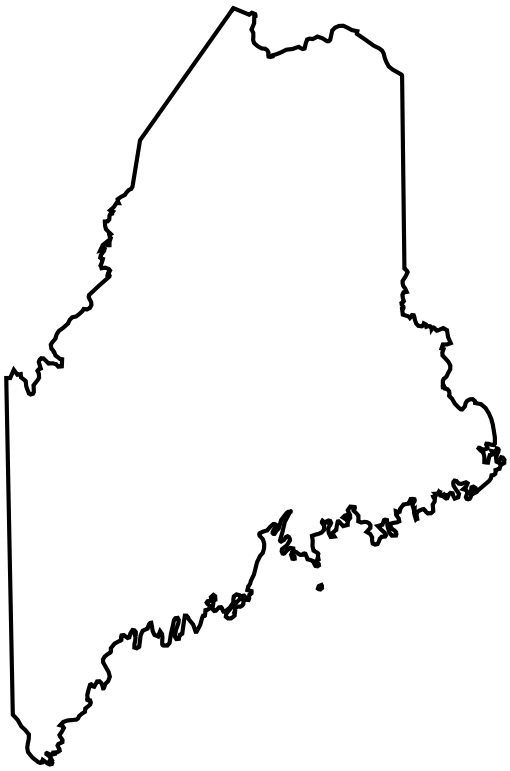
U.S. Department of the Interior
U.S. Geological Survey

# Water Resources Data
# Maine
# Water Year 2001

By G.J. Stewart, J.P. Nielsen, J.M. Caldwell, and A.R. Cloutier

Water-Data Report ME-01-1



Prepared in cooperation with the
State of Maine and with other agencies

# CALENDAR FOR WATER YEAR 2001

## 2000

### OCTOBER

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | | | | |

### NOVEMBER

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| 26 | 27 | 28 | 29 | 30 | | |

### DECEMBER

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| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 31 | | | | | | |

## 2001

### JANUARY

| S | M | T | W | T | F | S |
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### FEBRUARY

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| 25 | 26 | 27 | 28 | | | |

### MARCH

| S | M | T | W | T | F | S |
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### APRIL

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| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
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### MAY

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| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

### JUNE

| S | M | T | W | T | F | S |
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| 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 |

### JULY

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 29 | 30 | 31 | | | | |

### AUGUST

| S | M | T | W | T | F | S |
|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

### SEPTEMBER

| S | M | T | W | T | F | S |
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| | | | | | | 1 |
| 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | | | | | | |

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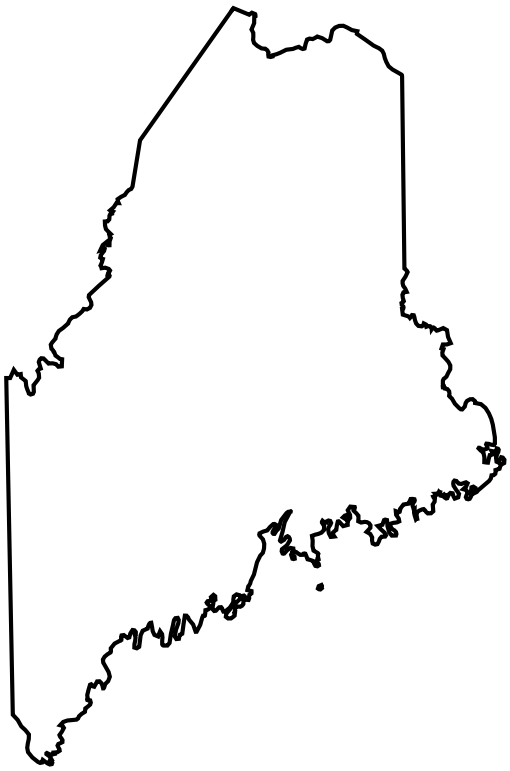

Prepared in cooperation with the
State of Maine and with other agencies

**U.S. DEPARTMENT OF THE INTERIOR**
**Gale Norton, Secretary**

**U.S. GEOLOGICAL SURVEY**
**Charles G. Groat, Director**

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2002

# PREFACE

This volume of the annual hydrologic data report of Maine is one of a series of annual reports that document data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and quality of water provide the hydrologic information needed by State, local, and Federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. In addition to the authors, who had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to U.S. Geological Survey policy and established guidelines, the following individuals contributed significantly to the collection, processing, and tabulation of the data.

| | |
|---|---|
| Jason R. Cyr | Sarah E. Giffen |
| Laura E. Flight | Timothy C. Sargent |

Gloria L. Morrill prepared the illustrations for the report.

This report was prepared in cooperation with the State of Maine and with other agencies under the general supervision of Robert M. Lent, Maine District Chief.

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The Water Resources Division of the U.S. Geological Survey, in cooperation with State, Federal, and other local governmental agencies, obtains a large amount of data pertaining to the water resources of Maine each year. These data, accumulated during the many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State.

Water-resources data for the 2001 water year for Maine consists of records of stage, discharge, ground water levels, water quality of streams and ground-water wells, precipitation quantity, and snow quantity,. This report contains discharge records for: 5 gage-height stations, 58 discharge gaging stations, stream water-quality data for 3 stations, water levels for 17 ground-water wells, water-quality data for 1 ground-water well, precipitation quantity data for 12 stations, and snow quantity data for 82 stations. Additional water data were collected at other sites, not part of the systematic data-collection program, and are published as special study and miscellaneous record sections.

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*Maine, *Hydrologic Data, *Surface Water, *Ground Water, *Water Quality, Flow Rate, Gaging Stations, Chemical Analyses, Water Temperature, Sediments, Sampling Sites, Water Levels, Water Analyses

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## CONTENTS


| | Page |
|---|---|
| Preface | iii |
| List of surface-water stations, in downstream order, for which records are published in this volume | vi |
| List of ground-water wells, by county, for which records are published in this volume | viii |
| List of precipitation stations for which records are published in this volume | ix |
| List of discontinued surface-water discharge or gage-height stations | x |
| List of discontinued surface-water quality stations | xiii |
| List of discontinued ground-water observation wells | xvii |
| List of discontinued precipitation quantity stations | xviii |
| Introduction | 1 |
| Cooperation | 1 |
| Summary of hydrologic conditions | 6 |
| Streamflow | 6 |
| Floods and droughts | 6 |
| Reservoir storage | 6 |
| Water quality | 9 |
| Ground-water levels | 9 |
| Special networks and programs | 9 |
| Explanation of the records | 11 |
| Station identification numbers | 11 |
| Downstream order system | 11 |
| Latitude-longitude system | 11 |
| Records of stage and water discharge | 11 |
| Data collection and computation | 12 |
| Data presentation | 13 |
| Station manuscript. | 13 |
| Data table of daily mean values | 14 |
| Statistics of monthly mean data | 14 |
| Summary statistics | 14 |
| Hydrograph | 15 |
| Identifying estimated daily discharge | 15 |
| Accuracy of the records | 15 |
| Special Study records | 16 |
| Other records available | 16 |
| Records of surface-water quality | 16 |
| Classification of records | 16 |
| Arrangement of records | 16 |
| On-site measurements and sample collection | 16 |
| Water temperature | 16 |
| Laboratory measurements | 17 |
| Data presentation | 17 |
| Accuracy of the records | 17 |
| Remark codes | 18 |
| Records of ground-water levels | 18 |
| Data collection and computation | 18 |
| Data presentation | 18 |
| Records of ground-water quality | 19 |
| Classification of records | 19 |
| Arrangement of records | 19 |
| On-site measurements and sample collection | 19 |
| Laboratory measurements | 19 |
| Analyses of pesticides | 19 |
| Analyses of volatile organic compounds | 20 |
| Data presentation | 21 |
| Remark codes | 22 |
| Records of precipitation quantity | 22 |
| Data collection and computation | 22 |
| Data presentation | 22 |
| Records of snow quantity | 22 |
| Data collection and computation | 22 |
| Data presentation | 22 |
| Access to USGS water data | 22 |
| Definition of terms | 23 |
| Publications on Techniques of Water-Resources Investigations | 35 |
| Station records, surface water | 40 |
| Discharge at partial-record and special study stations | 176 |
| Station records, ground water | 182 |
| Ground-water quality analyses at special study stations | 200 |
| Station records, precipitation quantity | 206 |
| Station records, snow quantity | 218 |
| Index | 229 |


## ILLUSTRATIONS


| | | |
|---|---|---|
| Figure 1. | Map showing location of active surface-water and water-quality gaging stations | 2 |
| 2. | Map showing location of active ground-water data-collection stations. | 3 |
| 3. | Map showing location of active precipitation quantity stations | 4 |
| 4. | Map showing location of active snow quantity stations. | 5 |
| 5. | Map showing one-day low flow recurrance intervals | 6 |
| 6. | Comparison of mean discharge at three long-term index gaging stations during 2001 water year with median discharge for period 1961-90 | 7 |
| 7. | Maps showing monthly surface-water conditions during the 2001 water year in Maine | 8 |
| 8. | Maps showing monthly ground-water conditions during the 2001 water year in Maine | 10 |
| 9. | System for numbering wells and special study sites | 11 |


## TABLES


| | | |
|---|---|---|
| Table 1. | Total usable storage in five Maine reservoir systems for the 2001 water year | 10 |
| 2. | Rating continuous water-quality records | 17 |
| 3. | Factors for converting inch-pound units to International System units (SI) | inside back cover |

# SURFACE-WATER AND WATER-QUALITY STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

NOTE: Data for miscellaneous sites for both surface-water discharge and quality are published in separate sections of the data report. See references at the end of this list for page numbers for these sections.

[Letters after station name designate type of data collected: (d) discharge, (c) chemical, (b) biological, (e) minor element, (n) nutrient, (m) continuous water-quality monitor, (g) gage height or elevation.]


| NORTH ATLANTIC SLOPE BASINS | Station number | Page |
|---|---|---|
| ST. JOHN RIVER BASIN | | |
| St. John River at Ninemile Bridge (d) | 01010000 | 40 |
| Big Black River near Depot Mountain (d) | 01010070 | 42 |
| St. John River at Dickey (d) | 01010500 | 44 |
| Allagash River near Allagash (d) | 01011000 | 46 |
| St. Francis River at outlet of Glasier Lake, near Connors, New Brunswick (d) | 01011500 | 48 |
| Fish River near Fort Kent (d) | 01013500 | 50 |
| St. John River below Fish River, at Fort Kent (d) | 01014000 | 52 |
| Aroostook River near Masardis (d) | 01015800 | 54 |
| Aroostook River at Washburn (d) | 01017000 | 56 |
| Prestile Stream: | | |
| Williams Brook at Phair (d) | 01017550 | 58 |
| ST. CROIX RIVER BASIN | | |
| St. Croix River at Vanceboro (d) | 01018500 | 60 |
| Grand Lake Stream at Grand Lake Stream (d) | 01019000 | 62 |
| St. Croix River at Baring (d) | 01021000 | 64 |
| St. Croix River at Milltown (m) | 01021050 | 66 |
| DENNYS RIVER BASIN | | |
| Dennys River at Dennysville (d) | 01021200 | 70 |
| MACHIAS RIVER BASIN | | |
| Machias River: | | |
| Old Stream near Wesley (d) | 01021480 | 72 |
| Machias River at Whitneyville (d) | 01021500 | 74 |
| PLEASANT RIVER BASIN | | |
| Pleasant River near Epping (d) | 01022260 | 76 |
| NARRAGUAGUS RIVER BASIN | | |
| Narraguagus River: | | |
| East Branch Bear Brook near Beddington (d) | 01022294 | 78 |
| West Branch Bear Brook near Beddington (d) | 01022295 | 80 |
| Narraguagus River at Cherryfield (d) | 01022500 | 82 |
| OTTER CREEK BASIN | | |
| Otter Creek: | | |
| Cadillac Brook near Bar Harbor (d) | 01022835 | 84 |
| HADLOCK BROOK BASIN | | |
| Hadlock Brook near Cedar Swamp Mountain near Northeast Harbor (d) | 01022860 | 86 |
| PENOBSCOT RIVER BASIN | | |
| Penobscot River: | | |
| Seboeis River near Shin Pond (d) | 01029200 | 88 |
| East Branch Penobscot River at Grindstone (d) | 01029500 | 90 |
| Mattawamkeag River near Mattawamkeag (d) | 01030500 | 92 |
| Piscataquis River at Blanchard (d) | 01031300 | 94 |
| Kingsbury Stream at Abbot Village (d) | 01031450 | 96 |
| Piscataquis River near Dover-Foxcroft (d) | 01031500 | 98 |
| Piscataquis River at Medford (d) | 01034000 | 100 |
| Penobscot River at West Enfield (d) | 01034500 | 102 |
| Penobscot River at Eddington (g) | 01036390 | 104 |
| DUCKTRAP RIVER BASIN | | |
| Ducktrap River near Lincolnville (d) | 01037380 | 106 |
| SHEEPSCOT RIVER BASIN | | |
| Sheepscot River at North Whitefield (d) | 01038000 | 108 |

**NORTH ATLANTIC SLOPE BASINS**--Continued

| | Station number | Page |
|---|---|---|
| KENNEBEC RIVER BASIN | | |
| Kennebec River at The Forks (d) | 01042500 | 110 |
| Spencer Stream near Grand Falls (d) | 01044550 | 112 |
| Kennebec River at Bingham (d) | 01046500 | 116 |
| Carrabassett River near North Anson (d) | 01047000 | 118 |
| Sandy River near Mercer (d) | 01048000 | 120 |
| Sebasticook River near Pittsfield (d) | 01049000 | 122 |
| Kennebec River at North Sidney (d) | 01049265 | 124 |
| Kennebec River at Father Curran Bridge at Augusta (g) | 01049320 | 126 |
| Cobbosseecontee Stream at Gardiner (d) | 01049500 | 128 |
| Kennebec River at Gardiner (g) | 01049505 | 130 |
| ANDROSCOGGIN RIVER BASIN | | |
| Androscoggin River: | | |
| Umbagog Lake: | | |
| Magalloway River: | | |
| Diamond River near Wentworth Location, NH (d) | 01052500 | 132 |
| Androscoggin River at Errol, NH (d) | 01053500 | 134 |
| Androscoggin River near Gorham, NH (d) | 01054000 | 136 |
| Wild River at Gilead (d,c,e,n) | 01054200 | 138 |
| Ellis River near South Andover (d) | 01054300 | 142 |
| Androscoggin River at Rumford (d) | 01054500 | 144 |
| Swift River near Roxbury (d) | 01055000 | 146 |
| Androscoggin River at Jay (m) | 01055100 | 148 |
| The Basin outlet at North Auburn (d) | 01056400 | 150 |
| Townsend Brook near Auburn (d) | 01056480 | 152 |
| Bobbin Mill Brook near Auburn (d) | 01056505 | 154 |
| Little Androscoggin River near South Paris (d) | 01057000 | 156 |
| Androscoggin River near Auburn (d) | 01059000 | 158 |
| ROYAL RIVER BASIN | | |
| Royal River: | | |
| Collyer Brook near Gray (d) | 01059800 | 160 |
| Royal River at Yarmouth (d) | 01060000 | 162 |
| PRESUMPSCOT RIVER BASIN | | |
| Sebago Lake: | | |
| Stony Brook at East Sebago (d) | 01063310 | 164 |
| Sebago Lake near North Windham (g) | 01063995 | 166 |
| Presumpscot River at Westbrook (g) | 01064118 | 168 |
| SACO RIVER BASIN | | |
| Saco River near Conway, NH (d) | 01064500 | 170 |
| Saco River at Cornish (d) | 01066000 | 172 |
| PISCATAQUA RIVER BASIN | | |
| Salmon Falls River (head of Piscataqua River) at Milton, NH (d) | 01072100 | 174 |

Discharge at partial-record and special study stations ..... 176

NOTE: Data for miscellaneous sites for both surface-water discharge and quality are published in separate sections of the data report. See references at the end of this list for page numbers for these sections.

[Letters after station name designate type of data collected:(l) water level, (c) chemical, (e) minor element, (n) nutrient, (m) continuous water-quality monitor]

Page

ANDROSCOGGIN COUNTY

Well 440213070203201 Local numbr ANW 1135 (l,c). ..... 182

AROOSTOOK COUNTY

Well 471457068353001 Local number ARW 890 (l). ..... 184
Well 464259067572901 Local number ARW 906 (l) ..... 185

CUMBERLAND COUNTY

Well 435453070013601 Local number CW 26 (l). ..... 186
Well 435039070261101 Local number CW 1983 (l) ..... 187

KENNEBEC COUNTY

Well 441849069442001 Local number KW 52 (l) ..... 188
Well 440918069564001 Local number KW 766 (l) ..... 189
Well 440810069553601 Local number KW 872A (l) ..... 190

OXFORD COUNTY

Well 443647070552302 Local number OW 400A (l) ..... 191
Well 440823070291501 Local number OW 1214 (l). ..... 192

PENOBSCOT COUNTY

Well 445319068560101 Local number PEW 456 (l) ..... 193
Well 453629068531801 Local number PEW 594 (l) ..... 194

SOMERSET COUNTY

Well 445148069513301 Local number SMW 61 (l) ..... 195

WALDO COUNTY

Well 442822069081301 Local number WOW 85 (l) ..... 196

WASHINGTON COUNTY

Well 450713067162801 Local number WW 796 (l) ..... 197
Well 445227067520101 Local number WW 797 (l) ..... 198

YORK COUNTY

Well 432310070393301 Local number YW 807 (l) ..... 199

Ground-water quality analyses at special study stations..... 200

| | Station number | Page |
|---|---|---|
| PENOBSCOT RIVER BASIN | | |
| Shirley Precipitation at Shirley Mills | 452156069371801 | 206 |
| Piscataquis River at Blanchard | 01031300 | 207 |
| Kingsbury Precipitation at Kingsbury | 450705069384801 | 208 |
| Kingsbury Stream at Abbot Village | 01031450 | 209 |
| Piscataquis River near Dover-Foxcroft | 01031500 | 210 |
| KENNEBEC RIVER BASIN | | |
| Kennebec River at The Forks | 01042500 | 211 |
| Kennebec River at Bingham | 01046500 | 212 |
| Carrabassett River near North Anson | 01047000 | 213 |
| Sandy River near Mercer | 01048000 | 214 |
| ANDROSCOGGIN RIVER BASIN | | |
| Androscoggin River at Errol, NH | 01053500 | 215 |
| Androscoggin River at Rumford | 01054500 | 216 |
| SACO RIVER BASIN | | |
| Saco River at Cornish | 01066000 | 217 |
| Snow quantity data | | 218 |

## DISCONTINUED SURFACE-WATER DISCHARGE OR GAGE-HEIGHT STATIONS

The following continuous- or partial-record surface-water discharge or gage-height stations in Maine have been discontinued. Daily or partial streamflow records or gage-heights were collected and published for the period of record shown for each station.

[Letters after station name designate type of data collected: (d) discharge, (g) gage height or elevation, (c) crest-stage partial record]

| Station Name | Station Number | Drainage Area ($mi^2$) | Period of Record (Water Year) |
|---|---|---|---|
| **St. John River basin** | | | |
| Shields Branch Big Black River near Seven Islands, ME (d) | 01010100 | 158 | 1977-1980 |
| St. John River above Fish River at Fort Kent, ME (d) | 01012500 | 4,764 | 1906-1915 |
| Clayton Stream at outlet of Clayton Lake, ME (d) | 01012515 | 13.0 | 1982-1984 |
| Bald Mountain Brook near Bald Mountain, ME (d) | 01012520 | 1.69 | 1981-1984 |
| Bishop Mountain Brook near Bishop Mountain, ME (d) | 01012525 | 1.04 | 1982-1984 |
| Fish River at inlet of Fish River Lake, ME (d) | 01012570 | 70.3 | 1982-1984 |
| Factory Brook near Madawaska, ME (c) | 01014700 | 5.83 | 1964-1974 |
| St. John River at Van Buren, ME (d) | 01015000 | 8,174 | 1908-1928 |
| Houlton Brook near Oxbow, ME (c) | 01015700 | 5.08 | 1964-1974 |
| Machias River near Ashland, ME (d) | 01016500 | 329 | 1951-1983 |
| Nichols Brook near Caribou, ME (c) | 01017300 | 3.94 | 1964-1974 |
| Aroostook River at Fort Fairfield, ME (d) | 01017500 | 2,301 | 1904-1910 |
| Marley Brook near Ludlow, ME (d) | 01017900 | 1.47 | 1964-1982 |
| Meduxnekeag River near Houlton, ME (d) | 01018000 | 175 | 1941-1982 |
| **St. Croix River basin** | | | |
| St. Croix River near Baileyville, ME (d) [b] | 01020000 | 1,315 | 1920-1983 |
| **Wiggins Brook basin** | | | |
| Wiggins Brook near West Lubec, ME (c) | 01021300 | 5.04 | 1965-1974 |
| **Machias River basin** | | | |
| Middle River near Machias, ME (c) | 01021600 | 8.32 | 1965-1974 |
| East Machias River near East Machias, ME (d) | 01022000 | 251 | 1927-1958 |
| **Pleasant River basin** | | | |
| Taylor Brook at the Great Heath, ME (d) | 01022250 | 7.06 | 1980-1982 |
| **Forbes Pond Brook basin** | | | |
| Forbes Pond Brook near Prospect Harbor, ME (c) | 01022700 | 8.78 | 1965-1974 |
| **Northeast Creek basin** | | | |
| Old Mill Brook at Old Norway Drive near Bar Harbor, ME (d) | 01022800 | 1.55 | 1999-2000 |
| **Union River basin** | | | |
| West Branch Union River at Amherst, ME (d) | 01023000 | 148 | 1910-1919 |
| | | | 1929-1979 |
| Garland Brook near Mariaville, ME (d) | 01024200 | 9.79 | 1964-1982 |
| Green Lake Stream at Lakewood, ME (d) | 01025000 | [a]47.0 | 1910-1911 |
| | | | 1913-1913 |
| Branch Lake Stream near Ellsworth, ME (d) | 01026000 | [a]31.0 | 1910-1913 |
| **Frost Pond Brook basin** | | | |
| Frost Pond Brook near Sedgwick, ME (c) | 01026800 | 5.68 | 1965-1974 |
| **Penobscot River basin** | | | |
| West Branch Penobscot River near Medway, ME (d) | 01028000 | [a]2,115 | 1917-1940 |
| Penobscot River near Mattawamkeag, ME (d)[b] | 01030000 | 3,356 | 1940-1991 |
| Trout Brook near Danforth, ME (c) | 01030300 | 4.39 | 1964-1973 |
| Gulliver Brook near Monarda, ME (c) | 01030400 | 11.0 | 1964-1974 |
| Mattawamkeag River at Mattawamkeag, ME (d) | 01031000 | 1,507 | 1903-1934 |

**DISCONTINUED SURFACE-WATER DISCHARGE OR GAGE-HEIGHT STATIONS--Continued**

| Station Name | Station Number | Drainage Area ($mi^2$) | Period of Record (Water Year) |
|---|---|---|---|
| **Penobscot River basin--Continued** | | | |
| Morrison Brook near Sebec Corners, ME (d) | 01031600 | 4.35 | 1964-1978 |
| Sebec River at Sebec, ME (d) | 01033000 | 326 | 1925-1982 |
| | | | 1985-1993 |
| Pleasant River near Milo, ME (d) | 01033500 | 323 | 1920-1979 |
| Coffin Brook near Lee, ME (c) | 01034900 | 2.21 | 1964-1974 |
| Passadumkeag River at Lowell, ME (d) | 01035000 | 297 | 1916-1979 |
| Cold Stream at Enfield, ME (d) | 01035500 | [a]28.5 | 1904-1907 |
| Penobscot River at Passadumkeag, ME (d) | 01036000 | [a]7,000 | 1939-1958 |
| Penobscot River at Eddington, ME (d) | 01036390 | 7,764 | 1979-1996 |
| Kenduskeag Stream near Kenduskeag, ME (d) | 01036500 | 176 | 1942-1979 |
| Kenduskeag Stream near Bangor, ME (d) | 01037000 | [a]195 | 1909-1919 |
| Shaw Brook[c] near Northern Maine Junction, ME (c) | 01037200 | 3.06 | 1964-1974 |
| **Goose River basin** | | | |
| Goose River at Rockport, ME (c) | 01037430 | 8.32 | 1964-1974 |
| **Damariscotta River basin** | | | |
| Tributary A, Little Pond near Damariscotta (d) | 01037700 | 0.31 | 1977-1978 |
| **Kennebec River basin** | | | |
| Moose River near Rockwood, ME (d) | 01039000 | [a]708 | 1920-1925 |
| Moosehead Lake at East Outlet, ME (g) | 01040500 | 1,268 | 1895-1994 |
| Kennebec River at Moosehead, ME (d) | 01041000 | 1,268 | 1920-1982 |
| Mountain Brook near Lake Parlin, ME (c) | 01041900 | 3.91 | 1964-1974 |
| Dead River near Dead River, ME (d) | 01043500 | 516 | 1940-1982 |
| Dead River at The Forks, ME (d) | 01045000 | 867 | 1901-1907 |
| | | | 1911-1979 |
| Austin Stream at Bingham, ME (d) | 01046000 | 90.0 | 1932-1969 |
| South Branch Carrabassett River at Bigelow, ME (c) | 01046800 | 14.2 | 1964-1974 |
| Sandy River near Farmington, ME (d) | 01047500 | 242 | 1911-1915 |
| Wilson Stream at East Wilton, ME (d) | 01047730 | 45.8 | 1977-1984 |
| Pelton Brook near Anson, ME (c) | 01048100 | 14.1 | 1965-1974 |
| Kennebec River at Waterville, ME (d)[b] | 01048500 | 4,228 | 1893-1935 |
| Kennebec River near Waterville, ME (d) | 01049205 | 5,179 | 1993-2000 |
| Hall Brook at Thorndike, ME (c) | 01049100 | 5.23 | 1964-1974 |
| Johnson Brook at South Albion, ME (d) | 01049130 | 2.92 | 1980-1991 |
| Kennebec River near Waterville, ME (d) | 01049205 | 5,179 | 1993-2000 |
| Cold Brook near North Belgrade, ME (d) | 01049218 | 0.85 | 1978-1979 |
| Hatchery Brook at North Belgrade, ME (d) | 01049221 | 8.83 | 1978-1979 |
| Stony Brook near South Vassalboro, ME (d) | 01049270 | 2.99 | 1979-1980 |
| North Branch Tanning Brook near Manchester, ME (d) | 01049300 | 0.93 | 1964-1983 |
| Mill Stream at Winthrop, ME (d) | 01049373 | 32.7 | 1978-1992 |
| Jock Stream at South Monmouth, ME (d) | 01049396 | 13.7 | 1978-1983 |
| Cobbosseecontee Lake at East Winthrop, ME (g) | 01049400 | 131 | 1975-1992 |
| Togus Stream at Togus, ME (d) | 01049550 | 23.7 | 1982-1995 |
| Gardiner Pond Brook at Dresden Mills, ME (c) | 01049700 | 8.19 | 1965-1974 |
| **Androscoggin River basin** | | | |
| Four Ponds Brook near Houghton, ME (c) | 01050900 | 3.41 | 1964-1974 |
| Bog Brook near Buckfield, ME (c) | 01055300 | 10.5 | 1964-1974 |
| Nezinscot River at Turner Center, ME (d) | 01055500 | 169 | 1941-1996 |
| Pennesseewassee Lake Outlet at Norway, ME (d) | 01057510 | [a]30.3 | 1982-1983 |

