	24.3	0.0	44.9	3.1	Urban	50.3	1.4	1.0
28	21.0	4.7	0.0	68.8	5.5	Mixed	60.9	0.9	1.4
29	2.3	12.1	0.0	82.8	2.8	Undeveloped	68.6	0.0	0.4
30	23.4	27.6	0.0	47.7	1.3	Mixed	64.8	0.0	0.4
31	2.4	9.8	0.0	85.0	2.8	Undeveloped	43.5	31.8	15.6
32	9.1	25.4	0.0	61.2	4.4	Mixed	54.9	0.0	6.6
33	5.6	16.2	0.0	75.1	3.1	Mixed	47.6	38.1	10.0
34	69.9	6.4	0.0	20.1	3.6	Urban	43.8	0.0	1.4
35	9.2	64.3	0.0	26.1	0.4	Mixed	58.2	0.0	1.5
36	2.8	48.5	0.0	48.0	0.6	Mixed	54.9	4.8	0.1
37	3.5	28.0	0.0	66.5	2.1	Mixed	44.9	359.3	11.6
38	32.4	32.8	0.0	31.3	3.5	Mixed	54.0	0.6	3.6
39	3.6	56.8	0.0	38.3	1.3	Agricultural	48.2	1.9	7.9
40	5.1	33.4	0.0	59.8	1.6	Mixed	43.8	65.1	11.7
41	4.7	34.7	0.0	59.4	1.2	Mixed	45.1	4.2	8.0
42	2.7	23.0	0.0	69.1	5.2	Undeveloped	43.2	3.4	3.1
43	2.2	18.6	0.0	73.8	5.4	Undeveloped	43.5	0.2	2.6
44	3.9	15.0	0.0	79.3	1.9	Undeveloped	46.8	5.0	13.7
45	2.0	19.8	0.0	74.3	3.8	Undeveloped	45.0	0.0	3.6
46	8.7	23.5	0.0	66.6	1.2	Mixed	31.4	0.0	2.9
47	12.1	28.7	0.0	56.8	2.4	Mixed	34.0	101.1	2.1
48	4.3	41.9	0.0	52.7	1.2	Mixed	39.4	23.8	1.0
49	--	--	--	--	--	--	--	--	--
50	2.0	31.8	0.0	60.0	6.2	Mixed	69.8	127.3	1.3
51	4.3	18.1	0.0	69.5	8.1	Undeveloped	58.8	34.8	4.6
52	20.8	12.8	0.0	63.3	3.1	Mixed	48.5	0.0	3.9
53	12.0	22.7	0.0	59.4	5.9	Mixed	47.8	12.4	3.0
54	3.1	18.9	0.0	72.0	5.9	Undeveloped	51.2	2.1	3.8
55	6.0	24.3	0.0	62.9	6.8	Mixed	47.1	22.6	2.9
56	1.9	32.0	0.0	56.2	10.0	Mixed	33.8	2.0	0.7
57	30.0	13.8	14.7	20.1	21.4	Urban	52.2	1.1	0.4
58	3.0	21.9	25.0	18.5	31.6	Undeveloped	43.0	0.0	0.2
59	10.9	26.7	26.1	21.4	14.9	Mixed	47.4	4.4	0.3
60	10.4	42.7	23.1	19.7	4.2	Mixed	35.8	0.0	0.3
61	3.7	19.4	25.7	18.1	33.1	Undeveloped	41.6	0.0	0.3

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Land cover in the basin, in percent[1]					Land-use classification[3]	Base-flow index, in percent	Area with subsurface (tile) drains	Mean basin slope, in percent
	Urban	Agriculture	Rangeland	Forest	Other[2]				
62	35.4	14.4	24.4	17.4	8.4	Urban	40.0	0.0	0.4
63	28.0	12.8	21.1	26.6	11.6	Urban	39.2	0.0	0.3
64	0.3	1.0	0.2	86.2	12.2	Undeveloped	33.5	0.0	0.0
65	3.1	49.7	0.3	39.8	7.1	Mixed	42.1	43.9	1.1
66	62.3	0.0	0.0	37.4	0.3	Urban	49.7	0.0	4.1
67	23.0	9.7	0.0	63.5	3.8	Mixed	56.5	0.0	6.7
68	10.4	13.3	0.0	70.2	6.1	Mixed	53.3	1.9	4.6
69	4.0	30.7	0.0	59.6	5.7	Mixed	53.8	12.5	2.5
70	61.5	7.7	0.0	26.0	4.8	Urban	42.6	0.0	1.6
71	1.8	34.2	0.0	62.1	1.9	Mixed	41.6	0.0	1.8
72	78.8	19.3	0.0	1.8	0.1	Urban	23.6	1.8	0.8
73	5.4	37.7	0.1	54.7	2.1	Mixed	33.4	36,591.3	8.9
74	0.1	3.4	0.6	92.6	3.3	Undeveloped	68.3	0.0	1.6
75	9.0	76.8	1.2	9.1	4.0	Mixed	51.2	3.4	1.6
76	11.3	64.9	0.7	21.0	2.1	Mixed	47.5	147.0	2.1
77	26.3	49.0	0.0	24.5	0.2	Mixed	51.0	0.7	1.1
78	5.8	58.3	0.0	34.6	1.3	Mixed	53.3	5.2	3.3
79	43.6	44.4	0.0	11.5	0.5	Mixed	52.1	0.6	2.6
80	47.8	32.3	0.0	19.0	0.9	Mixed	52.9	11.7	3.1
81	0.0	9.9	3.6	0.0	0.7	--	25.1	0.0	1.2
82	0.3	21.2	8.8	0.1	1.4	--	25.4	0.0	1.3
83	13.7	52.1	0.0	14.6	19.6	Mixed	52.9	0.0	1.5
84	8.3	87.2	0.5	3.5	0.4	Mixed	58.3	7.5	1.7
85	12.3	82.8	0.5	4.2	0.2	Mixed	56.2	2.7	2.7
86	42.9	53.8	0.3	1.4	1.6	Mixed	44.5	1.4	0.8
87	1.6	67.9	4.1	25.4	1.1	Agricultural	14.1	0.0	2.4
88	1.0	72.7	2.6	23.3	0.4	Agricultural	11.2	0.0	2.1
89	0.8	97.3	0.3	1.5	0.1	Agricultural	33.8	239.3	0.3
90	82.3	2.2	3.2	9.6	2.7	Urban	33.6	0.4	0.9
91	54.4	28.9	1.9	11.9	2.9	Mixed	36.5	94.9	0.8
92	97.9	0.0	0.0	0.2	1.9	Urban	38.7	3.2	0.5
93	8.6	77.9	0.8	10.8	2.0	Mixed	36.2	16,132.9	1.0
94	2.3	21.2	1.0	73.9	1.7	Undeveloped	29.3	0.0	5.9
95	1.8	43.5	36.4	13.2	3.7	Mixed	43.3	59,053.9	4.3
96	0.4	72.4	27.0	0.1	0.1	Agricultural	66.6	0.0	2.3
97	0.0	0.8	0.8	0.0	0.5	--	17.9	0.0	2.7
98	0.2	3.6	81.5	9.1	5.7	Undeveloped	54.8	52.9	11.5
99	0.2	8.4	72.4	14.3	4.7	Undeveloped	52.6	93.2	10.8
100	0.2	19.7	58.7	12.0	3.5	Undeveloped	48.5	105.3	8.7
101	0.2	11.9	83.7	0.5	3.6	Undeveloped	71.6	0.0	2.9
102	0.3	68.0	26.0	0.9	4.7	Agricultural	24.9	0.0	0.7
103	15.2	8.7	70.9	4.6	0.7	Mixed	44.4	0.0	4.4
104	1.0	1.8	32.3	59.3	5.7	Undeveloped	62.2	0.8	17.7
105	2.9	2.8	34.2	54.1	6.1	Undeveloped	62.2	1.4	16.6
106	0.9	23.1	74.7	0.4	1.0	Undeveloped	59.7	5.2	2.7
107	8.1	13.3	38.5	34.5	5.7	Mixed	61.7	37.4	13.3
108	0.0	1.1	72.0	12.8	14.2	Undeveloped	81.6	0.0	12.5
109	0.4	96.7	1.4	1.1	0.5	Agricultural	41.3	12.2	3.2
110	1.5	25.5	61.5	8.1	3.6	Mixed	58.5	108.0	5.0
111	1.5	86.6	5.5	5.4	0.9	Agricultural	33.4	97.4	3.6
112	0.7	30.8	54.4	8.1	3.5	Mixed	47.0	3,369.6	5.8
113	1.7	73.9	6.2	16.9	1.2	Agricultural	16.2	187.5	3.3
114	1.9	68.0	5.4	22.1	2.6	Agricultural	20.5	12.4	3.4
115	1.0	65.1	2.0	31.4	0.7	Agricultural	34.1	0.0	3.7
116	1.3	55.6	7.9	31.5	3.7	Agricultural	23.8	0.0	3.2
117	1.1	36.7	1.1	60.3	0.8	Mixed	32.1	0.0	5.8
118	0.9	35.8	49.2	9.0	3.1	Mixed	43.4	3,902.9	5.1
119	1.1	82.0	0.0	15.8	1.1	Agricultural	27.7	0.1	0.5
120	1.8	71.3	0.3	25.8	0.7	Agricultural	36.8	0.0	5.5
121	0.3	10.8	0.6	87.5	0.8	Undeveloped	29.1	0.0	16.9
122	2.1	30.6	0.8	63.2	3.3	Mixed	37.1	0.0	9.6

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Land cover in the basin, in percent[1]					Land-use classification[3]	Base-flow index, in percent	Area with subsurface (tile) drains	Mean basin slope, in percent
	Urban	Agriculture	Rangeland	Forest	Other[2]				
123	0.0	2.0	0.1	97.8	0.2	Undeveloped	35.0	0.0	13.7
124	0.5	19.2	0.4	79.6	0.4	Undeveloped	46.2	0.0	7.3
125	0.2	13.5	0.3	85.5	0.4	Undeveloped	44.5	0.0	8.2
126	1.2	49.3	1.2	47.0	1.2	Mixed	34.9	0.0	4.1
127	2.8	77.1	0.0	18.4	1.8	Agricultural	31.6	0.0	0.5
128	6.8	0.3	16.6	71.6	4.7	Mixed	49.5	0.0	26.7
129	9.8	1.3	31.0	57.1	0.8	Mixed	51.5	0.0	12.7
130	21.1	0.7	26.6	49.5	2.1	Mixed	50.2	0.0	15.6
131	23.8	0.6	24.6	49.0	2.0	Mixed	50.0	0.0	16.2
132	18.6	2.6	50.4	27.1	1.4	Mixed	49.1	0.0	10.7
133	17.9	2.6	53.3	24.9	1.4	Mixed	48.8	0.0	10.0
134	2.8	43.3	2.1	51.0	0.8	Mixed	47.7	0.0	6.0
135	10.7	61.7	0.2	26.3	1.1	Mixed	40.4	0.0	4.1
136	24.5	65.6	0.1	9.3	0.4	Mixed	45.2	0.0	1.5
137	6.2	66.9	0.5	25.4	1.1	Mixed	45.6	0.0	3.2
138	7.4	56.2	0.9	34.3	1.2	Mixed	41.2	0.0	4.7
139	1.4	46.0	0.7	51.3	0.6	Mixed	37.4	0.0	6.5
140	0.3	5.2	83.5	10.6	0.4	Undeveloped	30.1	0.0	5.3
141	0.5	43.4	54.7	1.0	0.5	Mixed	21.3	0.0	1.2
142	0.7	43.8	53.9	1.0	0.6	Mixed	21.6	0.0	1.2
143	1.4	43.5	53.4	1.1	0.6	Mixed	21.7	0.0	1.2
144	1.5	43.4	53.3	1.2	0.6	Mixed	21.7	0.0	1.2
145	0.8	25.1	0.0	71.5	2.6	Mixed	19.7	0.0	8.2
146	0.1	6.2	0.0	93.0	0.8	Undeveloped	20.0	0.0	15.1
147	0.2	5.7	0.0	92.4	1.7	Undeveloped	19.8	0.0	12.6
148	1.4	19.0	0.0	79.1	0.5	Undeveloped	15.3	0.0	8.1
149	1.7	31.1	50.7	14.5	2.0	Mixed	26.4	45.0	3.6
150	1.0	36.4	51.5	9.3	1.8	Mixed	26.1	14.3	2.7
151	12.3	68.3	0.0	16.8	2.5	Mixed	38.4	0.0	0.3
152	1.4	13.8	0.0	80.7	4.1	Undeveloped	22.5	0.0	5.0
153	2.4	41.0	29.6	22.9	3.2	Mixed	38.5	95,810.1	4.9
154	3.4	33.4	0.0	61.3	1.9	Mixed	37.3	0.0	1.6
155	1.6	18.5	0.0	76.6	3.3	Undeveloped	30.9	0.0	1.1
156	1.6	34.9	22.0	37.9	3.5	Mixed	23.2	64.1	2.2
157	16.6	69.2	0.2	10.0	4.0	Mixed	19.8	0.0	0.2
158	2.9	26.7	0.1	61.8	8.5	Mixed	19.8	0.0	1.9
159	4.5	45.9	0.0	44.1	5.5	Mixed	22.3	0.0	2.7
160	2.9	28.9	0.0	62.6	5.7	Mixed	21.9	0.0	2.4
161	0.3	37.9	45.8	15.2	0.9	Mixed	12.4	0.0	3.0
162	2.7	77.0	5.5	12.3	2.5	Agricultural	11.8	0.0	1.6
163	9.6	49.6	16.0	19.8	5.1	Mixed	12.6	0.0	1.8
164	1.2	11.6	85.4	0.9	0.9	Undeveloped	29.3	0.0	1.7
165	1.7	13.8	75.0	7.4	2.1	Undeveloped	9.0	0.0	2.2
166	1.2	19.0	75.4	3.0	1.4	Undeveloped	18.7	0.0	1.4
167	4.1	1.6	42.7	50.5	1.0	Undeveloped	31.5	0.0	4.7
168	6.5	1.4	40.0	50.9	1.2	Mixed	30.8	0.0	5.1
169	17.3	6.2	34.9	40.5	1.0	Mixed	34.9	0.0	3.3
170	1.7	17.0	68.3	11.4	1.6	Undeveloped	23.4	0.0	2.0
171	1.8	17.3	68.0	11.4	1.6	Undeveloped	23.3	0.0	2.0
172	19.1	16.2	21.1	41.6	2.0	Mixed	40.7	0.0	5.1
173	0.3	8.4	50.9	34.3	6.1	Undeveloped	63.2	18.9	15.8
174	0.8	4.2	33.5	54.8	6.7	Undeveloped	65.6	6.1	22.2
175	0.7	4.2	33.6	54.8	6.7	Undeveloped	65.6	6.1	22.2
176	0.1	4.2	66.6	17.7	11.4	Undeveloped	65.2	0.0	12.3
177	0.2	2.1	83.4	8.3	5.9	Undeveloped	60.4	0.0	8.3
178	0.2	2.6	74.1	19.4	3.8	Undeveloped	59.4	0.0	9.9
179	0.3	2.2	63.8	27.5	6.2	Undeveloped	57.6	6.5	14.4
180	0.1	0.6	69.0	29.4	0.9	Undeveloped	77.7	0.0	12.9
181	0.7	0.7	69.4	23.2	5.9	Undeveloped	70.6	0.0	14.5
182	0.6	0.7	69.5	22.4	6.8	Undeveloped	68.0	0.0	15.0
183	0.1	0.3	56.2	42.8	0.6	Undeveloped	52.1	0.0	17.2

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Land cover in the basin, in percent[1]					Land-use classification[3]	Base-flow index, in percent	Area with subsurface (tile) drains	Mean basin slope, in percent
	Urban	Agriculture	Rangeland	Forest	Other[2]				
184	0.3	0.0	31.1	67.8	0.8	Undeveloped	47.4	0.0	16.8
185	1.1	0.3	50.7	47.2	0.6	Undeveloped	32.5	0.0	11.5
186	0.9	2.0	68.7	22.9	5.0	Undeveloped	44.6	55.8	12.0
187	0.2	6.8	74.3	16.3	2.4	Undeveloped	64.7	0.0	12.5
188	0.7	18.3	60.6	16.2	4.2	Undeveloped	73.3	3.2	15.2
189	0.1	1.2	48.9	49.4	0.4	Undeveloped	63.7	0.0	17.8
190	0.0	0.0	18.8	79.9	1.3	Undeveloped	66.7	0.0	19.6
191	0.0	2.3	22.5	74.2	1.0	Undeveloped	67.2	0.2	18.3
192	1.4	4.3	24.9	68.4	0.9	Undeveloped	68.4	1.1	18.0
193	0.2	0.8	51.4	44.7	2.9	Undeveloped	72.2	0.0	14.8
194	0.0	0.0	26.7	67.0	6.3	Undeveloped	65.8	0.0	23.9
195	1.9	0.0	22.1	71.9	4.1	Undeveloped	67.1	0.0	25.7
196	7.8	0.0	20.1	68.8	3.2	Mixed	67.6	0.0	22.4
197	17.7	0.0	29.5	45.1	7.7	Mixed	73.9	0.0	25.9
198	0.0	0.0	33.9	65.7	0.4	Undeveloped	73.8	0.0	23.0
199	4.8	0.0	27.0	67.7	0.4	Undeveloped	74.2	0.0	23.9
200	13.0	0.0	19.9	66.7	0.3	Mixed	74.1	0.0	23.1
201	0.0	0.0	6.5	93.5	0.0	Undeveloped	73.7	0.0	20.1
202	19.6	0.0	11.9	68.3	0.2	Mixed	74.4	0.0	24.4
203	3.0	11.7	3.5	69.3	12.4	Undeveloped	58.4	2.2	29.6
204	1.3	1.4	9.2	71.2	17.0	Undeveloped	60.4	3.7	45.2
205	4.0	2.5	6.5	77.3	9.7	Undeveloped	57.2	9.7	33.0
206	22.6	4.4	3.2	57.2	12.6	Mixed	61.2	14.5	20.4
207	0.2	0.0	3.4	77.2	19.2	Undeveloped	59.1	0.0	33.8
208	--	--	--	--	--	--	--	--	--
209	3.8	16.2	4.4	71.8	3.9	Undeveloped	54.4	54.8	20.6
210	2.6	3.9	4.8	84.0	4.7	Undeveloped	59.2	6.4	24.9
211	1.0	1.2	4.1	89.1	4.7	Undeveloped	65.3	0.7	27.3
212	0.7	5.2	47.9	43.5	2.6	Undeveloped	76.0	0.0	10.0
213	3.8	18.2	4.3	69.9	3.7	Undeveloped	54.1	158.9	20.3
214	5.5	23.1	3.7	64.5	3.3	Mixed	53.8	638.5	18.0
215	--	--	--	--	--	--	--	--	--
216	6.2	2.9	3.5	70.2	17.2	Mixed	61.5	8.7	28.8
217	10.4	34.2	4.5	46.6	4.4	Mixed	37.6	6.1	10.5
218	75.6	13.9	0.7	9.6	0.2	Urban	46.7	1.3	5.6
219	0.1	1.8	37.6	59.7	0.8	Undeveloped	59.7	0.0	18.9
220	--	--	--	--	--	--	--	--	--
221	2.5	0.1	12.7	83.3	1.4	Undeveloped	65.6	0.0	38.3
222	1.4	4.1	6.2	80.4	7.9	Undeveloped	63.9	3.0	28.4
223	0.5	17.4	59.2	16.6	6.3	Undeveloped	76.4	0.0	12.2
224	0.8	0.5	48.8	43.2	6.7	Undeveloped	71.4	0.0	30.3
225	1.5	72.5	14.9	9.6	1.5	Agricultural	46.4	18.0	7.9
226	1.1	95.2	0.8	2.6	0.3	Agricultural	50.8	4.0	1.4
227	5.5	23.1	3.7	64.5	3.3	Mixed	53.8	638.5	18.0
228	0.9	12.0	45.6	36.4	5.0	Undeveloped	67.3	130.4	17.3
229	0.4	1.3	1.8	80.6	16.0	Undeveloped	52.0	0.0	34.2
230	2.0	56.1	23.6	17.8	0.4	Agricultural	60.7	0.0	15.1
231	19.8	33.9	0.8	43.3	2.1	Mixed	48.3	159.5	10.5
232	1.2	22.2	0.5	73.3	2.7	Undeveloped	49.4	16.6	16.2
233	2.1	15.0	41.9	36.3	4.7	Undeveloped	67.1	14.8	17.2
234	0.6	1.4	18.7	70.1	9.3	Undeveloped	68.7	0.0	40.5
235	0.1	0.2	12.0	75.1	12.6	Undeveloped	67.5	0.0	41.6
236	0.4	0.8	28.0	65.6	5.2	Undeveloped	68.1	0.0	36.0
237	1.0	5.0	48.8	41.2	4.1	Undeveloped	67.3	0.0	20.3
238	3.5	13.3	7.8	68.6	6.8	Undeveloped	63.0	13.7	24.2
239	--	--	--	--	--	--	--	--	--
240	0.0	0.0	43.7	40.0	16.4	Undeveloped	59.6	0.0	36.5
241	0.3	95.3	3.5	0.0	1.0	Agricultural	27.6	0.0	0.1
242	2.8	4.3	33.9	48.5	10.7	Undeveloped	53.5	0.0	27.9
243	3.1	22.1	34.8	33.8	6.3	Undeveloped	44.5	114.0	20.3
244	2.4	13.0	29.5	52.2	2.8	Undeveloped	55.7	12.0	19.0

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference streamflow, in cubic meters per second	Mean annual precipitation, in centimeters	Median annual source yield, in kilograms per square kilometer				
			Nitrogen in atmospheric deposition	Nitrogen in fertilizer	Nitrogen in manure	Phosphorus in fertilizer	Phosphorus in manure
1	13.70	132.4	480	323	578	55	123
2	5.00	129.4	481	339	221	67	52
3	22.25	131.6	456	369	672	66	168
4	379.66	119.3	497	222	261	48	50
5	0.63	123.2	486	1,281	1,504	215	286
6	16.17	133.1	523	149	109	26	21
7	27.44	131.9	515	392	126	65	25
8	3.15	127.8	486	636	416	108	78
9	2.95	136.5	489	758	870	130	249
10	4.80	131.2	517	720	11	99	2
11	43.66	128.1	564	280	327	50	64
12	10.84	137.1	538	361	274	59	55
13	0.47	136.0	592	295	55	43	12
14	0.87	133.5	592	606	35	84	8
15	91.16	119.5	645	470	828	112	149
16	1.72	129.2	590	1,310	6	213	1
17	0.42	133.2	597	201	19	37	4
18	2.80	135.4	589	361	27	63	5
19	14.48	132.4	607	839	38	154	8
20	1.90	129.3	595	1,872	13	324	3
21	0.47	134.0	586	1,771	3	303	1
22	0.65	131.8	579	1,805	2	309	1
23	0.32	130.3	537	745	314	134	75
24	0.33	125.3	528	1,787	739	324	176
25	6.82	122.9	525	1,652	264	382	61
26	18.39	127.0	536	1,376	369	274	87
27	1.54	124.1	526	1,921	299	384	58
28	5.09	122.5	500	548	51	91	10
29	2.99	117.7	499	727	130	133	27
30	3.47	116.9	499	2,576	360	472	95
31	108.40	121.0	578	126	370	31	73
32	3.94	120.8	569	521	488	125	103
33	240.81	122.9	579	535	344	129	73
34	0.59	119.7	499	2,362	38	408	8
35	0.82	117.8	499	4,569	489	821	142
36	1.89	113.7	508	4,010	1,191	702	322
37	764.53	110.2	596	712	1,296	174	321
38	7.69	114.2	566	1,720	459	343	111
39	13.51	108.6	630	1,899	3,865	466	969
40	213.18	106.8	540	969	2,066	245	582
41	32.46	111.6	486	996	1,485	282	427
42	17.17	110.8	538	857	732	240	216
43	9.31	111.1	505	806	284	224	75
44	147.16	114.6	515	333	688	93	207
45	18.95	112.0	519	622	1,247	177	368
46	0.54	123.3	489	1,262	921	270	238
47	48.43	120.0	507	2,538	1,676	547	657
48	10.21	119.8	498	4,370	3,142	924	1,285
49	49.27	--	--	--	--	--	--
50	67.39	123.4	348	1,420	826	258	249
51	384.30	130.1	412	611	1,170	150	356
52	49.94	125.1	385	383	572	113	163
53	147.53	121.6	365	1,025	521	284	150
54	113.18	122.2	385	495	1,601	139	484
55	336.17	121.7	363	1,007	893	272	270
56	10.70	130.2	302	2,516	1,536	714	484
57	0.86	126.0	356	1,801	593	311	190
58	2.34	140.4	358	2,450	1,605	438	495
59	14.38	134.2	354	3,007	1,925	524	582
60	0.61	137.4	358	5,904	3,236	993	1,046
61	1.60	141.2	357	2,248	1,536	383	486

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference streamflow, in cubic meters per second	Mean annual precipitation, in centimeters	Median annual source yield, in kilograms per square kilometer				
			Nitrogen in atmospheric deposition	Nitrogen in fertilizer	Nitrogen in manure	Phosphorus in fertilizer	Phosphorus in manure
62	0.95	136.7	336	2,308	1,474	376	479
63	3.68	136.7	329	1,667	1,221	273	388
64	17.03	133.5	299	63	31	19	9
65	8.10	128.8	308	3,944	721	1,082	211
66	0.92	139.8	425	128	0	30	0
67	115.56	146.3	445	278	2,063	82	642
68	260.33	135.6	385	556	862	139	266
69	168.15	125.7	362	1,646	655	447	185
70	67.45	142.6	504	337	525	92	140
71	47.14	166.7	468	1,558	1,860	179	484
72	0.30	109.0	592	3,287	98	717	26
73	6,996.15	123.8	560	2,021	964	412	290
74	2.66	82.5	405	29	48	7	12
75	0.95	85.9	544	2,941	2,372	642	473
76	10.89	88.3	601	2,147	1,921	480	384
77	0.21	89.9	593	1,480	311	363	58
78	0.90	85.9	562	1,432	629	396	121
79	0.15	87.0	572	1,702	302	394	56
80	3.07	86.9	574	1,604	346	363	65
81	0.15	38.0	173	1,905	274	291	77
82	1.22	41.1	203	2,631	323	386	99
83	0.72	83.0	496	2,960	850	545	185
84	0.75	91.5	608	3,728	2,490	790	562
85	0.09	94.2	604	3,656	2,556	801	545
86	0.04	93.6	577	2,846	1,251	615	293
87	5.14	100.9	516	3,289	1,231	597	400
88	5.06	107.7	519	3,882	1,296	694	412
89	5.13	97.7	603	8,152	388	1,420	130
90	3.85	96.4	644	2,382	9	573	2
91	16.79	93.6	650	2,498	263	491	57
92	0.18	96.8	645	3,170	91	569	22
93	824.87	98.8	589	6,045	630	1,081	219
94	15.97	118.5	559	503	814	89	257
95	8,873.13	65.0	364	2,397	1,029	356	318
96	2.26	33.2	90	2,241	714	442	224
97	0.11	32.1	129	632	209	127	59
98	55.72	35.3	100	560	260	64	76
99	338.31	41.6	120	414	373	59	112
100	510.45	41.3	120	517	365	87	111
101	22.26	47.1	300	915	904	102	274
102	0.33	47.2	321	2,857	469	450	141
103	0.61	48.3	246	254	382	45	108
104	1.29	57.0	262	106	271	14	74
105	0.85	55.4	262	167	324	22	87
106	0.41	39.2	282	1,283	1,964	173	534
107	26.64	51.2	300	672	819	99	221
108	6.03	55.2	397	146	618	17	158
109	3.44	78.2	532	7,645	3,702	860	1,178
110	324.79	51.7	343	2,058	1,139	232	344
111	28.76	92.9	556	4,300	1,805	628	603
112	1,821.07	48.4	254	1,359	792	204	247
113	100.76	98.4	557	2,009	1,493	346	478
114	38.02	102.3	560	1,981	1,503	311	483
115	4.02	116.0	490	1,897	2,939	348	838
116	387.34	113.1	550	2,012	1,620	320	507
117	62.90	119.3	494	1,271	1,663	235	450
118	3,945.46	55.3	301	1,711	894	243	279
119	6.03	126.6	496	6,580	102	896	29
120	1.09	118.0	464	1,402	7,958	173	2,524
121	12.99	127.0	411	325	543	39	164
122	363.03	120.3	444	881	1,939	144	597

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference streamflow, in cubic meters per second	Mean annual precipitation, in centimeters	Median annual source yield, in kilograms per square kilometer				
			Nitrogen in atmospheric deposition	Nitrogen in fertilizer	Nitrogen in manure	Phosphorus in fertilizer	Phosphorus in manure
123	0.63	129.5	384	76	228	10	69
124	13.93	122.4	514	641	794	116	236
125	91.97	126.3	536	430	543	78	161
126	15.65	123.0	572	3,450	502	498	154
127	2.02	126.0	499	6,068	121	825	36
128	0.52	58.9	208	42	91	12	23
129	0.22	57.0	205	87	144	19	42
130	1.64	55.4	208	106	152	32	44
131	3.31	55.0	209	118	147	37	42
132	3.42	49.6	213	166	283	36	83
133	3.70	48.4	213	162	283	35	83
134	20.69	118.2	493	899	3,859	152	1,190
135	16.58	125.3	484	1,638	7,876	226	2,498
136	0.41	123.8	484	1,975	7,786	305	2,447
137	2.78	123.1	485	1,656	6,975	217	2,218
138	24.71	124.7	484	1,481	6,569	199	2,079
139	8.15	129.8	484	1,384	4,074	162	1,271
140	2.21	44.5	211	325	472	38	140
141	4.42	52.8	348	2,196	2,062	249	601
142	6.65	53.5	349	2,229	2,056	254	599
143	10.47	54.1	351	2,228	2,037	256	593
144	15.39	54.4	351	2,221	2,028	256	591
145	1.86	137.8	490	316	2,629	42	818
146	1.60	149.7	483	104	560	12	174
147	1.60	145.3	485	108	470	12	146
148	1.32	137.1	473	494	945	56	292
149	1,188.45	73.0	369	1,594	1,289	187	373
150	66.07	89.0	418	1,825	1,585	204	466
151	793.30	156.7	433	4,266	1,054	469	286
152	132.49	145.4	485	275	1,075	39	338
153	16,338.57	80.1	405	2,215	1,008	342	309
154	26.72	171.3	472	1,899	1,849	205	428
155	7.73	177.3	471	651	746	80	189
156	6,980.76	111.3	410	1,304	1,226	153	358
157	22.17	164.6	433	3,926	750	462	233
158	167.84	133.1	419	968	1,325	108	390
159	11.64	116.0	394	2,109	1,627	231	492
160	35.28	122.4	363	1,271	1,107	141	334
161	1.26	101.8	359	1,521	1,721	164	506
162	0.99	99.9	375	2,982	1,483	319	396
163	141.53	102.9	376	1,965	1,405	225	418
164	2.11	51.7	208	347	502	37	123
165	0.76	75.7	303	772	1,003	81	290
166	6.88	54.4	228	960	581	108	155
167	0.05	89.6	294	222	638	34	191
168	0.08	89.3	295	301	555	50	166
169	0.11	89.8	295	625	603	87	174
170	35.53	61.5	236	926	682	105	191
171	31.98	61.8	237	955	685	109	193
172	7.94	80.0	248	1,085	634	147	188
173	12.90	57.0	179	597	289	79	88
174	27.37	61.4	197	175	317	23	93
175	200.30	61.5	198	175	318	23	93
176	40.17	49.2	104	164	283	18	86
177	40.91	37.1	109	89	176	10	52
178	106.68	42.8	142	98	196	12	56
179	389.40	42.6	143	86	195	12	57
180	0.29	45.5	111	17	47	4	15
181	6.09	40.5	118	30	93	7	28
182	7.54	39.8	116	27	85	6	25
183	9.82	50.0	109	17	122	3	36

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference streamflow, in cubic meters per second	Mean annual precipitation, in centimeters	Median annual source yield, in kilograms per square kilometer				
			Nitrogen in atmospheric deposition	Nitrogen in fertilizer	Nitrogen in manure	Phosphorus in fertilizer	Phosphorus in manure
184	15.01	62.4	94	1	40	0	12
185	10.51	53.1	105	11	138	2	40
186	82.21	38.5	123	165	164	26	44
187	9.04	50.8	141	216	545	31	165
188	25.37	59.3	214	447	741	95	194
189	1.55	69.7	136	25	442	5	122
190	4.03	85.2	148	0	88	0	24
191	5.33	80.3	150	42	222	9	54
192	3.78	77.0	153	69	327	16	77
193	1.38	41.6	108	23	116	5	33
194	0.45	131.8	88	0	46	0	12
195	1.09	123.2	87	13	46	2	13
196	1.40	116.6	86	40	50	6	14
197	0.20	107.0	72	128	142	21	35
198	0.08	96.4	69	0	126	0	31
199	0.12	92.0	69	37	104	6	26
200	0.22	91.0	69	80	71	13	18
201	0.01	74.0	71	0	3	0	1
202	0.09	70.6	70	74	63	12	19
203	84.12	213.3	178	765	1,635	79	300
204	404.73	202.5	181	217	211	22	45
205	199.53	219.6	157	148	381	18	79
206	26.82	179.4	130	469	639	72	114
207	17.07	214.1	133	2	39	0	8
208	763.65	--	--	--	--	--	--
209	328.47	168.0	90	1,374	302	176	78
210	264.32	172.4	95	227	109	29	30
211	99.38	167.0	93	66	54	8	15
212	158.52	65.1	102	315	230	38	67
213	529.99	174.1	93	1,768	340	226	84
214	762.85	170.3	125	2,332	452	290	110
215	4,894.24	--	--	--	--	--	--
216	72.70	202.0	123	205	387	24	81
217	9.18	155.1	80	1,893	659	244	177
218	1.56	147.1	233	3,153	521	401	136
219	34.15	57.0	68	26	191	3	60
220	5.84	--	--	--	--	--	--
221	9.21	132.8	110	15	7	3	2
222	110.76	116.3	110	165	33	33	9
223	301.51	52.1	112	1,436	597	284	148
224	19.48	80.5	97	81	129	16	38
225	6.06	57.4	111	3,269	256	375	77
226	0.19	120.7	152	14,477	1,775	1,892	383
227	757.47	170.3	125	2,332	452	290	110
228	6,587.22	68.4	105	752	337	111	90
229	19.57	350.7	109	79	45	8	13
230	7.37	63.7	84	3,620	378	373	112
231	21.27	139.1	186	3,396	530	424	117
232	6.88	167.0	163	1,834	377	240	86
233	73.14	76.1	138	1,402	743	145	185
234	54.59	131.1	165	255	15	27	4
235	52.97	155.3	174	32	9	3	2
236	23.48	90.9	175	44	148	5	46
237	68.39	51.1	162	283	199	29	61
238	122.44	105.7	110	513	101	81	28
239	2,582.28	--	--	--	--	--	--
240	4.81	98.5	204	0	64	0	16
241	0.60	32.3	174	10,687	13,627	1,689	3,063
242	24.03	93.8	203	492	792	79	193
243	97.35	70.9	175	2,426	2,571	380	571
244	627.66	101.7	115	993	337	154	94

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Change in source load from 1993 to 2003, in percent					
	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Phosphorus loading from fertilizer	Phosphorus loading from manure
1	6.5	–32.0	243.4	–33.8	130.0	–38.1
2	3.1	–36.3	8.3	–31.6	–33.2	–35.1
3	5.2	–31.4	56.1	–44.8	5.3	–54.7
4	2.2	–25.9	19.2	–14.4	–32.5	–10.4
5	4.3	–35.5	295.5	–25.2	146.3	–21.3
6	6.4	–24.0	49.1	–25.2	–6.6	–18.4
7	5.0	–24.6	52.1	–29.5	8.5	–25.0
8	2.6	–25.8	128.2	–26.1	97.1	–22.3
9	16.7	–27.5	170.7	–57.4	51.4	–69.1
10	1.3	–23.5	66.7	–33.3	61.6	–28.5
11	7.1	–22.7	42.9	–21.0	–10.8	–13.5
12	1.4	–27.3	75.8	–30.1	39.6	–22.1
13	7.2	–13.6	86.6	–26.1	81.7	–26.8
14	10.2	–13.5	74.0	–26.2	73.7	–26.9
15	–2.9	–4.2	–27.3	–15.1	–52.7	–6.2
16	2.9	–15.6	2.5	239.6	–17.1	162.4
17	11.8	–12.3	9.9	–29.5	–51.4	–39.9
18	23.1	–16.3	1.0	–34.7	–29.2	–36.8
19	11.3	–13.2	13.3	–43.9	–63.6	–50.5
20	4.8	–12.8	9.6	–95.2	–67.1	–94.8
21	8.8	–16.1	5.3	–73.8	–77.6	–55.9
22	5.4	–21.8	0.9	–79.2	–78.7	–64.6
23	18.8	–19.6	–6.6	–35.4	–48.6	–34.9
24	13.8	–21.4	–5.1	–35.4	–48.0	–34.9
25	29.2	–21.3	–40.9	–27.9	–69.3	–30.4
26	23.5	–20.6	–23.4	–34.3	–70.5	–35.8
27	22.4	–20.4	–24.6	–12.9	–86.1	–15.0
28	27.9	–26.1	77.4	–18.6	8.2	–15.6
29	–5.1	–36.9	–12.3	–17.9	–56.3	–16.3
30	9.4	–33.5	–9.0	–18.6	–58.0	–26.0
31	10.0	–20.0	–20.0	–14.0	–56.6	–1.8
32	10.3	–21.1	–45.0	–32.7	–71.6	–26.8
33	11.1	–17.7	–31.7	–19.1	–59.3	–12.1
34	2.9	–27.5	–2.5	–38.4	–71.6	–35.8
35	52.9	–27.6	–9.0	–10.7	–59.6	–22.9
36	8.6	–26.9	–7.4	14.4	–42.7	12.8
37	3.7	0.9	–12.3	0.5	–57.5	4.6
38	23.8	–23.5	29.0	–34.2	–14.5	–36.9
39	8.3	–1.1	–11.7	20.4	–59.7	31.6
40	21.1	–16.1	3.5	5.1	–34.1	6.7
41	22.7	–26.3	–0.9	–5.0	–16.8	–8.4
42	35.3	–37.3	–2.8	–12.1	–17.5	–12.0
43	30.4	–33.3	3.0	–4.7	–9.6	–4.9
44	8.7	–30.1	–1.4	–5.0	–16.5	–5.6
45	26.7	–36.7	0.8	7.8	–12.2	10.2
46	19.6	9.0	–47.0	–7.8	–19.8	–1.7
47	35.8	8.1	–52.3	61.7	–28.3	70.2
48	18.4	9.6	–52.5	30.5	–30.0	36.4
49	--	--	--	--	--	--
50	13.0	11.8	–11.9	8.0	–23.3	4.2
51	14.3	–20.1	–13.9	41.2	7.7	41.1
52	33.7	17.7	–21.3	1.6	6.2	4.1
53	30.9	6.4	–43.9	9.9	–21.7	10.2
54	28.1	3.8	–27.9	13.9	2.5	14.4
55	28.8	–7.7	–38.5	11.4	–15.0	10.7
56	14.3	–14.3	–43.5	8.4	–16.5	–0.8
57	21.5	–11.5	21.2	3.0	13.5	6.8
58	44.4	–6.9	–5.1	12.1	–10.1	13.2
59	13.6	–11.1	4.8	13.6	–3.9	14.6
60	5.5	–6.5	12.4	–26.2	6.8	–31.3
61	0.0	–7.5	21.5	–7.7	12.9	–10.1

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Change in source load from 1993 to 2003, in percent					
	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Phosphorus loading from fertilizer	Phosphorus loading from manure
62	11.3	–9.1	2.7	–13.5	–6.0	–17.1
63	20.6	–9.2	10.5	–16.8	–4.9	–20.7
64	0.0	–20.7	–39.2	17.4	–2.8	13.0
65	15.2	–20.5	–39.3	–5.0	–9.6	–19.2
66	13.7	18.1	–34.7	–96.3	–85.9	–100.0
67	34.6	–1.5	0.3	–1.0	25.2	–1.1
68	28.1	7.0	–15.3	2.9	8.7	0.9
69	23.7	1.2	–36.8	29.4	–13.2	23.9
70	18.8	4.9	–47.3	13.8	–37.6	–1.4
71	4.8	–21.1	–17.2	32.0	–50.2	51.9
72	30.9	–0.5	20.7	–78.7	–8.2	–84.6
73	8.0	–7.6	–6.6	–1.9	–20.0	–3.7
74	0.0	38.0	–19.0	–27.9	–66.7	–26.4
75	0.0	7.0	13.1	–20.2	–43.9	–21.3
76	2.0	1.8	7.3	–12.6	–49.6	–13.2
77	4.2	3.1	–23.8	–32.7	–54.0	–26.4
78	27.3	7.5	–39.7	6.4	–58.6	10.2
79	4.8	6.0	–27.0	–37.3	–53.1	–31.4
80	5.4	6.4	–26.5	–18.6	–52.4	–14.2
81	0.0	32.9	96.6	20.7	101.4	4.6
82	0.0	25.8	43.7	22.5	56.2	18.4
83	47.9	–7.6	–7.0	–43.4	9.6	–43.6
84	29.4	–0.7	14.3	–24.1	–49.9	–26.9
85	52.2	–1.1	–6.3	–21.0	–60.3	–22.8
86	27.5	–1.5	–16.9	–47.6	–70.3	–51.6
87	0.0	–1.5	24.3	–4.4	21.2	–14.1
88	12.5	–20.8	8.0	–9.7	3.0	–17.2
89	–14.3	–15.4	–16.9	–31.7	–14.6	–35.3
90	5.9	–3.6	–30.2	–63.9	–27.6	–71.4
91	11.1	–2.2	–0.1	–25.0	–29.4	–27.2
92	84.5	0.5	–69.5	–100.0	–35.2	–100.0
93	10.4	–13.4	–23.7	–19.6	–17.1	–23.1
94	7.7	–10.4	–14.1	–0.5	–14.6	–1.5
95	5.6	–4.0	4.2	–3.7	6.7	–4.7
96	–33.3	–3.4	–48.4	–17.7	–41.1	–16.5
97	0.0	22.9	234.2	15.7	181.2	19.1
98	0.0	–5.9	12.0	–11.5	6.6	–8.4
99	0.0	11.0	–9.7	–10.3	–12.6	–8.5
100	0.0	11.6	14.3	–4.9	10.0	–4.7
101	0.0	–4.9	26.5	–3.7	62.8	–4.9
102	–50.0	–6.0	–32.8	–9.7	–22.8	–10.6
103	46.3	–1.5	–5.4	–22.6	–29.6	–27.6
104	20.0	–3.5	–41.0	–21.2	–26.1	–26.6
105	14.8	0.3	–39.3	–21.8	–21.7	–27.3
106	0.0	11.9	–30.9	–10.4	–1.1	–16.1
107	30.7	4.4	–32.1	–19.7	–10.6	–25.3
108	0.0	10.3	144.4	35.6	215.7	6.5
109	0.0	–11.4	–2.0	–6.9	45.9	–8.5
110	28.6	–3.5	–11.4	–0.8	26.9	–6.6
111	0.0	–3.8	4.5	–18.1	6.7	–27.0
112	16.7	1.1	19.4	–2.0	35.1	–4.3
113	0.0	–1.7	18.4	4.6	20.4	1.9
114	0.0	–7.6	13.0	5.5	14.3	5.3
115	28.6	–14.3	2.5	7.0	1.0	10.8
116	16.7	–7.5	9.4	10.7	14.6	12.1
117	8.3	–8.1	16.8	3.3	14.6	8.6
118	14.3	–6.0	14.8	–0.7	32.0	–3.6
119	6.7	10.0	6.6	5.8	25.7	14.1
120	25.0	–16.7	15.8	12.0	33.3	10.7
121	0.0	–17.9	13.0	17.1	23.5	–1.1
122	27.8	–14.1	12.4	9.5	16.7	9.9

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Change in source load from 1993 to 2003, in percent					
	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Phosphorus loading from fertilizer	Phosphorus loading from manure
123	0.0	–11.8	71.7	8.1	99.4	6.0
124	16.7	–2.0	10.8	8.5	9.7	11.0
125	0.0	2.0	11.1	9.4	9.8	13.4
126	20.0	9.5	12.9	21.1	23.0	15.2
127	10.3	7.4	2.4	12.3	23.0	–3.7
128	16.7	–7.5	–6.1	–40.3	–50.2	–33.2
129	65.9	–6.5	–2.5	–41.0	–38.0	–39.1
130	34.9	–7.3	–1.8	–45.1	–50.1	–43.2
131	26.8	–7.3	–8.9	–45.1	–50.9	–42.9
132	28.5	–7.5	–14.5	–39.8	–41.2	–37.9
133	26.9	–6.9	–17.1	–39.2	–41.3	–37.6
134	50.0	–23.2	40.3	13.2	41.6	9.0
135	47.2	–18.2	16.1	4.2	50.4	2.9
136	25.2	–20.7	2.1	15.3	34.1	14.7
137	30.4	–23.3	4.8	22.8	21.4	23.2
138	45.5	–21.5	17.0	6.8	40.2	5.8
139	30.0	–21.7	–6.7	–11.8	–12.0	–14.2
140	0.0	6.3	11.8	–3.3	–14.5	–11.1
141	0.0	7.6	–10.4	29.8	–25.5	31.5
142	20.0	7.9	–10.1	29.3	–22.7	30.8
143	0.0	8.1	–10.2	29.1	–22.8	30.6
144	7.7	8.2	–10.1	29.1	–22.0	30.6
145	11.1	–18.4	57.3	35.1	77.2	34.3
146	33.3	–18.8	38.8	41.2	43.1	40.7
147	33.3	–16.9	31.7	47.0	28.0	47.0
148	0.0	–10.8	1.6	16.0	–16.1	17.2
149	14.3	–7.4	4.2	11.3	8.7	8.2
150	0.0	3.4	–14.0	14.9	–30.0	12.6
151	–13.5	3.5	102.1	13.3	75.6	–11.1
152	16.7	–18.7	9.7	4.0	33.9	–8.1
153	8.7	–1.0	6.0	–0.4	–0.5	–2.0
154	11.1	–18.3	–8.0	3.4	–30.1	19.3
155	16.7	–17.9	–26.3	–6.0	–41.4	6.9
156	8.3	6.5	0.5	17.9	–12.7	14.3
157	13.7	–0.1	43.8	4.9	25.0	6.2
158	10.0	9.1	–13.9	17.8	–29.6	23.8
159	18.2	10.5	–8.1	3.2	–25.3	4.8
160	14.3	5.2	–13.2	5.9	–26.3	5.7
161	33.3	25.1	–8.2	16.1	–25.7	14.1
162	32.1	9.9	6.5	4.7	–12.2	–3.2
163	29.3	17.7	–5.2	9.9	–22.3	7.4
164	0.0	–4.2	18.8	–40.6	0.2	–38.7
165	0.0	14.0	4.7	–13.9	–9.9	–16.8
166	0.0	–8.1	–20.1	–26.5	–28.3	–27.1
167	100.0	–31.1	–29.9	–8.0	–40.9	–11.3
168	80.6	–31.4	–22.4	–7.8	–42.2	–11.1
169	42.7	–33.1	–6.6	–13.3	–15.6	–16.8
170	23.1	–10.2	–17.1	–17.8	–28.0	–19.6
171	23.1	–10.6	–16.4	–17.2	–27.9	–18.9
172	17.0	–19.8	–14.0	–4.0	–23.4	–15.7
173	0.0	–1.5	–26.4	–20.1	3.0	–37.1
174	40.0	–21.7	–54.3	–31.8	–38.3	–34.3
175	40.0	–21.6	–53.5	–31.4	–37.8	–34.0
176	0.0	–4.1	62.0	–17.4	55.3	–33.2
177	0.0	–19.9	50.1	–24.4	35.8	–32.4
178	0.0	–22.2	17.3	–15.3	15.2	–16.7
179	50.0	–19.1	–36.8	–25.0	–36.1	–27.4
180	100.0	–16.5	–20.8	–19.9	–10.0	–18.8
181	80.0	–0.1	14.3	–15.3	32.5	–15.4
182	100.0	–0.3	13.0	–16.6	28.0	–16.4
183	0.0	18.9	–1.4	–23.5	–15.7	–27.0

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Change in source load from 1993 to 2003, in percent					
	Population density	Nitrogen loading from atmospheric deposition	Nitrogen loading from fertilizer	Nitrogen loading from manure	Phosphorus loading from fertilizer	Phosphorus loading from manure
184	50.0	20.7	–89.0	–63.5	–55.7	–66.5
185	66.7	5.2	–4.6	–23.4	24.3	–41.8
186	50.0	–8.2	–1.6	–19.7	22.6	–26.7
187	0.0	–32.8	–10.6	–10.9	–10.0	–21.7
188	14.3	–50.5	20.0	–6.2	31.8	–9.8
189	100.0	–35.3	–56.0	9.7	–72.7	12.8
190	200.0	–35.0	0.0	–9.7	0.0	–5.2
191	300.0	–35.6	–51.1	–15.8	–63.5	–8.7
192	71.4	–36.3	–32.4	–26.4	–33.9	–19.1
193	0.0	–11.4	–35.2	–3.2	–24.8	–12.8
194	85.7	–14.1	0.0	–4.9	0.0	11.0
195	62.5	–15.1	38.7	–16.0	12.6	–1.5
196	23.8	–16.3	81.8	–18.0	43.3	–3.9
197	18.6	–25.3	17.9	–26.2	7.0	–27.5
198	57.1	–21.6	0.0	–26.1	0.0	–27.6
199	51.6	–21.6	5.3	–26.2	–2.0	–27.4
200	39.1	–22.0	41.1	–26.2	18.9	–27.6
201	133.3	–22.1	0.0	–31.3	0.0	–60.0
202	67.9	–22.9	–1.4	–30.7	–5.9	–42.5
203	29.4	–7.1	–26.0	–1.4	–41.7	5.8
204	16.7	–7.9	–39.6	–23.9	–55.2	–24.7
205	43.5	–11.2	–17.8	–31.5	–27.4	–29.5
206	24.3	–14.0	–21.8	–39.0	–15.8	–35.0
207	100.0	–15.3	–34.8	–23.7	–43.0	–16.9
208	--	--	--	--	--	--
209	13.8	–28.2	18.8	–18.3	–14.3	–21.8
210	11.8	–37.2	19.3	–23.8	–9.7	–27.7
211	0.0	–38.8	23.4	–23.1	–13.3	–26.7
212	50.0	–26.8	46.2	–13.5	15.9	–10.7
213	13.8	–22.8	24.4	–13.7	–10.0	–16.7
214	23.2	–31.5	40.6	–10.8	4.9	–14.9
215	--	--	--	--	--	--
216	26.8	–12.4	5.5	–47.3	–2.9	–52.7
217	13.3	–23.5	24.5	–25.0	–6.3	–29.1
218	17.4	–5.0	31.9	–32.2	15.6	–34.3
219	0.0	–26.0	–15.3	–11.6	–42.9	–12.4
220	--	--	--	--	--	--
221	0.0	10.8	–11.2	–56.2	–37.1	–65.7
222	37.5	8.9	–27.8	–30.5	–7.3	–43.8
223	25.0	–23.5	–13.5	24.8	18.3	12.8
224	20.0	–38.0	2.9	10.7	0.9	5.3
225	10.0	5.8	–21.9	–28.7	–21.3	–41.7
226	10.9	–21.0	52.9	–6.8	15.2	–8.2
227	23.2	–31.5	40.6	–10.8	4.9	–14.9
228	40.0	–12.1	–11.1	4.7	–2.6	–2.2
229	50.0	–25.5	134.1	–2.2	90.2	–3.6
230	7.1	–4.1	–48.1	–10.2	–54.1	–13.9
231	40.0	–6.7	58.2	–21.0	19.2	–25.4
232	0.0	–16.1	69.4	–5.1	32.6	–10.0
233	12.5	–16.8	–10.6	8.5	–28.7	–1.7
234	50.0	–11.5	33.7	–38.0	7.0	–41.8
235	0.0	–12.7	32.9	–38.4	7.7	–42.0
236	0.0	–11.5	–44.9	–9.4	–57.0	–11.2
237	25.0	–12.6	–44.2	–11.0	–56.1	–12.4
238	22.2	7.9	–27.5	–22.0	–14.3	–28.3
239	--	--	--	--	--	--
240	100.0	–1.5	0.0	–2.0	0.0	11.5
241	–42.9	–27.5	68.2	3.6	69.5	–0.2
242	12.5	–3.9	73.5	4.5	67.5	2.3
243	18.2	2.3	60.3	18.0	69.5	16.1
244	13.3	–24.1	37.1	–15.4	35.0	–16.3

