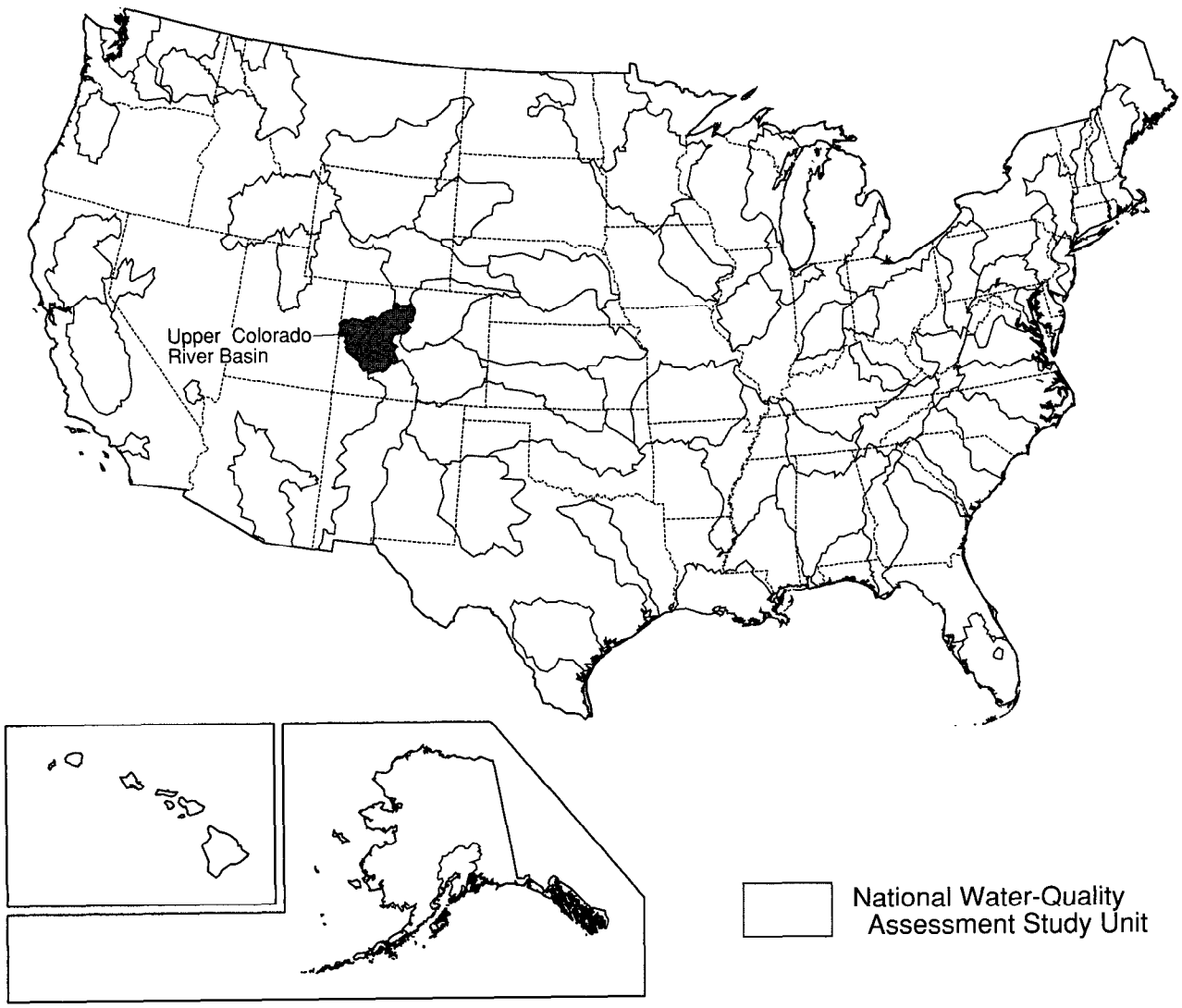
NITROGEN AND PHOSPHORUS DATA FOR SURFACE WATER IN THE UPPER COLORADO RIVER BASIN, COLORADO, 1980–94



U.S. GEOLOGICAL SURVEY

Open-File Report 97–233

NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

Nitrogen and Phosphorus Data for Surface Water in the Upper Colorado River Basin, Colorado, 1980–94

By Kirby H. Wynn and Norman E. Spahr

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Open-File Report 97–233

Denver, Colorado
1997

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
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FOREWORD

The mission of the U.S. Geological Survey (USGS) is to assess the quantity and quality of the earth resources of the Nation and to provide information that will assist resource managers and policymakers at Federal, State, and local levels in making sound decisions. Assessment of water-quality conditions and trends is an important part of this overall mission.

One of the greatest challenges faced by water-resources scientists is acquiring reliable information that will guide the use and protection of the Nation's water resources. That challenge is being addressed by Federal, State, interstate, and local water-resource agencies and by many academic institutions. These organizations are collecting water-quality data for a host of purposes that include: compliance with permits and water-supply standards; development of remediation plans for specific contamination problems; operational decisions on industrial, wastewater, or water-supply facilities; and research on factors that affect water quality. An additional need for water-quality information is to provide a basis on which regional- and national-level policy decisions can be based. Wise decisions must be based on sound information. As a society we need to know whether certain types of water-quality problems are isolated or ubiquitous, whether there are significant differences in conditions among regions, whether the conditions are changing over time, and why these conditions change from place to place and over time. The information can be used to help determine the efficacy of existing water-quality policies and to help analysts determine the need for and likely consequences of new policies.

To address these needs, the U.S. Congress appropriated funds in 1986 for the USGS to begin a pilot program in seven project areas to develop and refine the National Water-Quality Assessment (NAWQA) Program. In 1991, the USGS began full implementation of the program. The NAWQA Program builds upon an existing base of water-quality studies of the USGS, as well as those of other Federal, State, and local agencies. The objectives of the NAWQA Program are to:

- Describe current water-quality conditions for a large part of the Nation's freshwater streams, rivers, and aquifers.
- Describe how water quality is changing over time.
- Improve understanding of the primary natural and human factors that affect water-quality conditions.