**DISCONTINUED SURFACE-WATER DISCHARGE OR GAGE-HEIGHT STATIONS--Continued**

| Station Name | Station Number | Drainage Area ($mi^2$) | Period of Record (Water Year) |
|---|---|---|---|
| **Androscoggin River basin--Continued** | | | |
| Thompson Lake Outlet at Oxford, ME (d) | 01058005 | 47.7 | 1975-1978<br>1981-1983 |
| Little Androscoggin River near Auburn, ME (d) | 01058500 | 328 | 1941-1982 |
| Hooper Brook at Sprague Mill, ME (d) | 01059090 | 8.30 | 1978-1980 |
| Sabattus River at Lisbon Center, ME (d) | 01059160 | 72.5 | 1975-1977 |
| Cathance River near Topsham, ME (d) | 01059500 | 36.4 | 1953-1955 |
| **Presumpscot River basin** | | | |
| Patte Brook near Bethel, ME (c) | 01062700 | 5.35 | 1965-1974 |
| Crooked River near Naples, ME (d) | 01063100 | 150 | 1975-1977<br>1995-2000 |
| Standish Brook at Mouth, at Sebago Lake, ME (d) | 01063452 | 0.52 | 1999-2000 |
| Presumpscot River at Outlet of Sebago Lake, ME (d) | 01064000 | 441 | 1887-2000 |
| Presumpscot River at Westbrook, ME (d)[b] | 01064118 | 577 | 1976-1995 |
| **Stroudwater River basin** | | | |
| Stroudwater River at South Portland, ME (d) | 01064158 | 27.6 | 1975-1977 |
| **Jones Creek basin** | | | |
| Mill Brook near Old Orchard Beach, ME (c) | 01064200 | 2.23 | 1965-1974 |
| **Saco River basin** | | | |
| Ossipee River at Effingham Falls, NH (d) | 01065000 | 330 | 1942-1990 |
| Ossipee River at Cornish, ME (d) | 01065500 | 452 | 1916-1996 |
| Pease Brook near Cornish, ME (c) | 01066100 | 4.62 | 1965-1974 |
| Little Ossipee River near South Limington, ME (d) | 01066500 | 168 | 1940-1982 |
| Saco River at West Buxton, ME (d) [b] | 01067000 | 1,572 | 1908-1916<br>1919-1940 |
| Saco River at Salmon Falls, ME (d) | 01067500 | 1,593 | 1939-1948 |
| Sandy Brook above landfill near Saco, ME (d) | 01067851 | 1.28 | 1993-1994 |
| Sandy Brook below landfill near Saco, ME (d) | 01067853 | 1.42 | 1993-1994 |
| **Mousam River basin** | | | |
| Littlefield River at Alfred, ME (d) | 01068980 | 22.4 | 1978-1980 |
| Mousam River near West Kennebunkport, ME (d) | 01069500 | 99.0 | 1940-1984 |
| **Little River basin** | | | |
| Branch Brook near Kennebunk, ME (c) | 01069700 | 10.7 | 1965-1974 |
| **Webhannet River basin** | | | |
| Blacksmith Brook at Wells, ME (d) | 01069800 | [a]2.48 | 1975-1976 |
| **Piscataqua River basin** | | | |
| Salmon Falls River near South Lebanon, ME (d) | 01072500 | 140 | 1929-1969 |

[a] Station not included in last systematic recomputation of drainage areas in Maine. Drainage area may conflict with other published information.
[b] Revisions to the maximum discharges for some periods at this site have been published in WDR ME-97-1.
[c] Station formerly published as Cold Brook near Northern Maine Junction, Maine

## DISCONTINUED SURFACE-WATER QUALITY STATIONS

The following stations were discontinued as continuous-recording surface-water quality monitor stations. Daily records of specific conductance (sc), pH (pH), water temperature (wt), dissolved oxygen (do), and sediment discharge (sd) were collected and published for the period of record shown for each station.

**Discontinued continuous-recording surface-water quality monitor stations**

| Station Name | Station Number | Drainage Area ($mi^2$) | Type of Record | Period of Record (water year) |
|---|---|---|---|---|
| **St. John River basin** | | | | |
| St. John River at Ninemile Bridge, ME | 01010000 | 1,341 | sc,wt | 1976-80 |
| St. John River at Dickey, ME | 01010500 | 2,680 | sc,wt | 1975-80 |
| | | | sd | 1976 |
| Allagash River near Allagash, ME | 01011000 | 1,229 | sc,wt | 1975-80 |
| | | | sd | 1976 |
| St. John River above Fish River at Ft. Kent, ME | 01012500 | 4,764 | sc,wt | 1977-80 |
| St. John River at Van Buren, ME | 01015000 | 8,174 | sc,wt | 1979-81 |
| St. John River near Hamlin, ME | 01015010 | 8,236 | sc,wt,do | 1989-95 |
| | | | pH | 1989-94 |
| Aroostook River at Caribou, ME | 01017100 | 1,943 | sc,wt | 1976-81 |
| **St. Croix River basin** | | | | |
| St. Croix River at Baring, ME | 01021000 | 1,374 | wt | 1960-76 |
| **Dennys River basin** | | | | |
| Dennys River at Dennysville, ME | 01021200 | 92.9 | wt | 1959-72 |
| **Narraguagus River basin** | | | | |
| Narraguagus River at Cherryfield, ME | 01022500 | 227 | sc,wt | 1978-81 |
| **Penobscot River basin** | | | | |
| Piscataquis River near Dover-Foxcroft, ME | 01031500 | 298 | wt | 1987-89 |
| Penobscot River at West Enfield, ME | 01034500 | 6,671 | wt | 1966-78 |
| | | | sc | 1974-78 |
| Penobscot River at Eddington, ME | 01036390 | 7,764 | sc,pH,wt,do | 1979-94 |
| **Sheepscot River basin** | | | | |
| Sheepscot River at North Whitefield, ME | 01038000 | 145 | wt | 1958-71 |
| | | | | 1974-76 |
| | | | sc | 1974-76 |
| **Kennebec River basin** | | | | |
| Kennebec River at Bingham, ME | 01046500 | 2,715 | sc,wt | 1976-78 |
| Kennebec River at North Sidney, ME | 01049265 | 5,403 | sc,pH,wt,do | 1979-94 |
| **Androscoggin River basin** | | | | |
| Wild River at Gilead, ME | 01054200 | 69.6 | wt | 1964-83 |
| | | | | 1992-93 |
| Androscoggin River at Turner Bridge, ME | 01055700 | 2,840 | wt | 1981, 1995 |
| | | | sc,do | 1995 |
| Gulf Island Pond near Lewiston, ME | 01056000 | 2,863 | sc,wt,do | 1981-95 |
| Androscoggin River at North Bridge at Auburn, ME | 01056600 | 2,907 | wt,do | 1988-95 |
| Androscoggin River below Dressers Rips near Auburn, ME | 01059010 | 3,263 | sc,pH,wt,do | 1988-95 |
| Androscoggin River at Brunswick, ME | 01059400 | 3,434 | sc,wt | 1981 |
| **Presumpscot River basin** | | | | |
| Presumpscot River near West Falmouth, ME | 01064140 | 598 | sc,pH,wt,do | 1976-93 |
| Presumpscot River at Presumpscot Falls near Falmouth, ME | 01064149 | 641 | sc,wt,do | 1994-96 |
| **Saco River basin** | | | | |
| Saco River at Cornish, ME | 01066000 | 1,293 | sc,wt | 1975-81 |

**DISCONTINUED SURFACE-WATER QUALITY STATIONS--Continued**

The following stations were discontinued as surface-water quality sampling stations. Samples were collected and analyzed for various record types for the period of record (in water years) and the number of samples shown.

There is a broad range of water-quality parameters available for most stations whose record exceeds more than a few years operation. Sampling schedules are often intermittent for certain types of data, with analyses available for some but not all years within a station's period of record. A description of the variety of data available is shown by grouping similar parameters into lettered record types. **Chemical data (c)** includes most of the "major ions," and may include some of the following physical properties: specific conductance, pH, temperature, color, turbidity, dissolved oxygen; **Minor element data (e)** comprises the "heavy metals" and some of the "alkaline earth" groups. Determinations usually include some but not all of the following: Al, As, Ba, Cd, Cr, Co, Cu, Hg, Li, Ni, Pb, Se, Sn, Sr, Zn; **Radiochemical data (r)** reports determinations of the concentrations of individual radioactive element, such as radium 226, cobalt 60, strontium 90, and tritium. This category also includes the gross measurement of radioactivity (alpha, beta, gamma) without regard to the radiochemical species that produce the radioactivity; **Pesticide data (p)** are organic compound (insecticides and herbicides) used to control insects and plants. Routinely, the analyses search for traces of between 12 to 22 compounds; **Organic data (o)** includes organic data (other than pesticides) such as OC, PCB, and PCN; **Nutrient data (n)** are constituents containing nitrogen or phosphorus. Results usually include several of the following: nitrite plus nitrate, phosphorus, ammonia nitrogen, organic nitrogen, ammonia nitrogen plus organic nitrogen (Kjeldahl method); **Biological data (b)** reports the identification and concentrations of microscopic plant organisms (phytoplankton, periphyton), or enteric bacteria (total coliform, fecal coliform or fecal streptococcal) living in aquatic habitats; and **Sediment data (s)** includes suspended-sediment concentration, suspended-sediment discharge, and particle-size data for discrete samples.

**Discontinued surface-water quality sampling stations**

| Station Name | Station Number | Drainage Area ($mi^2$) | Type of Record | Period of Record and (number of samples) |
|---|---|---|---|---|
| **St. John River basin** | | | | |
| St. John River at Ninemile Bridge, ME | 01010000 | 1,341 | c,e,n | 1981 (5) |
| Big Black River near Seven Islands, ME | 01010080 | 304 | c,e,n | 1981 (5) |
| Shields Branch Big Black River near Seven Islands, ME | 01010100 | 158 | c,e,n | 1981 (5) |
| Little Black River near Dickey, ME | 01010480 | 264 | c,e,n | 1981 (5) |
| St. John River at Dickey, ME | 01010500 | 2,680 | c,e,n | 1952-53 (2), 1975 (2), 1981 (5) |
| Allagash River near Allagash, ME | 01011000 | 1,229 | c,e,n | 1952-53 (2), 1975 (2), 1981 (5) |
| St. John River at Lincoln School, ME | 01011400 | 4,014 | c,e,n | 1981 (5) |
| Fish River near Fort Kent, ME | 01013500 | 873 | c,e,n | 1954 (2) |
| St. John River below Fish River, at Ft. Kent, ME | 01014000 | 5,665 | c,e,n | 1954-55 (4) |
| St. John River at Van Buren, ME | 01015000 | 8,174 | c,e,o,n,b,s | 1979-94 (105) |
| Aroostook River at Washburn, ME | 01017000 | 1,654 | c,e,n | 1952-53 (3) |
| Aroostook River at Caribou, ME | 01017100 | 1,943 | c,e,p,o,n,b,s | 1975-85 (111) |
| Aroostook River at Fort Fairfield, ME | 01017500 | 2,301 | c,e,n,b,s | 1971 (1) 1986 (4) |
| **St. Croix River basin** | | | | |
| St. Croix River at Vanceboro, ME | 01018500 | 413 | c,e,n | 1955 (2) |
| Grand Lake Stream at Grand Lake Stream, ME | 01019000 | 227 | c,e,n | 1954 (2) |
| St. Croix River near Baileyville, ME | 01020000 | 1,315 | c,e,r,p,n,b | 1952-53 (2), 1972-74 (9) |
| St. Croix River at Baring, ME | 01021000 | 1,374 | e | 1971 (1) |
| St. Croix River at Milltown, ME | 01021050 | 1,455 | c,e,r,p,o,n,b,s | 1969-91 (132) |
| **Machias River basin** | | | | |
| Machias River at Whitneyville, ME | 01021500 | 457 | c,e,n | 1952-53 (2) |
| East Machias River near East Machias, ME | 01022000 | [a]251 | c,e,n | 1955 (2) |
| **Narraguagus River basin** | | | | |
| Narraguagus River at Cherryfield, ME | 01022500 | 227 | c,e,o,n,b,s | 1954 (2), 1978-86 (69) |
| **Union River basin** | | | | |
| West Branch Union River at Amherst, ME | 01023000 | 148 | c,e,n | 1954 (2) |

**DISCONTINUED SURFACE-WATER QUALITY STATIONS--Continued**

**Discontinued surface-water quality sampling stations--Continued**

| Station Name | Station Number | Drainage Area ($mi^2$) | Type of Record | Period of Record and (number of samples) |
|---|---|---|---|---|
| | **Penobscot River basin** | | | |
| East Branch Penobscot River at Grindstone, ME | 01029500 | 1,086 | c,e,n | 1952-53 (2) |
| Penobscot River near Mattawamkeag, ME | 01030000 | 3,356 | c,e,n | 1954 (2) |
| Mattawamkeag River near Mattawamkeag, ME | 01030500 | 1,418 | c,e,n | 1954 (2) |
| Piscataquis River near Dover Foxcroft, ME | 01031500 | 298 | c,e,n | 1955 (2) |
| Sebec River at Sebec, ME | 01033000 | 326 | c,e,n | 1954 (2) |
| Pleasant River near Milo, ME | 01033500 | 323 | c,e,n | 1955 (2) |
| Piscataquis River at Medford, ME | 01034000 | 1,162 | c,e,n | 1952-53 (2) |
| Penobscot River at West Enfield, ME | 01034500 | 6,671 | c,e,r,o,n,b,s | 1952 (1), 1955 (2), 1961 (3), 1966-78 (151) |
| Passadumkeag River at Lowell, ME | 01035000 | 297 | c,e,n | 1955 (2) |
| Penobscot River at Passadumkeag, ME | 01036000 | [a]7,000 | c,e,n | 1954 (2) |
| Penobscot River at Orono, ME | -------- | 7,710 | e | 1971 (1) |
| Penobscot River at Eddington, ME | 01036390 | 7,764 | c,e,r,o,n,b,s | 1979-94 (87) |
| Kenduskeag Stream near Kenduskeag, ME | 01036500 | 176 | c,e,n | 1955 (2) |
| | **Sheepscot River basin** | | | |
| Sheepscot River at North Whitefield, ME | 01038000 | 145 | c,e,n | 1955 (2) |
| | **Kennebec River basin** | | | |
| Moosehead Lake at East Outlet, ME | 01040500 | 1,268 | c,e,n | 1958 (2) |
| Kennebec River at the Forks, ME | 01042500 | 1,590 | c,e,n | 1952-53 (2) |
| Dead River near Dead River, ME | 01043500 | 516 | c,e,n | 1954-55 (2) |
| Dead River at the Forks, ME | 01045000 | 876 | c,e,n | 1952-53 (2) |
| Austin Stream at Bingham, ME | 01046000 | 90.0 | c,e,n | 1958 (2) |
| Kennebec River at Bingham, ME | 01046500 | 2,715 | c,e,r,o,n,b,s | 1952-54 (3), 1966-78 (148) |
| Carrabassett River near North Anson, ME | 01047000 | 353 | c,e,n,r | 1953-54 (2), 1961 (3) |
| Sandy River near Mercer, ME | 01048000 | 516 | c,e,n | 1954 (2) |
| Kennebec River at Waterville, ME | 01048500 | 4,228 | e | 1971 (1) |
| Sebasticook River near Pittsfield, ME | 01049000 | 572 | c,e,n | 1952-53 (2) |
| Cobbosseecontee Stream at Gardiner, ME | 01049500 | 217 | c,e,n | 1954-56 (3) |
| Kennebec River at Bath, ME | 01059550 | ---- | c,e,n | 1957 (1) |
| | **Androscoggin River basin** | | | |
| Diamond River near Wentworth Location, NH | 01052500 | 152 | c,e,n | 1954 (2) |
| Androscoggin River at Errol, NH | 01053500 | 1,046 | c,e,n | 1955 (1), 1958 (2) |
| Androscoggin River at Gilead, ME | 01054250 | 1,525 | c,e,r,p,n,b | 1969-73 (15) |

**DISCONTINUED SURFACE-WATER QUALITY STATIONS--Continued**

**Discontinued surface-water quality sampling stations--Continued**

| Station Name | Station Number | Drainage Area ($mi^2$) | Type of Record | Period of Record and (number of samples) |
|---|---|---|---|---|
| **Androscoggin River basin--Continued** | | | | |
| Androscoggin River at Rumford, ME | 01054500 | 2,068 | c,e,n | 1953 (2) |
| Swift River at Roxbury, ME | 01055000 | 96.9 | c,e,n | 1956 (1) |
| Androscoggin River at Jay, ME | 01055100 | 2,488 | c,e,r,p,o,n,b | 1973-74 (6) |
| Nezinscot River at Turner Center, ME | 01055500 | 169 | c,e,n,r | 1955 (2), 1961 (3) |
| Little Androscoggin River near South Paris, ME | 01057000 | 75.8 | c,e,n | 1958 (5) |
| Little Androscoggin River near Auburn, ME | 01058500 | 328 | c,e,n,s | 1953 (2) |
| Androscoggin River near Auburn, ME | 01059000 | 3,263 | c,e,o,n,b,s | 1952 (1), 1954 (2), 1956 (1), 1966-75 (117) |
| Androscoggin River at Brunswick, ME | 01059400 | 3,434 | c,e,o,n,b,s | 1976-93 (130), 1995 (3) |
| **Presumpscot River basin** | | | | |
| Presumpscot River at Outlet of Sebago Lake, ME | 01064000 | 441 | c,e,n | 1953 (2), 1971 (1) |
| Presumpscot River near West Falmouth, ME | 01064140 | 598 | c,e,o,n,b,s | 1973-74 (12), 1976-95 (99) |
| Presumpscot River at Martin Point Bridge, ME | 01064150 | 647 | c,e,r,p,o,n,b | 1969-73 (15) |
| Portland Harbor near Fish Point, ME | 01064160 | --- | c,e,r,p,o,n,b | 1969-73 (15) |
| Portland Harbor at Four River Bridge, ME | 01064170 | --- | c,e,r,p,o,n,b | 1969-74 (18) |
| **Saco River basin** | | | | |
| Ossipee River at Cornish, ME | 01065500 | 452 | c,e,n | 1954 (2) |
| Little Ossipee River near South Limington, ME | 01066500 | 168 | c,e,n | 1954-55 (2) |
| Saco River at Cornish, ME | 01066000 | 1,293 | c,e,o,n,b,s | 1954 (2), 1975-95 (174) |
| Saco River at Salmon Falls, ME | 01067500 | 1,593 | c,e,n | 1953-55 (5) |
| **Mousam River basin** | | | | |
| Mousam River near West Kennebunk, ME | 01069500 | 99.0 | c,e,n | 1953 (2) |
| **Piscataqua River basin** | | | | |
| Salmon Falls River near South Lebanon, ME | 01072500 | 140 | c,e,n | 1954-55 (2), 1958 (5) |

[a] Site not included in last systematic recomputation of drainage areas in Maine. Drainage area may conflict with other published information.

**DISCONTINUED GROUND-WATER OBSERVATION WELLS**

The following continuous-record ground-water observation wells in Maine have been discontinued. Records were collected and published for the period of record shown for each well.

| Well Number | Local Number | County | Locality | Aquifer | Period of Record |
|---|---|---|---|---|---|
| 440227070124101 | ANW 1 | Androscoggin | Auburn | Marine deposits - clay | 1959-1976 |
| 440438070261601 | ANW 986 | " | Poland | Ice-contact deposits | 1976-1983 |
| 440730070035303 | ANW 988B | " | Sabattus | Ice-contact deposits | 1976-1983 |
| 440730070035304 | ANW 988C | " | Sabattus | Outwash | 1976-1989 |
| 464619068280401 | ARW 1 | Aroostook | Portage Lake | Glacial till | 1943-1983 |
| 464807068284401 | ARW 1A | " | Portage Lake | Bedrock | 1976-1991 |
| 455611068194601 | ARW 2 | " | Sherman Mills | Glacial till-bedrock | 1943-1970<br>1975-1978 |
| 460657067512201 | ARW 3 | " | Houlton | Bedrock | 1958-1975 |
| 460728067513201 | ARW 61 | " | Houlton | Ice-contact deposits | 1980-1983 |
| 460855067552201 | ARW 887 | " | Ludlow | Glacial till | 1976-1981 |
| 463642069344601 | ARW 891 | " | Clayton Lake | Seboomook Formation | 1978-2000 |
| 464234068010401 | ARW 895 | " | Presque Isle | Ice-contact deposits | 1986-2000 |
| 464018068010101 | ARW 904 | " | Presque Isle | Bedrock | 1986-1987 |
| 464239067574401 | ARW 905 | " | Presque Isle | Bedrock | 1986-1990 |
| 464303067592201 | ARW 907 | " | Presque Isle | Glacial Till | 1986-1991 |
| 435902070171301 | CW 1382 | Cumberland | New Gloucester | Glacial Till | 1989-2000 |
| 435653070201801 | CW 1383 | " | New Gloucester | Glacial sand and gravel | 1981-1982<br>1989-2000 |
| 451128070280301 | FW 893 | Franklin | Eustis | Glacial sand and gravel | 1985-2000 |
| 443831070002601 | FW 901 | " | New Sharon | Glacial Till | 1987-2000 |
| 450539070301301 | FW 908 | " | Stratton | Glacial Till | 1990-2000 |
| 444950068220601 | HW 1 | Hancock | Amherst | Glacial Till | 1943-1991 |
| 444950068220602 | HW 1A | " | Amherst | Glacial Till | 1989-2000 |
| 441440068182701 | HW 137 | " | Southwest Harbor | Bedrock | 1981-2000 |
| 442023069553801 | KW 88 | Kennebec | East Winthrop | Bedrock | 1967-1983 |
| 441533069452401 | KW 881 | " | Augusta | Glacial Till | 1987-2000 |
| 442233069490701 | KW 882 | " | Augusta | Glacial sand and gravel | 1989-2000 |
| 444637070552301 | OW 400 | Oxford | Middle Dam | Glacial till | 1944-1992 |
| 441507070310201 | OW 413 | " | South Paris | Outwash | 1976-1978 |
| 440642070583401 | OW 615 | " | Fryeburg | Outwash | 1978-1991 |
| 440642070583402 | OW 615A | " | Fryeburg | Outwash | 1989-2000 |
| 442515070481001 | OW 616 | " | Bethel | Outwash | 1978-1989 |
| 442515070481002 | OW 616A | " | Bethel | Outwash | 1989-2000 |
| 444720068523001 | PEW 33 | Penobscot | Hermon | Bedrock | 1958-1960 |
| 444953068424701 | PEW 401 | " | Veazie | Ice-contact deposits | 1963-1967 |
| 451047068512201 | PEW 455 | " | Lagrange | Glacial till | 1975-1983 |
| 451955068344501 | PEW 457 | " | South Lincoln | Ice-contact deposits | 1982-1989 |
| 452829069322101 | PIW 2 | " | Greenville Junction | Glacial Till | 1988-2000 |

**DISCONTINUED GROUND-WATER OBSERVATION WELLS--Continued**

| Well Number | Local Number | County | Locality | Aquifer | Period of Record |
|---|---|---|---|---|---|
| 444219069545801 | SMW 1 | Somerset | Mercer | Eolian deposits | 1943-1983 |
| 450234069525701 | SMW 48 | " | Bingham | Ice-contact deposits | 1981-1983 |
| 454105070170201 | SMW 49 | " | Dennistown | Glacial till | 1981-1983 |
| 454105070170202 | SMW 49A | " | Dennistown | Glacial till | 1981-1983 |
| 442858068593201 | WOW 78 | Waldo | Belfast | Ice-contact deposits | 1981-1983 |
| 442858068593202 | WOW 79 | " | Belfast | Ice-contact deposits | 1981-1983 |
| 443407069020901 | WOW 82 | " | Monroe | Glacial sand and gravel | 1989-2000 |
| 442822069080901 | WOW 84 | " | Morrill | Glacial till | 1989-1991 |
| 444240067283501 | WW 1 | Washington | Machias | Bedrock | 1958-1983 |
| 444950067000501 | WW 2 | " | Lubec | Terminal moraine deposits | 1958-1983 |
| 443754067384401 | WW 901 | " | Carr Hill | Ice-contact deposits - till | 1985-1988 |
| 444500068011601 | WW 921 | " | Deblois | Glacial till | 1988-1991 |
| 444526068013301 | WW 922 | " | Deblois | Glacial till | 1987-1999 |
| 434822070482501 | YW 1 | York | Cornish | Outwash | 1943-1983 |
| 432611070404601 | YW 834 | " | South Sanford | Glacial sand and gravel | 1989-1991 |

**DISCONTINUED PRECIPITATION STATIONS**

The following continuous-record precipitation stations in Maine have been discontinued. Records were collected and published for the period of record shown for each station.

| Station Name | Station Number | Period of Record (water year) |
|---|---|---|
| Wild River Precipitation at Beans Purchase, NH | 441852071033101 | 1990-1994 |
| Crooked River Precipitation near Naples, ME | 01063100 | 2000 |
| Shirley Precipitation near Lower Shirley Corner, ME | 452031069352101 | 1997-2000 |

# INTRODUCTION

The Water Resources Division of the U.S. Geological Survey, in cooperation with State agencies, obtains a large amount of data pertaining to the water resources of Maine each water year. These data, accumulated during many water years, constitute a valuable data base for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled "Water Resources Data - Maine." This report series includes records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water levels and water quality of ground-water wells; precipitation quantity; and snow quantity. This volume contains records for water discharge at 58 gaging stations, gage-height at 5 gaging stations, water quality data at 3 gaging stations, water levels at 17 observation wells, precipitation totals for 12 sites, and snow quantity for 82 sites. Locations of these sites are shown on figures 1, 2, 3, and 4. Also included are data from 64 low-flow partial-record stations. Additional water data were collected at various sites not involved in the systematic data-collection program, and are published as special study data. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Maine.

