

Report of the River Master of the Delaware River

For the period December 1, 1998 - November 30, 1999

By Bruce E. Krejmas, Gary N. Paulachok, and William J. Carswell, Jr.

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Reston, Virginia
2002

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
<i>Length</i>		
inch (in.)	25.4	millimeter
foot (ft)	0.3048	meter
mile (mi)	1.609	kilometer
<i>Area</i>		
square mile (mi ²)	2.590	square kilometer
<i>Volume</i>		
million gallons (Mgal)	3,785	cubic meter
million gallons (Mgal)	1.547	cubic foot per second-day
billion gallons (Bgal)	3.785	cubic hectometer
cubic foot per second-day (ft ³ /s.d)	0.002447	cubic hectometer
<i>Flow rate</i>		
million gallons per day (Mgal/d)	1.547	cubic foot per second
million gallons per day (Mgal/d)	0.04381	cubic meter per second
billion gallons per day (Bgal/d)	43.81	cubic meter per second
cubic foot per second (ft ³ /s)	0.02832	cubic meter per second

Vertical datum: In this report, the term "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) as follows: °C= (°F-32)/1.8

RIVER MASTER LETTER OF TRANSMITTAL AND SPECIAL REPORT

OFFICE OF THE DELAWARE RIVER MASTER
United States Geological Survey
433 National Center
Reston, Virginia 20192

May 3, 2002

The Honorable
William H. Rehnquist
Chief Justice of the United States

The Honorable
Ruth Ann Minner
Governor of Delaware

The Honorable
James E. McGreevey
Governor of New Jersey

The Honorable
George E. Pataki
Governor of New York

The Honorable
Mark Schweiker
Governor of Pennsylvania

The Honorable
Michael R. Bloomberg
Mayor of the City of New York

New Jersey v. New York et al
No. 5 Original, October Term 1950

Dear Sirs and Madam:

For the record and in compliance with the provisions of the Amended Decree of the Supreme Court of the United States entered June 7, 1954, I am transmitting herewith the 46th Annual Report of the River Master of the Delaware River for the 12-month period from December 1, 1998 to November 30, 1999. In this report, this period is referred to as the River Master report year or the report year.

During the 1999 River Master report year, monthly precipitation in the upper Delaware River Basin ranged from 45 percent of the long-term average during December 1998 to 244 percent of the long-term average during September 1999. Total precipitation during the report year was 2.18 inches less than the long-term average. Precipitation during the December to May period, when reservoirs typically refill, was 1.44 inches less than the 58-year average.

On December 1, 1998, when the report year began, combined storage in the New York City reservoirs in the upper Delaware River Basin was 119.682 billion gallons (Bgal) or 44.2 percent of combined storage capacity. Median combined storage on December 1, computed on the basis of 31 years of record, is 166.770 Bgal. Operations from December 1, 1998 to February 1, 1999 were being conducted as prescribed by agreements between the Parties to the Decree and the Delaware River Basin Commission (DRBC) and by the "Interstate Water Management Recommendations of the Parties to the Decree" (Delaware River Basin Commission Resolution 83-13). On December 1, 1998, the New York City diversions were limited to 680 million gallons per day (Mgal/d) and the Montague flow objective was 1,655 cubic feet per second (ft³/s); the Trenton flow objective was 2,700 ft³/s. On December 23, the New York City diversions were reduced to 560 Mgal/d and New Jersey diversions were reduced from 85 Mgal/d to 70 Mgal/d. Effective December 26, the Montague flow objective was reduced to 1,550 ft³/s. On February 2, 1999, conditions returned to normal, and operations resumed as prescribed by the Decree.

Precipitation during the report year was below normal in all months except January, March, and September. Although storage increased rapidly during January and continued to increase during winter, reservoir levels remained below spillway levels in the spring. Combined storage reached a maximum of 93 percent on May 31, and then began the seasonal cycle of decline until mid-September. Precipitation during September was much above average as a result of Tropical Storm Floyd, which delivered drenching rains throughout the Delaware River Basin, and storage increased through the end of the report year.

The Delaware River Master Advisory Committee met at Milford, Pennsylvania on May 19, 1999, to discuss hydrologic conditions in the basin and operational procedures for the 1999 reservoir-release season. During the report year, the following individuals served as members of the Advisory Committee:

Delaware	Dr. Robert R. Jordan
New Jersey	Robert C. Shinn, Jr.
New York	N.G. Kaul
New York City	Joel A. Miele, Sr.
Pennsylvania	Irene B. Brooks

The River Master informed the Committee that, on the basis of information provided by New York City, the excess-release quantity beginning June 15 was 7.381 Bgal. Based on modifications to reservoir release programs in Delaware River Basin Commission Docket No. D-77-20 CP (Revision No. 4), the excess-release quantity was to be used for various purposes. In response to hydrologic conditions in mid-May and forecast below-normal conditions, the Parties to the Decree unanimously agreed to bank the portion of the excess-release quantity that could be released starting June 15.

Combined storage in the New York City Delaware River Basin reservoirs declined at above-normal rates throughout summer as a result of below-normal precipitation and above-normal releases to meet the Montague flow objective. One-half of the excess-release quantity was released from these reservoirs to help meet the Trenton flow objective during July and August. On July 21, the DRBC reduced the Trenton flow objective from 3,000 ft³/s to 2,700 ft³/s. As drought conditions intensified, the Commission on August 18 took additional action to conserve water supplies in the basin. On September 30, the emergency action described above was terminated. Copies of the resolutions authorizing the above-noted actions are attached as Appendixes of this report. Storage in New York City reservoirs increased steadily from mid-September to the end of the report year.

On November 30, 1999, the end of the report year, combined storage in the New York City reservoirs was 175.936 Bgal or 65.0 percent of capacity, and Delaware River operations were being conducted in normal mode as prescribed by the Decree.

During the report year, the River Master and staff participated in a number of water-supply related meetings of the Delaware River Basin Commission. Upon invitation of the representatives of the Parties to the Decree, the Deputy Delaware River Master met periodically with those representatives as an adviser to DRBC's Flow Management Technical Advisory Committee. Discussions of particular interest to the River Master focused mainly on proposals for managing reservoir releases and dealing with streamflow deficiencies.

The U.S. Geological Survey (USGS) continued the operation of its field office of the Delaware River Master at Milford, Pennsylvania. William E. Harkness, Deputy Delaware River Master, retired on April 3, 1999, after more than 35 years of Federal service, of which 15 years were with this office. On April 4, Gary N. Paulachok began serving as Deputy Delaware River Master. Bruce E. Krejmas and Heidi L. Soden continued their service as staff members of the Delaware River Master office.

During the year, the Milford office continued the weekly distribution of a summary hydrologic report. These weekly reports contain preliminary data on precipitation in the upper Delaware River Basin, releases and spill from New York City reservoirs to the Delaware River, diversions to the New York City water-supply system, reservoir contents, daily segregation of flow of the Delaware River at the Montague gaging station, and diversions by New Jersey. The reports were distributed to members of the Delaware River Master Advisory Committee and to other parties interested in Delaware River operations. A monthly summary of hydrologic conditions, supplemented by an outlook of river flow for the upcoming month, also was provided to Advisory Committee members.

The following section of this report documents Delaware River operations during the report year. During the year, the City of New York diverted 202.472 Bgal from the Delaware River Basin and released 99.153 Bgal from Pepacton, Cannonsville, and Neversink Reservoirs to the Delaware River. The River Master directed releases from these reservoirs to the Delaware River totaling 81.137 Bgal.

The final section of this report describes water quality at various monitor sites on the Delaware Estuary. It includes basic data on chemical properties and physical characteristics of the water and presents summary statistics on the data.

Throughout the year, diversions to supply water to New York City and releases designed to maintain the flow of the Delaware River at Montague were made as directed by the River Master. Diversions by New York City from its reservoirs in the Delaware River basin did not exceed the limit stipulated by the Decree, limits specified in the "Interstate Water Management Recommendations of the Parties to the Decree" (DRBC Resolution 83-13), or limits specified in agreements by the Parties to the Decree and the Delaware River Basin Commission. Diversions by New Jersey also were within the applicable legal limits.

The River Master and staff are grateful for the continued cooperation and support of the Parties to the Decree. Also, the contributions of the Pennsylvania Power & Light Company and Orange and Rockland Utilities, Inc. in informing the River Master of plans for power generation and furnishing data on reservoir releases, are greatly appreciated.

A draft of this report was furnished to the River Master Advisory Committee members for review and comment. These comments have been incorporated into this final report.

Sincerely yours,


William J. Carswell, Jr., Ph.D.
Delaware River Master

DELAWARE RIVER OPERATIONS

Abstract

A Decree of the United States Supreme Court in 1954 established the position of Delaware River Master. In addition, the Decree authorizes diversions of water from the Delaware River Basin and requires compensating releases from certain reservoirs, owned by New York City, to be made under the supervision and direction of the River Master. The Decree stipulates that the River Master would furnish reports to the Court, not less frequently than annually. This report is the 46th Annual Report of the River Master of the Delaware River. It covers the 1999 River Master report year, that is, the period from December 1, 1998 to November 30, 1999.