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference concentration of total phosphorus, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total phosphorus, in milligrams per liter	Enrichment ratio for total phosphorus[4]	Reference concentration of total nitrogen, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total nitrogen, in milligrams per liter	Enrichment ratio for total nitrogen[4]
1	0.021	0.031	0.668	0.603	0.710	0.849
2	0.036	0.031	1.146	0.530	0.710	0.746
3	0.046	0.031	1.464	0.913	0.710	1.286
4	0.033	0.031	1.042	0.624	0.710	0.878
5	0.092	0.031	2.943	4.259	0.710	5.999
6	--	--	--	0.270	0.710	0.381
7	0.087	0.031	2.796	1.018	0.710	1.434
8	0.364	0.031	11.662	3.480	0.710	4.902
9	--	--	--	0.436	0.710	0.613
10	0.241	0.031	7.713	3.208	0.710	4.518
11	0.021	0.031	0.665	0.661	0.710	0.931
12	0.227	0.031	7.252	2.492	0.710	3.510
13	0.012	0.031	0.398	0.307	0.710	0.432
14	0.030	0.031	0.970	0.642	0.710	0.904
15	0.034	0.033	1.044	1.048	0.540	1.941
16	0.065	0.031	2.082	1.032	0.710	1.454
17	0.025	0.010	2.493	0.500	0.380	1.315
18	0.120	0.031	3.826	1.537	0.710	2.165
19	0.372	0.037	10.174	3.357	0.690	4.865
20	0.369	0.031	11.800	5.794	0.710	8.161
21	--	--	--	1.727	0.690	2.503
22	0.071	0.037	1.953	1.407	0.690	2.039
23	--	--	--	1.090	0.690	1.580
24	0.042	0.037	1.139	1.753	0.690	2.540
25	0.195	0.037	5.339	2.902	0.690	4.207
26	0.160	0.037	4.374	2.316	0.690	3.357
27	0.099	0.031	3.167	--	--	--
28	0.024	0.031	0.763	--	--	--
29	--	--	--	0.386	0.710	0.544
30	0.014	0.031	0.455	--	--	--
31	0.041	0.010	4.072	0.487	0.380	1.281
32	0.025	0.010	2.527	0.958	0.310	3.089
33	0.057	0.031	1.836	1.277	0.710	1.799
34	0.198	0.031	6.343	0.921	0.710	1.298
35	0.117	0.031	3.738	1.658	0.710	2.336
36	0.045	0.031	1.437	1.457	0.710	2.052
37	0.021	0.037	0.581	1.526	0.690	2.211
38	0.116	0.037	3.174	2.078	0.690	3.012
39	0.114	0.010	11.450	5.429	0.310	17.514
40	0.030	0.037	0.823	2.010	0.690	2.913
41	0.033	0.037	0.897	0.577	0.690	0.836
42	0.066	0.037	1.802	0.653	0.690	0.947
43	0.059	0.037	1.601	0.623	0.690	0.903
44	0.100	0.037	2.743	0.478	0.690	0.692
45	0.047	0.037	1.279	0.587	0.690	0.851
46	0.025	0.037	0.696	0.664	0.690	0.963
47	--	--	--	1.493	0.690	2.164
48	--	--	--	1.242	0.690	1.800
49	--	--	--	1.363	0.690	1.975
50	--	--	--	--	--	--
51	0.093	0.040	2.316	--	--	--
52	0.177	0.037	4.846	1.350	0.690	1.957
53	0.117	0.037	3.195	0.965	0.690	1.398
54	0.135	0.037	3.696	--	--	--
55	0.106	0.040	2.647	--	--	--
56	0.140	0.040	3.489	--	--	--
57	--	--	--	0.889	0.900	0.987

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference concentration of total phosphorus, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total phosphorus, in milligrams per liter	Enrichment ratio for total phosphorus[4]	Reference concentration of total nitrogen, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total nitrogen, in milligrams per liter	Enrichment ratio for total nitrogen[4]
58	0.620	0.040	15.493	1.696	0.900	1.884
59	0.940	0.040	23.496	1.780	0.900	1.977
60	0.227	0.040	5.683	0.782	0.900	0.869
61	0.954	0.040	23.854	1.056	0.900	1.173
62	0.807	0.040	20.172	1.693	0.900	1.881
63	0.323	0.040	8.081	--	--	--
64	0.066	0.040	1.652	--	--	--
65	0.150	0.037	4.101	1.005	0.690	1.456
66	0.017	0.037	0.459	--	--	--
67	--	--	--	1.386	0.690	2.009
68	0.085	0.037	2.331	--	--	--
69	0.049	0.037	1.346	--	--	--
70	0.217	0.010	21.727	--	--	--
71	0.070	0.040	1.745	0.819	0.900	0.910
72	0.024	0.076	0.312	1.079	2.180	0.495
73	0.082	0.037	2.233	1.344	0.690	1.948
74	0.027	0.010	2.663	0.453	0.380	1.192
75	0.134	0.033	4.073	--	--	--
76	0.083	0.033	2.509	1.724	0.540	3.193
77	0.402	0.033	12.188	--	--	--
78	0.070	0.033	2.110	--	--	--
79	0.090	0.033	2.726	--	--	--
80	0.068	0.033	2.056	--	--	--
81	0.424	0.076	5.561	2.076	2.180	0.952
82	0.264	0.076	3.461	1.507	2.180	0.691
83	0.139	0.033	4.217	--	--	--
84	0.149	0.033	4.507	--	--	--
85	0.390	0.033	11.812	--	--	--
86	0.129	0.033	3.916	--	--	--
87	0.102	0.037	2.777	--	--	--
88	0.136	0.037	3.712	--	--	--
89	0.060	0.076	0.780	--	--	--
90	1.019	0.076	13.359	--	--	--
91	0.517	0.076	6.778	--	--	--
92	0.079	0.076	1.038	1.615	2.180	0.741
93	0.264	0.037	7.211	--	--	--
94	0.032	0.010	3.159	--	--	--
95	0.230	0.037	6.303	3.227	0.690	4.677
96	--	--	--	--	--	--
97	0.029	0.067	0.435	0.613	0.880	0.697
98	--	--	--	--	--	--
99	0.075	0.023	3.252	0.606	0.560	1.081
100	--	--	--	0.193	0.560	0.345
101	0.121	0.023	5.261	0.441	0.560	0.788
102	--	--	--	1.518	2.180	0.696
103	--	--	--	3.828	0.880	4.350
104	--	--	--	--	--	--
105	--	--	--	--	--	--
106	0.325	0.067	4.846	9.761	0.880	11.092
107	0.636	0.067	9.487	6.215	0.880	7.063
108	--	--	--	0.717	0.560	1.280
109	0.207	0.076	2.711	6.015	2.180	2.759
110	0.313	0.076	4.099	2.642	2.180	1.212
111	0.327	0.076	4.290	5.273	2.180	2.419

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference concentration of total phosphorus, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total phosphorus, in milligrams per liter	Enrichment ratio for total phosphorus[4]	Reference concentration of total nitrogen, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total nitrogen, in milligrams per liter	Enrichment ratio for total nitrogen[4]
112	0.216	0.076	2.829	3.257	2.180	1.494
113	0.202	0.037	5.530	1.723	0.690	2.498
114	0.207	0.037	5.655	1.607	0.690	2.329
115	0.047	0.010	4.696	0.544	0.310	1.754
116	--	--	--	0.752	0.310	2.425
117	--	--	--	--	--	--
118	0.187	0.037	5.128	2.025	0.690	2.935
119	--	--	--	--	--	--
120	0.039	0.010	3.884	2.529	0.310	8.157
121	--	--	--	--	--	--
122	--	--	--	--	--	--
123	--	--	--	--	--	--
124	--	--	--	0.448	0.310	1.446
125	--	--	--	0.426	0.310	1.375
126	--	--	--	--	--	--
127	--	--	--	--	--	--
128	--	--	--	--	--	--
129	--	--	--	--	--	--
130	--	--	--	--	--	--
131	--	--	--	--	--	--
132	--	--	--	--	--	--
133	--	--	--	--	--	--
134	0.041	0.010	4.078	1.721	0.310	5.550
135	0.112	0.010	11.232	2.523	0.310	8.140
136	0.495	0.010	49.503	6.666	0.310	21.503
137	0.092	0.010	9.206	1.882	0.310	6.070
138	0.063	0.010	6.276	1.723	0.310	5.559
139	0.028	0.010	2.786	1.033	0.310	3.331
140	--	--	--	--	--	--
141	--	--	--	--	--	--
142	--	--	--	--	--	--
143	--	--	--	--	--	--
144	--	--	--	--	--	--
145	0.106	0.010	10.574	0.439	0.310	1.417
146	--	--	--	0.315	0.310	1.017
147	--	--	--	0.322	0.310	1.037
148	0.051	0.037	1.384	0.610	0.690	0.885
149	0.081	0.128	0.634	0.842	0.760	1.108
150	0.201	0.037	5.497	0.988	0.690	1.432
151	0.095	0.128	0.746	0.715	0.760	0.941
152	0.041	0.037	1.112	0.312	0.690	0.452
153	0.175	0.128	1.371	2.096	0.760	2.758
154	0.112	0.040	2.793	0.909	0.900	1.010
155	0.074	0.040	1.842	0.873	0.900	0.970
156	0.146	0.128	1.144	1.776	0.760	2.337
157	0.297	0.128	2.317	1.888	0.760	2.484
158	--	--	--	--	--	--
159	--	--	--	--	--	--
160	--	--	--	--	--	--
161	--	--	--	--	--	--
162	--	--	--	--	--	--
163	--	--	--	--	--	--
164	--	--	--	--	--	--
165	0.205	0.037	5.607	--	--	--

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference concentration of total phosphorus, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total phosphorus, in milligrams per liter	Enrichment ratio for total phosphorus[4]	Reference concentration of total nitrogen, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total nitrogen, in milligrams per liter	Enrichment ratio for total nitrogen[4]
166	0.077	0.023	3.337	--	--	--
167	--	--	--	--	--	--
168	--	--	--	--	--	--
169	0.076	0.067	1.135	--	--	--
170	0.269	0.128	2.104	--	--	--
171	0.291	0.128	2.271	--	--	--
172	--	--	--	--	--	--
173	0.079	0.022	3.592	0.440	0.380	1.157
174	--	--	--	--	--	--
175	--	--	--	--	--	--
176	--	--	--	0.230	0.380	0.604
177	0.026	0.022	1.167	--	--	--
178	0.062	0.022	2.834	--	--	--
179	--	--	--	0.368	0.380	0.969
180	0.035	0.022	1.616	--	--	--
181	--	--	--	--	--	--
182	0.106	0.022	4.835	0.841	0.380	2.212
183	0.122	0.022	5.596	--	--	--
184	0.013	0.010	1.302	--	--	--
185	0.023	0.010	2.274	--	--	--
186	0.280	0.022	12.776	--	--	--
187	--	--	--	--	--	--
188	0.188	0.022	8.581	--	--	--
189	--	--	--	--	--	--
190	--	--	--	--	--	--
191	--	--	--	--	--	--
192	--	--	--	--	--	--
193	0.085	0.010	8.492	--	--	--
194	--	--	--	--	--	--
195	--	--	--	--	--	--
196	--	--	--	0.210	0.120	1.746
197	--	--	--	--	--	--
198	--	--	--	--	--	--
199	--	--	--	0.304	0.120	2.536
200	--	--	--	--	--	--
201	--	--	--	0.313	0.120	2.612
202	--	--	--	0.328	0.120	2.735
203	0.021	0.010	2.098	--	--	--
204	0.015	0.010	1.480	--	--	--
205	0.009	0.010	0.891	--	--	--
206	0.025	0.010	2.523	--	--	--
207	0.005	0.010	0.503	--	--	--
208	0.070	0.047	1.485	0.967	0.310	3.118
209	0.075	0.047	1.599	0.791	0.310	2.553
210	0.046	0.047	0.970	0.430	0.310	1.387
211	0.028	0.047	0.591	--	--	--
212	0.080	0.022	3.657	0.316	0.380	0.831
213	0.064	0.047	1.358	0.912	0.310	2.942
214	0.082	0.047	1.738	1.171	0.310	3.776
215	0.040	0.047	0.855	0.459	0.310	1.479
216	0.036	0.010	3.640	--	--	--
217	0.081	0.047	1.718	1.009	0.310	3.255
218	0.090	0.047	1.910	4.554	0.310	14.689
219	0.041	0.010	4.058	0.293	0.120	2.444

Appendix 1. Study-site characteristics.—Continued

[--, not determined or not applicable; USEPA, U.S. Environmental Protection Agency]

Site number (figure 1)	Reference concentration of total phosphorus, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total phosphorus, in milligrams per liter	Enrichment ratio for total phosphorus[4]	Reference concentration of total nitrogen, in milligrams per liter	USEPA recommended ecoregional nutrient criteria for total nitrogen, in milligrams per liter	Enrichment ratio for total nitrogen[4]
220	0.104	0.022	4.742	2.665	0.380	7.013
221	0.011	0.010	1.088	0.230	0.120	1.919
222	0.011	0.010	1.126	0.138	0.120	1.150
223	0.068	0.022	3.100	1.480	0.380	3.896
224	0.083	0.022	3.788	0.565	0.380	1.487
225	0.195	0.022	8.896	1.724	0.380	4.537
226	--	--	--	--	--	--
227	0.061	0.047	1.298	0.781	0.310	2.518
228	0.031	0.010	3.134	0.473	0.120	3.944
229	0.009	0.010	0.943	--	--	--
230	0.112	0.022	5.107	--	--	--
231	0.175	0.047	3.724	2.701	0.310	8.714
232	0.039	0.047	0.832	0.553	0.310	1.784
233	0.102	0.022	4.669	--	--	--
234	0.004	0.022	0.175	--	--	--
235	0.004	0.010	0.444	--	--	--
236	0.003	0.022	0.142	--	--	--
237	0.017	0.022	0.773	--	--	--
238	0.019	0.010	1.873	--	--	--
239	0.011	0.010	1.129	--	--	--
240	--	--	--	--	--	--
241	0.183	0.047	3.890	2.839	0.310	9.160
242	0.074	0.047	1.573	0.378	0.310	1.220
243	0.274	0.047	5.821	2.012	0.310	6.490
244	0.039	0.047	0.828	0.238	0.310	0.768

[1] Land use characteristics for the drainage area in the United States.

[2] "Other" includes open water, wetlands, tundra, bare rock/sand/clay, perennial ice/snow, quarries/strip mines/gravel pits, and transitional.

[3] Agricultural: > 50 percent agricultural land and ≤ 5 percent urban land; Urban: > 25 percent urban land and ≤ 25 percent agricultural land; Undeveloped: ≤ 5 percent urban land and ≤ 25 percent agricultural land; Mixed - all other combinations of urban, agricultural, and undeveloped land (Gilliom and others, 2006).

[4] Enrichment ratio: the reference concentration of total phosphorus or total nitrogen divided by the U.S. Environmental Protection Agency's recommended nutrient criteria (U.S. Environmental Protection Agency, 2002) in the respective ecoregion.

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic feet per second	Reference streamflow, in cubic meters per second
1	01122610	Shetucket River at South Windham, Conn.	01122610	483.77	13.70
2	01124000	Quinebaug River at Quinebaug, Conn.	01124000	176.52	5.00
3	01127000	Quinebaug River at Jewett City, Conn.	01127000	785.58	22.25
4	01184000	Connecticut River at Thompsonville, Conn.	01184000	13,407.74	379.66
5	01184490	Broad Brook at Broad Brook, Conn.	01184490	22.38	0.63
6	01188090	Farmington River at Unionville, Conn.	01188090	570.91	16.17
7	01189995	Farmington River at Tariffville, Conn.	01189995	968.91	27.44
8	01192500	Hockanum River near East Hartford, Conn.	01192500	111.30	3.15
9	01193500	Salmon River near East Hampton, Conn.	01193500	104.22	2.95
10	01196500	Quinnipiac River at Wallingford, Conn.	01196500	169.35	4.80
11	01205500	Housatonic River at Stevenson, Conn.	01205500	1,541.71	43.66
12	01208500	Naugatuck River at Beacon Falls, Conn.	01208500	382.89	10.84
13	01208990	Saugatuck River near Redding, Conn.	01208990	16.77	0.47
14	01209710	Norwalk River at Winnipauk, Conn.	01209710	30.79	0.87
15	01357500	Mohawk River at Cohoes, N.Y.	01357500	3,219.33	91.16
16	01377000	Hackensack River at Rivervale, N.J.	01377000	60.63	1.72
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	01382500	14.98	0.42
18	01387500	Ramapo River near Mahwah, N.J.	01387500	98.72	2.80
19	01389500	Passaic River at Little Falls, N.J.	01389500	511.42	14.48
20	01391500	Saddle River at Lodi, N.J.	01391500	67.23	1.90
21	01394500	Rahway River near Springfield, N.J.	01394500	16.72	0.47
22	01395000	Rahway River at Rahway, N.J.	01395000	23.04	0.65
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	01396660	11.42	0.32
24	01398000	Neshanic River at Reaville, N.J.	01398000	11.82	0.33
25	01402000	Millstone River at Blackwells Mills, N.J.	01402000	240.78	6.82
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	01403300	649.45	18.39
27	01408000	Manasquan River at Squankum, N.J.	01408000	54.29	1.54
28	01408500	Toms River near Toms River, N.J.	01408500	179.65	5.09
29	01409500	Batsto River at Batsto, N.J.	01409500	105.60	2.99
30	01411500	Maurice River at Norma, N.J.	01411500	122.56	3.47
31	01438500	Delaware River at Montague, N.J.	01438500	3,828.23	108.40
32	01443500	Paulins Kill at Blairstown, N.J.	01443500	139.02	3.94
33	01463500	Delaware River at Trenton, N.J.	01463500	8,504.29	240.81
34	01467150	Cooper River at Haddonfield, N.J.	01467150	20.86	0.59
35	01477120	Raccoon Creek near Swedesboro, N.J.	01477120	29.02	0.82
36	01491000	Choptank River near Greensboro, Md.	01491000	66.58	1.89
37	01578310	Susquehanna River at Conowingo, Md.	01578310	26,999.08	764.53
38	01594440	Patuxent River near Bowie, Md.	01594440	271.43	7.69
39	01614500	Conococheague Creek at Fairview, Md.	01614500	477.02	13.51
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	01646580	7,528.21	213.18
41	01668000	Rappahannock River near Fredericksburg, Va.	01668000	1,146.30	32.46
42	01673000	Pamunkey River near Hanover, Va.	01673000	606.25	17.17
43	01674500	Mattaponi River near Beulahville, Va.	01674500	328.88	9.31
44	02035000	James River at Cartersville, Va.	02035000	5,196.79	147.16
45	02041650	Appomattox River at Matoaca, Va.	02041650	669.32	18.95
46	02085000	Eno River at Hillsborough, N.C.	02085000	18.93	0.54
47	02089500	Neuse River at Kinston, N.C.	02089500	1,710.44	48.43
48	02091500	Contentnea Creek at Hookerton, N.C.	02091500	360.73	10.21
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	02102500	1,739.98	49.27
50	02175000	Edisto River near Givhans, S.C.	02175000	2,379.70	67.39
51	02198500	Savannah River near Clyo, Ga.	02198500	13,571.33	384.30
52	02213700	Ocmulgee River near Warner Robins, Ga.	02213700	1,763.69	49.94
53	02215500	Ocmulgee River at Lumber City, Ga.	02215500	5,209.86	147.53
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	02223500	3,996.93	113.18
55	02226010	Altamaha River near Gardi, Ga.	02226000	11,871.78	336.17

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic feet per second	Reference streamflow, in cubic meters per second
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	02226500	377.80	10.70
57	02271500	Josephine Creek near De Soto City, Fla.	02271500	30.37	0.86
58	02295420	Payne Creek near Bowling Green, Fla.	02295420	82.79	2.34
59	02296750	Peace River at Arcadia, Fla.	02296750	507.75	14.38
60	02300700	Bullfrog Creek near Wimauma, Fla.	02300700	21.46	0.61
61	02301300	South Prong Alafia River near Lithia, Fla.	02301300	56.53	1.60
62	02302500	Blackwater Creek near Knights, Fla.	02302500	33.69	0.95
63	02303000	Hillsborough River near Zephyrhills, Fla.	02303000	129.96	3.68
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	02314500	601.58	17.03
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	02318500	286.14	8.10
66	02335870	Sope Creek near Marietta, Ga.	02335870	32.58	0.92
67	02338000	Chattahoochee River near Whitesburg, Ga.	02338000	4,080.95	115.56
68	02344040	Chattahoochee River near Steam Mill, Ga.	02343801	9,193.59	260.33
69	02353000	Flint River at Newton, Ga.	02353000	5,938.05	168.15
70	02388520	Oostanaula River at Rome, Ga.	02388500	2,381.84	67.45
71	02492000	Bogue Chitto River near Bush, La.	02492000	1,664.91	47.14
72	03353637	Little Buck Creek near Indianapolis, Ind.	03353637	10.49	0.30
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	03611500	247,066.83	6,996.15
74	04063700	Popple River near Fence, Wis.	04063700	93.81	2.66
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	04073468	33.51	0.95
76	04087000	Milwaukee River at Milwaukee, Wis.	04087000	384.42	10.89
77	0422026250	Northrup Creek at North Greece, N.Y.	0422026250	7.28	0.21
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	04232034	31.78	0.90
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	0423204920	5.29	0.15
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	0423205025	108.46	3.07
81	05114000	Souris River near Sherwood, N. Dak.	05114000	5.18	0.15
82	05120000	Souris River near Verendrye, N. Dak.	05120000	43.14	1.22
83	05287890	Elm Creek near Champlin, Minn.	05287890	25.56	0.72
84	05427718	Yahara River at Windsor, Wis.	05427718	26.54	0.75
85	05427948	Pheasant Branch at Middleton, Wis.	05427948	3.23	0.09
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	054310157	1.43	0.04
87	05500000	South Fabius River near Taylor, Mo.	05500000	181.50	5.14
88	05514500	Cuivre River near Troy, Mo.	05514500	178.57	5.06
89	05525500	Sugar Creek at Milford, Ill.	05525500	181.04	5.13
90	05531500	Salt Creek at Western Springs, Ill.	05531500	135.94	3.85
91	05532500	Des Plaines River at Riverside, Ill.	05532500	592.90	16.79
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	05540275	6.39	0.18
93	05586100	Illinois River at Valley City, Ill.	05586100	29,129.99	824.87
94	07018100	Big River near Richwoods, Mo.	07018100	563.98	15.97
95	07022000	Mississippi River at Thebes, Ill.	07022000	313,351.60	8,873.13
96	06088500	Muddy Creek at Vaughn, Mont.	06088500	79.97	2.26
97	06178000	Poplar River at International Boundary, Mont.	06178000	3.78	0.11
98	06274300	Bighorn River at Basin, Wyo.	06274300	1,967.85	55.72
99	06329500	Yellowstone River near Sidney, Mont.	06329500	11,947.18	338.31
100	06338490	Missouri River at Garrison Dam, N. Dak.	06338490	18,026.30	510.45
101	06461500	Niobrara River near Sparks, Nebr.	06461500	785.96	22.26
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	06468250	11.72	0.33
103	06713500	Cherry Creek at Denver, Colo.	06713500	21.69	0.61
104	06752260	Cache La Poudre River at Fort Collins, Colo.	06752260	45.63	1.29
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	06752280	30.06	0.85
106	06753990	Lonetree Creek near Greeley, Colo.	06753990	14.55	0.41
107	06754000	South Platte River near Kersey, Colo.	06754000	940.63	26.64
108	06775900	Dismal River near Thedford, Nebr.	06775900	212.97	6.03
109	06800000	Maple Creek near Nickerson, Nebr.	06800000	121.59	3.44
110	06805500	Platte River at Louisville, Nebr.	06805500	11,469.82	324.79

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic feet per second	Reference streamflow, in cubic meters per second
111	06817700	Nodaway River near Graham, Mo.	06817700	1,015.57	28.76
112	06818000	Missouri River at St. Joseph, Mo.	06818000	64,310.44	1,821.07
113	06902000	Grand River near Sumner, Mo.	06902000	3,558.24	100.76
114	06905500	Chariton River near Prairie Hill, Mo.	06905500	1,342.71	38.02
115	06921070	Pomme De Terre River near Polk, Mo.	06921070	141.91	4.02
116	06926510	Osage River below St. Thomas, Mo.	06926510	13,678.79	387.34
117	06930800	Gasconade River above Jerome, Mo.	06930800	2,221.23	62.90
118	06934500	Missouri River at Hermann, Mo.	06934500	139,332.46	3,945.46
119	07047942	L'Anguille River near Colt, Ark.	07047942	213.05	6.03
120	07053250	Yocum Creek near Oak Grove, Ark.	07053250	38.63	1.09
121	07056000	Buffalo River near St Joe, Ark.	07056000	458.89	12.99
122	07060500	White River at Calico Rock, Ark.	07060500	12,820.44	363.03
123	07060710	North Sylamore Creek near Fifty Six, Ark.	07060710	22.21	0.63
124	07066110	Jacks Fork above Two River, Mo.	07066000	491.80	13.93
125	07068000	Current River at Doniphan, Mo.	07068000	3,247.85	91.97
126	07077500	Cache River at Patterson, Ark.	07077500	552.80	15.65
127	07077700	Bayou DeView near Morton, Ark.	07077700	71.37	2.02
128	07103700	Fountain Creek near Colorado Springs, Colo.	07103700	18.42	0.52
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	07103780	7.68	0.22
130	07105500	Fountain Creek at Colorado Springs, Colo.	07105500	58.03	1.64
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	07105530	116.94	3.31
132	07106300	Fountain Creek near Pinon, Colo.	07106300	120.71	3.42
133	07106500	Fountain Creek at Pueblo, Colo.	07106500	130.80	3.70
134	07189000	Elk River near Tiff City, Mo.	07189000	730.81	20.69
135	07195500	Illinois River near Watts, Okla.	07195500	585.65	16.58
136	07195865	Sager Creek near West Siloam Springs, Okla.	07195865	14.52	0.41
137	07196000	Flint Creek near Kansas, Okla.	07196000	98.34	2.78
138	07196500	Illinois River near Tahlequah, Okla.	07196500	872.49	24.71
139	07197000	Baron Fork at Eldon, Okla.	07197000	287.82	8.15
140	07227500	Canadian River near Amarillo, Tex.	07227500	78.12	2.21
141	07239450	North Canadian River near Calumet, Okla.	07239450	156.02	4.42
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	07241000	234.81	6.65
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	07241520	369.81	10.47
144	07241550	North Canadian River near Harrah, Okla.	07241550	543.37	15.39
145	07247015	Poteau River at Loving, Okla.	07247015	65.85	1.86
146	07247250	Black Fork below Big Creek near Page, Okla.	07247250	56.66	1.60
147	07247345	Black Fork at Hodgen, Okla.	07247250	56.51	1.60
148	07247650	Fourche Maline near Leflore, Okla.	07247500	46.49	1.32
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	07263450	41,969.83	1,188.45
150	07331000	Washita River near Dickson, Okla.	07331000	2,333.19	66.07
151	07355500	Red River at Alexandria, La.	07355500	28,015.06	793.30
152	07362000	Ouachita River at Camden, Ark.	07362000	4,678.67	132.49
153	07373420	Mississippi River near St Francisville, La.	07373420	576,991.28	16,338.57
154	07375500	Tangipahoa River at Robert, La.	07375500	943.50	26.72
155	07376000	Tickfaw River at Holden, La.	07376000	272.81	7.73
156	07381495	Atchafalaya River at Melville, La.	07381495	246,523.35	6,980.76
157	07386980	Vermilion River at Perry, La.	07386980	782.85	22.17
158	08030500	Sabine River near Ruliff, Tex.	08030500	5,927.29	167.84
159	08032000	Neches River near Neches, Tex.	08032000	411.19	11.64
160	08033500	Neches River near Rockland, Tex.	08033500	1,245.79	35.28
161	08051500	Clear Creek near Sanger, Tex.	08051500	44.48	1.26
162	08064100	Chambers Creek near Rice, Tex.	08064100	35.08	0.99
163	08065350	Trinity River near Crockett, Tex.	08065350	4,997.95	141.53
164	08136500	Concho River at Paint Rock, Tex.	08136500	74.38	2.11

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic feet per second	Reference streamflow, in cubic meters per second
165	08143600	Pecan Bayou near Mullin, Tex.	08143600	26.92	0.76
166	08147000	Colorado River near San Saba, Tex.	08147000	242.83	6.88
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	08155200	1.84	0.05
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	08155240	2.77	0.08
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	08159000	3.92	0.11
170	08162000	Colorado River at Wharton, Tex.	08162000	1,254.86	35.53
171	08162500	Colorado River near Bay City, Tex.	08162500	1,129.38	31.98
172	08181800	San Antonio River near Elmendorf, Tex.	08181800	280.56	7.94
173	08251500	Rio Grande near Lobatos, Colo.	08251500	455.47	12.90
174	09058000	Colorado River near Kremmling, Colo.	09058000	966.42	27.37
175	09163500	Colorado River near Colorado-Utah State Line	09163500	7,073.37	200.30
176	09211200	Green River below Fontenelle Reservoir, Wyo.	09211200	1,418.71	40.17
177	09217010	Green River below Green River, Wyo.	09217000	1,444.65	40.91
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	09261000	3,767.24	106.68
179	09380000	Colorado River at Lees Ferry, Ariz.	09380000	13,751.49	389.40
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	09403600	10.07	0.29
181	09413500	Virgin River below First Narrows, Utah	09413500	214.94	6.09
182	09415000	Virgin River at Littlefield, Ariz.	09415000	266.28	7.54
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	09448500	346.76	9.82
184	09498500	Salt River near Roosevelt, Ariz.	09498500	529.91	15.01
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	09508500	371.09	10.51
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	09522000	2,903.14	82.21
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	10038000	319.30	9.04
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	10126000	895.81	25.37
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	10131000	54.87	1.55
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	10154200	142.47	4.03
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	10155000	188.18	5.33
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	10155500	133.64	3.78
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	10189000	48.66	1.38
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	10336580	16.00	0.45
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	103366092	38.45	1.09
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	10336610	49.56	1.40
197	10336698	Third Creek near Crystal Bay, Nev.	10336698	7.08	0.20
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	103366993	2.96	0.08
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	103366995	4.23	0.12
200	10336700	Incline Creek near Crystal Bay, Nev.	10336700	7.69	0.22
201	10336740	Logan House Creek near Glenbrook, Nev.	10336740	0.21	0.01
202	10336760	Edgewood Creek at Stateline, Nev.	10336760	3.31	0.09
203	01A050	Nooksack River at Brennan, Wash.	01A050	2,970.69	84.12
204	03A060	Skagit River near Mount Vernon, Wash.	03A060	14,292.96	404.73
205	07A090	Snohomish River at Snohomish, Wash.	07A090	7,046.18	199.53
206	09A080	Green River at Tukwila, Wash.	09A080	947.25	26.82
207	09A190	Green River at Kanaskat, Wash.	09A190	602.74	17.07
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	10332	26,967.94	763.65
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	10350	11,599.72	328.47
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	10355	9,334.51	264.32
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	10386	3,509.56	99.38
212	10411	Deschutes River at Deschutes River Park, Oreg.	10411	5,597.93	158.52
213	10555	Willamette River at Marion Street at Salem, Oreg.	10555	18,716.49	529.99
214	10611	Willamette River at Hawthorne Bridge, Oreg.	10611	26,939.66	762.85
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	10616	172,838.33	4,894.24
216	10A070	Puyallup River at Meridian Street, Wash.	10A070	2,567.46	72.70
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	11140	324.20	9.18

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Station number	Station name	Streamflow station number	Reference streamflow, in cubic feet per second	Reference streamflow, in cubic meters per second
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	11321	55.11	1.56
219	11478	John Day River at Service Creek, Oreg.	11478	1,206.16	34.15
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	11489	206.29	5.84
221	12413470	South Fork Coeur D'Alene River near Pinehurst, Idaho	12413470	325.10	9.21
222	12419000	Spokane River near Post Falls, Idaho	12419000	3,911.28	110.76
223	13154500	Snake River at King Hill, Idaho	13154500	10,647.62	301.51
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	13206000	687.95	19.48
225	13351000	Palouse River at Hooper, Wash.	13351000	214.15	6.06
226	14201300	Zollner Creek near Mt. Angel, Oreg.	14201300	6.56	0.19
227	14211720	Willamette River at Portland, Oreg.	14211720	26,749.77	757.47
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	14246900	232,625.53	6,587.22
229	16A070	Skokomish River near Potlatch, Wash.	16A070	691.14	19.57
230	32A070	Walla Walla River near Touchet, Wash.	32A070	260.41	7.37
231	3701002	Tualatin River at Weiss Bridge, Oreg.	3701002	751.09	21.27
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	3701612	243.03	6.88
233	37A090	Yakima River at Kiona, Wash.	37A090	2,582.89	73.14
234	45A070	Wenatchee River at Wenatchee, Wash.	45A070	1,927.84	54.59
235	45A110	Wenatchee River near Leavenworth, Wash.	45A110	1,870.50	52.97
236	48A070	Methow River near Pateros, Wash.	48A070	829.26	23.48
237	49A070	Okanogan River at Malott, Wash.	49A070	2,415.34	68.39
238	54A120	Spokane River at Riverside State Park, Wash.	54A120	4,323.99	122.44
239	61A070	Columbia River at Northport, Wash.	61A070	91,192.51	2,582.28
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	11264500	169.70	4.81
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	11274538	21.35	0.60
242	11290000	Tuolumne River at Modesto, Calif.	11290000	848.47	24.03
243	11303500	San Joaquin River near Vernalis, Calif.	11303500	3,437.77	97.35
244	11447650	Sacramento River at Freeport, Calif.	11447650	22,165.47	627.66

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Trend, in percent from 1993 to 2003			Properties of the calibration data set		
	Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	Start date	End date	Number of observations
1	–20.09	35.75	–52.96	10/1/1992	9/30/2003	4,017
2	–24.00	36.50	–57.68	10/1/1992	9/30/2003	4,017
3	–3.74	63.17	–43.21	10/1/1992	9/30/2003	4,017
4	–10.12	25.25	–35.51	10/1/1992	9/30/2003	4,017
5	–18.36	15.06	–42.07	10/1/1992	9/30/2003	4,017
6	–24.01	16.08	–50.25	10/1/1992	9/30/2003	4,017
7	–25.45	13.76	–51.15	10/1/1992	9/30/2003	4,017
8	–21.67	12.63	–45.52	10/1/1992	9/30/2003	4,017
9	–11.31	56.45	–49.72	10/1/1992	9/30/2003	4,017
10	–7.19	39.65	–38.32	10/1/1992	9/30/2003	4,017
11	–4.82	86.90	–51.53	10/1/1992	9/30/2003	4,017
12	–13.16	35.79	–44.46	10/1/1992	9/30/2003	4,017
13	17.58	164.94	–47.82	10/1/1992	9/30/2003	4,017
14	–0.88	93.23	–49.16	10/1/1992	9/30/2003	4,017
15	23.29	89.21	–19.66	10/1/1992	9/30/2003	4,017
16	–23.87	20.21	–51.78	10/1/1992	9/30/2003	4,017
17	–46.63	100.42	–85.79	10/1/1992	9/30/2003	4,000
18	14.67	151.39	–47.69	10/1/1992	9/30/2003	4,017
19	–18.58	139.20	–72.29	10/1/1992	9/30/2003	4,017
20	4.46	81.35	–39.83	10/1/1992	9/30/2003	4,017
21	17.68	78.33	–22.34	10/1/1992	9/30/2003	4,017
22	10.34	89.87	–35.87	10/1/1992	9/30/2003	4,017
23	4.20	93.78	–43.97	10/1/1992	9/30/2003	4,017
24	3.03	175.69	–61.50	10/1/1992	9/30/2003	3,938
25	–14.34	37.97	–46.82	10/1/1992	9/30/2003	4,017
26	–17.31	43.06	–52.20	10/1/1992	9/30/2003	4,017
27	–16.44	25.75	–44.48	10/1/1992	9/30/2003	4,017
28	–10.02	31.26	–38.31	10/1/1992	9/30/2003	4,017
29	–23.58	13.30	–48.46	10/1/1992	9/30/2003	4,017
30	1.18	76.11	–41.87	10/1/1992	9/30/2003	4,017
31	6.27	63.49	–30.92	10/1/1992	9/30/2003	4,017
32	–20.60	65.47	–61.90	10/1/1992	9/30/2003	4,017
33	0.93	63.68	–37.76	10/1/1992	9/30/2003	4,017
34	–28.62	–3.38	–47.26	10/1/1992	9/30/2003	4,017
35	–12.68	38.60	–44.98	10/1/1992	9/30/2003	4,017
36	43.84	332.25	–52.13	10/1/1992	9/30/2003	4,017
37	–21.03	32.07	–52.78	10/1/1992	9/30/2003	4,017
38	1.20	92.75	–46.87	10/1/1992	9/30/2003	4,017
39	–38.33	33.36	–71.48	10/1/1992	9/30/2003	4,017
40	–25.99	108.51	–73.73	10/1/1992	9/30/2003	4,017
41	–42.69	73.75	–81.09	10/1/1992	9/30/2003	4,017
42	–46.94	59.54	–82.35	10/1/1992	9/30/2003	4,017
43	–53.89	96.74	–89.19	10/1/1992	9/30/2003	4,017
44	–34.78	38.64	–69.32	10/1/1992	9/30/2003	4,017
45	–36.08	99.23	–79.49	10/1/1992	9/30/2003	4,017
46	0.82	201.95	–66.34	10/1/1992	9/30/2003	4,017
47	23.45	172.20	–44.01	10/1/1992	9/30/2003	4,016
48	52.67	283.87	–39.28	10/1/1992	9/30/2003	4,015
49	–6.35	101.73	–56.52	10/1/1992	9/30/2003	4,017
50	–51.00	18.36	–79.71	10/1/1992	9/30/2003	4,017
51	–51.95	–5.97	–75.45	10/1/1992	9/30/2003	4,017
52	–40.36	–4.21	–62.87	10/10/1992	9/30/2003	2,527
53	–47.60	14.40	–76.00	10/1/1992	9/30/2003	4,017
54	–59.99	–9.57	–82.30	10/1/1992	9/30/2003	4,017
55	–51.45	23.90	–80.98	10/1/1992	9/30/2003	4,017
56	–68.11	73.46	–94.14	10/1/1992	9/30/2003	4,017
57	–3.83	270.94	–75.07	10/1/1992	9/30/2003	4,017
58	–41.53	119.85	–84.45	10/1/1992	9/30/2003	4,017
59	–35.78	183.72	–85.46	10/1/1992	9/30/2003	4,017
60	–25.78	42.03	–61.22	10/1/1992	9/30/2003	4,013
61	–41.87	211.34	–89.15	10/1/1992	9/30/2003	3,983

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Trend, in percent from 1993 to 2003			Properties of the calibration data set		
	Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	Start date	End date	Number of observations
62	–59.09	112.22	–92.11	10/1/1992	9/30/2003	3,926
63	–14.21	127.43	–67.64	10/1/1992	9/30/2003	4,017
64	–83.56	–22.23	–96.52	10/1/1992	9/30/2003	4,017
65	–18.20	339.98	–84.79	6/1/1993	9/30/2003	3,774
66	–37.34	7.60	–63.51	10/1/1992	9/30/2003	4,017
67	–48.48	–10.88	–70.22	10/1/1992	9/30/2003	4,017
68	–28.21	21.34	–57.53	10/1/1992	9/30/2003	4,017
69	–46.12	4.10	–72.11	10/1/1992	9/30/2003	4,017
70	–11.15	55.96	–49.38	10/1/1992	9/30/2003	4,017
71	–31.18	5.95	–55.29	10/1/1992	9/30/2003	4,017
72	–47.86	28.18	–78.79	10/1/1992	9/30/2003	3,495
73	–18.06	20.92	–44.47	10/1/1992	9/30/2003	4,017
74	–35.22	–9.96	–53.39	10/1/1992	9/30/2003	4,017
75	–44.81	7.95	–71.79	10/1/1992	9/30/2003	4,009
76	–29.12	6.87	–52.99	10/1/1992	9/30/2003	4,017
77	58.64	165.31	–5.14	10/1/1992	9/30/2003	4,017
78	–26.71	–1.44	–45.51	10/1/1992	9/30/2003	4,017
79	–20.40	19.78	–47.10	10/1/1992	12/31/2002	3,744
80	–20.92	9.11	–42.69	10/1/1992	12/31/2002	3,744
81	935.99	9,496.68	11.84	10/1/1992	9/30/2003	3,935
82	84.53	678.32	–56.25	10/1/1992	9/30/2003	4,017
83	–60.06	8.68	–85.32	10/1/1992	9/30/2003	4,017
84	–36.21	–19.03	–49.74	10/1/1992	9/30/2003	4,017
85	–9.68	23.68	–34.05	10/1/1992	9/30/2003	4,017
86	–8.53	67.45	–50.03	10/1/1992	9/30/2003	4,017
87	–85.60	–55.45	–95.34	10/1/1992	9/30/2003	4,017
88	–61.49	23.05	–87.95	10/1/1992	9/30/2003	4,017
89	–56.05	39.65	–86.17	10/1/1992	9/30/2003	4,017
90	–3.42	30.52	–28.54	10/1/1992	9/30/2003	4,017
91	–21.88	14.94	–46.91	10/1/1992	9/30/2003	4,017
92	–40.47	22.19	–71.00	10/1/1992	9/30/2003	4,016
93	–59.42	–31.58	–75.93	10/1/1992	9/30/2003	4,017
94	–61.09	–33.55	–77.21	10/1/1992	9/30/2003	4,017
95	–54.17	–35.15	–67.62	10/1/1992	9/30/2003	4,017
96	–8.24	10.67	–23.92	10/1/1992	9/30/2003	4,017
97	–17.28	140.85	–71.59	10/1/1992	9/30/2003	2,615
98	–54.76	–9.76	–77.32	10/1/1992	9/30/2003	4,017
99	–49.57	–21.70	–67.52	10/1/1992	9/30/2003	4,017
100	10.16	102.10	–39.96	10/1/1992	9/30/2003	4,017
101	–5.33	6.04	–15.49	10/1/1992	9/30/2003	4,017
102	127.28	1,477.31	–67.25	11/11/1992	9/30/2003	3,839
103	40.29	158.97	–24.00	10/1/1992	9/30/2003	4,017
104	–43.47	70.82	–81.29	10/1/1992	9/30/2003	4,017
105	–62.36	74.41	–91.88	10/1/1992	9/30/2003	4,017
106	–93.30	–80.20	–97.74	3/17/1993	9/30/2003	1,546
107	–46.40	10.26	–73.95	10/1/1992	9/30/2003	4,017
108	6.81	12.00	1.85	10/1/1992	9/30/2003	4,017
109	–71.28	–42.92	–85.55	10/1/1992	9/30/2003	4,017
110	–61.40	–44.36	–73.23	10/1/1992	9/30/2003	4,017
111	–90.02	–74.40	–96.11	10/1/1992	9/30/2003	4,017
112	–43.38	–20.12	–59.87	10/1/1992	9/30/2003	4,017
113	–89.05	–63.62	–96.71	10/1/1992	9/30/2003	4,017
114	–88.81	–61.04	–96.79	10/1/1992	9/30/2003	4,017
115	–72.43	–30.84	–89.01	10/1/1992	9/30/2003	4,017
116	–84.61	–56.94	–94.50	10/1/1992	9/30/2003	4,017
117	–67.50	–44.51	–80.97	10/1/1992	9/30/2003	4,017
118	–63.20	–43.52	–76.02	10/1/1992	9/30/2003	4,017
119	52.18	217.98	–27.17	10/1/1992	9/30/2003	4,017
120	–58.98	–36.26	–73.60	4/15/1993	9/30/2003	3,821
121	–49.76	0.41	–74.86	10/1/1992	9/30/2003	4,017
122	–68.03	–42.08	–82.35	10/1/1992	9/30/2003	4,017

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Trend, in percent from 1993 to 2003			Properties of the calibration data set		
	Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	Start date	End date	Number of observations
123	–55.02	–24.15	–73.33	10/1/1992	9/30/2003	4,017
124	–53.92	–32.31	–68.64	10/1/1992	9/30/2003	4,017
125	–48.45	–29.10	–62.52	10/1/1992	9/30/2003	4,017
126	–19.39	81.46	–64.19	10/1/1996	9/30/2003	2,257
127	189.77	832.53	–9.96	10/1/1997	9/30/2003	1,958
128	–46.90	37.19	–79.44	10/1/1992	9/30/2003	4,017
129	–14.33	116.13	–66.04	10/1/1992	9/30/2003	4,017
130	–30.06	86.76	–73.81	10/1/1992	9/30/2003	4,017
131	–10.10	62.13	–50.15	10/1/1992	9/30/2003	4,017
132	4.53	134.55	–53.41	10/1/1992	9/30/2003	4,017
133	–2.33	120.06	–56.65	10/1/1992	9/30/2003	4,017
134	–64.28	–35.45	–80.23	10/1/1992	9/30/2003	4,017
135	–48.67	–18.72	–67.59	10/1/1992	9/30/2003	4,017
136	–20.34	40.30	–54.78	9/12/1996	9/30/2003	2,574
137	–51.59	–18.07	–71.40	10/1/1992	9/30/2003	4,017
138	–50.46	–18.63	–69.83	10/1/1992	9/30/2003	4,017
139	–62.23	–33.05	–78.69	10/1/1992	9/30/2003	4,017
140	–82.32	–27.94	–95.66	10/1/1992	9/30/2003	3,866
141	–35.88	129.54	–82.09	10/1/1992	9/30/2003	4,017
142	–78.87	21.32	–96.32	10/1/1992	9/30/2003	4,017
143	–55.77	19.54	–83.64	10/1/1992	9/30/2003	4,017
144	–47.86	2.36	–73.44	10/1/1992	9/30/2003	4,017
145	–33.36	67.93	–73.55	10/1/1992	9/30/2003	4,015
146	–59.00	41.80	–88.15	10/1/1992	9/30/2003	3,643
147	–59.00	41.80	–88.15	10/1/1992	9/30/2003	3,643
148	–68.28	–12.35	–88.52	10/1/1992	9/30/2003	3,930
149	–61.89	–16.38	–82.63	10/1/1992	9/30/2003	4,017
150	–72.26	–45.80	–85.80	10/1/1992	9/30/2003	4,017
151	–16.56	64.45	–57.66	10/1/1992	9/30/2003	3,892
152	–15.66	57.59	–54.86	10/1/1992	9/30/2003	4,017
153	–33.22	–9.58	–50.67	10/1/1992	9/30/2003	4,017
154	–29.02	13.68	–55.68	10/1/1992	9/30/2003	4,017
155	–37.56	–0.96	–60.64	10/1/1992	9/30/2003	4,017
156	–34.21	–11.91	–50.86	10/1/1992	9/30/2003	4,017
157	4.35	100.34	–45.65	10/1/1992	9/30/2003	3,358
158	–9.30	114.59	–61.66	10/1/1992	9/30/2003	4,017
159	–20.75	91.41	–67.19	10/1/1992	9/30/2003	4,017
160	–8.84	155.19	–67.44	10/1/1992	9/30/2003	4,017
161	–90.37	9.92	–99.16	10/1/1992	9/30/2003	3,464
162	–17.89	596.90	–90.33	10/1/1992	9/30/2003	3,724
163	–43.85	22.10	–74.18	10/1/1992	9/30/2003	4,017
164	–98.97	–96.44	–99.70	10/1/1992	9/30/2003	3,189
165	–45.27	80.44	–83.40	10/1/1992	9/30/2003	3,963
166	–53.55	5.81	–79.61	10/1/1992	9/30/2003	4,017
167	453.02	11,365.96	–73.33	10/1/1992	9/30/2003	3,423
168	279.80	4,489.77	–68.57	10/1/1992	9/30/2003	3,890
169	455.32	3,367.86	–11.07	10/1/1992	9/30/2003	3,238
170	35.94	224.70	–43.09	10/1/1992	9/30/2003	4,017
171	12.32	211.47	–59.50	10/1/1992	9/30/2003	4,017
172	67.48	218.94	–12.06	10/1/1992	9/30/2003	4,017
173	–81.28	–29.61	–95.02	10/1/1992	9/30/2003	4,017
174	–35.18	7.93	–61.07	10/1/1992	9/30/2003	4,017
175	–55.41	–26.99	–72.77	10/1/1992	9/30/2003	4,017
176	–34.67	18.22	–63.89	10/1/1992	9/30/2003	4,017
177	–37.33	23.63	–68.23	10/1/1992	9/30/2003	4,017
178	–40.94	2.99	–66.13	10/1/1992	9/30/2003	4,017
179	–7.28	40.07	–38.62	10/1/1992	9/30/2003	4,017
180	–37.81	–17.94	–52.86	10/1/1992	9/30/2003	4,017
181	–74.85	–43.69	–88.76	10/1/1992	9/30/2003	4,017
182	–63.34	–35.27	–79.23	10/1/1992	9/30/2003	4,017
183	–66.40	–18.62	–86.13	10/1/1992	9/30/2003	4,017