This series of annual reports for Maine began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1965 water year, the report included data relating to water quality. Beginning with the l968 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Maine were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir contents and stage, through September 1960, were published annually under the title "Surface Water Supply of the United States, Part 1A." For the 1961 through 1970 water years, the data were published in two 5-year reports. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title "Quality of Surface Waters of the United States." Records of ground water levels for the 1935 through 1955 water years were published under the title "Water Levels and Artesian Pressures in Observation Wells in the United States" and from 1956 through 1974 water years were published under the title "Ground-Water Levels in the United States." The above mentioned Water-Supply Papers may be consulted in the libraries of the principal cities of the United States or may be purchased from Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225.

Publications similar to this report are published annually by the U.S. Geological Survey for all States. These reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as "U.S. Geological Survey Water-Data Report ME-01-1." These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

Additional information, including current prices, for ordering specific reports may be obtained from the District Office at the address given on the back of the title page or by telephone (207) 622-8201.

Data published in these water-data reports is also available at the USGS homepage:

http://me.water.usgs.gov

# COOPERATION

The U.S. Geological Survey and organizations of the State of Maine have had cooperative agreements for the systematic collection of surface-water records since 1909, and for water-quality and ground-water records since 1957. Organizations that assisted in collecting the data in this report through cooperative agreement with the Survey are:

*Atlantic Salmon Commission*
*L. Perry, Chair*
*Lake Auburn Watershed Protection Commission*
*N. Lamie, General Manager, Auburn Water District*
*R.Burnham, Supervisor, Lewiston Water Division*
*Maine Department of Conservation,*
*R. Lovaglio, Commissioner*
*Maine Department of Defense, Veterans and Emergency Management,*
*J. E. Tinkham II, Commissioner*
*Maine Department of Transportation,*
*J.G. Melrose, Commissioner*
*Piscataquis County*
*E. DeWitt, Chair, County Commissioners*
*Town of Jay,*
*R.Marden, Town Manager*
*Town of Windham,*
*A.Plante, Town Manager*
*Town of Yarmouth*
*N. Tupper, Town Manager*
*University of Maine,*
*P. Hoff, President*

Assistance with funds or services was given by the U.S. Department of State in collecting records for 2 gaging stations and 1 water-quality station.

The following organizations contributed funds and services through the requirements of the Federal Energy Regulatory Commission:

*Mead Publishing Paper*
*Consolidated Hydro Maine*
*FPL Energy - Maine*
*Domtar Incorporated*
*Kennebec Water Power Company*
*Penobscot Hydro*
*SAPPI Fine Paper*

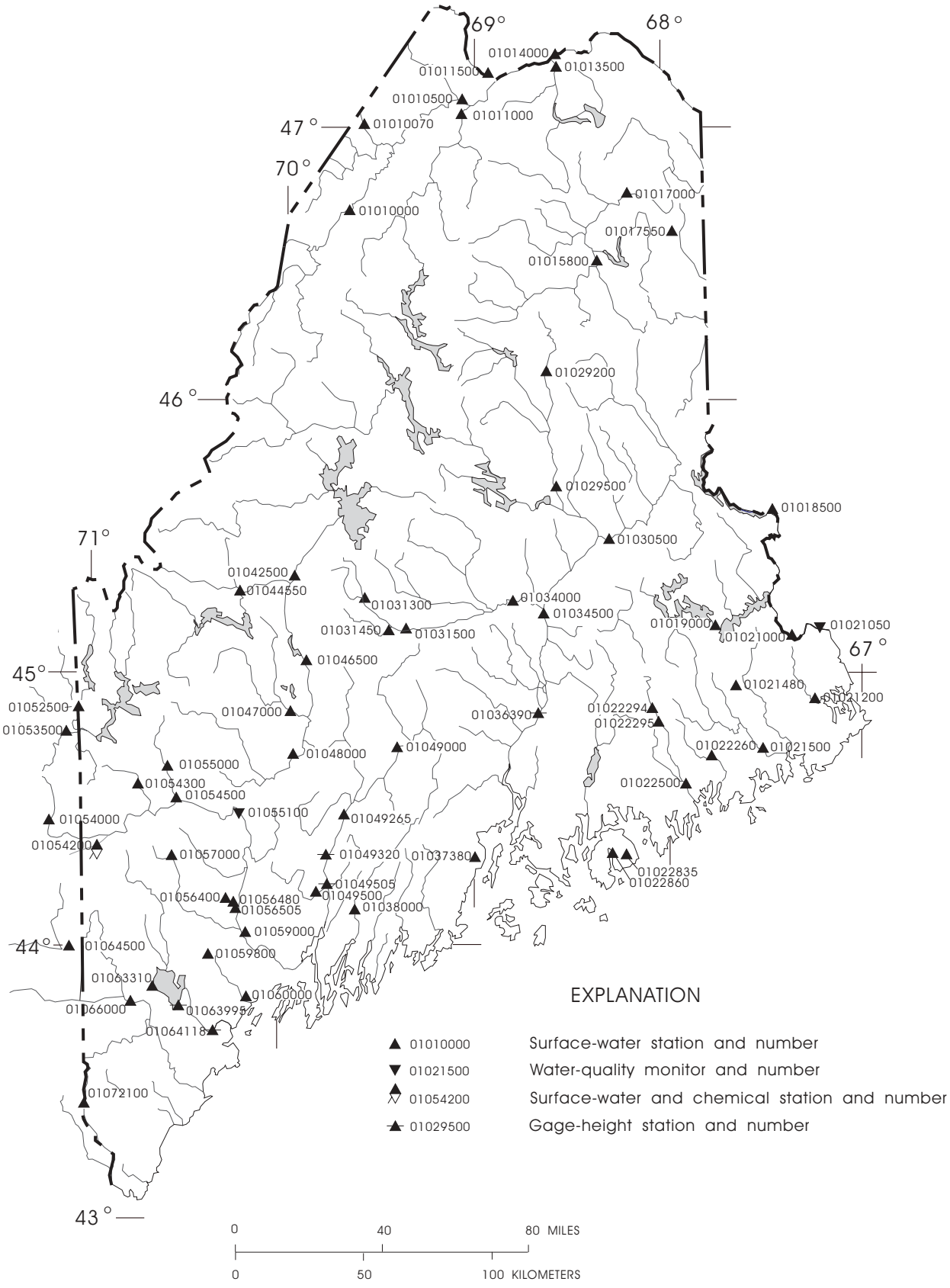


Figure 1.--Location of active surface-water and water-quality gaging stations.

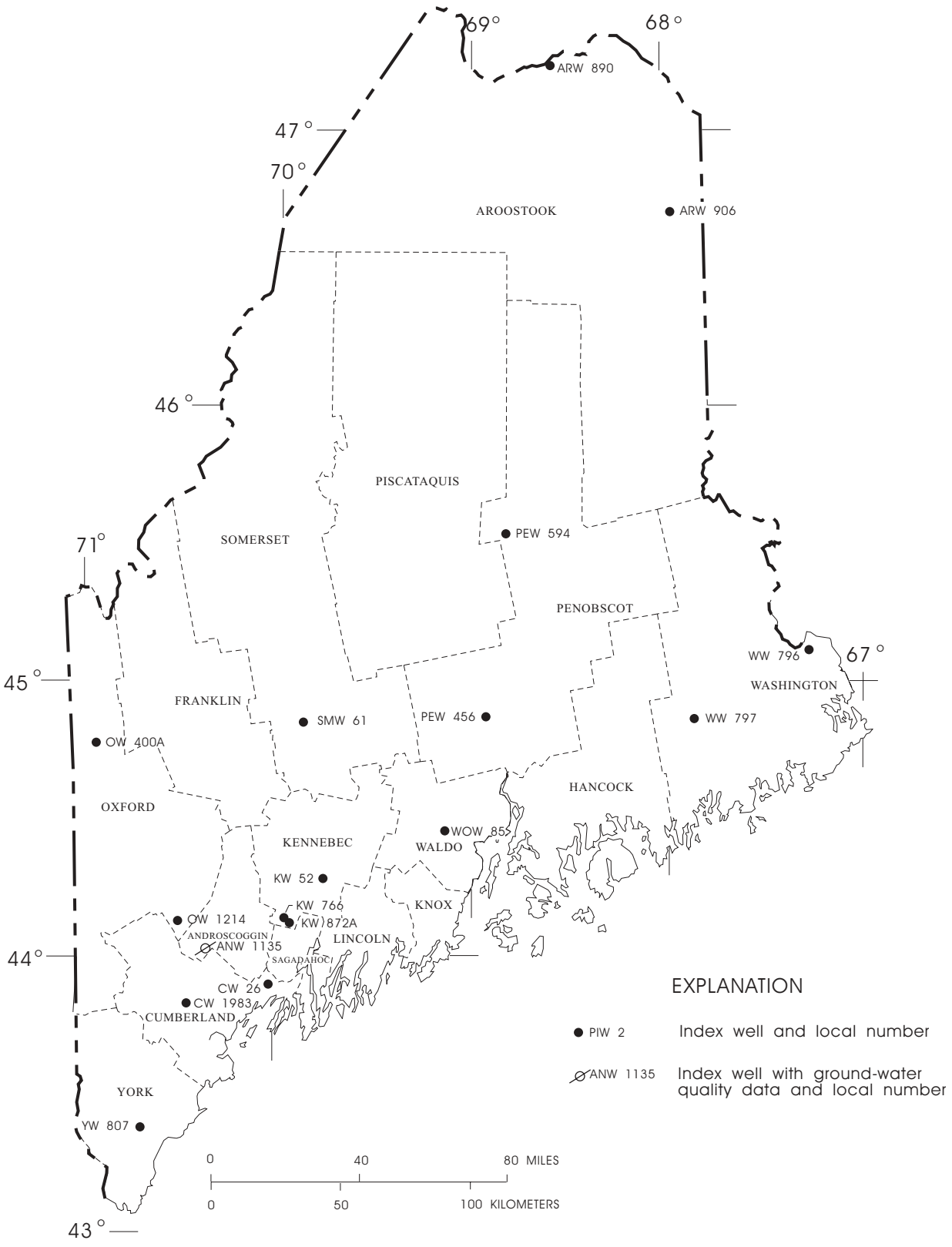


Figure 2.--Location of active ground-water data collection stations.

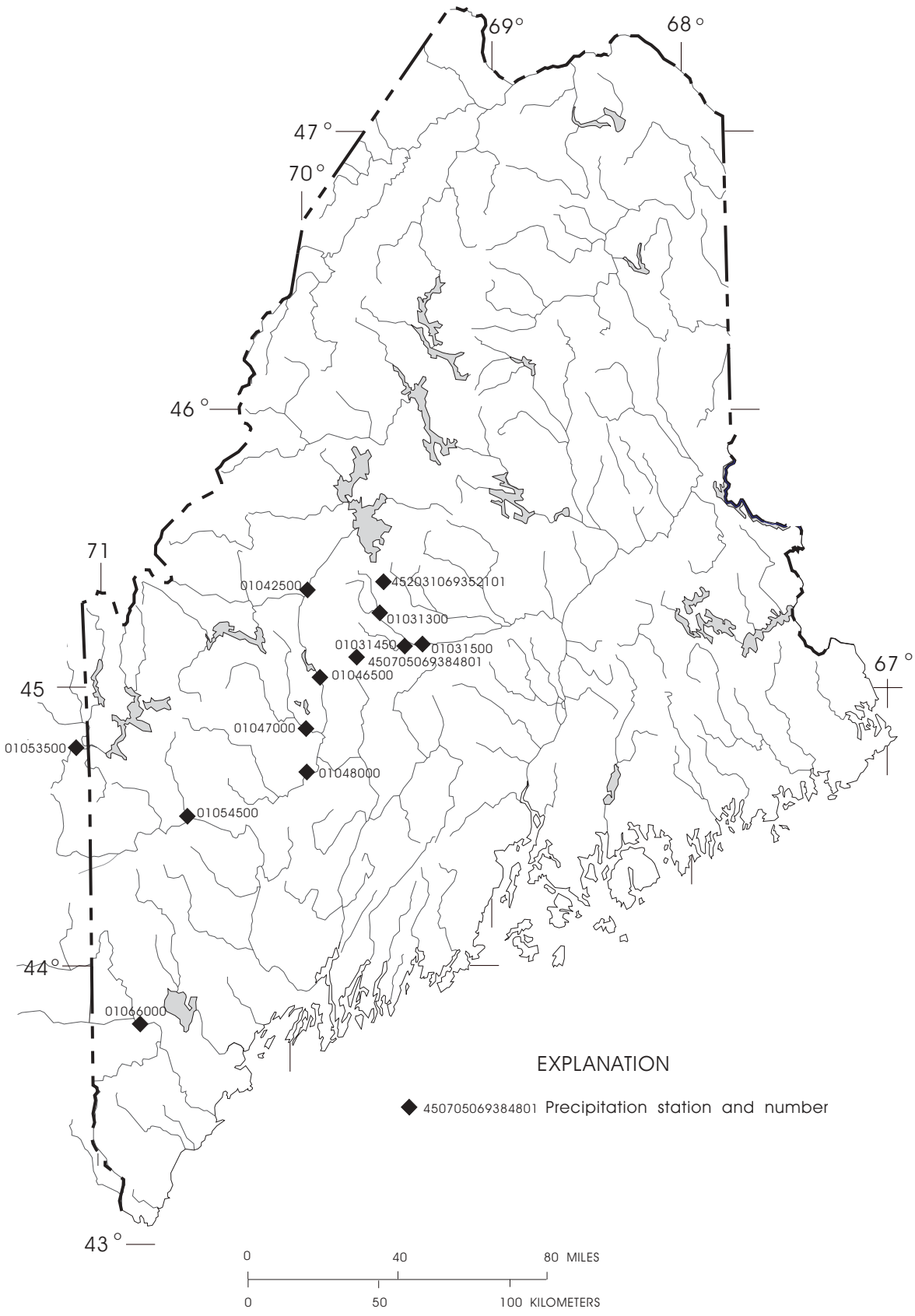


Figure 3.--Location of active precipitation quantity stations.

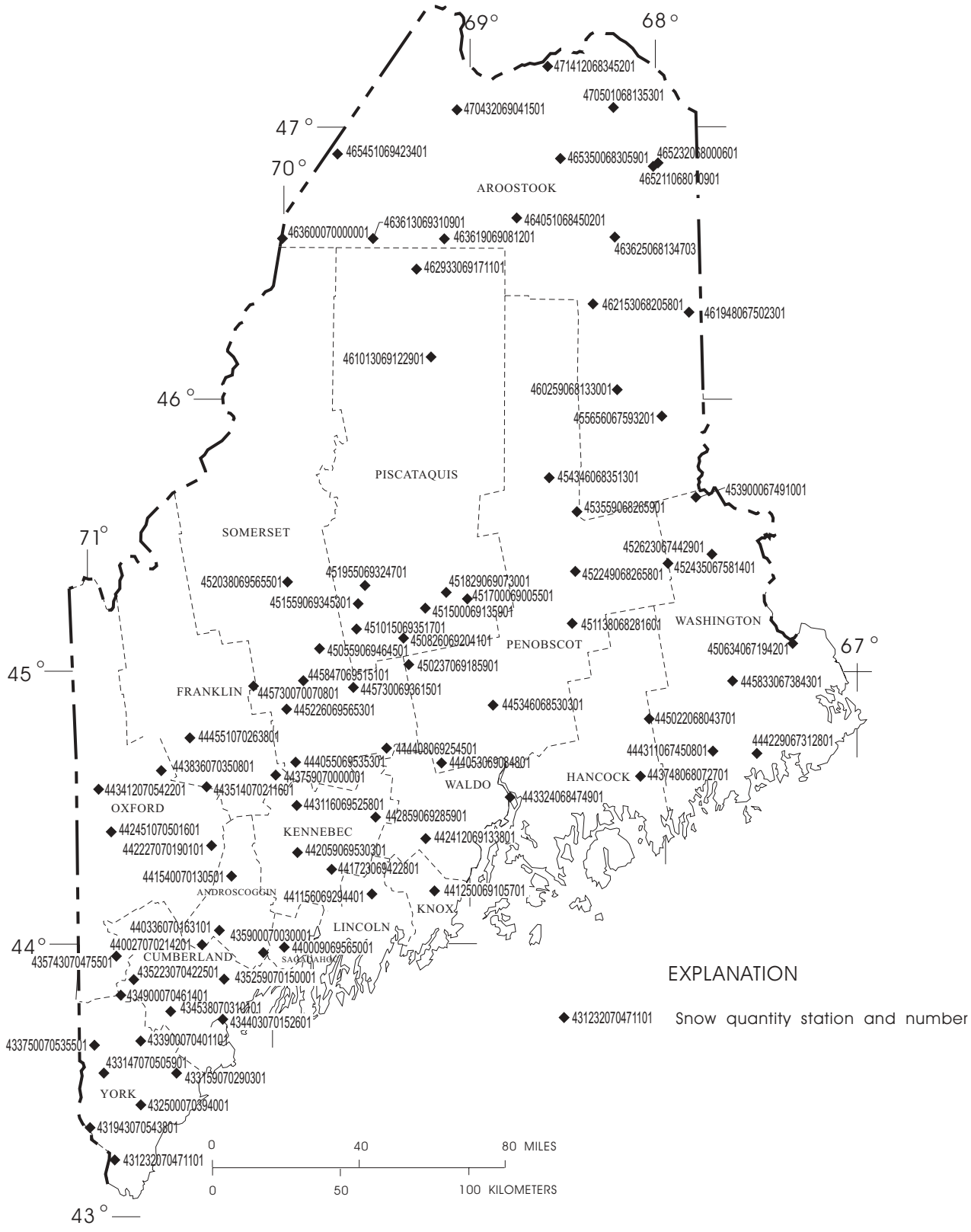


Figure 4.--Location of active snow quantity stations.

Organizations that provided data are acknowledged in station descriptions.

On waters adjacent to the international boundary, certain gaging stations are maintained by the United States (or Canada) under agreement with Canada (or the United States) and records are obtained and compiled in a manner equally acceptable to both countries. These stations are designated herein as "International gaging stations".

# SUMMARY OF HYDROLOGIC CONDITIONS

## Streamflow

Runoff for the 2001 water year was characterized by flows in the below normal range to the lower part of the normal range throughout Maine (above normal refers to the upper 25 percent of the record, below normal refers to the lower 25 percent of the record, and normal refers to the middle 50 percent of the record). Annual runoff was in the below normal range at 32 of 35 sites and normal range at 3 sites. The 2001 monthly and annual mean discharges and the median monthly and annual discharges for the 1961-90 reference period are shown in figure 6 for three long-term index stations. Monthly runoff conditions for Maine are summarized in figure 7. These maps show the area of normal, above-normal, and below-normal runoff for each month and are based on records for many of the streamflow gaging stations contained in this report. Additional statistics for each gaging station are provided with the tables of daily mean discharge.

## Floods and Droughts

Significant, wide-spread flooding did not occur during the 2001 water year in Maine. Annual peak flows had less than a 2-year recurrence interval at 14 sites, a 2- year to 5-year recurrence interval at 19 sites, a 5-year to 10-year recurrence interval at 1 sites, and a 10-year to 25-year recurrence interval at 2 sites. The greatest recurrence interval peak flows were in the upper Androscoggin River basin and were associated with a rain event in late April.

Minimum flows at most sites occurred in mid to late September. Minimum flows at 24 sites were at flows which have been equaled or exceeded over 99 percent of the time, minimum flows at 5 sites were at flows which have been equaled or exceeded 98 to 99 percent of the time, minimum flows at 3 sites were at flows which have been equaled or exceeded 95 to 97 percent of the time, and minimum flows at 5 sites were at flows which have been equalled or exceeded 87 to 94 percent of the time.

Significant, state wide low flows occurred during the summer and early fall, of the 2001 water year. Twenty sites with more then 20 years of record that are not effected by regulation were analyzed for the low flow recurrence interval of the 1-day low flow. The 1-day low-flow recurrence interval is the average time interval between daily flows equal or less than a given flow. All of Maine experienced a 20-50 year 1-day low-flow recurrence interval, except a band through central Maine and extreme northern Maine, which experienced a 5-20 year 1-day low-flow recurrence interval (Figure 5).

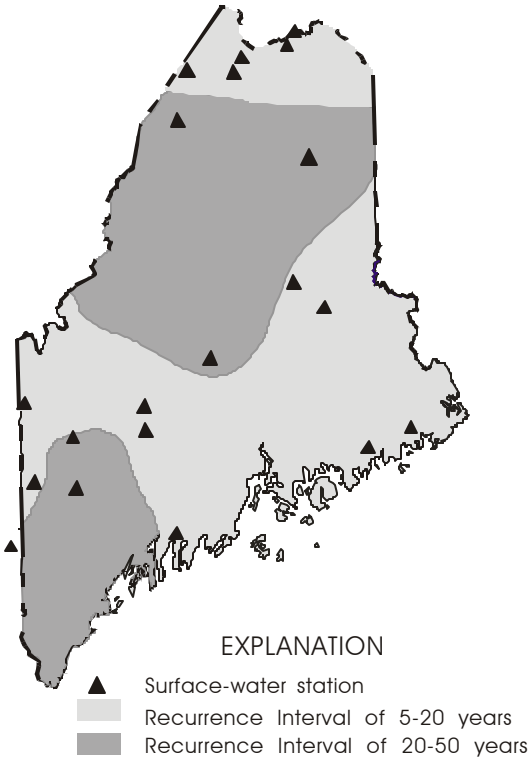


Figure 5.--One-Day low-flow recurrence interval and site location.

## Reservoir Storage

Usable surface-water storage in five reservoir systems representing the St. Croix, Penobscot, Kennebec, Androscoggin, and Presumpscot River basins in Maine, as reported by river basin managers, totaled 91.509 billion cubic feet ($ft^3$) at the beginning of the water year; this volume is 54 percent of capacity and is below the long-term average storage for the beginning of the water year (table 1). The minimum month-end storage during water year 2001 occurred at the end of March when storage was 45.350 billion $ft^3$. The maximum month-end storage during water year 2001 occurred at the end of May, when storage was 131.776 billion $ft^3$. Usable storage at the end of the water year was 82.846 billion $ft^3$ (49 percent of capacity and below the long-term average)

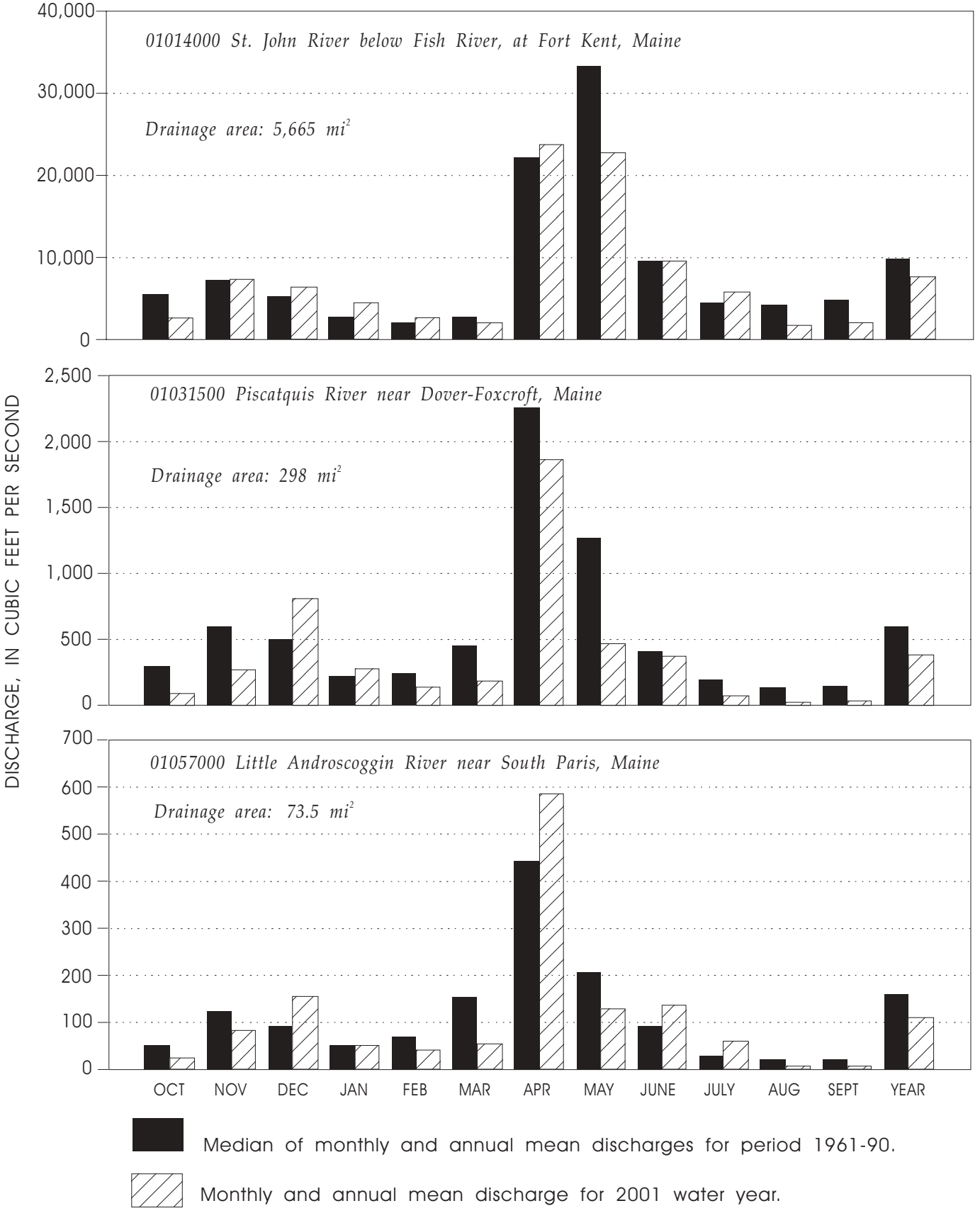


Figure 6.--Comparison of mean discharge at three long-term index gaging stations during 2001 water year with median discharge for period 1961-90.