During the report year, precipitation in the upper Delaware River Basin was 2.18 inches less than the long-term average. Combined storage in Pepacton, Cannonsville, and Neversink Reservoirs was below normal on December 1, 1998, and hydrologic conditions were approaching drought. Storage increased rapidly in January, however, and the reservoirs continued to fill, but reservoir levels remained below spillway levels by spring. Storage declined steadily from early-June to mid-September, when heavy rains from the remnants of Tropical Storm Floyd fell throughout the basin. Delaware River operations were conducted at reduced levels from December 1, 1998 to February 1, 1999, when near or actual drought-warning conditions prevailed, and at modified levels from June 15 to September 30, 1999, when drought conditions affected the lower basin.

Diversions from the Delaware River Basin by New York City and New Jersey were in compliance with the terms of the Decree or with the reduced limits imposed as a result of drought-warning conditions. Reservoir releases were made as directed by the River Master at rates designed to meet the flow objective for the Delaware River at Montague, N.J. on 155 days during the report year. Releases were made at experimental conservation rates--or rates designed to relieve thermal stress and protect the fishery in the tailwaters of the reservoirs--on all other days.

During the report year, New York City and New Jersey complied fully with the terms of the Decree, and, during drought-warning conditions, with the terms of the "Interstate Water Management Recommendations of the Parties to the Decree" (DRBC Resolution 83-13), other agreements among the Parties to the Decree and the Delaware River Basin Commission, and with the directives of the River Master.

As part of a long-term program, the quality of water in the Delaware Estuary between Trenton, N.J. and Reedy Island Jetty, Del. was monitored at various locations. Data on water temperature, specific conductance, dissolved oxygen, and pH were collected by electronic instruments at 4 sites, and data on water temperature and specific conductance were collected at 1 site. In addition, discrete water-quality data were collected at 3 sites on a monthly basis and at 18 sites on a bi-monthly basis.

Introduction

An Amended Decree of the United States Supreme Court, entered June 7, 1954, authorized diversions of water from the Delaware River Basin and provided for releases of water from certain New York City reservoirs to the Delaware River. The Decree stipulated that these diversions and releases were to be made under the supervision and direction of the Delaware River Master. The Decree also stipulated that reports on Delaware River operations be made to the Court not less frequently than annually. This report documents operations from December 1, 1998 to November 30, 1999, or the 1999 River Master report year. The report also presents contemporaneous information on water quality in the Delaware Estuary.

Some hydrologic data presented in this report are records of streamflow and water quality for U.S. Geological Survey data-collection stations. These records were collected, computed, and furnished by the offices of the U.S. Geological Survey at Troy, New York; Malvern and Lemoyne, Pennsylvania; and Trenton, New Jersey, in cooperation with the States of New York and New Jersey, the Commonwealth of Pennsylvania, and the City of New York. The locations of major streams and reservoirs, and selected streamflow-gaging stations in the Delaware River Basin are shown in figure 1.

Acknowledgments

The River Master's daily operation records were prepared from hydrologic data collected chiefly on a day-to-day basis. Data for these records were collected and computed by the Office of the Delaware River Master or were furnished by the following agencies and utilities: Data for Pepacton, Cannonsville, and Neversink Reservoirs by the New York City Department of Environmental Protection, Bureau of Water Supply; for Lake Wallenpaupack by the Pennsylvania Power & Light Company; and for Rio Reservoir by Orange and Rockland Utilities, Inc. Precipitation data and quantitative precipitation forecasts were provided by the National Weather Service.

Definition of Terms and Procedures

The following definitions apply to various terms and procedures used in the operations documented in this report. A table for converting inch-pound units to the International System of Units (SI) is given on page v.

Capacity. - Total usable volume in a reservoir between the point of maximum depletion and the elevation of the lowest crest of the spillway.

Conservation releases. - Controlled releases from reservoirs designed to maintain specified flows in stream channels below the reservoirs.

Daily excess-release credits. - Daily credits and deficits during the seasonal release period (June 15 to the following March 15) are computed as the arithmetic difference between the daily mean discharge of the Delaware River at Montague, N.J. and 1,750 ft³/s. The daily credit cannot exceed the 24-hour period releases from Pepacton, Cannonsville, and Neversink Reservoirs

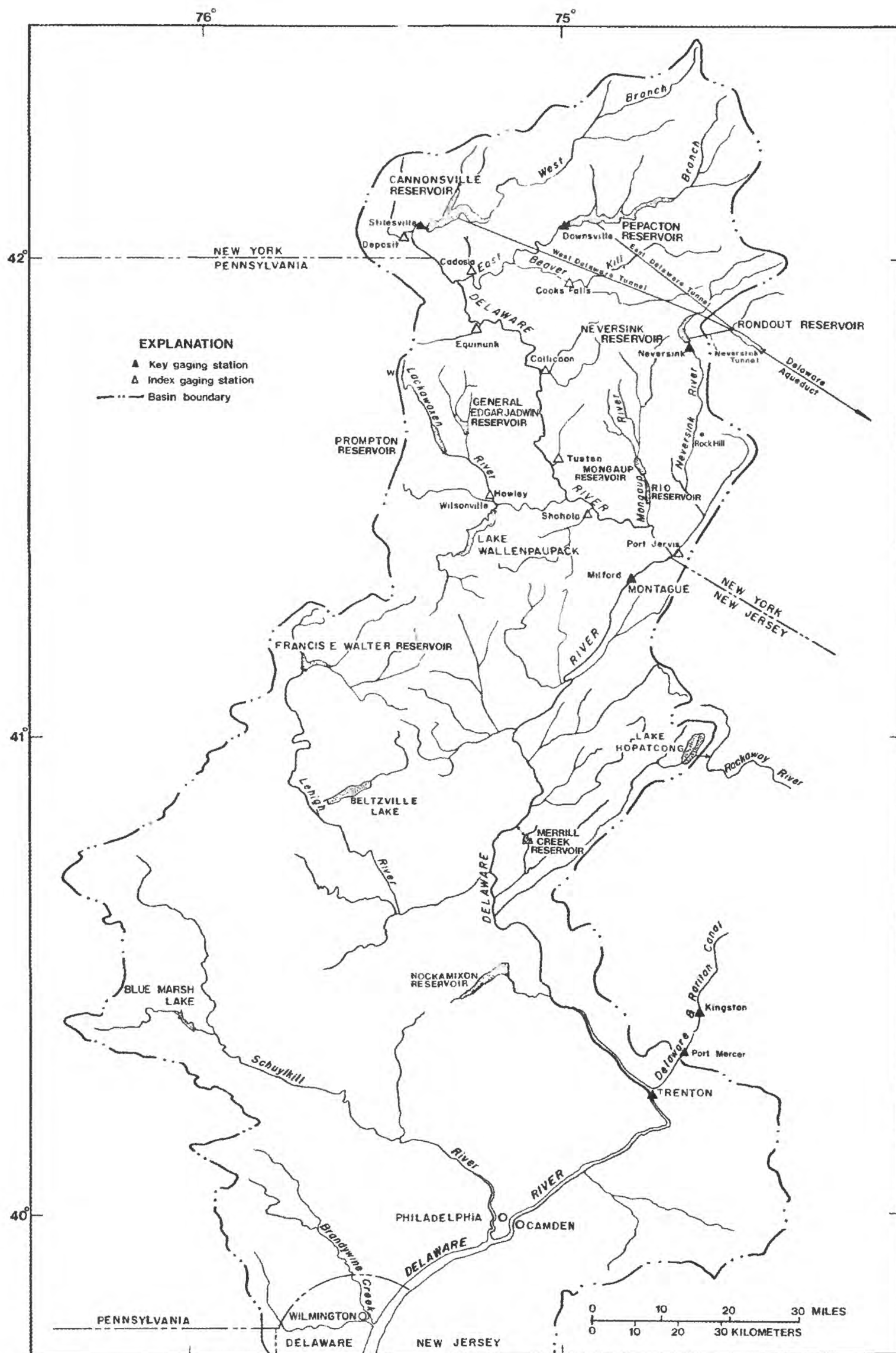


Figure 1. Delaware River Basin above Wilmington, Delaware.

routed to Montague and made in accordance with direction, however, with the following exception: during the seasonal period, credits also are applied for part or all of other releases from these reservoirs that contribute to the daily mean discharge at Montague between 1,750 ft³/s and the applicable excess-release rate.

Directed releases. - Controlled releases from New York City reservoirs in the upper Delaware River Basin, designed by the Delaware River Master to meet the Montague flow objective.

Diversions. - The transfer of water by New York City from Pepacton, Cannonsville, and Neversink Reservoirs in the upper Delaware River Basin through the East Delaware, West Delaware, and Neversink Tunnels, respectively, to the City's water-supply system. Also, the transfer of water by New Jersey from the Delaware River through the Delaware and Raritan Canal.

Excess quantity. - As defined in the Decree, the excess quantity of water is equal to 83 percent of the amount by which the estimated consumption in New York City during the year is less than the City's estimate of continuous safe yield (1,665 Mgal/d stipulated by 1954 Decree) from all its sources of supply obtainable without pumping, except that the excess quantity shall not exceed 70 billion gallons. Each year, the seasonal period for release of the excess quantity begins on June 15. The flow objective for the period becomes effective at Montague on that date and remains in effect until the following March 15, or until the cumulative total of excess-release credits equals the seasonal quantity, whichever occurs first.

Point of maximum reservoir depletion. - Elevation of the top of the highest outlet, sometimes referred to as minimum full-operation level.

Rate of flow. - Mean discharge for a specified 24-hour period, in cubic feet per second or million gallons per day.

Rate of flow at Montague. - Daily mean discharge of the Delaware River at Montague, N.J., computed on a calendar-day basis.