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Trend, in percent from 1993 to 2003			Properties of the calibration data set		
	Modeled estimate	Upper 95-percent CI	Lower 95-percent CI	Start date	End date	Number of observations
184	–63.86	–11.16	–85.30	10/1/1992	9/30/2003	4,017
185	–54.20	–26.76	–71.36	10/1/1992	9/30/2003	4,017
186	–23.84	46.47	–60.40	10/1/1992	9/30/2003	4,017
187	–47.38	50.22	–81.57	10/1/1992	9/30/2003	3,771
188	–29.35	250.61	–85.76	10/1/1992	9/30/2003	4,017
189	–53.57	4.23	–79.32	10/1/1992	9/30/2003	4,017
190	–37.45	–9.13	–56.95	10/1/1992	9/30/2003	4,017
191	–46.37	–12.59	–67.10	10/1/1992	9/30/2003	4,017
192	84.10	242.36	–1.00	10/1/1992	9/30/2003	4,017
193	–21.32	18.71	–47.85	10/1/1992	9/30/2003	4,017
194	–36.45	60.70	–74.87	10/1/1992	9/30/2003	4,017
195	–29.28	90.85	–73.80	10/1/1992	9/30/2003	4,017
196	–37.31	121.64	–82.27	10/1/1992	9/30/2003	4,017
197	–45.98	34.05	–78.23	10/1/1992	9/30/2003	4,017
198	4.75	291.76	–71.99	10/1/1992	9/30/2003	4,017
199	–13.03	235.54	–77.46	10/1/1992	9/30/2003	4,017
200	–37.05	50.64	–73.69	10/1/1992	9/30/2003	4,017
201	108.69	1,442.99	–71.77	10/1/1992	9/30/2003	4,017
202	23.04	240.54	–55.54	10/1/1992	9/30/2003	4,017
203	5.89	51.03	–25.76	10/1/1992	9/30/2003	4,017
204	0.62	42.81	–29.11	10/1/1992	9/30/2003	4,017
205	–0.96	49.78	–34.50	10/1/1992	9/30/2003	4,017
206	–11.36	41.13	–44.32	10/1/1992	9/30/2003	4,017
207	–12.83	42.44	–46.65	10/1/1992	9/30/2003	4,017
208	–15.07	32.23	–45.45	10/1/1992	9/30/2003	4,017
209	–15.28	33.55	–46.26	10/1/1992	9/30/2003	4,017
210	–11.27	36.57	–42.35	10/1/1992	9/30/2003	4,017
211	–8.72	40.64	–40.75	10/1/1992	9/30/2003	4,017
212	0.20	35.51	–25.91	10/1/1992	9/30/2003	4,017
213	–15.02	32.63	–45.55	10/1/1992	9/30/2003	4,017
214	–15.07	32.23	–45.45	10/1/1992	9/30/2003	4,017
215	–7.19	43.70	–40.06	10/1/1992	9/30/2003	4,017
216	10.27	55.78	–21.94	10/1/1992	9/30/2003	4,017
217	–26.08	35.80	–59.77	10/1/1992	9/30/2003	4,017
218	–22.97	23.38	–51.91	10/1/1992	9/30/2003	4,017
219	–45.76	5.22	–72.04	10/1/1992	9/30/2003	4,017
220	21.56	115.88	–31.55	10/1/1992	9/30/2003	4,017
221	–2.39	81.63	–47.54	10/1/1992	9/30/2003	4,017
222	–12.79	70.84	–55.48	10/1/1992	9/30/2003	4,017
223	–20.44	33.54	–52.60	10/1/1992	9/30/2003	4,017
224	–0.64	166.07	–62.90	10/1/1992	9/30/2003	4,017
225	24.77	259.47	–56.69	10/1/1992	9/30/2003	4,017
226	–45.62	20.68	–75.50	10/1/1993	9/30/2003	3,652
227	–15.07	32.23	–45.45	10/1/1992	9/30/2003	4,017
228	–12.72	31.75	–42.18	10/1/1992	9/30/2003	4,017
229	11.40	66.53	–25.49	10/1/1992	9/30/2003	4,017
230	–4.11	60.90	–42.85	10/1/1992	9/30/2003	4,017
231	2.58	97.90	–46.83	10/1/1992	9/30/2003	4,017
232	14.16	110.47	–38.08	10/1/1992	9/30/2003	4,017
233	11.07	141.37	–48.89	10/1/1992	9/30/2003	4,017
234	–4.41	89.86	–51.88	10/1/1992	9/30/2003	4,017
235	–4.41	89.86	–51.88	10/1/1992	9/30/2003	4,017
236	–16.02	51.52	–53.46	10/1/1992	9/30/2003	4,017
237	–37.95	19.28	–67.72	10/1/1992	9/30/2003	4,017
238	–6.57	77.83	–50.91	10/1/1992	9/30/2003	4,017
239	2.06	39.37	–25.26	10/1/1992	9/30/2003	4,017
240	–45.22	40.19	–78.60	10/1/1992	9/30/2003	4,017
241	–20.65	103.40	–69.04	10/1/1992	9/30/2003	3,898
242	–21.12	184.87	–78.16	10/1/1992	9/30/2003	4,017
243	–17.66	141.06	–71.88	10/1/1992	9/30/2003	4,017
244	–5.87	65.43	–46.44	10/1/1992	9/30/2003	4,017

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Properties of the calibrated model								
	Intercept	Time coefficient	Standard error of the intercept	Standard error of the time coefficient	Degrees of freedom	Log likelihood statistic	t statistic	p-value	ARMA 6 p-value[1]
1	6.0792	–0.0204	0.0790	0.0246	3980	–366.8	–0.830	0.407	0.065
2	5.0466	–0.0250	0.0875	0.0272	3980	–129.7	–0.919	0.358	0.148
3	6.6524	–0.0035	0.0788	0.0245	3980	–847.5	–0.142	0.887	0.012
4	9.4572	–0.0097	0.0492	0.0154	3980	885.5	–0.630	0.529	0.005
5	3.0310	–0.0184	0.0512	0.0159	3980	–527.5	–1.159	0.247	0.589
6	6.2314	–0.0250	0.0631	0.0197	3980	179.9	–1.270	0.204	0.063
7	6.7466	–0.0267	0.0630	0.0196	3980	964.1	–1.362	0.173	0.157
8	4.5983	–0.0222	0.0543	0.0169	3980	–957.3	–1.318	0.188	0.100
9	4.5979	–0.0109	0.0847	0.0263	3980	–1,757.1	–0.414	0.679	0.023
10	5.1062	–0.0068	0.0609	0.0190	3980	–1,088.9	–0.358	0.720	0.519
11	7.3322	–0.0045	0.1007	0.0313	3980	–4,873.4	–0.144	0.886	0.000
12	5.8850	–0.0128	0.0664	0.0207	3980	–1,355.1	–0.619	0.536	0.294
13	2.9353	0.0147	0.1216	0.0377	3980	–1,680.7	0.391	0.696	0.504
14	3.4490	–0.0008	0.0998	0.0310	3980	–1,822.4	–0.026	0.979	0.631
15	8.1963	0.0190	0.0636	0.0199	3980	–1,573.4	0.958	0.338	0.013
16	4.0000	–0.0248	0.0680	0.0212	3980	–1,393.5	–1.170	0.242	0.007
17	2.4808	–0.0571	0.1988	0.0614	3963	–2,680.5	–0.930	0.352	0.270
18	4.6586	0.0125	0.1175	0.0364	3980	–1,653.4	0.342	0.732	0.537
19	6.1662	–0.0187	0.1621	0.0500	3980	–1,263.1	–0.374	0.708	0.322
20	4.2391	0.0040	0.0829	0.0256	3980	–2,629.9	0.155	0.877	0.412
21	2.8921	0.0148	0.0619	0.0193	3980	–4,448.5	0.768	0.443	0.191
22	3.1884	0.0089	0.0809	0.0252	3980	–4,731.3	0.355	0.722	0.491
23	2.4757	0.0037	0.0934	0.0288	3980	–2,781.9	0.130	0.897	0.227
24	2.4588	0.0027	0.1474	0.0457	3901	–4,367.3	0.059	0.953	0.598
25	5.4028	–0.0141	0.0708	0.0221	3980	–2,255.2	–0.637	0.524	0.210
26	6.3878	–0.0173	0.0816	0.0254	3980	–2,656.1	–0.680	0.497	0.415
27	3.9185	–0.0163	0.0613	0.0190	3980	–1,799.2	–0.861	0.389	0.078
28	5.1440	–0.0096	0.0569	0.0175	3980	2,873.6	–0.548	0.584	0.089
29	4.5504	–0.0245	0.0594	0.0183	3980	3,693.3	–1.339	0.181	0.001
30	4.8456	0.0011	0.0848	0.0257	3980	3,971.4	0.041	0.967	0.043
31	8.2944	0.0055	0.0641	0.0200	3980	725.0	0.277	0.782	0.386
32	4.8588	–0.0210	0.1102	0.0341	3980	91.1	–0.616	0.538	0.266
33	9.0734	0.0008	0.0721	0.0224	3980	1,382.6	0.038	0.970	0.693
34	2.8800	–0.0307	0.0449	0.0140	3980	–3,614.9	–2.183	0.029	0.139
35	3.3106	–0.0123	0.0696	0.0214	3980	–1,655.1	–0.575	0.565	0.086
36	4.4386	0.0331	0.1677	0.0510	3980	–738.6	0.648	0.517	0.188
37	10.1162	–0.0215	0.0764	0.0239	3980	–1,266.3	–0.900	0.368	0.000
38	5.6340	0.0011	0.0974	0.0299	3980	–1,699.4	0.036	0.971	0.019
39	6.0136	–0.0440	0.1159	0.0358	3980	–707.9	–1.229	0.219	0.232
40	8.8603	–0.0274	0.1566	0.0481	3980	546.6	–0.570	0.569	0.470
41	6.8985	–0.0506	0.1679	0.0515	3980	–1,605.3	–0.984	0.325	0.257
42	6.1949	–0.0576	0.1665	0.0511	3980	–427.7	–1.128	0.259	0.005
43	5.5627	–0.0704	0.2210	0.0673	3980	986.9	–1.046	0.296	0.011
44	8.4064	–0.0389	0.1135	0.0350	3980	134.0	–1.111	0.267	0.599
45	6.4041	–0.0407	0.1710	0.0527	3980	–707.9	–0.772	0.440	0.189
46	3.0232	0.0007	0.1655	0.0509	3980	–3,708.1	0.015	0.988	0.008
47	7.5623	0.0192	0.1192	0.0367	3979	3,457.8	0.522	0.602	0.451
48	6.1238	0.0385	0.1389	0.0428	3978	1,877.5	0.899	0.368	0.373
49	7.4737	–0.0060	0.1151	0.0356	3980	–1,068.5	–0.168	0.867	0.017
50	7.4621	–0.0649	0.1353	0.0409	3980	6,673.5	–1.585	0.113	0.040
51	9.1939	–0.0667	0.1044	0.0312	3980	7,230.8	–2.140	0.032	0.114
52	7.4596	–0.0471	0.0724	0.0220	2490	810.9	–2.138	0.033	0.150
53	8.2854	–0.0588	0.1197	0.0362	3980	6,418.6	–1.622	0.105	0.335
54	7.8935	–0.0833	0.1237	0.0378	3980	701.7	–2.202	0.028	0.400
55	9.0774	–0.0657	0.1441	0.0435	3980	7,595.5	–1.512	0.131	0.858
56	5.4846	–0.1039	0.2580	0.0786	3980	516.6	–1.323	0.186	0.291
57	3.4880	–0.0036	0.2071	0.0626	3980	1,711.5	–0.057	0.955	0.768
58	4.2192	–0.0488	0.2029	0.0615	3980	277.0	–0.794	0.427	0.464
59	6.1293	–0.0403	0.2268	0.0689	3980	2,133.8	–0.584	0.559	0.037
60	2.9402	–0.0271	0.0964	0.0301	3976	–2,471.2	–0.900	0.368	0.208
61	3.8240	–0.0493	0.2573	0.0779	3946	514.9	–0.634	0.526	0.019

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Properties of the calibrated model								
	Intercept	Time coefficient	Standard error of the intercept	Standard error of the time coefficient	Degrees of freedom	Log likelihood statistic	t statistic	p-value	ARMA 6 p-value[1]
62	3.1004	–0.0813	0.2488	0.0764	3889	–2,505.4	–1.064	0.287	0.011
63	4.8793	–0.0139	0.1490	0.0452	3980	1,336.8	–0.308	0.758	0.040
64	5.6355	–0.1642	0.2367	0.0721	3980	3,342.0	–2.277	0.023	0.339
65	5.6396	–0.0194	0.2592	0.0831	3737	–461.0	–0.234	0.815	0.212
66	3.3200	–0.0425	0.0811	0.0251	3980	–4,094.9	–1.695	0.090	0.171
67	8.0566	–0.0603	0.0836	0.0254	3980	–569.1	–2.372	0.018	0.000
68	8.9807	–0.0301	0.0791	0.0244	3980	–1,342.1	–1.238	0.216	0.000
69	8.4264	–0.0562	0.1001	0.0306	3980	1,809.4	–1.840	0.066	0.138
70	7.7324	–0.0107	0.0847	0.0261	3980	903.9	–0.412	0.681	0.423
71	7.2519	–0.0340	0.0645	0.0200	3980	1,724.5	–1.698	0.090	0.000
72	1.8607	–0.0592	0.1354	0.0417	3458	–4,407.2	–1.419	0.156	0.056
73	12.3350	–0.0181	0.0580	0.0181	3980	2,736.2	–1.003	0.316	0.001
74	4.3474	–0.0395	0.0489	0.0153	3980	3,362.4	–2.585	0.010	0.513
75	3.2251	–0.0541	0.1011	0.0311	3972	–1,270.1	–1.736	0.083	0.010
76	5.8022	–0.0313	0.0611	0.0191	3980	237.8	–1.643	0.100	0.056
77	2.1930	0.0420	0.0771	0.0239	3980	–1,333.5	1.759	0.079	0.011
78	3.3288	–0.0283	0.0441	0.0137	3980	–544.2	–2.056	0.040	0.364
79	1.5986	–0.0223	0.0631	0.0203	3707	–2,542.8	–1.094	0.274	0.176
80	4.6188	–0.0229	0.0499	0.0160	3707	–910.0	–1.429	0.153	0.052
81	2.4788	0.2126	0.3403	0.1033	3898	990.0	2.059	0.040	0.460
82	3.9613	0.0557	0.2189	0.0668	3980	1,140.5	0.834	0.404	0.030
83	2.8417	–0.0835	0.1500	0.0464	3980	1,739.9	–1.797	0.072	0.772
84	3.0661	–0.0409	0.0355	0.0111	3980	40.2	–3.694	0.000	0.139
85	1.1197	–0.0093	0.0466	0.0146	3980	–3,180.6	–0.635	0.525	0.344
86	0.3357	–0.0081	0.0901	0.0281	3980	–3,885.6	–0.289	0.773	0.771
87	4.3914	–0.1762	0.1685	0.0524	3980	–3,217.8	–3.363	0.001	0.027
88	4.8294	–0.0868	0.1738	0.0539	3980	–4,098.4	–1.610	0.107	0.121
89	4.9366	–0.0748	0.1740	0.0536	3980	–1,191.7	–1.394	0.163	0.153
90	4.8891	–0.0032	0.0445	0.0140	3980	–1,035.3	–0.227	0.821	0.471
91	6.2650	–0.0225	0.0573	0.0179	3980	–575.6	–1.253	0.210	0.633
92	1.6268	–0.0472	0.1070	0.0334	3979	–2,387.7	–1.414	0.158	0.065
93	9.8677	–0.0820	0.0783	0.0242	3980	4,179.1	–3.384	0.001	0.025
94	5.8984	–0.0858	0.0799	0.0248	3980	–1,541.4	–3.457	0.001	0.510
95	12.2810	–0.0710	0.0522	0.0161	3980	7,365.4	–4.404	0.000	0.153
96	4.3438	–0.0078	0.0277	0.0087	3980	1,943.7	–0.899	0.369	0.053
97	0.9736	–0.0173	0.2564	0.0496	2578	–1,007.2	–0.348	0.728	0.307
98	7.1852	–0.0721	0.1053	0.0320	3980	3,172.3	–2.252	0.024	0.092
99	9.0666	–0.0623	0.0660	0.0204	3980	4,662.9	–3.050	0.002	0.034
100	9.8307	0.0088	0.0957	0.0282	3980	6,718.5	0.312	0.755	0.010
101	6.6377	–0.0050	0.0169	0.0053	3980	5,543.6	–0.946	0.344	0.426
102	2.6235	0.0754	0.2904	0.0908	3802	1,263.7	0.831	0.406	0.364
103	3.2110	0.0308	0.0926	0.0284	3980	–1,492.5	1.082	0.279	0.028
104	3.5405	–0.0519	0.1657	0.0513	3980	–2,269.2	–1.011	0.312	0.219
105	2.9265	–0.0889	0.2327	0.0711	3980	–2,631.7	–1.249	0.212	0.576
106	1.3404	–0.2565	0.2137	0.0525	1509	–937.8	–4.888	0.000	0.011
107	6.5691	–0.0567	0.1085	0.0335	3980	1,036.1	–1.695	0.090	0.061
108	5.3912	0.0060	0.0071	0.0022	3980	8,097.7	2.718	0.007	0.710
109	4.2292	–0.1134	0.1035	0.0319	3980	–1,917.2	–3.560	0.000	0.034
110	8.8993	–0.0866	0.0546	0.0170	3980	1,857.0	–5.101	0.000	0.053
111	5.8701	–0.2096	0.1424	0.0437	3980	–1,117.1	–4.796	0.000	0.046
112	10.7954	–0.0517	0.0523	0.0160	3980	5,344.0	–3.239	0.001	0.007
113	7.2115	–0.2012	0.1814	0.0557	3980	–1,538.3	–3.610	0.000	0.406
114	6.2637	–0.1992	0.1886	0.0579	3980	–1,873.8	–3.441	0.001	0.013
115	4.3699	–0.1172	0.1376	0.0427	3980	–3,012.7	–2.746	0.006	0.466
116	8.6771	–0.1702	0.1543	0.0477	3980	–3,019.4	–3.565	0.000	0.001
117	7.1855	–0.1022	0.0798	0.0248	3980	388.3	–4.118	0.000	0.719
118	11.3697	–0.0909	0.0648	0.0199	3980	4,378.3	–4.574	0.000	0.589
119	5.5242	0.0382	0.1091	0.0342	3980	–672.5	1.117	0.264	0.114
120	3.2739	–0.0852	0.0663	0.0215	3784	–1,159.4	–3.963	0.000	0.687
121	5.8097	–0.0626	0.1033	0.0321	3980	–1,646.5	–1.948	0.051	0.006
122	8.9275	–0.1037	0.0893	0.0276	3980	–1,822.9	–3.762	0.000	0.000
123	2.7286	–0.0727	0.0777	0.0242	3980	–2,681.5	–2.996	0.003	0.407

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Properties of the calibrated model								
	Intercept	Time coefficient	Standard error of the intercept	Standard error of the time coefficient	Degrees of freedom	Log likelihood statistic	t statistic	p-value	ARMA 6 p-value[1]
124	5.8323	–0.0705	0.0574	0.0178	3980	–322.6	–3.948	0.000	0.007
125	7.7686	–0.0603	0.0476	0.0148	3980	2,198.7	–4.075	0.000	0.023
126	6.3821	–0.0308	0.1883	0.0592	2220	952.8	–0.521	0.603	0.635
127	3.7680	0.1774	0.3254	0.0994	1921	–2,057.4	1.784	0.075	0.000
128	2.5983	–0.0576	0.1463	0.0440	3980	1,271.7	–1.307	0.191	0.344
129	1.9386	–0.0141	0.1414	0.0429	3980	503.8	–0.328	0.743	0.910
130	3.8610	–0.0325	0.1510	0.0456	3980	–1,257.6	–0.714	0.476	0.024
131	4.6931	–0.0097	0.0896	0.0274	3980	–156.3	–0.354	0.723	0.039
132	4.7906	0.0040	0.1226	0.0375	3980	–1,697.4	0.108	0.914	0.004
133	4.8406	–0.0021	0.1232	0.0377	3980	–1,530.5	–0.057	0.955	0.232
134	6.1105	–0.0936	0.0884	0.0275	3980	–400.5	–3.410	0.001	0.597
135	6.0534	–0.0606	0.0685	0.0213	3980	–1,253.2	–2.844	0.004	0.332
136	2.5791	–0.0323	0.0852	0.0410	2537	–1,326.3	–0.788	0.431	0.787
137	4.2448	–0.0660	0.0787	0.0244	3980	–798.2	–2.702	0.007	0.203
138	6.4394	–0.0639	0.0740	0.0230	3980	64.5	–2.774	0.006	0.264
139	5.2092	–0.0885	0.0853	0.0266	3980	–1,408.6	–3.334	0.001	0.149
140	3.5054	–0.1575	0.2097	0.0652	3829	–3,149.4	–2.417	0.016	0.089
141	4.8674	–0.0404	0.1933	0.0592	3980	–829.7	–0.683	0.495	0.014
142	4.7854	–0.1414	0.2701	0.0811	3980	–2,243.1	–1.743	0.081	0.391
143	5.5101	–0.0742	0.1509	0.0461	3980	–2,622.3	–1.608	0.108	0.036
144	5.9694	–0.0592	0.1016	0.0313	3980	–1,215.6	–1.892	0.059	0.014
145	4.0195	–0.0369	0.1375	0.0429	3978	–3,341.8	–0.861	0.389	0.072
146	3.1806	–0.0811	0.1869	0.0576	3606	–3,493.2	–1.408	0.159	0.010
147	3.1806	–0.0811	0.1869	0.0576	3606	–3,493.2	–1.408	0.159	0.010
148	3.2008	–0.1044	0.1509	0.0472	3893	–3,637.5	–2.214	0.027	0.906
149	10.2105	–0.0877	0.1172	0.0365	3980	–3,908.5	–2.406	0.016	0.006
150	7.1617	–0.1166	0.0999	0.0311	3980	–887.3	–3.753	0.000	0.942
151	10.1738	–0.0165	0.1021	0.0315	3855	–937.7	–0.523	0.601	0.156
152	8.3662	–0.0155	0.0935	0.0290	3980	105.2	–0.534	0.593	0.027
153	13.0773	–0.0367	0.0455	0.0141	3980	9,864.2	–2.612	0.009	0.883
154	6.7007	–0.0312	0.0706	0.0219	3980	318.8	–1.426	0.154	0.110
155	5.3961	–0.0428	0.0687	0.0214	3980	–146.6	–2.001	0.045	0.147
156	12.2294	–0.0381	0.0438	0.0135	3980	6,865.2	–2.812	0.005	0.006
157	6.5903	0.0039	0.0970	0.0303	3321	–3,311.4	0.128	0.898	0.003
158	8.6258	–0.0089	0.1302	0.0400	3980	2,471.4	–0.222	0.824	0.000
159	5.9286	–0.0211	0.1335	0.0409	3980	1,858.1	–0.517	0.605	0.164
160	7.0786	–0.0084	0.1551	0.0478	3980	1,402.7	–0.176	0.860	0.383
161	2.4460	–0.2128	0.3745	0.1130	3427	–3,164.6	–1.884	0.060	0.144
162	3.2789	–0.0179	0.3229	0.0992	3687	–3,670.4	–0.181	0.857	0.173
163	8.2294	–0.0525	0.1164	0.0360	3980	1,467.3	–1.456	0.145	0.126
164	1.9644	–0.4160	0.1864	0.0575	3152	–3,082.0	–7.230	0.000	0.004
165	3.0401	–0.0548	0.1785	0.0554	3926	–3,143.7	–0.990	0.322	0.330
166	5.1708	–0.0697	0.1229	0.0382	3980	–1,679.1	–1.826	0.068	0.870
167	1.1718	0.1555	0.4672	0.1407	3386	–2,484.2	1.106	0.269	0.185
168	1.7003	0.1214	0.3803	0.1156	3853	–2,164.0	1.050	0.294	0.457
169	1.7398	0.1559	0.2779	0.0850	3201	–4,240.1	1.834	0.067	0.004
170	7.2854	0.0279	0.1315	0.0404	3980	54.3	0.691	0.490	0.193
171	7.1081	0.0106	0.1536	0.0473	3980	–1,514.8	0.223	0.823	0.010
172	5.8834	0.0469	0.0970	0.0299	3980	–1,225.5	1.569	0.117	0.287
173	5.3169	–0.1524	0.2032	0.0614	3980	2,909.7	–2.480	0.013	0.199
174	6.6923	–0.0394	0.0771	0.0237	3980	5,240.7	–1.667	0.096	0.014
175	8.4754	–0.0734	0.0747	0.0229	3980	5,920.9	–3.210	0.001	0.902
176	7.0528	–0.0387	0.0906	0.0275	3980	6,946.5	–1.407	0.160	0.242
177	7.0340	–0.0425	0.1044	0.0315	3980	6,446.9	–1.348	0.178	0.253
178	7.9704	–0.0479	0.0845	0.0258	3980	5,786.5	–1.856	0.064	0.422
179	9.4725	–0.0069	0.0642	0.0191	3980	4,658.6	–0.359	0.719	0.000
180	2.1280	–0.0432	0.0413	0.0129	3980	253.6	–3.358	0.001	0.422
181	4.6820	–0.1255	0.1221	0.0374	3980	–1,234.6	–3.356	0.001	0.557
182	5.1140	–0.0912	0.0859	0.0264	3980	–85.6	–3.460	0.001	0.020
183	5.3916	–0.0992	0.1341	0.0410	3980	266.7	–2.416	0.016	0.001
184	5.9085	–0.0926	0.1365	0.0417	3980	810.0	–2.218	0.027	0.044

Appendix 2. Model output for trends in daily mean streamflow from 1993 to 2003.—Continued

[CI, confidence interval; ARMA, autoregressive moving average]

Site number (figure 1)	Properties of the calibrated model								
	Intercept	Time coefficient	Standard error of the intercept	Standard error of the time coefficient	Degrees of freedom	Log likelihood statistic	t statistic	p-value	ARMA 6 p-value[1]
185	5.5569	–0.0710	0.0701	0.0218	3980	313.0	–3.260	0.001	0.042
186	7.8597	–0.0248	0.1000	0.0303	3980	3,521.2	–0.816	0.414	0.309
187	5.5172	–0.0584	0.1679	0.0487	3734	4,468.2	–1.200	0.230	0.005
188	6.5833	–0.0316	0.2527	0.0743	3980	246.9	–0.425	0.671	0.192
189	3.5982	–0.0698	0.1241	0.0375	3980	1,626.3	–1.860	0.063	0.705
190	4.7320	–0.0427	0.0555	0.0173	3980	3,415.1	–2.462	0.014	0.066
191	4.9306	–0.0567	0.0727	0.0227	3980	3,274.4	–2.500	0.012	0.798
192	5.1656	0.0555	0.0934	0.0288	3980	3,653.9	1.928	0.054	0.004
193	3.7705	–0.0218	0.0611	0.0191	3980	1,871.7	–1.143	0.253	0.488
194	2.5430	–0.0412	0.1416	0.0430	3980	984.2	–0.958	0.338	0.168
195	3.5008	–0.0315	0.1518	0.0461	3980	1,621.5	–0.684	0.494	0.115
196	3.7220	–0.0425	0.1945	0.0586	3980	621.0	–0.725	0.469	0.475
197	1.6544	–0.0560	0.1401	0.0422	3980	3,111.8	–1.328	0.184	0.122
198	1.0477	0.0042	0.2154	0.0612	3980	3,911.5	0.069	0.945	0.070
199	1.3650	–0.0127	0.2236	0.0626	3980	3,611.7	–0.203	0.839	0.006
200	1.8046	–0.0421	0.1346	0.0405	3980	3,252.3	–1.040	0.299	0.003
201	–1.1104	0.0669	0.3244	0.0928	3980	1,811.6	0.721	0.471	0.595
202	1.2736	0.0189	0.1678	0.0472	3980	1,652.7	0.399	0.690	0.009
203	8.0251	0.0052	0.0532	0.0165	3980	215.2	0.316	0.752	0.128
204	9.5743	0.0006	0.0528	0.0162	3980	2,315.2	0.035	0.972	0.029
205	8.8489	–0.0009	0.0620	0.0192	3980	856.4	–0.045	0.964	0.060
206	6.8042	–0.0110	0.0699	0.0216	3980	2,104.8	–0.508	0.611	0.499
207	6.3468	–0.0125	0.0735	0.0228	3980	1,506.2	–0.548	0.584	0.025
208	10.1065	–0.0149	0.0667	0.0205	3980	4,348.3	–0.723	0.470	0.212
209	9.2654	–0.0151	0.0687	0.0211	3980	4,245.1	–0.714	0.475	0.002
210	9.0744	–0.0109	0.0649	0.0200	3980	3,206.2	–0.544	0.587	0.040
211	8.1157	–0.0083	0.0647	0.0201	3980	2,807.2	–0.414	0.679	0.000
212	8.6243	0.0002	0.0466	0.0140	3980	6,263.9	0.013	0.990	0.000
213	9.7451	–0.0148	0.0671	0.0207	3980	4,217.7	–0.717	0.474	0.621
214	10.1065	–0.0149	0.0667	0.0205	3980	4,348.3	–0.723	0.470	0.212
215	12.0165	–0.0068	0.0686	0.0203	3980	3,138.3	–0.335	0.738	0.000
216	7.9014	0.0089	0.0518	0.0160	3980	659.1	0.555	0.579	0.158
217	5.6307	–0.0275	0.0906	0.0282	3980	–171.4	–0.974	0.330	0.269
218	3.8598	–0.0237	0.0707	0.0219	3980	–948.0	–1.086	0.278	0.687
219	6.7924	–0.0556	0.1010	0.0307	3980	2,684.7	–1.809	0.070	0.175
220	5.3769	0.0178	0.0850	0.0266	3980	–478.4	0.666	0.505	0.069
221	5.7531	–0.0022	0.0944	0.0288	3980	2,076.5	–0.076	0.939	0.015
222	8.2109	–0.0124	0.1021	0.0312	3980	4,097.1	–0.399	0.690	0.000
223	9.1554	–0.0208	0.0808	0.0240	3980	6,573.1	–0.866	0.387	0.149
224	6.5155	–0.0006	0.1500	0.0457	3980	4,268.2	–0.013	0.990	0.654
225	5.4657	0.0201	0.1644	0.0491	3980	1,215.1	0.410	0.682	0.066
226	1.6263	–0.0609	0.1231	0.0407	3615	–2,035.2	–1.498	0.134	0.207
227	10.1065	–0.0149	0.0667	0.0205	3980	4,348.3	–0.723	0.470	0.212
228	12.2844	–0.0124	0.0639	0.0191	3980	4,004.8	–0.647	0.517	0.000
229	6.5780	0.0098	0.0600	0.0187	3980	–676.0	0.526	0.599	0.000
230	5.5318	–0.0038	0.0781	0.0240	3980	1,165.5	–0.159	0.874	0.282
231	6.6311	0.0023	0.0994	0.0305	3980	3,306.9	0.076	0.940	0.005
232	5.5698	0.0120	0.0921	0.0284	3980	1,446.2	0.424	0.671	0.184
233	7.9252	0.0095	0.1205	0.0360	3980	4,299.4	0.265	0.791	0.686
234	7.5247	–0.0041	0.1050	0.0318	3980	3,531.8	–0.129	0.897	0.000
235	7.5247	–0.0041	0.1050	0.0318	3980	3,531.8	–0.129	0.897	0.000
236	6.6382	–0.0159	0.0900	0.0274	3980	5,662.4	–0.580	0.562	0.817
237	7.5576	–0.0434	0.0997	0.0303	3980	5,220.2	–1.431	0.152	0.309
238	8.3219	–0.0062	0.0984	0.0299	3980	5,409.7	–0.207	0.836	0.075
239	11.4358	0.0019	0.0476	0.0145	3980	5,849.6	0.128	0.898	0.105
240	4.8270	–0.0547	0.1427	0.0436	3980	1,301.4	–1.255	0.209	0.042
241	2.8587	–0.0210	0.1402	0.0437	3861	–4,392.0	–0.482	0.630	0.122
242	6.5405	–0.0216	0.1974	0.0596	3980	2,118.3	–0.362	0.717	0.003
243	8.0070	–0.0177	0.1668	0.0498	3980	6,155.2	–0.355	0.723	0.021
244	9.9586	–0.0055	0.0858	0.0262	3980	5,852.1	–0.210	0.833	0.027

[1] ARMA 6 p-value is the p-value for the joint significance of serial correlation for the lag-21 through lag-26 residuals.

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total phosphorus							
1	01122610	Shetucket River at South Windham, Conn.	0.021	24.7	61.1	154.4	2.0	0.044	2.043
2	01124000	Quinebaug River at Quinebaug, Conn.	0.036	15.4	20.4	88.0	–22.9	0.418	0.814
3	01127000	Quinebaug River at Jewett City, Conn.	0.046	87.8	81.3	168.8	22.3	0.004	2.960
4	01184000	Connecticut River at Thompsonville, Conn.	0.033	1,067.5	26.9	90.0	–15.3	0.250	1.155
5	01184490	Broad Brook at Broad Brook, Conn.	0.092	5.0	–6.5	26.3	–30.8	0.662	–0.439
7	01189995	Farmington River at Tariffville, Conn.	0.087	207.1	38.5	78.2	7.7	0.013	2.535
8	01192500	Hockanum River near East Hartford, Conn.	0.364	99.4	–19.9	0.6	–36.2	0.059	–1.909
10	01196500	Quinnipiac River at Wallingford, Conn.	0.241	99.8	–20.3	1.6	–37.6	0.071	–1.829
11	01205500	Housatonic River at Stevenson, Conn.	0.021	78.3	10.6	189.5	–57.8	0.839	0.205
12	01208500	Naugatuck River at Beacon Falls, Conn.	0.227	212.5	61.1	121.3	17.3	0.004	2.946
13	01208990	Saugatuck River near Redding, Conn.	0.012	0.5	25.2	326.5	–63.2	0.720	0.360
14	01209710	Norwalk River at Winnipauk, Conn.	0.030	2.3	44.0	94.3	6.7	0.018	2.384
15	01357500	Mohawk River at Cohoes, N.Y.	0.034	270.9	7.9	64.9	–29.4	0.727	0.350
16	01377000	Hackensack River at Rivervale, N.J.	0.065	9.7	14.8	93.3	–31.8	0.607	0.519
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.025	0.9	–54.1	67.6	–87.4	0.245	–1.178
18	01387500	Ramapo River near Mahwah, N.J.	0.120	28.9	–0.9	34.0	–26.8	0.951	–0.062
19	01389500	Passaic River at Little Falls, N.J.	0.372	467.2	8.8	32.8	–10.9	0.413	0.824
20	01391500	Saddle River at Lodi, N.J.	0.369	60.4	120.1	216.1	53.2	0.000	4.267
22	01395000	Rahway River at Rahway, N.J.	0.071	4.0	34.1	83.5	–2.0	0.074	1.832
24	01398000	Neshanic River at Reaville, N.J.	0.042	1.2	23.2	177.4	–45.3	0.616	0.503
25	01402000	Millstone River at Blackwells Mills, N.J.	0.195	113.9	25.9	66.4	–4.8	0.114	1.613
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	0.160	255.1	10.8	41.1	–13.0	0.407	0.832
27	01408000	Manasquan River at Squankum, N.J.	0.099	13.1	9.8	78.4	–32.5	0.709	0.376
28	01408500	Toms River near Toms River, N.J.	0.024	10.5	32.2	271.5	–53.0	0.599	0.530
30	01411500	Maurice River at Norma, N.J.	0.014	4.3	–14.4	217.9	–76.9	0.818	–0.232
31	01438500	Delaware River at Montague, N.J.	0.041	379.5	–45.3	52.7	–80.4	0.256	–1.152
32	01443500	Paulins Kill at Blairstown, N.J.	0.025	8.6	7.7	124.2	–48.2	0.843	0.199
33	01463500	Delaware River at Trenton, N.J.	0.057	1,193.6	–10.8	26.2	–36.9	0.521	–0.644
34	01467150	Cooper River at Haddonfield, N.J.	0.198	10.1	0.1	42.8	–29.9	0.996	0.005
35	01477120	Raccoon Creek near Swedesboro, N.J.	0.117	8.3	29.8	83.2	–8.0	0.142	1.483
36	01491000	Choptank River near Greensboro, Md.	0.045	7.1	91.1	157.7	41.6	0.000	4.240
37	01578310	Susquehanna River at Conowingo, Md.	0.021	1,396.0	78.6	134.7	35.9	0.000	4.159
38	01594440	Patuxent River near Bowie, Md.	0.116	76.5	40.7	78.9	10.6	0.006	2.785
39	01614500	Conococheague Creek at Fairview, Md.	0.114	132.9	26.3	73.4	–8.0	0.150	1.445
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	0.030	549.2	95.6	186.3	33.6	0.001	3.447
41	01668000	Rappahannock River near Fredericksburg, Va.	0.033	89.8	51.2	102.2	13.0	0.006	2.785
42	01673000	Pamunkey River near Hanover, Va.	0.066	98.5	80.4	112.0	53.5	0.000	7.165
43	01674500	Mattaponi River near Beulahville, Va.	0.059	46.9	0.3	14.1	–11.9	0.968	0.040
44	02035000	James River at Cartersville, Va.	0.100	1,282.6	–2.9	20.1	–21.5	0.789	–0.268
45	02041650	Appomattox River at Matoaca, Va.	0.047	75.7	–6.7	8.3	–19.6	0.362	–0.912
46	02085000	Eno River at Hillsborough, N.C.	0.025	1.2	42.2	134.8	–13.9	0.173	1.376
51	02198500	Savannah River near Clyo, Ga.	0.093	3,076.5	14.3	47.9	–11.7	0.311	1.017
52	02213700	Ocmulgee River near Warner Robins, Ga.	0.177	765.1	–47.9	–27.8	–62.4	0.000	–3.922
53	02215500	Ocmulgee River at Lumber City, Ga.	0.117	1,473.5	–34.9	–16.0	–49.5	0.001	–3.304
54	02223600	Oconee River at Interstate 16, near Dublin, Ga.	0.135	1,321.5	–26.4	–7.4	–41.5	0.010	–2.620
55	02226010	Altamaha River near Gardi, Ga.	0.106	3,075.5	–17.0	–2.1	–29.7	0.029	–2.214
56	02226582	Satilla River at GA 15&121, near Hoboken, Ga.	0.140	129.0	19.4	49.2	–4.4	0.121	1.564
58	02295420	Payne Creek near Bowling Green, Fla.	0.620	122.8	37.6	69.2	11.8	0.004	3.020
59	02296750	Peace River at Arcadia, Fla.	0.940	1,179.6	–6.0	10.9	–20.3	0.464	–0.736
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.227	11.9	14.4	34.3	–2.6	0.104	1.641
61	02301300	South Prong Alafia River near Lithia, Fla.	0.954	127.3	–36.0	–13.8	–52.5	0.005	–2.942
62	02302500	Blackwater Creek near Knights, Fla.	0.807	66.1	–36.5	–19.2	–50.0	0.000	–3.700

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total phosphorus—Continued							
63	02303000	Hillsborough River near Zephyrhills, Fla.	0.323	102.8	–44.5	–23.9	–59.5	0.001	–3.653
64	02314500	Suwannee River at U.S. 441, at Fargo, Ga.	0.066	97.3	–73.9	–61.7	–82.2	0.000	–6.866
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.150	107.9	21.1	45.6	0.7	0.044	2.031
66	02335870	Sope Creek near Marietta, Ga.	0.017	1.3	–2.9	64.3	–42.6	0.913	–0.109
68	02344040	Chattahoochee River near Steam Mill, Ga.	0.085	1,917.0	–55.7	–31.6	–71.3	0.000	–3.671
69	02353000	Flint River at Newton, Ga.	0.049	714.8	–9.9	20.6	–32.7	0.487	–0.700
70	02388520	Oostanaula River at Rome, Ga.	0.217	1,266.1	–55.8	–42.8	–65.8	0.000	–6.222
71	02492000	Bogue Chitto River near Bush, La.	0.070	286.0	49.2	99.8	11.4	0.009	2.684
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.024	0.6	29.8	87.3	–10.0	0.165	1.395
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	0.082	49,089.7	82.2	124.0	48.1	0.000	5.680
74	04063700	Popple River near Fence, Wis.	0.027	6.1	–18.3	40.3	–52.5	0.465	–0.733
75	04073468	Green Lake Inlet at County Highway A near Green Lake, Wis.	0.134	11.0	–24.4	–15.7	–32.3	0.000	–5.016
76	04087000	Milwaukee River at Milwaukee, Wis.	0.083	77.8	26.9	54.9	3.9	0.021	2.337
77	0422026250	Northrup Creek at North Greece, N.Y.	0.402	7.2	–35.5	–23.3	–45.7	0.000	–4.985
78	04232034	Irondequoit Creek at Railroad Mills near Fishers, N.Y.	0.070	5.4	–19.9	5.2	–39.0	0.111	–1.596
79	0423204920	East Branch Allen Creek at Pittsford, N.Y.	0.090	1.2	–15.5	0.1	–28.6	0.052	–1.951
80	0423205025	Irondequoit Creek at Empire Boulevard at Rochester, N.Y.	0.068	18.0	52.6	68.6	38.1	0.000	8.317
81	05114000	Souris River near Sherwood, N. Dak.	0.424	5.5	–35.8	–8.0	–55.1	0.018	–2.418
82	05120000	Souris River near Verendrye, N. Dak.	0.264	28.1	–15.2	18.7	–39.4	0.341	–0.960
83	05287890	Elm Creek near Champlin, Minn.	0.139	8.7	42.0	77.2	13.7	0.002	3.099
84	05427718	Yahara River at Windsor, Wis.	0.149	9.7	8.2	28.2	–8.7	0.364	0.908
85	05427948	Pheasant Branch at Middleton, Wis.	0.390	3.1	–62.6	–56.2	–68.1	0.000	–12.242
86	054310157	Jackson Creek Tributary near Elkhorn, Wis.	0.129	0.5	–12.2	9.2	–29.4	0.242	–1.172
87	05500000	South Fabius River near Taylor, Mo.	0.102	45.1	63.7	134.3	14.4	0.008	2.694
88	05514500	Cuivre River near Troy, Mo.	0.136	60.8	15.7	77.9	–24.7	0.508	0.666
89	05525500	Sugar Creek at Milford, Ill.	0.060	26.4	66.0	165.1	4.0	0.037	2.123
90	05531500	Salt Creek at Western Springs, Ill.	1.019	338.8	46.2	81.8	17.6	0.001	3.423
91	05532500	Des Plaines River at Riverside, Ill.	0.517	749.7	62.0	96.6	33.4	0.000	4.874
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.079	1.2	–11.5	26.8	–38.2	0.508	–0.664
93	05586100	Illinois River at Valley City, Ill.	0.264	18,788.7	110.3	172.5	62.3	0.000	5.624
94	07018100	Big River near Richwoods, Mo.	0.032	43.6	2.0	64.7	–36.8	0.936	0.081
95	07022000	Mississippi River at Thebes, Ill.	0.230	176,092.9	102.1	159.4	57.4	0.000	5.524
97	06178000	Poplar River at International Boundary, Mont.	0.029	0.3	–17.5	53.8	–55.7	0.548	–0.606
99	06329500	Yellowstone River near Sidney, Mont.	0.075	2,177.1	60.8	229.4	–21.5	0.197	1.297
101	06461500	Niobrara River near Sparks, Nebr.	0.121	232.7	38.8	85.8	3.7	0.031	2.206
106	06753990	Lonetree Creek near Greeley, Colo.	0.325	11.3	–16.9	89.5	–63.5	0.662	–0.439
107	06754000	South Platte River near Kersey, Colo.	0.636	1,454.4	26.7	49.0	7.6	0.005	2.848
109	06800000	Maple Creek near Nickerson, Nebr.	0.207	61.0	290.4	473.1	165.9	0.000	6.952
110	06805500	Platte River at Louisville, Nebr.	0.313	8,767.3	188.4	294.6	110.7	0.000	6.616
111	06817700	Nodaway River near Graham, Mo.	0.327	806.1	102.5	250.2	17.1	0.013	2.525
112	06818000	Missouri River at St. Joseph, Mo.	0.216	33,847.8	68.3	146.9	14.7	0.009	2.661
113	06902000	Grand River near Sumner, Mo.	0.202	1,754.8	193.7	383.1	78.5	0.000	4.243
114	06905500	Chariton River near Prairie Hill, Mo.	0.207	663.6	36.4	129.6	–19.0	0.246	1.169
115	06921070	Pomme De Terre River near Polk, Mo.	0.047	16.3	9.3	64.4	–27.3	0.669	0.429
118	06934500	Missouri River at Hermann, Mo.	0.187	63,637.4	233.3	422.7	112.5	0.000	5.241
120	07053250	Yocum Creek near Oak Grove, Ark.	0.039	3.7	47.9	90.4	14.9	0.003	3.037
134	07189000	Elk River near Tiff City, Mo.	0.041	73.3	231.1	374.1	131.2	0.000	6.534
135	07195500	Illinois River near Watts, Okla.	0.112	160.9	117.4	211.0	51.9	0.000	4.249
136	07195865	Sager Creek near West Siloam Springs, Okla.	0.495	17.7	66.3	158.7	6.8	0.029	2.252
137	07196000	Flint Creek near Kansas, Okla.	0.092	22.1	111.2	160.4	71.3	0.000	7.000

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total phosphorus—Continued							
138	07196500	Illinois River near Tahlequah, Okla.	0.063	133.8	135.6	190.3	91.1	0.000	8.032
139	07197000	Baron Fork at Eldon, Okla.	0.028	19.5	67.4	140.2	16.6	0.006	2.793
145	07247015	Poteau River at Loving, Okla.	0.106	17.2	–9.5	34.3	–39.0	0.622	–0.495
148	07247650	Fourche Maline near Leflore, Okla.	0.051	5.7	17.9	60.0	–13.1	0.293	1.060
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.081	8,280.0	78.7	121.7	43.9	0.000	5.262
150	07331000	Washita River near Dickson, Okla.	0.201	1,137.5	140.7	277.7	53.4	0.000	3.822
151	07355500	Red River at Alexandria, La.	0.095	6,494.3	–25.1	–5.4	–40.6	0.017	–2.425
152	07362000	Ouachita River at Camden, Ark.	0.041	464.8	–26.6	27.8	–57.9	0.279	–1.093
153	07373420	Mississippi River near St Francisville, La.	0.175	247,836.4	50.4	87.9	20.3	0.000	3.586
154	07375500	Tangipahoa River at Robert, La.	0.112	258.7	16.0	56.6	–14.1	0.335	0.968
155	07376000	Tickfaw River at Holden, La.	0.074	49.4	57.1	117.3	13.6	0.008	2.731
156	07381495	Atchafalaya River at Melville, La.	0.146	89,521.1	71.8	105.6	43.6	0.000	5.907
157	07386980	Vermilion River at Perry, La.	0.297	565.1	1.2	26.0	–18.8	0.918	0.103
165	08143600	Pecan Bayou near Mullin, Tex.	0.205	13.5	–0.0	88.4	–47.0	0.999	–0.001
166	08147000	Colorado River near San Saba, Tex.	0.077	45.6	–68.0	8.1	–90.5	0.072	–1.835
169	08159000	Onion Creek at U.S. Highway 183, Austin, Tex.	0.076	0.7	–93.9	–71.3	–98.7	0.001	–3.540
170	08162000	Colorado River at Wharton, Tex.	0.269	826.8	–5.9	47.1	–39.8	0.791	–0.266
171	08162500	Colorado River near Bay City, Tex.	0.291	803.2	–26.1	26.3	–56.7	0.274	–1.105
173	08251500	Rio Grande near Lobatos, Colo.	0.079	86.6	52.9	96.9	18.6	0.002	3.282
177	09217010	Green River below Green River, Wyo.	0.026	90.0	51.1	186.1	–20.2	0.210	1.266
178	09261000	Green River at Dinosaur National Monument Utah 149 Crossing, Utah	0.062	571.6	–34.8	55.5	–72.6	0.338	–0.964
180	09403600	Kanab Creek at U.S. 89 Crossing, Utah	0.035	0.9	232.7	656.8	46.2	0.005	2.866
182	09415000	Virgin River at Littlefield, Ariz.	0.106	68.0	463.4	1,200.6	144.0	0.000	4.050
183	09448500	Gila River at Head of Safford Valley, near Solomon, Ariz.	0.122	103.9	216.0	730.0	20.3	0.024	2.335
184	09498500	Salt River near Roosevelt, Ariz.	0.013	16.9	4,678.5	14,832.1	1,428.8	0.000	6.651
185	09508500	Verde River below Tangle Creek, above Horseshoe Dam, Ariz.	0.023	20.6	166.7	493.8	19.8	0.019	2.402
186	09522000	Colorado River at Northerly International Boundary, above Morelos Dam, Ariz.	0.280	1,985.5	–85.9	–65.2	–94.3	0.000	–4.253
188	10126000	Bear River near Corinne at Utah 83 Crossing, Utah	0.188	411.5	–50.7	–29.9	–65.3	0.000	–3.940
193	10189000	East Fork Sevier River at Utah 62 Crossing East of Kingston, Utah	0.085	10.1	–3.4	37.7	–32.2	0.849	–0.191
203	01A050	Nooksack River at Brennan, Wash.	0.021	152.5	37.9	104.2	–6.9	0.112	1.601
204	03A060	Skagit River near Mount Vernon, Wash.	0.015	517.6	5.5	112.6	–47.6	0.880	0.151
205	07A090	Snohomish River at Snohomish, Wash.	0.009	152.9	26.3	123.2	–28.5	0.423	0.804
206	09A080	Green River at Tukwila, Wash.	0.025	58.5	19.2	59.3	–10.8	0.238	1.187
207	09A190	Green River at Kanaskat, Wash.	0.005	7.4	254.0	606.4	77.4	0.000	3.586
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.070	4,604.1	–7.6	9.1	–21.7	0.355	–0.934
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.075	2,126.5	–18.8	–3.0	–32.1	0.023	–2.301
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.046	1,037.8	–2.6	18.5	–20.0	0.790	–0.267
211	10386	Middle Fork Willamette at Jasper Bridge, Oreg.	0.028	238.6	–13.8	3.5	–28.1	0.117	–1.592
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.080	1,096.0	–8.9	29.5	–35.9	0.606	–0.519
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.064	2,912.6	–18.6	–4.1	–30.9	0.015	–2.459
214	10611	Willamette River at Hawthorne Bridge, Oreg.	0.082	5,385.0	–22.9	–13.6	–31.2	0.000	–4.480
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.040	16,869.6	–21.9	–1.9	–37.9	0.039	–2.121
216	10A070	Puyallup River at Meridian Street, Wash.	0.036	228.7	79.6	176.1	16.8	0.009	2.667
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.081	63.9	–21.7	–2.0	–37.4	0.037	–2.140

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total phosphorus—Continued							
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	0.090	12.0	–7.8	11.1	–23.6	0.397	–0.854
219	11478	John Day River at Service Creek, Oreg.	0.041	118.8	–19.2	10.5	–40.9	0.187	–1.335
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	0.104	51.7	–36.8	–13.8	–53.7	0.005	–2.900
221	12413470	South Fork Coeur D›Alene River near Pinehurst, Idaho	0.011	8.6	93.0	235.6	11.0	0.022	2.329
222	12419000	Spokane River near Post Falls, Idaho	0.011	107.9	–37.3	87.4	–79.0	0.405	–0.836
223	13154500	Snake River at King Hill, Idaho	0.068	1,759.9	–13.2	7.2	–29.8	0.191	–1.315
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.083	141.8	36.3	98.7	–6.4	0.110	1.614
225	13351000	Palouse River at Hooper, Wash.	0.195	101.6	–54.4	–37.0	–67.0	0.000	–4.761
227	14211720	Willamette River at Portland, Oreg.	0.061	3,996.4	13.5	37.0	–6.1	0.192	1.311
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.031	17,761.9	14.8	75.2	–24.8	0.523	0.641
229	16A070	Skokomish River near Potlatch, Wash.	0.009	15.9	104.8	265.9	14.6	0.017	2.422
230	32A070	Walla Walla River near Touchet, Wash.	0.112	71.2	–4.2	21.3	–24.3	0.724	–0.354
231	3701002	Tualatin River at Weiss Bridge, Oreg.	0.175	319.9	–32.0	–24.2	–39.1	0.000	–6.917
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.039	23.3	–41.9	–29.4	–52.2	0.000	–5.456
233	37A090	Yakima River at Kiona, Wash.	0.102	645.6	3.1	23.1	–13.7	0.740	0.332
234	45A070	Wenatchee River at Wenatchee, Wash.	0.004	17.7	53.4	274.4	–37.2	0.349	0.940
235	45A110	Wenatchee River near Leavenworth, Wash.	0.004	20.5	13.5	154.5	–49.4	0.759	0.307
236	48A070	Methow River near Pateros, Wash.	0.003	6.3	99.5	292.6	1.3	0.048	1.998
237	49A070	Okanogan River at Malott, Wash.	0.017	98.8	16.2	111.7	–36.3	0.626	0.489
238	54A120	Spokane River at Riverside State Park, Wash.	0.019	195.0	39.9	123.2	–12.4	0.162	1.407
239	61A070	Columbia River at Northport, Wash.	0.011	2,516.8	–33.5	24.5	–64.5	0.205	–1.274
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	0.183	9.5	16.2	55.8	–13.4	0.319	0.999
242	11290000	Tuolumne River at Modesto, Calif.	0.074	146.6	–4.9	26.0	–28.3	0.726	–0.350
243	11303500	San Joaquin River near Vernalis, Calif.	0.274	2,217.1	–3.2	11.8	–16.2	0.660	–0.441
244	11447650	Sacramento River at Freeport, Calif.	0.039	2,100.3	59.6	121.8	14.9	0.006	2.786
		Total nitrogen							
1	01122610	Shetucket River at South Windham, Conn.	0.603	713.2	6.2	31.2	–14.1	0.581	0.553
2	01124000	Quinebaug River at Quinebaug, Conn.	0.530	228.7	34.8	60.2	13.4	0.001	3.381
3	01127000	Quinebaug River at Jewett City, Conn.	0.913	1,755.0	–4.3	12.3	–18.4	0.590	–0.540
4	01184000	Connecticut River at Thompsonville, Conn.	0.624	20,452.8	2.6	21.1	–13.1	0.766	0.298
5	01184490	Broad Brook at Broad Brook, Conn.	4.259	233.2	–2.2	5.9	–9.7	0.585	–0.549
6	01188090	Farmington River at Unionville, Conn.	0.270	377.6	37.6	103.3	–6.9	0.115	1.603
7	01189995	Farmington River at Tariffville, Conn.	1.018	2,412.9	10.4	29.7	–5.9	0.229	1.213
8	01192500	Hockanum River near East Hartford, Conn.	3.480	947.7	–4.5	10.2	–17.3	0.526	–0.636
9	01193500	Salmon River near East Hampton, Conn.	0.436	111.0	16.4	58.7	–14.6	0.341	0.962
10	01196500	Quinnipiac River at Wallingford, Conn.	3.208	1,328.9	–4.2	7.4	–14.5	0.462	–0.739
11	01205500	Housatonic River at Stevenson, Conn.	0.661	2,492.3	12.1	41.3	–11.0	0.338	0.968
12	01208500	Naugatuck River at Beacon Falls, Conn.	2.492	2,334.6	–52.9	–43.6	–60.7	0.000	–8.145
13	01208990	Saugatuck River near Redding, Conn.	0.307	12.6	40.1	106.2	–4.8	0.094	1.708
14	01209710	Norwalk River at Winnipauk, Conn.	0.642	48.4	24.3	46.3	5.7	0.009	2.623
15	01357500	Mohawk River at Cohoes, N.Y.	1.048	8,255.2	–10.1	1.1	–20.1	0.078	–1.775
16	01377000	Hackensack River at Rivervale, N.J.	1.032	153.1	10.4	37.0	–11.0	0.372	0.902
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.500	18.3	23.2	73.4	–12.5	0.239	1.195
18	01387500	Ramapo River near Mahwah, N.J.	1.537	371.2	0.4	20.9	–16.6	0.965	0.044
19	01389500	Passaic River at Little Falls, N.J.	3.357	4,200.5	–19.1	–4.7	–31.3	0.013	–2.543
20	01391500	Saddle River at Lodi, N.J.	5.794	953.1	26.4	56.6	2.1	0.037	2.151
21	01394500	Rahway River near Springfield, N.J.	1.727	70.7	–0.3	23.4	–19.5	0.978	–0.028
22	01395000	Rahway River at Rahway, N.J.	1.407	79.3	–0.1	25.0	–20.2	0.993	–0.009