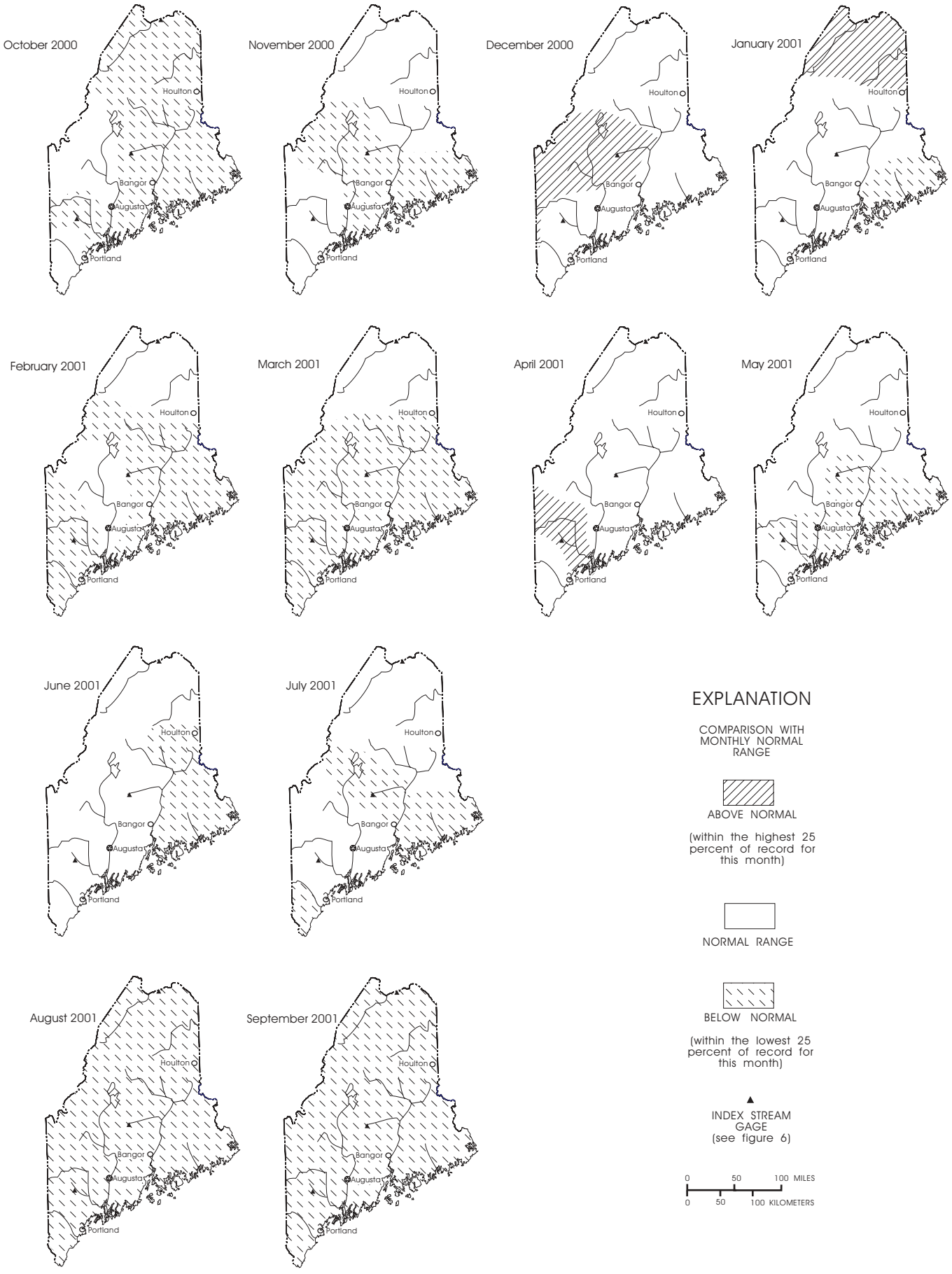


Figure 7.--Monthly surface-water conditions during the 2001 water year in Maine.

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Table 1. Total usable storage in five Maine reservoir systems for the 2001 water year, expressed as percent of total capacity of 168.075 billion cubic feet

| Month | Storage at month end (percent) | Long-term average (percent) |
|---|---|---|
| September | 54 | 61 |
| October | 47 | 57 |
| November | 49 | 60 |
| December | 53 | 60 |
| January | 45 | 52 |
| February | 36 | 44 |
| March | 27 | 40 |
| April | 60 | 72 |
| May | 78 | 90 |
| June | 77 | 87 |
| July | 72 | 79 |
| August | 59 | 69 |
| September | 49 | 61 |

## Water Quality

Two continuous recording monitoring stations for specific conductance, dissolved oxygen, water temperature and (at one monitor) pH were operated in water-year 2001. The water-quality monitor at Jay, in the Adroscoggin River Basin, recorded a new maximum water temperature value. All other readings were within the previous extreme values for the period of daily record at these two sites.

One surface-water sample was collected at the Hydrologic Bench-mark station (Wild River at Gilead) in 2001. All values of the constituents analyzed were within the historical extremes for this site.

Two water samples were collected at a newly drilled bedrock well in Poland, Maine. This well will be one of six bedrock wells chosen to provide a network of permanent, long-term ground-water-quality sites in cooperation with the Maine Geological Survey. National Water-Quality Assessment (NAWQA) collected ground-water samples at 10 selected wells.

## Ground-Water Levels

The ground-water observation well network consisted of 17 wells during the 2001 water year. Month-end ground-water level conditions for Maine are summarized in figure 8.

Record ground-water levels were recorded during the water year at the following wells where data have been collected for at least 10 years. The all-time record high of 0.00, at WW 796 was tied in April. New all-time record lows were recorded at KW 872A in September, WOW 85 in September, WW 796 in September, and WW 797 in September.

# SPECIAL NETWORKS AND PROGRAMS

Hydrologic Bench-Mark Network is a network of 50 sites in small drainage basins around the country whose purpose is to provide consistent data on the hydrology, including water quality, and related factors in representative undeveloped watersheds nationwide, and to provide analyses on a continuing basis to compare and contrast conditions observed in basins more obviously affected by human activities. The gaging station on the Wild River at Gilead (01054200) is in this network.

The Statewide Cooperative Snow Survey involves international, Federal and State agencies and private companies. Approximately 217 snow courses have been established in Maine and adjacent parts of New Brunswick, Quebec and New Hampshire. This report presents data from 82 of these sites collected by the U.S. Geological Survey and cooperative observers. Additional information, including state snow maps and data can be obtained from the USGS Augusta office.

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey is a long-term program with goals to describe the status and trends of water-quality conditions for a large, representative part of the Nations ground- and surface-water resources; provide an improved understanding of the primary natural and human factors affecting these observed conditions and trends; and provide information that supports development and evaluation of management, regulatory, and monitoring decisions by other agencies.

Assessment activities are being conducted in 53 study units (major watersheds and aquifer systems) that represent a wide range of environmental settings nationwide and that account for a large percentage of the Nations water use. A wide array of chemical constituents will be measured in ground water, surface water, streambed sediments, and fish tissues. The coordinated application of comparative hydrologic studies at a wide range of spatial and temporal scales will provide information for decision making by water-resources managers and a foundation for aggregation and comparison of findings to address water-quality issues of regional and national interest.

Communication and coordination between USGS personnel and other local, State, and federal interests are critical components of the NAWQA Program. Each study unit has a local liaison committee consisting of representatives from key federal, State, and local water resources agencies, Indian nations, and universities in the study unit. Liaison committees typically meet semiannually to discuss their information needs, monitoring plans and progress, desired information products, and opportunities to collaborate efforts among the agencies.

The New England Coastal Basins (NECB) NAWQA study unit encompasses 23,000 square miles in western and central Maine, eastern New Hampshire, eastern Massachusetts, most of Rhode Island, and a small part of eastern Connecticut.

Additional information about the NAWQA Program is available through the world wide web at:

http://wwwrvares.er.usgs.gov/nawqa/nawqa_home.html

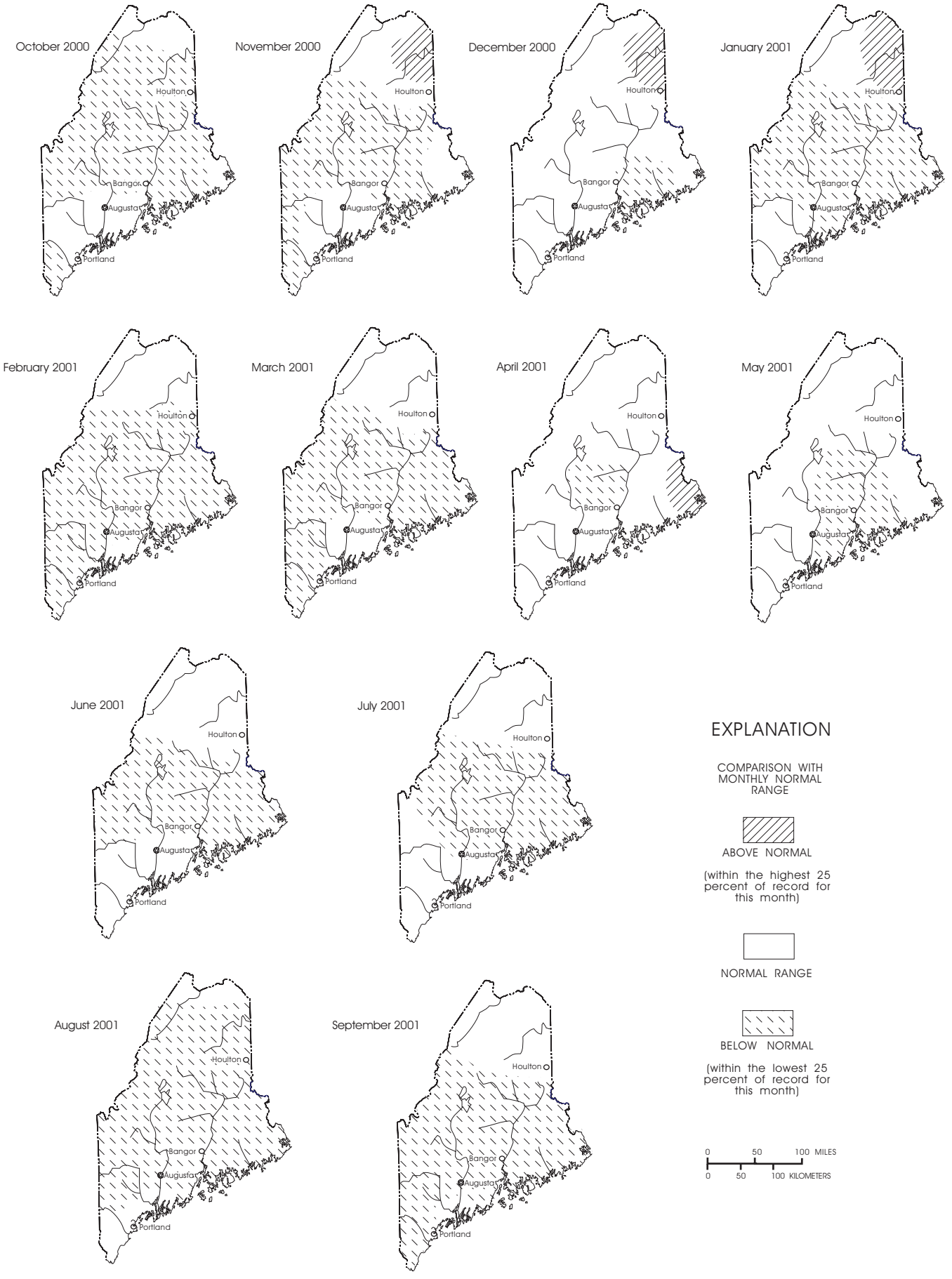


Figure 8.--Month-end ground-water conditions during the 2001 water year in Maine.

# EXPLANATION OF THE RECORDS

The surface-water and ground-water records published in this report are for the 2001 water year that began October 1, 2000, and ended September 30, 2001. A calendar of the water year is provided on the inside of the front cover. The records contain streamflow data, stage data for streams, water-quality data for surface water and ground-water, ground-water level data, precipitation quantity, and snow quantity. The locations of the stations and wells where the data were collected are shown in figures 1, 2, 3, and 4. The following sections of the introductory text are presented to provide users with a more detailed explanation of how the hydrologic data published in this report were collected, analyzed, computed, and arranged for presentation.

## Station Identification Numbers

Each data station, whether stream site, well, or precipitation station, in this report is assigned a unique identification number. This number is unique in that it applies specifically to a given station and to no other. The number usually is assigned when a station is first established and is retained for that station indefinitely. The systems used by the U.S. Geological Survey to assign identification numbers for surface-water stations and for ground-water well sites differ, but both are based on geographic location. The "downstream order" system is used for regular surface-water and co-located precipitation stations and the "latitude-longitude" system is used for wells and precipitation stations which are not located at surface-water stations.

### Downstream Order System

Since October 1, 1950, the order of listing hydrologic-station records in Survey reports is in a downstream direction along the main stream. All stations on a tributary entering upstream from a mainstream station are listed before that station. A station on a tributary that enters between two mainstream stations is listed between them. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary with respect to the stream to which it is immediately tributary is indicated by an indention in the "List of Stations" in the front of this report. Each indention represents one rank. This downstream order and system of indention shows which stations are on tributaries between any two stations and the rank of the tributary on which each station is situated.

The station-identification number is assigned according to downstream order. In assigning station numbers, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list made up of both types of stations. Gaps are left in the series of numbers to allow for new stations that may be established; hence, the numbers are not consecutive. The complete eight-digit number for each station, such as 01031500, which appears just to the left of the station name, includes the two-digit Part number "01" plus the six-digit downstream-order number "031500." The Part number designates the major river basins; for example, Part "01" is for the North Atlantic Slope basins.

### Latitude-Longitude System

The identification numbers for wells, snow sampling, and precipitation stations which are not located at surface-water stations are assigned according to the grid system of latitude and longitude. The number consists of 15 digits. The first six digits denote the degrees, minutes, and seconds of latitude, the next seven digits denote degrees, minutes, and seconds of longitude, and the last two digits (assigned sequentially) identify the wells or other sites within a 1-second grid. This site-identification number, once assigned, is a pure number and has no locational significance. In the rare instance where the initial determination of latitude and longitude are found to be in error, the station will retain its initial identification number; however, its true latitude and longitude will be listed in the LOCATION paragraph of the station description. (See figure 9.)

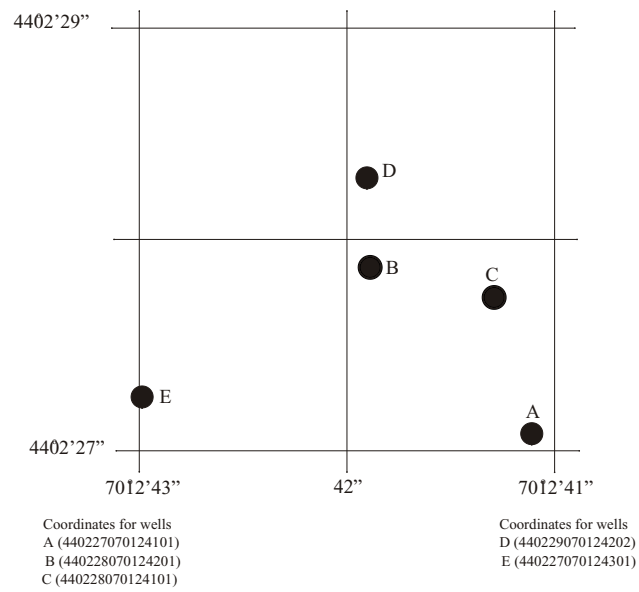


Figure 9.--System for numbering wells and special study sites (latitude and longitude).

## Records of Stage and Water Discharge

Records of stage and water discharge may be complete or partial. Complete records of discharge are those obtained using a continuous stage-recording device through which either instantaneous or mean daily discharges may be computed for any time, or any period of time, during the period of record. Complete records of lake or reservoir content, similarly, are those for which stage or content may be computed or estimated with reasonable accuracy for any time, or period of time. They may be obtained using a continuous stage-recording device, but need not be. Because daily mean discharges and end-of-day contents commonly are published for such stations, they are referred to as "daily stations."

By contrast, partial records are obtained through discrete measurements without using a continuous stage-recording device and pertain only to a few flow characteristics, or perhaps only one. The nature of the partial record is indicated by table titles such as “Crest-stage partial records,” or “Low-flow partial records.” Records of measurements from special studies, such as low-flow seepage studies, may be considered as partial records, but they are presented separately in this report. Location of all complete-record stations for which data are given in this report are shown in figure 1.

### Data Collection and Computation

The data obtained at a complete-record gaging station on a stream or canal consist of a continuous record of stage, individual measurements of discharge throughout a range of stages, and notations regarding factors that may affect the relationships between stage and discharge. These data, together with supplemental information, such as weather records, are used to compute daily discharges. The data obtained at a complete-record gaging station on a lake or reservoir consist of a record of stage and of notations regarding factors that may affect the relationship between stage and lake content. These data are used with stage-area and stage-capacity curves or tables to compute water-surface areas and lake storage.

Continuous records of stage are obtained with electronic data loggers which collect, store, and transmit data via satellite. Measurements of discharge are made with current meters using methods adopted by the Geological Survey as a result of experience accumulated since 1880. These methods are described in standard textbooks, Water-Supply Paper 2175, and U.S. Geological Survey Techniques of Water-Resources Investigations (TWRI’s), Book 3, Chapter A1 through A19 and Book 8, Chapters A2 and B2. The methods are consistent with the American Society for Testing and Materials (ASTM) standards and generally follow the standards of the International Organization for Standards (ISO).

In computing discharge records, results of individual measurements are plotted against the corresponding stages, and stage-discharge relation curves are then constructed. From these curves, rating tables indicating the approximate discharge for any stage within the range of the measurements are prepared. If it is necessary to define extremes of discharge outside the range of the current-meter measurements, the curves are extended using: (1) logarithmic plotting; (2) velocity-area studies; (3) results of indirect measurements of peak discharge, such as slope-area or contracted-opening measurements, and computations of flow over dams or weirs; or (4) step-backwater techniques.

Daily mean discharges are computed by applying the stages (gage heights) to the stage-discharge curves or tables. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features that form the control, the daily mean discharge is determined by the shifting-control method, in which correction factors based on the individual discharge measurements and notes of the personnel making the measurements are applied to the gage heights before the discharges are determined from the curves or tables. This shifting-control method also is used if the stage-discharge relation is changed temporarily because of aquatic growth or debris on the control. For many stations, formation of ice in the winter may so obscure the stage-discharge relations that daily mean discharges must be estimated from other information such as temperature and precipitation records, notes of observations, and records for other stations in the same or nearby basins for comparable periods.

At some stream-gaging stations, the stage-discharge relation is affected by the backwater from reservoirs, tributary streams, or other sources. This necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage set at some distance from the base gage. At some stations the stage-discharge relation is affected by changing stage; at these stations the rate of change in stage is used as a factor in computing discharge.

In computing records of lake or reservoir contents, it is necessary to have available from surveys, curves or tables which define the relationship between stage and content. The application of stage to the stage-content curves or tables gives the contents from which daily, monthly, or yearly changes then are determined. Periodic resurveys may be necessary to determine if the stage-content relationship changes because of deposition of sediment in a lake or reservoir. Even when this is done, the contents computed may become increasingly in error as the lapsed time since the last survey increases. Discharges over lake or reservoir spillways are computed from stage-discharge relationships much as other stream discharges are computed.

For some gaging stations, there are periods when no gage-height record is obtained, or the recorded gage height is so faulty that it cannot be used to compute daily discharge or contents. This happens when the recorder stops or otherwise fails to operate properly, intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated from the recorded range in stage, previous or following record, discharge measurements, weather records, and comparison with other station records from the same or nearby basins. Likewise, daily contents may be estimated from operator's logs, previous or following record, inflow-outflow studies, and other information. Information explaining how estimated daily-discharge values are identified in station records is included in the next two sections, “Data Presentation” (REMARKS paragraph) and “Identifying Estimated Daily Discharge.”

## Data Presentation

The records published for each continuous-record surface-water discharge station (gaging station) consist of five parts, the manuscript or station description; the data table of daily mean values of discharge for the current water year with summary data; a tabular statistical summary of monthly mean flow data for a designated period, by water year; a summary statistics table that includes statistical data of annual, daily, and instantaneous flows as well as data pertaining to annual runoff, 7-day low-flow minimums, and flow duration; and a hydrograph of the daily mean values of discharge for the current water year.

### Station manuscript

The manuscript provides, under various headings, descriptive information, such as station location; period of record; historical extremes outside the period of record; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments to follow clarify information presented under the various headings of the station description.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council.

DRAINAGE AREA.--Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.--This indicates the period for which there are published records for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not, and whose location was such that records from it can reasonably be considered equivalent with records from the present station.

REVISED RECORDS.--Published records, because of new information, occasionally are found to be incorrect, and revisions are printed in later reports. Listed under this heading are all the reports in which revisions have been published for the station and the water years to which the revisions apply. If a revision did not include daily, monthly, or annual figures of discharge, that fact is noted after the year dates as follows: "(M)" means that only the instantaneous maximum discharge was revised; "(m)" that only the instantaneous minimum was revised; and "(P)" that only peak discharges were revised. If the drainage area has been revised, the report in which the most recently revised figure was first published is given.

GAGE.--The type of gage in current use, the datum of the current gage referred to National Geodetic Vertical Datum of 1929 (see glossary), and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.--All periods of estimated daily-discharge record will either be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily-discharge table. (See next section, "Identifying Estimated Daily Discharge.") If a REMARKS statement is used to identify estimated record, the paragraph will begin with this information presented as the first entry. The paragraph is also used to present information relative to the accuracy of the records, to special methods of computation, to conditions that affect natural flow at the station and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, and purpose and use of the reservoir.

COOPERATION.--Records provided by a cooperating organization or obtained for the Geological Survey by a cooperating organization are identified here.

EXTREMES FOR PERIOD OF RECORD.--Extremes may include maximum and minimum stages and maximum and minimum discharges or content. Unless otherwise qualified, the maximum discharge or content is the instantaneous maximum corresponding to the highest stage that occurred. The highest stage may have been obtained from a graphic or digital recorder, a crest-stage gage, or by direct observation of a nonrecording gage. If the maximum stage did not occur on the same day as the maximum discharge or content, it is given separately. Similarly, the minimum is the instantaneous minimum discharge, unless otherwise qualified, and was determined and is reported in the same manner as the maximum.

EXTREMES OUTSIDE PERIOD OF RECORD.--Included here is information concerning major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the U.S. Geological Survey.

EXTREMES FOR CURRENT YEAR.--Extremes given here are similar to those for the period of record, except the peak discharge listing may include secondary peaks. For stations meeting certain criteria, all peak discharges and stages occurring during the water year and greater than a selected base discharge are presented under this heading. The peaks greater than the base discharge, excluding the highest one, are referred to as secondary peaks. Peak discharges are not published for canals, ditches, drains, or streams for which the peaks are subject to substantial control by man. The time of occurrence for peaks is expressed in 24-hour local standard time. For example, 12:30 a.m. is 0030, and 1:30 p.m. is 1330. The minimum for the current water year appears below the table of peak data.

REVISIONS.--If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because, for these stations, there would be no current or, possibly, future station manuscript published to document the revision in a "Revised Records" entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the offices whose addresses are given on the back of the title page of this report to determine if the published records were ever revised after the station was discontinued. Of course, if the data were obtained by computer retrieval, the data would be current and there would be no need to check because any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the "Remarks" and in the inclusion of a skeleton stage-capacity table when daily contents are given.

Data table of daily mean values

The daily table of discharge records for stream-gaging stations gives mean discharge for each day of the water year. In the monthly summary for the table, the line headed "TOTAL" gives the sum of the daily figures for each month; the line headed "MEAN" gives the average flow in cubic feet per second for the month; and the lines headed "MAX" and "MIN" give the maximum and minimum daily mean discharges, respectively, for each month. Discharge for the month also is usually expressed in cubic feet per second per square mile (line head "CFSM"); or in inches (line headed "IN"). Figures for cubic feet per second per square mile and runoff in inches may be omitted if there is extensive regulation or diversion or if the drainage area includes large noncontributing areas.

Statistics of monthly mean data

A tabular summary of the mean (line headed "MEAN"), maximum (line headed "MAX"), and minimum (line headed "MIN") of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those figures. The designated period will be expressed as "FOR WATER YEARS _____- _____, BY WATER YEAR (WY)," and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. It will consist of all of the station record within the specified water years, inclusive, including complete months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript.

Summary statistics

A table titled "SUMMARY STATISTICS" follows the statistics of monthly mean tabulation. This table consists of four columns, with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a designated period, as appropriate. The designated period selected, "WATER YEARS ____-____", will consist of all of the station record within the specified water years, inclusive, including months of record for partial water years, if any, and may coincide with the period of record for the station. The water years for which the statistics are computed will be consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (see line headings below), except for the "ANNUAL 7-DAY MINIMUM" statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrence may be noted in the EXTREMES FOR PERIOD OF RECORD or EXTREMES FOR CURRENT YEAR paragraphs of the manuscript. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designated-period column may not be within the selected water years listed in the heading. When this occurs, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow duration curve statistics and runoff are also given. Runoff data may be omitted if there is extensive regulation or diversion of flow in the drainage basin.