Reservoir-controlled releases. - Controlled releases from reservoirs passed through outlet valves in the dams or through turbines in powerplants. These releases do not include spillway overflow at the reservoirs.

Storage or contents. - Usable volume of water in a reservoir. Unless otherwise indicated, volume is computed on the basis of level pool and above the point of maximum depletion.

Time of day. - Time of day is expressed in 24-hour Eastern Standard Time, which during the report year included a 23-hour day on April 4 and a 25-hour day on October 31.

Uncontrolled runoff at Montague. - Runoff from the drainage area above Montague excluding the drainage area above the Downsville, Cannonsville, Neversink, Wallenpaupack, and Rio Dams, but including spillway overflow at these dams.

Precipitation

Precipitation in the Delaware River Basin above Montague totaled 41.06 in. for the 1999 report year and was 2.18 in. less than the long-term (58-year) average. Monthly precipitation ranged from 45 percent of the long-term average in December 1998 to 244 percent of average in September 1999. Data on monthly precipitation during the report year and long-term average precipitation are presented in table 1¹. These data were computed from records collected by the National Weather Service; the New York City Department of Environmental Protection, Bureau of Water Supply; and the River Master, at 10 geographically distributed stations.

The seasonal period from December to May typically is when surface-water and ground-water reservoirs fill. During this period in 1998-99, average precipitation at the 10 stations was 18.86 inches, which is 93 percent of the 58-year average. During June to November, average precipitation at the 10 stations was 22.20 inches, which was 97 percent of the long-term average. The maximum monthly precipitation was 11.74 inches in September 1999, measured at Rock Hill, New York; the minimum monthly precipitation was 0.96 inches in December 1998, measured at Hawley, Pennsylvania (locations shown on figure 1).

Operations

December to May

Hydrologic conditions in the Delaware River Basin were approaching drought warning in late November. Conservation releases from New York City reservoirs were being made at the experimental release rates shown in table 2. On November 20, 1998, in anticipation of entry into drought warning in the basin, the Parties to the Decree and DRBC agreed to operational modifications pursuant to DRBC Resolution No. 83-13. The modified agreement mandated reductions in New York City's diversions from reservoirs in the Delaware River Basin to 680 Mgal/d. The Montague flow objective was reduced to 1,655 ft³/s and the Trenton flow objective was reduced to 2,700 ft³/s. The remainder of the excess-release bank (903 (ft³/s)·d or 0.584 Bgal) was placed in a fishery protection bank for use during drought warning. Water from this bank was to be used to enhance winter basic conservation releases by increasing the releases to the levels of the summer basic conservation releases. A copy of the agreement authorizing this action is presented in Appendix A.

1. All numbered tables in the section "Delaware River Operations" are grouped at the end of this section, beginning on page 31.

On December 1, 1998, the Parties to the Decree and DRBC agreed to additional operational modifications pursuant to DRBC Resolution No. 83-13. The new modified agreement maintained reductions in New York City's diversions from reservoirs in the Delaware River Basin at 680 Mgal/d. The Montague flow objective was continued at the reduced rate of 1,655 ft³/s and the Trenton flow objective was continued at the reduced rate of 2,700 ft³/s until such time when combined storage in the New York City reservoirs entered into the lower half of drought-warning zone of the operation curves. Diversions by New Jersey would continue at 100 Mgal/d until combined storage entered into the upper half of drought-warning zone. The fishery protection bank would be used during drought warning and would expire when combined storage entered the drought zone or one of the reservoirs spilled. In addition, the agreement stipulated that water could be saved by reductions in directed releases and added to the fishery protection bank. The Delaware River Master would continue to use a balancing adjustment to help conserve water. If storage in the New York City Delaware River Basin reservoirs entered into the lower half of the drought-warning zone, diversions and flow objectives at Montague and Trenton would be determined according to DRBC Resolution No. 83-13. This agreement was designed to expire on April 15, 1999, if not terminated before this date for reasons specified above. A copy of the modified agreement is included in this report as Appendix B.

The fishery protection bank balance was 903 (ft³/s)·d on December 1, 1998, the start of the River Master year. A total of 173 (ft³/s)·d was released to protect the fishery and 625 (ft³/s)·d was set aside in the bank through reductions in releases to meet the Montague flow objective from December 2, 1998, when the agreement became effective, to April 15, 1999, when the agreement expired. The fishery releases and the reductions in release requirements are summarized in table 3.

Combined storage in New York City reservoirs entered into the lower half of the drought-warning zone on December 23, 1998. Average diversions by New York City were reduced to 560 Mgal/d and by New Jersey to 70 Mgal/d. The Montague flow objective was reduced to 1,550 ft³/s, effective December 26, 1998. Reservoir releases were reduced to basic conservation rates (table 2).

On February 2, 1999, combined reservoir storage was 15 Bgal above drought warning for the fifth consecutive day. Allowable diversions to New York City and New Jersey were restored to 800 and 100 Mgal/d, respectively. The Montague flow objective was increased to 1,750 ft³/s, effective February 5, 1999. On February 20, 1999, conservation releases from New York City reservoirs were increased to the experimental release rates shown in table 2.

From December 1998 to May 1999, the first half of the report year, total precipitation was 1.44 inches below average. Monthly precipitation ranged from 45 percent of the long-term average in December 1998 to 190 percent in January 1999 (table 1). Runoff in the upper basin was below normal during December, April, and May; above normal during January; and in the normal range during February and March.

On December 1, 1998, when the 1999 report year began, Pepacton Reservoir contained 85.116 Bgal of water in storage above the point of maximum depletion, or 60.7 percent of the 140.190 Bgal storage capacity. Cannonsville Reservoir contained 22.237 Bgal, or 23.2 percent of the 95.706 Bgal storage capacity. Neversink Reservoir contained 12.329 Bgal, or 35.3 percent of the 34.941 Bgal storage capacity. Combined storage in these reservoirs on December 1 was 119.682 Bgal, or 44.2 percent of combined capacity. Daily storage in Pepacton, Cannonsville, and Neversink Reservoirs is shown in tables 4, 5, and 6, respectively, and combined storage is illustrated in figure 2.

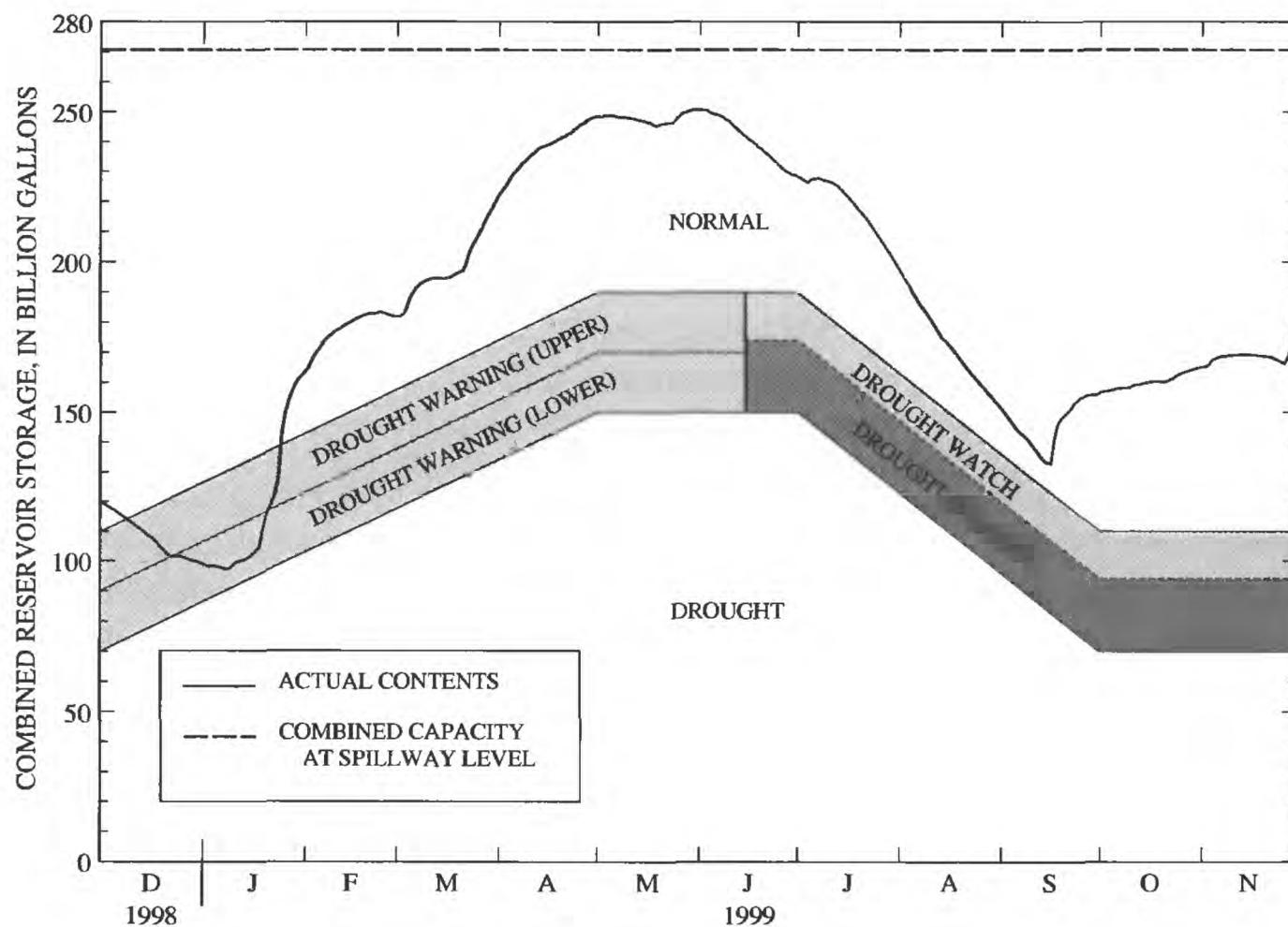


Figure 2. Operation curves and actual contents for New York City reservoirs in the Delaware River Basin, December 1, 1998 to November 30, 1999. (Sources: Operation curves from Interstate Water Management Recommendations of the Parties to the U.S. Supreme Court Decree of 1954 and DRBC Docket No. D-77-20-CP (Revision No. 4); reservoir contents from New York City Bureau of Water Supply data).