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total nitrogen—Continued							
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	1.090	30.5	–13.5	7.2	–30.2	0.193	–1.322
24	01398000	Neshanic River at Reaville, N.J.	1.753	50.7	–14.9	26.0	–42.5	0.423	–0.806
25	01402000	Millstone River at Blackwells Mills, N.J.	2.902	1,709.8	8.1	34.4	–13.1	0.490	0.697
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	2.316	3,680.5	11.0	26.6	–2.7	0.125	1.548
29	01409500	Batsto River at Batsto, N.J.	0.386	99.8	–10.3	23.9	–35.1	0.513	–0.660
31	01438500	Delaware River at Montague, N.J.	0.487	4,559.0	–23.2	–1.2	–40.3	0.046	–2.056
32	01443500	Paulins Kill at Blairstown, N.J.	0.958	325.7	7.7	36.1	–14.8	0.540	0.617
33	01463500	Delaware River at Trenton, N.J.	1.277	26,572.9	–18.3	–3.7	–30.6	0.018	–2.412
34	01467150	Cooper River at Haddonfield, N.J.	0.921	47.0	5.1	29.4	–14.7	0.644	0.464
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.658	117.8	6.9	30.0	–12.1	0.507	0.667
36	01491000	Choptank River near Greensboro, Md.	1.457	237.3	23.5	36.6	11.7	0.000	4.114
37	01578310	Susquehanna River at Conowingo, Md.	1.526	100,777.9	–8.5	0.6	–16.8	0.067	–1.839
38	01594440	Patuxent River near Bowie, Md.	2.078	1,380.1	0.6	9.1	–7.2	0.883	0.147
39	01614500	Conococheague Creek at Fairview, Md.	5.429	6,336.5	1.3	10.4	–7.0	0.763	0.302
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	2.010	37,023.5	–12.0	1.2	–23.5	0.075	–1.793
41	01668000	Rappahannock River near Fredericksburg, Va.	0.577	1,618.4	44.3	69.3	23.0	0.000	4.505
42	01673000	Pamunkey River near Hanover, Va.	0.653	968.7	31.9	45.5	19.5	0.000	5.500
43	01674500	Mattaponi River near Beulahville, Va.	0.623	501.5	16.2	26.3	7.0	0.000	3.548
44	02035000	James River at Cartersville, Va.	0.478	6,074.1	21.5	38.4	6.7	0.004	2.938
45	02041650	Appomattox River at Matoaca, Va.	0.587	961.9	14.1	24.6	4.5	0.004	2.932
46	02085000	Eno River at Hillsborough, N.C.	0.664	30.8	17.9	40.0	–0.7	0.064	1.882
47	02089500	Neuse River at Kinston, N.C.	1.493	6,248.6	–36.1	–26.9	–44.2	0.000	–6.511
48	02091500	Contentnea Creek at Hookerton, N.C.	1.242	1,095.9	–11.1	–2.9	–18.5	0.010	–2.630
49	0210215985	Cape Fear River at State Highway 42 near Brickhaven, N.C.	1.363	5,800.4	1.2	37.4	–25.4	0.939	0.077
52	02213700	Ocmulgee River near Warner Robins, Ga.	1.350	5,825.2	–5.5	27.2	–29.8	0.710	–0.374
53	02215500	Ocmulgee River at Lumber City, Ga.	0.965	12,295.7	–16.4	1.1	–30.8	0.068	–1.844
57	02271500	Josephine Creek near De Soto City, Fla.	0.889	66.0	36.4	61.5	15.1	0.001	3.589
58	02295420	Payne Creek near Bowling Green, Fla.	1.696	343.5	–10.3	15.3	–30.2	0.401	–0.847
59	02296750	Peace River at Arcadia, Fla.	1.780	2,210.8	–2.1	13.1	–15.3	0.771	–0.293
60	02300700	Bullfrog Creek near Wimauma, Fla.	0.782	41.0	22.1	49.5	–0.3	0.056	1.931
61	02301300	South Prong Alafia River near Lithia, Fla.	1.056	146.0	2.6	29.7	–18.9	0.832	0.213
62	02302500	Blackwater Creek near Knights, Fla.	1.693	139.6	–16.5	6.5	–34.6	0.152	–1.454
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	1.005	703.5	36.0	57.5	17.4	0.000	4.091
67	02338000	Chattahoochee River near Whitesburg, Ga.	1.386	13,838.9	11.8	37.7	–9.2	0.297	1.048
71	02492000	Bogue Chitto River near Bush, La.	0.819	3,334.4	16.5	103.3	–33.2	0.592	0.538
72	03353637	Little Buck Creek near Indianapolis, Ind.	1.079	27.7	–2.8	15.9	–18.6	0.749	–0.320
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.344	812,588.8	20.4	44.1	0.7	0.044	2.032
74	04063700	Popple River near Fence, Wis.	0.453	104.0	26.3	47.2	8.4	0.003	2.998
76	04087000	Milwaukee River at Milwaukee, Wis.	1.724	1,621.8	31.9	48.4	17.2	0.000	4.597
81	05114000	Souris River near Sherwood, N. Dak.	2.076	26.3	–18.0	10.9	–39.4	0.201	–1.291
82	05120000	Souris River near Verendrye, N. Dak.	1.507	159.0	0.6	39.0	–27.2	0.970	0.037
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	1.615	25.2	–32.2	–12.4	–47.5	0.004	–2.972
95	07022000	Mississippi River at Thebes, Ill.	3.227	2,473,864.5	13.7	36.7	–5.5	0.176	1.362
97	06178000	Poplar River at International Boundary, Mont.	0.613	5.7	7.6	44.1	–19.6	0.625	0.492
99	06329500	Yellowstone River near Sidney, Mont.	0.606	17,700.9	51.2	114.0	6.8	0.022	2.331
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.193	8,511.6	39.8	131.3	–15.5	0.197	1.304
101	06461500	Niobrara River near Sparks, Nebr.	0.441	848.9	67.8	138.6	18.0	0.005	2.884
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	1.518	43.5	5.4	36.7	–18.7	0.692	0.398
103	06713500	Cherry Creek at Denver, Colo.	3.828	203.1	–44.3	–30.7	–55.3	0.000	–5.243
106	06753990	Lonetree Creek near Greeley, Colo.	9.761	347.6	–42.3	–22.1	–57.3	0.001	–3.595

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total nitrogen—Continued							
107	06754000	South Platte River near Kersey, Colo.	6.215	14,303.8	7.6	16.6	–0.6	0.074	1.802
108	06775900	Dismal River near Thedford, Nebr.	0.717	373.4	–5.5	10.1	–18.8	0.473	–0.722
109	06800000	Maple Creek near Nickerson, Nebr.	6.015	1,789.4	34.2	71.4	5.0	0.020	2.354
110	06805500	Platte River at Louisville, Nebr.	2.642	74,129.1	60.2	105.0	25.2	0.000	3.748
111	06817700	Nodaway River near Graham, Mo.	5.273	13,102.7	–4.4	48.8	–38.6	0.841	–0.201
112	06818000	Missouri River at St. Joseph, Mo.	3.257	512,446.0	–43.7	–27.5	–56.2	0.000	–4.460
113	06902000	Grand River near Sumner, Mo.	1.723	15,003.1	21.4	83.2	–19.6	0.358	0.923
114	06905500	Chariton River near Prairie Hill, Mo.	1.607	5,279.4	–17.0	24.5	–44.7	0.369	–0.902
115	06921070	Pomme De Terre River near Polk, Mo.	0.544	188.8	36.1	116.2	–14.4	0.196	1.303
116	06926510	Osage River below St. Thomas, Mo.	0.752	25,153.3	–7.3	24.9	–31.2	0.620	–0.499
118	06934500	Missouri River at Hermann, Mo.	2.025	690,237.8	22.5	58.4	–5.2	0.124	1.550
120	07053250	Yocum Creek near Oak Grove, Ark.	2.529	239.0	89.9	138.3	51.3	0.000	5.530
124	07066110	Jacks Fork above Two River, Mo.	0.448	539.4	6.6	31.5	–13.5	0.549	0.602
125	07068000	Current River at Doniphan, Mo.	0.426	3,386.9	–20.8	–3.9	–34.7	0.020	–2.362
134	07189000	Elk River near Tiff City, Mo.	1.721	3,076.2	36.6	63.2	14.3	0.001	3.429
135	07195500	Illinois River near Watts, Okla.	2.523	3,615.6	5.8	32.4	–15.4	0.621	0.496
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.666	236.8	11.3	46.3	–15.4	0.448	0.765
137	07196000	Flint Creek near Kansas, Okla.	1.882	452.7	63.1	83.2	45.1	0.000	8.236
138	07196500	Illinois River near Tahlequah, Okla.	1.723	3,678.5	20.5	41.2	2.8	0.023	2.301
139	07197000	Baron Fork at Eldon, Okla.	1.033	727.1	40.7	83.1	8.2	0.012	2.545
145	07247015	Poteau River at Loving, Okla.	0.439	70.8	16.8	53.8	–11.3	0.271	1.109
146	07247250	Black Fork below Big Creek near Page, Okla.	0.315	43.7	–5.0	41.4	–36.1	0.802	–0.251
147	07247345	Black Fork at Hodgen, Okla.	0.322	44.5	5.9	49.0	–24.7	0.744	0.328
148	07247650	Fourche Maline near Leflore, Okla.	0.610	69.4	9.4	36.6	–12.4	0.430	0.794
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.842	86,502.2	8.5	29.9	–9.3	0.373	0.895
150	07331000	Washita River near Dickson, Okla.	0.988	5,642.1	72.5	124.8	32.3	0.000	4.030
151	07355500	Red River at Alexandria, La.	0.715	49,016.7	7.7	23.5	–6.1	0.292	1.059
152	07362000	Ouachita River at Camden, Ark.	0.312	3,570.6	52.9	127.0	2.9	0.040	2.103
153	07373420	Mississippi River near St Francisville, La.	2.096	2,958,811.0	–5.0	11.7	–19.2	0.534	–0.623
154	07375500	Tangipahoa River at Robert, La.	0.909	2,098.0	–10.2	15.4	–30.1	0.402	–0.841
155	07376000	Tickfaw River at Holden, La.	0.873	582.4	–3.0	26.3	–25.5	0.820	–0.229
156	07381495	Atchafalaya River at Melville, La.	1.776	1,071,142.5	–5.6	8.6	–17.9	0.424	–0.802
157	07386980	Vermilion River at Perry, La.	1.888	3,615.4	–16.8	1.3	–31.7	0.070	–1.834
173	08251500	Rio Grande near Lobatos, Colo.	0.440	489.8	14.3	46.8	–11.0	0.298	1.047
176	09211200	Green River below Fontenelle Reservoir, Wyo.	0.230	797.3	28.9	76.9	–6.1	0.119	1.573
179	09380000	Colorado River at Lees Ferry, Ariz.	0.368	12,388.6	5.6	40.6	–20.8	0.713	0.369
182	09415000	Virgin River at Littlefield, Ariz.	0.841	547.7	194.4	382.6	79.6	0.000	4.281
196	10336610	Upper Truckee River at South Lake Tahoe, Calif.	0.210	25.4	8.0	30.0	–10.3	0.418	0.812
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.304	3.1	–4.8	23.6	–26.7	0.713	–0.369
201	10336740	Logan House Creek near Glenbrook, Nev.	0.313	0.2	–21.3	–1.5	–37.2	0.038	–2.088
202	10336760	Edgewood Creek at Stateline, Nev.	0.328	2.7	–34.6	–20.9	–46.0	0.000	–4.381
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.967	63,781.1	–22.0	6.0	–42.6	0.118	–1.590
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.791	22,459.5	–50.0	–35.8	–61.0	0.000	–5.436
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.430	9,822.5	–49.5	–33.9	–61.3	0.000	–4.988
212	10411	Deschutes River at Deschutes River Park, Oreg.	0.316	4,325.5	–24.4	1.1	–43.5	0.064	–1.885
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.912	41,756.6	–51.9	–41.3	–60.6	0.000	–7.192
214	10611	Willamette River at Hawthorne Bridge, Oreg.	1.171	77,155.4	–39.1	–24.9	–50.5	0.000	–4.647
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.459	193,915.3	–28.4	6.0	–51.6	0.101	–1.670

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Total nitrogen—Continued							
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	1.009	800.3	–45.0	–27.8	–58.1	0.000	–4.302
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.554	613.9	–30.4	–23.5	–36.6	0.000	–7.535
219	11478	John Day River at Service Creek, Oreg.	0.293	865.5	–36.8	–9.1	–56.1	0.016	–2.471
220	11489	Umatilla River at Westland Road at Hermiston, Oreg.	2.665	1,344.9	–38.5	–18.8	–53.4	0.001	–3.431
221	12413470	South Fork Coeur D›Alene River near Pinehurst, Idaho	0.230	183.1	16.7	53.7	–11.4	0.276	1.096
222	12419000	Spokane River near Post Falls, Idaho	0.138	1,320.8	14.0	61.6	–19.5	0.462	0.739
223	13154500	Snake River at King Hill, Idaho	1.480	38,562.4	–5.4	4.1	–14.1	0.259	–1.134
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.565	951.1	22.7	47.5	2.1	0.032	2.178
225	13351000	Palouse River at Hooper, Wash.	1.724	903.2	2.3	21.9	–14.2	0.800	0.254
227	14211720	Willamette River at Portland, Oreg.	0.781	51,090.1	–2.4	14.3	–16.7	0.760	–0.305
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.473	269,349.9	–7.2	10.6	–22.1	0.406	–0.835
231	3701002	Tualatin River at Weiss Bridge, Oreg.	2.701	4,963.9	6.4	13.5	–0.3	0.064	1.859
232	37016120	Tualatin River at Springhill Road Bridge at Dilley, Oreg.	0.553	328.8	–33.8	–24.1	–42.2	0.000	–5.946
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.839	148.3	2.5	31.7	–20.3	0.849	0.190
242	11290000	Tuolumne River at Modesto, Calif.	0.378	784.8	128.5	170.8	92.8	0.000	9.533
243	11303500	San Joaquin River near Vernalis, Calif.	2.012	16,922.7	1.9	13.5	–8.6	0.737	0.336
244	11447650	Sacramento River at Freeport, Calif.	0.238	12,908.4	48.8	95.5	13.2	0.005	2.851
		Nitrate							
1	01122610	Shetucket River at South Windham, Conn.	0.393	466.0	–18.2	3.2	–35.2	0.093	–1.694
2	01124000	Quinebaug River at Quinebaug, Conn.	0.260	109.8	10.3	34.2	–9.4	0.331	0.978
3	01127000	Quinebaug River at Jewett City, Conn.	0.481	907.9	–19.5	14.1	–43.3	0.226	–1.220
4	01184000	Connecticut River at Thompsonville, Conn.	0.327	10,733.3	5.1	24.5	–11.2	0.562	0.580
5	01184490	Broad Brook at Broad Brook, Conn.	3.743	205.1	–0.9	8.2	–9.2	0.838	–0.206
6	01188090	Farmington River at Unionville, Conn.	0.183	255.1	–28.6	–8.1	–44.6	0.012	–2.610
7	01189995	Farmington River at Tariffville, Conn.	0.641	1,508.4	1.9	15.3	–9.9	0.767	0.297
8	01192500	Hockanum River near East Hartford, Conn.	2.545	687.6	–3.3	17.5	–20.4	0.735	–0.339
9	01193500	Salmon River near East Hampton, Conn.	0.297	74.5	–25.6	20.8	–54.2	0.237	–1.197
10	01196500	Quinnipiac River at Wallingford, Conn.	2.625	1,078.3	–14.9	–4.3	–24.3	0.008	–2.703
11	01205500	Housatonic River at Stevenson, Conn.	0.342	1,289.9	13.0	51.7	–15.9	0.421	0.811
12	01208500	Naugatuck River at Beacon Falls, Conn.	1.055	973.7	–19.4	–2.8	–33.1	0.027	–2.253
13	01208990	Saugatuck River near Redding, Conn.	0.120	4.8	–5.1	82.3	–50.6	0.876	–0.157
14	01209710	Norwalk River at Winnipauk, Conn.	0.392	28.9	–1.2	28.3	–23.9	0.928	–0.090
15	01357500	Mohawk River at Cohoes, N.Y.	0.689	5,427.1	–11.8	3.5	–24.9	0.127	–1.534
16	01377000	Hackensack River at Rivervale, N.J.	0.461	68.6	–26.3	8.8	–50.0	0.132	–1.536
17	01382500	Pequannock River at Macopin Intake Dam, N.J.	0.184	6.8	21.2	124.5	–34.5	0.544	0.612
18	01387500	Ramapo River near Mahwah, N.J.	1.292	312.8	0.2	25.6	–20.0	0.986	0.018
19	01389500	Passaic River at Little Falls, N.J.	2.719	3,429.6	–28.0	–12.0	–41.0	0.002	–3.216
20	01391500	Saddle River at Lodi, N.J.	4.463	735.0	31.1	61.2	6.7	0.013	2.578
21	01394500	Rahway River near Springfield, N.J.	1.356	55.5	1.8	34.4	–22.9	0.900	0.126
22	01395000	Rahway River at Rahway, N.J.	0.867	48.9	10.1	55.6	–22.1	0.588	0.546
23	01396660	Mulhockaway Creek at Van Syckel, N.J.	0.931	26.1	–20.5	0.3	–37.0	0.059	–1.932
24	01398000	Neshanic River at Reaville, N.J.	1.430	40.5	–16.8	58.3	–56.3	0.577	–0.561
25	01402000	Millstone River at Blackwells Mills, N.J.	2.410	1,404.9	–2.0	20.6	–20.3	0.851	–0.190
26	01403300	Raritan River at Queens Bridge at Bound Brook, N.J.	1.878	2,988.1	9.0	27.4	–6.7	0.280	1.085
29	01409500	Batsto River at Batsto, N.J.	0.168	43.6	–60.9	–36.3	–76.1	0.001	–3.763
31	01438500	Delaware River at Montague, N.J.	0.295	2,761.8	–43.7	–18.9	–60.9	0.004	–3.088
32	01443500	Paulins Kill at Blairstown, N.J.	0.795	269.5	4.6	67.9	–34.9	0.854	0.186
33	01463500	Delaware River at Trenton, N.J.	1.003	20,884.3	–24.2	–10.1	–36.1	0.002	–3.184

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Flow-adjusted trend in concentration from 1993 to 2003				
					Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Nitrate—Continued							
34	01467150	Cooper River at Haddonfield, N.J.	0.349	17.8	–26.5	3.8	–48.0	0.084	–1.749
35	01477120	Raccoon Creek near Swedesboro, N.J.	1.398	99.3	–27.9	2.3	–49.2	0.070	–1.834
36	01491000	Choptank River near Greensboro, Md.	1.291	211.9	8.4	24.6	–5.8	0.262	1.125
37	01578310	Susquehanna River at Conowingo, Md.	1.299	85,810.9	–22.5	–13.1	–30.9	0.000	–4.375
38	01594440	Patuxent River near Bowie, Md.	1.434	955.5	–10.1	–1.9	–17.7	0.018	–2.386
39	01614500	Conococheague Creek at Fairview, Md.	4.995	5,844.6	–7.8	0.2	–15.2	0.057	–1.912
40	01646580	Potomac River at Chain Bridge, at Washington, D.C.	1.807	33,032.7	–34.0	–18.8	–46.4	0.000	–3.918
41	01668000	Rappahannock River near Fredericksburg, Va.	0.312	842.3	24.6	73.0	–10.2	0.189	1.318
42	01673000	Pamunkey River near Hanover, Va.	0.282	426.2	0.6	15.8	–12.6	0.932	0.086
43	01674500	Mattaponi River near Beulahville, Va.	0.155	127.2	14.6	38.1	–4.9	0.153	1.433
44	02035000	James River at Cartersville, Va.	0.219	2,747.3	–18.1	5.3	–36.3	0.121	–1.553
45	02041650	Appomattox River at Matoaca, Va.	0.142	235.0	–18.8	–0.4	–33.8	0.046	–2.003
50	02175000	Edisto River near Givhans, S.C.	0.099	576.7	–25.9	11.4	–50.7	0.153	–1.440
65	02318500	Withlacoochee River at U.S. 84, near Quitman, Ga.	0.374	278.3	34.3	64.1	9.9	0.005	2.887
66	02335870	Sope Creek near Marietta, Ga.	0.523	41.7	–6.3	9.8	–20.1	0.422	–0.805
71	02492000	Bogue Chitto River near Bush, La.	0.243	993.5	139.0	343.6	28.7	0.007	2.761
72	03353637	Little Buck Creek near Indianapolis, Ind.	0.862	22.2	–36.2	–19.8	–49.3	0.000	–3.839
73	03612500	Ohio River at Dam 53 near Grand Chain, Ill.	1.030	623,006.8	–8.0	16.9	–27.6	0.495	–0.684
74	04063700	Popple River near Fence, Wis.	0.045	10.4	12.4	71.6	–26.5	0.591	0.539
76	04087000	Milwaukee River at Milwaukee, Wis.	0.673	629.2	92.2	181.0	31.4	0.001	3.369
81	05114000	Souris River near Sherwood, N. Dak.	0.047	0.6	–14.7	104.8	–64.4	0.724	–0.355
82	05120000	Souris River near Verendrye, N. Dak.	0.147	15.2	–61.7	24.9	–88.3	0.116	–1.591
88	05514500	Cuivre River near Troy, Mo.	0.329	143.6	37.6	305.4	–53.3	0.565	0.578
92	05540275	Spring Brook at 87th Street near Naperville, Ill.	0.842	13.1	–51.7	–30.1	–66.7	0.000	–3.854
95	07022000	Mississippi River at Thebes, Ill.	2.367	1,815,610.3	0.7	31.2	–22.6	0.956	0.055
96	06088500	Muddy Creek at Vaughn, Mont.	2.327	455.3	–49.8	–27.9	–65.1	0.000	–3.725
98	06274300	Bighorn River at Basin, Wyo.	0.288	1,385.5	–47.7	–19.3	–66.1	0.006	–2.929
99	06329500	Yellowstone River near Sidney, Mont.	0.171	4,962.6	–10.0	123.1	–63.7	0.820	–0.228
100	06338490	Missouri River at Garrison Dam, N. Dak.	0.135	5,929.0	–73.2	–55.6	–83.8	0.000	–5.115
101	06461500	Niobrara River near Sparks, Nebr.	0.262	504.1	51.9	131.0	–0.1	0.055	1.954
102	06468250	James River above Arrowwood Lake near Kensal, N. Dak.	0.071	1.9	–74.2	–14.7	–92.2	0.029	–2.220
103	06713500	Cherry Creek at Denver, Colo.	2.735	146.0	–46.6	–35.0	–56.2	0.000	–6.219
104	06752260	Cache La Poudre River at Fort Collins, Colo.	0.293	32.7	–73.6	–56.5	–84.0	0.000	–5.208
105	06752280	Cache La Poudre River above Boxelder Creek, near Timnath, Colo.	0.576	42.3	–13.4	30.9	–42.7	0.497	–0.681
106	06753990	Lonetree Creek near Greeley, Colo.	6.915	248.1	–56.3	–40.4	–68.0	0.000	–5.210
107	06754000	South Platte River near Kersey, Colo.	4.974	11,468.1	2.7	11.4	–5.4	0.533	0.626
108	06775900	Dismal River near Thedford, Nebr.	0.458	238.9	7.7	25.1	–7.3	0.335	0.973
109	06800000	Maple Creek near Nickerson, Nebr.	6.192	1,851.1	–29.7	5.2	–53.0	0.089	–1.713
110	06805500	Platte River at Louisville, Nebr.	1.487	41,578.2	9.7	108.4	–42.3	0.779	0.282
111	06817700	Nodaway River near Graham, Mo.	3.433	8,367.0	52.4	407.1	–54.2	0.494	0.686
112	06818000	Missouri River at St. Joseph, Mo.	1.951	306,902.8	–62.9	–37.1	–78.1	0.000	–3.678
113	06902000	Grand River near Sumner, Mo.	0.431	3,650.1	51.2	297.9	–42.6	0.404	0.837
114	06905500	Chariton River near Prairie Hill, Mo.	0.420	1,363.0	80.7	286.0	–15.4	0.130	1.527
115	06921070	Pomme De Terre River near Polk, Mo.	0.215	73.3	126.1	470.8	–10.5	0.088	1.726
116	06926510	Osage River below St. Thomas, Mo.	0.352	11,602.8	–59.5	–18.1	–80.0	0.015	–2.515
117	06930800	Gasconade River above Jerome, Mo.	0.416	2,262.0	–0.7	49.1	–33.8	0.974	–0.032
118	06934500	Missouri River at Hermann, Mo.	1.399	477,034.2	–29.6	11.6	–55.6	0.138	–1.493
119	07047942	L›Anguille River near Colt, Ark.	0.451	234.9	–46.1	–6.6	–68.9	0.032	–2.201
120	07053250	Yocum Creek near Oak Grove, Ark.	2.245	212.2	109.0	195.9	47.6	0.000	4.152
121	07056000	Buffalo River near St Joe, Ark.	0.067	75.2	67.3	151.7	11.3	0.015	2.473

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Nitrate—Continued							
122	07060500	White River at Calico Rock, Ark.	0.241	7,572.9	28.2	81.9	–9.6	0.169	1.394
123	07060710	North Sylamore Creek near Fifty Six, Ark.	0.064	3.5	–2.3	30.5	–26.9	0.873	–0.160
124	07066110	Jacks Fork above Two River, Mo.	0.290	349.2	22.7	53.9	–2.2	0.081	1.770
125	07068000	Current River at Doniphan, Mo.	0.282	2,237.4	–13.2	5.1	–28.3	0.150	–1.448
126	07077500	Cache River at Patterson, Ark.	0.256	346.6	–17.5	39.7	–51.3	0.479	–0.715
127	07077700	Bayou DeView near Morton, Ark.	0.153	26.7	69.9	222.4	–10.5	0.117	1.621
128	07103700	Fountain Creek near Colorado Springs, Colo.	0.750	33.8	–5.8	14.7	–22.6	0.555	–0.593
129	07103780	Monument Creek above North Gate Boulevard at United States Air Force Academy, Colo.	0.127	2.4	282.0	708.1	80.5	0.001	3.505
130	07105500	Fountain Creek at Colorado Springs, Colo.	1.563	221.8	8.6	25.1	–5.7	0.254	1.146
131	07105530	Fountain Creek below Janitell Road below Colorado Springs, Colo.	1.665	476.5	45.2	68.9	24.8	0.000	4.820
132	07106300	Fountain Creek near Pinon, Colo.	5.192	1,533.4	–48.4	–35.0	–59.0	0.000	–5.624
133	07106500	Fountain Creek at Pueblo, Colo.	5.306	1,698.0	–55.1	–50.0	–59.7	0.000	–14.605
134	07189000	Elk River near Tiff City, Mo.	1.572	2,808.9	46.4	76.1	21.7	0.000	4.044
135	07195500	Illinois River near Watts, Okla.	2.450	3,516.5	–17.7	13.4	–40.3	0.236	–1.192
136	07195865	Sager Creek near West Siloam Springs, Okla.	6.241	222.0	11.5	49.4	–16.8	0.469	0.730
137	07196000	Flint Creek near Kansas, Okla.	1.871	450.8	59.6	79.5	42.0	0.000	7.831
138	07196500	Illinois River near Tahlequah, Okla.	1.684	3,597.3	2.6	24.0	–15.1	0.791	0.265
139	07197000	Baron Fork at Eldon, Okla.	1.033	728.8	35.0	78.2	2.2	0.037	2.116
140	07227500	Canadian River near Amarillo, Tex.	0.173	33.1	515.1	1,605.0	121.9	0.001	3.492
141	07239450	North Canadian River near Calumet, Okla.	0.084	31.9	–32.6	58.2	–71.3	0.366	–0.907
142	07241000	North Canadian River below Lake Overholser near Oklahoma City, Okla.	0.249	143.1	–47.1	–1.6	–71.6	0.046	–2.011
143	07241520	North Canadian River at Britton Road at Oklahoma City, Okla.	0.601	543.7	–28.4	19.1	–56.9	0.201	–1.286
144	07241550	North Canadian River near Harrah, Okla.	1.176	1,563.3	–0.0	44.8	–31.0	0.998	–0.002
145	07247015	Poteau River at Loving, Okla.	0.088	14.1	45.8	161.3	–18.6	0.209	1.267
146	07247250	Black Fork below Big Creek near Page, Okla.	0.063	8.6	124.0	263.5	38.0	0.002	3.263
147	07247345	Black Fork at Hodgen, Okla.	0.033	4.6	109.8	281.3	15.5	0.018	2.432
148	07247650	Fourche Maline near Leflore, Okla.	0.093	10.4	8.4	76.4	–33.3	0.745	0.327
149	07263620	Arkansas River at David D. Terry Lock and Dam below Little Rock, Ark.	0.382	39,163.4	–50.8	–12.6	–72.3	0.018	–2.419
150	07331000	Washita River near Dickson, Okla.	0.366	2,068.8	17.6	178.9	–50.4	0.714	0.368
151	07355500	Red River at Alexandria, La.	0.155	10,592.5	–43.1	–9.9	–64.1	0.018	–2.406
152	07362000	Ouachita River at Camden, Ark.	0.126	1,444.2	2.9	62.8	–35.0	0.903	0.123
153	07373420	Mississippi River near St Francisville, La.	1.562	2,204,310.2	–15.4	3.1	–30.6	0.100	–1.654
154	07375500	Tangipahoa River at Robert, La.	0.366	846.8	–13.6	6.2	–29.6	0.168	–1.386
155	07376000	Tickfaw River at Holden, La.	0.301	201.3	–13.9	6.7	–30.4	0.175	–1.368
156	07381495	Atchafalaya River at Melville, La.	1.123	687,594.0	–16.0	5.1	–32.9	0.129	–1.527
157	07386980	Vermilion River at Perry, La.	0.376	724.2	27.9	91.3	–14.4	0.233	1.200
158	08030500	Sabine River near Ruliff, Tex.	0.078	1,136.0	–31.8	–0.9	–53.1	0.047	–2.008
159	08032000	Neches River near Neches, Tex.	0.135	135.7	–9.4	57.1	–47.7	0.727	–0.350
160	08033500	Neches River near Rockland, Tex.	0.184	561.9	8.9	74.3	–31.9	0.722	0.357
161	08051500	Clear Creek near Sanger, Tex.	0.122	13.2	67.4	219.6	–12.4	0.122	1.560
162	08064100	Chambers Creek near Rice, Tex.	0.254	21.8	–16.4	57.9	–55.7	0.582	–0.552
163	08065350	Trinity River near Crockett, Tex.	1.673	20,455.8	–2.3	66.3	–42.6	0.932	–0.086
164	08136500	Concho River at Paint Rock, Tex.	11.897	2,164.9	–93.4	–76.6	–98.1	0.000	–4.222
167	08155200	Barton Creek at State Highway 71 near Oak Hill, Tex.	0.042	0.2	5.0	83.9	–40.0	0.864	0.171
168	08155240	Barton Creek at Lost Creek Boulevard near Austin, Tex.	0.063	0.4	54.9	132.9	2.9	0.039	2.099
172	08181800	San Antonio River near Elmendorf, Tex.	8.417	5,777.2	13.3	51.2	–15.0	0.396	0.852

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

					Flow-adjusted trend in concentration from 1993 to 2003				
Site number (figure 1)	Station number	Station name	Reference concentration, in milligrams per liter	Reference load, in kilograms per day	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	t-statistic
		Nitrate—Continued							
174	09058000	Colorado River near Kremmling, Colo.	0.121	284.9	–0.2	49.5	–33.3	0.994	–0.008
175	09163500	Colorado River near Colorado-Utah State Line	0.579	10,028.4	–9.2	10.7	–25.5	0.343	–0.951
177	09217010	Green River below Green River, Wyo.	0.070	248.9	–10.1	32.5	–38.9	0.594	–0.536
181	09413500	Virgin River below First Narrows, Utah	0.901	473.6	29.8	84.3	–8.6	0.148	1.460
187	10038000	Bear River below Smiths Fork, near Cokeville, Wyo.	0.089	69.8	–39.3	–10.9	–58.7	0.013	–2.547
189	10131000	Chalk Creek at U.S. 189 Crossing, Utah	0.253	34.0	–17.9	19.3	–43.5	0.303	–1.036
190	10154200	Provo River above Woodland at U.S. Geological Survey Gage Number 10154200, Utah	0.112	39.0	98.6	207.9	28.1	0.003	3.067
191	10155000	Provo River at Bridge 2.5 miles East of Hailstone Junction, Utah	0.039	18.0	301.6	649.6	115.1	0.000	4.365
192	10155500	Provo River above Confluence with Snake Creek at McKeller Bridge, Utah	0.463	151.3	–54.8	–36.5	–67.8	0.000	–4.581
194	10336580	Upper Truckee River at South Upper Truckee Road near Meyers, Calif.	0.009	0.4	2.1	39.2	–25.1	0.894	0.133
195	103366092	Upper Truckee River at Highway 50 above Meyers, Calif.	0.014	1.3	–21.3	–2.2	–36.7	0.032	–2.162
197	10336698	Third Creek near Crystal Bay, Nev.	0.017	0.3	–67.9	–56.7	–76.2	0.000	–7.433
198	103366993	Incline Creek above Tyrol Village near Incline Village, Nev.	0.013	0.1	10.3	45.9	–16.6	0.491	0.690
199	103366995	Incline Creek at Highway 28 at Incline Village, Nev.	0.019	0.2	2.4	26.6	–17.2	0.829	0.216
200	10336700	Incline Creek near Crystal Bay, Nev.	0.021	0.4	–0.7	21.7	–18.9	0.949	–0.065
201	10336740	Logan House Creek near Glenbrook, Nev.	0.004	0.0	70.7	396.2	–41.3	0.328	0.981
205	07A090	Snohomish River at Snohomish, Wash.	0.236	4,071.6	–7.0	10.2	–21.6	0.401	–0.842
207	09A190	Green River at Kanaskat, Wash.	0.084	123.5	–4.0	32.2	–30.2	0.805	–0.247
208	10332	Willamette River at SP&S Railroad Bridge, Oreg.	0.587	38,708.1	–24.1	6.9	–46.1	0.121	–1.579
209	10350	Willamette River at Eastbound Highway 20 Bridge at Albany, Oreg.	0.348	9,869.7	–39.8	–20.0	–54.6	0.001	–3.505
210	10355	Willamette River at Highway 99 East at Harrisburg, Oreg.	0.153	3,494.3	–27.0	–10.3	–40.7	0.003	–2.990
213	10555	Willamette River at Marion Street at Salem, Oreg.	0.473	21,656.5	–44.2	–30.8	–54.9	0.000	–5.337
215	10616	Columbia River at Marker number 47 upstream of Willamette River, Oreg.	0.152	63,995.8	30.3	94.9	–12.9	0.203	1.288
217	11140	Long Tom River at Stow Pit Road at Monearoe, Oreg.	0.161	128.5	–22.9	54.5	–61.6	0.467	–0.734
218	11321	Johnson Creek at Southeast 17th Avenue at Portland, Oreg.	4.288	578.3	–29.6	–20.8	–37.5	0.000	–5.852
224	13206000	Boise River at Glenwood Bridge near Boise, Idaho	0.446	750.9	–11.8	17.2	–33.6	0.390	–0.865
225	13351000	Palouse River at Hooper, Wash.	1.113	577.5	–12.2	27.8	–39.7	0.499	–0.678
226	14201300	Zollner Creek near Mt. Angel, Oreg.	8.370	134.4	25.0	54.2	1.3	0.039	2.085
228	14246900	Columbia River at Beaver Army Terminal near Quincy, Oreg.	0.289	164,026.5	–33.2	–11.5	–49.5	0.006	–2.813
229	16A070	Skokomish River near Potlatch, Wash.	0.105	177.0	–59.7	–47.4	–69.1	0.000	–6.705
234	45A070	Wenatchee River at Wenatchee, Wash.	0.064	302.1	1.2	25.8	–18.6	0.916	0.105
235	45A110	Wenatchee River near Leavenworth, Wash.	0.026	117.0	7.6	57.9	–26.7	0.709	0.374
237	49A070	Okanogan River at Malott, Wash.	0.023	138.1	7.6	87.5	–38.3	0.796	0.259
238	54A120	Spokane River at Riverside State Park, Wash.	0.346	3,664.7	47.9	86.7	17.2	0.001	3.300
239	61A070	Columbia River at Northport, Wash.	0.056	12,434.4	0.5	19.1	–15.2	0.956	0.055
240	11264500	Merced River at Happy Isles Bridge near Yosemite, Calif.	0.053	21.9	–50.6	–16.3	–70.8	0.010	–2.623
241	11274538	Orestimba Creek at River Road near Crows Landing, Calif.	2.006	105.3	5.3	36.8	–18.9	0.698	0.389
242	11290000	Tuolumne River at Modesto, Calif.	0.254	529.0	125.8	173.3	86.5	0.000	8.362
243	11303500	San Joaquin River near Vernalis, Calif.	0.987	8,323.0	4.8	15.4	–4.8	0.335	0.964
244	11447650	Sacramento River at Freeport, Calif.	0.147	7,982.7	–32.4	–10.0	–49.2	0.008	–2.683

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
Site number (figure 1)	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
					Total phosphorus					
1	66.7	166.4	4.3	0.033	0.239	33.7	152.9	–29.3	0.372	0.325
2	24.2	94.9	–20.9	0.347	0.230	–5.3	86.7	–52.0	0.874	0.347
3	81.6	169.9	22.2	0.003	0.202	75.0	228.8	–6.9	0.082	0.322
4	28.0	91.3	–14.3	0.228	0.205	15.2	90.0	–30.1	0.578	0.255
5	–17.0	19.2	–42.3	0.312	0.185	–31.6	25.7	–62.8	0.221	0.311
7	55.8	110.8	15.1	0.004	0.154	16.6	65.9	–18.1	0.394	0.180
8	–8.1	24.8	–32.3	0.590	0.156	–27.7	–5.0	–45.0	0.020	0.139
10	–18.1	9.1	–38.5	0.173	0.146	–24.0	8.1	–46.5	0.127	0.179
11	10.3	188.7	–57.8	0.841	0.491	5.2	242.2	–67.7	0.933	0.602
12	74.8	163.2	16.1	0.007	0.209	52.2	119.1	5.7	0.024	0.186
13	26.6	326.9	–62.5	0.704	0.620	48.3	553.1	–66.3	0.602	0.756
14	43.9	95.6	5.8	0.020	0.157	42.6	214.6	–35.4	0.379	0.404
15	13.9	76.5	–26.5	0.559	0.223	38.7	169.9	–28.7	0.336	0.340
16	20.7	104.4	–28.7	0.484	0.269	–7.6	74.3	–51.0	0.806	0.324
17	–53.1	67.0	–86.8	0.242	0.648	–74.7	50.9	–95.8	0.131	0.911
18	–6.9	48.7	–41.7	0.763	0.239	6.5	77.8	–36.2	0.811	0.262
19	19.3	101.4	–29.3	0.509	0.267	–2.5	78.7	–46.8	0.935	0.309
20	115.1	241.7	35.4	0.001	0.236	124.3	246.3	45.2	0.000	0.222
22	35.7	87.2	–1.7	0.063	0.164	49.4	193.2	–23.9	0.243	0.344
24	23.8	184.0	–46.0	0.614	0.424	27.5	416.9	–68.5	0.734	0.714
25	34.3	89.1	–4.7	0.092	0.175	15.9	69.0	–20.6	0.444	0.193
26	21.4	73.2	–14.9	0.285	0.181	0.7	44.9	–30.0	0.969	0.186
27	–4.7	71.7	–47.1	0.872	0.301	–20.2	91.9	–66.8	0.614	0.448
28	29.1	269.6	–54.9	0.634	0.537	16.4	265.1	–62.9	0.794	0.583
30	–14.1	221.7	–77.1	0.821	0.674	–13.1	282.5	–80.3	0.852	0.756
31	–43.9	57.1	–80.0	0.271	0.525	–40.4	94.0	–81.7	0.390	0.602
32	4.5	116.1	–49.4	0.905	0.370	–16.8	148.0	–72.1	0.742	0.557
33	–10.7	26.2	–36.9	0.520	0.177	–9.9	63.5	–50.4	0.731	0.304
34	–3.7	37.1	–32.3	0.835	0.180	–30.7	12.2	–57.2	0.136	0.246
35	27.9	80.9	–9.6	0.164	0.177	12.1	105.5	–38.9	0.712	0.309
36	113.6	235.0	36.1	0.001	0.230	205.9	1211.1	–28.6	0.132	0.743
37	64.5	127.5	18.9	0.003	0.165	30.3	172.5	–37.7	0.482	0.376
38	41.0	84.2	7.9	0.012	0.136	42.7	214.3	–35.2	0.378	0.403
39	14.5	63.0	–19.6	0.454	0.180	–27.5	85.7	–71.7	0.503	0.480
40	76.4	196.4	5.0	0.032	0.265	31.1	445.9	–68.5	0.709	0.728
41	6.7	125.6	–49.6	0.866	0.382	–38.7	278.1	–90.0	0.599	0.928
42	82.3	113.6	55.5	0.000	0.081	–3.0	188.3	–67.4	0.956	0.556
43	–6.9	12.2	–22.8	0.451	0.095	–56.9	110.9	–91.2	0.299	0.810
44	–11.0	15.1	–31.2	0.375	0.131	–41.8	46.9	–76.9	0.252	0.472
45	–13.5	10.1	–32.0	0.238	0.123	–44.6	110.0	–85.4	0.385	0.680
46	42.4	144.6	–17.1	0.200	0.276	43.6	471.3	–63.9	0.608	0.705
51	42.2	91.4	5.6	0.020	0.152	–30.5	15.3	–58.1	0.159	0.258
52	–38.3	–11.8	–56.9	0.008	0.182	–63.1	–42.1	–76.4	0.000	0.229
53	–40.4	–23.2	–53.8	0.000	0.130	–68.6	–21.9	–87.4	0.013	0.465
54	–20.3	0.4	–36.7	0.054	0.118	–67.8	–30.6	–85.0	0.004	0.392
55	–9.2	11.0	–25.7	0.347	0.102	–55.7	1.5	–80.6	0.054	0.423
56	48.0	118.5	0.3	0.049	0.199	–52.3	89.4	–88.0	0.293	0.704
58	31.4	66.8	3.5	0.025	0.122	–22.7	225.4	–81.6	0.726	0.733
59	–3.8	15.4	–19.8	0.676	0.093	–38.0	152.9	–84.8	0.505	0.717
60	7.9	32.4	–12.1	0.469	0.105	–19.7	76.3	–63.4	0.584	0.401
61	–39.2	–14.7	–56.7	0.004	0.173	–64.5	124.6	–94.4	0.271	0.941
62	–40.3	–22.1	–54.3	0.000	0.136	–75.3	43.3	–95.8	0.119	0.898
63	–49.8	2.7	–75.5	0.059	0.366	–56.9	122.0	–91.6	0.314	0.836
64	–71.0	–57.7	–80.0	0.000	0.191	–95.2	–78.4	–98.9	0.000	0.764

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
Site number (figure 1)	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
					Total phosphorus—Continued					
65	29.9	140.8	–30.0	0.407	0.315	6.4	218.3	–64.4	0.912	0.559
66	–26.2	38.8	–60.7	0.346	0.322	–52.8	27.9	–82.5	0.140	0.508
68	–54.8	–31.0	–70.3	0.000	0.215	–67.4	–38.0	–82.9	0.001	0.328
69	–20.7	8.0	–41.7	0.141	0.157	–56.9	–0.9	–81.3	0.048	0.425
70	–55.1	–41.0	–65.7	0.000	0.139	–60.0	–31.3	–76.7	0.001	0.276
71	38.2	86.6	2.3	0.035	0.153	–4.7	72.2	–47.3	0.872	0.302
72	0.0	66.7	–40.0	0.999	0.261	–46.7	92.0	–85.2	0.336	0.654
73	60.9	121.2	17.0	0.003	0.162	32.1	155.8	–31.8	0.409	0.337
74	–26.0	33.5	–58.9	0.318	0.301	–51.2	–1.4	–75.8	0.046	0.359
75	–27.3	–18.0	–35.5	0.000	0.061	–59.0	–17.5	–79.6	0.012	0.357
76	23.3	50.2	1.2	0.038	0.101	–11.1	41.8	–44.3	0.621	0.238
77	–41.3	–28.5	–51.9	0.000	0.101	–8.7	39.1	–40.1	0.672	0.215
78	–31.8	–6.9	–50.1	0.016	0.159	–49.4	–15.3	–69.8	0.010	0.263
79	–19.2	–2.4	–33.1	0.027	0.096	–35.3	7.5	–61.0	0.093	0.259
80	41.6	63.3	22.8	0.000	0.073	12.7	72.8	–26.5	0.585	0.218
81	–42.8	–9.8	–63.7	0.016	0.232	439.6	4,189.7	–32.1	0.111	1.058
82	–13.7	21.5	–38.7	0.399	0.174	55.5	571.7	–64.0	0.554	0.747
83	16.5	58.1	–14.2	0.327	0.156	–52.2	59.8	–85.7	0.230	0.616
84	–37.9	–12.3	–56.0	0.007	0.176	–59.9	–30.1	–77.0	0.001	0.284
85	–64.7	–55.3	–72.1	0.000	0.121	–68.1	–46.9	–80.8	0.000	0.259
86	–15.5	18.3	–39.6	0.327	0.172	–22.5	85.3	–67.6	0.567	0.445
87	–15.8	39.0	–49.0	0.501	0.256	–87.1	–41.4	–97.2	0.008	0.773
88	–23.0	46.5	–59.5	0.426	0.328	–69.5	62.7	–94.3	0.165	0.853
89	23.0	128.5	–33.8	0.513	0.316	–44.3	176.3	–88.8	0.474	0.817
90	49.4	99.1	12.1	0.006	0.147	44.5	83.9	13.5	0.003	0.123
91	84.0	143.4	39.1	0.000	0.143	45.0	88.3	11.7	0.005	0.133
92	–19.2	17.5	–44.5	0.265	0.191	–51.3	19.8	–80.2	0.117	0.459
93	112.3	171.1	66.3	0.000	0.125	–10.9	55.1	–48.8	0.682	0.283
94	–11.7	37.5	–43.3	0.581	0.226	–64.5	–25.6	–83.1	0.006	0.378
95	26.2	73.1	–7.9	0.148	0.161	–41.5	6.6	–67.9	0.080	0.306
97	–20.6	55.0	–59.4	0.499	0.342	–34.2	172.2	–84.1	0.564	0.724
99	6.3	118.5	–48.3	0.868	0.367	–46.1	42.2	–79.6	0.212	0.495
101	33.5	80.4	–1.3	0.061	0.154	26.4	79.2	–10.9	0.189	0.178
106	–73.0	–35.5	–88.7	0.003	0.444	–98.2	–89.8	–99.7	0.000	0.871
107	34.6	59.6	13.5	0.001	0.087	–25.7	40.4	–60.6	0.361	0.324
109	105.8	237.0	25.7	0.004	0.252	–36.9	82.3	–78.2	0.395	0.541
110	89.4	161.3	37.2	0.000	0.164	–26.0	33.8	–59.0	0.320	0.302
111	–36.2	27.3	–68.0	0.203	0.352	–93.2	–70.3	–98.5	0.000	0.753
112	23.4	81.2	–16.0	0.284	0.196	–29.7	31.4	–62.4	0.270	0.319
113	12.9	119.5	–41.9	0.720	0.339	–87.2	–26.3	–97.8	0.021	0.893
114	–42.8	13.8	–71.2	0.112	0.351	–93.4	–60.4	–98.9	0.003	0.912
115	–22.8	20.9	–50.7	0.258	0.229	–78.2	–26.9	–93.5	0.014	0.618
118	64.5	169.3	0.5	0.048	0.252	–38.3	40.2	–72.9	0.249	0.419
120	18.9	52.9	–7.5	0.176	0.128	–50.8	–11.3	–72.7	0.018	0.301
134	280.3	433.1	171.2	0.000	0.172	38.2	151.9	–24.1	0.290	0.306
135	110.3	206.8	44.1	0.000	0.193	8.5	99.6	–41.0	0.792	0.311
136	94.5	250.7	7.9	0.027	0.301	55.9	149.2	–2.5	0.064	0.239
137	79.7	130.6	40.1	0.000	0.127	–12.4	72.0	–55.4	0.700	0.345
138	80.4	139.7	35.7	0.000	0.145	–10.0	83.5	–55.9	0.772	0.363
139	6.5	64.0	–30.9	0.777	0.220	–59.4	–0.2	–83.5	0.049	0.459
145	–13.6	29.7	–42.4	0.481	0.207	–41.8	71.2	–80.2	0.326	0.550
148	–0.6	39.0	–28.9	0.971	0.171	–67.9	5.5	–90.2	0.061	0.606
149	47.4	91.5	13.4	0.004	0.134	–42.4	48.3	–77.6	0.253	0.483
150	19.8	109.7	–31.5	0.526	0.285	–66.3	2.5	–88.9	0.055	0.567