This information will help support the development and evaluation of management, regulatory, and monitoring decisions by other Federal, State, and local agencies to protect, use, and enhance water resources.

The goals of the NAWQA Program are being achieved through ongoing and proposed investigations of 59 of the Nation's most important river basins and aquifer systems, which are referred to as study units. These study units are distributed throughout the Nation and cover a diversity of hydrogeologic settings. More than two-thirds of the Nation's freshwater use occurs within the 59 study units and more than two-thirds of the people served by public water-supply systems live within their boundaries.

National synthesis of data analysis, based on aggregation of comparable information obtained from the study units, is a major component of the program. This effort focuses on selected water-quality topics using nationally consistent information. Comparative studies will explain differences and similarities in observed water-quality conditions among study areas and will identify changes and trends and their causes. The first topics addressed by the national synthesis are pesticides, nutrients, volatile organic compounds, and aquatic biology. Discussions on these and other water-quality topics will be published in periodic summaries of the quality of the Nation's ground and surface water as the information becomes available.

This report is an element of the comprehensive body of information developed as part of the NAWQA Program. The program depends heavily on the advice, cooperation, and information from many Federal, State, interstate, Tribal, and local agencies and the public. The assistance and suggestions of all are greatly appreciated.

Robert M. Hirsch

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Chief Hydrologist

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[Data-Set Diskette in Pocket]

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
cubic foot per second (ft^3/s)	0.028	cubic meter per second
mile (mi)	1.609	kilometer

Degree Celsius (°C) may be converted to degree Fahrenheit (°F) by using the following equation:

$$°F = (1.8 \times °C) + 32$$

Nitrogen and Phosphorus Data for Surface Water in the Upper Colorado River Basin, Colorado, 1980–94

By Kirby H. Wynn *and* Norman E. Spahr

Abstract

This report documents, summarizes, and provides on 3.5-in. diskette the surface-water data collected from January 1980 through August 1994 for nitrogen and phosphorus in the Upper Colorado River Basin from the Colorado-Utah State line to the Continental Divide. Ancillary data for parameters, such as water temperature, streamflow, specific conductance, dissolved oxygen, pH, and alkalinity, also are compiled, if available. Data were retrieved from the U.S. Geological Survey National Water Information System and the U.S. Environmental Protection Agency STORET (STOrage and RETrieval) system. The water-quality data are presented for sites having five or more nutrient analyses that reflect ambient stream conditions. The compiled data base contains 4,927 samples from 123 sites. The median sample period of record for individual sites is 2.5 years, and the seventy-fifth percentile is about 12 years. Sixteen sites have only five samples each. The median number of samples per site is 14 samples, whereas the seventy-fifth percentile is 65 samples. The compiled data set was used in the design of a basinwide sampling network that incorporates sites that lack historic surface-water-quality data.

INTRODUCTION

The Upper Colorado River Basin (UCOL) is 1 of 59 U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) study units. The UCOL study began in October 1993 (Driver, 1994). A major part of each NAWQA study is retrospective analysis of existing water-quality data. The four goals of the retrospective analysis are:

1. Develop an improved conceptual model of spatial and temporal patterns of concentrations and loads within the study unit;
2. Guide additional data collection;
3. Contribute data to the National Synthesis Program of NAWQA; and
4. Document findings for future NAWQA work.

The UCOL study-unit team has done a retrospective analysis of available surface-water data for nitrogen and phosphorus, which are essential nutrients for plant and animal growth. Results of nutrient retrospective analysis have guided the design of the UCOL surface-water-quality sampling network. Many of the selected sampling sites lack historic water-quality data (Spahr and others, 1996), and one of the priorities of network design was to select some sites without current or historic water-quality monitoring to expand the spatial extent of available data.

Purpose and Scope

This report documents, summarizes, and provides on 3.5-in. diskette the surface-water nutrient data that were collected from January 1980 through August 1994. Interpretive analyses of the data are in Spahr and Wynn (1997). Ancillary data for parameters, such as water temperature, streamflow, specific conductance, dissolved oxygen, pH, and alkalinity, also are included on the data diskette, if available, but are not summarized in this report. The compiled data base contains 4,927 samples from 123 sites.

Description of Study Unit

The UCOL study unit (fig. 1) consists of the Colorado River and its tributaries that drain the mountains of central and western Colorado. The major tributaries to the Colorado River within the study unit are the Blue, Eagle, Roaring Fork, and Gunnison Rivers. The Colorado River, the largest river within the study-unit basin, flows southwest for about 230 mi from its headwaters in the mountains of central Colorado to the Colorado-Utah State line.

Land use is the major factor affecting nutrient loading within the study unit. Areas that have a rapidly developing infrastructure to support recreational activities within the Fraser and Eagle River Basins and agricultural areas within the Grand Valley and lower Gunnison River Basin are most associated with elevated nutrient loading (Spahr and Wynn, 1997). The study unit is primarily rural and has a population of 234,000 people (Bureau of Census, 1990). More than a quarter of the population resides in the immediate vicinity of Grand Junction, Colo. Although not accounted for in Bureau of Census figures, tourism attracts a large influx of people to the basin during summer and winter (Driver, 1994). An extensive analysis of the environmental setting of the UCOL study unit, including land use, physiography, climate, ecoregion, and hydrologic characteristics, is presented in Apodaca and others (1996).

NITROGEN AND PHOSPHORUS DATA

Sources

Data used in the surface-water nutrient analyses were obtained from two sources: (1) The USGS National Water Information System (NWIS) (Maddy and others, 1990), and (2) the U.S. Environmental Protection Agency (USEPA) STORET (STOrage and RETrieval) system. The STORET system is used as a repository for water-quality data by many agencies. The following agencies provided data for this report: USGS; Colorado Department of Public Health and Environment; U.S. Department of Agriculture, Forest Service; and Denver Board of Water Commissioners.