From December to May, inflow to the City's reservoirs typically exceeds outflow and consequently, the amount of water in storage increases. The average inflow to Pepacton, Cannonsville, and Neversink Reservoirs for these 6 months during the 58-year period from December 1940 to May 1998 was 303.5 Bgal. During the corresponding 6 months of the current report year, inflow to the three reservoirs totaled 235.6 Bgal. Evaporation loss is not included in the computations.

Combined storage decreased from December to mid-January. Substantial precipitation in the second half of January, however, in combination with above-normal temperatures, resulted in large volumes of runoff and a rapid increase in storage during January. Combined storage continued to increase, although more gradually, from February to early May. The combined storage of the reservoirs was about 93 percent of full capacity at the end of May.

Combined storage in the three New York City reservoirs was 120.291 Bgal on November 30, 1998 and 250.784 Bgal on May 31, 1999, a net increase of 130.493 Bgal or 48.2 percent of capacity. The maximum combined storage during the period from December to May was 250.784 Bgal on May 31. Typically, maximum storage in the individual reservoirs occurs on different days. Maximum storage in Pepacton Reservoir during the December to May period was 130.422 Bgal on May 31; maximum storage in Cannonsville Reservoir was 90.382 Bgal on May 1; and

maximum storage in Neversink Reservoir was 31.578 Bgal on May 31, 1999. These reservoirs did not spill during the December to May period.

During the December to May period, diversions to Rondout Reservoir by New York City totaled 83.446 Bgal (458 Mgal/d). The forecasted discharge at Montague, exclusive of water released from the City reservoirs, was less than the flow objective on 49 days in December, January, and May, and releases were directed. The observed daily mean discharge at Montague was less than the applicable flow objective on 28 days. On 21 of the 28 days, observed flows were within 10 percent of the flow objective and on 7 days, flows were more than 10 percent below the applicable flow objective.

The total discharge measured at Montague, the portion derived from uncontrolled runoff from the drainage area below the reservoirs, the portion contributed by power reservoirs, and the portion contributed by Pepacton, Cannonsville, and Neversink Reservoirs during December and January are shown on figure 3. Applicable design rates for the gaging station Delaware River at Montague, N.J. are presented in table 7.

June to November

Monthly precipitation from June to November was below average in all months except for September, which was much above average because of the remnant effects of Tropical Storm Floyd. Total precipitation during the period was 22.20 inches or 0.74 inches less than the 58-year average (table 1).

Releases were directed to meet the Montague flow objective on 106 days between June 1 and November 30, 1999, when the forecasted discharge at Montague, exclusive of water released from the New York City reservoirs, was less than 1,750 ft³/s. Releases at experimental conservation rates or at rates designed to protect the fishery were made at other times during the period. River Master records show that from May 29 to September 7, a total of 2,790 (ft³/s)-d or 1.803 Bgal was released to help relieve thermal stress in the upper Delaware River Basin.

From June 1 to June 14, the Montague flow objective was 1,750 ft³/s. The forecasted flow, exclusive of releases from Pepacton, Cannonsville, and Neversink Reservoirs, fell below the flow objective on 8 days and releases were directed. On 3 of the 8 days, the observed flow was less than the flow objective, although on all 3 days, flows were within 10 percent of the flow objective.

The New York City Department of Environmental Protection, Bureau of Water Supply, Quality, and Protection furnished the River Master with the following data for the 1999 calendar year, as stipulated in the Decree:

1. The estimated continuous safe yield from all the City's sources, obtainable without pumping, is 1,665 Mgal/d, or a total during calendar year 1999 of 1.665 Bgal/d x 365 days = 607.725 Bgal.

2. The estimated consumption that the City must provide for, from all its sources of supply during calendar year 1999, is 591.582 + 7.250 = 598.832 Bgal.

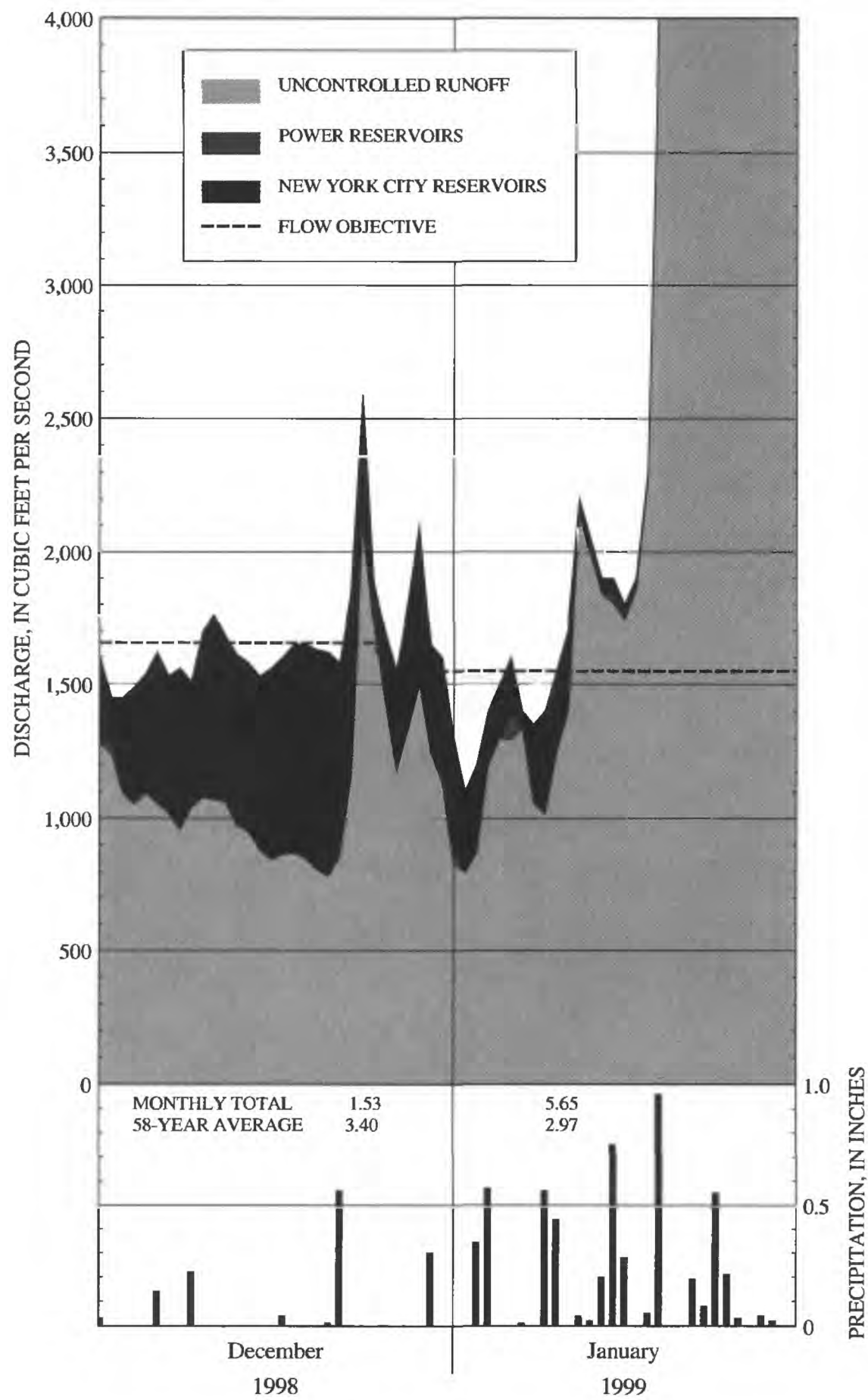


Figure 3. Components of flow, Delaware River at Montague, N.J., December 1, 1998 to January 31, 1999.

On the basis of the Decree and the above data, the aggregate quantity of excess-release water was 83 percent of (607.725 - 598.832), or 7.381 Bgal.

Data on water consumption by the City of New York for each calendar year since 1950, from all sources of supply, are presented in table 8.

Modifications to reservoir release programs in DRBC Docket No. D-77-20 CP (Revision No. 4) were made on April 28, 1999. As part of these modifications, 50 percent of the annual excess-release quantity was placed in a fishery-protection bank to augment releases during drought warning. The remainder of the excess-release quantity would be used to provide a proportionally reduced increase in the Montague flow objective or could be banked in accordance with the procedures outlined in the Lower Basin Drought Management Plan. Other modifications included redesignation of the upper drought-warning zone of the reservoir operation curves as the "drought-watch zone." A copy of these modifications is attached to this report as Appendix C.