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
Total phosphorus—Continued										
151	–30.4	–0.1	–51.5	0.050	0.185	–41.9	54.7	–78.1	0.277	0.499
152	–27.2	26.5	–58.1	0.260	0.282	–38.4	43.7	–73.6	0.262	0.432
153	45.7	82.0	16.6	0.001	0.113	–2.5	44.5	–34.2	0.899	0.201
154	1.6	43.7	–28.2	0.929	0.177	–27.8	47.6	–64.7	0.372	0.365
155	46.0	103.3	4.9	0.025	0.169	–8.3	70.2	–50.6	0.784	0.315
156	52.7	85.9	25.4	0.000	0.100	1.0	52.4	–33.0	0.961	0.210
157	1.9	30.1	–20.3	0.882	0.125	6.2	132.2	–51.4	0.879	0.399
165	–3.2	81.1	–48.2	0.920	0.319	–45.3	110.1	–85.7	0.380	0.686
166	–69.1	2.4	–90.7	0.055	0.611	–85.0	–36.3	–96.5	0.010	0.739
169	–91.7	–61.7	–98.2	0.001	0.778	–56.9	458.4	–96.7	0.519	1.307
170	–3.1	52.1	–38.3	0.890	0.230	29.7	257.2	–52.9	0.614	0.517
171	–24.9	30.6	–56.8	0.310	0.282	–16.1	187.6	–75.5	0.780	0.629
173	25.8	66.8	–5.2	0.111	0.144	–75.8	5.9	–94.5	0.060	0.753
177	90.3	281.9	–5.2	0.070	0.355	20.3	140.9	–39.9	0.602	0.354
178	–43.8	33.1	–76.2	0.190	0.439	–66.3	1.0	–88.7	0.052	0.559
180	135.1	451.5	0.2	0.049	0.435	50.3	288.2	–41.8	0.401	0.484
182	58.4	336.2	–42.5	0.373	0.517	–41.2	154.6	–86.4	0.477	0.748
183	–26.9	230.6	–83.8	0.684	0.770	–75.3	138.6	–97.4	0.227	1.156
184	514.5	5,184.4	–28.6	0.098	1.098	127.0	4,158.2	–87.9	0.584	1.496
185	35.8	234.2	–44.9	0.506	0.460	–36.8	106.1	–80.6	0.447	0.603
186	–88.7	–67.6	–96.1	0.000	0.539	–91.4	–61.7	–98.1	0.001	0.761
188	–48.3	–22.2	–65.6	0.002	0.208	–63.4	50.4	–91.1	0.163	0.721
193	–8.5	32.7	–36.9	0.639	0.190	–27.9	33.7	–61.1	0.299	0.315
203	43.5	129.1	–10.1	0.130	0.239	51.9	212.6	–26.2	0.256	0.368
204	6.0	123.6	–49.7	0.878	0.381	6.7	169.4	–57.8	0.891	0.473
205	26.0	125.1	–29.5	0.435	0.296	24.8	170.1	–42.3	0.574	0.394
206	18.6	58.5	–11.3	0.250	0.148	5.2	84.7	–40.1	0.860	0.287
207	244.0	597.2	69.7	0.001	0.361	200.1	649.7	20.1	0.019	0.467
208	–7.3	9.6	–21.6	0.372	0.085	–21.1	24.9	–50.1	0.312	0.234
209	–20.1	–4.4	–33.2	0.014	0.091	–32.1	14.2	–59.6	0.144	0.265
210	–4.9	17.6	–23.2	0.641	0.109	–15.5	45.9	–51.0	0.546	0.279
211	–15.3	3.7	–30.8	0.107	0.103	–22.6	33.4	–55.1	0.356	0.278
212	–8.9	29.5	–35.9	0.604	0.179	–8.7	44.9	–42.5	0.699	0.236
213	–20.6	–5.4	–33.3	0.010	0.089	–32.3	15.0	–60.1	0.149	0.270
214	–21.7	–11.6	–30.5	0.000	0.061	–33.3	0.2	–55.6	0.051	0.207
215	–24.8	3.1	–45.1	0.077	0.161	–30.1	38.8	–64.8	0.306	0.350
216	87.4	196.4	18.5	0.007	0.234	106.5	298.1	7.1	0.030	0.335
217	–21.5	–2.2	–36.9	0.031	0.112	–41.7	9.7	–69.0	0.095	0.322
218	–10.3	8.5	–25.9	0.261	0.097	–30.6	19.6	–59.7	0.188	0.277
219	–32.8	–2.8	–53.5	0.035	0.188	–63.3	–8.9	–85.2	0.031	0.464
220	–33.7	–6.6	–52.9	0.019	0.175	–19.7	73.9	–62.9	0.578	0.394
221	94.5	250.1	8.1	0.027	0.300	89.9	278.2	–4.6	0.068	0.351
222	–36.0	93.6	–78.8	0.430	0.565	–44.1	92.7	–83.8	0.357	0.631
223	–8.9	14.4	–27.5	0.422	0.116	–27.4	13.8	–53.6	0.163	0.229
224	37.0	199.8	–37.4	0.431	0.400	36.1	118.5	–15.2	0.202	0.242
225	–51.7	–26.2	–68.4	0.001	0.216	–40.1	129.4	–84.3	0.455	0.685
227	13.8	37.2	–5.5	0.173	0.095	–3.1	54.4	–39.1	0.896	0.237
228	7.8	70.6	–31.9	0.748	0.234	–5.7	95.1	–54.4	0.875	0.371
229	112.2	282.8	17.7	0.012	0.301	136.2	416.5	8.0	0.031	0.399
230	–4.5	21.2	–24.7	0.707	0.121	–8.4	67.1	–49.8	0.776	0.307
231	–31.9	–23.6	–39.4	0.000	0.059	–30.2	41.1	–65.4	0.317	0.359
232	–40.9	–27.2	–52.0	0.000	0.106	–32.5	38.3	–67.1	0.283	0.366

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
Site number (figure 1)	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
Total phosphorus—Continued										
233	3.8	24.8	–13.7	0.693	0.094	15.2	167.0	–50.3	0.742	0.429
234	52.5	272.8	–37.6	0.354	0.456	45.9	371.6	–54.9	0.528	0.599
235	12.3	156.4	–50.8	0.783	0.421	7.4	246.0	–66.7	0.905	0.597
236	95.3	280.8	0.1	0.050	0.341	64.2	317.9	–35.5	0.298	0.477
237	–2.1	89.8	–49.6	0.949	0.338	–39.1	79.3	–79.3	0.368	0.550
238	42.1	131.9	–13.0	0.160	0.250	32.8	161.6	–32.6	0.412	0.346
239	–33.2	25.4	–64.5	0.209	0.322	–31.9	41.3	–67.1	0.303	0.372
241	15.8	54.8	–13.4	0.324	0.148	–7.7	145.6	–65.3	0.873	0.499
242	2.0	63.7	–36.4	0.934	0.241	–18.9	101.1	–67.3	0.651	0.463
243	–2.4	13.2	–15.9	0.748	0.076	–19.6	126.3	–71.4	0.680	0.528
244	57.9	122.4	12.1	0.009	0.175	48.8	208.8	–28.3	0.286	0.372
Total nitrogen										
1	10.4	39.2	–12.4	0.403	0.118	–11.5	42.9	–45.2	0.618	0.244
2	44.3	81.0	15.0	0.002	0.116	10.0	75.4	–31.0	0.689	0.238
3	–4.0	13.6	–18.8	0.638	0.086	–7.5	51.7	–43.6	0.758	0.252
4	4.9	25.4	–12.4	0.604	0.091	–5.6	28.3	–30.6	0.712	0.157
5	0.1	9.4	–8.5	0.988	0.046	–17.5	11.2	–38.8	0.206	0.152
6	41.6	109.4	–4.2	0.081	0.200	8.6	85.1	–36.2	0.761	0.272
7	23.0	53.8	–1.6	0.069	0.114	–7.9	25.2	–32.2	0.598	0.157
8	5.5	29.7	–14.2	0.614	0.106	–17.1	6.9	–35.7	0.149	0.130
9	13.8	58.4	–18.3	0.445	0.169	1.2	110.3	–51.3	0.974	0.373
10	–1.3	20.4	–19.1	0.895	0.101	–8.4	19.9	–30.0	0.524	0.137
11	12.1	41.2	–11.0	0.333	0.118	6.8	114.3	–46.7	0.852	0.355
12	–49.3	–31.7	–62.3	0.000	0.152	–55.9	–42.0	–66.4	0.000	0.139
13	40.3	106.5	–4.6	0.085	0.197	64.5	301.9	–32.7	0.275	0.456
14	24.3	47.0	5.1	0.011	0.086	23.2	154.1	–40.3	0.572	0.369
15	–9.1	2.5	–19.4	0.120	0.061	10.7	72.1	–28.8	0.652	0.225
16	13.5	41.5	–9.0	0.261	0.113	–13.1	37.1	–45.0	0.545	0.233
17	21.5	69.4	–12.8	0.250	0.170	–34.4	157.8	–83.3	0.546	0.698
18	–5.3	39.2	–35.6	0.781	0.197	8.3	73.7	–32.4	0.740	0.241
19	–12.2	39.4	–44.7	0.582	0.236	–28.2	36.9	–62.4	0.314	0.329
20	24.5	66.9	–7.2	0.144	0.150	29.9	94.0	–13.1	0.202	0.205
21	0.9	25.5	–18.8	0.934	0.111	18.4	92.9	–27.4	0.499	0.249
22	–0.1	25.2	–20.3	0.993	0.115	10.0	96.1	–38.3	0.746	0.295
23	–13.6	7.2	–30.3	0.184	0.110	–10.0	68.2	–51.9	0.741	0.319
24	–14.2	39.0	–47.0	0.534	0.246	–11.6	227.3	–76.1	0.853	0.668
25	11.7	42.0	–12.2	0.368	0.123	–3.9	46.6	–37.1	0.852	0.216
26	16.4	40.5	–3.7	0.116	0.096	–3.5	47.2	–36.7	0.870	0.215
29	–22.1	12.0	–45.9	0.178	0.185	–40.1	16.2	–69.1	0.129	0.338
31	–23.2	–1.2	–40.2	0.040	0.128	–18.4	34.3	–50.4	0.423	0.254
32	4.7	34.2	–18.4	0.720	0.127	–16.7	94.6	–64.3	0.673	0.433
33	–18.3	–3.7	–30.6	0.016	0.084	–17.5	36.2	–50.0	0.452	0.256
34	0.9	24.3	–18.2	0.936	0.107	–27.4	7.3	–50.8	0.108	0.199
35	8.9	33.6	–11.3	0.415	0.104	–4.6	47.0	–38.0	0.832	0.220
36	22.4	35.8	10.2	0.000	0.053	75.3	407.3	–39.5	0.301	0.542
37	–9.4	–0.3	–17.6	0.042	0.048	–28.2	22.7	–58.0	0.226	0.273
38	0.5	11.0	–9.0	0.921	0.051	1.7	82.3	–43.3	0.955	0.298
39	–3.7	8.3	–14.3	0.530	0.060	–39.0	37.7	–73.0	0.234	0.415
40	–18.7	10.5	–40.2	0.186	0.157	–39.6	122.2	–83.6	0.448	0.665
41	17.5	82.1	–24.2	0.471	0.224	–32.4	208.8	–85.2	0.613	0.775
42	27.0	42.6	13.1	0.000	0.059	–32.4	116.5	–78.9	0.510	0.594
43	10.1	25.2	–3.1	0.140	0.065	–49.0	139.4	–89.1	0.393	0.789

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
Total nitrogen—Continued										
44	1.8	42.5	–27.3	0.918	0.172	–33.4	93.8	–77.1	0.456	0.545
45	11.9	23.6	1.3	0.027	0.051	–28.4	134.5	–78.1	0.581	0.605
46	18.0	48.3	–6.1	0.155	0.117	19.0	314.0	–65.8	0.785	0.636
47	–36.8	–27.3	–45.1	0.000	0.071	–22.4	63.1	–63.1	0.503	0.379
48	–11.5	–3.4	–18.9	0.006	0.044	33.7	226.2	–45.2	0.524	0.455
49	0.8	37.2	–26.0	0.961	0.158	–5.5	122.4	–59.8	0.897	0.436
52	6.7	44.8	–21.4	0.679	0.156	–36.2	0.8	–59.5	0.054	0.233
53	–7.5	14.8	–25.4	0.481	0.110	–51.3	–4.1	–75.2	0.037	0.345
57	37.2	78.2	5.6	0.018	0.134	32.0	314.5	–58.0	0.635	0.584
58	–5.1	26.9	–29.0	0.726	0.148	–44.1	84.8	–83.1	0.340	0.610
59	–3.7	12.4	–17.4	0.635	0.079	–37.9	187.6	–86.6	0.542	0.782
60	19.0	46.8	–3.6	0.106	0.107	–11.5	83.4	–57.2	0.743	0.371
61	7.2	40.6	–18.4	0.618	0.139	–37.4	193.5	–86.6	0.553	0.788
62	–20.7	2.8	–38.7	0.080	0.132	–67.2	86.4	–94.2	0.209	0.887
65	41.4	103.0	–1.5	0.060	0.184	15.9	345.8	–69.9	0.830	0.687
67	43.6	89.8	8.5	0.011	0.143	–23.8	10.2	–47.3	0.148	0.188
71	–10.9	67.8	–52.7	0.720	0.323	–38.6	54.5	–75.6	0.300	0.471
72	–15.5	9.7	–35.0	0.205	0.133	–55.0	32.2	–84.7	0.146	0.550
73	17.4	41.3	–2.4	0.089	0.095	–3.6	54.3	–39.7	0.879	0.240
74	12.3	33.5	–5.4	0.185	0.088	–25.9	14.0	–51.8	0.173	0.220
76	28.9	45.0	14.5	0.000	0.060	–7.1	43.3	–39.8	0.740	0.221
81	–24.5	7.4	–46.9	0.118	0.180	612.1	5,638.1	–11.6	0.065	1.065
82	4.0	45.5	–25.7	0.821	0.171	87.3	735.8	–58.0	0.411	0.763
92	–38.8	–18.2	–54.3	0.001	0.148	–63.1	–11.0	–84.7	0.027	0.449
95	–13.0	6.0	–28.6	0.166	0.101	–59.7	–34.3	–75.2	0.000	0.249
97	4.6	46.3	–25.2	0.791	0.171	–13.2	201.6	–75.0	0.824	0.635
99	25.7	77.5	–11.0	0.194	0.176	–36.3	21.1	–66.5	0.169	0.328
100	40.7	133.3	–15.1	0.185	0.258	54.9	250.1	–31.5	0.293	0.416
101	61.9	132.0	13.0	0.009	0.183	53.4	128.4	3.0	0.035	0.203
102	4.8	36.6	–19.6	0.728	0.135	135.9	1,506.8	–65.4	0.381	0.979
103	–49.8	–32.8	–62.5	0.000	0.149	–30.8	9.0	–56.0	0.113	0.232
106	–10.6	23.2	–35.1	0.493	0.164	–93.9	–84.3	–97.6	0.000	0.479
107	27.4	57.1	3.3	0.023	0.107	–29.6	15.7	–57.2	0.166	0.254
108	4.8	24.4	–11.6	0.588	0.087	11.9	36.1	–8.0	0.262	0.100
109	–11.3	21.3	–35.1	0.454	0.160	–72.8	–32.8	–89.0	0.005	0.461
110	11.2	44.6	–14.5	0.428	0.134	–56.5	–24.8	–74.9	0.003	0.280
111	–72.1	–46.9	–85.3	0.000	0.328	–97.0	–87.0	–99.3	0.000	0.752
112	–47.7	–34.4	–58.3	0.000	0.115	–70.2	–53.5	–80.9	0.000	0.227
113	–39.8	2.1	–64.5	0.060	0.270	–93.2	–66.0	–98.6	0.001	0.819
114	–42.1	–12.0	–61.9	0.011	0.213	–93.3	–70.6	–98.5	0.000	0.755
115	–6.2	57.9	–44.3	0.810	0.266	–73.6	–7.5	–92.4	0.037	0.639
116	–30.8	–5.6	–49.3	0.020	0.159	–89.0	–63.4	–96.7	0.000	0.613
118	–12.3	13.0	–32.0	0.311	0.130	–67.1	–40.0	–82.0	0.000	0.307
120	69.2	111.8	35.2	0.000	0.114	–30.0	20.0	–59.1	0.195	0.275
124	1.3	23.4	–16.8	0.897	0.101	–52.7	–25.9	–69.8	0.001	0.229
125	–29.7	–15.6	–41.5	0.000	0.093	–63.4	–44.9	–75.7	0.000	0.209
134	0.1	27.2	–21.2	0.993	0.122	–63.6	–20.9	–83.3	0.011	0.396
135	–4.0	22.2	–24.5	0.742	0.123	–50.4	–12.2	–72.0	0.016	0.292
136	18.3	61.5	–13.3	0.289	0.159	–5.2	53.5	–41.4	0.829	0.246
137	51.6	73.1	32.7	0.000	0.068	–26.2	32.8	–59.0	0.311	0.300
138	–9.2	17.4	–29.8	0.459	0.131	–54.7	–7.9	–77.7	0.029	0.362
139	2.8	41.9	–25.5	0.865	0.164	–60.8	–13.1	–82.3	0.021	0.406
145	13.4	50.3	–14.4	0.380	0.144	–23.9	109.7	–72.4	0.598	0.517
146	–10.6	33.7	–40.2	0.585	0.205	–62.8	45.4	–90.5	0.155	0.695

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
Total nitrogen—Continued										
147	–2.9	38.9	–32.1	0.874	0.183	–59.6	60.9	–89.8	0.199	0.705
148	2.1	28.0	–18.5	0.856	0.115	–67.0	–2.5	–88.8	0.045	0.552
149	1.7	22.0	–15.2	0.852	0.093	–60.2	–8.2	–82.8	0.031	0.427
150	27.3	71.2	–5.4	0.111	0.151	–64.2	–15.5	–84.8	0.019	0.438
151	4.7	24.4	–11.8	0.599	0.088	–12.5	92.7	–60.3	0.740	0.403
152	52.9	127.0	3.0	0.035	0.201	29.4	167.7	–37.4	0.487	0.371
153	–7.9	7.4	–21.1	0.295	0.079	–38.4	–11.8	–57.0	0.008	0.183
154	–29.0	6.3	–52.6	0.097	0.206	–49.5	15.5	–78.0	0.106	0.423
155	–26.1	7.3	–49.1	0.112	0.190	–53.6	–0.0	–78.5	0.050	0.392
156	–9.6	3.8	–21.3	0.153	0.071	–39.6	–15.2	–57.0	0.004	0.173
157	–16.9	1.3	–31.8	0.066	0.101	–13.4	66.5	–54.9	0.667	0.333
173	26.3	61.2	–1.0	0.060	0.124	–75.7	–15.6	–93.0	0.026	0.635
176	23.6	70.6	–10.4	0.197	0.164	–18.7	66.4	–60.3	0.571	0.365
179	5.8	40.9	–20.6	0.701	0.146	–1.6	58.8	–39.0	0.947	0.244
182	34.0	150.6	–28.4	0.360	0.319	–50.3	49.2	–83.4	0.213	0.561
196	4.6	28.1	–14.6	0.666	0.103	–33.7	150.8	–82.4	0.545	0.678
199	–8.9	50.0	–44.7	0.714	0.254	–20.7	370.9	–86.6	0.799	0.909
201	–2.6	81.2	–47.6	0.934	0.317	101.6	2,527.9	–84.5	0.593	1.310
202	–28.8	12.8	–55.1	0.148	0.235	–12.6	267.9	–79.2	0.854	0.733
208	–21.7	6.8	–42.6	0.122	0.158	–33.3	12.7	–60.5	0.131	0.268
209	–48.9	–34.5	–60.2	0.000	0.127	–56.6	–31.3	–72.6	0.000	0.234
210	–49.0	–33.3	–61.0	0.000	0.137	–54.7	–27.1	–71.8	0.001	0.242
212	–24.4	1.1	–43.5	0.059	0.149	–24.3	15.3	–50.3	0.195	0.215
213	–51.3	–40.7	–60.0	0.000	0.101	–58.5	–35.2	–73.4	0.000	0.227
214	–38.6	–24.5	–50.0	0.000	0.105	–47.7	–16.9	–67.1	0.006	0.236
215	–28.4	6.2	–51.7	0.097	0.201	–33.4	19.2	–62.8	0.171	0.297
217	–43.3	–25.6	–56.9	0.000	0.139	–57.9	–23.2	–76.9	0.005	0.307
218	–26.6	–16.2	–35.7	0.000	0.068	–43.2	–17.0	–61.1	0.003	0.193
219	–37.9	–10.9	–56.7	0.010	0.184	–66.1	–27.2	–84.2	0.006	0.390
220	–43.1	–18.4	–60.3	0.002	0.184	–31.0	6.7	–55.4	0.095	0.222
221	17.7	67.3	–17.2	0.365	0.179	14.9	85.4	–28.8	0.570	0.244
222	15.7	65.2	–19.0	0.423	0.182	1.0	101.7	–49.4	0.978	0.353
223	2.0	23.9	–16.0	0.842	0.099	–18.7	16.0	–43.0	0.254	0.181
224	23.1	95.7	–22.6	0.381	0.237	22.3	117.9	–31.4	0.495	0.295
225	6.8	39.7	–18.5	0.634	0.137	32.4	360.3	–61.9	0.659	0.636
227	–3.6	13.1	–17.7	0.654	0.081	–17.9	34.4	–49.8	0.433	0.251
228	–9.0	8.9	–24.0	0.305	0.092	–20.4	30.5	–51.4	0.366	0.252
231	6.0	17.9	–4.6	0.277	0.054	8.8	93.6	–38.9	0.775	0.294
232	–32.0	–18.4	–43.4	0.000	0.093	–22.4	63.7	–63.2	0.506	0.381
241	6.0	40.6	–20.2	0.688	0.144	–15.5	92.3	–62.9	0.688	0.419
242	171.5	600.0	5.3	0.039	0.483	115.7	207.6	51.3	0.000	0.181
243	9.0	60.5	–26.0	0.664	0.198	–10.0	80.0	–55.0	0.766	0.354
244	49.3	96.3	13.5	0.004	0.140	40.7	153.7	–22.0	0.257	0.301
Nitrate										
1	–12.4	16.6	–34.1	0.365	0.146	–29.7	7.8	–54.2	0.106	0.218
2	20.0	56.4	–8.0	0.179	0.135	–7.8	41.7	–40.1	0.710	0.219
3	–19.3	14.8	–43.3	0.233	0.180	–22.2	39.7	–56.7	0.400	0.299
4	8.5	31.7	–10.7	0.412	0.099	–2.4	29.8	–26.6	0.868	0.146
5	3.9	17.1	–7.8	0.528	0.061	–14.3	11.3	–34.1	0.246	0.133
6	–22.8	2.1	–41.6	0.070	0.143	–40.5	–13.3	–59.2	0.007	0.192
7	18.1	50.9	–7.6	0.184	0.125	–11.2	12.1	–29.6	0.318	0.119
8	9.9	44.4	–16.3	0.497	0.139	–13.3	11.7	–32.7	0.271	0.129

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
Site number (figure 1)	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
					Nitrate—Continued					
9	–26.1	20.4	–54.6	0.224	0.249	–34.1	39.7	–68.9	0.277	0.384
10	–11.7	11.5	–30.1	0.296	0.119	–17.8	2.8	–34.3	0.086	0.114
11	12.7	51.5	–16.2	0.430	0.151	7.4	127.4	–49.3	0.852	0.383
12	–13.4	16.3	–35.5	0.340	0.150	–24.4	–0.3	–42.7	0.048	0.141
13	–6.3	80.4	–51.3	0.845	0.334	9.3	186.4	–58.3	0.856	0.491
14	–1.3	30.6	–25.5	0.926	0.143	–2.2	116.2	–55.7	0.957	0.405
15	–10.1	6.0	–23.8	0.206	0.084	9.4	74.9	–31.6	0.707	0.239
16	–20.9	18.9	–47.4	0.260	0.208	–39.5	1.0	–63.7	0.054	0.261
17	30.1	139.2	–29.2	0.397	0.311	–29.8	155.8	–80.7	0.592	0.659
18	–6.4	46.7	–40.3	0.774	0.229	7.1	67.0	–31.3	0.761	0.227
19	–20.1	42.6	–55.2	0.448	0.296	–34.7	13.3	–62.3	0.130	0.281
20	28.7	76.6	–6.2	0.118	0.161	34.3	93.4	–6.7	0.113	0.186
21	3.0	36.5	–22.3	0.838	0.144	20.8	102.9	–28.1	0.476	0.265
22	9.7	55.3	–22.6	0.604	0.177	20.8	123.6	–34.8	0.548	0.314
23	–20.8	0.7	–37.7	0.057	0.122	–17.5	49.6	–54.5	0.526	0.304
24	–15.2	107.3	–65.3	0.717	0.456	–12.7	385.2	–84.3	0.877	0.875
25	3.1	33.6	–20.5	0.817	0.132	–11.0	27.9	–38.1	0.528	0.185
26	15.6	45.5	–8.1	0.214	0.117	–4.1	43.0	–35.7	0.839	0.204
29	–60.7	–36.6	–75.6	0.000	0.244	–69.8	–44.5	–83.5	0.000	0.310
31	–44.0	–19.3	–61.2	0.002	0.187	–40.6	1.0	–65.0	0.055	0.271
32	–1.1	62.3	–39.7	0.965	0.253	–21.3	117.2	–71.4	0.644	0.518
33	–24.2	–9.9	–36.3	0.002	0.089	–23.5	23.1	–52.5	0.269	0.243
34	–32.2	–3.7	–52.3	0.030	0.180	–51.2	–19.3	–70.5	0.005	0.257
35	–26.1	6.0	–48.4	0.100	0.184	–35.2	7.3	–60.8	0.092	0.257
36	3.2	26.4	–15.8	0.763	0.104	47.8	281.9	–42.8	0.420	0.484
37	–23.4	–14.0	–31.8	0.000	0.059	–39.3	4.6	–64.8	0.072	0.278
38	–10.3	5.2	–23.6	0.181	0.082	–9.3	50.9	–45.5	0.708	0.260
39	–9.5	–1.2	–17.1	0.026	0.045	–42.7	22.8	–73.2	0.152	0.388
40	–41.7	–6.5	–63.7	0.025	0.241	–56.7	86.7	–89.9	0.262	0.745
41	–29.6	130.1	–78.5	0.561	0.604	–59.5	289.6	–95.8	0.434	1.155
42	6.7	26.6	–10.1	0.457	0.087	–43.2	54.8	–79.2	0.269	0.512
43	23.2	54.0	–1.5	0.068	0.114	–43.0	113.5	–84.8	0.405	0.673
44	–43.6	14.0	–72.1	0.111	0.359	–63.1	54.0	–91.1	0.172	0.728
45	–13.9	10.5	–32.8	0.240	0.127	–44.9	50.4	–79.8	0.245	0.512
50	14.7	122.3	–40.8	0.685	0.338	–43.0	–5.9	–65.5	0.028	0.256
65	49.4	274.1	–40.3	0.391	0.468	22.4	172.6	–45.0	0.620	0.408
66	–11.3	4.9	–25.0	0.162	0.086	–43.2	3.4	–68.8	0.064	0.306
71	85.4	262.6	–5.3	0.071	0.342	27.8	227.6	–50.2	0.610	0.480
72	–41.7	–24.4	–54.9	0.000	0.132	–68.9	–13.9	–88.8	0.025	0.520
73	–8.9	15.9	–28.5	0.447	0.123	–25.2	19.7	–53.3	0.226	0.240
74	14.0	72.5	–24.7	0.535	0.211	–24.8	25.8	–55.0	0.277	0.262
76	49.8	141.6	–7.2	0.098	0.244	8.0	136.3	–50.6	0.847	0.400
81	41.2	313.1	–51.7	0.528	0.548	1,219.4	21,128.4	–18.0	0.069	1.417
82	–56.3	52.0	–87.4	0.193	0.636	–21.2	530.1	–90.2	0.822	1.061
88	–30.4	162.4	–81.5	0.593	0.677	–72.4	152.3	–97.0	0.254	1.129
92	–59.4	–36.8	–73.9	0.000	0.225	–75.5	–32.7	–91.1	0.006	0.516
95	–24.5	–1.7	–42.0	0.037	0.135	–65.0	–40.9	–79.3	0.000	0.267
96	–49.1	–26.8	–64.7	0.000	0.186	–53.3	–30.7	–68.5	0.000	0.201
98	–5.9	80.3	–50.8	0.856	0.332	–56.3	–32.8	–71.5	0.000	0.219
99	–47.7	29.8	–78.9	0.162	0.463	–73.5	–16.4	–91.6	0.024	0.586
100	–72.6	–53.5	–83.8	0.000	0.269	–69.8	–25.0	–87.8	0.010	0.464
101	51.4	130.8	–0.7	0.054	0.215	43.4	122.2	–7.5	0.107	0.224

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
Nitrate—Continued										
102	–67.1	25.7	–91.4	0.104	0.684	–25.9	1,081.4	–95.4	0.832	1.413
103	–56.4	–33.7	–71.3	0.000	0.214	–39.9	–19.1	–55.3	0.001	0.151
104	–65.4	–28.5	–83.3	0.004	0.371	–80.4	–58.0	–90.8	0.000	0.388
105	15.1	111.6	–37.4	0.651	0.311	–56.2	38.1	–86.1	0.159	0.586
106	–1.9	50.4	–36.0	0.931	0.218	–93.3	–85.0	–97.0	0.000	0.409
107	24.5	57.8	–1.7	0.069	0.121	–31.2	10.0	–57.0	0.118	0.239
108	8.2	25.8	–7.0	0.308	0.077	15.4	35.4	–1.6	0.077	0.081
109	–47.0	–22.1	–63.9	0.001	0.197	–83.8	–60.8	–93.3	0.000	0.449
110	–62.0	–22.5	–81.4	0.008	0.364	–85.2	–61.0	–94.3	0.000	0.493
111	–92.8	–62.2	–98.6	0.002	0.848	–99.3	–91.4	–99.9	0.000	1.239
112	–66.8	–47.0	–79.2	0.000	0.239	–81.1	–65.0	–89.8	0.000	0.315
113	–74.7	–10.7	–92.8	0.033	0.644	–97.1	–71.5	–99.7	0.002	1.173
114	–62.0	19.1	–87.9	0.097	0.583	–95.6	–58.9	–99.5	0.006	1.141
115	–21.4	151.1	–75.4	0.685	0.593	–77.9	45.0	–96.6	0.116	0.958
116	–79.9	–58.2	–90.3	0.000	0.373	–96.8	–85.2	–99.3	0.000	0.779
117	–50.0	–19.0	–69.1	0.005	0.246	–83.4	–58.3	–93.4	0.000	0.471
118	–49.0	–23.7	–65.9	0.001	0.205	–80.9	–62.4	–90.2	0.000	0.344
119	–51.3	–11.8	–73.1	0.018	0.303	–26.5	61.7	–66.5	0.445	0.402
120	86.8	158.1	35.1	0.000	0.165	–22.7	38.9	–57.0	0.389	0.299
121	23.4	105.1	–25.8	0.418	0.259	–37.4	82.3	–78.5	0.390	0.546
122	–20.0	20.8	–47.0	0.289	0.210	–73.8	–36.1	–89.2	0.003	0.454
123	–12.5	16.5	–34.3	0.360	0.146	–60.1	–23.7	–79.1	0.005	0.330
124	17.0	42.6	–3.9	0.118	0.101	–45.4	–14.6	–65.1	0.008	0.228
125	–27.3	–12.5	–39.6	0.001	0.095	–62.2	–41.7	–75.4	0.000	0.220
126	–15.4	45.2	–50.7	0.545	0.275	–29.3	55.5	–67.9	0.388	0.403
127	63.4	201.1	–11.4	0.116	0.312	353.1	1,463.1	31.3	0.017	0.632
128	5.6	36.9	–18.5	0.681	0.132	–43.6	24.7	–74.5	0.157	0.405
129	303.8	813.7	78.5	0.001	0.417	246.7	791.7	34.8	0.010	0.482
130	22.3	74.9	–14.4	0.269	0.182	–13.8	65.4	–55.1	0.654	0.333
131	50.7	95.1	16.4	0.002	0.132	35.8	103.0	–9.2	0.136	0.205
132	–48.5	–34.7	–59.4	0.000	0.121	–46.3	14.8	–74.8	0.109	0.387
133	–55.0	–46.9	–61.8	0.000	0.084	–56.0	–13.1	–77.7	0.018	0.347
134	2.9	33.9	–20.9	0.829	0.134	–62.6	–16.6	–83.2	0.016	0.409
135	–20.0	12.1	–42.8	0.195	0.172	–58.7	–26.1	–76.9	0.003	0.297
136	20.1	69.5	–14.8	0.296	0.176	–3.7	53.5	–39.6	0.873	0.238
137	51.9	72.6	33.7	0.000	0.065	–26.0	31.0	–58.2	0.301	0.291
138	–23.2	1.7	–42.0	0.065	0.143	–61.7	–21.1	–81.4	0.009	0.368
139	0.3	39.3	–27.8	0.988	0.168	–61.8	–15.6	–82.7	0.017	0.404
140	264.3	960.6	25.1	0.018	0.545	–33.7	417.8	–91.5	0.695	1.048
141	–44.1	53.4	–79.6	0.259	0.515	–63.9	162.5	–95.0	0.314	1.012
142	–45.7	2.5	–71.3	0.059	0.324	–88.4	–28.4	–98.1	0.020	0.928
143	4.1	99.5	–45.7	0.904	0.332	–53.6	–6.2	–77.1	0.032	0.360
144	56.4	180.7	–12.8	0.134	0.298	–18.0	23.6	–45.6	0.344	0.209
145	35.4	147.2	–25.9	0.324	0.307	–9.2	208.6	–73.3	0.878	0.624
146	80.8	220.3	2.0	0.043	0.292	–24.7	270.7	–84.7	0.727	0.813
147	76.7	233.4	–6.4	0.079	0.324	–26.5	254.6	–84.7	0.702	0.802
148	–24.2	33.8	–57.0	0.340	0.290	–75.5	–0.7	–93.9	0.049	0.713
149	–56.3	–20.6	–75.9	0.007	0.304	–82.9	–51.5	–94.0	0.001	0.532
150	–56.9	14.2	–83.7	0.090	0.496	–87.9	–48.6	–97.1	0.004	0.735
151	–46.2	–10.8	–67.5	0.016	0.258	–55.1	21.7	–83.4	0.115	0.508
152	0.9	60.6	–36.6	0.969	0.237	–14.6	94.7	–62.5	0.708	0.420
153	–20.8	–4.1	–34.6	0.017	0.098	–47.0	–21.2	–64.4	0.002	0.202

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Non-flow-adjusted trend in concentration from 1993 to 2003					Trend in load from 1993 to 2003				
Site number (figure 1)	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error	Modeled estimate, in percent from 1993 to 2003	Upper 95-percent CI, in percent from 1993 to 2003	Lower 95-percent CI, in percent from 1993 to 2003	p-value	Standard error
					Nitrate—Continued					
154	–30.8	–0.2	–52.0	0.049	0.187	–50.8	9.5	–77.9	0.082	0.408
155	–32.3	–6.8	–50.8	0.017	0.163	–57.4	–12.2	–79.4	0.021	0.369
156	–20.2	–0.9	–35.7	0.041	0.110	–47.2	–22.2	–64.2	0.001	0.198
157	26.6	95.2	–17.9	0.286	0.221	32.0	147.4	–29.5	0.386	0.320
158	–30.0	8.5	–54.9	0.110	0.224	–36.3	28.4	–68.3	0.207	0.357
159	–6.8	63.7	–46.9	0.807	0.287	–25.4	87.6	–70.3	0.534	0.471
160	11.6	92.1	–35.1	0.691	0.277	2.2	140.3	–56.6	0.961	0.436
161	–44.5	106.6	–85.1	0.380	0.670	–94.3	101.9	–99.8	0.115	1.820
162	–22.1	110.3	–71.1	0.622	0.507	–35.8	1,108.6	–96.6	0.767	1.498
163	23.8	126.4	–32.3	0.489	0.308	–28.8	38.7	–63.5	0.318	0.340
164	–99.5	–97.9	–99.9	0.000	0.703	–100.0	–99.9	–100.0	0.000	1.155
167	52.2	263.0	–36.2	0.344	0.444	693.9	29,857.9	–79.0	0.263	1.852
168	99.2	272.1	6.6	0.031	0.319	637.6	13,902.3	–61.2	0.183	1.502
172	–17.0	34.5	–48.8	0.449	0.247	38.2	101.8	–5.3	0.094	0.193
174	–31.6	23.4	–62.1	0.207	0.301	–55.5	24.2	–84.0	0.122	0.523
175	20.5	54.5	–6.1	0.143	0.127	–45.9	–22.2	–62.4	0.001	0.186
177	6.2	67.0	–32.5	0.796	0.231	–32.9	19.0	–62.2	0.173	0.292
181	165.0	347.3	56.9	0.000	0.267	–32.8	10.7	–59.1	0.119	0.254
187	–40.1	–15.2	–57.7	0.004	0.178	–68.1	–3.6	–89.4	0.043	0.564
189	14.4	88.1	–30.4	0.596	0.254	–46.4	–5.1	–69.7	0.032	0.291
190	116.0	239.6	37.4	0.001	0.231	35.6	132.9	–21.0	0.269	0.276
191	337.2	700.0	138.9	0.000	0.308	137.0	391.4	14.3	0.020	0.372
192	–65.2	–46.2	–77.6	0.000	0.223	–36.3	4.4	–61.1	0.073	0.251
194	11.0	57.4	–21.8	0.560	0.178	–29.1	58.9	–68.3	0.404	0.412
195	–21.6	–2.5	–36.9	0.029	0.111	–44.3	53.3	–79.8	0.258	0.517
197	–67.8	–56.9	–75.9	0.000	0.148	–82.5	–55.2	–93.1	0.000	0.478
198	10.1	46.8	–17.5	0.514	0.147	15.2	309.7	–67.6	0.827	0.647
199	4.0	34.8	–19.8	0.767	0.133	–9.4	201.1	–72.7	0.872	0.613
200	–1.3	20.5	–19.1	0.901	0.102	–37.5	53.1	–74.5	0.304	0.457
201	38.4	323.3	–54.8	0.569	0.570	186.3	1,474.1	–47.9	0.226	0.870
205	–7.0	10.8	–21.9	0.419	0.089	–7.8	38.5	–38.6	0.694	0.208
207	–2.7	34.4	–29.5	0.870	0.164	–15.1	46.3	–50.7	0.556	0.277
208	–24.1	7.3	–46.3	0.118	0.177	–35.4	12.7	–62.9	0.124	0.284
209	–38.2	–17.6	–53.6	0.001	0.146	–47.5	–16.2	–67.0	0.007	0.238
210	–25.8	–8.1	–40.1	0.006	0.109	–34.0	0.1	–56.5	0.051	0.213
213	–42.9	–28.9	–54.1	0.000	0.112	–51.3	–25.2	–68.3	0.001	0.219
215	28.4	93.8	–14.9	0.234	0.210	19.3	129.4	–37.9	0.596	0.333
217	–13.4	77.7	–57.8	0.694	0.367	–35.7	39.1	–70.3	0.262	0.394
218	–25.6	–13.2	–36.2	0.000	0.079	–42.4	–15.8	–60.6	0.004	0.193
224	–11.5	48.2	–47.2	0.642	0.263	–12.1	62.2	–52.4	0.680	0.313
225	–5.8	56.8	–43.4	0.820	0.260	16.9	383.5	–71.7	0.829	0.724
226	12.2	44.0	–12.6	0.368	0.128	–38.7	59.3	–76.4	0.315	0.487
228	–35.2	–13.3	–51.5	0.003	0.148	–43.3	0.1	–67.9	0.050	0.290
229	–59.6	–47.4	–69.0	0.000	0.135	–55.1	–27.3	–72.2	0.001	0.245
234	3.4	53.4	–30.3	0.868	0.201	–1.1	49.5	–34.6	0.957	0.211
235	5.1	77.7	–37.8	0.853	0.268	0.5	204.1	–66.8	0.993	0.565
237	8.5	87.0	–37.1	0.769	0.278	–32.4	56.2	–70.8	0.359	0.428
238	56.4	178.1	–12.1	0.128	0.294	46.2	89.3	12.9	0.004	0.132
239	0.7	19.7	–15.3	0.938	0.088	2.7	50.4	–29.8	0.889	0.194
240	–50.6	–17.7	–70.4	0.007	0.261	–72.7	–21.4	–90.5	0.016	0.539
241	10.9	54.5	–20.5	0.543	0.169	–11.6	88.6	–58.6	0.750	0.387
242	170.7	635.3	–0.4	0.051	0.510	115.1	197.6	55.4	0.000	0.166
243	17.1	117.4	–36.9	0.617	0.316	–3.5	54.0	–39.5	0.881	0.238
244	–31.7	–7.7	–49.5	0.013	0.154	–35.7	10.2	–62.4	0.108	0.275

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Total phosphorus						
1	11/10/1992	9/3/2003	105	7	34.5	113	AMLE	8	2.421	–1.828	0.138
2	10/20/1992	9/4/2003	106	5	35	88	AMLE	9	–1.970	–0.590	0.047
3	11/10/1992	9/3/2003	104	2	35	91	AMLE	9	0.174	–0.989	0.070
4	11/16/1992	9/25/2003	153	4	25	74	AMLE	8	15.971	–3.989	0.206
5	3/25/1993	9/15/2003	94	0	32	580	OLS	8	–3.061	–0.229	0.141
7	11/19/1992	9/23/2003	91	0	44	139	OLS	9	7.081	–2.474	0.154
8	11/19/1992	9/17/2003	108	0	33	85	OLS	3	1.591	–0.573	--
10	10/16/1992	9/16/2003	90	0	44	77	OLS	9	2.162	–0.876	0.049
11	11/13/1992	7/8/2003	53	9	69.5	142	AMLE	3	–4.129	0.046	--
12	11/18/1992	9/10/2003	91	0	42.5	78	OLS	9	0.418	0.200	–0.067
13	10/14/1992	7/28/2003	58	13	75	189	AMLE	7	–4.429	0.066	--
14	10/14/1992	9/30/2003	196	13	15	79	AMLE	8	–4.370	0.513	–0.060
15	4/8/1993	8/4/2003	138	3	28	115	AMLE	8	10.097	–3.553	0.234
16	11/12/1992	8/27/2003	48	2	86	156	AMLE	9	–1.696	–0.624	0.055
17	11/9/1992	8/27/2003	50	10	90	122	AMLE	3	–3.931	–0.033	--
18	10/27/1992	8/20/2003	47	0	90	183	OLS	8	2.847	–1.679	0.130
19	10/29/1992	8/12/2003	82	0	28	414	OLS	8	–1.890	0.785	–0.101
20	2/9/1993	8/13/2003	49	0	85.5	127	OLS	9	–1.204	1.015	–0.185
22	11/24/1992	9/4/2003	49	1	80	133	AMLE	8	–2.234	–0.277	0.062
24	11/5/1992	9/4/2003	76	9	47	131	AMLE	9	–3.372	–0.395	0.113
25	2/17/1993	8/5/2003	47	0	84	148	OLS	5	6.332	–2.458	0.187
26	11/18/1992	9/9/2003	110	0	29	133	OLS	8	10.934	–3.477	0.234
27	10/28/1992	9/3/2003	50	3	84	119	AMLE	9	–7.117	1.115	–0.040
28	11/25/1992	8/21/2003	51	17	78	128	AMLE	9	–14.259	3.636	–0.331
30	11/17/1992	8/19/2003	50	12	71	496	AMLE	7	–5.583	0.270	--
31	10/19/1992	9/3/2003	49	11	81	132	AMLE	9	1.270	–1.737	0.130
32	10/21/1992	9/2/2003	50	4	84	119	AMLE	8	–1.771	–0.897	0.106
33	10/22/1992	9/4/2003	94	0	35	119	OLS	8	24.946	–6.163	0.341
34	11/18/1992	8/7/2003	86	0	35	120	OLS	8	–1.047	–0.523	0.111
35	11/30/1992	8/7/2003	82	0	35	124	OLS	8	–0.627	–0.956	0.162
36	11/3/1992	9/16/2003	185	6	20	86	AMLE	9	–3.989	0.112	0.022
37	11/18/1992	9/24/2003	255	11	14	79	AMLE	8	5.929	–2.243	0.129
38	11/17/1992	9/19/2003	295	0	11	63	OLS	9	–3.034	0.016	0.015
39	4/15/1993	9/3/2003	278	0	8	56	OLS	8	–1.485	–0.427	0.054
40	11/18/1992	9/20/2003	150	3	26	208	AMLE	9	1.473	–1.340	0.096
41	10/19/1992	9/23/2003	341	1	10	405	AMLE	8	–3.626	–0.558	0.087
42	10/14/1992	9/25/2003	413	0	7	42	OLS	9	–0.920	–0.573	0.045
43	10/14/1992	9/24/2003	410	0	7	63	OLS	9	–3.368	0.010	0.008
44	10/28/1992	9/25/2003	358	0	9	60	OLS	9	5.486	–2.171	0.142
45	10/8/1992	9/25/2003	417	0	8.5	42	OLS	9	–2.749	–0.370	0.043
46	10/8/1992	8/21/2003	83	55	47	179	AMLE	9	–3.712	–0.017	0.034
51	10/1/1992	6/24/2003	115	11	28	344	AMLE	9	1.923	–0.630	0.018
52	10/20/1992	9/11/2003	87	7	32	415	AMLE	9	–20.344	5.285	–0.389
53	10/28/1992	9/25/2003	132	14	28	141	AMLE	9	–7.464	0.974	–0.051
54	10/28/1992	9/11/2003	123	5	28	259	AMLE	9	–7.821	1.432	–0.097
55	10/21/1992	9/17/2003	119	5	28	400	AMLE	9	–2.077	–0.015	–0.006
56	10/29/1992	9/22/2003	123	2	28	300	AMLE	9	–1.400	–0.032	–0.015
58	10/29/1992	9/8/2003	60	0	61	272	OLS	9	–0.641	0.060	0.003
59	10/28/1992	9/25/2003	82	0	35	315	OLS	9	–0.156	0.053	–0.009
60	10/21/1992	9/10/2003	103	0	31.5	153	OLS	9	–1.986	0.270	–0.012
61	10/21/1992	9/10/2003	63	0	56	162	OLS	9	–0.102	–0.201	0.039
62	10/26/1992	9/9/2003	64	0	56	152	OLS	9	–0.771	–0.005	0.012
63	10/26/1992	9/9/2003	64	1	56	160	AMLE	9	–8.183	2.032	–0.140
64	10/21/1992	9/24/2003	125	84	28	180	AMLE	9	–2.983	–0.304	0.022

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibration data set						Properties of the calibrated model				
	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Total phosphorus—Continued						
65	6/3/1993	9/3/2003	140	0	25	210	OLS	9	1.692	–0.939	0.052
66	3/9/1993	9/9/2003	167	73	17	135	AMLE	9	–4.909	0.032	0.089
68	10/22/1992	9/10/2003	123	34	28	237	AMLE	9	–1.585	–0.316	0.014
69	11/5/1992	9/10/2003	78	14	28	1,503	AMLE	9	–3.598	–0.063	0.016
70	10/28/1992	9/3/2003	125	1	28	258	AMLE	9	3.714	–1.310	0.075
71	10/13/1992	9/23/2003	98	0	35	70	OLS	3	–4.000	0.206	--
72	1/15/1993	9/2/2003	154	58	21	182	AMLE	9	–3.901	0.072	0.083
73	10/20/1992	9/9/2003	124	0	21	177	OLS	8	4.692	–1.760	0.097
74	3/4/1993	9/15/2003	110	51	21	1,541	AMLE	3	–4.734	0.236	--
75	1/8/1993	8/20/2003	662	9	4	49	AMLE	8	–1.938	–0.208	0.042
76	4/6/1993	9/16/2003	168	5	20	127	AMLE	8	0.518	–1.099	0.103
77	1/4/1993	7/21/2003	606	4	2	62	AMLE	9	–0.530	–0.867	0.147
78	1/3/1993	7/21/2003	496	95	3	78	AMLE	7	–4.630	0.541	--
79	1/3/1993	12/16/2002	545	44	3	64	AMLE	8	–2.637	–0.027	0.074
80	1/4/1993	12/30/2002	1,313	177	3	31	AMLE	8	–2.757	–0.240	0.062
81	3/8/1993	9/26/2003	85	1	36	147	AMLE	9	–1.627	–0.310	0.045
82	2/17/1993	9/11/2003	71	1	46	142	AMLE	9	–0.697	–0.584	0.074
83	1/19/1993	9/25/2003	198	4	14	107	AMLE	9	–2.933	0.578	–0.063
84	1/4/1993	9/26/2003	775	23	2	54	AMLE	9	–7.761	2.537	–0.207
85	1/4/1993	9/26/2003	738	1	2	157	AMLE	5	–2.142	0.691	–0.051
86	1/4/1993	9/15/2003	855	47	1	42	AMLE	8	–2.269	0.455	–0.030
87	1/6/1993	9/3/2003	115	18	29	272	AMLE	8	–3.562	0.185	0.020
88	1/6/1993	9/3/2003	59	4	62	440	AMLE	7	–4.236	0.440	--
89	1/5/1993	8/14/2003	96	9	34	741	AMLE	8	–2.304	–0.551	0.095
90	1/11/1993	8/20/2003	112	0	28	694	OLS	9	7.048	–2.137	0.152
91	1/8/1993	8/20/2003	92	0	35	694	OLS	9	8.396	–2.244	0.136
92	1/5/1993	9/23/2003	122	31	32	72	AMLE	9	–3.211	0.123	0.018
93	1/14/1993	8/18/2003	127	0	28	131	OLS	9	–20.667	4.046	–0.206
94	1/19/1993	9/4/2003	63	45	58.5	469	AMLE	5	0.535	–1.538	0.144
95	11/11/1992	9/10/2003	141	0	23.5	131	OLS	3	–8.884	0.612	--
97	10/15/1992	8/13/2003	46	17	63	250	AMLE	8	–3.985	0.019	0.073
99	10/8/1992	9/9/2003	113	9	27	197	AMLE	7	–8.059	0.609	--
101	10/7/1992	9/9/2003	70	0	43	176	OLS	8	–76.708	21.784	–1.586
106	4/13/1993	9/24/2003	74	0	20	2,131	OLS	810	–2.998	0.501	–0.030
107	4/7/1993	9/23/2003	131	0	28	456	OLS	7	0.364	–0.102	--
109	4/15/1993	9/16/2003	129	0	27	615	OLS	5	–2.359	–0.037	0.068
110	11/13/1992	9/19/2003	150	0	22	210	OLS	7	–4.846	0.448	--
111	11/10/1992	7/24/2003	94	2	31	433	AMLE	7	–4.354	0.515	--
112	11/10/1992	9/24/2003	119	0	29	433	OLS	7	–7.402	0.552	--
113	11/12/1992	9/9/2003	111	1	29	433	AMLE	8	–6.610	0.986	–0.038
114	11/12/1992	9/11/2003	94	6	35	433	AMLE	7	–4.345	0.403	--
115	11/17/1992	9/8/2003	84	23	43	493	AMLE	8	–2.870	–0.429	0.081
118	11/24/1992	9/9/2003	131	1	22	138	AMLE	3	–9.624	0.720	--
120	4/26/1993	9/3/2003	126	34	28	119	AMLE	8	–2.272	–0.831	0.167
134	11/18/1992	9/9/2003	96	3	34	874	AMLE	9	1.531	–1.206	0.088
135	10/7/1992	9/2/2003	103	1	31.5	358	AMLE	8	1.622	–1.192	0.103
136	10/16/1996	8/28/2003	58	0	42	91	OLS	8	3.031	–1.942	0.240
137	10/6/1992	8/31/2003	98	0	35	353	OLS	8	–2.022	–0.265	0.058
138	10/14/1992	9/3/2003	118	5	30	327	AMLE	8	–2.066	–0.516	0.070
139	10/13/1992	9/3/2003	105	37	33	355	AMLE	8	–3.789	–0.382	0.082
145	11/18/1992	8/4/2003	89	0	48	127	OLS	5	–2.573	0.014	0.013
148	10/14/1992	8/5/2003	72	4	52	120	AMLE	8	–3.216	–0.013	0.025
149	12/17/1992	9/2/2003	92	0	33	156	OLS	9	0.227	–0.762	0.047