Retrieval

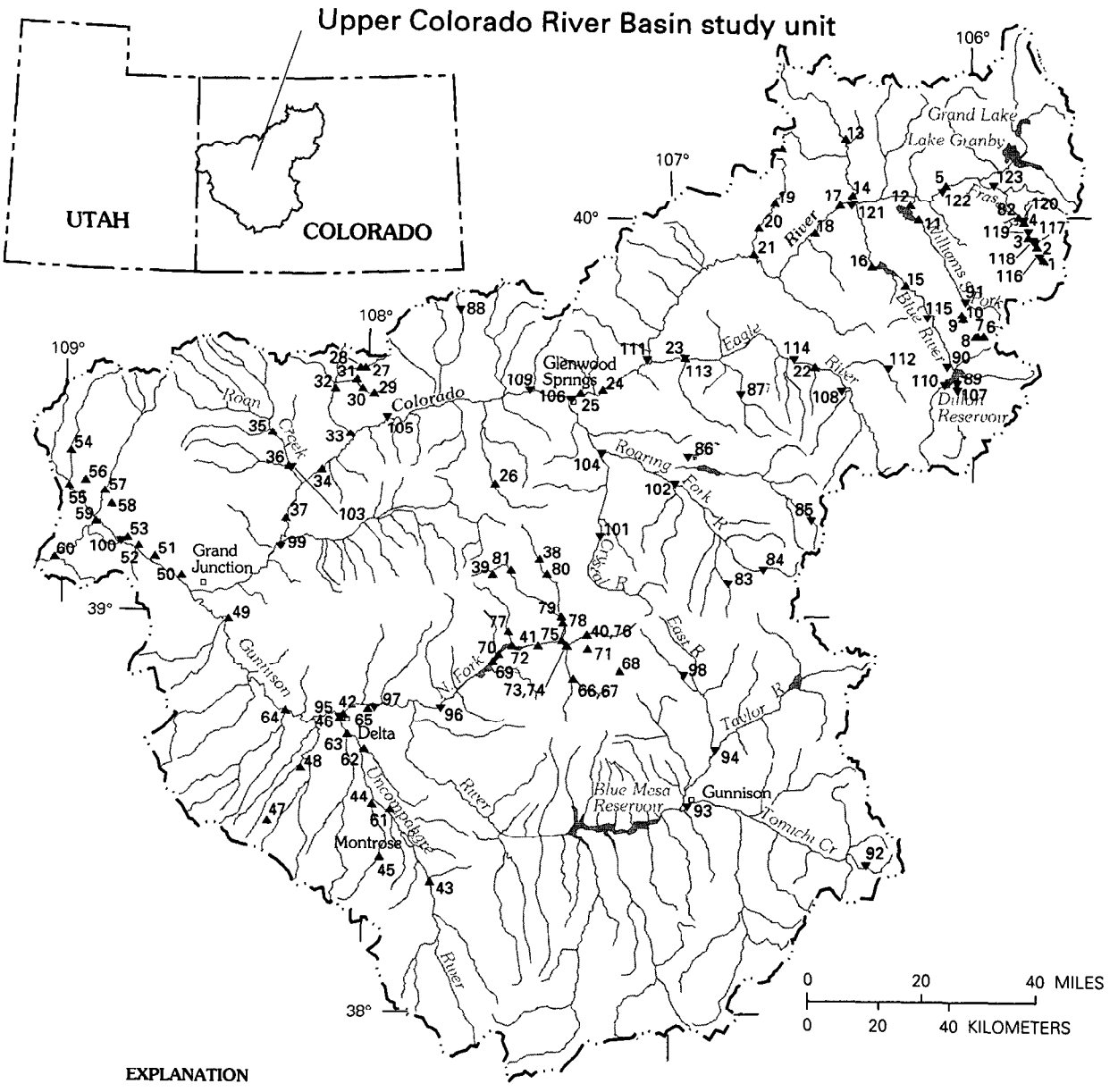
Water-quality data for January 1, 1980, through August 31, 1994, were retrieved for sites within the UCOL study unit. Only records containing data for concentrations of nitrate, ammonia, total nitrogen, total phosphorus, orthophosphate, or a related constituent were retained. Effort was made to exclude sample sites that do not reflect ambient stream conditions; therefore, data collected at point sources are not included in this report. In December 1994, STORET records for sites were retrieved. Updates or changes made to data in the STORET system after December 1994 are not included in this report.

Screening

Many sites and samples were excluded from the final data set if definitive corrections for erroneous location information, site type, or nutrient data values were not possible. In some instances, data entry errors were discovered and then corrected after verifying data values with the agency that collected the data. The data set was compiled to determine water-quality patterns on a regional scale; therefore, some sites were retained that have only generalized latitude and longitude values. These sites are identifiable by latitude and longitude values that end in "00." Other sites that had comparatively large errors in latitude and longitude or did not represent ambient surface-water conditions were excluded. Additional screening of sites based on quantity of data was performed during data compilation.

Compilation

The NWIS and STORET data were combined into a single data set for analysis after screening for errors. The parameter codes for the STORET data were converted, as necessary, to their NWIS equivalents before merging the two data sets into a single data base. All the NWIS parameter codes and their definitions in the order that they appear on the data diskette provided with this report are listed in table 1. Additional parameters created during data compilation or analysis are included in table 1 and on the data diskette.



EXPLANATION

SAMPLING SITES

[Number designates map reference number ("mapno" parameter in table 1 and table 2)]

▲ Data from U.S. Geological Survey National Water Information System

▼ Data from U.S. Environmental Protection Agency STOrage and RETrieval System

Figure 1. Location of study unit and sampling sites for nutrient data collection.