On May 19, 1999, at the Delaware River Master Advisory Committee meeting, the Parties to the Decree agreed to suspend the excess quantity in response to the existing and forecasted dry conditions in the basin. A copy of this agreement is included in this report as Appendix D.

On June 15, 1999, the normal beginning of the seasonal excess-release period, the Montague flow objective remained at 1,750 ft³/s. From June to mid-September, precipitation was below normal. On July 13, the DRBC began requesting releases from the excess-release bank to provide lower basin drought assistance in accordance with procedures in section 2.5.6A of DRBC Resolution 88-22 (Revised). This release program was administered by the River Master office. Between July 13 and August 14, a total of 3.69 Bgal or 5,709 (ft³/s)·d was released to maintain the Trenton flow objective. A summary of daily operations for the Delaware River at Montague and Trenton, N.J. during the implementation of the Lower Basin Drought Management Plan is given in table 9.

On July 21, the DRBC Commissioners and the Parties to the Decree reduced the flow objective at Trenton from 3,000 ft³/s to 2,700 ft³/s to conserve storage in the lower basin reservoirs. A copy of this temporary modification is attached to this report as Appendix E.

On August 18, with drought conditions persisting in parts of the basin, DRBC took emergency actions to preserve and protect water supplies and to support drought-warning and emergency programs of the four basin states. A copy of DRBC Resolution No. 99-18, which describes the emergency actions, is included in this report as Appendix F. The same day, Orange and Rockland Utilities, Inc. reduced the conservation release at Swinging Bridge, Mongaup Falls, and Rio Dams on the Mongaup River to 30 ft³/s to conserve water. This action was in accordance with Federal Energy Regulatory Commission license requirements for the Rio generating facility.

As mentioned previously, the drought was broken in mid-September 1999 when remnants of Tropical Storm Floyd delivered heavy rains throughout the basin. On September 27, with much improved hydrologic conditions, Orange and Rockland Utilities, Inc. restored the conservation releases to normal rates. On September 30, through DRBC Resolution No. 99-22, DRBC terminated the drought-emergency actions specified in DRBC Resolution No. 99-18. A copy of DRBC Resolution No. 99-22 is attached as Appendix G.

The drought of 1998-99 in the Delaware River Basin was one of the most severe short-term droughts of the 20th century. Staff of the River Master's office prepared a separate report¹ to document the effects of the drought on streamflow, reservoir storage, and ground-water levels. Copies of the report were provided to the Court, the Parties to the Decree, the Delaware River Basin Commission, and other agencies, organizations, and individuals.

Between June 15 and September 16, 1999, the forecasted flow at Montague, exclusive of releases from the New York City reservoirs, was less than the flow objective on 92 days and releases were directed. On 29 days during the June 15 to September 16 period, the observed flow was less than the flow objective. On 21 of the 29 days, observed flows were within 10 percent of the flow objective and, on 8 days, flows were more than 10 percent below the flow objective. Between November 22 and November 27, 1999, the forecasted flow at Montague, exclusive of releases from New York City reservoirs, was less than the flow objective on 6 days and releases were directed. Applicable design rates for the gaging station Delaware River at Montague, N.J. are presented in table 7.

The total discharge measured at Montague, the portion derived from uncontrolled runoff from the drainage area below the reservoirs, the portion contributed by power reservoirs, and the portion contributed by Pepacton, Cannonsville, and Neversink Reservoirs from May to September are shown graphically on figure 4. In analyzing the water budget for Montague, uncontrolled runoff was computed as the residual of observed flow minus releases and spill from all reservoirs, and, therefore, was subject to errors in observations, transit times, and routing of the various components of flow. The conservation release of 30 or 100 ft³/s from Rio Reservoir is included in the uncontrolled-runoff component. The net effect of these uncertainties is incorporated in the derived hydrograph of uncontrolled runoff. Diversions to Rondout Reservoir from June 1 to November 30, 1999 totaled 119.026 Bgal.

1. Paulachok, G.N., Krejmas, B.E., and Soden, H.L., 2000, Hydrologic aspects of the 1998-99 drought in the Delaware River Basin: U.S. Geological Survey Water-Resources Investigations Report 00-4112, 29 p.

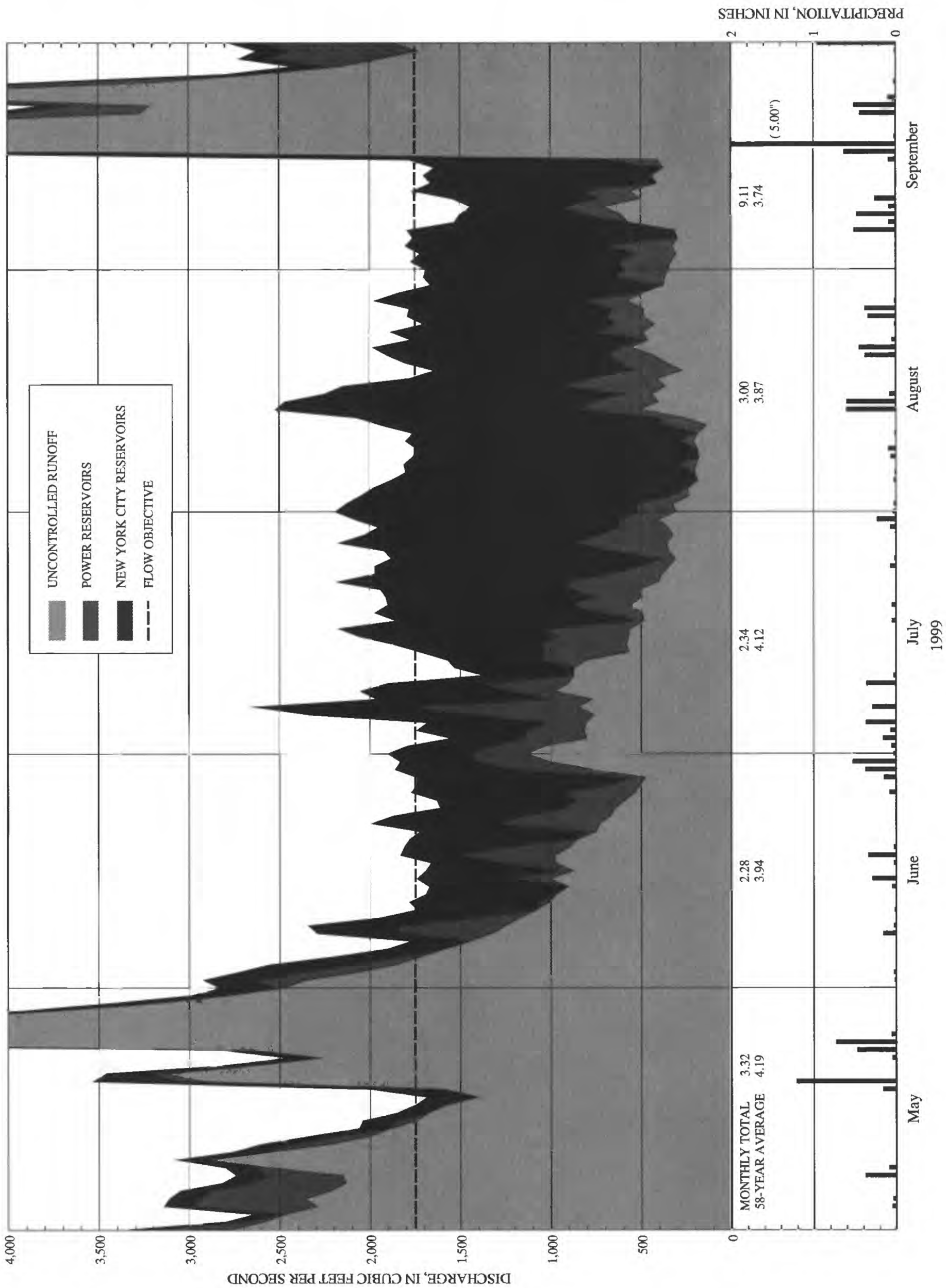


Figure 4. Components of flow, Delaware River at Montague, N.J., May 1 to September 30, 1999.

Summary of Operations

From December 1, 1998 to November 30, 1999, diversions from three New York City reservoirs in the Delaware River Basin to Rondout Reservoir totaled 202.472 Bgal, and all releases from the three reservoirs to the Delaware River totaled 99.153 Bgal. Actual directed releases to the Delaware River from these reservoirs totaled 81.137 Bgal.

During the year, maximum storage in Pepacton Reservoir was 130.652 Bgal on June 2; 90.382 Bgal in Cannonsville Reservoir on May 1; and 31.639 Bgal in Neversink Reservoir on June 1. Maximum combined storage in the three reservoirs was 250.784 Bgal on May 31, 1999. None of the reservoirs spilled during the year.

During the year, minimum storage in Pepacton Reservoir was 69.725 Bgal (49.7 percent of capacity) on January 8, 1999; 16.648 Bgal (17.4 percent of capacity) in Cannonsville Reservoir on December 22, 1998; and 9.095 Bgal (26.0 percent of capacity) in Neversink Reservoir on December 3, 1998. Minimum combined storage in the three reservoirs was 97.097 Bgal on January 8, 1999.

On November 30, 1999, the end of the report year, combined storage in the three reservoirs was 175.936 Bgal or 65.0 percent of combined capacity. During the year, the net change in combined storage was 55.645 Bgal, or an increase in contents of 20.5 percent.