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibration data set						Properties of the calibrated model				
	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Total phosphorus—Continued						
150	10/21/1992	9/3/2003	98	0	33	411	OLS	7	–5.447	0.550	--
151	10/27/1992	9/23/2003	122	2	29	76	AMLE	8	–2.820	–0.352	0.038
152	11/17/1992	8/27/2003	60	21	63	156	AMLE	3	–3.737	0.048	--
153	10/14/1992	9/23/2003	139	0	22	106	OLS	5	–82.855	12.366	–0.470
154	10/12/1992	9/23/2003	132	0	28	43	OLS	7	–4.780	0.388	--
155	11/16/1992	9/23/2003	98	0	35	70	OLS	3	–3.275	0.158	--
156	11/19/1992	9/24/2003	142	0	21	102	OLS	5	–45.724	6.914	–0.271
157	10/12/1992	8/13/2003	108	0	28	126	OLS	8	0.394	–0.645	0.061
165	11/18/1992	4/16/2003	55	1	63	182	AMLE	7	–1.769	0.056	--
166	11/18/1992	4/16/2003	58	12	63	182	AMLE	5	1.341	–1.769	0.176
169	10/13/1992	4/24/2003	56	22	62	305	AMLE	5	–3.862	–0.079	0.059
170	10/14/1992	4/2/2003	70	0	56	183	OLS	3	–2.041	0.099	--
171	10/14/1992	4/2/2003	55	1	62	253	AMLE	3	–2.386	0.143	--
173	10/27/1992	8/20/2003	78	1	36	169	AMLE	8	–4.425	0.638	–0.049
177	10/30/1992	8/15/2003	65	6	57.5	112	AMLE	8	26.004	–7.828	0.519
178	10/28/1992	7/1/2003	80	5	47	174	AMLE	7	–5.351	0.290	--
180	5/5/1993	9/16/2003	92	5	36	217	AMLE	5	–2.466	–1.251	0.484
182	10/21/1992	9/3/2003	61	5	63	116	AMLE	7	–8.551	1.279	--
183	10/8/1992	9/10/2003	55	3	71	181	AMLE	8	–12.425	2.453	–0.102
184	10/27/1992	8/1/2003	96	29	32	199	AMLE	8	–21.185	4.018	–0.166
185	10/27/1992	7/29/2003	76	18	36	218	AMLE	7	–8.515	0.884	--
186	10/22/1992	8/19/2003	74	12	45	156	AMLE	9	–6.931	0.005	0.053
188	10/20/1992	9/23/2003	88	0	42	169	OLS	9	–0.649	–0.233	0.007
193	10/14/1992	9/17/2003	88	1	42	273	AMLE	9	–3.967	0.381	–0.020
203	10/20/1992	9/23/2003	128	3	28	64	AMLE	9	20.789	–6.708	0.462
204	10/21/1992	9/22/2003	130	24	28	70	AMLE	8	54.977	–13.093	0.722
205	10/19/1992	9/22/2003	131	27	28	64	AMLE	9	14.900	–4.552	0.272
206	10/21/1992	9/24/2003	128	1	28	63	AMLE	9	10.082	–3.950	0.294
207	10/19/1992	9/24/2003	131	34	28	63	AMLE	9	–2.440	–0.737	0.075
208	10/21/1992	8/6/2003	57	0	69.5	113	OLS	8	24.079	–5.270	0.259
209	10/21/1992	8/12/2003	129	0	30	84	OLS	9	12.711	–3.445	0.191
210	10/20/1992	8/12/2003	130	0	30	62	OLS	8	15.363	–4.269	0.246
211	10/20/1992	8/12/2003	57	0	70.5	105	OLS	5	10.364	–3.658	0.238
212	10/26/1992	8/18/2003	64	0	63	175	OLS	5	67.553	–16.251	0.942
213	10/21/1992	8/12/2003	129	0	30	84	OLS	9	18.191	–4.505	0.239
214	10/21/1992	8/11/2003	133	0	29	84	OLS	9	27.947	–5.959	0.289
215	10/21/1992	8/6/2003	57	0	69.5	113	OLS	8	165.710	–28.614	1.210
216	10/27/1992	9/24/2003	130	3	28	63	AMLE	8	25.568	–7.666	0.513
217	10/20/1992	8/12/2003	56	0	71	105	OLS	9	–1.111	–0.599	0.052
218	10/28/1992	8/11/2003	57	0	69	204	OLS	8	–0.239	–1.251	0.175
219	10/14/1992	9/3/2003	64	0	63	176	OLS	5	–1.639	–0.821	0.083
220	10/26/1992	8/18/2003	75	0	56	158	OLS	8	–2.348	–0.291	0.050
221	11/18/1992	9/8/2003	117	8	27	216	AMLE	9	9.727	–4.371	0.350
222	10/7/1992	9/3/2003	112	22	27	216	AMLE	8	6.915	–2.664	0.153
223	11/4/1992	9/24/2003	136	0	28	84	OLS	8	40.473	–9.217	0.491
224	11/2/1992	9/16/2003	93	1	35	130	AMLE	5	6.938	–2.127	0.109
225	12/21/1992	9/3/2003	164	0	27	118	OLS	8	–1.324	–0.497	0.069
227	11/16/1992	9/10/2003	145	0	27	91	OLS	9	31.739	–6.845	0.337
228	11/19/1992	9/8/2003	118	6	28	195	AMLE	8	70.349	–12.467	0.526
229	10/28/1992	9/23/2003	130	25	28	63	AMLE	9	–0.100	–1.543	0.142
230	10/5/1992	9/10/2003	128	0	28	62	OLS	8	4.075	–2.340	0.217
231	10/5/1992	9/29/2003	423	0	7	29	OLS	9	–4.364	0.628	–0.043
232	10/1/1992	9/29/2003	449	92	7	29	AMLE	9	–1.010	–0.900	0.092

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Total phosphorus—Continued						
233	10/12/1992	9/10/2003	130	0	28	63	OLS	8	7.713	–2.583	0.167
234	10/12/1992	9/8/2003	127	34	28	91	AMLE	9	5.819	–2.761	0.191
235	10/12/1992	9/8/2003	126	50	28	67	AMLE	9	3.785	–2.423	0.177
236	10/13/1992	9/9/2003	129	53	28	65	AMLE	9	2.631	–2.228	0.177
237	10/13/1992	9/9/2003	126	9	28	91	AMLE	9	2.512	–2.021	0.157
238	10/6/1992	9/8/2003	130	8	28	63	AMLE	9	6.597	–2.143	0.115
239	10/7/1992	9/7/2003	132	69	28	43	AMLE	3	–6.975	0.202	--
241	12/15/1992	9/17/2003	261	0	10.5	211	OLS	7	–1.688	0.015	--
242	1/21/1993	9/17/2003	156	0	14	212	OLS	7	–0.575	–0.306	--
243	10/2/1992	9/12/2003	333	0	9	44	OLS	9	–5.806	1.085	–0.070
244	12/16/1992	9/23/2003	202	1	14	160	AMLE	7	–4.836	0.182	--
					Total nitrogen						
1	11/10/1992	9/3/2003	104	0	34	113	OLS	5	2.803	–0.896	0.059
2	10/20/1992	9/4/2003	104	1	34	175	AMLE	3	0.812	–0.252	--
3	11/10/1992	9/3/2003	102	0	35	184	OLS	3	0.547	–0.098	--
4	11/16/1992	9/25/2003	153	1	25	74	AMLE	7	1.534	–0.210	--
5	3/25/1993	9/15/2003	94	0	32	580	OLS	8	2.065	–0.286	0.028
6	11/19/1992	7/2/2003	59	11	72.5	173	AMLE	3	–0.459	–0.109	--
7	11/19/1992	9/23/2003	89	0	43	173	OLS	9	4.161	–0.881	0.038
8	11/19/1992	9/17/2003	107	0	32.5	131	OLS	7	3.182	–0.415	--
9	11/9/1992	7/17/2003	58	6	77	186	AMLE	9	–2.819	0.571	–0.040
10	10/16/1992	9/16/2003	88	0	44	185	OLS	7	3.203	–0.401	--
11	11/13/1992	7/8/2003	53	0	69.5	142	OLS	7	–0.392	0.005	--
12	11/18/1992	9/10/2003	89	0	42	173	OLS	9	6.322	–1.310	0.066
13	10/14/1992	7/28/2003	56	7	76	189	AMLE	3	–1.046	0.011	--
14	10/14/1992	9/30/2003	195	4	15	97	AMLE	8	–1.074	0.368	–0.045
15	4/8/1993	8/4/2003	137	0	28	115	OLS	8	2.773	–0.734	0.048
16	11/12/1992	8/27/2003	46	0	89	156	OLS	5	1.509	–0.610	0.064
17	11/9/1992	8/27/2003	50	1	90	122	AMLE	8	–0.900	0.229	–0.042
18	10/27/1992	8/20/2003	48	0	89	187	OLS	5	4.421	–1.284	0.091
19	10/29/1992	8/12/2003	82	0	28	414	OLS	8	0.635	0.580	–0.080
20	11/4/1992	8/13/2003	50	0	86	127	OLS	5	0.003	1.251	–0.192
21	11/18/1992	8/28/2003	50	0	83	126	OLS	3	0.331	0.076	--
22	11/24/1992	9/4/2003	48	0	84	133	OLS	8	0.672	–0.208	0.033
23	11/5/1992	8/5/2003	50	0	83	145	OLS	3	0.094	–0.031	--
24	11/5/1992	9/4/2003	74	1	47	183	AMLE	5	–0.588	0.568	–0.055
25	11/19/1992	8/5/2003	48	0	85	148	OLS	3	2.305	–0.219	--
26	11/18/1992	9/9/2003	112	0	29	133	OLS	8	5.553	–1.198	0.074
29	11/24/1992	8/19/2003	49	5	83.5	138	AMLE	5	–6.375	1.802	–0.139
31	10/19/1992	9/3/2003	50	1	79	132	AMLE	8	15.918	–4.055	0.245
32	10/21/1992	9/2/2003	50	0	84	119	OLS	8	–1.956	0.676	–0.057
33	10/22/1992	9/4/2003	94	0	35	119	OLS	5	6.762	–1.452	0.080
34	11/18/1992	8/7/2003	86	0	35	120	OLS	8	–0.159	–0.067	0.033
35	11/30/1992	8/7/2003	82	0	35	134	OLS	8	1.753	–0.591	0.068
36	11/3/1992	9/16/2003	184	0	20	86	OLS	7	0.591	–0.027	--
37	11/18/1992	9/24/2003	255	0	14	79	OLS	7	–0.030	0.040	--
38	11/17/1992	9/19/2003	260	0	13	63	OLS	9	0.777	0.040	–0.012
39	4/15/1993	9/3/2003	278	0	8	56	OLS	9	–0.824	0.657	–0.046
40	11/18/1992	9/20/2003	150	1	26	208	AMLE	9	–7.050	1.431	–0.066
41	10/19/1992	9/23/2003	331	1	11	405	AMLE	5	–2.322	0.170	0.015
42	10/14/1992	9/20/2003	399	0	8	45	OLS	9	–0.457	–0.041	0.008
43	10/14/1992	9/24/2003	391	0	8	68	OLS	9	–1.055	0.063	0.001
44	10/28/1992	9/25/2003	349	0	10	60	OLS	9	–3.101	0.128	0.017

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Total nitrogen—Continued						
45	10/8/1992	9/25/2003	413	0	8	42	OLS	9	–0.277	–0.174	0.017
46	10/8/1992	8/21/2003	87	0	46.5	122	OLS	9	–1.013	0.154	–0.002
47	12/16/1992	9/2/2003	128	0	28	162	OLS	9	–2.051	0.676	–0.048
48	12/16/1992	9/2/2003	146	0	23	162	OLS	9	–0.625	0.309	–0.026
49	10/5/1992	6/23/2003	83	0	46.5	106	OLS	9	–1.849	0.442	–0.025
52	10/20/1992	9/11/2003	85	0	33	415	OLS	9	–22.408	6.514	–0.468
53	10/28/1992	9/25/2003	119	0	28	387	OLS	9	0.935	–0.115	–0.003
57	10/29/1992	9/3/2003	61	0	57	224	OLS	9	1.105	–0.406	0.037
58	10/29/1992	9/8/2003	60	0	61	272	OLS	9	0.664	–0.069	–0.004
59	10/28/1992	9/25/2003	89	0	32	315	OLS	9	–1.327	0.555	–0.043
60	10/21/1992	9/10/2003	103	0	31.5	153	OLS	9	–0.368	0.112	–0.004
61	10/21/1992	9/10/2003	63	0	56	162	OLS	9	0.299	–0.047	–0.004
62	10/26/1992	9/9/2003	63	0	58	152	OLS	9	0.067	0.170	–0.018
65	6/3/1993	9/3/2003	123	0	27	210	OLS	9	2.284	–0.593	0.035
67	3/11/1993	9/8/2003	114	0	28	566	OLS	9	9.713	–1.863	0.092
71	10/13/1992	9/23/2003	97	5	35	70	AMLE	5	–12.313	2.611	-0.130
72	1/15/1993	9/2/2003	154	0	21	182	OLS	7	–0.470	0.223	--
73	10/20/1992	9/9/2003	124	0	21	177	OLS	7	–1.210	0.128	--
74	3/4/1993	9/15/2003	110	1	21	1,541	AMLE	9	–2.756	0.754	–0.054
76	4/6/1993	9/16/2003	164	0	21	127	OLS	7	0.254	0.071	--
81	3/8/1993	9/26/2003	85	1	36	147	AMLE	9	0.426	–0.121	0.015
82	2/17/1993	9/11/2003	71	0	46	142	OLS	7	0.209	0.056	--
92	1/5/1993	9/23/2003	121	0	33.5	72	OLS	7	–0.080	0.204	--
95	11/11/1992	9/10/2003	141	0	23	131	OLS	8	–32.946	5.202	–0.198
97	10/15/1992	8/13/2003	46	0	63	250	OLS	8	–0.799	0.024	0.049
99	10/8/1992	9/9/2003	113	1	27	197	AMLE	7	–2.853	0.272	--
100	10/6/1992	8/28/2003	61	0	49	567	OLS	3	–2.129	0.067	--
101	10/7/1992	9/9/2003	68	0	42	259	OLS	7	–4.954	0.658	--
102	11/23/1992	8/25/2003	86	0	41	157	OLS	7	0.463	–0.007	--
103	4/12/1993	9/22/2003	96	0	16	2,041	OLS	510	2.711	–0.759	0.068
106	4/13/1993	9/24/2003	73	0	20	2,131	OLS	710	2.146	–0.164	--
107	4/7/1993	9/23/2003	132	0	28	456	OLS	8	3.404	–0.157	–0.010
108	11/3/1992	9/8/2003	61	0	34.5	765	OLS	8	249.550	–94.239	8.883
109	4/15/1993	9/16/2003	132	0	27	615	OLS	7	0.254	0.350	--
110	11/13/1992	9/19/2003	152	0	22	163	OLS	3	–2.439	0.389	--
111	11/10/1992	7/24/2003	107	0	29	238	OLS	8	–4.893	1.512	–0.082
112	11/10/1992	9/24/2003	132	0	29	58	OLS	8	9.387	–1.711	0.085
113	11/12/1992	9/9/2003	125	1	29	92	AMLE	7	–2.015	0.322	--
114	11/12/1992	9/11/2003	107	1	35	90	AMLE	7	–0.823	0.167	--
115	11/17/1992	9/8/2003	90	1	44	146	AMLE	5	–0.926	–0.171	0.053
116	11/17/1992	9/3/2003	67	0	60	97	OLS	7	–1.844	0.159	--
118	11/24/1992	9/9/2003	132	0	22	138	OLS	7	–3.242	0.341	--
120	4/26/1993	9/3/2003	125	2	28	119	AMLE	7	0.747	0.130	--
124	11/12/1992	9/5/2003	70	2	56	539	AMLE	7	–1.186	0.067	--
125	11/12/1992	9/10/2003	118	6	29	465	AMLE	7	–2.451	0.184	--
134	11/18/1992	9/9/2003	96	0	34	874	OLS	8	–5.055	1.534	–0.101
135	10/7/1992	9/2/2003	102	1	32	358	AMLE	8	–1.860	0.769	–0.051
136	10/16/1996	8/28/2003	58	0	42	91	OLS	3	2.694	–0.278	--
137	10/6/1992	8/31/2003	99	0	35	353	OLS	9	0.447	0.180	–0.009
138	10/14/1992	9/3/2003	118	0	30	327	OLS	8	–5.427	1.435	–0.080
139	10/13/1992	9/3/2003	105	0	33	355	OLS	9	–2.062	0.614	–0.028
145	10/13/1992	8/4/2003	85	1	48.5	127	AMLE	9	–0.377	–0.099	0.022
146	10/15/1992	8/5/2003	74	23	50	196	AMLE	8	–1.199	–0.060	0.018

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
Total nitrogen—Continued											
147	10/14/1992	8/5/2003	71	20	50	196	AMLE	8	–1.266	–0.016	0.016
148	10/14/1992	8/5/2003	72	0	52	120	OLS	7	–0.679	0.061	--
149	12/17/1992	9/2/2003	92	0	33	156	OLS	8	0.470	–0.194	0.013
150	10/21/1992	9/3/2003	99	0	33.5	411	OLS	9	–0.871	0.126	0.008
151	10/27/1992	9/23/2003	123	0	29	76	OLS	8	0.371	–0.290	0.022
152	11/17/1992	8/27/2003	60	9	63	156	AMLE	7	–0.927	–0.004	--
153	10/14/1992	9/23/2003	134	0	21	106	OLS	8	–52.498	8.067	–0.306
154	10/12/1992	9/23/2003	131	6	28	71	AMLE	5	–13.282	3.203	–0.188
155	11/16/1992	9/23/2003	97	7	35	71	AMLE	5	–10.657	3.271	–0.249
156	2/23/1993	9/24/2003	134	0	21	102	OLS	8	–44.611	7.282	–0.294
157	10/12/1992	8/13/2003	108	0	28	126	OLS	7	0.753	–0.031	--
173	10/27/1992	8/20/2003	78	1	36	169	AMLE	7	–0.383	–0.061	--
176	11/6/1992	9/3/2003	108	8	35	113	AMLE	3	–2.074	0.100	--
179	12/18/1992	6/24/2003	62	0	61	176	OLS	3	–0.688	–0.030	--
182	10/21/1992	9/3/2003	61	0	63	116	OLS	8	–7.981	2.329	–0.150
196	12/16/1992	9/2/2003	274	0	8	127	OLS	9	–1.687	–0.268	0.045
199	10/21/1992	9/5/2003	235	0	13	84	OLS	9	–2.566	0.298	0.007
201	10/22/1992	9/4/2003	221	0	14	170	OLS	9	–1.656	0.258	–0.018
202	10/21/1992	9/4/2003	261	0	12	70	OLS	9	–2.573	0.483	–0.025
208	10/21/1992	8/6/2003	57	0	69.5	113	OLS	9	11.693	–2.383	0.116
209	10/21/1992	8/12/2003	126	22	31	84	AMLE	9	8.871	–1.982	0.100
210	10/20/1992	8/12/2003	126	57	33	70	AMLE	9	8.170	–2.047	0.109
212	10/26/1992	8/18/2003	63	19	63	175	AMLE	5	81.687	–19.241	1.116
213	10/21/1992	8/12/2003	128	10	30	84	AMLE	9	13.816	–2.926	0.145
214	10/21/1992	8/11/2003	132	0	29	84	OLS	9	8.089	–1.641	0.079
215	10/21/1992	8/6/2003	57	13	69.5	113	AMLE	7	–0.957	0.001	--
217	10/20/1992	8/12/2003	55	0	72	116	OLS	9	1.501	–0.597	0.044
218	10/28/1992	8/11/2003	56	0	69	204	OLS	9	1.636	0.145	–0.045
219	10/14/1992	9/3/2003	63	32	63	176	AMLE	5	1.011	–0.751	0.057
220	10/26/1992	8/18/2003	76	0	56	158	OLS	9	2.091	–0.014	–0.036
221	11/18/1992	9/8/2003	115	47	27	216	AMLE	9	6.314	–2.229	0.162
222	10/7/1992	9/3/2003	111	88	27	216	AMLE	5	7.135	–2.094	0.121
223	11/4/1992	9/24/2003	138	0	28	79	OLS	7	3.452	–0.332	--
224	11/2/1992	9/16/2003	93	6	35	130	AMLE	9	7.835	–2.231	0.137
225	12/21/1992	9/3/2003	164	0	27	118	OLS	9	0.434	–0.031	0.021
227	11/16/1992	9/10/2003	145	1	27	91	AMLE	9	11.450	–2.454	0.125
228	11/19/1992	9/8/2003	118	22	28	195	AMLE	9	–5.984	0.665	–0.021
231	10/5/1992	9/29/2003	404	0	7	132	OLS	9	1.421	–0.076	–0.004
232	10/1/1992	9/29/2003	430	80	7	132	AMLE	7	–1.893	0.200	--
241	12/15/1992	9/17/2003	244	0	12	686	OLS	8	1.565	–0.194	0.008
242	1/21/1993	9/17/2003	135	2	14	1666	AMLE	9	2.392	0.043	–0.060
243	11/17/1992	9/12/2003	264	0	12	483	OLS	8	–1.534	0.918	–0.079
244	12/16/1992	9/23/2003	202	22	14	160	AMLE	7	–0.713	–0.053	--
Nitrate											
1	11/10/1992	9/3/2003	105	0	34.5	113	OLS	9	3.059	–1.105	0.065
2	2/10/1993	9/4/2003	104	0	34	88	OLS	5	1.826	–0.909	0.059
3	1/21/1993	9/3/2003	103	1	35	91	AMLE	8	–5.331	1.436	–0.114
4	11/16/1992	9/25/2003	153	1	25	74	AMLE	8	–3.089	0.722	–0.054
5	3/25/1993	9/15/2003	94	0	32	580	OLS	8	1.312	0.268	–0.085
6	1/15/1993	7/2/2003	60	0	69	112	OLS	7	0.065	–0.303	--
7	1/26/1993	9/23/2003	90	0	43	139	OLS	8	1.133	0.074	–0.044
8	1/14/1993	9/17/2003	107	0	32.5	85	OLS	7	3.467	–0.541	--
9	1/11/1993	7/17/2003	59	2	76.5	110	AMLE	9	–2.457	0.153	–0.011

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Nitrate—Continued						
10	2/18/1993	9/16/2003	88	0	44	77	OLS	7	3.529	–0.514	--
11	11/13/1992	7/8/2003	53	0	69.5	142	OLS	7	–1.429	0.056	--
12	1/25/1993	9/10/2003	90	0	42	78	OLS	9	4.184	–0.842	0.027
13	2/9/1993	7/28/2003	56	7	76	189	AMLE	7	–1.911	–0.083	--
14	2/9/1993	9/30/2003	195	4	15	79	AMLE	5	–2.017	0.472	–0.046
15	4/8/1993	8/4/2003	138	0	28	115	OLS	8	–5.096	1.048	–0.058
16	11/12/1992	8/27/2003	47	0	87	156	OLS	8	1.535	–0.954	0.087
17	11/9/1992	8/27/2003	50	3	90	122	AMLE	8	–1.565	0.122	–0.048
18	10/27/1992	8/20/2003	48	0	89	187	OLS	7	2.581	–0.504	--
19	10/29/1992	8/12/2003	83	0	28	414	OLS	8	0.088	0.781	–0.105
20	11/4/1992	8/13/2003	49	0	88	127	OLS	5	–0.608	1.497	–0.229
21	11/18/1992	8/28/2003	50	0	83	126	OLS	5	–0.720	0.647	–0.099
22	11/24/1992	9/4/2003	49	0	80	133	OLS	7	0.039	–0.043	--
23	11/5/1992	8/5/2003	50	0	83	145	OLS	3	0.055	–0.096	--
24	11/5/1992	9/4/2003	74	5	47	183	AMLE	5	–2.680	1.721	–0.213
25	2/17/1993	8/5/2003	48	0	83	148	OLS	7	2.760	–0.344	--
26	11/18/1992	9/9/2003	112	0	29	133	OLS	8	4.456	–0.859	0.043
29	11/24/1992	8/19/2003	49	6	83.5	138	AMLE	7	–2.124	–0.023	--
31	10/19/1992	9/3/2003	49	1	81	132	AMLE	8	14.722	–3.822	0.225
32	10/21/1992	9/2/2003	49	1	85	146	AMLE	9	–6.427	2.134	–0.195
33	10/22/1992	9/4/2003	94	0	35	119	OLS	7	0.501	–0.069	--
34	11/18/1992	8/7/2003	86	0	35	120	OLS	7	–1.946	0.247	--
35	11/30/1992	8/7/2003	83	0	35	124	OLS	7	0.824	–0.191	--
36	11/3/1992	9/16/2003	183	0	20	86	OLS	9	0.196	0.122	–0.029
37	11/18/1992	9/24/2003	255	0	14	79	OLS	8	–4.696	0.907	–0.042
38	11/17/1992	9/19/2003	297	0	11	63	OLS	8	0.721	0.064	–0.024
39	4/15/1993	9/3/2003	278	0	8	56	OLS	9	–0.709	0.636	–0.050
40	11/18/1992	9/20/2003	150	0	26	208	OLS	8	–17.725	3.678	–0.185
41	10/19/1992	9/23/2003	347	17	10	405	AMLE	8	–21.642	4.920	–0.284
42	10/14/1992	9/25/2003	421	0	7	45	OLS	8	–1.232	0.094	–0.015
43	10/14/1992	9/19/2003	417	5	7	45	AMLE	9	–2.456	0.203	–0.027
44	10/28/1992	9/25/2003	369	7	9	60	AMLE	9	–26.915	5.077	–0.251
45	10/8/1992	9/25/2003	420	3	8	42	AMLE	8	0.630	–0.707	0.045
50	11/19/1992	9/3/2003	125	12	28	105	AMLE	9	9.851	–2.552	0.130
65	6/3/1993	9/3/2003	140	2	25	210	AMLE	9	2.725	–0.735	0.018
66	3/9/1993	9/9/2003	165	0	19	135	OLS	9	–1.804	0.557	–0.066
71	10/13/1992	9/23/2003	98	3	35	70	AMLE	5	–32.454	7.976	–0.503
72	1/15/1993	9/2/2003	155	1	19.5	182	AMLE	8	–0.827	0.258	–0.028
73	10/20/1992	9/9/2003	132	0	21	177	OLS	7	–0.636	0.050	--
74	3/4/1993	9/15/2003	110	48	21	1,541	AMLE	7	–2.848	–0.035	--
76	4/6/1993	9/16/2003	165	9	21	127	AMLE	8	–10.858	2.924	-0.187
81	3/8/1993	9/10/2003	84	31	36	147	AMLE	7	–3.437	0.225	--
82	2/17/1993	9/11/2003	71	24	46	142	AMLE	7	–3.121	0.225	--
88	1/6/1993	9/3/2003	64	13	62	131	AMLE	7	–4.775	0.736	--
92	1/5/1993	9/23/2003	123	2	32	72	AMLE	7	–1.145	0.341	--
95	11/11/1992	9/10/2003	143	1	23	131	AMLE	8	–53.142	8.408	–0.327
96	10/20/1992	9/10/2003	96	1	35	99	AMLE	8	5.964	–2.338	0.250
98	12/17/1992	8/5/2003	44	0	84	169	OLS	8	11.184	–2.693	0.134
99	10/8/1992	9/9/2003	113	25	27	197	AMLE	8	8.494	–3.130	0.217
100	10/6/1992	8/28/2003	62	0	49	567	OLS	5	–7.858	0.806	–0.028
101	10/7/1992	9/9/2003	68	3	42	259	AMLE	7	–1.538	0.060	--
102	11/23/1992	8/25/2003	86	43	41	157	AMLE	7	–3.955	0.302	--

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibration data set						Properties of the calibrated model				
	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Nitrate—Continued						
103	4/12/1993	9/22/2003	96	0	16	2,041	OLS	710	2.369	–0.629	--
104	10/28/1992	9/17/2003	130	1	29	70	AMLE	3	–0.009	–0.479	--
105	10/30/1992	9/17/2003	128	1	29	71	AMLE	7	0.402	–0.294	--
106	4/13/1993	9/24/2003	73	0	20	2,131	OLS	810	2.195	–0.295	–0.003
107	4/7/1993	9/23/2003	132	0	28	456	OLS	8	1.794	0.306	–0.048
108	11/3/1992	9/8/2003	61	0	34.5	765	OLS	8	187.435	–69.842	6.480
109	4/15/1993	9/16/2003	132	1	27	615	AMLE	8	–0.502	0.736	–0.059
110	11/13/1992	9/19/2003	152	17	22	163	AMLE	8	–37.107	7.224	–0.343
111	11/10/1992	7/24/2003	108	17	29	238	AMLE	8	–17.569	4.748	–0.289
112	11/10/1992	9/24/2003	132	4	29	58	AMLE	7	–1.983	0.197	--
113	11/12/1992	9/9/2003	126	34	29	92	AMLE	8	–11.801	2.084	–0.088
114	11/12/1992	9/11/2003	107	21	35	90	AMLE	8	–13.096	3.147	–0.196
115	11/17/1992	9/8/2003	90	14	44	146	AMLE	8	–7.271	1.777	–0.108
116	11/17/1992	9/3/2003	67	9	60	97	AMLE	7	–5.093	0.380	--
117	11/17/1992	9/5/2003	121	2	31	77	AMLE	8	–16.797	3.744	–0.218
118	11/24/1992	9/9/2003	133	2	21.5	138	AMLE	7	–3.713	0.328	--
119	11/11/1992	8/25/2003	65	3	56.5	230	AMLE	9	–3.838	1.111	–0.121
120	4/26/1993	9/3/2003	126	2	28	119	AMLE	7	0.684	0.127	--
121	10/27/1992	9/1/2003	136	41	23	168	AMLE	9	–7.037	1.158	–0.061
122	11/17/1992	8/20/2003	65	2	58.5	100	AMLE	7	–5.293	0.422	--
123	11/17/1992	9/2/2003	112	30	30	121	AMLE	3	–3.192	0.141	--
124	11/12/1992	9/5/2003	77	0	56	105	OLS	9	–5.247	1.397	–0.115
125	11/12/1992	9/10/2003	132	1	29	70	AMLE	8	–14.635	3.136	–0.184
126	10/16/1997	8/25/2003	41	3	56	104	AMLE	8	–3.424	0.806	–0.076
127	11/24/1997	8/25/2003	33	2	57	169	AMLE	7	–1.749	–0.038	--
128	10/15/1992	9/3/2003	101	0	35	194	OLS	7	0.218	–0.182	--
129	10/14/1992	8/21/2003	91	8	35	194	AMLE	9	0.185	–0.284	–0.020
130	10/15/1992	7/28/2003	116	0	28	194	OLS	9	2.120	–0.330	–0.001
131	10/15/1992	7/28/2003	105	0	35	194	OLS	9	2.288	–0.136	–0.024
132	12/18/1992	7/23/2003	53	0	74	194	OLS	8	–1.738	1.342	–0.146
133	10/16/1992	7/24/2003	110	0	28	194	OLS	9	1.635	0.056	–0.022
134	11/18/1992	9/9/2003	105	0	33.5	687	OLS	8	–6.056	1.797	–0.119
135	10/7/1992	9/2/2003	103	0	31.5	358	OLS	8	–2.348	1.000	–0.079
136	10/16/1996	8/28/2003	58	0	42	91	OLS	3	2.789	–0.337	--
137	10/6/1992	8/31/2003	99	0	35	353	OLS	9	–0.272	0.528	–0.054
138	10/14/1992	9/3/2003	118	0	30	327	OLS	8	–8.041	2.208	–0.139
139	10/13/1992	9/3/2003	105	0	33	355	OLS	9	–3.525	1.172	–0.083
140	11/17/1992	9/9/2003	57	9	62	484	AMLE	9	–3.486	0.321	–0.002
141	11/17/1992	9/10/2003	131	60	28	71	AMLE	7	–4.828	0.427	--
142	10/14/1992	9/9/2003	132	22	29	49	AMLE	8	–0.773	–0.366	0.036
143	10/14/1992	9/9/2003	132	6	29	50	AMLE	9	8.665	–3.014	0.231
144	10/14/1992	9/9/2003	130	0	29	71	OLS	8	10.752	–2.780	0.175
145	10/13/1992	8/4/2003	85	16	48.5	127	AMLE	3	–3.022	0.186	--
146	10/15/1992	8/5/2003	74	17	50	196	AMLE	9	–3.480	0.469	–0.031
147	10/14/1992	8/5/2003	72	23	50	196	AMLE	9	–3.065	0.126	0.010
148	10/14/1992	8/5/2003	73	16	51.5	120	AMLE	9	–4.072	0.939	–0.094
149	12/17/1992	9/2/2003	92	13	33	156	AMLE	7	–2.616	0.124	--
150	10/21/1992	9/3/2003	99	18	33.5	411	AMLE	8	–16.016	3.328	–0.178
151	10/27/1992	9/23/2003	123	33	29	76	AMLE	8	–17.066	2.621	–0.113
152	11/17/1992	8/27/2003	60	7	63	156	AMLE	8	–15.778	3.158	–0.181
153	10/14/1992	9/23/2003	138	0	22	106	OLS	8	–64.890	9.821	–0.369
154	10/12/1992	9/23/2003	132	3	28	43	AMLE	5	–21.913	5.544	–0.365
155	11/16/1992	9/23/2003	98	2	35	70	AMLE	8	–14.412	4.324	–0.353

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibration data set						Properties of the calibrated model				
Site number (figure 1)	Start date	End date	Number of observations	Number of censored observations	Median number of days between successive samples	Maximum number of days between successive samples	Model calibration method	Model specification[1]	Intercept	Log streamflow coefficient	Log streamflow squared coefficient
					Nitrate—Continued						
156	11/19/1992	9/24/2003	140	0	21	102	OLS	8	–42.923	6.901	–0.277
157	10/12/1992	8/13/2003	108	1	28	126	AMLE	9	–1.541	0.522	–0.058
158	10/15/1992	4/9/2003	114	45	33	125	AMLE	8	–5.106	0.828	–0.064
159	1/21/1993	8/5/2003	65	10	44	198	AMLE	8	–4.517	0.976	–0.093
160	1/22/1993	8/5/2003	64	13	49	203	AMLE	5	–15.247	4.117	–0.309
161	11/2/1992	7/15/2003	95	22	30.5	273	AMLE	8	–3.362	0.178	0.051
162	10/20/1992	8/6/2003	116	24	21	259	AMLE	7	–2.862	0.366	--
163	1/20/1993	8/4/2003	66	1	44	198	AMLE	9	–4.050	1.747	–0.132
164	11/5/1992	6/24/2003	59	5	62	362	AMLE	8	–1.341	1.050	–0.112
167	1/25/1993	9/9/2003	84	31	30	428	AMLE	7	–3.312	0.224	--
168	11/19/1992	9/3/2003	77	10	36	239	AMLE	7	–2.781	0.192	--
172	10/21/1992	9/10/2003	126	1	28	245	AMLE	3	5.642	–0.611	--
174	10/5/1992	8/20/2003	63	5	48	196	AMLE	9	–35.894	9.127	–0.617
175	10/14/1992	9/10/2003	118	0	28	147	OLS	9	–2.629	0.814	–0.069
177	10/30/1992	8/15/2003	65	16	57.5	112	AMLE	7	–0.068	–0.362	--
181	10/13/1992	9/16/2003	88	0	42	176	OLS	7	2.824	–0.520	--
187	12/15/1992	9/23/2003	71	15	36.5	210	AMLE	7	–2.784	0.021	--
189	10/20/1992	8/27/2003	112	2	35	140	AMLE	8	1.464	–1.086	0.089
190	10/20/1992	9/17/2003	111	5	31.5	184	AMLE	7	–0.960	–0.181	--
191	10/22/1992	8/12/2003	118	24	27	167	AMLE	9	2.758	–2.186	0.207
192	10/14/1992	9/17/2003	125	1	28	147	AMLE	7	0.975	–0.432	--
194	10/23/1992	9/2/2003	225	0	13	93	OLS	7	–4.128	–0.185	--
195	10/23/1992	9/2/2003	229	0	14	93	OLS	9	–4.729	0.085	-0.011
197	10/21/1992	9/5/2003	310	0	8	91	OLS	7	–4.598	–0.008	--
198	10/21/1992	9/5/2003	227	0	14	88	OLS	9	–4.089	–0.038	-0.006
199	10/21/1992	9/5/2003	236	0	13	84	OLS	7	–3.765	–0.114	--
200	10/21/1992	9/5/2003	317	0	8	76	OLS	8	–4.044	0.186	–0.047
201	10/22/1992	9/4/2003	221	1	14	170	AMLE	9	–4.637	–0.079	0.105
205	10/19/1992	9/22/2003	131	0	28	64	OLS	8	–9.752	1.968	–0.117
207	10/19/1992	9/24/2003	130	2	28	63	AMLE	8	1.757	–1.241	0.090
208	10/21/1992	8/6/2003	57	0	69.5	113	OLS	9	2.375	–0.675	0.033
209	10/21/1992	8/12/2003	129	0	30	84	OLS	9	12.629	–2.929	0.149
210	10/20/1992	8/12/2003	129	0	30	70	OLS	9	13.826	–3.455	0.182
213	10/21/1992	8/12/2003	129	0	30	84	OLS	9	16.110	–3.477	0.171
215	10/21/1992	8/6/2003	57	0	69.5	113	OLS	7	–4.179	0.200	--
217	10/20/1992	8/12/2003	56	0	71	105	OLS	8	6.051	–2.424	0.180
218	10/28/1992	8/11/2003	57	0	69	204	OLS	9	0.852	0.521	–0.095
224	11/2/1992	9/16/2003	93	1	35	130	AMLE	9	7.882	–2.398	0.150
225	12/21/1992	9/3/2003	164	8	27	118	AMLE	9	–2.721	0.795	–0.042
226	10/4/1993	9/3/2003	131	0	28	448	OLS	8	1.794	0.293	–0.035
228	11/19/1992	9/8/2003	118	1	28	195	AMLE	9	17.927	–3.424	0.148
229	10/28/1992	9/23/2003	130	2	28	64	AMLE	9	–5.599	0.779	–0.058
234	10/12/1992	9/8/2003	128	0	28	91	OLS	9	12.141	–3.321	0.188
235	10/12/1992	9/8/2003	127	27	28	67	AMLE	7	–7.606	0.526	--
237	10/13/1992	9/9/2003	127	28	28	90	AMLE	7	–3.575	–0.017	--
238	10/6/1992	9/8/2003	131	0	28	63	OLS	9	6.966	–0.968	0.009
239	10/7/1992	9/7/2003	132	0	28	43	OLS	9	–5.097	0.337	–0.010
240	11/18/1992	9/11/2003	123	6	7.5	1,741	AMLE	9	–2.711	–0.467	0.048
241	12/15/1992	9/17/2003	263	0	11	211	OLS	8	1.165	–0.066	–0.027
242	1/21/1993	9/17/2003	156	0	14	212	OLS	9	3.453	–0.314	–0.036
243	10/2/1992	9/12/2003	533	0	6	44	OLS	9	0.763	0.490	–0.066
244	12/16/1992	9/23/2003	202	8	14	160	AMLE	7	–0.349	–0.174	--

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
					Total phosphorus					
1	–0.312	–0.142	0.044	--	--	0.558	1.578	0.531	0.044	0.133
2	–0.044	–0.148	0.008	0.019	--	0.543	1.089	0.471	0.050	0.141
3	–0.223	–0.203	0.046	0.017	--	0.539	1.792	0.568	0.045	0.119
4	–0.230	0.136	0.022	--	--	0.683	5.701	1.203	0.063	0.109
5	–0.500	–0.183	–0.006	--	--	0.471	0.889	0.531	0.077	0.091
7	–0.194	–0.082	0.022	0.013	--	0.356	2.753	0.812	0.059	0.063
8	--	--	–0.020	--	--	0.363	0.229	0.049	--	--
10	–0.226	–0.047	–0.013	-0.016	--	0.344	1.437	0.550	0.052	0.064
11	--	--	0.009	--	--	0.720	0.956	0.126	--	--
12	–0.203	–0.092	0.053	–0.016	--	0.455	1.983	0.677	0.057	0.090
13	–0.161	–0.690	0.021	--	--	0.634	0.478	0.131	--	0.213
14	–0.436	–0.668	0.033	--	--	0.557	0.331	0.210	0.033	0.096
15	–0.378	–0.049	0.007	--	--	0.583	3.326	0.780	0.045	0.100
16	–0.318	–0.516	0.000	0.024	--	0.497	1.466	0.728	0.085	0.132
17	--	--	–0.072	--	--	0.729	0.342	0.088	--	--
18	–0.210	–0.179	–0.001	--	--	0.311	0.700	0.300	0.031	0.081
19	–0.251	–0.035	0.008	--	--	0.255	0.631	0.219	0.018	0.046
20	–0.154	–0.176	0.086	–0.015	--	0.378	1.389	0.670	0.080	0.090
22	–0.382	–0.205	0.027	--	--	0.308	0.390	0.225	0.031	0.067
24	–0.169	–0.288	0.008	0.022	--	0.776	0.310	0.187	0.030	0.169
25	--	--	0.022	--	--	0.296	1.089	0.393	0.035	--
26	–0.141	–0.232	0.009	--	--	0.306	1.009	0.294	0.021	0.048
27	–0.227	–0.425	–0.009	0.036	--	0.479	2.710	1.299	0.155	0.123
28	–0.648	–0.466	0.011	0.028	--	0.870	13.869	5.165	0.480	0.272
30	–0.304	–0.457	–0.014	--	--	0.848	2.088	0.428	--	0.323
31	–0.110	–0.150	–0.068	0.027	--	0.629	18.276	4.184	0.238	0.225
32	–0.340	–0.557	0.007	--	--	0.554	1.787	0.723	0.072	0.172
33	–0.174	–0.110	–0.010	--	--	0.498	5.948	1.263	0.067	0.087
34	–0.086	–0.295	0.000	--	--	0.419	0.484	0.282	0.038	0.069
35	–0.220	–0.270	0.024	--	--	0.396	0.649	0.329	0.039	0.076
36	–0.119	–0.384	0.053	0.011	--	0.541	0.457	0.172	0.016	0.068
37	–0.289	0.010	0.053	--	--	0.532	2.924	0.539	0.025	0.065
38	–0.285	–0.175	0.022	0.017	--	0.566	1.138	0.359	0.028	0.049
39	–0.420	–0.278	0.023	--	--	0.751	1.233	0.373	0.027	0.074
40	–0.211	–0.223	0.068	–0.010	--	0.677	2.293	0.502	0.027	0.103
41	–0.265	–0.169	0.038	--	--	0.631	1.149	0.298	0.019	0.063
42	–0.210	–0.025	0.049	0.010	--	0.448	0.457	0.135	0.010	0.035
43	–0.201	–0.261	–0.003	0.007	--	0.357	0.152	0.053	0.005	0.030
44	–0.270	–0.093	–0.010	0.013	--	0.561	1.593	0.353	0.019	0.047
45	–0.036	0.021	–0.011	0.008	--	0.419	0.413	0.121	0.009	0.035
46	–0.078	0.023	0.033	–0.000	--	0.525	0.477	0.214	0.023	0.142
51	–0.047	–0.057	0.011	0.006	--	0.359	8.123	1.710	0.090	0.056
52	0.187	0.005	–0.069	0.019	--	0.400	6.285	1.768	0.124	0.076
53	0.006	–0.043	–0.048	0.016	--	0.411	2.494	0.562	0.031	0.073
54	0.138	–0.022	–0.036	0.016	--	0.345	1.914	0.485	0.030	0.058
55	0.052	–0.029	–0.025	0.015	--	0.238	1.786	0.389	0.021	0.037
56	0.051	–0.264	0.012	0.008	--	0.357	0.308	0.122	0.011	0.053
58	0.029	–0.028	0.030	–0.000	--	0.215	0.226	0.114	0.014	0.047
59	–0.004	–0.086	–0.007	0.003	--	0.201	0.289	0.092	0.007	0.032
60	–0.143	–0.161	0.015	–0.005	--	0.233	0.126	0.066	0.008	0.035
61	0.027	–0.106	–0.041	0.001	--	0.329	0.215	0.124	0.017	0.063
62	–0.042	–0.220	–0.045	0.007	--	0.285	0.104	0.050	0.007	0.058
63	–0.276	–0.246	–0.057	0.006	--	0.412	1.099	0.409	0.036	0.080

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
					Total phosphorus—Continued					
64	0.049	–0.231	–0.135	0.023	--	0.411	0.665	0.238	0.022	0.097
65	–0.044	–0.005	0.012	0.007	--	0.366	0.298	0.110	0.010	0.050
66	–0.201	–0.298	0.008	–0.013	--	0.717	1.034	0.449	0.047	0.141
68	0.070	–0.091	–0.083	0.016	--	0.532	10.611	2.329	0.127	0.091
69	0.009	–0.063	–0.007	–0.005	--	0.319	2.761	0.604	0.032	0.069
70	–0.157	–0.047	–0.075	0.000	--	0.420	2.343	0.579	0.035	0.074
71	--	--	0.037	--	--	0.408	0.441	0.061	--	--
72	–0.387	–0.470	0.032	–0.011	--	0.510	0.180	0.096	0.016	0.087
73	–0.150	0.121	0.055	--	--	0.312	7.281	1.164	0.046	0.053
74	--	--	–0.019	--	--	0.341	1.078	0.166	--	--
75	0.015	–0.406	–0.026	--	--	0.411	0.216	0.117	0.015	0.026
76	–0.121	–0.426	0.023	--	--	0.444	1.416	0.477	0.040	0.053
77	–0.298	–0.457	–0.053	0.020	--	0.568	0.174	0.115	0.019	0.037
78	–0.408	–0.495	–0.021	--	--	0.837	0.223	0.056	--	0.069
79	–0.370	–0.375	–0.017	--	--	0.552	0.101	0.083	0.016	0.033
80	–0.263	–0.622	0.042	--	--	0.509	0.440	0.174	0.017	0.025
81	0.023	–0.400	–0.074	0.036	--	0.501	0.223	0.125	0.015	0.094
82	–0.228	–0.297	–0.029	0.016	--	0.448	0.422	0.170	0.017	0.090
83	–0.057	–0.419	0.036	–0.004	--	0.455	0.156	0.096	0.013	0.052
84	–0.006	–0.057	0.012	–0.007	--	0.632	0.559	0.285	0.035	0.032
85	--	--	–0.092	--	--	0.629	0.088	0.075	0.014	--
86	–0.318	–0.208	–0.012	--	--	0.929	0.054	0.056	0.018	0.051
87	–0.214	–0.250	0.046	--	--	0.533	0.287	0.119	0.011	0.089
88	–0.279	–0.194	0.014	--	--	0.484	0.231	0.045	--	0.118
89	–0.251	–0.354	0.048	--	--	0.589	0.607	0.239	0.022	0.134
90	–0.151	0.045	0.036	–0.001	--	0.326	1.371	0.543	0.053	0.047
91	–0.149	0.014	0.047	–0.002	--	0.287	1.816	0.561	0.043	0.047
92	–0.129	–0.110	–0.020	0.012	--	0.592	0.135	0.077	0.016	0.074
93	–0.105	0.140	0.073	–0.005	--	0.351	5.900	1.190	0.060	0.056
94	--	--	0.002	--	--	0.331	1.762	0.520	0.038	--
95	--	--	0.065	--	--	0.397	0.750	0.060	--	--
97	0.176	–0.492	–0.018	--	--	0.539	0.251	0.069	0.015	0.230
99	0.432	–0.547	0.043	--	--	0.906	1.425	0.156	--	0.142
101	–0.027	–0.189	0.030	--	--	0.376	24.862	7.361	0.545	0.101
106	0.112	–0.893	–0.123	--	1.106	0.868	0.589	0.107	0.029	0.147
107	0.224	0.296	0.023	--	--	0.288	0.177	0.027	--	0.036
109	--	--	0.131	--	--	0.609	0.395	0.171	0.019	--
110	–0.070	–0.361	0.098	--	--	0.518	0.606	0.067	--	0.068
111	0.155	–0.291	0.066	--	--	0.639	0.318	0.052	--	0.095
112	0.380	–0.164	0.048	--	--	0.578	1.634	0.151	--	0.075
113	–0.043	–0.390	0.100	--	--	0.580	1.057	0.277	0.018	0.092
114	0.194	–0.457	0.029	--	--	0.678	0.337	0.052	--	0.106
115	–0.441	–0.560	0.008	--	--	0.428	0.406	0.176	0.018	0.099
118	--	--	0.112	--	--	0.608	1.194	0.103	--	--
120	–0.172	–0.155	0.038	--	--	0.320	0.374	0.205	0.027	0.060
134	–0.118	–0.082	0.111	–0.000	--	0.505	1.782	0.538	0.040	0.107
135	–0.321	–0.099	0.071	--	--	0.529	1.425	0.411	0.029	0.085
136	–0.132	–0.030	0.074	--	--	0.491	0.836	0.532	0.076	0.117
137	–0.119	–0.155	0.069	--	--	0.286	0.414	0.156	0.014	0.051
138	–0.274	–0.169	0.079	--	--	0.340	0.815	0.226	0.015	0.051
139	–0.379	–0.311	0.047	--	--	0.445	0.962	0.293	0.022	0.092
145	--	--	–0.009	--	--	0.537	0.191	0.094	0.010	--
148	–0.093	–0.229	0.015	--	--	0.360	0.124	0.069	0.010	0.076

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Total phosphorus—Continued										
149	–0.214	0.053	0.048	0.010	--	0.288	0.829	0.174	0.009	0.052
150	–0.262	–0.397	0.081	--	--	0.555	0.392	0.053	--	0.092
151	–0.066	0.125	–0.026	--	--	0.406	4.393	0.876	0.043	0.068
152	--	--	–0.029	--	--	0.525	0.771	0.092	--	--
153	--	--	0.037	--	--	0.366	17.291	2.649	0.101	--
154	–0.029	–0.138	0.014	--	--	0.502	0.469	0.070	--	0.066
155	--	--	0.042	--	--	0.458	0.285	0.053	--	--
156	--	--	0.050	--	--	0.304	12.288	2.015	0.083	--
157	0.152	0.028	0.001	--	--	0.337	0.499	0.158	0.013	0.048
165	0.269	0.314	–0.000	--	--	0.691	0.213	0.065	--	0.135
166	--	--	–0.110	--	--	1.165	2.161	0.800	0.072	--
169	--	--	–0.266	--	--	1.570	0.400	0.265	0.047	--
170	--	--	–0.006	--	--	0.584	0.612	0.085	--	--
171	--	--	–0.029	--	--	0.591	0.542	0.074	--	--
173	0.054	–0.326	0.039	--	--	0.331	0.475	0.190	0.018	0.059
177	0.348	–0.281	0.038	--	--	0.699	9.119	2.498	0.170	0.156
178	0.703	–0.613	–0.040	--	--	0.966	1.492	0.184	--	0.198
180	--	--	0.116	--	--	1.031	1.513	1.205	0.232	--
182	–0.269	0.449	0.159	--	--	0.775	0.994	0.191	--	0.170
183	–0.858	–0.825	0.105	--	--	0.909	2.503	0.827	0.066	0.175
184	–1.291	–1.044	0.359	--	--	1.429	3.509	0.968	0.065	0.319
185	–0.204	–0.758	0.091	--	--	0.773	0.766	0.126	--	0.180
186	–0.116	–0.535	–0.201	0.046	--	1.006	17.076	4.134	0.249	0.231
188	0.269	–0.063	–0.063	–0.003	--	0.478	1.465	0.457	0.035	0.088
193	0.173	–0.008	–0.009	0.011	--	0.503	1.360	0.674	0.081	0.081
203	–0.072	0.106	0.036	–0.012	--	0.515	6.883	1.662	0.100	0.094
204	–0.121	0.128	0.005	--	--	0.638	20.392	4.173	0.213	0.149
205	0.029	0.244	0.030	–0.017	--	0.518	7.725	1.722	0.095	0.144
206	–0.044	0.058	0.023	–0.013	--	0.363	2.415	0.702	0.050	0.081
207	0.010	0.023	0.126	–0.019	--	0.511	2.770	0.844	0.063	0.146
208	–0.008	0.158	–0.007	--	--	0.186	3.994	0.762	0.036	0.053
209	–0.011	0.184	–0.021	0.005	--	0.289	4.767	0.984	0.051	0.046
210	–0.057	0.098	–0.002	--	--	0.327	5.686	1.205	0.064	0.046
211	--	--	–0.014	--	--	0.210	3.824	0.922	0.055	--
212	--	--	–0.009	--	--	0.405	42.172	9.625	0.549	--
213	–0.058	0.142	–0.022	0.006	--	0.266	4.297	0.846	0.041	0.045
214	0.004	0.176	–0.026	0.004	--	0.188	2.273	0.426	0.020	0.034
215	0.075	0.176	–0.023	--	--	0.258	32.098	5.278	0.217	0.060
216	–0.557	–0.300	0.054	--	--	0.635	6.793	1.712	0.108	0.118
217	–0.116	0.219	–0.025	0.007	--	0.238	0.524	0.189	0.016	0.048
218	–0.222	–0.055	–0.008	--	--	0.205	0.581	0.297	0.037	0.053
219	--	--	–0.020	--	--	0.363	1.107	0.340	0.025	--
220	–0.152	0.036	–0.042	--	--	0.382	0.248	0.106	0.013	0.084
221	–0.166	0.218	0.067	–0.011	--	0.525	2.301	0.733	0.057	0.154
222	0.209	0.340	–0.043	--	--	0.598	5.534	1.300	0.077	0.278
223	0.076	0.027	–0.013	--	--	0.329	14.784	3.145	0.167	0.042
224	--	--	0.029	--	--	0.469	1.857	0.570	0.043	--
225	–0.275	0.093	–0.073	--	--	0.657	0.530	0.169	0.014	0.126
227	–0.054	0.191	0.006	0.009	--	0.330	4.601	0.874	0.041	0.056
228	0.026	0.266	0.013	--	--	0.493	37.241	5.962	0.238	0.096
229	–0.135	0.009	0.069	–0.006	--	0.487	3.506	0.994	0.069	0.152
230	0.193	0.011	–0.004	--	--	0.388	1.727	0.601	0.051	0.073
231	0.088	0.329	–0.038	0.005	--	0.343	0.625	0.180	0.013	0.038