The following summary statistics data, as appropriate, are provided with each continuous record of discharge. Comments to follow clarify information presented under the various line headings of the summary statistics table.

ANNUAL TOTAL.--The sum of the daily mean values of discharge for the year.

ANNUAL MEAN.--The arithmetic mean for the individual daily mean discharges for the year noted or for the designated period.

HIGHEST ANNUAL MEAN.--The maximum annual mean discharge occurring for the designated period.

LOWEST ANNUAL MEAN.--The minimum annual mean discharge occurring for the designated period.

HIGHEST DAILY MEAN.--The maximum daily mean discharge for the year or for the designated period.

LOWEST DAILY MEAN.--The minimum daily mean discharge for the year or for the designated period.

ANNUAL 7-DAY MINIMUM.--The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic).

INSTANTANEOUS PEAK FLOW.--The maximum instantaneous discharge occurring for the water year or for the designated period. Note that secondary instantaneous peak discharges above a selected base discharge are stored in District computer files for stations meeting certain criteria. Those discharge values may be obtained by writing to the District Office. (see address on back title page of this report.)

INSTANTANEOUS PEAK STAGE.--The maximum instantaneous stage occurring for the water year or for the designated period. If the dates of occurrence for the instantaneous peak flow and instantaneous peak stage differ, the EXTREMES FOR PERIOD OF RECORD or EXTREMES FOR CURRENT YEAR paragraphs of the manuscript may be used to provide further information.

INSTANTANEOUS LOW FLOW.--The minimum instantaneous discharge occurring for the water year or for the designated period.

ANNUAL RUNOFF--Indicates the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

Acre-foot (AC-FT) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equal to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

Cubic feet per second per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile area drained, assuming the runoff is distributed uniformly in time and area.

Inches (INCHES) indicates the depth to which the drainage area would be covered if all of the runoff for a given time period were uniformly distributed on it.

10 PERCENT EXCEEDS.--The discharge that has been exceeded 10 percent of the time for the designated period.

50 PERCENT EXCEEDS.--The discharge that has been exceeded 50 percent of the time for the designated period.

90 PERCENT EXCEEDS.--The discharge that has been exceeded 90 percent of the time for the designated period.

Hydrograph

The hydrograph gives a graphical presentation of the mean discharge for each day of the water year. Where possible, the same scale is used between gaging stations in order to facilitate visual comparison.

## Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified by flagging individual daily values with the letter symbol “e” and printing a table footnote, “e Estimated.”

## Accuracy of the Records

The accuracy of streamflow records depends primarily on: (1) The stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements; and (2) the accuracy of measurements of stage, measurements of discharge, and interpretation of records.

The accuracy attributed to the records is indicated under “REMARKS.” “Excellent” means that about 95 percent of the daily discharges are within 5 percent of their true values; “good,” within 10 percent; and “fair,” within 15 percent. Records that do not meet the criteria mentioned are rated “poor.” Different accuracies may be attributed to different parts of a given record.

Daily mean discharges in this report are given to the nearest hundredth of a cubic foot per second for values less than 1 $ft^3/s$; to the nearest tenth between 1.0 and 10 $ft^3/s$; to whole numbers between 10 and 1,000 $ft^3/s$; and to 3 significant figures for more than 1,000 $ft^3/s$. The number of significant figures used is based solely on the magnitude of the discharge value.

Discharges listed for partial-record stations and special study sites are given to the nearest hundredth of a cubic foot per second for values less than 10 $ft^3/s$ and to 3 significant figures for more than 10 $ft^3/s$. Exceptions are made for discharge measurements made with volumetric techniques (see TWRI, Book 3, Chapter A8) and flume techniques (see TWRI, Book 3, Chapter A14) which are given to the nearest thousandth of a cubic foot per second for values less than 0.10 $ft^3/s$. Measurements made using volumetric techniques are footnoted in the table of special study measurements.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, figures of cubic feet per second per square mile and of runoff, in inches, are not published unless satisfactory adjustments can be made for diversions, for changes in contents to reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may

occur if adjustments or losses are large in comparison with the observed discharge.

### Special Study Records

Data collected at special study sites are presented in a table following the information for continuous sites. This table summarizes discharge measurements made at sites other than continuous-record sites.

### Other Records Available

Information used in the preparation of the records in this publication, such as discharge-measurement notes, gage-height records, temperature measurements, and rating tables are on file in the Maine District Office. Also, most of the daily mean discharges are in computer readable form and have been analyzed statistically. Information on the availability of the unpublished information or on the results of statistical analyses of the published records may be obtained from the Maine District Office.

## Records of Surface-Water Quality

Records of surface-water quality ordinarily are obtained at or near stream-gaging stations because interpretation of records of surface-water quality nearly always requires corresponding discharge data. Records of surface-water quality in this report may involve a variety of types of data and measurement frequencies.

### Classification of records

Water-quality data for surface-water sites are grouped into one of three classifications. A **continuing-record station** is a site where data are collected on a regularly scheduled basis. Frequency may be once or more times daily, weekly, monthly, or quarterly. A **partial-record station** is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A **special study sampling site** is a location other than a continuing or partial-record station where random samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between "continuing **records"**, as used in this report, and "continuous **recordings,"** which refers to a continuous graph or a series of discrete values recorded at short intervals. Some records of water quality, such as temperature and specific conductance, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. In this report, continuing-record stations where data are collected on a continuous basis are referred to as **continuous-recording stations**. Locations of stations for which records on the quality of surface water appear in this report are shown in figure 1.

### Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for special study sampling sites appear in separate tables following the table of discharge measurements at special study sites.

### On-Site Measurements and Sample Collection

In obtaining water-quality data, a major concern is to assure that the data obtained represent the in-situ quality of the water. To do this, certain measurements, such as water temperature, pH, alkalinity, dissolved oxygen, and specific conductance need to be made on-site when the samples are taken. To assure that measurements made in the laboratory also represent the in-situ water, carefully prescribed procedures need to be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory.

Procedures for on-site measurements and for collecting, treating, and shipping samples are given in the TWRI Book 1, Chapter D2; Book 3, Chapter C2; and Book 5, Chapters A1, A3, and A4. These references are listed in the PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS section of this report.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary widely with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled through several vertical sections to obtain a representative sample needed for an accurate mean concentration and for use in calculating load. Whether samples are obtained from the centroid of flow or from several verticals depends on flow conditions and other factors which must be evaluated by the collector.

Water-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis.

For stations equipped with continuous water-quality monitors, the records consist of daily maximum, minimum, and mean values for each constituent measured and are based upon hourly observations. More detailed records (hourly values) may be obtained from the Maine District Office, whose address is given on the back of the title page of this report.

### Water temperature

Water temperatures are measured at all water-quality stations. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges. At stations where recording instruments are used,

both mean, maximum, and minimum temperatures for each day are published.

### Laboratory Measurements

Samples are analyzed locally for specific conductance, dissolved oxygen, pH, and temperature. All other samples were analyzed in the Geological Survey laboratory in Lakewood, Colorado. Methods used by the U.S. Geological Survey laboratory are given in Fishman, M.J., 1993, Methods of analysis by the U. S. Geological Survey National Water Quality Laboratory--Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125.

### Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, and extremes for parameters currently measured daily. Tables of water-quality data, including chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance, pH, water temperature, and dissolved oxygen data from water-quality monitor recorders follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information, as appropriate, is provided with each continuing-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

DRAINAGE AREA.--See Data Presentation under "Records of Stage and Water Discharge;" same comments apply.

PERIOD OF RECORD.--This indicates the periods for which there are published water-quality records for the station. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of daily record are given for the parameters individually.

INSTRUMENTATION.--Information on instrumentation is given only if a water-quality monitor, or temperature recording device is in operation at a station.

REMARKS.--Remarks provide added information pertinent to the collection, analysis, or computation of the records.

EXTREMES.--Maximums and minimums are given only for parameters measured daily or more frequently. Extremes are provided for both the period of daily record and for the current water year. If a value from a special study measurement from outside the period of daily record has higher maximum or lower minimum, that value is reported in a descriptive heading for extremes outside the period of daily record.

REVISIONS.--If errors in published water-quality records are discovered after publication, appropriate updates are made to the Water-Quality File in the U.S. Geological Survey's computerized data system, WATSTORE, and subsequently by monthly transfer of update transactions to the U.S. Environmental Protection Agency's STORET system. Because the usual volume of updates makes it impractical to document individual changes in the State data-report series or elsewhere, potential users of U.S. Geological Survey water-quality data are encouraged to obtain all required data from the appropriate computer file to insure the most recent updates.

The surface-water-quality records for special study sampling sites are published in separate tables following the table of discharge measurements at special study sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

### Accuracy of the Records

The accuracy attributed to the records is indicated under "REMARKS." The values for rating each physical property are listed in table 2.

**Table 2. Rating continuous water-quality records.**

[≤, less than or equal to; ±, plus or minus value shown; °C, degree Celsius; >, greater than; %, percent; mg/L, milligram per liter; pH unit, standard pH unit; Table from: Wagner, R. J. , Mattraw H. C., Ritz G. F., and Smith B. A., 2000, *Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Site Selction, Field Operation, Calibration, Record Computation, and Reporting*, U. S. Geological Survey, Water-Resources Investigation Report 00-4252, page 23.]

| Measued physical property | Ratings | | | |
|---|---|---|---|---|
| | Excellent | Good | Fair | Poor |
| Water temperature | ≤ ± 0.2 °C | > ± 0.2 to 0.5 °C | > ± 0.5 to 0.8 °C | > ± 0.8 °C |
| Specific conductance | ≤ ± 3% | > ± 3 to 10% | > ± 10 to 15% | > ± 15% |
| Dissolved oxygen | ≤ ± 0.3 mg/L | > ± 0.3 to 0.5 mg/L | > ± 0.5 to 0.8 mg/L | > ± 0.8 mg/L |
| pH | ≤ ± 0.2 unit | > ± 0.2 to 0.5 unit | > ± 0.5 to 0.8 unit | > ± 0.8 unit |

### Remark Codes

The following remark codes may appear with the water-quality data in this report:

| *PRINTED OUTPUT* | *REMARK* |
|---|---|
| *E* | *Estimated value.* |
| > | *Actual value is known to be greater than the value shown.* |
| < | *Actual value is known to be less than the value shown.* |

## Records of Ground-Water Levels

Only water-level data from a national network of observation wells are given in this report. These data are intended to provide a sampling and historical record of water-level changes in the Nation's most important aquifers. Locations of the observation wells in this network in Maine are shown in figure 2.

### Data Collection and Computation

Measurements of water levels are made in many types of wells under varying conditions, but the methods of measurement are standardized to the extent possible. The equipment and measuring techniques used at each observation well ensure that measurements at each well are of consistent accuracy and reliability.

Tables of water-level data are presented by counties arranged in alphabetical order. The primary identification number for a given well is the 15-digit number that appears in the upper left corner of the table. The secondary identification number is the local well number, an alphanumeric number, composed of an abbreviation of the county name and sequential number.

Water-level records are obtained from direct measurements with a steel tape or from the electronic water-stage recorders. The water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Daily-mean water levels are reported for wells equipped with recording gages.

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth to water of several hundred feet, the error of determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water, the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given to a tenth of a foot.

### Data Presentation

Each well record consists of three parts: The station description, data table of water levels observed during the water year, and a hydrograph of water levels observed during the past decade. The description of the well is presented first, through use of descriptive headings, preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--This paragraph follows the well-identification number and reports the latitude and longitude (given in degrees, minutes, and seconds); the hydrologic-unit number; the distance and direction from a geographic point of reference; and the owner's name.

AQUIFER.--This entry designates by name (if a name exists) and geologic age (if known) the aquifer(s) open to the well.

WELL CHARACTERISTICS.--This entry describes the well in terms of depth, diameter, casing depth and/or screened interval.

INSTRUMENTATION.--This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on weekly, monthly, or some other frequency of measurement. It is also used to identify wells measured by local (non-Survey) observers.

DATUM.--This entry describes both the measuring point and the land-surface elevation at the well. The measuring point is described physically (such as top of collar, notch in top of casing, plug in pump base and so on) and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above (or below) National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision depending on the method of determination.

REMARKS.--This entry describes factors that may influence the water level in a well or the measurement of the water level. It should identify wells that also are water-quality observation wells.

REVISIONS.--This entry lists the reports in which revised water-level data have been published, each followed by the water years for which figures were revised.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the well. It reports the month and year of the start of publication of water-level records by the U.S. Geological Survey and the words “to current year” if the records are to be continued into the following year. Periods for which water-level records are available, but are not published by the Geological Survey, may be noted.

EXTREMES FOR PERIOD OF RECORD.--This entry contains the highest and lowest water levels of the period of published record, with respect to land-surface datum, and the dates of their occurrence.

A table of water levels follows the station description for each well. Water levels are reported in feet below land-surface datum. Direct measurements obtained with steel tape are listed. For wells equipped with recorders, tables of daily-mean water levels are published. The highest and lowest water levels of the water year and their dates of occurrence are shown on a line below the daily-mean table. Because all

values are not published for wells with recorders (hourly values are not published but are available in the files of the Geological Survey) the extremes may be values that are not listed in the table. Missing records are indicated by dashes in place of the water level.

A hydrograph of water levels observed during the past decade follows the table of water levels for each well. The water levels presented are referenced to both the land-surface datum at the site and to the NGVD of 1929. Because all values are not used to produce the hyrographs, the extremes listed in the station description may not be reflected in the hydrographs. Periods of missing records are indicated by blank spaces in the hydrograph.

## Records of Ground-Water Quality

Water samples were collected at a newly drilled bedrock well in Poland, Maine. This well will be one of six bedrock wells chosen to provide a network of permanent, long-term ground-water-quality sites in cooperation with the Maine Geological Survey. Samples were analyzed at the Geological Survey laboratory in Lakewood, Colorado for major ions, nutrients and arsenic.

Water samples were collected from domestic bedrock wells and public-supply gravel-packed wells as part of the NAWQA program. Only one sample was collected from each well. These samples were analyzed for major ions, nutrients, trace elements, radon gas, radionuclides, 48 pesticide compounds, and 86 volatile organic compounds (VOCs).

### Classification of records

Classification of ground-water quality records are arranged as described in "Records of Surface-Water Quality", located on page 15.

### Arrangement of Records

Water-quality records collected at a ground-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a ground-water daily record station is not available or where the water quality differs significantly from that at the nearby ground-water station, the continuing water-quality record is published with its own station number and name in the regular county order sequence. Water-quality data for special study sampling sites appear in separate tables following the continuous ground water records.

### On-Site Measurements and Sample Collection

NAWQA sampling protocols were followed to obtain and evaluate accurate water-quality data (Koterba and others, 1995)[1]. At the new bedrock well in Poland samples were analyzed locally (in the field) for alkalinity, specific conductance, dissolved oxygen, pH, and temperature. A submersible pump was used to collect the samples.

1. Koterba, M.T., Wilde, F.D., and Lapham, W.W., 1995, Ground-water data-collection protocols and procedures for the National Water-Quality Assessment Program-Collection and documentation of water quality samples and related data: U.S. Geological Survey Open-File Report 95-399, 113 p.

The NAWQA program collected untreated water samples from domestic bedrock wells using a sample line connected to the faucet that is at the base of the pressure tank from inside the home. Untreated water samples were collected from public-supply gravel-packed wells using a sample line connected to a faucet either at the well head (where available) or at a nearby pumphouse. Samples were analyzed locally (in the field) for alkalinity, specific conductance, dissolved oxygen, pH, temperature, ferrous iron, and sulfide.

### Laboratory Measurements

Samples were analyzed in the Geological Survey laboratory in Lakewood, Colorado. Methods used by the U.S. Geological Survey laboratory are given in Fishman, M.J., 1993, Methods of analysis by the U. S. Geological Survey National Water Quality Laboratory--Determination of inorganic and organic constituents in water and fluvial sediments: U.S. Geological Survey Open-File Report 93-125.

### Analyses of pesticides in ground-water samples (schedule 2001)

Selected ground-water samples from the New England Coastal Basins National Water-Quality Assessment Program (NECB NAWQA) were analyzed for pesticides on schedule 2001 during the 2001 water year. This table lists the pesticides on the schedule, the unit of measure (micrograms per liter, µg/L), the U.S. Geological Survey National Water Information System parameter code, the Union of Pure and Applied Chemistry (IUPAC) compound name, and the reporting level. Only pesticides measured at or above the minimum reporting level for one or more samples are listed in the water-quality tables.

SCHEDULE DESCRIPTION.--Pesticides in filtered water extracted on C-18 Solid Phase Extraction (SPE) cartridge and analyzed by Gas Chromatography/Mass Spectrometry (GC/MS).

SAMPLE REQUIREMENTS.--1 liter of water filtered through 0.7-micron glass-fiber depth filter, chilled at 4° C (packed in ice).

CONTAINER REQUIREMENTS.--1 liter baked amber glass bottle (GCC) from NWQL.

PCODE.--The EPA/USGS parameter code.

COMPOUND NAME.--IUPAC nomenclature.

COMMON NAME.--Common or trade name(s) for constituent

LRL.--Laboratory reporting level.

| PCode | Compound name (Common name) | LRL (µg/L) |
|---|---|---|
| 82660 | 2,6-Diethylaniline | 0.002 |
| 49260 | Acetochlor (Harness Plus, Surpass) | 0.004 |
| 46342 | Alachlor (Lasso, Bullet) | 0.002 |
| 39632 | Atrazine (Atrex, Atred) | 0.007 |
| 04040 | Atrazine, Deethyl- (Metabolite of Atrazine) | 0.006 |
| 82686 | Azinphos, Methyl- (Guthion, Gusathion) | 0.050 |
| 82673 | Benfluralin (Benefin, Balan) | 0.010 |
| 04028 | Butylate (Genate Plus, Suntan+) | 0.002 |
| 82680 | Carbaryl (Sevin, Denapan) | 0.041 |

| PCode | Compound name (Common name) | LRL (µg/L) |
|---|---|---|
| 82674 | Carbofuran (Furandan, Curaterr) | 0.020 |
| 38933 | Chlorpyrifos (Brodan, Dursban) | 0.005 |
| 04041 | Cyanazine (Bledex, Fortrol) | 0.018 |
| 82682 | DCPA (Dacthal, Chlorthal-dimethyl) | 0.003 |
| 34653 | DDE, p,p′ | 0.003 |
| 39572 | Diazinon (Basudin, Diazatol) | 0.005 |
| 39381 | Dieldrin (Panoram D-31, Octalox) | 0.005 |
| 82660 | Diethylanaline (Metabolite of Alachlor) | 0.002 |
| 82677 | Disulfoton (Disyston, Frumin AL) | 0.021 |
| 82668 | EPTC (Eptam, Farmarox) | 0.002 |
| 82663 | Ethalfluralin (Sonalan, Curbit) | 0.009 |
| 82672 | Ethoprop (Mocap, Ethoprophos) | 0.005 |
| 04095 | Fonofos (Dyfonate, Capfos) | 0.003 |
| 34253 | HCH,alpha- (alpha-BHC, alpha-lindane) | 0.005 |
| 39341 | HCH,gamma- (Lindane, gamma-BHC) | 0.004 |
| 82666 | Linuron (Lorex, Linex) | 0.035 |
| 39532 | Malathion | 0.027 |
| 39415 | Metolachlor (Dual, Pennant) | 0.013 |
| 82630 | Metribuzin (Lexon, Sencor) | 0.006 |
| 82671 | Molinate (Ordram) | 0.002 |
| 82684 | Napropamide (Devrinol) | 0.007 |
| 39542 | Parathion, Ethyl- (Roethyl-P, Alkron) | 0.007 |
| 82667 | Parathion, Methyl- (Penncap-M) | 0.006 |
| 82669 | Pebulate (Tillam, PEBL) | 0.002 |
| 82683 | Pendimethalin (Prowl, Stomp, Pre-M) | 0.010 |
| 82687 | Permethrin,cis- (Ambush, Astro) | 0.006 |
| 82664 | Phorate (Thimet, Granutox) | 0.011 |
| 04037 | Prometon (Pramitol, Princep) | 0.015 |
| 82676 | Pronamide (Kerb) (Propyzamid) | 0.004 |
| 04024 | Propachlor (Ramrod, Satecid) | 0.010 |
| 82679 | Propanil (Stampede, Stam) | 0.011 |
| 82685 | Propargite (Omite, Alkyl sulfite) | 0.023 |
| 04035 | Simazine (Princep, Caliber 91) | 0.011 |
| 82670 | Tebuthiuron (Spike, Tebusan) | 0.016 |
| 82665 | Terbacil (Sinbar) | 0.034 |
| 82675 | Terbufos (Counter, Contraven) | 0.017 |
| 82681 | Thiobencarb (Bolero, Saturn) | 0.005 |
| 82678 | Triallate (Avadex BW, Far-Go) | 0.002 |
| 82661 | Trifluralin (Treflan, Gowan) | 0.009 |

## Analyses of volatile organic compounds in ground-water samples (schedule 2020/2021)

Selected ground-water samples from the NECB NAWQA study were analyzed for volatile organic compounds (VOCs) in 2001. The National Water Quality Lab (NWQL) created a method for accurate determination of VOCs in water in the nanogram per liter range, schedules 2020/2021. This method is described in USGS Open-File Report 97-829 (Connor and others, 1998)[1]. Minor improvements to instrument operating conditions include the following: additional compounds, quantitation ions that are different from those recommended in USEPA Method 524.2 because of interferences from the additional compounds, and a data reporting strategy for measuring detected compounds extrapolated at less than the lowest calibration standard or measured at less than the reporting limit.

This table lists the volatile organic compounds on the schedule, the unit of measure (micrograms per liter (µg/L), the U.S. Geological Survey National Water Information System parameter code, the Union of Pure and Applied Chemistry (IUPAC) compound name, and the National Water Quality Laboratory compound name. Positive detections measured at less than LRL are reported as estimated concentrations (E) to alert the data user to decreased confidence in accurate quantitation. Values for analytes in the 2020/2021 schedules are preceded by an “E” in the following situations:

1. When the calculated concentration is less than the lowest calibration standard. The analyte meets all identification criteria to be positively identified, but the amount detected is below where it can be reliably quantified.

2. If a sample is diluted for any reason. The method reporting level is multiplied by the dilution factor to obtain the adjusted method reporting level. Values below the lowest calibration standard, multiplied by the dilution factor are qualified with an “E”. For example, a value of 0.19 in a 1:2 dilution is reported as E0.1.

3. If the set spike has recoveries out of the specified range (60-140 percent).

4. If the analyte is also detected in the set blank. If the value in the sample is less than five times the blank value and greater than the blank value plus the long term method detection limit, the value is preceded by an “E” to indicate that the analyte is positively identified but not positively quantified because the analyte was also detected in the blank.

SCHEDULE DESCRIPTION.--The sample water is actively purged with helium to extract the volatile organic compounds. The volatile compounds are trapped onto a sorbent trap, thermally desorbed, separated by a megabore gas chromatographic capillary column, and finally determined by a full scan quadropole mass spectrometer. Compound identification is confirmed by the gas chromatographic retention time and by the resultant mass spectrum, typically identified by three unique ions.

SAMPLE REQUIREMENTS.--Water collected in vials placed in stainless steel VOC sampler. Hydrochloric acid is used for preservation. Chilled at 4°C (packed in ice).

CONTAINER REQUIREMENTS.--
40 milliliter baked amber septum glass vial, from OCALA Quality Water Service Unit.