Table 1. Parameter codes for data compiled on data-set diskette

[mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; N, nitrogen; NH_4, ammonium ion; NO_3, nitrate; P, phosphorus; PO_4, phosphate; °C, degrees Celsius; ft^3/s, cubic feet per second; $CaCO_3$, calcium carbonate]

Parameter	Definition
mapno	Map reference number
staid	Site identification number
lat	Latitude, degrees
lon	Longitude, degrees
date	Sample date
time	Sample time
name	Site name
nitrate	Nitrate, as N (mg/L); computed[1]
ammon	Ammonia, as N (mg/L); computed[1]
totaln	Total nitrogen, as N (mg/L); computed[1]
phos	Total phosphorus, as P (mg/L); computed[1]
ortho	Orthophosphate, as P (mg/L); computed[1]
p00608	Nitrogen, ammonia, dissolved (mg/L as N)
p71846	Nitrogen, ammonia, dissolved (mg/L as NH_4)
p00610	Nitrogen, ammonia, total (mg/L as N)
p71845	Nitrogen, ammonia, total (mg/L as NH_4)
p00613	Nitrogen, nitrite, dissolved (mg/L as N)
p71856	Nitrogen, nitrite, dissolved (mg/L as NO_2)
p00615	Nitrogen, nitrite, total (mg/L as N)
p00631	Nitrogen, nitrite plus nitrate, dissolved (mg/L as N)
p00630	Nitrogen, nitrite plus nitrate, total (mg/L as N)
p00618	Nitrogen, nitrate, dissolved (mg/L as N)
p71851	Nitrogen, nitrate, dissolved (mg/L as NO_3)
p00620	Nitrogen, nitrate, total (mg/L as N)
p00600	Nitrogen, total (mg/L as N)
p71887	Nitrogen, total (mg/L as NO_3)
p00625	Nitrogen, ammonia plus organic, total (mg/L as N)
p00671	Phosphorus, orthophosphate, dissolved (mg/L as P)
p00660	Phosphate, ortho, dissolved (mg/L as PO_4)
p70507	Phosphorus, orthophosphate, total (mg/L as P)
p00650	Phosphate, total (mg/L as PO_4)
p00665	Phosphorus, total (mg/L as P)
p71886	Phosphorus, total (mg/L as PO_4)
p00666	Phosphorus, dissolved (mg/L as P)
temp	Water temperature (°C)
p00060	Discharge (ft^3/s)
p00061	Discharge, instantaneous (ft^3/s)
sc	Specific conductance (µS/cm)
labsc	Specific conductance, laboratory (µS/cm)
do	Oxygen, dissolved, field (mg/L)
ph	pH, water, whole, field, standard units
labph	pH, water, whole, laboratory, standard units
p00410	Alkalinity, water, whole, total, fixed endpoint titration, field (mg/L as $CaCO_3$)
p90410	Alkalinity, titration to pH 4.5, laboratory (mg/L as $CaCO_3$)
p39086	Alkalinity, water, dissolved, total, incremental titration, field (mg/L as $CaCO_3$)
yr	Year sample collected
mo	Month sample collected
day	Day sample collected
agency	Agency collecting sample

[1]Value computed from a related parameter field using method of Mueller and others (1995, p. 7).

Because many agencies collected the data for different purposes, nutrient parameters are reported in numerous ways. Nutrient parameters were combined to reduce the total number from 20 to a more manageable 5 for data-analysis purposes. Procedures described by Mueller and others (1995, p. 7) for combining nutrient parameters were followed. The combined nutrient parameters summarized in this report, included on the data diskette with other nutrient and ancillary data, and used in interpretive work by Spahr and Wynn (1997) are:

- Nitrate as nitrogen (hereinafter referred to as nitrate).
- Ammonia as nitrogen (hereinafter referred to as ammonia).
- Total nitrogen as nitrogen (hereinafter referred to as total nitrogen).
- Total phosphorus as phosphorus (hereinafter referred to as total phosphorus).
- Orthophosphate as phosphorus (hereinafter referred to as orthophosphate).

The data set was screened to include only sites that had a minimum of five observations for at least one of the five nutrients listed above. The resulting data set contains 4,927 samples at 123 sites located within the UCOL study unit. The locations of these 123 sites are shown in figure 1. The sites labeled with map reference numbers 1 through 82 are from the USGS NWIS data base, and the remaining 41 sites are from the USEPA STORET data base. Map reference number, site number, and site name for each of the 123 sites that met data-screening criteria are listed in table 2. The data set presented here was used for analysis of the spatial distribution, relation to land use, and temporal trends of nutrient concentrations in surface waters of the UCOL study unit. However, because of especially restrictive data requirements, temporal trend analysis was possible for fewer than 10 percent of the sites for each of the five combined nutrient parameters.

DATA-SET SUMMARY

The selected set of 123 sampling sites for analyzing surface-water quality has widely varying sampling periods. The sample-collection dates range from January 7, 1980, to August 29, 1994. The median sample period of record for individual sites is only 2.5 years, whereas the seventy-fifth percentile is about 12 years. The distribution of sampling dates for the USGS NWIS (map reference numbers 1–82) and USEPA STORET (map reference numbers 83–123) sites where nutrient data were collected are shown in figure 2.

It is important to determine the similarity of sampling frequency and period of record before attempting to compare data values between sites. Sites 11 and 12 on the Williams Fork and sites 15 and 16 on the Blue River were sampled for short, but concurrent, time intervals and would, therefore, be good sites for comparing water quality between the two rivers. However, comparison of the data for these four sites with data from site 63 on Dry Creek, near Delta, Colo., would be misleading because data for site 63 were collected several years later. Sites 49 and 60 were appropriate choices for determining water-quality trends, in part, because they each have many samples collected over a 14.5-year period.

The number of samples and the number of samples collected for each of the five combined nutrient parameters (nitrate, ammonia, total nitrogen, total phosphorus, and orthophosphate) are listed, by site, in table 3. The total number of samples for the whole data set and for each of the five combined nutrient parameters is listed in the last row of table 3. None of the sites have data for all five nutrients for each and every sample. Therefore, for a given site, the number of samples in column 2 of table 3 usually is greater than the number of samples collected for nitrate, ammonia, total nitrogen, total phosphorus, or orthophosphate. Site 22 is typical: the number of samples is 76 but there are only 50 nitrate, 1 ammonia, 0 total nitrogen, 0 total phosphorus, and 69 orthophosphate samples. The number of samples per site is variable. Because sites retained must have at least five samples for one of the combined nutrients, the minimum number of samples listed in table 3 is five. Sixteen of the sites (about 13 percent) have only 5 samples. The median number of samples per site is 14 samples, whereas the seventy-fifth percentile is 65 samples. Site 100, Colorado River near Loma, has the most samples (263), collected from 1980 to 1992.