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Total phosphorus—Continued										
232	0.241	0.209	–0.044	–0.011	--	0.482	1.033	0.361	0.031	0.046
233	–0.118	–0.010	0.003	--	--	0.297	2.639	0.652	0.040	0.043
234	0.075	0.276	0.058	–0.040	--	0.592	6.363	1.649	0.106	0.169
235	0.028	0.251	0.025	–0.029	--	0.669	6.171	1.583	0.101	0.210
236	–0.003	0.126	0.080	–0.035	--	0.586	4.546	1.222	0.081	0.159
237	0.157	0.094	0.018	–0.010	--	0.462	5.453	1.341	0.082	0.131
238	0.246	0.762	0.038	–0.017	--	0.583	5.577	1.321	0.078	0.129
239	--	--	–0.037	--	--	0.737	3.302	0.289	--	--
241	–0.079	–0.517	0.014	--	--	0.738	0.117	0.035	--	0.067
242	–0.025	–0.587	–0.005	--	--	0.576	0.385	0.062	--	0.074
243	0.078	0.121	–0.008	0.010	--	0.422	2.104	0.497	0.029	0.041
244	0.067	0.309	0.043	--	--	0.466	0.748	0.074	--	0.057
Total nitrogen										
1	--	--	0.006	--	--	0.306	0.784	0.267	0.022	--
2	--	--	0.027	--	--	0.245	0.098	0.021	--	--
3	--	--	–0.004	--	--	0.231	0.144	0.022	--	--
4	0.086	0.169	0.002	--	--	0.322	0.378	0.040	--	0.044
5	–0.025	0.114	–0.002	--	--	0.126	0.237	0.142	0.021	0.024
6	--	--	0.030	--	--	0.397	0.447	0.072	--	--
7	–0.057	0.052	0.005	0.006	--	0.221	1.709	0.504	0.037	0.039
8	0.022	0.154	–0.004	--	--	0.226	0.175	0.037	--	0.037
9	–0.157	–0.198	0.010	0.010	--	0.355	0.611	0.296	0.036	0.103
10	–0.055	0.046	–0.004	--	--	0.157	0.137	0.027	--	0.029
11	–0.081	0.138	0.011	--	--	0.258	0.246	0.033	--	0.063
12	–0.009	0.010	–0.064	–0.010	--	0.252	1.105	0.377	0.032	0.051
13	--	--	0.031	--	--	0.393	0.114	0.038	--	--
14	0.000	–0.087	0.020	--	--	0.379	0.178	0.113	0.018	0.050
15	0.010	0.114	–0.010	--	--	0.196	0.963	0.225	0.013	0.030
16	--	--	0.009	--	--	0.209	0.524	0.256	0.030	--
17	–0.036	0.193	0.019	--	--	0.354	0.094	0.069	0.012	0.085
18	--	--	0.000	--	--	0.194	0.378	0.168	0.018	--
19	–0.059	0.046	–0.020	--	--	0.209	0.517	0.180	0.015	0.038
20	--	--	0.022	--	--	0.224	0.800	0.390	0.047	--
21	--	--	–0.000	--	--	0.224	0.111	0.038	--	--
22	0.140	–0.036	–0.000	--	--	0.231	0.295	0.169	0.023	0.053
23	--	--	–0.013	--	--	0.228	0.082	0.029	--	--
24	--	--	–0.015	--	--	0.401	0.116	0.081	0.013	--
25	--	--	0.007	--	--	0.232	0.201	0.037	--	--
26	–0.043	0.055	0.010	--	--	0.167	0.549	0.160	0.011	0.026
29	--	--	–0.010	--	--	0.308	2.835	1.168	0.119	--
31	0.101	0.083	–0.024	--	--	0.268	5.110	1.186	0.068	0.055
32	0.019	0.110	0.007	--	--	0.239	0.633	0.256	0.025	0.053
33	--	--	–0.019	--	--	0.237	2.568	0.551	0.029	--
34	0.028	–0.206	0.005	--	--	0.245	0.284	0.165	0.022	0.041
35	0.235	0.064	0.006	--	--	0.227	0.372	0.188	0.023	0.044
36	0.047	0.042	0.019	--	--	0.198	0.054	0.011	--	0.023
37	–0.002	0.144	–0.008	--	--	0.224	0.166	0.016	--	0.024
38	0.063	0.090	–0.001	0.003	--	0.188	0.389	0.123	0.010	0.017
39	–0.176	0.005	–0.006	0.008	--	0.190	0.313	0.095	0.007	0.019
40	–0.106	0.101	–0.015	0.005	--	0.266	0.770	0.167	0.009	0.038
41	--	--	0.034	--	--	0.431	0.439	0.121	0.008	--
42	–0.164	–0.107	0.024	0.003	--	0.270	0.281	0.083	0.006	0.022
43	–0.076	–0.190	0.009	0.009	--	0.226	0.100	0.035	0.003	0.020

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Total nitrogen—Continued										
44	–0.216	–0.099	0.016	0.003	--	0.341	0.982	0.217	0.012	0.029
45	–0.084	–0.007	0.009	0.007	--	0.248	0.245	0.072	0.005	0.021
46	–0.061	–0.108	0.012	0.008	--	0.245	0.107	0.058	0.007	0.046
47	–0.047	–0.002	–0.039	–0.004	--	0.234	1.061	0.273	0.017	0.032
48	0.027	–0.039	–0.008	–0.004	--	0.153	0.276	0.088	0.007	0.020
49	–0.043	0.175	–0.001	0.009	--	0.419	2.398	0.615	0.039	0.077
52	0.055	0.188	–0.008	0.005	--	0.371	5.797	1.632	0.115	0.072
53	0.050	0.064	–0.019	0.004	--	0.267	1.613	0.365	0.020	0.042
57	–0.012	0.047	0.031	–0.004	--	0.184	0.134	0.079	0.011	0.041
58	–0.044	–0.067	–0.014	0.007	--	0.260	0.275	0.138	0.017	0.057
59	–0.068	–0.012	–0.004	0.003	--	0.177	0.247	0.078	0.006	0.027
60	–0.103	0.026	0.020	–0.003	--	0.294	0.159	0.084	0.011	0.044
61	–0.062	–0.051	0.002	0.001	--	0.259	0.170	0.098	0.013	0.050
62	–0.084	–0.075	–0.017	–0.000	--	0.279	0.106	0.052	0.007	0.057
65	–0.008	0.063	0.026	0.004	--	0.283	0.243	0.090	0.008	0.040
67	–0.013	–0.050	0.016	–0.007	--	0.330	3.515	0.844	0.050	0.047
71	--	--	0.014	--	--	0.776	6.958	1.851	0.122	--
72	0.009	–0.118	–0.003	--	--	0.367	0.054	0.021	--	0.046
73	0.213	–0.009	0.017	--	--	0.270	0.524	0.042	--	0.046
74	0.111	–0.001	0.029	–0.008	--	0.317	0.990	0.422	0.044	0.045
76	0.172	0.279	0.026	--	--	0.245	0.164	0.028	--	0.031
81	0.173	0.168	–0.032	0.014	--	0.407	0.177	0.096	0.012	0.070
82	0.122	0.232	0.001	--	--	0.398	0.148	0.031	--	0.073
92	0.157	0.196	–0.036	--	--	0.417	0.061	0.028	--	0.055
95	0.193	–0.028	0.012	--	--	0.260	9.883	1.580	0.063	0.039
97	–0.034	–0.518	0.007	--	--	0.273	0.095	0.029	0.006	0.087
99	0.273	0.270	0.038	--	--	0.473	0.702	0.077	--	0.074
100	--	--	0.031	--	--	0.566	1.779	0.180	--	--
101	0.065	0.302	0.047	--	--	0.445	2.159	0.325	--	0.115
102	0.173	–0.002	0.005	--	--	0.351	0.075	0.021	--	0.057
103	--	--	–0.070	--	0.149	0.277	0.462	0.295	0.045	--
106	0.033	0.240	–0.133	--	0.836	0.315	0.217	0.030	--	0.053
107	0.042	0.330	0.007	--	--	0.140	0.350	0.102	0.007	0.018
108	0.109	0.089	–0.005	--	--	0.188	96.966	36.073	3.354	0.035
109	0.008	0.274	0.028	--	--	0.377	0.152	0.033	--	0.054
110	--	--	0.043	--	--	0.415	0.434	0.048	--	--
111	0.222	0.096	–0.004	--	--	0.534	0.928	0.286	0.021	0.082
112	0.376	–0.148	–0.053	--	--	0.382	12.536	2.285	0.104	0.047
113	0.140	–0.045	0.018	--	--	0.577	0.300	0.041	--	0.080
114	0.198	–0.296	–0.017	--	--	0.556	0.293	0.046	--	0.079
115	--	--	0.028	--	--	0.576	0.408	0.200	0.022	--
116	0.168	–0.027	–0.007	--	--	0.325	0.274	0.031	--	0.058
118	0.279	–0.078	0.019	--	--	0.323	0.711	0.062	--	0.042
120	0.021	0.161	0.062	--	--	0.374	0.147	0.044	--	0.060
124	–0.119	0.104	0.006	--	--	0.261	0.291	0.050	--	0.052
125	0.067	0.081	–0.022	--	--	0.315	0.483	0.062	--	0.056
134	–0.016	0.219	0.029	--	--	0.255	0.856	0.263	0.020	0.050
135	0.103	0.205	0.005	--	--	0.311	0.877	0.254	0.018	0.051
136	--	--	0.016	--	--	0.307	0.137	0.050	--	--
137	0.051	0.245	0.048	–0.007	--	0.156	0.226	0.086	0.008	0.028
138	0.075	0.237	0.017	--	--	0.253	0.685	0.189	0.013	0.039
139	0.007	0.227	0.036	–0.011	--	0.380	0.562	0.183	0.014	0.064
145	–0.159	–0.102	0.019	–0.011	--	0.350	0.168	0.069	0.007	0.074

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Total nitrogen—Continued										
146	–0.195	–0.186	–0.005	--	--	0.496	0.117	0.049	0.006	0.107
147	–0.279	–0.197	0.005	--	--	0.412	0.107	0.036	0.005	0.095
148	–0.123	–0.172	0.008	--	--	0.284	0.077	0.022	--	0.056
149	0.111	0.093	0.008	--	--	0.241	0.690	0.144	0.008	0.043
150	–0.135	–0.190	0.055	–0.011	--	0.326	0.941	0.258	0.017	0.055
151	0.002	0.075	0.007	--	--	0.226	2.388	0.478	0.024	0.034
152	0.218	–0.087	0.039	--	--	0.401	0.572	0.069	--	0.084
153	0.133	–0.124	–0.005	--	--	0.240	11.571	1.770	0.068	0.045
154	--	--	–0.010	--	--	0.382	2.197	0.611	0.042	--
155	--	--	–0.003	--	--	0.363	1.220	0.427	0.036	--
156	0.043	–0.219	–0.005	--	--	0.217	9.037	1.479	0.060	0.042
157	0.133	–0.199	–0.017	--	--	0.303	0.204	0.030	--	0.043
173	0.144	–0.094	0.012	--	--	0.302	0.159	0.029	--	0.054
176	--	--	0.023	--	--	0.471	0.590	0.082	--	--
179	--	--	0.005	--	--	0.325	1.046	0.109	--	--
182	–0.346	0.263	0.099	--	--	0.481	2.801	1.052	0.098	0.099
196	0.131	0.337	–0.004	0.018	--	0.459	0.183	0.082	0.009	0.060
199	0.175	0.222	–0.019	0.030	--	0.569	0.165	0.159	0.039	0.067
201	0.122	0.026	–0.035	0.027	--	0.494	0.058	0.042	0.016	0.058
202	0.045	–0.003	–0.050	0.024	--	0.451	0.177	0.159	0.037	0.057
208	0.206	0.271	–0.028	0.012	--	0.344	7.369	1.405	0.067	0.098
209	0.274	0.461	–0.069	0.012	--	0.387	6.656	1.370	0.070	0.063
210	0.125	0.252	–0.067	0.010	--	0.364	7.339	1.548	0.081	0.060
212	--	--	–0.026	--	--	0.281	30.119	6.874	0.392	--
213	0.305	0.305	–0.074	0.015	--	0.329	6.108	1.195	0.058	0.064
214	0.233	0.300	–0.051	0.013	--	0.341	4.141	0.775	0.036	0.062
215	0.481	0.240	–0.031	--	--	0.416	2.364	0.197	--	0.100
217	0.224	0.285	–0.058	0.007	--	0.286	0.632	0.228	0.020	0.058
218	–0.081	0.080	–0.031	–0.005	--	0.102	0.346	0.167	0.020	0.029
219	--	--	–0.042	--	--	0.408	1.328	0.416	0.031	--
220	–0.158	0.016	–0.041	–0.008	--	0.341	0.227	0.095	0.011	0.076
221	–0.084	0.380	0.019	–0.008	--	0.327	1.299	0.412	0.032	0.078
222	--	--	0.012	--	--	0.354	2.005	0.514	0.032	--
223	–0.071	0.197	–0.005	--	--	0.158	0.332	0.036	--	0.020
224	0.091	0.068	0.011	0.014	--	0.252	1.475	0.425	0.030	0.045
225	0.056	0.370	0.009	–0.011	--	0.356	0.304	0.092	0.007	0.072
227	0.176	0.312	–0.009	0.012	--	0.298	4.003	0.760	0.036	0.050
228	0.305	0.478	–0.011	0.007	--	0.240	15.470	2.486	0.100	0.047
231	–0.018	0.206	0.001	0.009	--	0.198	0.372	0.107	0.008	0.022
232	0.364	0.286	–0.038	--	--	0.418	0.178	0.032	--	0.034
241	–0.031	–0.557	0.002	--	--	0.596	0.128	0.079	0.012	0.055
242	0.069	0.054	0.092	–0.019	--	0.313	1.534	0.477	0.036	0.045
243	0.088	0.149	0.002	--	--	0.289	1.695	0.403	0.024	0.030
244	0.154	0.417	0.037	--	--	0.400	0.609	0.061	--	0.047
Nitrate										
1	0.188	0.205	–0.023	0.009	--	0.337	0.906	0.303	0.025	0.060
2	--	--	0.009	--	--	0.282	0.501	0.212	0.022	--
3	0.196	0.270	–0.020	--	--	0.509	1.683	0.525	0.041	0.109
4	0.229	0.233	0.005	--	--	0.331	2.896	0.606	0.032	0.050
5	0.035	0.123	–0.001	--	--	0.138	0.260	0.155	0.022	0.027
6	0.196	0.284	–0.032	--	--	0.292	0.407	0.066	--	0.064
7	–0.006	0.081	0.002	--	--	0.175	1.357	0.400	0.029	0.031
8	0.062	0.149	–0.003	--	--	0.310	0.241	0.051	--	0.051
9	0.482	0.176	–0.041	0.023	--	0.570	0.994	0.478	0.057	0.162

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Nitrate—Continued										
10	–0.090	0.033	–0.015	--	--	0.166	0.144	0.028	--	0.030
11	0.169	0.307	0.011	--	--	0.329	0.313	0.042	--	0.081
12	–0.091	0.018	–0.016	–0.006	--	0.268	1.178	0.402	0.034	0.053
13	0.608	0.122	–0.005	--	--	0.750	0.334	0.112	--	0.176
14	--	--	–0.001	--	--	0.627	0.286	0.196	0.030	--
15	0.085	0.195	–0.012	--	--	0.267	1.314	0.308	0.018	0.041
16	0.398	0.318	–0.028	--	--	0.383	1.044	0.501	0.058	0.089
17	0.449	0.565	0.018	--	--	0.583	0.165	0.122	0.020	0.140
18	–0.127	0.107	0.000	--	--	0.235	0.166	0.035	--	0.058
19	–0.019	0.152	–0.030	--	--	0.258	0.633	0.221	0.019	0.046
20	--	--	0.025	--	--	0.214	0.765	0.374	0.045	--
21	--	--	0.002	--	--	0.292	0.462	0.296	0.044	--
22	0.286	–0.030	0.009	--	--	0.365	0.187	0.055	--	0.080
23	--	--	–0.021	--	--	0.247	0.089	0.031	--	--
24	--	--	–0.017	--	--	0.687	0.231	0.173	0.029	--
25	0.018	0.182	–0.002	--	--	0.219	0.219	0.041	--	0.053
26	–0.045	0.103	0.008	--	--	0.198	0.651	0.190	0.014	0.031
29	0.411	0.667	–0.088	--	--	0.493	0.669	0.145	--	0.116
31	0.326	0.247	–0.053	--	--	0.398	7.827	1.816	0.105	0.093
32	0.158	0.269	–0.003	0.016	--	0.483	1.442	0.577	0.057	0.117
33	0.007	0.112	–0.025	--	--	0.246	0.304	0.033	--	0.040
34	0.089	–0.118	–0.029	--	--	0.411	0.163	0.054	--	0.065
35	0.260	0.067	–0.031	--	--	0.416	0.222	0.065	--	0.073
36	0.082	0.134	0.005	0.004	--	0.270	0.190	0.075	0.007	0.032
37	0.046	0.248	–0.023	--	--	0.264	1.164	0.218	0.010	0.029
38	0.143	0.100	–0.010	--	--	0.207	0.407	0.129	0.010	0.018
39	–0.144	0.047	–0.017	0.010	--	0.186	0.306	0.093	0.007	0.018
40	–0.128	0.243	–0.038	--	--	0.416	1.222	0.268	0.014	0.055
41	0.173	0.154	0.020	--	--	0.888	1.606	0.425	0.028	0.081
42	–0.008	–0.093	0.001	--	--	0.404	0.400	0.119	0.009	0.031
43	0.284	–0.033	0.006	0.013	--	0.510	0.229	0.078	0.007	0.044
44	–0.097	0.082	–0.022	0.006	--	0.675	2.284	0.502	0.027	0.054
45	0.014	0.299	–0.019	--	--	0.634	0.619	0.184	0.013	0.056
50	0.248	–0.154	–0.022	–0.010	--	0.532	2.906	0.759	0.049	0.075
65	0.030	0.157	0.025	0.003	--	0.431	0.354	0.131	0.011	0.062
66	0.122	–0.070	–0.006	–0.000	--	0.343	0.211	0.111	0.013	0.044
71	--	--	0.080	--	--	0.815	7.009	1.877	0.125	--
72	0.124	0.016	–0.042	--	--	0.463	0.078	0.060	0.012	0.057
73	0.353	–0.030	–0.008	--	--	0.397	0.747	0.060	--	0.067
74	0.888	1.188	0.011	--	--	0.653	0.444	0.097	--	0.114
76	0.088	1.028	0.063	--	--	0.804	2.640	0.893	0.075	0.104
81	0.536	1.058	–0.015	--	--	1.101	0.325	0.069	--	0.188
82	0.520	1.154	–0.091	--	--	1.497	0.606	0.126	--	0.321
88	–0.023	0.740	0.030	--	--	1.218	0.557	0.110	--	0.257
92	0.417	0.355	–0.068	--	--	0.596	0.087	0.041	--	0.082
95	0.197	–0.033	0.001	--	--	0.356	13.248	2.119	0.085	0.049
96	0.082	0.610	–0.063	--	--	0.530	1.812	0.828	0.093	0.091
98	0.001	–0.465	–0.061	--	--	0.401	4.986	1.342	0.090	0.086
99	0.651	1.817	–0.010	--	--	1.045	13.320	2.860	0.153	0.146
100	--	--	–0.121	--	--	0.560	36.418	7.364	0.372	--
101	0.036	0.915	0.038	--	--	0.542	2.548	0.382	--	0.136
102	0.456	1.081	–0.126	--	--	1.389	0.348	0.087	--	0.244

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
					Nitrate—Continued					
103	–0.062	–0.042	–0.123	--	0.654	0.252	0.184	0.040	--	0.039
104	--	--	–0.122	--	--	0.801	0.173	0.046	--	--
105	0.050	0.598	–0.013	--	--	0.753	0.140	0.042	--	0.084
106	–0.126	0.352	–0.133	--	0.562	0.327	0.226	0.040	0.011	0.055
107	0.010	0.337	0.003	--	--	0.145	0.360	0.105	0.008	0.018
108	0.077	0.227	0.007	--	--	0.185	95.333	35.465	3.298	0.034
109	0.004	0.375	–0.034	--	--	0.567	0.391	0.162	0.017	0.079
110	0.321	0.813	0.009	--	--	1.075	8.829	1.900	0.102	0.142
111	0.347	0.987	0.039	--	--	1.386	2.587	0.783	0.057	0.207
112	0.672	0.088	–0.091	--	--	0.795	2.328	0.215	--	0.092
113	0.550	1.086	0.038	--	--	1.207	2.182	0.588	0.039	0.177
114	0.348	0.325	0.055	--	--	1.130	1.610	0.510	0.040	0.170
115	–0.632	0.084	0.075	--	--	1.175	1.158	0.522	0.054	0.246
116	0.299	0.253	–0.084	--	--	0.788	0.711	0.080	--	0.144
117	–0.006	0.327	–0.001	--	--	0.624	2.644	0.691	0.044	0.095
118	0.427	0.054	–0.033	--	--	0.606	1.289	0.112	--	0.074
119	0.401	–0.288	–0.063	0.011	--	0.647	0.775	0.323	0.032	0.117
120	0.045	0.161	0.071	--	--	0.567	0.236	0.070	--	0.102
121	–0.484	0.424	0.051	–0.007	--	0.700	1.027	0.299	0.021	0.144
122	–0.365	–0.066	0.023	--	--	0.404	0.490	0.055	--	0.074
123	--	--	–0.002	--	--	0.440	0.119	0.036	--	--
124	–0.062	0.133	0.022	–0.005	--	0.262	1.660	0.525	0.041	0.053
125	0.142	0.139	–0.013	--	--	0.283	2.892	0.698	0.042	0.043
126	0.611	–0.839	–0.033	--	--	0.530	0.953	0.346	0.030	0.111
127	0.588	–0.328	0.092	--	--	0.599	0.326	0.069	--	0.143
128	0.085	0.176	–0.005	--	--	0.287	0.109	0.040	--	0.040
129	0.326	0.963	0.136	–0.030	--	1.014	0.616	0.479	0.092	0.161
130	–0.041	0.200	0.011	–0.009	--	0.220	0.339	0.152	0.017	0.030
131	–0.065	0.130	0.040	–0.014	--	0.221	1.268	0.494	0.048	0.032
132	0.148	0.285	–0.062	--	--	0.247	1.738	0.727	0.075	0.048
133	0.128	0.309	–0.073	–0.004	--	0.155	0.364	0.145	0.015	0.021
134	–0.050	0.242	0.035	--	--	0.270	0.875	0.268	0.020	0.049
135	0.132	0.294	–0.018	--	--	0.465	1.371	0.396	0.028	0.076
136	--	--	0.016	--	--	0.328	0.146	0.054	--	--
137	0.057	0.309	0.045	–0.005	--	0.157	0.228	0.086	0.008	0.028
138	0.088	0.307	0.002	--	--	0.302	0.817	0.225	0.015	0.047
139	0.042	0.350	0.032	–0.009	--	0.401	0.593	0.193	0.015	0.067
140	0.254	0.237	0.143	0.044	--	1.210	0.640	0.266	0.033	0.243
141	0.247	1.104	–0.037	--	--	1.287	0.577	0.109	--	0.179
142	–0.121	0.919	–0.058	--	--	1.025	0.497	0.219	0.024	0.134
143	–0.022	0.663	–0.038	0.015	--	0.816	1.387	0.476	0.041	0.112
144	–0.040	0.337	–0.000	--	--	0.598	1.949	0.627	0.050	0.081
145	--	--	0.035	--	--	0.836	0.197	0.040	--	--
146	–0.168	0.228	0.078	–0.009	--	0.581	0.412	0.177	0.017	0.143
147	–0.010	0.509	0.077	–0.021	--	0.674	0.336	0.145	0.018	0.169
148	–0.051	–0.169	0.014	–0.016	--	0.597	0.436	0.216	0.026	0.136
149	0.719	0.420	–0.066	--	--	0.809	0.876	0.086	--	0.148
150	–0.490	0.373	0.015	--	--	1.043	3.510	0.956	0.064	0.186
151	0.296	0.399	–0.052	--	--	0.724	8.545	1.689	0.083	0.113
152	0.257	0.126	0.003	--	--	0.524	5.801	1.415	0.086	0.104
153	0.120	–0.171	–0.015	--	--	0.301	14.377	2.199	0.084	0.056
154	--	--	–0.013	--	--	0.350	2.101	0.591	0.041	--

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model									
	Sine coefficient	Cosine coefficient	Time coefficient	Time squared coefficient	Step trend coefficient	Root mean square error	Standard error of intercept	Standard error of log streamflow coefficient	Standard error of log streamflow squared coefficient	Standard error of sine coefficient
Nitrate—Continued										
155	0.017	–0.102	–0.014	--	--	0.317	1.085	0.376	0.032	0.046
156	–0.008	–0.367	–0.016	--	--	0.352	14.447	2.366	0.097	0.064
157	–0.061	–0.485	0.026	–0.007	--	0.644	0.918	0.292	0.024	0.094
158	0.353	0.473	–0.037	--	--	0.516	4.127	0.982	0.058	0.083
159	–0.475	0.326	–0.009	--	--	0.619	2.259	0.775	0.065	0.139
160	--	--	0.008	--	--	0.580	2.543	0.769	0.056	--
161	–0.421	0.143	0.048	--	--	0.856	0.205	0.070	0.010	0.150
162	0.626	0.373	–0.017	--	--	1.063	0.257	0.055	--	0.182
163	–0.379	0.197	0.014	–0.026	--	0.627	5.349	1.277	0.074	0.139
164	0.287	1.009	–0.255	--	--	1.158	0.508	0.297	0.039	0.245
167	–0.401	0.078	0.005	--	--	0.837	0.164	0.041	--	0.139
168	–0.348	0.164	0.041	--	--	0.531	0.114	0.030	--	0.087
172	--	--	0.012	--	--	0.427	0.306	0.051	--	--
174	0.207	0.346	–0.003	0.007	--	0.442	6.654	1.886	0.133	0.082
175	–0.271	–0.052	–0.013	0.008	--	0.246	3.128	0.700	0.039	0.034
177	0.292	0.270	–0.010	--	--	0.422	0.816	0.117	--	0.080
181	–0.207	0.114	0.024	--	--	0.432	0.266	0.056	--	0.067
187	0.186	0.413	–0.046	--	--	0.390	0.503	0.088	--	0.076
189	–0.270	–0.157	–0.018	--	--	0.573	0.552	0.273	0.033	0.090
190	0.194	0.456	0.063	--	--	0.690	0.441	0.093	--	0.096
191	0.835	0.804	0.122	0.015	--	0.847	1.983	0.708	0.062	0.154
192	–0.296	0.153	–0.073	--	--	0.558	0.342	0.066	--	0.071
194	0.272	0.107	0.002	--	--	0.695	0.137	0.043	--	0.091
195	0.237	0.412	–0.025	0.006	--	0.484	0.270	0.131	0.015	0.069
197	0.582	0.312	–0.105	--	--	0.761	0.111	0.052	--	0.072
198	0.983	0.190	0.012	–0.005	--	0.611	0.131	0.138	0.039	0.069
199	0.759	0.085	0.002	--	--	0.470	0.074	0.040	--	0.052
200	0.704	0.166	–0.001	--	--	0.503	0.174	0.156	0.032	0.050
201	0.598	0.434	0.058	–0.019	--	0.647	0.446	0.218	0.084	0.331
205	0.108	0.744	–0.007	--	--	0.285	2.803	0.631	0.035	0.044
207	0.067	0.890	–0.004	--	--	0.489	1.758	0.552	0.043	0.080
208	0.274	0.443	–0.031	0.013	--	0.384	8.225	1.569	0.074	0.109
209	0.504	0.628	–0.053	0.015	--	0.461	7.597	1.568	0.081	0.073
210	0.254	0.478	–0.036	0.017	--	0.343	5.984	1.267	0.067	0.049
213	0.468	0.480	–0.061	0.018	--	0.348	5.609	1.104	0.054	0.059
215	0.566	0.704	0.025	--	--	0.453	2.352	0.195	--	0.104
217	1.266	0.763	–0.024	--	--	0.739	1.626	0.582	0.050	0.149
218	–0.105	0.098	–0.031	–0.004	--	0.129	0.432	0.210	0.025	0.035
224	–0.020	0.214	–0.022	0.019	--	0.321	1.777	0.511	0.036	0.050
225	0.267	0.702	–0.006	–0.010	--	0.744	0.638	0.194	0.016	0.141
226	–0.136	0.094	0.023	--	--	0.361	0.055	0.042	0.008	0.065
228	0.364	0.886	–0.043	0.009	--	0.364	19.088	3.068	0.123	0.067
229	–0.169	0.596	–0.089	0.011	--	0.397	2.082	0.605	0.043	0.080
234	–0.063	0.126	0.009	–0.017	--	0.361	2.044	0.535	0.035	0.055
235	0.580	0.631	0.007	--	--	0.516	0.614	0.080	--	0.095
237	–0.066	1.090	0.007	--	--	0.644	0.930	0.122	--	0.103
238	0.305	0.250	0.041	–0.011	--	0.395	2.668	0.629	0.037	0.074
239	0.274	0.488	0.005	–0.010	--	0.289	22.226	3.864	0.168	0.036
240	–0.121	0.086	–0.077	0.020	--	0.362	0.508	0.228	0.025	0.222
241	–0.074	–0.591	0.005	--	--	0.648	0.124	0.076	0.012	0.059
242	0.004	0.073	0.095	–0.024	--	0.384	1.448	0.434	0.032	0.051
243	0.103	0.140	0.010	–0.012	--	0.302	1.198	0.281	0.016	0.023
244	0.314	0.588	–0.036	--	--	0.467	0.685	0.069	--	0.049

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Total phosphorus				
1	0.107	0.022	--	--	0.069	–0.425	0.008	1/1/1998
2	0.124	0.021	0.007	--	0.059	–0.232	0.004	1/1/1998
3	0.088	0.019	0.006	--	0.050	–0.221	0.005	1/1/1998
4	0.093	0.019	--	--	0.057	–0.089	0.002	1/1/1998
5	0.073	0.015	--	--	0.035	0.128	0.002	1/1/1998
7	0.054	0.012	0.004	--	0.027	–0.281	0.003	1/1/1998
8	--	0.011	--	--	0.025	–0.288	0.002	1/1/1998
10	0.054	0.012	0.004	--	0.027	–0.287	0.003	1/1/1998
11	--	0.046	--	--	0.129	0.128	0.016	1/1/1998
12	0.075	0.015	0.005	--	0.035	–0.540	0.009	1/1/1998
13	0.241	0.058	--	--	0.121	–0.314	0.019	1/1/1998
14	0.089	0.014	--	--	0.049	–0.171	0.004	1/1/1998
15	0.097	0.021	--	--	0.053	0.374	0.007	1/1/1998
16	0.151	0.025	0.009	--	0.080	–0.121	0.008	1/1/1998
17	--	0.061	--	--	0.147	0.065	0.041	1/1/1998
18	0.070	0.014	--	--	0.034	–0.837	0.036	1/1/1998
19	0.043	0.009	--	--	0.021	–0.808	0.018	1/1/1998
20	0.077	0.018	0.006	--	0.041	–0.350	0.008	1/1/1998
22	0.063	0.015	--	--	0.033	0.049	0.005	1/1/1998
24	0.145	0.039	0.012	--	0.097	0.516	0.041	1/1/1998
25	--	0.014	--	--	0.032	–0.316	0.007	1/1/1998
26	0.041	0.011	--	--	0.021	–0.388	0.006	1/1/1998
27	0.112	0.023	0.008	--	0.069	0.246	0.006	1/1/1998
28	0.243	0.050	0.016	--	0.146	–0.119	0.006	1/1/1998
30	0.252	0.062	--	--	0.163	0.011	0.004	1/1/1998
31	0.190	0.049	0.013	--	0.130	0.305	0.011	1/1/1998
32	0.172	0.034	--	--	0.094	–0.087	0.011	1/1/1998
33	0.077	0.016	--	--	0.037	0.127	0.003	1/1/1998
34	0.067	0.017	--	--	0.033	0.149	0.003	1/1/1998
35	0.066	0.016	--	--	0.032	0.105	0.003	1/1/1998
36	0.066	0.015	0.006	--	0.038	0.660	0.011	1/1/1998
37	0.068	0.013	--	--	0.038	0.576	0.005	1/1/1998
38	0.050	0.012	0.004	--	0.024	0.139	0.002	1/1/1998
39	0.071	0.016	--	--	0.032	0.232	0.004	1/1/1998
40	0.095	0.020	0.006	--	0.052	0.680	0.015	1/1/1998
41	0.059	0.014	--	--	0.035	1.294	0.013	1/1/1998
42	0.035	0.007	0.002	--	0.016	–0.082	0.001	1/1/1998
43	0.028	0.006	0.002	--	0.013	0.023	0.001	1/1/1998
44	0.045	0.010	0.003	--	0.021	0.471	0.003	1/1/1998
45	0.032	0.007	0.002	--	0.015	0.475	0.002	1/1/1998
46	0.137	0.024	0.009	--	0.097	0.743	0.024	1/1/1998
51	0.053	0.012	0.004	--	0.025	–0.119	0.001	1/1/1998
52	0.065	0.016	0.005	--	0.035	–0.024	0.001	1/1/1998
53	0.054	0.012	0.004	--	0.034	0.150	0.002	1/1/1998
54	0.051	0.011	0.003	--	0.024	–0.008	0.001	1/1/1998
55	0.030	0.008	0.003	--	0.014	–0.074	0.001	1/1/1998
56	0.050	0.011	0.004	--	0.023	–0.655	0.011	1/1/1998
58	0.042	0.010	0.003	--	0.021	0.138	0.002	1/1/1998
59	0.035	0.008	0.002	--	0.016	–0.113	0.001	1/1/1998
60	0.035	0.007	0.003	--	0.017	0.319	0.003	1/1/1998
61	0.062	0.014	0.005	--	0.031	0.185	0.006	1/1/1998
62	0.054	0.012	0.004	--	0.026	0.280	0.008	1/1/1998
63	0.077	0.015	0.006	--	0.033	0.647	0.019	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
Total phosphorus—Continued								
64	0.086	0.018	0.008	--	0.059	0.023	0.010	1/1/1998
65	0.047	0.010	0.004	--	0.022	–1.351	0.031	1/1/1998
66	0.145	0.026	0.009	--	0.101	0.851	0.013	1/1/1998
68	0.085	0.021	0.006	--	0.064	0.032	0.001	1/1/1998
69	0.061	0.015	0.007	--	0.040	0.369	0.005	1/1/1998
70	0.057	0.012	0.004	--	0.027	–0.147	0.002	1/1/1998
71	--	0.014	--	--	0.029	0.085	0.001	1/1/1998
72	0.093	0.017	0.007	--	0.051	1.018	0.022	1/1/1998
73	0.042	0.010	--	--	0.020	0.318	0.002	1/1/1998
74	--	0.026	--	--	0.148	0.207	0.002	1/1/1998
75	0.028	0.005	--	--	0.012	0.145	0.000	1/1/1998
76	0.049	0.010	--	--	0.027	0.057	0.001	1/1/1998
77	0.038	0.008	0.003	--	0.016	–0.287	0.001	1/1/1998
78	0.065	0.013	--	--	0.034	0.199	0.001	1/1/1998
79	0.035	0.009	--	--	0.019	0.245	0.001	1/1/1997
80	0.022	0.005	--	--	0.010	0.070	0.000	1/1/1997
81	0.115	0.018	0.006	--	0.036	0.300	0.025	1/1/1998
82	0.090	0.018	0.007	--	0.036	0.306	0.016	1/1/1998
83	0.054	0.010	0.004	--	0.026	0.436	0.006	1/1/1998
84	0.034	0.008	0.003	--	0.018	0.400	0.001	1/1/1998
85	--	0.007	--	--	0.018	0.546	0.002	1/1/1998
86	0.050	0.010	--	--	0.026	0.449	0.002	1/1/1998
87	0.073	0.017	--	--	0.038	1.272	0.041	1/1/1998
88	0.076	0.021	--	--	0.045	1.253	0.069	1/1/1998
89	0.096	0.023	--	--	0.048	0.930	0.033	1/1/1998
90	0.044	0.011	0.004	--	0.022	–0.308	0.002	1/1/1998
91	0.043	0.010	0.004	--	0.022	–0.357	0.004	1/1/1998
92	0.080	0.017	0.007	--	0.050	0.352	0.008	1/1/1998
93	0.049	0.013	0.004	--	0.023	–0.130	0.001	1/1/1998
94	--	0.023	--	--	0.081	0.445	0.010	1/1/1998
95	--	0.012	--	--	0.024	0.174	0.001	1/1/1998
97	0.265	0.029	--	--	0.081	0.799	0.107	1/1/1998
99	0.160	0.034	--	--	0.072	0.605	0.012	1/1/1998
101	0.075	0.014	--	--	0.033	0.034	0.000	1/1/1998
106	0.172	0.146	--	1.227	0.075	1.092	0.068	1/1/1998
107	0.036	0.008	--	--	0.018	–0.079	0.001	1/1/1998
109	--	0.019	--	--	0.038	0.604	0.013	1/1/1998
110	0.062	0.015	--	--	0.030	0.178	0.002	1/1/1998
111	0.104	0.026	--	--	0.049	1.013	0.033	1/1/1998
112	0.092	0.018	--	--	0.038	0.127	0.001	1/1/1998
113	0.089	0.023	--	--	0.039	0.997	0.031	1/1/1998
114	0.104	0.025	--	--	0.053	1.091	0.040	1/1/1998
115	0.079	0.019	--	--	0.043	0.395	0.020	1/1/1998
118	--	0.021	--	--	0.039	0.186	0.002	1/1/1998
120	0.050	0.012	--	--	0.036	0.273	0.003	1/1/1998
134	0.081	0.017	0.006	--	0.041	–0.326	0.007	1/1/1998
135	0.075	0.017	--	--	0.037	0.292	0.008	1/1/1998
136	0.095	0.033	--	--	0.048	–0.304	0.007	1/1/2000
137	0.043	0.010	--	--	0.021	0.627	0.011	1/1/1998
138	0.043	0.010	--	--	0.022	0.598	0.009	1/1/1998
139	0.081	0.017	--	--	0.044	1.370	0.045	1/1/1998
145	--	0.019	--	--	0.041	0.700	0.029	1/1/1998
148	0.073	0.014	--	--	0.037	0.337	0.011	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
Total phosphorus—Continued								
149	0.043	0.011	0.003	--	0.022	0.115	0.003	1/1/1998
150	0.080	0.021	--	--	0.041	0.697	0.017	1/1/1998
151	0.056	0.011	--	--	0.029	0.350	0.003	1/1/1998
152	--	0.026	--	--	0.102	0.045	0.004	1/1/1998
153	--	0.010	--	--	0.022	0.014	0.000	1/1/1998
154	0.063	0.014	--	--	0.031	0.165	0.001	1/1/1998
155	--	0.015	--	--	0.033	0.113	0.002	1/1/1998
156	--	0.008	--	--	0.018	0.074	0.000	1/1/1998
157	0.046	0.010	--	--	0.024	0.103	0.002	1/1/1998
165	0.141	0.031	--	--	0.070	0.234	0.031	1/1/1998
166	--	0.060	--	--	0.140	0.404	0.044	1/1/1998
169	--	0.075	--	--	0.236	0.459	0.220	1/1/1998
170	--	0.022	--	--	0.050	0.066	0.003	1/1/1998
171	--	0.026	--	--	0.058	0.155	0.008	1/1/1998
173	0.059	0.012	--	--	0.028	0.226	0.005	1/1/1998
177	0.152	0.030	--	--	0.090	–0.012	0.004	1/1/1998
178	0.228	0.042	--	--	0.109	0.558	0.017	1/1/1998
180	--	0.040	--	--	0.105	0.285	0.005	1/1/1998
182	0.157	0.039	--	--	0.083	0.601	0.020	1/1/1998
183	0.226	0.045	--	--	0.108	1.184	0.092	1/1/1998
184	0.254	0.054	--	--	0.145	1.422	0.122	1/1/1998
185	0.180	0.038	--	--	0.105	0.615	0.022	1/1/1998
186	0.231	0.041	0.015	--	0.130	0.391	0.013	1/1/1998
188	0.093	0.016	0.006	--	0.037	–0.046	0.005	1/1/1998
193	0.137	0.017	0.006	--	0.047	0.221	0.004	1/1/1998
203	0.086	0.019	0.007	--	0.055	0.322	0.003	1/1/1998
204	0.136	0.033	--	--	0.072	0.218	0.002	1/1/1998
205	0.124	0.026	0.012	--	0.062	0.218	0.002	1/1/1998
206	0.072	0.015	0.005	--	0.040	0.063	0.001	1/1/1998
207	0.147	0.032	0.011	--	0.076	0.213	0.003	1/1/1998
208	0.052	0.008	--	--	0.018	0.140	0.002	1/1/1998
209	0.050	0.008	0.003	--	0.018	0.166	0.001	1/1/1998
210	0.050	0.009	--	--	0.021	0.167	0.001	1/1/1998
211	--	0.009	--	--	0.020	0.100	0.001	1/1/1998
212	--	0.017	--	--	0.037	0.023	0.000	1/1/1998
213	0.049	0.008	0.003	--	0.017	0.209	0.001	1/1/1998
214	0.036	0.005	0.002	--	0.012	0.141	0.001	1/1/1998
215	0.051	0.011	--	--	0.025	0.125	0.001	1/1/1998
216	0.083	0.020	--	--	0.053	0.032	0.002	1/1/1998
217	0.067	0.011	0.004	--	0.024	0.184	0.006	1/1/1998
218	0.055	0.009	--	--	0.020	0.014	0.001	1/1/1998
219	--	0.015	--	--	0.033	0.523	0.013	1/1/1998
220	0.082	0.015	--	--	0.032	0.323	0.010	1/1/1998
221	0.102	0.027	0.008	--	0.062	–0.192	0.006	1/1/1998
222	0.205	0.051	--	--	0.108	–0.091	0.005	1/1/1998
223	0.041	0.010	--	--	0.020	0.014	0.000	1/1/1998
224	--	0.018	--	--	0.039	–0.737	0.015	1/1/1998
225	0.093	0.015	--	--	0.037	0.647	0.016	1/1/1998
227	0.054	0.009	0.003	--	0.020	0.174	0.002	1/1/1998
228	0.081	0.020	--	--	0.055	0.111	0.001	1/1/1998
229	0.167	0.027	0.008	--	0.060	0.286	0.003	1/1/1998
230	0.062	0.011	--	--	0.025	0.160	0.001	1/1/1998
231	0.037	0.005	0.002	--	0.012	0.252	0.001	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Total phosphorus—Continued				
232	0.050	0.009	0.003	--	0.027	0.202	0.001	1/1/1998
233	0.039	0.008	--	--	0.019	0.025	0.000	1/1/1998
234	0.150	0.037	0.017	--	0.075	0.136	0.004	1/1/1998
235	0.173	0.036	0.016	--	0.084	0.259	0.006	1/1/1998
236	0.221	0.032	0.013	--	0.073	0.342	0.006	1/1/1998
237	0.158	0.028	0.009	--	0.065	0.403	0.004	1/1/1998
238	0.117	0.022	0.008	--	0.067	–0.015	0.005	1/1/1998
239	--	0.029	--	--	0.084	0.024	0.000	1/1/1998
241	0.066	0.014	--	--	0.033	–0.108	0.005	1/1/1998
242	0.063	0.013	--	--	0.033	–0.218	0.003	1/1/1998
243	0.033	0.007	0.003	--	0.016	–0.060	0.000	1/1/1998
244	0.056	0.016	--	--	0.035	0.087	0.000	1/1/1998
				Total nitrogen				
1	--	0.010	--	--	0.022	–0.246	0.002	1/1/1998
2	--	0.008	--	--	0.018	–0.295	0.002	1/1/1998
3	--	0.008	--	--	0.016	–0.107	0.001	1/1/1998
4	0.036	0.008	--	--	0.020	–0.095	0.001	1/1/1998
5	0.019	0.004	--	--	0.009	–0.042	0.000	1/1/1998
6	--	0.019	--	--	0.041	–0.060	0.001	1/1/1998
7	0.034	0.008	0.003	--	0.017	–0.225	0.001	1/1/1998
8	0.033	0.007	--	--	0.016	–0.191	0.001	1/1/1998
9	0.085	0.015	0.007	--	0.037	0.106	0.003	1/1/1998
10	0.025	0.005	--	--	0.012	–0.238	0.001	1/1/1998
11	0.050	0.011	--	--	0.026	0.038	0.003	1/1/1998
12	0.042	0.009	0.003	--	0.020	–0.411	0.005	1/1/1998
13	--	0.018	--	--	0.040	0.049	0.006	1/1/1998
14	0.038	0.008	--	--	0.020	0.104	0.001	1/1/1998
15	0.028	0.006	--	--	0.012	0.147	0.001	1/1/1998
16	--	0.010	--	--	0.023	–0.064	0.001	1/1/1998
17	0.071	0.016	--	--	0.034	0.013	0.013	1/1/1998
18	--	0.009	--	--	0.021	–0.664	0.021	1/1/1998
19	0.035	0.008	--	--	0.017	–0.625	0.011	1/1/1998
20	--	0.010	--	--	0.023	–0.187	0.002	1/1/1998
21	--	0.010	--	--	0.023	0.054	0.001	1/1/1998
22	0.046	0.011	--	--	0.025	0.051	0.001	1/1/1998
23	--	0.010	--	--	0.023	–0.036	0.001	1/1/1998
24	--	0.018	--	--	0.032	0.751	0.023	1/1/1998
25	--	0.010	--	--	0.024	–0.182	0.002	1/1/1998
26	0.022	0.006	--	--	0.011	–0.241	0.002	1/1/1998
29	--	0.015	--	--	0.033	0.149	0.002	1/1/1998
31	0.053	0.012	--	--	0.027	0.131	0.002	1/1/1998
32	0.051	0.011	--	--	0.025	0.144	0.002	1/1/1998
33	--	0.008	--	--	0.018	0.040	0.001	1/1/1998
34	0.039	0.010	--	--	0.019	0.102	0.001	1/1/1998
35	0.038	0.009	--	--	0.018	0.026	0.001	1/1/1998
36	0.021	0.005	--	--	0.010	–0.028	0.001	1/1/1998
37	0.023	0.004	--	--	0.010	0.111	0.000	1/1/1998
38	0.017	0.004	0.001	--	0.008	–0.099	0.000	1/1/1998
39	0.018	0.005	0.002	--	0.008	0.002	0.000	1/1/1998
40	0.032	0.007	0.002	--	0.016	0.464	0.004	1/1/1998
41	--	0.007	--	--	0.019	0.795	0.005	1/1/1998
42	0.022	0.005	0.001	--	0.010	0.007	0.001	1/1/1998
43	0.018	0.004	0.001	--	0.008	0.043	0.000	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