PCODE.--The EPA/USGS parameter code

COMPOUND NAME.--IUPAC nomenclature

COMMON NAME.--NWQL nomenclature

LRL.--Laboratory Reporting Level

1. Connor, B.F., Rose, D.L.,Noriega, M.C., Murtagh, L.K., and Abney, S.R., 1998, Methods of analysis by the U.S. Geological Survey National Water Quality Laboratory--Determination of 86 volatile organic compounds in water by gas chromatograph/mass spectrometry, including detections less than reporting limits: U.S. Geological Survey Open-File Report 97-829, 78 p.

| PCode | Compound name | Common name | LRL (µg/L) |
|---|---|---|---|
| 77353 | (1,1-Dimethylethyl) benzene | *tert*-butylbenzene | 0.06 |
| 77223 | (1-Methylethyl) benzene | Isopropylbenzene | 0.032 |
| 77350 | (1-Methylpropyl) benzene | *sec*-butylbenzene | 0.032 |
| 34396 | 1,1,1,2,2,2-Hexachloro-ethane | Hexachloroethane | 0.19 |
| 77562 | 1,1,1,2-Tetrachloroet-hane | 1,1,2-tetrachloroethane | 0.03 |
| 34506 | 1,1,1-Trichloroethane | 1,1,1-trichloroethane | 0.032 |
| 34516 | 1,1,2,2-Tetrachloroet-hane | 1,1,2,2-tetrachloroethane | 0.09 |
| 77652 | 1,1,2-Trichloro-1,2,2-trifluoroethane | Freon-113 | 0.06 |
| 34511 | 1,1,2-Trichloroethane | 1,1,2-trichloroethane | 0.06 |
| 34496 | 1,1-Dichloroethane | 1,1-dichloroethane | 0.035 |
| 34501 | 1,1-Dichloroethene | 1,1-dichloroethene | 0.04 |
| 77168 | 1,1-Dichloropropene | 1,1-dichloropropene | 0.026 |
| 49999 | 1,2,3,4-Tetramethylben-zene | Preh-nitene | 0.23 |
| 50000 | 1,2,3,5-Tetramethylben-zene | Isodurence | 0.20 |
| 77613 | 1,2,3-Trichlorobenzene | 1,2,3-trichlorobenzene | 0.27 |
| 77443 | 1,2,3-Trichloropropane | 1,2,3-trichloropropane | 0.16 |
| 77221 | 1,2,3-Trimethylbenzene | 1,2,3-trimethylbenzene | 0.12 |
| 34551 | 1,2,4-Trichlorobenzene | 1,2,4-trichlorobenzene | 0.19 |
| 77222 | 1,2,4-Trimethylbenzene | 1,2,4-trimethylbenzene | 0.056 |
| 82625 | 1,2-Dibromo-3-chloro-propane | 1,2-dibromo-3-chloropro-pane (DBCP) | 0.21 |
| 77651 | 1,2-Dibromoethane | 1,2-dibromoethane | 0.036 |
| 34536 | 1,2-Dichlorobenzene | 1,2-dichlorobenzene | 0.031 |
| 32103 | 1,2-Dichloroethane | 1,2-dichloroethane | 0.13 |
| 34541 | 1,2-Dichloropropane | 1,2-dichloropropane | 0.028 |
| 77135 | 1,2-Dimethylbenzene | o-xylene | 0.038 |
| 85795 | 1,3 & 1,4-Dimethylben-zene | m & p-xylene | 0.06 |
| 77226 | 1,3,5-Trimethylbenzene | 1,3,5-trimethylbenzene | 0.044 |
| 34566 | 1,3-Dichlorobenzene | 1,3-dichlorobenzene | 0.030 |
| 77173 | 1,3-Dichloropropane | 1,3-dichloropropane | 0.12 |
| 34571 | 1,4-Dichlorobenzene | 1,4-dichlorobenzene | 0.05 |
| 77275 | 1-Chloro-2-methylben-zene | 2-chlorotoluene | 0.026 |
| 77277 | 1-Chloro-4-methylben-zene | 4-chlorotoluene | 0.06 |
| 77356 | 1-Isopropyl-4-methyl-benzene | p-Isopropyltoluene | 0.07 |
| 77170 | 2,2-Dichloropropane | 2,2-dichloropropane | 0.05 |
| 81595 | 2-Butanone | Methyl-ethyl ketone | 1.60 |
| 77220 | 2-Ethyltoluene | 2-ethyl toluene | 0.06 |
| 77103 | 2-Hexanone | 2-hexanone | 0.70 |
| 34215 | Acrylonitrile | 2-Propenenitrile | 1.20 |
| 78109 | 3-Chloro-1-propene | 3-chloro-1-propene | 0.07 |
| 78133 | 4-Methyl-2-pentanone | Methyl isobutyl ketone | 0.37 |
| 81552 | Acetone | Acetone | 7.00 |
| 34030 | Benzene | Benzene | 0.035 |
| 81555 | Bromobenzene | Bromobenzene | 0.036 |
| 77297 | Bromochloromethane | Bromochloromethane | 0.044 |
| 32101 | Bromodichloromethane | Bromodichloromethane | 0.048 |
| 50002 | Bromoethene | Vinyl Bromide | 0.10 |
| 34413 | Bromomethane | Methyl bromide | 0.26 |
| 77041 | Carbon disulfide | Carbon Disulfide | 0.07 |
| 34301 | Chlorobenzene | Chlorobenzene | 0.028 |
| 34311 | Chloroethane | Chloroethane | 0.12 |
| 39175 | Chloroethene | Vinyl Chloride | 0.11 |
| 34418 | Chloromethane | Methyl chloride | 0.25 |
| 77093 | cis-1,2-Dichloroethene | cis-1,2-dichloroethene | 0.038 |
| 34704 | cis-1,3-Dichloropro-pene | cis-1,3-dichloropropene | 0.09 |
| 32105 | Dibromochloromethane | Dibromochloromethane | 0.18 |
| 30217 | Dibromomethane | Dibromomethane | 0.05 |
| 34668 | Dichlorodifluo-romethane | Dichlorodifluoromethane | 0.27 |
| 34423 | Dichloromethane | Methylene Chloride | 0.16 |
| 81576 | Diethyl ether | Diethyl ether | 0.17 |
| 81577 | Di isopropyl | Ether | 0.10 |
| 77128 | Ethenylbenzene | Styrene | 0.042 |
| 73570 | Ethyl methacrylate | Ethyl Methacrylate | 0.18 |
| 50004 | Ethyl tert-butyl ether | Ethyl-t-butyl ether (ETBE) | 0.054 |
| 34371 | Ethylbenzene | Ethylbenzene | 0.03 |
| 39702 | Hexachlorobutadiene | Hexachlorobutadiene | 0.14 |
| 77424 | Iodomethane | Methyl iodide | 0.12 |
| 49991 | Methyl acrylate | Methyl Acrylate | 1.40 |
| 81593 | Methyl acrylonitrile | Methyl Acrylonitrile | 0.60 |
| 81597 | Methyl methacrylate | Methyl Methacrylate | 0.35 |
| 78032 | Methyl tert-butyl ether | Methyl-t-butyl ether (MTBE) | 0.17 |
| 34010 | Methylbenzene | Toluene | 0.05 |
| 77342 | n-Butylbenzene | n-butylbenzene | 0.19 |
| 77224 | n-Propylbenzene | n-propylbenzene | 0.042 |
| 34696 | Naphthalene | Naphthalene | 0.25 |
| 50005 | tert-Amyl methyl ether | tert-amyl methyl ether (TAME) | 0.11 |
| 34475 | Tetrachloroethene | Tetrachloroethene | 0.10 |
| 32102 | Tetrachloromethane | Carbon tetrachloride | 0.06 |
| 81607 | Tetrahydrofuran | Tetrahydrofuran | 2.20 |
| 34546 | trans-1,2-Dichloroet-hene | trans-1,2-dichloroethene | 0.032 |
| 34699 | trans-1,3-Dichloropro-pene | trans-1,3-dichloropro-pene | 0.09 |
| 73547 | trans-1,4-Dichloro-2-butene | trans-1,4-dichloro-2-butene | 0.70 |
| 32104 | Tribromomethane | Bromoform | 0.06 |
| 39180 | Trichloroethene | Trichloroethene | 0.038 |
| 34488 | Trichlorofluoromethane | Trichlorofluoromethane | 0.09 |
| 32106 | Trichloromethane | Chloroform | 0.024 |

## Data Presentation

The ground-water-quality records for special study sampling sites are published in separate tables following the continuous ground water records.

### Remark Codes

The following remark codes may appear with the water-quality data in this report:

| *PRINTED OUTPUT* | *REMARK* |
|---|---|
| *E* | *Estimated value.* |
| > | *Actual value is known to be greater than the value shown.* |
| < | *Actual value is known to be less than the value shown.* |
| *M* | *Presence verified, not quantified* |

## Records of Precipitation Quantity

Only precipitation data which is collected as part of long-term monitoring projects are given in this report. These data are intended or use in flood forecasting or other streamflow modeling applications. Locations of the precipitation quantity stations included in this report are shown in figure 3.

### Data Collection and Computation

Precipitation data in this report is collected using one of two methods. A weighing bucket collector measures precipitation by recording the weight of accumulated precipitation in a container. The precipitation total for each day is simply the difference in recorded values from the beginning to the end of the day. During winter months the collector is charged with an antifreeze solution to melt incoming snow or ice. Precipitation data from weighing bucket gages is reported to the nearest 0.1 in. Alternately, a tipping-bucket collector measures precipitation through the use of two equal-sized chambers which alternately fill and drain. As each chamber fills, it tips, simultaneously draining it, bringing the second bucket under the collector and recording a known amount of precipitation, usually 0.01 in. The precipitation total for each day is computed by summing the number of tips during the day. During winter months a heater is used to melt incoming snow or ice. Precipitation data from tipping- bucket gages is reported to the nearest 0.01 in.

Several factors can affect the precipitation recorded at a site, including the elevation of the collector above the land surface, the presence of vegetation, buildings or other barriers near the collector, or the use of a wind shield around the collector.

### Data Presentation

Each precipitation record consists of two parts: The station description and a data table of daily precipitation observed during the water year. The description of the station is presented first, through use of descriptive headings, preceding the tabular data. The comments to follow clarify information presented under the various headings.

LOCATION.--Information on locations is obtained from the most accurate maps available. The location of the gage with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given.

PERIOD OF RECORD.--This entry indicates the period for which there are published records for the station. It reports the month and year of the start of publication by the U.S. Geological Survey and the words “to current year” if the records are to be continued into the following year.

INSTRUMENTATION.--This paragraph provides information on the type of instrumentation used at the station, including its height above land surface and elevation above National Geodetic Vertical Datum of 1929 (NGVD of 1929); it is reported with a precision dependent on the method of determination.

REMARKS.--This entry describes any ancillary information about the station, including any real-time data telemetry capability.

A table of precipitation totals follows the station description for each station. Precipitation totals for each day are reported in inches of water. The total precipitation for each month is shown on a line below the daily-sum table. Missing records are indicated by dashes in place of the precipitation total.

## Records of Snow Quantity

Only snow data which is collected as part of long-term monitoring projects are given in this report. These data are intended or use in flood forecasting or other streamflow modeling applications. Locations of the snow sampling stations included in this report are shown in figure 4.

### Data Collection and Computation

Snow data were collected with snow tubes with graduations on the outside to measure the total depth of the snowpack. The inside diameter of the tube is such that one ounce of core in the tube equals one inch of water equivalent. At each sample point, the snow tube is used to record the total depth, and a core sample is removed and weighed to determine the water content.

At each snow course the reported values are the average of ten readings of snow depth and ten readings of water equivalent. Methods used are described in the Snow Survey Sampling Guide, Agriculture Handbook number 169, published by the U.S. Department of Agriculture.

### Data Presentation

Snow depth and water content records for snow sampling sites are published in inches for each sample date, in separate tables following the precipitation quantity records.

## ACCESS TO USGS WATER DATA

The USGS provides near real-time stage and discharge data for many of the gaging stations equipped with the necessary telemetry and historic daily-mean and peak-flow discharge data for most current or discontinued gaging stations on the internet. These data may be accessed at

http://me.water.usgs.gov

Some water-quality and ground-water data also are available through the internet. In addition, data can be provided in various machine-readable formats on magnetic tape or 3-1/2 inch floppy disk. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each of the Water Resources Division District Offices (See address on the back of the title page.)

## DEFINITION OF TERMS

Specialized technical terms related to streamflow, water-quality, and other hydrologic data, as used in this report, are defined below. Terms such as algae, water level, precipitation are used in their common everyday meanings, definitions of which are given in standard dictionaries. Not all terms defined in this alphabetical list apply to every State. See also table for converting English units to International System (SI) Units on the inside of the back cover.

**Acid neutralizing capacity** (ANC) is the equivalent sum of all bases or base-producing materials, solutes plus particulates, in an aqueous system that can be titrated with acid to an equivalence point. This term designates titration of an "unfiltered" sample (formerly reported as alkalinity).

**Acre-foot** (AC-FT, acre-ft) is a unit of volume, commonly used to measure quantities of water used or stored, equivalent to the volume of water required to cover 1 acre to a depth of 1 foot and equivalent to 43,560 cubic feet, 325,851 gallons, or 1,233 cubic meters. (See also "Annual runoff")

**Adenosine triphosphate** (ATP) is an organic, phosphate-rich, compound important in the transfer of energy in organisms. Its central role in living cells makes ATP an excellent indicator of the presence of living material in water. A measurement of ATP therefore provides a sensitive and rapid estimate of biomass. ATP is reported in micrograms per liter.

**Algal growth potential** (AGP) is the maximum algal dry weight biomass that can be produced in a natural water sample under standardized laboratory conditions. The growth potential is the algal biomass present at stationary phase and is expressed as milligrams dry weight of algae produced per liter of sample.

**Alkalinity** is the capacity of solutes in an aqueous system to neutralize acid. This term designates titration of a "filtered" sample.

**Annual runoff** is the total quantity of water that is discharged ("runs off") from a drainage basin in a year. Data reports may present annual runoff data as volumes in acre-feet, as discharges per unit of drainage area in cubic feet per second per square mile, or as depths of water on the drainage basin in inches.

**Annual 7-day minimum** is the lowest mean value for any 7-consecutive-day period in a year. Annual 7-day minimum values are reported herein for the calendar year and the water year (October 1 to September 30). Most low-flow frequency analyses use a climatic year (April 1-March 31), which tends to prevent the low-flow period from being artificially split between adjacent years. The date shown in the summary statistics table is the initial date of the 7-day period. (This value should not be confused with the 7-day 10-year low-flow statistic.)

**Aroclor** is the registered trademark for a group of polychlorinated biphenyls that were manufactured by the Monsanto Company prior to 1976. Aroclors are assigned specific 4-digit reference numbers dependent upon molecular type and degree of substitution of the biphenyl ring hydrogen atoms by chlorine atoms. The first two digits of a numbered aroclor represent the molecular type and the last two digits represent the weight percent of the hydrogen substituted chlorine.

**Artificial substrate** is a device that is purposely placed in a stream or lake for colonization of organisms. The artificial substrate simplifies the community structure by standardizing the substrate from which each sample is taken. Examples of artificial substrates are basket samplers (made of wire cages filled with clean streamside rocks) and multiplate samplers (made of hardboard) for benthic organism collection, and plexiglass strips for periphyton collection. (See also "Substrate")

**Ash mass** is the mass or amount of residue present after the residue from the dry mass determination has been ashed in a muffle furnace at a temperature of 500 °C for 1 hour. Ash mass of zooplankton and phytoplankton is expressed in grams per cubic meter ($g/m^3$), and periphyton and benthic organisms in grams per square meter ($g/m^2$). (See also "Biomass")

**Bacteria** are microscopic unicellular organisims, typically spherical, rodlike, or spiral and threadlike in shape, often clumped into colonies. Some bacteria cause disease, while others perform an essential role in nature in the recycling of materials; for example, by decomposing organic matter into a form available for reuse by plants.

**Base discharge (for peak discharge)** is a discharge value, determined for selected stations, above which peak discharge data are published. The base discharge at each station is selected so that an average of about three peaks per year will be published.

**Base flow** is sustained flow of a stream in the absence of direct runoff. It includes natural and human-induced streamflows. Natural base flow is sustained largely by ground-water discharge.

**Bedload** is material in transport that is supported primarily by the streambed. In this report, bedload is considered to consist of particles in transit from the bed to an elevation equal to the top of the bedload sampler nozzle (ranging from 0.25 to 0.5 ft) that are retained in the bedload sampler. A sample collected with a pressure-differential bedload sampler may also contain a component of the suspended load.

**Bedload discharge** (tons per day) is rate of sediment moving as bedload, reported as dry weight, that passes through a cross section in a given time. NOTE: Bedload discharge values in this report may include a component of the suspended-sediment discharge. A correction may be necessary when computing the total sediment discharge by summing

the bedload discharge and the suspended-sediment discharge. (See also “Bedload” and “Sediment”)

**Bed material** is the sediment mixture of which a streambed, lake, pond, reservoir, or estuary bottom is composed. (See also “Bedload” and “Sediment”)

**Benthic organisms** are the group of organisms inhabiting the bottom of an aquatic environment. They include a number of types of organisms, such as bacteria, fungi, insect larvae and nymphs, snails, clams, and crayfish. They are useful as indicators of water quality.

**Biochemical oxygen demand** (BOD) is a measure of the quantity of dissolved oxygen, in milligrams per liter, necessary for the decomposition of organic matter by microorganisms, such as bacteria.

**Biomass** is the amount of living matter present at any given time, expressed as mass per unit area or volume of habitat.

**Biomass pigment ratio** is an indicator of the total proportion of periphyton which are autotrophic (plants). This is also called the Autotrophic Index.

**Blue-green algae** (*Cyanophyta*) are a group of phytoplankton organisms having a blue pigment, in addition to the green pigment called chlorophyll. Blue-green algae often cause nuisance conditions in water. Concentrations are expressed as a number of cells per milliliter (cells / mL) of sample. (See also “Phytoplankton”)

**Bottom material (**See “Bed material”)

**Cells/volume** refers to the number of cells of any organism that is counted by using a microscope and grid or counting cell. Many planktonic organisms are multicelled and are counted according to the number of contained cells per sample volume, and are generally reported as cells or units per milliliter (mL) or liter (L).

**Cells volume** (biovolume) determination is one of several common methods used to estimate biomass of algae in aquatic systems. Cell members of algae are frequently used in aquatic surveys as an indicator of algal production. However, cell numbers alone cannot represent true biomass because of considerable cell-size variation among the algal species. Cell volume ($mm^3$) is determined by obtaining critical cell measurements on cell dimensions (for example, length, width, height, or radius) for 20 to 50 cells of each important species to obtain an average biovolume per cell. Cells are categorized according to the correspondence of their cellular shape to the nearest geometric solid or combinations of simple solids (for example, spheres, cones, or cylinders). Representative formulae used to compute biovolume are as follows:

$$\text{sphere } 4/3\ pr^3 \quad \text{cone } 1/3\ pr^3h \quad \text{cylinder } pr^3h.$$

pi is the ratio of the circumference to the diameter of a circle; pi = 3.14159…

From cell volume, total algal biomass expressed as biovolume ($mm^3$ / mL) is thus determined by multiplying the number of cells of a given species by its average cell volume and then summing these volumes over all species.

**Cfs-day** (See “Cubic foot per second-day”)

**Chemical oxygen demand** (COD) is a measure of the chemically oxidizable material in the water and furnishes an approximation of the amount of organic and reducing material present. The determined value may correlate with BOD or with carbonaceous organic pollution from sewage or industrial wastes. [See also “Biochemical oxygen demand (BOD)”]

***Clostridium perfringens*** *(C. perfringens)* is a spore-forming bacterium that is common in the feces of human and other warm-blooded animals. Clostridial spores are being used experimentally as an indicator of past fecal contamination and presence of microorganisms that are resistant to disinfection and environmental stresses. (See also “Bacteria”)

**Coliphages** are viruses that infect and replicate in coliform bacteria. They are indicative of sewage contamination of waters and of the survival and transport of viruses in the environment.

**Color unit** is produced by 1 milligram per liter of platinum in the form of the chloroplatinate ion. Color is expressed in units of the platinum-cobalt scale.

**Confined aquifer** is a term used to describe an aquifer containing water between two relatively impermeable boundaries. The water level in a well tapping a confined aquifer stands above the top of the confined aquifer and can be higher or lower than the water table that may be present in the material above it. In some cases, the water level can rise above the ground surface, yielding a flowing well. (See also “Aquifer”)

**Contents** is the volume of water in a reservoir or lake. Unless otherwise indicated, volume is computed on the basis of a level pool and does not include bank storage.

**Continuous-record station** is a site where data are collected with sufficient frequency to define daily mean values and variations within a day.

**Control** designates a feature in the channel downstream from a gaging station that physically influences the water-surface elevation and thereby determines the stage-discharge relation at the gage. This feature may be a constriction of the channel, a bedrock outcrop, a gravel bar, an artificial structure, or a uniform cross section over a long reach of the channel.

**Control structure** as used in this report is a structure on a stream or canal that is used to regulate the flow or stage of the stream or to prevent the intrusion of saltwater.

**Cubic foot per second** (CFS, $ft^3$ / s) is the rate of discharge representing a volume of 1 cubic foot passing a given point in 1 second. It is equivalent to approximately 7.48 gallons per second or approximately 449 gallons per minute, or 0.02832 cubic meters per second. The term “second-feet” sometimes is used synonymously with “cubic feet per second” but is now obsolete.

**Cubic foot per second-day** (CFS-DAY, Cfs-day, [($ft^3$ / s) / d]) is the volume of water represented by a flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet,

1.98347 acre-feet, 646,317 gallons, or 2,446.6 cubic meters. The daily-mean discharges reported in the daily-value data tables are numerically equal to the daily volumes in cfs-days, and the totals also represent volumes in cfs-days.

**Cubic foot per second per square mile** [CFSM, $(ft^3/s)/mi^2$] is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming the runoff is distributed uniformly in time and area. (See also "Annual runoff")

**Daily mean suspended-sediment concentration** is the time-weighted concentration of suspended sediment passing a stream cross section during a 24-hour day. (See also "Daily mean suspended-sediment concentration," "Sediment," and "Suspended-sediment concentration")

**Daily-record station** is a site where data are collected with sufficient frequency to develop a record of one or more data values per day. The frequency of data collection can range from continuous recording to periodic sample or data collection on a daily or near-daily basis.

**Data Collection Platform** (DCP) is an electronic instrument that collects, processes, and stores data from various sensors, and transmits the data by satellite data relay, line-of-sight radio, and/or landline telemetry.

**Data logger** is a microprocessor-based data acquisition system designed specifically to acquire, process, and store data. Data are usually downloaded from onsite data loggers for entry into office data systems.

**Datum** is a surface or point relative to which measurements of height and/or horizontal position are reported. A vertical datum is a horizontal surface used as the zero point for measurements of gage height, stage, or elevation; a horizontal datum is a reference for positions given in terms of latitude-longitude, State Plane coordinates, or UTM coordinates. (See also "Gage datum," "Land-surface datum," "National Geodetic Vertical Datum of 1929," and "North American Vertical Datum of 1988")

**Diatoms** are the unicellular or colonial algae having a siliceous shell. Their concentrations are expressed as number of cells per milliliter (cells/mL) of sample. (See also "Phytoplankton")

**Diel** is of or pertaining to a 24-hour period of time; a regular daily cycle.

**Discharge**, or flow, is the rate that matter passes through a cross section of a stream channel or other water body per unit of time. The term commonly refers to the volume of water (including, unless otherwise stated, any sediments or other constituents suspended or dissolved in the water) that passes a cross section in a stream channel, canal, pipeline, etc., within a given period of time (cubic feet per second). Discharge also can apply to the rate at which constituents such as suspended sediment, bedload, and dissolved or suspended chemical constituents, pass through a cross section, in which cases the quantity is expressed as the mass of constituent that passes the cross section in a given period of time (tons per day).

**Dissolved** refers to that material in a representative water sample that passes through a 0.45-micrometer membrane filter. This is a convenient operational definition used by Federal and State agencies that collect water-quality data. Determinations of "dissolved" constituent concentrations are made on sample water that has been filtered.

**Dissolved oxygen** (DO) is the molecular oxygen (oxygen gas) dissolved in water. The concentration in water is a function of atmospheric pressure, temperature, and dissolved-solids concentration of the water. The ability of water to retain oxygen decreases with increasing temperature or dissolved-solids concentration. Photosynthesis and respiration by plants commonly cause diurnal variations in dissolved-oxygen concentration in water from some streams.

**Dissolved-solids concentration** in water is the quantity of dissolved material in a sample of water. It is determined either analytically by the "residue-on-evaporation" method, or mathematically by totaling the concentrations of individual constituents reported in a comprehensive chemical analysis. During the analytical determination, the bicarbonate (generally a major dissolved component of water) is converted to carbonate. In the mathematical calculation, the bicarbonate value, in milligrams per liter, is multiplied by 0.4926 to convert it to carbonate. Alternatively, alkalinity concentration (as mg/L $CaCO_3$) can be converted to carbonate concentration by multiplying by 0.60.

**Diversity index** (H) (Shannon Index) is a numerical expression of evenness of distribution of aquatic organisms. The formula for diversity index is:

$$\bar{d} = -\sum_{i \approx 1}^{s} \frac{n_i}{n} \log_2 \frac{n_i}{n}$$

where $n_i$ is the number of individuals per taxon, $n$ is the total number of individuals, and $s$ is the total number of taxa in the sample of the community. Index values range from zero, when all the organisms in the sample are the same, to some positive number, when some or all of the organisms in the sample are different.

**Drainage area** of a stream at a specific location is that area upstream from the location, measured in a horizontal plane, that has a common outlet at the site for its surface runoff from precipitation that normally drains by gravity into a stream. Drainage areas given herein include all closed basins, or noncontributing areas, within the area unless otherwise specified.

**Drainage basin** is a part of the Earth's surface that contains a drainage system with a common outlet for its surface runoff. (See "Drainage area")

**Dry mass** refers to the mass of residue present after drying in an oven at 105 °C, until the mass remains unchanged. This mass represents the total organic matter, ash and sediment, in the sample. Dry-mass values are expressed in the same units as ash mass. (See also "Ash mass," "Biomass," and "Wet mass")

**Dry weight** refers to the weight of animal tissue after it has been dried in an oven at 65 ˚C until a constant weight is achieved. Dry weight represents total organic and inorganic matter in the tissue. (See also "Wet weight")

**Enterococcus bacteria** are commonly found in the feces of humans and other warm-blooded animals. Although some strains are ubiquitous and not related to fecal pollution, the presence of enterococci in water is an indication of fecal pollution and the possible presence of enteric pathogens. Enterococcus bacteria are those bacteria that produce pink to red colonies with black or reddish-brown precipitate after incubation at 41 °C on mE agar and subsequent transfer to EIA medium. Enterococci include *Streptococcus feacalis, Streptococcus feacium, Streptococcus avium,* and their variants. (See also "Bacteria")

**EPT Index** is the total number of distinct taxa within the insect orders Ephemeroptera, Plecoptera, and Trichoptera. This index summarizes the taxa richness within the aquatic insects that are generally considered pollution sensitive, the index usually decreases with pollution.

***Escherichia coli (E. coli)*** are bacteria present in the intestine and feces of warm-blooded animals. *E. coli* are a member species of the fecal coliform group of indicator bacteria. In the laboratory, they are defined as those bacteria that produce yellow or yellow-brown colonies on a filter pad saturated with urea substrate broth after primary culturing for 22 to 24 hours at 44.5 ˚C on mTEC medium. Their concentrations are expressed as number of colonies per 100 mL of sample. (See also "Bacteria")

**Estimated (E) value** of a concentration is reported when an analyte is detected and all criteria for a positive result are met. If the concentration is less than the method detection limit (MDL), an 'E' code will be reported with the value. If the analyte is qualitatively identified as present, but the quantitative determination is substantially more uncertain, the National Water Quality Laboratory will identify the result with an 'E' code even though the measured value is greater than the MDL. A value reported with an 'E' code should be used with caution. When no analyte is detected in a sample, the default reporting value is the MDL preceded by a less than sign (<).

**Euglenoids** (*Euglenophyta*) are a group of algae that are usually free-swimming and rarely creeping. They have the ability to grow either photosynthetically in the light or heterotrophically in the dark. (See also "Phytoplankton")

**Extractable organic halides** (EOX) are organic compounds that contain halogen atoms such as chlorine. These organic compounds are semi-volatile and extractable by ethyl acetate from air-dried streambed sediments. The ethyl acetate extract is combusted, and the concentration is determined by microcoulometric determination of the halides formed. The concentration is reported as micrograms of chlorine per gram of the dry weight of the streambed sediments.