The distribution of combined storage for the three reservoirs on the first day of the month, for the reference period June 1967 to November 1998, and for the report year, is shown in figure 5. Storage was below median in every month of the year except November. Storage was below the 25th percentile in December, January, and March through September.

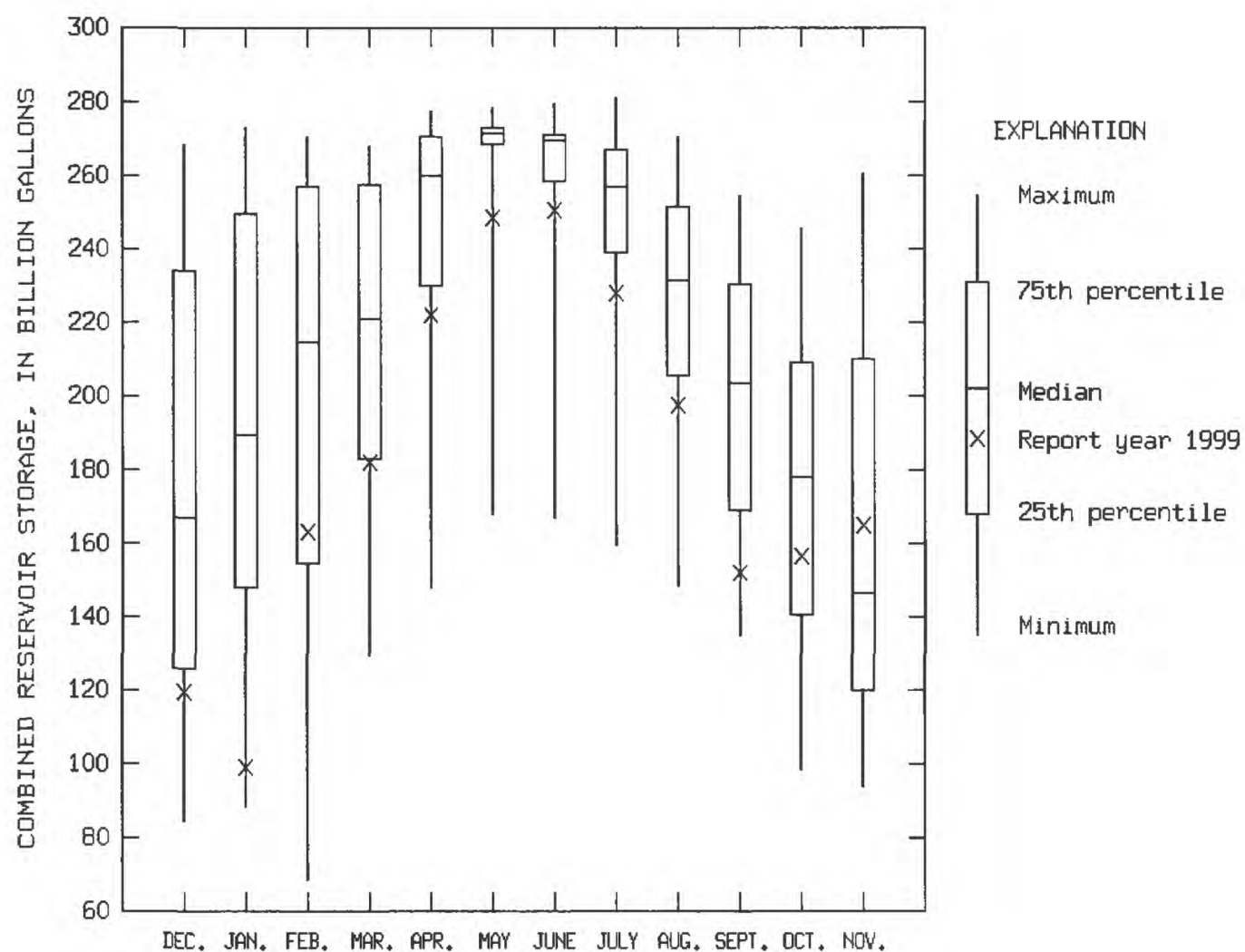


Figure 5. Combined storage in Pepacton, Cannonsville, and Neversink Reservoirs on the first day of the month, December 1998 to November 1999 (this report year), and summary statistics for the period of record, June 1967 to November 1998.

Supplemental Releases From Wallenpaupack Powerplant

An agreement between Pennsylvania Power & Light Company and New York City provides for supplemental releases from the Wallenpaupack hydroelectric powerplant if the Delaware River Basin Commission requests compensation for water consumed at the company's Martins Creek steam-electric generating station. Releases may be requested if the flow of the Delaware River at Trenton, N.J. is expected to be less than 3,000 ft³/s for more than 3 consecutive days. No supplemental releases were requested during the report year.

Streamflow

Components of Flow, Delaware River at Montague, N.J.

The data and computations of the various components of flow form the basic operational records used by the River Master to carry out specific responsibilities related to the Montague formula. The operational record has two parts: forecasted flow at Montague, exclusive of controlled releases from New York City's reservoirs (table 10), and segregation of components of daily mean flow at Montague (table 11).

The following components may be present in the flow of the Delaware River at Montague:

1. Controlled releases from Lake Wallenpaupack on Wallenpaupack Creek, for the production of hydroelectric power.
2. Controlled releases from Rio Reservoir on Mongaup River, for the production of hydroelectric power.
3. Runoff from the uncontrolled area above Montague, including spill from New York City reservoirs.
4. Controlled releases from Pepacton, Cannonsville, and Neversink Reservoirs of New York City.

The releases from New York City's reservoirs necessary to maintain the Montague objective were computed from the forecasted flow at Montague, exclusive of controlled releases from the reservoirs.

Time of Travel

Following are average times for the effective travel of water from the various sources of controlled supply to Montague. These times were used for flow routing during the 1999 report year:

<u>Source</u>	<u>Hours</u>
Pepacton Reservoir	60
Cannonsville Reservoir	48
Neversink Reservoir	33
Lake Wallenpaupack	16
Rio Reservoir	8

The travel times were computed from reservoir and powerplant operations data and historical gaging-station records. They generally are suitable for use in the operations of the River Master. Occasionally, however, notable exceptions are observed. For example, when a large release from Cannonsville Reservoir follows a small release, a substantial portion of the water fills the channel en route, and the remainder may arrive at Montague as much as 18 hours later. During winter, the development of ice cover, together with low streamflow, gradually increases the resistance to flow, resulting in increased travel times. Because ice-affected travel times increase gradually over several days, and releases generally were not being directed to meet the Montague objective during periods of ice cover, no adjustments were made to compensate for increased travel times during these periods.

Segregation of Flow At Montague

The River Master daily operations record of reservoir releases and segregation of the various components contributing to the flow of the Delaware River at Montague are presented in table 11. The data are arranged to conform to the downstream movement of water from the various sources to Montague. Summation of data along individual lines in the table is equivalent to routing the various flow contributions to Montague, using the average travel times given previously. Uncontrolled runoff was computed as a residual by subtracting the flow contributions of all other sources from the observed discharge at Montague.

Computation of Directed Releases

During the report year, the River Master used the following information for daily operations: (1) discharges computed from recorded or reported stream gage heights, for various 24-hour periods, without current information on any changes in stage-discharge relations; (2) daily discharge from New York City's three reservoirs, measured with venturi meters; (3) rainfall reports for the previous 24 hours; (4) actual powerplant releases converted to daily discharge; (5) advance estimates of power demand converted to daily discharge; (6) advance estimates of uncontrolled runoff at Montague; and (7) average times for routing of water from the various sources. Although variable uncertainty is inherent in estimating future conditions, these data nevertheless must be used in the daily designs and direction of releases.

The travel time of water from Pepacton Reservoir to Montague (60 hours) is greater than the travel time of water from any other reservoir. Releases from Cannonsville and Neversink Reservoirs were timed to arrive at Montague concurrently with releases from Pepacton Reservoir. To allow for differences in travel times, daily directed releases were scheduled to begin from Pepacton at 1200 hours, from Cannonsville at 2400 hours, and from Neversink at 1500 hours the following day.

Releases from the City's reservoirs required to maintain the specified flow at Montague were computed from estimates of releases from Lake Wallenpaupack and Rio Reservoir and forecasts of uncontrolled runoff at Montague. To account for the travel times from these sources to Montague, the computation requires that estimates of the following components of flow be made

two or more days in advance: (1) release of water from Lake Wallenpaupack; (2) release of water from Rio Reservoir; and (3) uncontrolled runoff at Montague. The River Master daily operations record for computing daily directed release requirements during periods of low flow is given in table 10.

The electric utilities furnished advance estimates of power generation and releases. Because the hydroelectric plants were used chiefly for meeting peak-power demands, advance estimates were subject to various modifying factors including the vagaries of weather on electricity demand. In addition, because the power companies are members of regional power pools, demand for power outside of the local service area unexpectedly may affect generation schedules. As a result, at times, the actual use of water for power generation differed considerably from the advance estimates that were used in the design of reservoir releases.

For computational purposes during periods of low flow, estimates of uncontrolled runoff at Montague were treated as two components: (1) current runoff and (2) forecasted increase in runoff from precipitation. Estimates for these components are given in table 10.