Table 2. Site identification numbers and site names for map reference numbers in figure 1

[Map reference number is the parameter "mapno" in table 1 and on data diskette; site identification number is the parameter "staid" in table 1 and on data diskette; site name is the parameter "name" in table 1 and on data diskette]

Map reference number	Site identification number	Site name
1	09023750	Fraser River below Buck Creek at Winter Park, CO
2	09025010	Fraser River below Vasquez Creek at Winter Park, CO
3	09027010	Fraser River below St. Louis Creek at Fraser, CO
4	09027100	Fraser River at Tabernash, CO
5	09034500	Colorado River at Hot Sulphur Springs, CO
6	09035830	South Fork Williams Fork near Ptarmigan Pass, CO
7	09035840	South Fork Williams Fork above tributary near Ptarmigan Pass, CO
8	09035850	South Fork Williams Fork above Short Creek near Ptarmigan Pass, CO
9	09035870	South Fork Williams Fork below Short Creek near Ptarmigan Pass, CO
10	09035880	South Fork Williams Fork below Old Baldy Mountain near Leal, CO
11	09037500	Williams Fork near Parshall, CO
12	09038500	Williams Fork below Williams Fork Reservoir, CO
13	09041090	Muddy Creek above Antelope Creek near Kremmling, CO
14	09041500	Muddy Creek at Kremmling, CO
15	09053500	Blue River above Green Mountain Reservoir, CO
16	09057500	Blue River below Green Mountain Reservoir, CO
17	09058000	Colorado River near Kremmling, CO
18	09058030	Colorado River near Radium, CO
19	09060500	Rock Creek near Toponas, CO
20	09060550	Rock Creek at Crater, CO
21	09060770	Rock Creek at McCoy, CO
22	09067000	Beaver Creek at Avon, CO
23	09069000	Eagle River at Gypsum, CO
24	09071100	Colorado River near Glenwood Springs, CO
25	09071750	Colorado River above Glenwood Springs, CO
26	09089500	West Divide Creek near Raven, CO
27	09092830	Northwater Creek near Anvil Points, CO
28	09092850	East Middle Fork Parachute Creek near Rio Blanco, CO
29	09092960	East Fork Parachute Creek near Anvil Points, CO
30	09092970	East Fork Parachute Creek near Rulison, CO
31	09092980	Ben Good Creek near Rulison, CO
32	09093000	Parachute Creek near Parachute, CO
33	09093500	Parachute Creek at Parachute, CO
34	09093700	Colorado River near De Beque, CO
35	09095000	Roan Creek near De Beque, CO
36	09095400	Dry Fork near De Beque, CO
37	09095500	Colorado River near Cameo, CO
38	09129800	Clear Fork near Ragged Mountain, CO
39	09131100	Cow Creek near Paonia, CO
40	09132050	Anthracite Creek near Somerset, CO
41	09132500	North Fork Gunnison River near Somerset, CO

Table 2. Site identification numbers and site names for map reference numbers in figure 1—Continued

[Map reference number is the parameter "mapno" in table 1 and on data diskette; site identification number is the parameter "staid" in table 1 and on data diskette; site name is the parameter "name" in table 1 and on data diskette]

Map reference number	Site identification number	Site name
42	09144250	Gunnison River at Delta, CO
43	09147500	Uncompahgre River at Colona, CO
44	09149400	Spring Creek near Beaver Hill, CO
45	09149420	Spring Creek near Montrose, CO
46	09149500	Uncompahgre River at Delta, CO
47	09149900	Potter Creek near Columbine Pass, CO
48	09149910	Potter Creek near Olathe, CO
49	09152500	Gunnison River near Grand Junction, CO
50	09152650	Leach Creek at Durham, CO
51	09152900	Adobe Creek near Fruita, CO
52	09153270	Big Salt Wash at Fruita, CO
53	09153300	Reed Wash near Loma, CO
54	09153330	West Salt Creek near Carbonera, CO
55	09153400	West Salt Creek near Mack, CO
56	09160500	Badger Wash Observation Res 12 near Mack, CO
57	09163310	East Salt Creek near Mack, CO
58	09163340	Mack Wash near Mack, CO
59	09163490	Salt Creek near Mack, CO
60	09163500	Colorado River near Colorado-Utah State line
61	383041107544201	Cedar Creek near mouth
62	383946107595301	Loutsenhizer Arroyo near mouth
63	384202108032001	Dry Creek at mouth, near Delta, CO
64	384527108152701	Gunnison River above Escalante Creek, near Delta, CO
65	384551107591901	Unnamed drainage at Highway 92, near Read, CO
66	385033107190300	Upper Coal Creek near Somerset, CO
67	385037107190300	Cliff Creek near Somerset, CO
68	385146107094700	Ruby Anthracite Creek near Kebler Pass, CO
69	385308107345100	North Fork Gunnison River above Paonia, CO
70	385414107334000	Terror Creek near Paonia, CO
71	385506107161400	Grouse Spring Creek near Marcelling Mountain, CO
72	385532107310400	Lower Hubbard Creek near Bowie, CO
73	385534107201900	Lower Coal Creek near Somerset, CO
74	385538107202400	Lower Anthracite Creek near Somerset, CO
75	385626107212000	Muddy Creek below Paonia Reservoir, CO
76	385712107162600	Upper Anthracite Creek near Somerset, CO
77	385741107315100	Upper Hubbard Creek near Bowie, CO
78	385903107210800	Muddy Creek above Paonia Reservoir, CO
79	390000107212700	Lower West Muddy Creek near Paonia Reservoir, CO
80	390620107241900	East Muddy Creek near Ragged Mountain, CO
81	390658107312500	West Muddy Creek near West Muddy Creek Ranger Station, CO
82	400009105504600	Fraser River below Crooked Creek at Tabernash, CO