**Fecal coliform bacteria** are present in the intestine or feces of warm-blooded animals. They are often used as indicators of the sanitary quality of the water. In the laboratory, they are defined as all organisms that produce blue colonies within 24 hours when incubated at 44.5 °C plus or minus 0.2 °C on M-FC medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample. (See also "Bacteria")

**Fecal streptococcal bacteria** are present in the intestine of warm-blooded animals and are ubiquitous in the environment. They are characterized as gram-positive, cocci bacteria that are capable of growth in brain-heart infusion broth. In the laboratory, they are defined as all the organisms that produce red or pink colonies within 48 hours at 35 °C plus or minus 1.0 °C on KF-streptococcus medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample. (See also "Bacteria")

**Fire algae** (*Pyrrhophyta*) are free-swimming unicells characterized by a red pigment spot. (See also "Phytoplankton")

**Flow-duration percentiles** are values on a scale of 100 that indicate the percentage of time for which a flow is not exceeded. For example, the 90th percentile of river flow is greater than or equal to 90 percent of all recorded flow rates.

**Gage datum** is a horizontal surface used as a zero point for measurement of stage or gage height. This surface usually is located slightly below the lowest point of the stream bottom such that the gage height is usually slightly larger than the maximum depth of water. Because the gage datum itself is not an actual physical object, the datum usually is defined by specifying the elevations of permanent reference marks such as bridge abutments and survey monuments, and the gage is set to agree with the reference marks. Gage datum is a local datum that is maintained independently of any National geodetic datum. However, if the elevation of the gage datum relative to the National datum (North American Vertical Datum of 1988 or National Geodetic Vertical Datum of 1929) has been determined, then the gage readings can be converted to elevations above the National datum by adding the elevation of the gage datum to the gage reading.

**Gage height** (G.H.) is the water-surface elevation, in feet above the gage datum. If the water surface is below the gage datum, the gage height is negative. Gage height is often used interchangeably with the more general term "stage," although gage height is more appropriate when used in reference to a reading on a gage.

**Gage values** are values that are recorded, transmitted and / or computed from a gaging station. Gage values typically are collected at 5-, 15-, or 30-minute intervals.

**Gaging station** is a site on a stream, canal, lake, or reservoir where systematic observations of stage, discharge, or other hydrologic data are obtained. When used in connection with a discharge record, the term is applied only to those gaging stations where a continuous record of discharge is computed.

**Gas chromatography/flame ionization detector** (GC / FID) is a laboratory analytical method used as a screening technique for semivolatile organic compounds that are extractable from water in methylene chloride.

**Green algae** have chlorophyll pigments similar in color to those of higher green plants. Some forms produce algae mats or floating "moss" in lakes. Their concentrations are expressed as number of cells per milliliter (cells / mL) of sample. (See also "Phytoplankton")

**Habitat quality index** is the qualitative description (level 1) of instream habitat and riparian conditions surrounding the reach sampled. Scores range from 0 to 100 percent with higher scores indicative of desirable habitat conditions for aquatic life. Index only applicable to wadable streams.

**Hardness** of water is a physical-chemical characteristic that is commonly recognized by the increased quantity of soap required to produce lather. It is computed as the sum of equivalents of polyvalent cations (primarily calcium and magnesium) and is expressed as the equivalent concentration of calcium carbonate ($CaCO_3$).

**High tide** is the maximum height reached by each rising tide. The high-high and low-high tides are the higher and lower of the two high tides, respectively, of each tidal day. *See NOAA web site: http://www.co-ops.nos.noaa.gov/tideglos.html*

**Hilsenhoff's Biotic Index** (HBI) is an indicator of organic pollution which uses tolerance values to weight taxa abundances; usually increases with pollution. It is calculated as follows:

$$HBI = sum\frac{(n)(a)}{N}$$

where $n$ is the number of individuals of each taxon, a is the tolerance value of each taxon, and $N$ is the total number of organisms in the sample.

**Horizontal datum** (See "Datum")

**Hydrologic benchmark station** is one that provides hydrologic data for a basin in which the hydrologic regimen will likely be governed solely by natural conditions. Data collected at a benchmark station may be used to separate effects of natural from human-induced changes in other basins that have been developed and in which the physiography, climate, and geology are similar to those in the undeveloped benchmark basin.

**Hydrologic index stations** referred to in this report are four continuous-record gaging stations that have been selected as representative of streamflow patterns for their respective regions. Station locations are shown on index maps.

**Hydrologic unit** is a geographic area representing part or all of a surface drainage basin or distinct hydrologic feature as defined by the former Office of Water Data Coordination and delineated on the State Hydrologic Unit Maps by the USGS. Each hydrologic unit is identified by an 8-digit number.

**Inch** (IN., in.), as used in this report, refers to the depth to which the drainage area would be covered with water if all of the runoff for a given time period were uniformly distributed on it. (See also "Annual runoff")

**Instantaneous discharge** is the discharge at a particular instant of time. (See also "Discharge")

**Laboratory Reporting Level** (LRL) is generally equal to twice the yearly determined long-term method detection level (LT-MDL). The LRL controls false negative error. The probability of falsely reporting a non-detection for a sample that contained an analyte at a concentration equal to or greater than the LRL is predicted to be less than or equal to 1 percent. The value of the LRL will be reported with a "less than" (<) remark code for samples in which the analyte was not detected. The National Water Quality Laboratory collects quality-control data from selected analytical methods on a continuing basis to determine LT-MDLs and to establish LRLs. These values are reevaluated annually based on the most current quality-control data and may, therefore, change. [Note: In several previous NWQL documents (Connor and others, 1998; NWQL Technical Memorandum 98.07, 1998), the LRL was called the non-detection value or NDV—a term that is no longer used.)

**Land-surface datum** (lsd) is a datum plane that is approximately at land surface at each ground-water observation well.

**Light-attenuation coefficient,** also known as the extinction coefficient, is a measure of water clarity. Light is attenuated according to the Lambert-Beer equation

$$I = I_o e^{-\lambda L},$$

where $I_o$ is the source light intensity, $I$ is the light intensity at length $L$ (in meters) from the source, $\lambda$ is the light-attenuation coefficient, and $e$ is the base of the natural logarithm. The light attenuation coefficient is defined as

$$\lambda = -\frac{1}{L}\log_e\frac{I}{I_o} .$$

**Lipid** is any one of a family of compounds that are insoluble in water and that make up one of the principal components of living cells. Lipids include fats, oils, waxes, and steroids. Many environmental contaminants such as organochlorine pesticides are lipophilic.

**Long-Term Method Detection Level** (LT–MDL) is a detection level derived by determining the standard deviation of a minimum of 24 method detection limit (MDL) spike sample measurements over an extended period of time. LT–MDL data are collected on a continuous basis to assess year-to-year variations in the LT–MDL. The LT–MDL controls false positive error. The chance of falsely reporting a concentration at or greater than the LT–MDL for a sample that did not contain the analyte is predicted to be less than or equal to 1 percent.

**Low tide** is the minimum height reached by each falling tide. The high-low and low-low tides are the higher and lower of the two low tides, respectively, of each tidal day. *See NOAA web site: http://www.co-ops.nos.noaa.gov/tideglos.html*

**Macrophytes** are the macroscopic plants in the aquatic environment. The most common macrophytes are the rooted vascular plants that are usually arranged in zones in aquatic ecosystems and restricted in the area by the extent

of illumination through the water and sediment deposition along the shoreline.

**Mean concentration of suspended sediment** (Daily mean suspended-sediment concentration) is the time-weighted concentration of suspended sediment passing a stream cross section during a given time period. (See also "Daily mean suspended-sediment concentration" and "Suspended-sediment concentration")

**Mean discharge** (MEAN) is the arithmetic mean of individual daily mean discharges during a specific period. (See also "Discharge")

**Mean high or low tide** is the average of all high or low tides, respectively, over a specific period.

**Mean sea level** is a local tidal datum. It is the arithmetic mean of hourly heights observed over the National Tidal Datum Epoch. Shorter series are specified in the name; for example, monthly mean sea level and yearly mean sea level. In order that they may be recovered when needed, such datums are referenced to fixed points known as benchmarks. (See also "Datum")

**Measuring point** (MP) is an arbitrary permanent reference point from which the distance to water surface in a well is measured to obtain water level.

**Membrane filter** is a thin microporous material of specific pore size used to filter bacteria, algae, and other very small particles from water.

**Metamorphic stage** refers to the stage of development that an organism exhibits during its transformation from an immature form to an adult form. This developmental process exists for most insects, and the degree of difference from the immature stage to the adult form varies from relatively slight to pronounced, with many intermediates. Examples of metamorphic stages of insects are egg-larva-adult or egg-nymph-adult.

**Method Detection Limit** (MDL) is the minimum concentration of a substance that can be measured and reported with 99-percent confidence that the analyte concentration is greater than zero. It is determined from the analysis of a sample in a given matrix containing the analyte. At the MDL concentration, the risk of a false positive is predicted to be less than or equal to 1 percent.

**Methylene blue active substances** (MBAS) are apparent detergents. The determination depends on the formation of a blue color when methylene blue dye reacts with synthetic anionic detergent compounds.

**Micrograms per gram** (UG/G, µg/g) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the element per unit mass (gram) of material analyzed.

**Micrograms per kilogram** (UG/KG, µg/kg) is a unit expressing the concentration of a chemical constituent as the mass (micrograms) of the constituent per unit mass (kilogram) of the material analyzed. One microgram per kilogram is equivalent to 1 part per billion.

**Micrograms per liter** (UG/L, µg/L) is a unit expressing the concentration of chemical constituents in water as mass (micrograms) of constituent per unit volume (liter) of water. One thousand micrograms per liter is equivalent to 1 milligram per liter. One microgram per liter is equivalent to 1 part per billion.

**Microsiemens per centimeter** (US/CM, µS/cm) is a unit expressing the amount of electrical conductivity of a solution as measured between opposite faces of a centimeter cube of solution at a specified temperature. Siemens is the International System of Units nomenclature. It is synonymous with mhos and is the reciprocal of resistance in ohms.

**Milligrams per liter** (MG/L, mg/L) is a unit for expressing the concentration of chemical constituents in water as the mass (milligrams) of constituent per unit volume (liter) of water. Concentration of suspended sediment also is expressed in mg/L and is based on the mass of dry sediment per liter of water-sediment mixture.

**Minimum Reporting Level** (MRL) is the smallest measured concentration of a constituent that may be reliably reported by using a given analytical method (Timme, 1995).

**Miscellaneous site,** miscellaneous station, or miscellaneous sampling site is a site where streamflow, sediment, and/or water-quality data or water-quality or sediment samples are collected once, or more often on a random or discontinuous basis to provide better areal coverage for defining hydrologic and water-quality conditions over a broad area in a river basin.

**Most probable number** (MPN) is an index of the number of coliform bacteria that, more probably than any other number, would give the results shown by the laboratory examination; it is not an actual enumeration. MPN is determined from the distribution of gas-positive cultures among multiple inoculated tubes.

**Multiple-plate samplers** are artificial substrates of known surface area used for obtaining benthic invertebrate samples. They consist of a series of spaced, hardboard plates on an eyebolt.

**Nanograms per liter** (NG/L, ng/L) is a unit expressing the concentration of chemical constituents in solution as mass (nanograms) of solute per unit volume (liter) of water. One million nanograms per liter is equivalent to 1 milligram per liter.

**National Geodetic Vertical Datum of 1929** (NGVD of 1929) is a fixed reference adopted as a standard geodetic datum for elevations determined by leveling. It was formerly called "Sea Level Datum of 1929" or "mean sea level." Although the datum was derived from the mean sea level at 26 tide stations**,** it does not necessarily represent local mean sea level at any particular place. *See NOAA web site: http://www.ngs.noaa.gov/faq.shtml#WhatVD29VD88* (See "North American Vertical Datum of 1988")

**Natural substrate** refers to any naturally occurring immersed or submersed solid surface, such as a rock or tree, upon which an organism lives. (See also "Substrate.")

**Nekton** are the consumers in the aquatic environment and consist of large free-swimming organisms that are capable of sustained, directed mobility.

**Nephelometric turbidity unit** (NTU) is the measurement for reporting turbidity that is based on use of a standard suspension of Formazin. Turbidity measured in NTU uses nephelometric methods that depend on passing specific light of a specific wavelength through the sample.

**North American Vertical Datum of 1988 (NAVD 1988)** is a fixed reference adopted as the official civilian vertical datum for elevations determined by Federal surveying and mapping activities in the U.S. This datum was established in 1991 by minimum-constraint adjustment of the Canadian, Mexican, and U.S. first-order terrestrial leveling networks.

**Open or screened interval** is the length of unscreened opening or of well screen through which water enters a well, in feet below land surface.

**Organic carbon** (OC) is a measure of organic matter present in aqueous solution, suspension, or bottom sediments. May be reported as dissolved organic carbon (DOC), particulate organic carbon (POC), or total organic carbon (TOC).

**Organic mass** or volatile mass of the living substance is the difference between the dry mass and ash mass and represents the actual mass of the living matter. Organic mass is expressed in the same units as for ash mass and dry mass. (See also “Ash mass,” “Biomass,” and “Dry mass”)

**Organism count/area** refers to the number of organisms collected and enumerated in a sample and adjusted to the number per area habitat, usually square meter ($m^2$), acre, or hectare. Periphyton, benthic organisms, and macrophytes are expressed in these terms.

**Organism count/volume** refers to the number of organisms collected and enumerated in a sample and adjusted to the number per sample volume, usually milliliter (mL) or liter (L). Numbers of planktonic organisms can be expressed in these terms.

**Organochlorine compounds** are any chemicals that contain carbon and chlorine. Organochlorine compounds that are important in investigations of water, sediment, and biological quality include certain pesticides and industrial compounds.

**Parameter Code** is a 5-digit number used in the USGS computerized data system, National Water Information System (NWIS), to uniquely identify a specific constituent or property.

**Partial-record station** is a site where discrete measurements of one or more hydrologic parameters are obtained over a period of time without continuous data being recorded or computed. A common example is a crest-stage gage partial-record station at which only peak stages and flows are recorded.

**Particle size** is the diameter, in millimeters (mm), of a particle determined by sieve or sedimentation methods. The sedimentation method utilizes the principle of Stokes Law to calculate sediment particle sizes. Sedimentation methods (pipet, bottom-withdrawal tube, visual-accumulation tube, Sedigraph) determine fall diameter of particles in either distilled water (chemically dispersed) or in native water (the river water at the time and point of sampling).

**Particle-size classification**, as used in this report, agrees with the recommendation made by the American Geophysical Union Subcommittee on Sediment Terminology. The classification is as follows:

| Classification | Size (mm) | Method of analysis |
|---|---|---|
| Clay | 0.00024 - 0.004 | Sedimentation |
| Silt | 0.004 - 0.062 | Sedimentation |
| Sand | 0.062 - 2.0 | Sedimentation/sieve |
| Gravel | 2.0 - 64.0 | Sieve |

The particle-size distributions given in this report are not necessarily representative of all particles in transport in the stream. Most of the organic matter is removed, and the sample is subjected to mechanical and chemical dispersion before analysis in distilled water. Chemical dispersion is not used for native water analysis.

**Peak flow (peak stage)** is an instantaneous local maximum value in the continuous time series of streamflows or stages, preceded by a period of increasing values and followed by a period of decreasing values. Several peak values ordinarily occur in a year. The maximum peak value in a year is called the annual peak; peaks lower than the annual peak are called secondary peaks. Occasionally, the annual peak may not be the maximum value for the year; in such cases, the maximum value occurs at midnight at the beginning or end of the year, on the recession from or rise toward a higher peak in the adjoining year. If values are recorded at a discrete series of times, the peak recorded value may be taken as an approximation to the true peak, which may occur between the recording instants. If the values are recorded with finite precision, a sequence of equal recorded values may occur at the peak; in this case, the first value is taken as the peak.

**Percent composition** or **percent of total** is a unit for expressing the ratio of a particular part of a sample or population to the total sample or population, in terms of types, numbers, weight, mass, or volume.

**Percent shading** is determined by using a clinometer to estimate left and right bank shading. The values are added together and divided by 180 to determine percent shading relative to a horizontal surface.

**Periodic-record station** is a site where stage, discharge, sediment, chemical, physical, or other hydrologic measurements are made one or more times during a year, but at a frequency insufficient to develop a daily record.

**Periphyton** is the assemblage of microorganisms attached to and living upon submerged solid surfaces. While primarily consisting of algae, they also include bacteria, fungi, protozoa, rotifers, and other small organisms. Periphyton are useful indicators of water quality.

**Pesticides** are chemical compounds used to control undesirable organisms. Major categories of pesticides include

insecticides, miticides, fungicides, herbicides, and rodenticides.

**pH** of water is the negative logarithm of the hydrogen-ion activity. Solutions with pH less than 7 are termed "acidic," and solutions with a pH greater than 7 are termed "basic." Solutions with a pH of 7 are neutral. The presence and concentration of many dissolved chemical constituents found in water are, in part, influenced by the hydrogen-ion activity of water. Biological processes including growth, distribution of organisms, and toxicity of the water to organisms are also influenced, in part, by the hydrogen-ion activity of water.

**Phytoplankton** is the plant part of the plankton. They are usually microscopic, and their movement is subject to the water currents. Phytoplankton growth is dependent upon solar radiation and nutrient substances. Because they are able to incorporate as well as release materials to the surrounding water, the phytoplankton have a profound effect upon the quality of the water. They are the primary food producers in the aquatic environment and are commonly known as algae. (See also "Plankton")

**Picocurie** (PC, pCi) is one trillionth ($1 \times 10^{-12}$) of the amount of radioactive nuclide represented by a curie (Ci). A curie is the quantity of radioactive nuclide that yields $3.7 \times 10^{10}$ radioactive disintegrations per second (dps). A picocurie yields 0.037 dps, or 2.22 dpm (disintegrations per minute).

**Plankton** is the community of suspended, floating, or weakly swimming organisms that live in the open water of lakes and rivers. Concentrations are expressed as a number of cells per milliliter (cells / mL of sample).

**Polychlorinated biphenyls** (PCBs) are industrial chemicals that are mixtures of chlorinated biphenyl compounds having various percentages of chlorine. They are similar in structure to organochlorine insecticides.

**Polychlorinated naphthalenes** (PCNs) are industrial chemicals that are mixtures of chlorinated naphthalene compounds. They have properties and applications similar to polychlorinated biphenyls (PCBs) and have been identified in commercial PCB preparations.

**Primary productivity** is a measure of the rate at which new organic matter is formed and accumulated through photosynthetic and chemosynthetic activity of producer organisms (chiefly, green plants). The rate of primary production is estimated by measuring the amount of oxygen released (oxygen method) or the amount of carbon assimilated (carbon method) by the plants.

**Primary productivity (carbon method)** is expressed as milligrams of carbon per area per unit time [mg C / ($m^2$ / time)] for periphyton and macrophytes or per volume [mg C / ($m^3$ / time)] for phytoplankton. Carbon method defines the amount of carbon dioxide consumed as measured by radioactive carbon (carbon-14). The carbon-14 method is of greater sensitivity than the oxygen light and dark bottle method and is preferred for use in unenriched waters. Unit time may be either the hour or day, depending on the incubation period. (See also "Primary productivity")

**Primary productivity (oxygen method)** is expressed as milligrams of oxygen per area per unit time [mg O / ($m^2$ / time)] for periphyton and macrophytes or per volume [mg O / ($m^3$ / time)] for phytoplankton. Oxygen method defines production and respiration rates as estimated from changes in the measured dissolved-oxygen concentration. The oxygen light and dark bottle method is preferred if the rate of primary production is sufficient for accurate measurements to be made within 24 hours. Unit time may be either the hour or day, depending on the incubation period. (See also "Primary productivity")

**Radioisotopes** are isotopic forms of an element that exhibit radioactivity. Isotopes are varieties of a chemical element that differ in atomic weight, but are very nearly alike in chemical properties. The difference arises because the atoms of the isotopic forms of an element differ in the number of neutrons in the nucleus; for example, ordinary chlorine is a mixture of isotopes having atomic weights of 35 and 37, and the natural mixture has an atomic weight of about 35.453. Many of the elements similarly exist as mixtures of isotopes, and a great many new isotopes have been produced in the operation of nuclear devices such as the cyclotron. There are 275 isotopes of the 81 stable elements, in addition to more than 800 radioactive isotopes.

**Recoverable from bed (bottom) material** is the amount of a given constituent that is in solution after a representative sample of bottom material has been digested by a method (usually using an acid or mixture of acids) that results in dissolution of readily soluble substances. Complete dissolution of all bottom material is not achieved by the digestion treatment and thus the determination represents less than the total amount (that is, less than 95 percent) of the constituent in the sample. To achieve comparability of analytical data, equivalent digestion procedures would be required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results. (See also "Bed material")

**Recurrence interval,** also referred to as return period, is the average time, usually expressed in years, between occurrences of hydrologic events of a specified type (such as exceedances of a specified high flow or non-exceedance of a specified low flow). The terms "return period" and "recurrence interval" do not imply regular cyclic occurrence. The actual times between occurrences vary randomly, with most of the times being less than the average and a few being substantially greater than the average. For example, the 100-year flood is the flow rate that is exceeded by the annual maximum peak flow at intervals whose average length is 100 years (that is, once in 100 years, on average); almost two-thirds of all exceedances of the 100-year flood occur less than 100 years after the previous exceedance, half occur less than 70 years after the previous exceedance, and about one-eighth occur more than 200 years after the previous exceedance. Similarly, the 7-day 10-year low flow ($7Q_{10}$) is the flow rate below which the annual minimum 7-day-mean flow dips at intervals whose average length is 10 years (that is, once in 10 years, on average); almost two-thirds of the non-exceedances of the $7Q_{10}$ occur less than 10 years after the previous non-exceedance, half occur less

than 7 years after, and about one-eighth occur more than 20 years after the previous non-exceedance. The recurrence interval for annual events is the reciprocal of the annual probability of occurrence. Thus, the 100-year flood has a 1-percent chance of being exceeded by the maximum peak flow in any year, and there is a 10-percent chance in any year that the annual minimum 7-day-mean flow will be less than the $7Q_{10}$.

**Replicate samples** are a group of samples collected in a manner such that the samples are thought to be essentially identical in composition.

**Return period** (See "Recurrence interval")

**River mileage** is the curvilinear distance, in miles, measured upstream from the mouth along the meandering path of a stream channel in accordance with Bulletin No. 14 (October 1968) of the Water Resources Council, and typically used to denote location along a river.

**Runoff** is the quantity of water that is discharged ("runs off") from a drainage basin in a given time period. Runoff data may be presented as volumes in acre-feet, as mean discharges per unit of drainage area in cubic feet per second per square mile, or as depths of water on the drainage basin in inches. (See also "Annual runoff")

**Sea level,** as used in this report, refers to one of the two commonly used national vertical datums, (NGVD 1929 or NAVD 1988). See separate entries for definitions of these datums. See conversion of units page (inside back cover) for identification of the datum used in this report.

**Sediment** is solid material that originates mostly from disintegrated rocks; when transported by, suspended in, or deposited from water, it is referred to as "fluvial sediment." Sediment includes chemical and biochemical precipitates and decomposed organic material, such as humus. The quantity, characteristics, and cause of the occurrence of sediment in streams are influenced by environmental and land-use factors. Some major factors are topography, soil characteristics, land cover, and depth and intensity of precipitation.

**Seven-day 10-year low flow** (7Q10) is the discharge below which the annual 7-day minimum flow falls in 1 year out of 10 on the long-run average. The recurrence interval of the 7Q10 is 10 years; the chance that the annual 7-day minimum flow will be less than the 7Q10 is 10 percent in any given year. (See also "Recurrence interval" and "Annual 7-day minimum")

**Sodium adsorption ratio** (SAR) is the expression of relative activity of sodium ions in exchange reactions within soil and is an index of sodium or alkali hazard to the soil. Sodium hazard in water is an index that can be used to evaluate the suitability of water for irrigating crops.

**Specific electrical conductance (conductivity)** is a measure of the capacity of water (or other media) to conduct an electrical current. It is expressed in microsiemens per centimeter at 25 °C. Specific electrical conductance is a function of the types and quantity of dissolved substances in water and can be used for approximating the dissolved-solids content of the water. Commonly, the concentration of dissolved solids (in milligrams per liter) is from 55 to 75 percent of the specific conductance (in microsiemens). This relation is not constant from stream to stream, and it may vary in the same source with changes in the composition of the water.

**Stable isotope ratio** (per MIL / MIL) is a unit expressing the ratio of the abundance of two radioactive isotopes. Isotope ratios are used in hydrologic studies to determine the age or source of specific waters, to evaluate mixing of different waters, as an aid in determining reaction rates, and other chemical or hydrologic processes.

**Stage** (See "Gage height")

**Stage-discharge relation** is the relation between the water-surface elevation, termed stage (gage height), and the volume of water flowing in a channel per unit time.

**Streamflow** is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "streamflow" uniquely describes the discharge in a surface stream course. The term "streamflow" is more general than "runoff" as streamflow may be applied to discharge whether or not it is affected by diversion or regulation.

**Substrate** is the physical surface upon which an organism lives.

**Substrate Embeddedness Class** is a visual estimate of riffle streambed substrate larger than gravel that is surrounded or covered by fine sediment (<2mm, sand or finer). Below are the class categories expressed as percent covered by fine sediment:

| | | | |
|---|---|---|---|
| 0 | < no gravel or larger substrate | | |
| 1 | > 75% | | |
| 2 | 51-75% | 4 | 5-25% |
| 3 | 26-50% | 5 | < 5% |

**Surface area of a lake** is that area (acres) encompassed by the boundary of the lake as shown on USGS topographic maps, or other available maps or photographs. Because surface area changes with lake stage, surface areas listed in this report represent those determined for the stage at the time the maps or photographs were obtained.

**Surficial bed material** is the upper surface (0.1 to 0.2 ft) of the bed material such as that material which is sampled using U.S. Series Bed-Material Samplers.

**Suspended** (as used in tables of chemical analyses) refers to the amount (concentration) of undissolved material in a water-sediment mixture. It is operationally defined as the material retained on a 0.45-micrometer filter.