During ice-free conditions, current runoff was computed using a routing and recession procedure based on discharges at 0800 hours at the following USGS gaging stations:

Station Name	Drainage Area (mi ²)
Beaver Kill at Cooks Falls, N.Y.	241
Cadosia Creek at Cadosia, N.Y.	17.9
Oquaga Creek at Deposit, N.Y.	67.6
Equinunk Creek at Equinunk, Pa.	56.3
Callicoon Creek at Callicoon, N.Y.	110
Tenmile River at Tusten, N.Y.	45.6
Lackawaxen River at Hawley, Pa.	290
Shohola Creek near Shohola, Pa.	83.6
Neversink River at Port Jervis, N.Y.	336

During the winter period, the advance estimate of uncontrolled runoff (current conditions) was made on the basis of flows at a reduced network of gaging stations and the recession curve for computed uncontrolled flow at Montague.

The forecasted runoff from precipitation is shown in table 10 under the heading "Weather Adjustment." Throughout the low-flow periods, the National Weather Service office at Binghamton, N.Y., furnished quantitative forecasts of average precipitation and air temperatures, for the drainage area above Montague, for each day of the 3-day design period. During winter, runoff was estimated on the basis of the current status of snow and ice, along with forecasted precipitation and temperature. During other periods, the forecasted precipitation was used to estimate runoff.

The forecasted flow at Montague, exclusive of releases from New York City's reservoirs (table 10), is computed as the sum of forecasted releases from power reservoirs, estimated

uncontrolled runoff including conservation releases from Rio Reservoir, and weather adjustments. If the computed flow was less than the desired flow at Montague, then the deficiency was made up by directed releases from the City's reservoirs.

When forecasts of precipitation or powerplant releases were revised appreciably, the releases required from the reservoirs were recomputed. Commonly, this procedure resulted in a reduced release requirement for New York City reservoirs for that day and, consequently, water was conserved. Only the final figures for releases from New York City reservoirs are given in table 10.

Analysis of Forecasts

Forecasts of streamflow at Montague, developed on the basis of anticipated contributions from the components described previously (excluding releases from New York City's reservoirs), differed on most days from observed flow. Occasionally, variations in the components were partially compensating and observed flows were in good agreement with forecasted flows.

The forecasted flow of the Delaware River at Montague, exclusive of releases from New York City reservoirs, was less than the flow objective on most days from June 7 to September 16, 1999. The following tabulation compares estimates of three contributions to flow at Montague with actual operations during this period.

Releases and Runoff	Forecasted flow [(ft ³ /s)·d]	Actual flow [(ft ³ /s)·d]
Power releases		
Lake Wallenpaupack	15,518	18,046
Rio Reservoir	1,788	6,139
Runoff from uncontrolled area	64,122	61,568

From June 7 to September 16, actual releases from Lake Wallenpaupack averaged 16 percent more than forecasted amounts, and actual releases from Rio Reservoir averaged 243 percent more than forecasted amounts. Observed runoff from the uncontrolled area was about 4 percent less than forecasted runoff.

On any given day, the forecasted flow and the actual flow can differ considerably. The range of actual daily flows from June 7 to September 16 are as follows: daily releases at Lake Wallenpaupack differed by 257 ft³/s less to 319 ft³/s more than forecasted releases, and daily releases at Rio Reservoir differed by 110 ft³/s less to 358 ft³/s more than forecasted releases. On the basis of observed flows at Montague, total directed releases from New York City's reservoirs during the report year were 2.2 percent more than required for exact forecasting.

Comparison of hydrographs of forecasted daily runoff and actual daily runoff (fig. 6) from the uncontrolled area indicates that the forecasts generally were adequate for use in designing

releases from New York City's reservoirs. Numerical adjustments to the designs were made when needed to compensate for errors in the forecasts, but because of travel times, the effects of the adjustments on flows at Montague are not evident until several days after the design date.

Analysis of the precipitation forecasts shows that the total precipitation amount forecasted for the 3-day design periods is fairly accurate, but often the timing of storms may be either earlier or later than forecasted. The accuracy of the runoff forecasts is affected greatly by the timing of precipitation events. In addition, if the actual storm track differs from the forecasted track, the amount and timing of runoff can be appreciably different than predicted.

Diversions to New York City Water Supply

The 1954 Amended Decree authorizes New York City to divert water from the Delaware River Basin at a rate not to exceed 800 Mgal/d. The Decree also specifies that the rate of diversions shall be computed as the aggregate total diversion beginning on June 1 of each year divided by the number of days elapsed since the preceding May 31.

Diversions during the report year from Pepacton, Cannonsville, and Neversink Reservoirs to the New York City water-supply system (Rondout Reservoir) are given in table 12. Included is a running account of the average rates of combined diversions from the three reservoirs, computed as prescribed by the Decree or the "Interstate Water Management Recommendations of the Parties to the Decree (DRBC Resolution 83-13)." The following tabulation shows allowable maximum diversion rates and average actual diversions for various periods during the report year.

Effective dates	Allowable diversions (Mgal/d)	Average actual diversions (Mgal/d)
November 21 to December 22, 1998	680	667
December 23, 1998 to February 1, 1999	560	293
February 2 to May 31, 1999	800	470
June 1 to November 30, 1999	800	650

During the year, a total of 202.472 Bgal of water was diverted to the New York City water-supply system. The allowable diversion was 280.467 Bgal.

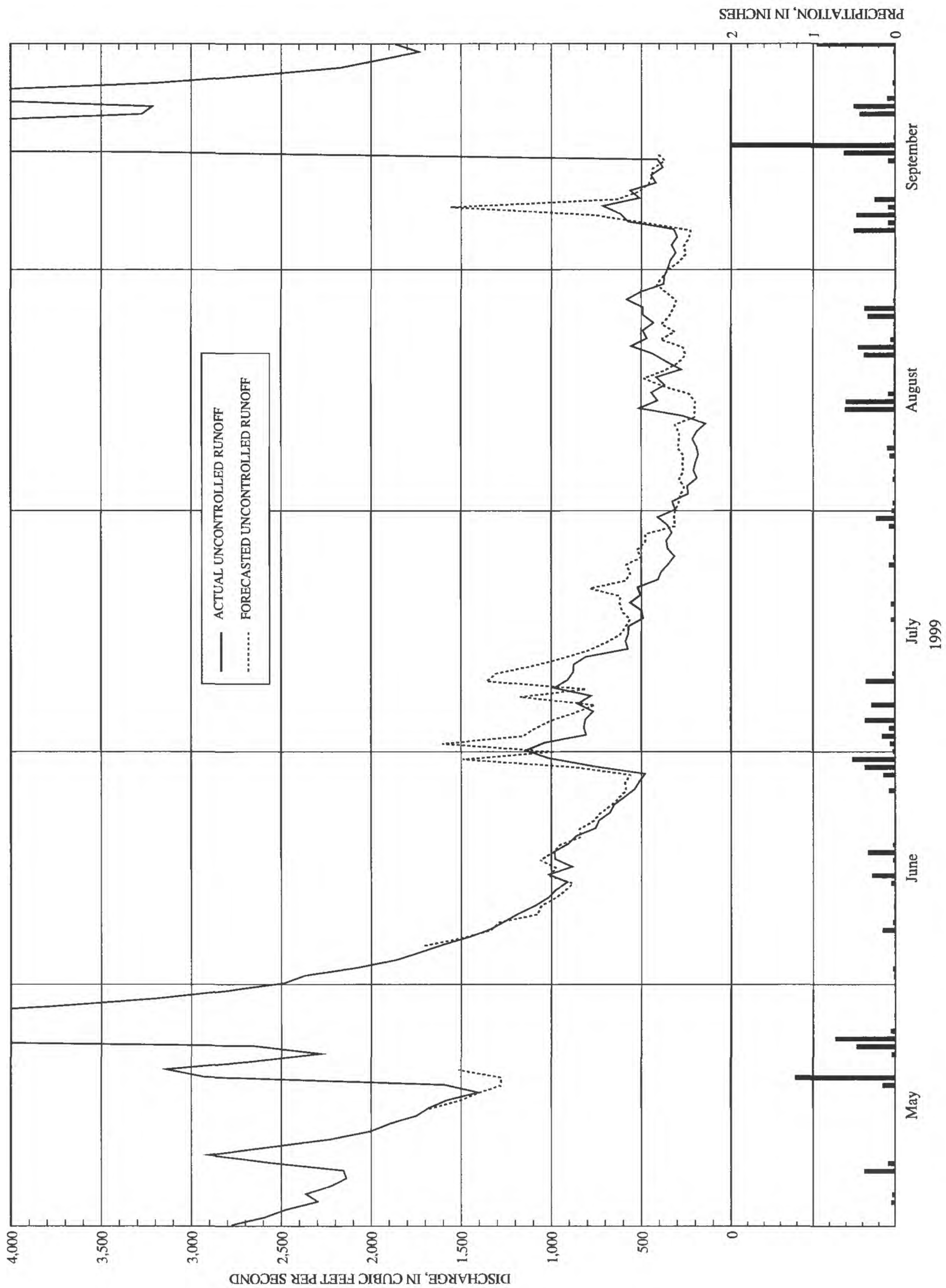


Figure 6. Uncontrolled runoff component, Delaware River at Montague, N.J., May 1 to September 30, 1999.

Storage in New York City Reservoirs

The following tabulation summarizes the “point of maximum depletion” and other pertinent levels and contents of Pepacton, Cannonsville, and Neversink Reservoirs. This information was provided by the New York City Board of Water Supply.