Table 2. Site identification numbers and site names for map reference numbers in figure 1—Continued

[Map reference number is the parameter "mapno" in table 1 and on data diskette; site identification number is the parameter "staid" in table 1 and on data diskette; site name is the parameter "name" in table 1 and on data diskette]

Map reference number	Site identification number	Site name
[1]83	FS021547A020001	Lower Castle Creek SI 9 80
84	FS021545A030001	Lower Lincoln Creek SI 8 76
85	FS021541S040002	Marten Creek SI 8
86	FS021543S020001	Lower Taylor Creek SI 7 99
87	FS021535E010001	Lower Brush Creek SI 14 71.5
88	FS021563R010001	Three Forks Creek SI 4 94
89	002102	So Plat Dillon Res Blue R @ Res
90	2501	Straight Creek at Res near Dillon, CO
91	003106	Williams Fork No 8 at Sugarloaf CMPGD
92	000149	Indian Creek near Sargents
93	000059	Tomichi Creek at Gunnison
94	000078	East River at confl. with Taylor
95	000055	Uncompahgre River at Delta
96	000100	N Fk of Gunnison below Hotchkiss
97	000056	Gunnison River near Delta
98	000151	Slate River below Crested Butte
99	000048	Colorado River near Cameo
100	000050	Colorado River near Loma
101	000145	Crystal River at Redstone
102	000144	Roaring Fork River below Aspen
103	000148	Roan Creek near De Beque
104	000146	Crystal River near mouth
105	000147	Colorado River at Rulison
106	000053	Roaring Fork at mouth
107	000115	Blue River above Dillon Resevoir
108	000118	Cross Creek Ar con. with Eagle
109	000047	Colorado River at New Castle
110	000141	Ten Mile Creek at Frisco
111	000046	Colorado River near Dotsero
112	000074	Gore Creek at mouth
113	000052	Eagle River at Gypsum
114	000076	Eagle River at town of Edwards
115	000098	Blue River below Dillon Resevoir
116	000FR3	Fraser River at USGS Gauge
117	000FR4	Fraser above Grand WWTP
118	000FR6	Fraser below Grand WWTP
119	000FR7	Fraser River above Fraser WWTP
120	00FR10	Fraser near Tabernsh
121	000099	Blue River near confluence with Colorado River
122	000045	Colorado River near Hot Sulfur Springs
123	000139	Fraser River near Granby

[1]The site names for map reference numbers 83–123 are spelled as they appear in the U.S. Environmental Protection Agency's STORET (STOrage and RETrieval) system.

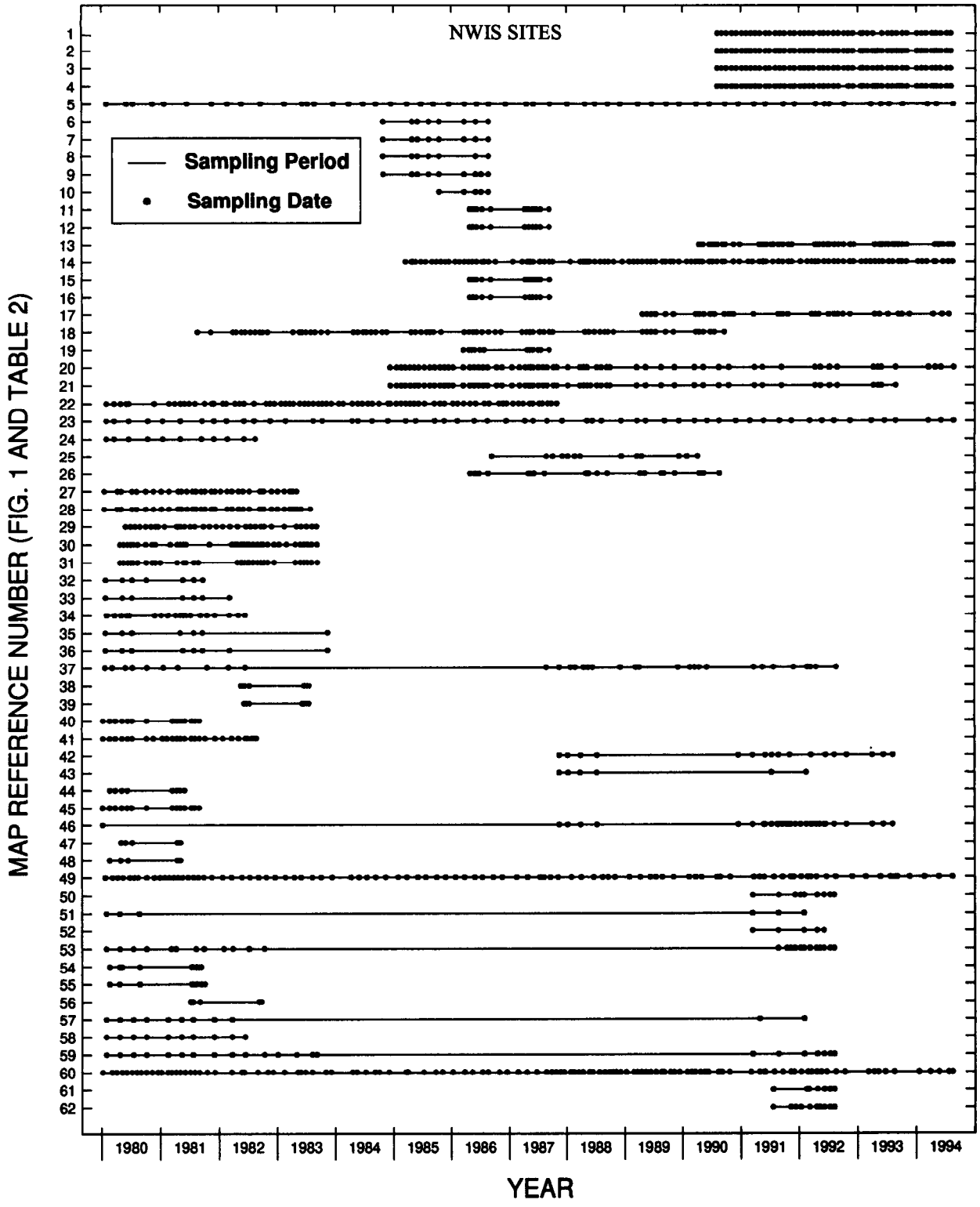


Figure 2. Distribution of sampling dates for National Water Information System (NWIS) and STOrage and RETrieval (STORET) surface-water sites for nutrient data collection.