**Suspended, recoverable** is the amount of a given constituent that is in solution after the part of a representative suspended water-sediment sample that is retained on a 0.45-micrometer membrane filter has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all the particulate matter is not achieved by the digestion treatment and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the sample. To

achieve comparability of analytical data, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures are likely to produce different analytical results. Determinations of "suspended, recoverable" constituents are made either by directly analyzing the suspended material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total recoverable concentrations of the constituent. (See also "Suspended")

**Suspended sediment** is the sediment maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid. (See also "Sediment")

**Suspended-sediment concentration** is the velocity-weighted concentration of suspended sediment in the sampled zone (from the water surface to a point approximately 0.3 ft above the bed) expressed as milligrams of dry sediment per liter of water-sediment mixture (mg/L). The analytical technique uses the mass of all of the sediment and the net weight of the water-sediment mixture in a sample to compute the suspended-sediment concentration. (See also "Sediment" and "Suspended sediment")

**Suspended-sediment discharge** (tons/day) is the rate of sediment transport, as measured by dry mass or volume, that passes a cross section in a given time. It is calculated in units of tons per day as follows: concentration (mg/L) x discharge ($ft^3/s$) x 0.0027. (See also "Sediment," "Suspended sediment," and "Suspended-sediment concentration")

**Suspended-sediment load** is a general term that refers to a given characteristic of the material in suspension that passes a point during a specified period of time. The term needs to be qualified, such as "annual suspended-sediment load" or "sand-size suspended-sediment load," and so on. It is not synonymous with either suspended-sediment discharge or concentration. (See also "Sediment")

**Suspended, total** is the total amount of a given constituent in the part of a water-sediment sample that is retained on a 0.45-micrometer membrane filter. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. Knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to determine when the results should be reported as "suspended, total." Determinations of "suspended, total" constituents are made either by directly analyzing portions of the suspended material collected on the filter or, more commonly, by difference, based on determinations of (1) dissolved and (2) total concentrations of the constituent. (See also "Suspended")

**Suspended solids, total residue at 105 ˚C concentration** is the concentration of inorganic and organic material retained on a filter, expressed as milligrams of dry material per liter of water (mg/L). An aliquot of the sample is used for this analysis.

**Synoptic studies** are short-term investigations of specific water-quality conditions during selected seasonal or hydrologic periods to provide improved spatial resolution for critical water-quality conditions. For the period and conditions sampled, they assess the spatial distribution of selected water-quality conditions in relation to causative factors, such as land use and contaminant sources.

**Taxa richness** is the total number of distinct species or groups and usually decreases with pollution. (See also "Percent Shading")

**Taxonomy** is the division of biology concerned with the classification and naming of organisms. The classification of organisms is based upon a hierarchical scheme beginning with Kingdom and ending with Species at the base. The higher the classification level, the fewer features the organisms have in common. For example, the taxonomy of a particular mayfly, *Hexagenia limbata*, is the following::

| | |
|---|---|
| Kingdom: | Animal |
| Phylum: | Arthropoda |
| Class: | Insecta |
| Order: | Ephemeroptera |
| Family: | Ephemeridae |
| Genus: | *Hexagenia* |
| Species: | *Hexagenia limbata* |

**Temperature preferences**:

Cold – preferred water temperature for the species is less than 20 ˚C or spawning temperature preference less than 16 ˚C and native distribution is considered to be predominantly north of 45˚ N. latitude.

Warm – preferred water temperatures for the species is greater than 20 ˚C or spawning temperature preference greater than 16 ˚C and native distribution is considered to be predominantly south of 45˚ N. latitude.

Cool – intermediate between cold and warm water temperature preferences.

**Thermograph** is an instrument that continuously records variations of temperature on a chart. The more general term "temperature recorder' is used in the table descriptions and refers to any instrument that records temperature whether on a chart, a tape, or any other medium.

**Time-weighted average** is computed by multiplying the number of days in the sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the total number of days. A time-weighted average represents the composition of water resulting from the mixing of flow proportionally to the duration of the concentration.

**Tons per acre-foot (T/acre-ft)** is the dry mass (tons) of a constituent per unit volume (acre-foot) of water. It is computed by multiplying the concentration of the constituent, in milligrams per liter, by 0.00136.

**Tons per day** (T/DAY, tons/d) is a common chemical or sediment discharge unit. It is the quantity of a substance in solution, in suspension, or as bedload that passes a stream

section during a 24-hour period. It is equivalent to 2,000 pounds per day, or 0.9072 metric tons per day.

**Total** is the amount of a given constituent in a representative whole-water (unfiltered) sample, regardless of the constituent's physical or chemical form. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent present in both the dissolved and suspended phases of the sample. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total." (Note that the word "total" does double duty here, indicating both that the sample consists of a water-suspended sediment mixture and that the analytical method determined at least 95 percent of the constituent in the sample.)

**Total coliform bacteria** are a particular group of bacteria that are used as indicators of possible sewage pollution. This group includes coliforms that inhabit the intestine of warm-blooded animals and those that inhabit soils. They are characterized as aerobic or facultative anaerobic, gram-negative, nonspore-forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35 °C. In the laboratory, these bacteria are defined as all the organisms that produce colonies with a golden-green metallic sheen within 24 hours when incubated at 35 °C plus or minus 1.0 °C on M-Endo medium (nutrient medium for bacterial growth). Their concentrations are expressed as number of colonies per 100 mL of sample. (See also "Bacteria")

**Total discharge** is the quantity of a given constituent, measured as dry mass or volume, that passes a stream cross section per unit of time. When referring to constituents other than water, this term needs to be qualified, such as "total sediment discharge," "total chloride discharge," and so on.

**Total in bottom material** is the amount of a given constituent in a representative sample of bottom material. This term is used only when the analytical procedure assures measurement of at least 95 percent of the constituent determined. A knowledge of the expected form of the constituent in the sample, as well as the analytical methodology used, is required to judge when the results should be reported as "total in bottom material."

**Total length** (fish) is the straight-line distance from the anterior point of a fish specimen's snout, with the mouth closed, to the posterior end of the caudal (tail) fin, with the lobes of the caudal fin squeezed together.

**Total load** refers to all of a constituent in transport. When referring to sediment, it includes suspended load plus bed load.

**Total organism count** is the number of organisms collected and enumerated in any particular sample. (See also "Organism count/volume.")

**Total recoverable** is the amount of a given constituent in a whole-water sample after a sample has been digested by a method (usually using a dilute acid solution) that results in dissolution of only readily soluble substances. Complete dissolution of all particulate matter is not achieved by the digestion treatment, and thus the determination represents something less than the "total" amount (that is, less than 95 percent) of the constituent present in the dissolved and suspended phases of the sample. To achieve comparability of analytical data for whole-water samples, equivalent digestion procedures are required of all laboratories performing such analyses because different digestion procedures may produce different analytical results.

**Total sediment discharge** is the mass of suspended-sediment plus bed-load transport, measured as dry weight, that passes a cross section in a given time. It is a rate and is reported as tons per day. (See also "Sediment," "Suspended sediment," "Suspended-Sediment Concentration," "Bedload," and "Bedload discharge")

**Total sediment load** or total load is the sediment in transport as bedload and suspended-sediment load. The term may be qualified, such as "annual suspended-sediment load" or "sand-size suspended-sediment load," and so on. It differs from total sediment discharge in that load refers to the material whereas discharge refers to the quantity of material, expressed in units of mass per unit time. (See also "Sediment," "Suspended-Sediment Load," and "Total load")

**Trophic group**:

**Filter feeder** – diet composed of suspended plant and/or animal material.

**Herbivore** – diet composed predominantly of plant material.

**Invertivore** – diet composed predominantly of invertebrates.

**Omnivore** – diet composed of at least 25-percent plant and 25-percent animal material.

**Piscivore** – diet composed predominantly of fish.

**Turbidity** is the reduction in the transparency of a solution due to the presence of suspended and some dissolved substances. The measurement technique records the collective optical properties of the solution that cause light to be scattered and attenuated rather than transmitted in straight lines; the higher the intensity of scattered or attenuated light, the higher the value of the turbidity. Turbidity is expressed in nephelometric turbidity units (NTU). Depending on the method used, the turbidity units as NTU can be defined as the intensity of light of a specified wavelength scattered or attenuated by suspended particles or absorbed at a method specified angle, usually 90 degrees, from the path of the incident light. Currently approved methods for the measurement of turbidity in the USGS include those that conform to EPA Method 180.1, ASTM D1889-00, and ISO 7027. Measurements of turbidity by these different methods and different instruments are unlikely to yield equivalent values. Consequently, the method of measurement and type of instrument used to derive turbidity records should be included in the "REMARKS" column of the Annual Data Report.

**Ultraviolet (UV) absorbance (absorption)** at 254 or 280 nanometers is a measure of the aggregate concentration of the mixture of UV absorbing organic materials dissolved in the analyzed water, such as lignin, tannin, humic sub-

stances, and various aromatic compounds. UV absorbance (absorption) at 254 or 280 nanometers is measured in UV absorption units per centimeter of pathlength of UV light through a sample.

**Vertical datum** (See "Datum")

**Volatile organic compounds** (VOCs) are organic compounds that can be isolated from the water phase of a sample by purging the water sample with inert gas, such as helium, and subsequently analyzed by gas chromatography. Many VOCs are human-made chemicals that are used and produced in the manufacture of paints, adhesives, petroleum products, pharmaceuticals, and refrigerants. They are often components of fuels, solvents, hydraulic fluids, paint thinners, and dry cleaning agents commonly used in urban settings. VOC contamination of drinking-water supplies is a human health concern because many are toxic and are known or suspected human carcinogens (U.S. Environmental Protection Agency, 1996).

**Water table** is the level in the saturated zone at which the pressure is equal to the atmospheric pressure.

**Water-table aquifer** is an unconfined aquifer within which is found the water table.

**Water year** in USGS reports dealing with surface-water supply is the 12-month period October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 2001, is called the "2001 water year."

**WDR** is used as an abbreviation for "Water-Data Report" in the REVISED RECORDS paragraph to refer to State annual hydrologic-data reports. (WRD was used as an abbreviation for "Water-Resources Data" in reports published prior to 1976.)

**Weighted average** is used in this report to indicate discharge-weighted average. It is computed by multiplying the discharge for a sampling period by the concentrations of individual constituents for the corresponding period and dividing the sum of the products by the sum of the discharges. A discharge-weighted average approximates the composition of water that would be found in a reservoir containing all the water passing a given location during the water year after thorough mixing in the reservoir.

**Wet mass** is the mass of living matter plus contained water. (See also "Biomass" and "Dry mass")

**Wet weight** refers to the weight of animal tissue or other substance including its contained water. (See also "Dry weight")

**WSP** is used as an acronym for "Water-Supply Paper" in reference to previously published reports.

**Zooplankton** is the animal part of the plankton. Zooplankton are capable of extensive movements within the water column and are often large enough to be seen with the unaided eye. Zooplankton are secondary consumers feeding upon bacteria, phytoplankton, and detritus. Because they are the grazers in the aquatic environment, the zooplankton are a vital part of the aquatic food web. The zooplankton community is dominated by small crustaceans and rotifers. (See also "Plankton")

# PUBLICATIONS ON TECHNIQUES OF WATER-RESOURCES INVESTIGATIONS

The U.S.G.S. publishes a series of manuals describing procedures for planning and conducting specialized work in water-resources investigations. The material is grouped under major subject headings called books and is further divided into sections and chapters. For example, section A of book 3 (Applications of Hydraulics) pertains to surface water. The chapter, the unit of publication, is limited to a narrow field of subject matter. This format permits flexibility in revision and publication as the need arises.

The reports listed below are for sale by the U.S.G.S., Information Services, Box 25286, Federal Center, Denver, Colorado 80225 (authorized agent of the Superintendent of Documents, Government Printing Office). Prepayment is required. Remittance should be made in the form of a check or money order payable to the "U.S. Geological Survey." Prices are not included because they are subject to change. Current prices can be obtained by writing to the above address. When ordering or inquiring about prices for any of these publications, please give the title, book number, chapter number, and mention the "U.S. Geological Survey Techniques of Water-Resources Investigations."

## Book 1. Collection of Water Data by Direct Measurement

### Section D. Water Quality

1-D1. *Water temperature—influential factors, field measurement, and data presentation*, by H.H. Stevens, Jr., J.F. Ficke, and G.F. Smoot: USGS–TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2. *Guidelines for collection and field analysis of ground-water samples for selected unstable constituents*, by W.W. Wood: USGS–TWRI Book 1, Chapter D2. 1976. 24 pages.

## Book 2. Collection of Environmental Data

### Section D. Surface Geophysical Methods

2-D1. *Application of surface geophysics to ground-water investigations*, by A.A.R. Zohdy, G.P. Eaton, and D.R. Mabey: USGS–TWRI Book 2, Chapter D1. 1974. 116 pages.

2-D2. *Application of seismic-refraction techniques to hydrologic studies*, by F.P. Haeni: USGS–TWRI Book 2, Chapter D2. 1988. 86 pages.

### Section E. Subsurface Geophysical.Methods

2-E1. *Application of borehole geophysics to water-resources investigations*, by W.S. Keys and L.M. MacCary: USGS–TWRI Book 2, Chapter E1. 1971. 126 pages.

2-E2. *Borehole geophysics applied to ground-water investigations*, by W.S. Keys: USGS–TWRI Book 2, Chapter E2. 1990. 150 pages.

### Section F. Drilling and Sampling Methods

2-F1. *Application of drilling, coring, and sampling techniques to test holes and wells*, by Eugene Shuter and W.E. Teasdale: USGS–TWRI Book 2, Chapter F1. 1989. 97 pages.

## Book 3. Applications of Hydraulics

### Section A. Surface-Water Techniques

3-A1. *General field and office procedures for indirect discharge measurements*, by M.A. Benson and Tate Dalrymple: USGS–TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. *Measurement of peak discharge by the slope-area method*, by Tate Dalrymple and M.A. Benson: USGS–TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. *Measurement of peak discharge at culverts by indirect methods*, by G.L. Bodhaine: USGS–TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. *Measurement of peak discharge at width contractions by indirect methods*, by H.F. Matthai: USGS-TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. *Measurement of peak discharge at dams by indirect methods*, by Harry Hulsing: USGS–TWRI Book 3. Chapter A5. 1967. 29 pages.

3-A6. *General procedure for gaging streams*, by R.W. Carter and Jacob Davidian: USGS–TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. *Stage measurement at gaging stations*, by T.J. Buchanan and W.P. Somers: USGS–TWRI Book 3, Chapter A7. 1968. 28 pages.

3-A8. *Discharge measurements at gaging stations*, by T.J. Buchanan and W.P. Somers: USGS–TWRI Book 3, Chapter A8. 1969. 65 pages.

3-A9. *Measurement of time of travel in streams by dye tracing*, by F.A. Kilpatrick and J.F. Wilson, Jr.: USGS–TWRI Book 3, Chapter A9. 1989. 27 pages.

3-Al0. *Discharge ratings at gaging stations*, by E.J. Kennedy: USGS–TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11. *Measurement of discharge by the moving-boat method*, by G.F. Smoot and C.E. Novak: USGS–TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. *Fluorometric procedures for dye tracing, Revised*, by J.F. Wilson, Jr., E.D. Cobb, and F.A. Kilpatrick: USGS–TWRI Book 3, Chapter A12. 1986. 34 pages.

3-A13. *Computation of continuous records of streamflow*, by E.J. Kennedy: USGS–TWRI Book 3, Chapter A13. 1983. 53 pages.

3-A14. *Use of flumes in measuring discharge*, by F.A. Kilpatrick and V.R. Schneider: USGS–TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. *Computation of water-surface profiles in open channels*, by Jacob Davidian: USGS–TWRI Book 3, Chapter A15. 1984. 48 pages.

3-A16. *Measurement of discharge using tracers*, by F.A. Kilpatrick and E.D. Cobb: USGS–TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. *Acoustic velocity meter systems*, by Antonius Laenen: USGS–TWRI Book 3, Chapter A17. 1985. 38 pages.

3-A18. *Determination of stream reaeration coefficients by use of tracers*, by F.A. Kilpatrick, R.E. Rathbun, Nobuhiro Yotsukura, G.W. Parker, and L.L. DeLong: USGS–TWRI Book 3, Chapter A18. 1989. 52 pages.

3-A19. *Levels at streamflow gaging stations*, by E.J. Kennedy: USGS–TWRI Book 3, Chapter A19. 1990. 31 pages.

3-A20. *Simulation of soluable waste transport and buildup in surface waters using tracers*, by F.A. Kilpatrick: USGS–TWRI Book 3, Chapter A20. 1993. 38 pages.

3-A21 *Stream-gaging cableways*, by C. Russell Wagner: USGS–TWRI Book 3, Chapter A21. 1995. 56 pages.

**Section B. Ground-Water Techniques**

3-B1. *Aquifer-test design, observation, and data analysis*, by R.W. Stallman: USGS–TWRI Book 3, Chapter B1. 1971. 26 pages.

3-B2. *Introduction to ground-water hydraulics, a programed text for self-instruction*, by G.D. Bennett: USGS–TWRI Book 3, Chapter B2. 1976. 172 pages.

3-B3. *Type curves for selected problems of flow to wells in confined aquifers*, by J.E. Reed: USGS–TWRI Book 3, Chapter B3. 1980. 106 pages.

3-B4. *Regression modeling of ground-water flow*, by R.L. Cooley and R.L. Naff: USGS–TWRI Book 3, Chapter B4. 1990. 232 pages.

3-B4. *Supplement 1. Regression modeling of ground-water flow --Modifications to the computer code for nonlinear regression solution of steady-state ground-water flow problems*, by R.L. Cooley: USGS–TWRI Book 3, Chapter B4. 1993. 8 pages.

3-B5. *Definition of boundary and initial conditions in the analysis of saturated ground-water flow systems—An introduction*, by O.L. Franke, T.E. Reilly, and G.D. Bennett: USGS–TWRI Book 3, Chapter B5. 1987. 15 pages.

3-B6. *The principle of superposition and its application in ground-water hydraulics*, by T.E. Reilly, O.L. Franke, and G.D. Bennett: USGS–TWRI Book 3, Chapter B6. 1987. 28 pages.

3-B7. *Analytical solutions for one-, two-, and three-dimensional solute transport in ground-water systems with uniform flow*, by E.J. Wexler: USGS–TWRI Book 3, Chapter B7. 1992. 190 pages.

3-B8. *System and boundary conceptualization in ground-water flow simulation*, by T.E. Reilly: USGS–TWRI book 3, chap. B8. 2001. 29 p.

**Section C. Sedimentation and Erosion Techniques**

3-C1. *Fluvial sediment concepts,* by H.P. Guy: USGS–TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. *Field methods for measurement of fluvial sediment,* by T.K. Edwards and G.D. Glysson: USGS–TWRI Book 3, Chapter C2. 1999. 89 pages.

3-C3. *Computation of fluvial-sediment discharge,* by George Porterfield: USGS–TWRI Book 3, Chapter C3. 1972. 66 pages.

## Book 4. Hydrologic Analysis and Interpretation

**Section A. Statistical Analysis**

4-A1. *Some statistical tools in hydrology,* by H.C. Riggs: USGS–TWRI Book 4, Chapter A1. 1968. 39 pages.

4-A2. *Frequency curves,* by H.C. Riggs: USGS–TWRI Book 4, Chapter A2. 1968. 15 pages.

**Section B. Surface Water**

4-B1. *Low-flow investigations,* by H.C. Riggs: USGS–TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. *Storage analyses for water supply,* by H.C. Riggs and C.H. Hardison: USGS–TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. *Regional analyses of streamflow characteristics,* by H.C. Riggs: USGS–TWRI Book 4, Chapter B3. 1973. 15 pages.

**Section D. Interrelated Phases of the Hydrologic Cycle**

4-D1. *Computation of rate and volume of stream depletion by wells,* by C.T. Jenkins: USGS–TWRI Book 4, Chapter D1. 1970. 17 pages.

## Book 5. Laboratory Analysis

**Section A. Water Analysis**

5-A1. *Methods for determination of inorganic substances in water and fluvial sediments,* by M.J. Fishman and L.C. Friedman, editors: USGS–TWRI Book 5, Chapter A1. 1989. 545 pages.

5-A2. *Determination of minor elements in water by emission spectroscopy,* by P.R. Barnett and E.C. Mallory, Jr.: USGS–TWRI Book 5, Chapter A2. 1971. 31 pages.

5-A3. *Methods for the determination of organic substances in water and fluvial sediments,* edited by R.L. Wershaw, M.J. Fishman, R.R. Grabbe, and L.E. Lowe: USGS–TWRI Book 5, Chapter A3. 1987. 80 pages.

5-A4. *Methods for collection and analysis of aquatic biological and microbiological samples,* by L.J. Britton and P.E. Greeson, editors: USGS–TWRI Book 5, Chapter A4. 1989. 363 pages.

5-A5. *Methods for determination of radioactive substances in water and fluvial sediments,* by L.L. Thatcher, V.J. Janzer, and K.W. Edwards: USGS–TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. *Quality assurance practices for the chemical and biological analyses of water and fluvial sediments,* by L.C. Friedman and D.E. Erdmann: USGS–TWRI Book 5, Chapter A6. 1982. 181 pages.

**Section C. Sediment Analysis**

5-C1. *Laboratory theory and methods for sediment analysis,* by H.P. Guy: USGS–TWRI Book 5, Chapter C1. 1969. 58 pages.

## Book 6. Modeling Techniques

**Section A. Ground Water**

6-A1. *A modular three-dimensional finite-difference ground-water flow model,* by M.G. McDonald and A.W. Harbaugh: USGS–TWRI Book 6, Chapter A1. 1988. 586 pages.

6-A2. *Documentation of a computer program to simulate aquifer-system compaction using the modular finite-difference ground-water flow model,* by S.A. Leake and D.E. Prudic: USGS–TWRI Book 6, Chapter A2. 1991. 68 pages.

6-A3. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems,* Part 1: Model Description and User's Manual, by L.J. Torak: USGS–TWRI Book 6, Chapter A3. 1993. 136 pages.

6-A4. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems,* Part 2: Derivation of finite-element equations and comparisons with analytical solutions, by R.L. Cooley: USGS–TWRI Book 6, Chapter A4. 1992. 108 pages.

6-A5. *A modular finite-element model (MODFE) for areal and axisymmetric ground-water-flow problems, Part 3: Design philosophy and programming details*, by L.J. Torak: USGS–TWRI book 6, chap. A5, 1993. 243 p.

6-A6. *A coupled surface-water and ground-water flow model (MODBRANCH) for simulation of stream-aquifer interaction*, by Eric D. Swain and Eliezer J. Wexler: USGS–TWRI book 6, chap. A5,1996. 125 p.

## Book 7. Automated Data Processing and Computations

### Section C. Computer Programs

7-C1. *Finite difference model for aquifer simulation in two dimensions with results of numerical experiments*, by P.C. Trescott, G.F. Pinder, and S.P. Larson: USGS–TWRI book 7, chap. C1. 1976. 116 p.

7-C2. *Computer model of two-dimensional solute transport and dispersion in ground water*, by L.F. Konikow and J.D. Bredehoeft: USGS–TWRI book 7, chap. C2. 1978. 90 p.

7-C3. *A model for simulation of flow in singular and interconnected channels*, by R.W. Schaffranek, R.A. Baltzer, and D.E. Goldberg: USGS–TWRI book 7, chap. C3. 1981. 110 p.

## Book 8. Instrumentation

### Section A. Instruments for Measurement of Water Level

8-A1. *Methods of measuring water levels in deep wells*, by M.S. Garber and F.C. Koopman: USGS–TWRI book 8, chap. A1. 1968. 23 p.

8-A2. *Installation and service manual for U.S. Geological Survey manometers*, by J.D. Craig: USGS–TWRI book 8, chap. A2. 1983. 57 p.

### Section B. Instruments for Measurement of Discharge

8-B2. *Calibration and maintenance of vertical-axis type current meters*, by G.F. Smoot and C.E. Novak: USGS–TWRI book 8, chap. B2. 1968. 15 p.

## Book 9. Handbooks for Water-Resources Investigations

### Section A. National Field Manual for the Collection of Water-Quality Data

9-A1. *National Field Manual for the Collection of Water-Quality Data: Preparations for Water Sampling*, by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A1. 1998. 47 p.

9-A2. *National Field Manual for the Collection of Water-Quality Data: Selection of Equipment for Water Sampling*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A2. 1998. 94 p.

9-A3. *National Field Manual for the Collection of Water-Quality Data: Cleaning of Equipment for Water Sampling*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A3. 1998. 75 p.

9-A4. *National Field Manual for the Collection of Water-Quality Data: Collection of Water Samples*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A4. 1999. 156 p.

9-A5. *National Field Manual for the Collection of Water-Quality Data: Processing of Water Samples*, edited by F.D. Wilde, D.B. Radtke, Jacob Gibs, and R.T. Iwatsubo: USGS–TWRI book 9, chap. A5. 1999, 149 p.

9-A6. *National Field Manual for the Collection of Water-Quality Data: Field Measurements*, edited by F.D. Wilde and D.B. Radtke: USGS–TWRI book 9, chap. A6. 1998. Variously paginated.

9-A7. *National Field Manual for the Collection of Water-Quality Data: Biological Indicators*, edited by D.N. Myers and F.D. Wilde: USGS–TWRI book 9, chap. A7. 1997 and 1999. Variously paginated.

9-A8. *National Field Manual for the Collection of Water-Quality Data: Bottom-material samples*, by D.B. Radtke: USGS–TWRI book 9, chap. A8. 1998. 48 p.

9-A9. *National Field Manual for the Collection of Water-Quality Data: Safety in Field Activities*, by S.L. Lane and R.G. Fay: USGS–TWRI book 9, chap. A9. 1998. 60 p.

SURFACE-WATER-DISCHARGE AND SURFACE-WATER-QUALITY RECORDS

## Remarks Codes

The following remark codes may appear with the water-quality data in this station:

| PRINTED OUTPUT | REMARK |
|---|---|
| E | Estimated Value. |
| > | Actual value is known to be greater than the value shown. |
| < | Actual value is known to be less than the value shown. |