	Properties of the calibrated model							
Site number (figure 1)	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Total nitrogen—Continued				
44	0.028	0.006	0.002	--	0.013	0.540	0.002	1/1/1998
45	0.019	0.004	0.001	--	0.009	0.079	0.000	1/1/1998
46	0.042	0.008	0.003	--	0.019	0.352	0.005	1/1/1998
47	0.032	0.007	0.002	--	0.015	–0.107	0.001	1/1/1998
48	0.021	0.004	0.001	--	0.009	–0.039	0.000	1/1/1998
49	0.072	0.014	0.006	--	0.034	0.100	0.003	1/1/1998
52	0.065	0.014	0.005	--	0.030	–0.016	0.001	1/1/1998
53	0.036	0.009	0.003	--	0.018	–0.124	0.001	1/1/1998
57	0.035	0.008	0.003	--	0.018	–0.294	0.005	1/1/1998
58	0.051	0.012	0.004	--	0.025	–0.131	0.003	1/1/1998
59	0.029	0.007	0.002	--	0.014	0.074	0.001	1/1/1998
60	0.044	0.009	0.003	--	0.021	0.163	0.002	1/1/1998
61	0.049	0.011	0.004	--	0.024	–0.145	0.003	1/1/1998
62	0.054	0.012	0.004	--	0.026	0.245	0.006	1/1/1998
65	0.039	0.008	0.003	--	0.018	–0.732	0.012	1/1/1998
67	0.044	0.011	0.004	--	0.022	–0.164	0.001	1/1/1998
71	--	0.026	--	--	0.055	0.301	0.005	1/1/1998
72	0.042	0.008	--	--	0.021	0.514	0.006	1/1/1998
73	0.036	0.008	--	--	0.017	0.127	0.001	1/1/1998
74	0.045	0.009	0.004	--	0.021	0.158	0.001	1/1/1998
76	0.028	0.006	--	--	0.014	0.060	0.001	1/1/1998
81	0.090	0.015	0.005	--	0.032	0.024	0.012	1/1/1998
82	0.080	0.016	--	--	0.034	0.168	0.009	1/1/1998
92	0.055	0.012	--	--	0.027	0.453	0.007	1/1/1998
95	0.042	0.009	--	--	0.016	0.124	0.000	1/1/1998
97	0.107	0.014	--	--	0.030	0.330	0.035	1/1/1998
99	0.078	0.016	--	--	0.035	0.131	0.002	1/1/1998
100	--	0.024	--	--	0.052	0.012	0.001	1/1/1998
101	0.085	0.016	--	--	0.039	0.064	0.000	1/1/1998
102	0.069	0.012	--	--	0.027	0.093	0.008	1/1/1998
103	--	0.043	--	0.359	0.020	–0.159	0.001	1/1/1998
106	0.059	0.054	--	0.454	0.027	–0.288	0.008	1/1/1998
107	0.020	0.004	--	--	0.009	–0.262	0.002	1/1/1998
108	0.035	0.007	--	--	0.018	0.008	0.000	1/1/1998
109	0.050	0.012	--	--	0.024	0.496	0.006	1/1/1998
110	--	0.012	--	--	0.024	0.193	0.001	1/1/1998
111	0.082	0.021	--	--	0.037	0.865	0.020	1/1/1998
112	0.057	0.012	--	--	0.024	0.091	0.001	1/1/1998
113	0.087	0.019	--	--	0.039	0.883	0.020	1/1/1998
114	0.074	0.019	--	--	0.040	0.556	0.013	1/1/1998
115	--	0.022	--	--	0.044	0.823	0.026	1/1/1998
116	0.057	0.014	--	--	0.029	0.403	0.009	1/1/1998
118	0.050	0.012	--	--	0.020	0.145	0.001	1/1/1998
120	0.045	0.011	--	--	0.021	0.070	0.002	1/1/1998
124	0.042	0.010	--	--	0.021	0.005	0.001	1/1/1998
125	0.042	0.009	--	--	0.022	0.109	0.001	1/1/1998
134	0.037	0.008	--	--	0.019	0.248	0.003	1/1/1998
135	0.047	0.010	--	--	0.024	0.138	0.002	1/1/1998
136	--	0.020	--	--	0.029	–0.189	0.002	1/1/2000
137	0.023	0.006	0.002	--	0.011	0.194	0.002	1/1/1998
138	0.034	0.007	--	--	0.017	0.463	0.005	1/1/1998
139	0.055	0.013	0.004	--	0.027	0.657	0.013	1/1/1998
145	0.061	0.013	0.004	--	0.030	0.255	0.012	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
Total nitrogen—Continued								
146	0.093	0.019	--	--	0.052	0.074	0.031	1/1/1998
147	0.077	0.016	--	--	0.040	–0.079	0.018	1/1/1998
148	0.050	0.010	--	--	0.024	0.070	0.005	1/1/1998
149	0.036	0.009	--	--	0.018	0.146	0.002	1/1/1998
150	0.047	0.013	0.004	--	0.024	0.294	0.004	1/1/1998
151	0.032	0.006	--	--	0.015	0.139	0.001	1/1/1998
152	0.071	0.019	--	--	0.039	0.052	0.003	1/1/1998
153	0.031	0.008	--	--	0.015	0.065	0.000	1/1/1998
154	--	0.012	--	--	0.026	0.255	0.002	1/1/1998
155	--	0.012	--	--	0.028	0.256	0.003	1/1/1998
156	0.029	0.007	--	--	0.014	0.055	0.000	1/1/1998
157	0.041	0.009	--	--	0.021	0.001	0.001	1/1/1998
173	0.052	0.012	--	--	0.025	–0.072	0.003	1/1/1998
176	--	0.015	--	--	0.048	0.024	0.001	1/1/1998
179	--	0.014	--	--	0.030	–0.004	0.000	1/1/1998
182	0.110	0.023	--	--	0.046	0.295	0.007	1/1/1998
196	0.043	0.009	0.003	--	0.020	0.213	0.003	1/1/1998
199	0.064	0.012	0.005	--	0.027	0.218	0.002	1/1/1998
201	0.056	0.011	0.005	--	0.024	0.427	0.004	1/1/1998
202	0.043	0.009	0.004	--	0.020	0.132	0.001	1/1/1998
208	0.098	0.015	0.005	--	0.034	0.198	0.004	1/1/1998
209	0.070	0.012	0.004	--	0.026	0.178	0.002	1/1/1998
210	0.065	0.013	0.004	--	0.034	0.086	0.001	1/1/1998
212	--	0.014	--	--	0.033	0.033	0.000	1/1/1998
213	0.060	0.010	0.004	--	0.021	0.184	0.002	1/1/1998
214	0.066	0.010	0.003	--	0.021	0.213	0.002	1/1/1998
215	0.084	0.019	--	--	0.044	0.072	0.001	1/1/1998
217	0.081	0.013	0.004	--	0.029	0.113	0.007	1/1/1998
218	0.029	0.005	0.002	--	0.010	–0.154	0.001	1/1/1998
219	--	0.017	--	--	0.050	0.060	0.005	1/1/1998
220	0.074	0.013	0.005	--	0.029	–1.025	0.034	1/1/1998
221	0.055	0.013	0.004	--	0.027	–0.449	0.006	1/1/1998
222	--	0.016	--	--	0.059	–0.280	0.004	1/1/1998
223	0.019	0.005	--	--	0.010	–0.057	0.000	1/1/1998
224	0.069	0.009	0.003	--	0.018	–0.490	0.007	1/1/1998
225	0.051	0.009	0.003	--	0.020	0.838	0.012	1/1/1998
227	0.057	0.008	0.003	--	0.018	0.246	0.002	1/1/1998
228	0.034	0.008	0.003	--	0.017	0.066	0.000	1/1/1998
231	0.022	0.003	0.001	--	0.007	–0.116	0.000	1/1/1998
232	0.039	0.006	--	--	0.017	0.241	0.001	1/1/1998
241	0.060	0.012	--	--	0.027	–0.428	0.005	1/1/1998
242	0.042	0.008	0.004	--	0.018	–0.392	0.003	1/1/1998
243	0.025	0.005	--	--	0.013	–0.222	0.001	1/1/1998
244	0.043	0.013	--	--	0.026	0.037	0.000	1/1/1998
Nitrate								
1	0.051	0.011	0.004	--	0.024	–0.295	0.003	1/1/1998
2	--	0.009	--	--	0.020	–0.411	0.004	1/1/1998
3	0.075	0.017	--	--	0.035	0.118	0.004	1/1/1998
4	0.041	0.008	--	--	0.018	–0.105	0.001	1/1/1998
5	0.021	0.004	--	--	0.010	–0.100	0.000	1/1/1998
6	0.054	0.012	--	--	0.028	–0.059	0.001	1/1/1998
7	0.027	0.006	--	--	0.013	–0.297	0.002	1/1/1998
8	0.045	0.009	--	--	0.022	–0.244	0.002	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Nitrate—Continued				
9	0.138	0.023	0.010	--	0.053	0.371	0.013	1/1/1998
10	0.026	0.006	--	--	0.013	–0.327	0.003	1/1/1998
11	0.064	0.014	--	--	0.033	0.259	0.008	1/1/1998
12	0.044	0.009	0.003	--	0.021	–0.433	0.005	1/1/1998
13	0.174	0.032	--	--	0.080	0.234	0.026	1/1/1998
14	--	0.013	--	--	0.032	0.264	0.004	1/1/1998
15	0.038	0.008	--	--	0.016	0.169	0.001	1/1/1998
16	0.087	0.018	--	--	0.042	–0.120	0.006	1/1/1998
17	0.119	0.029	--	--	0.060	–0.086	0.046	1/1/1998
18	0.052	0.011	--	--	0.025	–0.786	0.028	1/1/1998
19	0.044	0.009	--	--	0.021	–0.742	0.016	1/1/1998
20	--	0.010	--	--	0.022	–0.227	0.003	1/1/1998
21	--	0.013	--	--	0.030	–0.005	0.001	1/1/1998
22	0.073	0.016	--	--	0.039	0.019	0.004	1/1/1998
23	--	0.011	--	--	0.025	–0.117	0.002	1/1/1998
24	--	0.030	--	--	0.062	1.469	0.095	1/1/1998
25	0.044	0.010	--	--	0.023	–0.266	0.004	1/1/1998
26	0.026	0.007	--	--	0.014	–0.349	0.003	1/1/1998
29	0.098	0.023	--	--	0.057	0.161	0.005	1/1/1998
31	0.079	0.017	--	--	0.037	0.083	0.003	1/1/1998
32	0.104	0.022	0.008	--	0.047	0.295	0.011	1/1/1998
33	0.038	0.008	--	--	0.018	–0.034	0.001	1/1/1998
34	0.064	0.016	--	--	0.032	0.191	0.002	1/1/1998
35	0.067	0.017	--	--	0.033	–0.049	0.002	1/1/1998
36	0.030	0.007	0.002	--	0.014	–0.352	0.003	1/1/1998
37	0.027	0.005	--	--	0.012	0.123	0.001	1/1/1998
38	0.018	0.004	--	--	0.009	–0.223	0.001	1/1/1998
39	0.018	0.005	0.001	--	0.008	–0.103	0.000	1/1/1998
40	0.051	0.010	--	--	0.024	0.633	0.011	1/1/1998
41	0.072	0.015	--	--	0.036	1.674	0.024	1/1/1998
42	0.031	0.007	--	--	0.014	–0.280	0.001	1/1/1998
43	0.040	0.009	0.003	--	0.019	–0.033	0.002	1/1/1998
44	0.057	0.012	0.004	--	0.027	0.837	0.006	1/1/1998
45	0.050	0.009	--	--	0.024	–0.098	0.002	1/1/1998
50	0.071	0.020	0.006	--	0.032	–0.426	0.005	1/1/1998
65	0.055	0.010	0.004	--	0.024	–1.940	0.060	1/1/1998
66	0.039	0.008	0.003	--	0.019	0.091	0.001	1/1/1998
71	--	0.029	--	--	0.055	0.165	0.004	1/1/1998
72	0.056	0.011	--	--	0.029	0.359	0.005	1/1/1998
73	0.052	0.011	--	--	0.025	0.140	0.001	1/1/1998
74	0.136	0.021	--	--	0.059	–0.157	0.011	1/1/1998
76	0.093	0.019	--	--	0.046	0.369	0.007	1/1/1998
81	0.240	0.042	--	--	0.107	1.239	0.149	1/1/1998
82	0.320	0.057	--	--	0.167	0.638	0.156	1/1/1998
88	0.211	0.052	--	--	0.112	2.595	0.309	1/1/1998
92	0.079	0.018	--	--	0.038	0.803	0.019	1/1/1998
95	0.056	0.012	--	--	0.021	0.132	0.001	1/1/1998
96	0.145	0.017	--	--	0.041	–0.397	0.006	1/1/1998
98	0.106	0.021	--	--	0.045	–0.284	0.008	1/1/1998
99	0.187	0.042	--	--	0.077	0.175	0.015	1/1/1998
100	--	0.024	--	--	0.052	0.037	0.001	1/1/1998
101	0.109	0.020	--	--	0.046	0.036	0.001	1/1/1998
102	0.314	0.057	--	--	0.167	1.235	0.191	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Nitrate—Continued				
103	0.042	0.038	--	0.319	0.019	–0.346	0.003	1/1/1998
104	--	0.024	--	--	0.056	–1.258	0.042	1/1/1998
105	0.109	0.019	--	--	0.046	–1.199	0.039	1/1/1998
106	0.065	0.056	--	0.472	0.028	–0.519	0.016	1/1/1998
107	0.021	0.004	--	--	0.009	–0.314	0.002	1/1/1998
108	0.035	0.007	--	--	0.018	–0.001	0.000	1/1/1998
109	0.080	0.020	--	--	0.037	0.432	0.008	1/1/1998
110	0.131	0.030	--	--	0.067	0.623	0.012	1/1/1998
111	0.224	0.057	--	--	0.098	1.626	0.100	1/1/1998
112	0.137	0.025	--	--	0.049	0.083	0.002	1/1/1998
113	0.178	0.046	--	--	0.089	1.835	0.102	1/1/1998
114	0.156	0.036	--	--	0.074	1.427	0.073	1/1/1998
115	0.190	0.044	--	--	0.108	1.800	0.121	1/1/1998
116	0.136	0.033	--	--	0.074	1.034	0.057	1/1/1998
117	0.086	0.019	--	--	0.040	0.485	0.008	1/1/1998
118	0.098	0.022	--	--	0.036	0.176	0.002	1/1/1998
119	0.117	0.027	0.009	--	0.053	–0.098	0.023	1/1/1998
120	0.067	0.017	--	--	0.037	0.063	0.003	1/1/1998
121	0.095	0.019	0.008	--	0.054	0.974	0.030	1/1/1998
122	0.070	0.017	--	--	0.035	0.265	0.005	1/1/1998
123	--	0.014	--	--	0.039	0.247	0.004	1/1/1998
124	0.043	0.011	0.003	--	0.022	–0.060	0.001	1/1/1998
125	0.037	0.009	--	--	0.017	0.096	0.000	1/1/1998
126	0.115	0.046	--	--	0.062	0.096	0.047	1/1/1998
127	0.135	0.057	--	--	0.068	0.057	0.053	1/1/1998
128	0.049	0.009	--	--	0.021	–0.191	0.001	1/1/1998
129	0.157	0.034	0.016	--	0.076	–0.361	0.022	1/1/1998
130	0.033	0.007	0.003	--	0.015	–0.382	0.003	1/1/1998
131	0.033	0.007	0.003	--	0.016	–0.112	0.001	1/1/1998
132	0.063	0.011	--	--	0.025	–0.002	0.002	1/1/1998
133	0.027	0.005	0.002	--	0.011	–0.104	0.001	1/1/1998
134	0.038	0.009	--	--	0.019	0.271	0.003	1/1/1998
135	0.068	0.015	--	--	0.033	–0.109	0.005	1/1/1998
136	--	0.022	--	--	0.031	–0.228	0.003	1/1/2000
137	0.024	0.006	0.002	--	0.012	–0.050	0.002	1/1/1998
138	0.041	0.009	--	--	0.020	0.352	0.005	1/1/1998
139	0.058	0.013	0.004	--	0.029	0.400	0.010	1/1/1998
140	0.253	0.049	0.018	--	0.118	0.385	0.111	1/1/1998
141	0.205	0.040	--	--	0.122	0.881	0.046	1/1/1998
142	0.125	0.029	--	--	0.067	–0.071	0.029	1/1/1998
143	0.103	0.024	0.009	--	0.052	–0.610	0.015	1/1/1998
144	0.077	0.017	--	--	0.038	–0.506	0.007	1/1/1998
145	--	0.028	--	--	0.073	0.959	0.063	1/1/1998
146	0.109	0.022	0.008	--	0.056	1.542	0.107	1/1/1998
147	0.149	0.028	0.010	--	0.082	1.703	0.134	1/1/1998
148	0.117	0.022	0.009	--	0.054	1.043	0.051	1/1/1998
149	0.127	0.027	--	--	0.071	0.676	0.030	1/1/1998
150	0.148	0.041	--	--	0.075	0.995	0.041	1/1/1998
151	0.105	0.021	--	--	0.051	0.434	0.007	1/1/1998
152	0.096	0.022	--	--	0.050	0.240	0.006	1/1/1998
153	0.039	0.009	--	--	0.018	0.093	0.000	1/1/1998
154	--	0.010	--	--	0.021	0.165	0.001	1/1/1998
155	0.044	0.010	--	--	0.023	0.118	0.002	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model							
	Standard error of cosine coefficient	Standard error of time coefficient	Standard error of time squared coefficient	Standard error of step trend coefficient	Standard error of root mean square error	Covariance of log of concentration and log of streamflow	Variance of the covariance of log of concentration and log of streamflow	Centered time
				Nitrate—Continued				
156	0.045	0.011	--	--	0.021	0.054	0.000	1/1/1998
157	0.090	0.019	0.008	--	0.043	–0.160	0.006	1/1/1998
158	0.080	0.018	--	--	0.052	–0.148	0.005	1/1/1998
159	0.134	0.027	--	--	0.058	–0.350	0.013	1/1/1998
160	--	0.023	--	--	0.056	–0.256	0.021	1/1/1998
161	0.135	0.031	--	--	0.082	1.919	0.132	1/1/1998
162	0.156	0.030	--	--	0.078	2.948	0.219	1/1/1998
163	0.130	0.027	0.010	--	0.054	–0.841	0.031	1/1/1998
164	0.212	0.060	--	--	0.102	2.312	0.463	1/1/1998
167	0.136	0.027	--	--	0.083	1.274	0.095	1/1/1998
168	0.078	0.019	--	--	0.049	1.158	0.062	1/1/1998
172	--	0.013	--	--	0.025	–0.286	0.002	1/1/1998
174	0.118	0.019	0.007	--	0.048	0.172	0.003	1/1/1998
175	0.040	0.009	0.003	--	0.016	–0.237	0.001	1/1/1998
177	0.083	0.018	--	--	0.045	–0.152	0.002	1/1/1998
181	0.079	0.016	--	--	0.033	–0.653	0.013	1/1/1998
187	0.089	0.018	--	--	0.044	–0.015	0.003	1/1/1998
189	0.099	0.018	--	--	0.034	–0.538	0.010	1/1/1998
190	0.145	0.021	--	--	0.053	–0.405	0.009	1/1/1998
191	0.173	0.028	0.010	--	0.074	0.244	0.019	1/1/1998
192	0.086	0.016	--	--	0.034	–0.420	0.005	1/1/1998
194	0.086	0.015	--	--	0.033	–0.386	0.008	1/1/1998
195	0.055	0.010	0.004	--	0.023	–0.040	0.003	1/1/1998
197	0.074	0.014	--	--	0.031	0.155	0.003	1/1/1998
198	0.074	0.013	0.005	--	0.029	0.154	0.004	1/1/1998
199	0.051	0.010	--	--	0.022	0.093	0.002	1/1/1998
200	0.047	0.010	--	--	0.020	0.129	0.001	1/1/1998
201	0.322	0.055	0.021	--	0.169	–0.048	0.005	1/1/1998
205	0.037	0.008	--	--	0.018	0.065	0.002	1/1/1998
207	0.079	0.015	--	--	0.033	0.170	0.005	1/1/1998
208	0.109	0.017	0.006	--	0.038	0.287	0.006	1/1/1998
209	0.079	0.013	0.005	--	0.029	0.265	0.003	1/1/1998
210	0.053	0.010	0.003	--	0.022	0.139	0.001	1/1/1998
213	0.064	0.010	0.004	--	0.022	0.254	0.002	1/1/1998
215	0.090	0.019	--	--	0.044	0.090	0.002	1/1/1998
217	0.209	0.033	--	--	0.073	–0.009	0.060	1/1/1998
218	0.036	0.006	0.002	--	0.013	–0.178	0.002	1/1/1998
224	0.093	0.014	0.004	--	0.025	–0.586	0.010	1/1/1998
225	0.106	0.018	0.007	--	0.041	1.545	0.042	1/1/1998
226	0.066	0.011	--	--	0.023	0.635	0.011	1/1/1998
228	0.048	0.013	0.004	--	0.023	0.096	0.001	1/1/1998
229	0.080	0.012	0.005	--	0.033	0.162	0.003	1/1/1998
234	0.054	0.010	0.004	--	0.023	–0.471	0.005	1/1/1998
235	0.089	0.018	--	--	0.054	0.507	0.009	1/1/1998
237	0.126	0.026	--	--	0.064	–0.464	0.009	1/1/1998
238	0.053	0.011	0.004	--	0.025	–0.553	0.006	1/1/1998
239	0.039	0.008	0.003	--	0.018	–0.022	0.000	1/1/1998
240	0.154	0.026	0.012	--	0.083	–0.320	0.007	1/1/1998
241	0.061	0.012	--	--	0.029	–0.591	0.007	1/1/1998
242	0.043	0.009	0.004	--	0.022	–0.484	0.004	1/1/1998
243	0.019	0.004	0.002	--	0.009	–0.369	0.001	1/1/1998
244	0.048	0.014	--	--	0.027	0.058	0.001	1/1/1998

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
				Total phosphorus			
1	98	–83.96	0.99	0.99	0.99	0.99	0.396
2	98	–74.12	0.98	0.98	0.99	0.97	0.040
3	96	–78.89	0.96	0.95	0.97	0.94	0.000
4	146	–150.09	0.96	0.95	0.97	0.94	0.000
5	88	0.42	0.98	0.97	0.98	0.96	0.013
7	84	0.62	0.94	0.92	0.96	0.91	0.000
8	105	0.56	0.97	0.96	0.98	0.95	0.000
10	83	0.63	0.99	0.99	0.99	0.98	0.307
11	49	–55.83	0.94	0.91	0.96	0.90	0.000
12	84	0.69	0.99	0.98	0.99	0.97	0.051
13	52	–45.93	0.98	0.97	0.99	0.96	0.077
14	189	–164.40	0.96	0.95	0.97	0.93	0.000
15	131	–119.09	0.98	0.97	0.99	0.97	0.010
16	40	–32.89	0.98	0.96	0.99	0.97	0.196
17	46	–50.02	0.99	0.98	0.99	0.97	0.177
18	41	0.87	0.98	0.97	0.99	0.98	0.614
19	76	0.88	0.99	0.99	1.00	0.98	0.368
20	42	0.73	0.95	0.92	0.97	0.93	0.005
22	42	–10.77	0.98	0.97	0.99	0.96	0.111
24	68	–84.46	0.96	0.95	0.98	0.95	0.003
25	43	0.69	0.95	0.92	0.97	0.93	0.007
26	104	0.77	0.97	0.95	0.98	0.95	0.000
27	42	–31.77	0.98	0.97	0.99	0.96	0.110
28	43	–50.71	0.97	0.95	0.98	0.95	0.023
30	44	–52.18	0.95	0.92	0.97	0.92	0.002
31	41	–42.22	0.98	0.96	0.99	0.97	0.249
32	43	–38.24	0.97	0.95	0.98	0.95	0.043
33	88	0.38	1.00	0.99	1.00	0.99	0.723
34	80	0.40	0.89	0.85	0.92	0.81	0.000
35	76	0.51	0.96	0.94	0.97	0.95	0.002
36	177	–151.41	0.98	0.97	0.98	0.96	0.000
37	248	–203.19	0.98	0.98	0.98	0.97	0.000
38	288	0.23	0.98	0.97	0.98	0.96	0.000
39	272	0.21	0.99	0.99	0.99	0.98	0.001
40	142	–151.27	0.98	0.98	0.99	0.97	0.004
41	334	–325.35	1.00	0.99	1.00	0.99	0.072
42	406	0.25	0.99	0.99	0.99	0.98	0.000
43	403	0.23	0.99	0.99	0.99	0.98	0.000
44	351	0.46	0.99	0.99	0.99	0.98	0.000
45	410	0.41	0.99	0.99	0.99	0.99	0.009
46	75	–37.78	0.96	0.95	0.98	0.94	0.001
51	107	–49.93	0.99	0.99	0.99	0.99	0.291
52	79	–46.26	0.97	0.96	0.98	0.96	0.004
53	124	–73.77	0.99	0.99	0.99	0.99	0.601
54	115	–44.42	0.99	0.98	0.99	0.98	0.072
55	111	0.23	0.97	0.96	0.98	0.95	0.000
56	115	–47.15	0.93	0.91	0.95	0.88	0.000
58	53	0.33	0.99	0.99	0.99	0.98	0.395
59	75	0.22	0.99	0.99	0.99	0.98	0.151
60	96	0.65	1.00	0.99	1.00	0.99	0.915
61	56	0.30	0.95	0.92	0.97	0.92	0.000

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Total phosphorus—Continued							
62	57	0.51	0.99	0.99	1.00	0.98	0.548
63	56	–31.04	1.00	0.99	1.00	0.99	0.972
64	117	–45.13	0.99	0.99	0.99	0.97	0.019
65	133	0.80	0.99	0.99	0.99	0.99	0.138
66	159	–109.09	0.98	0.97	0.98	0.95	0.000
68	115	–88.40	0.91	0.88	0.93	0.85	0.000
69	70	–23.89	1.00	0.99	1.00	0.99	0.941
70	117	–67.55	0.99	0.99	1.00	0.99	0.544
71	95	0.14	0.96	0.95	0.97	0.94	0.000
72	146	–86.72	0.99	0.99	1.00	0.99	0.419
73	118	0.71	0.99	0.99	1.00	0.99	0.483
74	106	–23.10	0.98	0.97	0.99	0.95	0.000
75	655	–353.16	0.99	0.99	1.00	0.99	0.001
76	161	–100.71	0.99	0.99	0.99	0.98	0.025
77	598	–513.78	0.98	0.97	0.98	0.96	0.000
78	490	–565.25	0.98	0.98	0.98	0.96	0.000
79	538	–448.06	0.99	0.99	0.99	0.98	0.000
80	1,306	–966.71	0.97	0.96	0.97	0.93	0.000
81	77	–60.26	0.99	0.98	0.99	0.98	0.241
82	63	–42.54	0.98	0.96	0.98	0.97	0.048
83	190	–123.51	0.99	0.99	0.99	0.99	0.046
84	767	–746.79	0.99	0.99	0.99	0.99	0.000
85	733	–708.80	0.99	0.99	0.99	0.99	0.000
86	848	–1,135.13	0.97	0.97	0.97	0.94	0.000
87	108	–86.49	1.00	1.00	1.00	0.99	0.593
88	53	–38.49	1.00	0.99	1.00	0.99	0.995
89	89	–81.56	0.98	0.97	0.99	0.97	0.029
90	105	0.69	0.96	0.95	0.97	0.94	0.000
91	85	0.75	0.98	0.97	0.99	0.97	0.020
92	114	–99.71	0.91	0.88	0.94	0.85	0.000
93	120	0.39	0.98	0.97	0.98	0.97	0.003
94	58	–14.21	0.95	0.93	0.97	0.91	0.000
95	138	0.44	0.98	0.97	0.98	0.96	0.001
97	39	–29.51	0.99	0.98	0.99	0.96	0.149
99	107	–142.24	0.97	0.95	0.97	0.94	0.000
101	64	0.27	0.93	0.90	0.96	0.90	0.000
106	67	0.54	0.98	0.98	0.99	0.97	0.136
107	126	0.49	0.97	0.96	0.98	0.96	0.001
109	125	0.54	0.99	0.99	0.99	0.99	0.172
110	145	0.43	0.98	0.98	0.99	0.97	0.004
111	88	–89.85	0.98	0.97	0.98	0.97	0.034
112	114	0.36	0.99	0.99	0.99	0.98	0.057
113	104	–95.02	1.00	1.00	1.00	1.00	0.965
114	88	–94.12	1.00	0.99	1.00	0.99	0.674
115	77	–42.55	1.00	0.99	1.00	0.99	0.578
118	127	–122.97	0.97	0.96	0.98	0.96	0.001
120	119	–37.31	0.98	0.98	0.99	0.97	0.011
134	88	–69.03	0.99	0.99	0.99	0.98	0.071
135	96	–78.06	0.90	0.86	0.93	0.83	0.000
136	52	0.53	0.86	0.80	0.91	0.77	0.000
137	92	0.80	0.95	0.93	0.97	0.93	0.000

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Total phosphorus—Continued							
138	111	–38.98	0.98	0.97	0.98	0.97	0.004
139	98	–47.01	0.99	0.99	1.00	0.99	0.676
145	85	0.26	0.99	0.99	0.99	0.98	0.134
148	65	–27.74	0.99	0.98	0.99	0.97	0.136
149	85	0.47	0.99	0.98	0.99	0.98	0.303
150	93	0.60	0.99	0.98	0.99	0.97	0.057
151	115	–59.89	0.99	0.99	0.99	0.99	0.308
152	56	–43.34	0.97	0.95	0.98	0.95	0.010
153	135	0.22	0.99	0.99	0.99	0.99	0.192
154	127	0.22	0.95	0.93	0.96	0.93	0.000
155	95	0.14	0.97	0.96	0.98	0.96	0.005
156	138	0.35	0.97	0.96	0.98	0.95	0.000
157	102	0.31	0.99	0.99	0.99	0.98	0.129
165	49	–56.32	0.99	0.98	0.99	0.97	0.271
166	53	–79.93	0.99	0.98	0.99	0.98	0.357
169	51	–74.09	0.98	0.96	0.99	0.96	0.042
170	67	0.02	0.98	0.97	0.99	0.97	0.063
171	51	–49.03	0.97	0.96	0.98	0.97	0.187
173	71	–20.85	0.99	0.99	1.00	0.99	0.738
177	58	–63.79	0.98	0.97	0.99	0.97	0.111
178	74	–109.04	0.98	0.97	0.98	0.95	0.007
180	87	–129.71	0.99	0.98	0.99	0.97	0.029
182	55	–66.74	0.99	0.99	1.00	0.99	0.946
183	48	–69.06	0.99	0.98	0.99	0.98	0.613
184	89	–133.30	1.00	0.99	1.00	0.99	0.418
185	70	–79.74	0.99	0.99	0.99	0.98	0.191
186	66	–90.63	0.98	0.98	0.99	0.97	0.076
188	81	0.25	0.97	0.96	0.98	0.96	0.012
193	80	–62.31	0.99	0.99	0.99	0.98	0.090
203	120	–90.79	0.99	0.99	0.99	0.99	0.391
204	123	–122.48	0.97	0.96	0.98	0.95	0.000
205	123	–98.20	0.98	0.97	0.98	0.97	0.002
206	120	–50.32	0.97	0.96	0.98	0.95	0.000
207	123	–90.91	0.99	0.99	0.99	0.98	0.158
208	51	0.70	0.97	0.95	0.98	0.95	0.015
209	122	0.49	0.93	0.91	0.95	0.88	0.000
210	124	0.45	0.94	0.92	0.96	0.90	0.000
211	53	0.53	0.97	0.95	0.98	0.93	0.002
212	60	0.10	0.75	0.65	0.83	0.60	0.000
213	122	0.62	0.94	0.92	0.95	0.90	0.000
214	126	0.76	0.98	0.98	0.99	0.97	0.007
215	51	0.73	0.96	0.93	0.97	0.93	0.003
216	123	–124.48	1.00	0.99	1.00	0.99	0.761
217	49	0.54	0.99	0.98	0.99	0.97	0.194
218	51	0.54	0.99	0.98	0.99	0.99	0.829
219	60	0.58	0.99	0.99	0.99	0.98	0.275
220	69	0.40	0.98	0.97	0.99	0.97	0.074
221	109	–86.96	0.99	0.99	0.99	0.99	0.245
222	105	–85.04	0.96	0.94	0.97	0.93	0.000
223	130	0.11	0.97	0.96	0.98	0.95	0.000
224	88	–56.35	0.99	0.99	0.99	0.98	0.154

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Total phosphorus—Continued							
225	158	0.44	0.99	0.99	0.99	0.98	0.054
227	138	0.58	0.98	0.97	0.98	0.97	0.002
228	111	–83.32	0.99	0.98	0.99	0.97	0.018
229	122	–83.74	0.99	0.99	0.99	0.98	0.066
230	122	0.28	0.99	0.98	0.99	0.98	0.068
231	416	0.45	0.97	0.96	0.97	0.94	0.000
232	441	–305.84	0.98	0.98	0.98	0.97	0.000
233	124	0.19	0.98	0.97	0.98	0.97	0.003
234	119	–99.78	1.00	1.00	1.00	0.99	0.690
235	118	–103.11	0.99	0.98	0.99	0.98	0.126
236	121	–94.41	1.00	1.00	1.00	1.00	0.944
237	118	–82.39	0.98	0.98	0.99	0.98	0.026
238	122	–113.58	0.97	0.96	0.98	0.95	0.000
239	128	–113.44	0.92	0.90	0.94	0.86	0.000
241	256	0.22	0.95	0.94	0.96	0.92	0.000
242	151	0.45	0.98	0.98	0.99	0.98	0.011
243	326	0.16	0.99	0.99	0.99	0.99	0.041
244	196	–127.16	0.99	0.99	0.99	0.99	0.074
Total nitrogen							
1	100	0.37	0.99	0.98	0.99	0.98	0.146
2	100	–3.60	0.97	0.96	0.98	0.95	0.001
3	99	0.17	0.98	0.97	0.98	0.97	0.026
4	147	–42.97	0.91	0.88	0.93	0.84	0.000
5	88	0.42	0.98	0.97	0.98	0.97	0.017
6	55	–34.18	0.99	0.98	0.99	0.97	0.112
7	82	0.68	0.91	0.88	0.94	0.86	0.000
8	102	0.63	0.89	0.86	0.92	0.83	0.000
9	50	–23.53	1.00	0.99	1.00	0.99	0.894
10	83	0.81	0.99	0.99	1.00	0.99	0.693
11	48	0.22	0.97	0.95	0.98	0.95	0.037
12	82	0.83	0.99	0.99	1.00	0.99	0.644
13	52	–29.64	0.98	0.97	0.99	0.95	0.017
14	188	–87.30	0.97	0.97	0.98	0.95	0.000
15	131	0.42	1.00	1.00	1.00	0.99	0.716
16	42	0.19	0.95	0.92	0.97	0.92	0.003
17	43	–16.84	0.99	0.98	0.99	0.98	0.712
18	44	0.90	0.99	0.99	1.00	0.98	0.556
19	76	0.87	0.99	0.99	1.00	0.99	0.531
20	46	0.64	0.94	0.91	0.96	0.91	0.001
21	47	0.08	0.98	0.97	0.99	0.97	0.317
22	42	0.20	0.99	0.99	1.00	0.99	0.897
23	47	0.06	0.99	0.98	0.99	0.98	0.463
24	69	–36.80	0.98	0.98	0.99	0.97	0.138
25	45	0.44	0.97	0.95	0.98	0.96	0.131
26	106	0.71	0.97	0.96	0.98	0.96	0.002
29	44	–13.05	1.00	1.00	1.00	0.99	0.870
31	43	–3.31	0.99	0.99	0.99	0.99	0.824
32	44	0.38	0.95	0.92	0.97	0.93	0.005
33	90	0.16	0.99	0.99	0.99	0.98	0.171
34	80	0.41	0.99	0.99	1.00	0.99	0.889
35	76	0.30	0.93	0.89	0.95	0.88	0.000

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
			Total nitrogen—Continued				
36	179	0.12	0.98	0.98	0.99	0.97	0.000
37	250	0.26	0.99	0.99	1.00	0.99	0.219
38	253	0.31	0.99	0.99	1.00	0.99	0.097
39	271	0.36	0.99	0.98	0.99	0.98	0.000
40	142	–13.50	0.99	0.99	0.99	0.98	0.089
41	326	–191.93	1.00	1.00	1.00	1.00	0.615
42	392	0.22	0.99	0.99	0.99	0.98	0.000
43	384	0.30	0.99	0.99	0.99	0.99	0.001
44	342	0.66	1.00	0.99	1.00	0.99	0.078
45	406	0.19	1.00	1.00	1.00	1.00	0.280
46	80	0.50	0.99	0.99	1.00	0.99	0.693
47	121	0.39	0.98	0.97	0.99	0.97	0.015
48	139	0.25	0.99	0.98	0.99	0.98	0.047
49	76	0.16	0.66	0.55	0.75	0.47	0.000
52	78	0.22	0.95	0.94	0.97	0.93	0.000
53	112	0.23	0.90	0.86	0.92	0.83	0.000
57	54	0.69	0.99	0.99	1.00	0.99	0.753
58	53	0.22	0.99	0.99	0.99	0.98	0.451
59	82	0.47	0.99	0.99	0.99	0.99	0.692
60	96	0.25	0.98	0.97	0.99	0.97	0.019
61	56	0.18	0.97	0.95	0.98	0.95	0.015
62	56	0.35	0.99	0.99	1.00	0.99	0.780
65	116	0.69	0.98	0.97	0.99	0.97	0.005
67	107	0.41	0.78	0.72	0.84	0.64	0.000
71	92	–110.46	0.78	0.71	0.84	0.64	0.000
72	149	0.48	0.98	0.98	0.99	0.98	0.007
73	119	0.40	1.00	1.00	1.00	0.99	0.547
74	102	–26.25	0.95	0.93	0.96	0.91	0.000
76	159	0.53	0.99	0.99	0.99	0.99	0.154
81	77	–41.05	0.94	0.91	0.96	0.90	0.000
82	66	0.22	0.91	0.87	0.94	0.86	0.000
92	116	0.47	0.98	0.97	0.98	0.96	0.002
95	135	0.53	0.99	0.99	0.99	0.99	0.402
97	40	0.75	0.99	0.98	0.99	0.98	0.645
99	107	–75.33	0.95	0.93	0.96	0.91	0.000
100	58	0.03	0.93	0.90	0.95	0.90	0.000
101	63	0.37	0.95	0.93	0.97	0.93	0.001
102	81	0.12	0.99	0.98	0.99	0.97	0.092
103	91	0.56	0.96	0.94	0.97	0.93	0.000
106	67	0.49	0.97	0.95	0.98	0.95	0.007
107	126	0.87	0.99	0.99	0.99	0.99	0.451
108	55	0.44	0.98	0.97	0.99	0.97	0.182
109	127	0.58	0.97	0.96	0.98	0.96	0.001
110	149	0.31	0.98	0.97	0.98	0.97	0.001
111	101	0.64	0.97	0.96	0.98	0.96	0.002
112	126	0.49	0.99	0.99	0.99	0.98	0.031
113	119	–108.38	0.96	0.95	0.97	0.94	0.000
114	101	–86.90	0.99	0.99	1.00	0.99	0.814
115	85	–75.16	0.98	0.97	0.99	0.96	0.011
116	62	0.47	0.96	0.95	0.98	0.95	0.008
118	127	0.50	0.99	0.98	0.99	0.98	0.038
120	119	–54.52	0.69	0.61	0.76	0.50	0.000
124	64	–5.71	0.98	0.98	0.99	0.98	0.204

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Total nitrogen—Continued							
125	112	–31.14	0.92	0.89	0.94	0.86	0.000
134	90	0.64	0.99	0.99	0.99	0.99	0.501
135	95	–23.83	0.82	0.75	0.86	0.69	0.000
136	55	0.38	0.88	0.82	0.92	0.81	0.000
137	92	0.76	0.96	0.95	0.97	0.95	0.000
138	112	0.78	1.00	1.00	1.00	1.00	0.991
139	98	0.64	0.94	0.92	0.96	0.91	0.000
145	77	–30.58	0.99	0.99	0.99	0.98	0.333
146	67	–54.75	0.97	0.96	0.98	0.94	0.002
147	64	–42.89	0.97	0.95	0.98	0.93	0.001
148	67	0.19	0.99	0.98	0.99	0.98	0.344
149	86	0.30	0.98	0.98	0.99	0.98	0.135
150	92	0.49	1.00	1.00	1.00	0.99	0.816
151	117	0.35	1.00	0.99	1.00	0.99	0.813
152	54	–32.57	0.99	0.99	0.99	0.98	0.534
153	128	0.38	0.99	0.99	1.00	0.98	0.085
154	126	–61.52	0.97	0.96	0.98	0.95	0.000
155	92	–40.63	0.99	0.99	1.00	0.99	0.943
156	128	0.49	0.99	0.99	0.99	0.98	0.048
157	103	0.24	0.98	0.97	0.99	0.97	0.025
173	72	–16.29	0.98	0.97	0.99	0.98	0.152
176	104	–69.14	0.96	0.94	0.97	0.93	0.000
179	59	0.00	0.98	0.98	0.99	0.98	0.290
182	55	0.63	0.98	0.97	0.99	0.97	0.216
196	267	0.32	0.98	0.98	0.99	0.97	0.000
199	228	0.31	0.98	0.98	0.99	0.97	0.000
201	214	0.39	0.99	0.98	0.99	0.98	0.001
202	254	0.30	0.99	0.98	0.99	0.98	0.000
208	50	0.45	0.99	0.99	1.00	0.99	0.945
209	118	–66.85	0.97	0.96	0.98	0.95	0.000
210	118	–55.37	0.97	0.96	0.98	0.94	0.000
212	58	–22.90	0.95	0.93	0.97	0.92	0.000
213	120	–44.45	0.99	0.98	0.99	0.98	0.041
214	125	0.48	0.90	0.87	0.92	0.83	0.000
215	51	–32.11	0.97	0.95	0.98	0.94	0.004
217	48	0.48	0.99	0.99	0.99	0.97	0.249
218	49	0.84	0.98	0.97	0.99	0.97	0.179
219	58	–35.66	0.98	0.97	0.99	0.97	0.156
220	69	0.80	0.98	0.98	0.99	0.97	0.049
221	107	–41.38	0.95	0.93	0.96	0.91	0.000
222	106	–30.94	0.93	0.90	0.95	0.88	0.000
223	133	0.64	0.89	0.85	0.91	0.82	0.000
224	85	–7.48	0.99	0.99	1.00	0.99	0.692
225	157	0.72	0.98	0.98	0.99	0.97	0.002
227	137	–29.61	0.99	0.99	0.99	0.99	0.142
228	110	–11.39	0.99	0.99	1.00	0.99	0.272
231	397	0.47	1.00	1.00	1.00	1.00	0.433
232	424	–259.96	0.96	0.95	0.96	0.92	0.000
241	238	0.40	0.98	0.98	0.99	0.97	0.000
242	127	–32.74	0.93	0.91	0.95	0.89	0.000
243	258	0.55	1.00	1.00	1.00	1.00	0.586
244	196	–108.51	1.00	1.00	1.00	0.99	0.357

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
				Nitrate			
1	98	0.49	0.99	0.99	0.99	0.98	0.210
2	100	0.65	1.00	0.99	1.00	0.99	0.690
3	96	–75.77	0.93	0.91	0.95	0.89	0.000
4	146	–47.79	0.86	0.82	0.89	0.77	0.000
5	88	0.67	0.98	0.97	0.99	0.97	0.022
6	55	0.43	0.98	0.98	0.99	0.98	0.348
7	84	0.85	0.97	0.96	0.98	0.95	0.002
8	102	0.58	0.86	0.81	0.90	0.77	0.000
9	51	–47.34	0.99	0.99	0.99	0.99	0.852
10	83	0.88	1.00	0.99	1.00	0.99	0.726
11	48	0.48	0.97	0.95	0.98	0.95	0.036
12	83	0.79	0.99	0.99	0.99	0.99	0.571
13	50	–61.05	0.98	0.97	0.99	0.95	0.015
14	190	–186.88	0.95	0.94	0.96	0.91	0.000
15	132	0.41	0.97	0.96	0.98	0.95	0.000
16	41	0.58	0.97	0.96	0.98	0.97	0.172
17	43	–43.15	0.97	0.96	0.98	0.97	0.164
18	43	0.89	0.99	0.99	0.99	0.97	0.274
19	77	0.86	0.99	0.98	0.99	0.98	0.107
20	45	0.74	0.95	0.93	0.97	0.94	0.010
21	46	0.10	0.94	0.90	0.96	0.91	0.001
22	44	0.23	0.99	0.99	1.00	0.98	0.556
23	47	0.21	0.99	0.99	1.00	0.99	0.899
24	69	–76.59	0.97	0.96	0.98	0.96	0.018
25	43	0.70	0.91	0.86	0.95	0.87	0.000
26	106	0.75	0.99	0.98	0.99	0.98	0.151
29	43	–33.45	0.99	0.99	1.00	0.99	0.907
31	42	–22.75	0.98	0.97	0.99	0.97	0.269
32	41	–31.77	0.95	0.92	0.97	0.94	0.009
33	89	0.20	0.98	0.97	0.98	0.96	0.009
34	81	0.29	0.97	0.95	0.98	0.95	0.003
35	78	0.19	0.82	0.75	0.87	0.70	0.000
36	176	0.51	0.99	0.98	0.99	0.98	0.004
37	249	0.38	1.00	1.00	1.00	0.99	0.564
38	291	0.60	0.99	0.99	0.99	0.99	0.005
39	271	0.44	1.00	0.99	1.00	0.99	0.052
40	144	0.72	0.96	0.95	0.97	0.94	0.000
41	340	–436.92	0.92	0.90	0.93	0.86	0.000
42	415	0.20	0.97	0.97	0.98	0.95	0.000
43	409	–311.23	0.98	0.97	0.98	0.96	0.000
44	361	–374.33	0.95	0.94	0.96	0.92	0.000
45	413	–401.55	0.98	0.97	0.98	0.95	0.000
50	117	–99.39	0.97	0.97	0.98	0.96	0.001
65	132	–76.11	0.99	0.98	0.99	0.98	0.032
66	158	0.28	0.88	0.84	0.90	0.80	0.000
71	93	–115.07	0.73	0.64	0.80	0.56	0.000
72	148	–101.18	0.97	0.97	0.98	0.96	0.000
73	127	0.31	0.98	0.98	0.99	0.97	0.009
74	104	–75.70	0.98	0.98	0.99	0.96	0.005
76	158	–195.31	0.98	0.98	0.99	0.97	0.004

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Nitrate—Continued							
81	78	–101.31	0.99	0.99	0.99	0.99	0.691
82	65	–104.84	0.99	0.98	0.99	0.98	0.445
88	58	–91.42	1.00	0.99	1.00	0.99	0.669
92	117	–110.00	0.97	0.96	0.98	0.96	0.001
95	136	–54.92	0.99	0.99	0.99	0.99	0.135
96	89	–73.31	0.91	0.87	0.93	0.85	0.000
98	38	0.66	0.99	0.98	0.99	0.98	0.564
99	106	–143.98	0.98	0.98	0.99	0.98	0.061
100	58	0.33	0.98	0.97	0.99	0.97	0.103
101	62	–54.08	0.97	0.95	0.98	0.95	0.007
102	80	–97.42	0.99	0.98	0.99	0.98	0.152
103	90	0.80	1.00	1.00	1.00	0.99	0.896
104	126	–156.62	0.96	0.94	0.97	0.93	0.000
105	122	–144.49	0.87	0.83	0.90	0.78	0.000
106	66	0.72	0.94	0.91	0.96	0.91	0.000
107	126	0.90	0.99	0.98	0.99	0.98	0.087
108	55	0.48	0.91	0.86	0.94	0.86	0.000
109	125	–111.75	0.88	0.84	0.91	0.79	0.000
110	145	–220.83	0.97	0.96	0.98	0.95	0.000
111	101	–174.36	0.99	0.99	0.99	0.99	0.525
112	126	–158.62	0.92	0.90	0.94	0.87	0.000
113	119	–169.77	1.00	0.99	1.00	1.00	0.955
114	100	–147.39	0.97	0.96	0.98	0.96	0.002
115	83	–131.67	0.98	0.98	0.99	0.97	0.026
116	61	–75.56	0.99	0.98	0.99	0.99	0.605
117	114	–110.67	0.98	0.98	0.99	0.97	0.004
118	127	–120.81	0.90	0.87	0.92	0.83	0.000
119	57	–60.41	0.99	0.99	0.99	0.98	0.445
120	120	–106.35	0.58	0.48	0.67	0.36	0.000
121	128	–122.64	0.98	0.98	0.99	0.97	0.008
122	59	–32.48	0.98	0.97	0.99	0.97	0.157
123	108	–72.99	0.96	0.94	0.97	0.93	0.000
124	70	0.27	0.98	0.98	0.99	0.97	0.088
125	125	–19.85	0.99	0.98	0.99	0.98	0.066
126	34	–29.81	0.97	0.95	0.98	0.94	0.026
127	27	–28.79	1.00	0.99	1.00	0.99	0.954
128	96	0.45	0.94	0.92	0.96	0.91	0.000
129	83	–124.13	0.99	0.99	1.00	0.98	0.233
130	109	0.78	1.00	1.00	1.00	0.99	0.503
131	98	0.62	1.00	1.00	1.00	0.99	0.851
132	47	0.69	0.87	0.80	0.92	0.79	0.000
133	103	0.85	0.99	0.98	0.99	0.97	0.029
134	99	0.66	0.99	0.98	0.99	0.98	0.218
135	97	0.32	0.74	0.66	0.81	0.58	0.000
136	55	0.44	0.87	0.81	0.92	0.79	0.000
137	92	0.81	0.95	0.93	0.97	0.93	0.000
138	112	0.72	0.98	0.98	0.99	0.98	0.042
139	98	0.59	0.94	0.91	0.95	0.90	0.000
140	49	–82.06	0.98	0.97	0.99	0.96	0.041
141	125	–152.39	0.99	0.99	1.00	0.99	0.327

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
Nitrate—Continued							
142	125	–177.31	0.99	0.99	1.00	0.99	0.713
143	124	–159.38	0.98	0.97	0.98	0.96	0.001
144	124	0.54	0.93	0.90	0.94	0.87	0.000
145	81	–97.42	0.98	0.98	0.99	0.97	0.071
146	66	–53.72	0.97	0.95	0.98	0.95	0.005
147	64	–59.05	0.99	0.98	0.99	0.98	0.332
148	65	–53.63	0.96	0.94	0.97	0.92	0.000
149	86	–108.53	0.99	0.99	0.99	0.99	0.478
150	92	–130.87	0.99	0.99	0.99	0.99	0.656
151	116	–121.25	0.99	0.99	0.99	0.98	0.057
152	53	–45.31	0.97	0.96	0.98	0.96	0.040
153	132	0.40	1.00	0.99	1.00	0.99	0.261
154	127	–51.81	0.97	0.96	0.98	0.96	0.000
155	91	–26.32	0.97	0.96	0.98	0.95	0.001
156	134	0.43	0.99	0.99	1.00	0.99	0.181
157	100	–102.46	0.96	0.95	0.97	0.94	0.000
158	107	–76.22	1.00	0.99	1.00	0.99	0.557
159	58	–58.65	0.99	0.98	0.99	0.98	0.395
160	59	–53.21	0.96	0.94	0.97	0.94	0.006
161	88	–108.41	0.99	0.99	0.99	0.99	0.635
162	110	–153.37	0.96	0.95	0.97	0.94	0.000
163	58	–61.54	0.84	0.76	0.89	0.73	0.000
164	52	–85.32	0.96	0.94	0.98	0.94	0.010
167	78	–83.67	0.96	0.94	0.97	0.93	0.000
168	71	–59.16	0.98	0.97	0.98	0.97	0.057
172	122	–68.89	0.80	0.75	0.85	0.67	0.000
174	55	–36.65	0.99	0.99	1.00	0.98	0.597
175	111	0.73	0.99	0.98	0.99	0.97	0.012
177	59	–38.19	1.00	0.99	1.00	0.99	0.904
181	83	0.69	0.97	0.96	0.98	0.96	0.013
187	65	–36.08	0.99	0.99	1.00	0.98	0.491
189	105	–94.03	0.99	0.99	1.00	0.99	0.824
190	105	–115.54	0.95	0.94	0.97	0.93	0.000
191	110	–134.53	0.97	0.95	0.98	0.95	0.000
192	119	–102.66	0.98	0.97	0.98	0.97	0.003
194	220	0.15	1.00	1.00	1.00	0.99	0.179
195	222	0.31	0.99	0.99	0.99	0.98	0.011
197	305	0.33	0.99	0.99	1.00	0.99	0.030
198	220	0.54	0.99	0.99	0.99	0.98	0.002
199	231	0.51	0.98	0.97	0.98	0.96	0.000
200	311	0.47	0.97	0.97	0.98	0.96	0.000
201	213	–187.44	1.00	1.00	1.00	0.99	0.547
205	125	0.78	0.98	0.97	0.99	0.97	0.005
207	123	–89.76	0.98	0.97	0.99	0.96	0.002
208	50	0.56	0.99	0.98	0.99	0.98	0.634
209	122	0.61	0.96	0.95	0.97	0.94	0.000
210	122	0.60	1.00	1.00	1.00	1.00	0.983
213	122	0.67	0.99	0.99	0.99	0.99	0.219
215	52	0.71	0.99	0.98	0.99	0.99	0.797
217	50	0.62	0.98	0.97	0.99	0.98	0.505

Appendix 3. Model output for flow-adjusted trends in concentration, non-flow-adjusted trends in concentration, and trends in load from 1993 to 2003.—Continued

[CI, confidence interval; OLS, ordinary least squares; AMLE, adjusted maximum likelihood estimation]

Site number (figure 1)	Properties of the calibrated model						
	Degrees of freedom	Fit statistic[2]	Probability plot correlation coefficient[3]	Probability plot correlation coefficient, lower bound	Probability plot correlation coefficient, upper bound	Shapiro-Wilk test statistic[3]	Shapiro-Wilk p-value
				Nitrate—Continued			
218	50	0.80	0.99	0.99	0.99	0.99	0.826
224	85	–26.20	0.98	0.97	0.98	0.96	0.011
225	156	–183.66	0.96	0.95	0.97	0.94	0.000
226	125	0.53	0.99	0.99	0.99	0.98	0.071
228	110	–46.44	0.98	0.98	0.99	0.97	0.008
229	122	–57.13	0.98	0.98	0.99	0.97	0.007
234	121	0.70	0.95	0.93	0.96	0.92	0.000
235	121	–89.90	0.98	0.97	0.99	0.96	0.002
237	121	–115.26	0.98	0.97	0.98	0.97	0.008
238	124	0.73	0.97	0.96	0.98	0.96	0.001
239	125	0.67	0.98	0.98	0.99	0.97	0.007
240	115	–36.90	0.99	0.99	0.99	0.98	0.065
241	257	0.48	0.97	0.97	0.98	0.96	0.000
242	149	0.77	0.98	0.97	0.98	0.97	0.001
243	526	0.71	0.97	0.96	0.97	0.94	0.000
244	196	–134.94	0.97	0.96	0.97	0.94	0.000

[1] Model specification values: (1) log streamflow; (2) log streamflow and log streamflow squared; (3) log streamflow and time; (4) log streamflow and sine/cosine of time; (5) log streamflow, log streamflow squared, and time; (6) log streamflow, log streamflow squared, and sine/cosine of time; (7) log streamflow, time, and sine/cosine of time; (8) log streamflow, log streamflow squared, time, and since/cosine of time; (9) log streamflow, log streamflow squared, time, time squared, and sine/cosine of time.

[2] Fit statistic is R-square for ordinary least squares model calibration method and the value of the likelihood function for the adjusted maximum likelihood model calibration method.

[3] Probability plot correlations and Shapiro-Wilk tests indicate whether samples are from a normal distribution (Helsel and Hirsch, 1992).

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