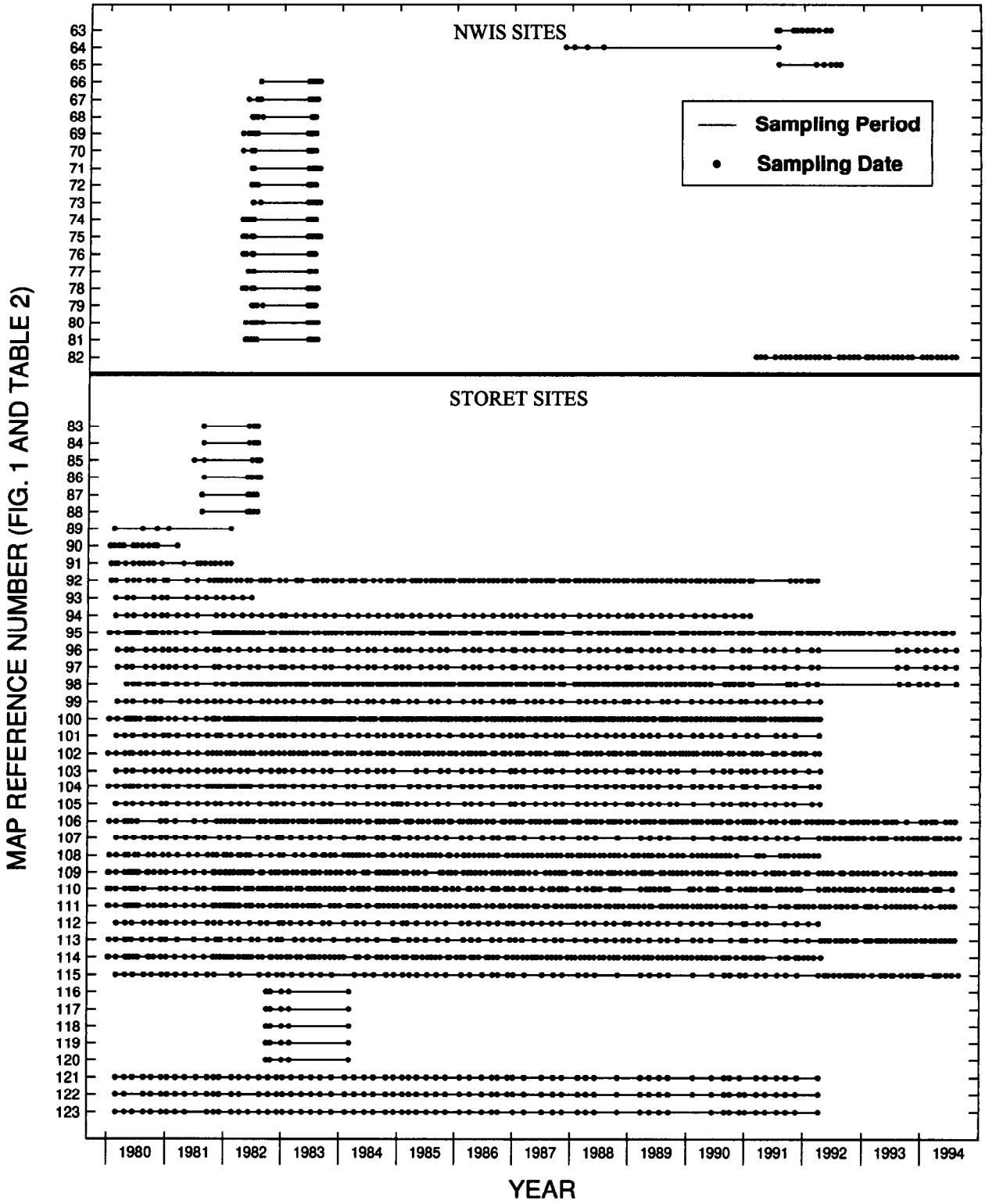


Figure 2. Distribution of sampling dates for National Water Information System (NWIS) and STOrage and RETrieval (STORET) surface-water sites for nutrient data collection—Continued.

Table 3. Number of samples collected per site and number of samples collected per site for each of the five combined nutrient parameters

[Map reference number is the parameter "mapno" in table 1 and data diskette]

Map reference number	Number of samples	Combined nutrient parameters				
		Nitrate samples	Ammonia samples	Total nitrogen samples	Total phosphorus samples	Orthophosphate samples
1	47	45	47	0	0	1
2	61	59	61	0	0	2
3	48	47	48	0	0	1
4	60	60	60	0	0	1
5	58	24	16	56	57	16
6	8	8	8	0	0	7
7	8	8	8	0	0	6
8	7	7	7	0	0	5
9	9	8	9	0	0	8
10	5	4	5	0	0	4
11	13	1	13	11	13	13
12	12	5	12	12	12	12
13	49	11	49	47	49	49
14	118	56	117	116	117	104
15	13	10	13	13	13	13
16	12	11	12	12	12	12
17	35	23	35	33	35	35
18	69	21	12	65	68	69
19	12	2	12	12	12	12
20	64	28	64	46	56	52
21	61	28	61	51	57	49
22	76	50	1	0	0	69
23	57	53	15	55	57	16
24	14	8	0	11	14	1
25	13	13	0	0	0	0
26	20	2	20	15	20	20
27	32	25	0	0	0	30
28	33	26	0	0	0	32
29	33	30	0	0	0	31
30	37	28	1	0	0	33
31	33	31	0	0	0	28
32	7	7	0	7	7	1
33	7	7	1	6	7	1
34	19	19	0	0	0	0
35	8	8	0	7	7	1
36	8	7	1	6	7	1
37	33	31	3	9	10	3
38	6	5	0	0	6	0
39	7	4	0	0	7	0
40	14	12	0	14	14	0
41	29	18	8	24	27	0
42	17	17	13	9	9	13

Table 3. Number of samples collected per site and number of samples collected per site for each of the five combined nutrient parameters—Continued

[Map reference number is the parameter "mapno" in table 1 and data diskette]

Map reference number	Number of samples	Combined nutrient parameters				
		Nitrate samples	Ammonia samples	Total nitrogen samples	Total phosphorus samples	Orthophosphate samples
43	6	6	1	0	0	1
44	8	6	0	8	8	0
45	14	14	0	13	13	0
46	30	30	13	9	9	14
47	5	5	0	0	0	0
48	5	5	0	0	0	0
49	97	97	75	94	94	76
50	9	9	2	0	0	2
51	6	6	2	0	0	2
52	5	5	2	0	0	2
53	24	24	2	0	0	1
54	20	20	0	0	0	2
55	9	9	0	0	0	0
56	15	15	0	0	0	2
57	11	10	1	0	0	1
58	10	10	0	0	0	0
59	22	22	2	0	0	2
60	120	120	79	97	98	79
61	7	7	1	0	0	1
62	10	10	2	0	0	1
63	11	11	2	0	0	2
64	5	5	1	0	0	1
65	6	6	1	0	0	1
66	7	6	0	0	3	0
67	8	6	0	0	4	0
68	7	5	0	0	6	0
69	10	9	0	0	7	0
70	8	7	0	0	7	0
71	8	7	0	0	5	0
72	8	6	0	0	7	0
73	10	9	0	0	6	0
74	10	10	0	0	6	0
75	12	11	0	0	5	0
76	9	8	0	0	5	0
77	5	3	0	0	5	0
78	10	10	0	0	5	0
79	9	6	0	0	8	0
80	11	10	0	0	8	0
81	10	7	0	0	8	0
82	39	37	39	0	0	0
83	5	5	0	0	0	4
84	5	5	0	0	0	3

Table 3. Number of samples collected per site and number of samples collected per site for each of the five combined nutrient parameters—Continued

[Map reference number is the parameter "mapno" in table 1 and data diskette]

Map reference number	Number of samples	Combined nutrient parameters				
		Nitrate samples	Ammonia samples	Total nitrogen samples	Total phosphorus samples	Orthophosphate samples
85	6	6	0	0	0	3
86	7	6	0	0	0	5
87	5	5	0	0	0	3
88	5	5	0	0	0	3
89	5	5	0	0	4	0
90	11	11	0	0	9	0
91	19	15	0	0	17	0
92	124	14	112	11	117	1
93	14	2	5	0	14	0
94	67	4	56	5	66	0
95	174	105	154	86	154	0
96	80	42	69	36	79	0
97	78	3	68	5	77	0
98	129	6	116	8	121	0
99	75	4	65	14	74	0
100	263	78	242	62	235	0
101	72	3	60	7	72	0
102	137	12	123	8	127	0
103	71	58	60	53	70	0
104	80	6	66	1	75	0
105	75	3	63	11	73	0
106	159	6	133	5	149	0
107	92	5	68	2	91	0
108	128	6	113	3	124	0
109	174	8	141	4	154	0
110	146	34	118	22	137	0
111	175	10	141	6	156	0
112	73	35	61	33	71	0
113	102	29	75	21	99	0
114	150	32	131	28	134	0
115	90	5	65	6	90	0
116	5	2	5	3	0	0
117	5	3	5	3	0	0
118	5	2	5	4	0	0
119	5	2	5	2	0	0
120	5	4	5	2	0	0
121	67	5	56	4	66	0
122	66	3	56	9	65	0
123	65	6	55	8	65	0
Total	4,927	2,076	3,454	1,330	3,795	963

DESCRIPTION OF DATA-SET DISKETTE

The MSDOS format 3.5-in. diskette inside the back cover pocket contains the compiled nutrient and ancillary data set in an ASCII text file named ucol.txt. The diskette contains 76 tab-delimited parameter fields, including remark fields, for the 49 parameters listed in table 1. The data are arranged as one line per unique sample date and time for each site. The data set is sorted sequentially by map reference number, date, and time.

The first line of the file contains the parameter field names in the same order as listed in table 1. The second line of the file defines the type (n = numeric, s = character string, d = date) and width of each parameter field. Data values begin on line 3 of ucol.txt. Water-quality constituents that have a laboratory reporting limit have a separate character field for remark (data censoring) codes. These remark fields are positioned to the left of their associated constituent. All remark fields have the same name as their associated constituent, except the first letter of the remark field is an "r." For example, the remark fields for the nitrate and p00600 parameter fields are rnitrate and r00600, respectively. Constituent concentrations reported as above or below a laboratory reporting limit or undetected are considered censored values and have a ">," "<," or "U" in their remark field. A ">" in the remark field indicates that the actual value is known to be greater than the value in the parameter field for that constituent. A "<" in the remark field indicates the actual value is known to be less than the value in the parameter field for that constituent, whereas a "U" in the remark field indicates the material was specifically analyzed for, but was undetected (Maddy and others, 1990, p. 2–14). There are several methods for determining the concentration of a given constituent in water; therefore, several different laboratory reporting limits may be present for a single constituent.

To load the data set into a spread sheet or other software package, insert the file as ASCII text, tab-delimited data. For best results, if possible, be sure to import the parameter field for the site identification number (staid, table 1) as character text to preserve the leading zeros for site identification numbers.

An ASCII text version of table 1 is included on the data diskette. The file is named table1.txt and is provided so table 1 can be printed out and easily referenced while working with the nutrient data set.

The data set also is available for retrieval on the World Wide Web at: http://webserver.cr.usgs.gov/nawqa/ucol/ucol_home.html

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