Level	Pepacton Reservoir		Cannonsville Reservoir		Neversink Reservoir	
	Elevation (ft.)	Contents (Bgal)	Elevation (ft.)	Contents (Bgal)	Elevation (ft.)	Contents (Bgal)
Full pool or spillway crest	1,280.00	*140.190	1,150.00	*95.706	1,440.00	*34.941
Point of maxi- mum depletion	1,152.00	*3.511	1,040.00	*1.020	1,319.00	*.525
Sill of diversion tunnel	1,143.00	*4.200	+1,035.00 1,020.50	*1.564	1,314.00	
Sill of river outlet tunnel	1,126.50				1,314.00	
Dead storage		1.800		0.328		1.680

*Contents shown are quantities stored between listed elevations.

+Elevation of mouth of inlet channel of diversion works.

Storage in Pepacton, Cannonsville, and Neversink Reservoirs, above the “point of maximum depletion” or minimum full-operating level, is given in tables 4, 5, and 6.

On December 1, 1998, combined storage in the three reservoirs was 119.682 Bgal, or 44.2 percent of combined capacity. As discussed previously, storage increased from below normal to normal during the winter period. None of the three reservoirs spilled during the year. Combined storage reached a maximum for the year on May 31, 1999. The seasonal decline in storage began in early June. Combined storage declined to 175.936 Bgal, or 65.0 percent of combined capacity on November 30, 1999.

Comparison of River Master Operations Data With Other Streamflow Records

River Master operations essentially are day-to-day operations, which by necessity use preliminary data on streamflow. In this section, records used in River Master operations are compared to final data published for U.S. Geological Survey gaging stations. The data on releases were reported in million gallons per day and converted to cubic feet per second for use in the comparisons.

Releases from New York City Reservoirs

River Master operations data on controlled releases from Pepacton, Cannonsville, and Neversink Reservoirs to the Delaware River were furnished by New York City. These data were obtained from calibrated instruments connected to venturi meters installed in the outlet conduits of the reservoirs.

The U.S. Geological Survey gaging station on East Branch Delaware River at Downsville, N.Y. is 0.5 mile downstream from Pepacton Reservoir Dam (fig. 1). Discharge measured at this station includes releases from Pepacton Reservoir and a small amount of seepage and any runoff that enters the channel between the dam and the gaging station. The drainage area is 371 mi² at the dam and 372 mi² at the gaging station.

The following tabulation compares releases from Pepacton Reservoir (table 11), reported by New York City, to the final records for the USGS gaging station on East Branch Delaware River at Downsville, N.Y. (table 13), for the flow objectives shown.

Flow objective (ft ³ /s)	6	19	45	70	95
NYC-measured flow (ft ³ /s)	6.2	18.6	45.2	69.6	94.1
USGS-measured flow (ft ³ /s)	7.4	19.0	43.3	68.5	89.0
Percent difference*	-16.2	-2.1	+4.4	+1.6	+5.7

*Computed as $\frac{(\text{NYC measured flow minus USGS measured flow})}{(\text{USGS measured flow})} \times 100$

The differences at all flow rates except 6 ft³/s are small. The River Master's office made three discharge measurements during the year. These measurements yielded differences similar to those in the tabulation at the 6 ft³/s, 45 ft³/s and 95 ft³/s flow rates. The calibration of instruments connected to the venturi meters was adjusted periodically by New York City to improve the accuracy of the readings.

The U.S. Geological Survey gaging station on West Branch Delaware River at Stilesville, N.Y. is 1.4 miles downstream from Cannonsville Dam (fig. 1). Discharge measured at this station includes releases from Cannonsville Reservoir and runoff from 2 mi² of drainage area between the dam and the gaging station. The drainage area is 454 mi² at the dam and 456 mi² at the gaging station.

The following tabulation compares releases from Cannonsville Reservoir (table 11), reported by New York City, to the final records for the USGS gaging station on West Branch Delaware River at Stilesville, N.Y. (table 14), for the flow objectives shown.

Flow objective (ft ³ /s)	8	23	45	160-500	500-900	900-1,300	1,300-1,600
NYC-measured flow (ft ³ /s)	7.7	23.2	44.6	316	634	1,058	1,461
USGS-measured flow (ft ³ /s)	14.7	30.8	50.9	286	560	1,001	1,384
Percent difference*	-47.6	-24.7	-12.4	+10.5	+13.2	+5.7	+5.6

*Computed as $\frac{(\text{NYC measured flow minus USGS measured flow})}{(\text{USGS measured flow})} \times 100$

The gaging-station records are considered fair at flows greater than 100 ft³/s and poor at flows less than 100 ft³/s. The records include runoff from precipitation on the area between the dam and the gaging station and seepage near the base of the dam. On January 21, 1998, the seepage was measured at 3.9 ft³/s, which was greater than rates estimated in previous years. The differences in flow between reservoir-release records and USGS gaging-station records continue to be monitored by the River Master's office, in cooperation with New York City and the USGS District office in Troy, N.Y. To further investigate the differences, two discharge measurements were made during the report year, just below the Cannonsville release outlet. By measuring flow at this location, most of the runoff contribution from the intervening area between the outlet and the gaging station is eliminated, but seepage near the base of the dam is included. The first measurement differed from New York City release records by -23 percent (unadjusted) and +25 percent when adjusted for the seepage of 3.9 ft³/s for the 8 ft³/s flow objective. The second measurement differed from New York City release records by -3.7 percent (unadjusted) and +4.7 percent (adjusted) for the 45 ft³/s flow objective.

The U.S. Geological Survey gaging station on Neversink River at Neversink, N.Y. is 1,650 feet downstream from Neversink Dam (fig. 1). Discharge measured at this station includes releases from Neversink Reservoir and, during storms, a small amount of runoff that originates between the dam and the gaging station. The drainage area is 92.5 mi² at the dam and is 92.6 mi² at the gaging station.

The following tabulation compares releases from Neversink Reservoir (table 11), reported by New York City, to the final records for the USGS gaging station on Neversink River at Neversink, N.Y. (table 15), for the flow objectives shown.

Flow objective (ft ³ /s)	5	25	53	70	90 -140
NYC-measured flow (ft ³ /s)	4.6	24.6	52.6	69.5	108
USGS-measured flow (ft ³ /s)	5.2	24.7	52.3	65.2	97.0
Percent difference*	-11.5	-0.4	+0.6	+6.6	+11.3

*Computed as $\frac{(\text{NYC measured flow minus USGS measured flow})}{(\text{USGS measured flow})} \times 100$

The flow objectives are the basic and experimental conservation release rates except for the two highest release rates, which represent elevated rates of release for thermal protection during the report year. The River Master's office made three discharge measurements during the year to further investigate the differences between reservoir-release records and USGS gaging-station records. These measurements yielded differences similar to those in the tabulation at flows of 5 ft³/s, 25 ft³/s and 53 ft³/s.

Releases from Lake Wallenpaupack

Records of daily discharge through the Wallenpaupack powerplant were furnished by the Pennsylvania Power & Light Company and published by the U.S. Geological Survey as Wallenpaupack Creek at Wilsonville, Pa. (table 16). These discharges represent the flow through the turbines of the powerplant and were computed on a midnight-to-midnight basis. For River Master operations, flows were computed on a 24-hour basis beginning at 0800 hours to compensate for the travel time to Montague (table 11).

From December 1998 to November 1999, the River Master's record agrees with the published U.S. Geological Survey record except for some small variations which result mainly from differences in time frame and rounding of computations. Overall, the records agree to within 0.08 percent for the year.

Delaware River at Montague, N.J.

The River Master's operations record for the Delaware River at Montague, N.J. (table 11) showed 0.24 percent less discharge for the year than the published U.S. Geological Survey record for the gaging station at that site (table 17). Daily values for the two records were in good agreement.

Diversion Tunnels

Records of diversions through the East Delaware, West Delaware, and Neversink Tunnels (fig. 1) were furnished by the City of New York. These records were obtained from the City's calibrated instruments connected to venturi meters installed in the tunnel conduits. The measured flows were transmitted electronically, on a 15-second interval, to the New York City Department of Environmental Protection computer at the Rondout Effluent Chamber. On 5-minute intervals, release and diversion quantities for the preceding 5-minute period are computed on the basis of the instantaneous rate-of-flow data from each instrument. These 5-minute quantities are summed to compute daily total flows, which were reported to the River Master's office on a daily basis. On a weekly basis, the diversion values were checked against the flow meter totalizer readings and were corrected when necessary. Periodic current-meter measurements were made by the River Master's office to verify the reported diversions. The measurements were made in the outlet channels below the tunnels.

The East Delaware Tunnel is used to divert water from Pepacton Reservoir to Rondout Reservoir. Conditions in the outlet channel of the East Delaware Tunnel were unfavorable for flow measurements during the report year because of high water levels in Rondout Reservoir. Comparison of diversion data provided by New York City with gage height record for the outlet channel of the East Delaware Tunnel did not indicate any large discrepancies in diversions reported by the City.

The generating plant at the downstream end of the East Delaware Tunnel operated most days of the report year. When the powerplant was not in operation, some water leaked through the wicket gates and was not recorded on the totalizer. A current-meter measurement made in 1989

shows that the rate of leakage (if unchanged with time) is about 8.0 Mgal/d. Because the powerplant was not in operation for the equivalent of 83 days during the 1999 report year, the unmeasured leakage totaled about 0.7 Bgal. The record of diversions through the East Delaware Tunnel is considered substantially correct.

The West Delaware Tunnel is used to divert water from Cannonsville Reservoir to Rondout Reservoir. Two current-meter measurements of flow in the West Delaware Tunnel outlet channel were made during the year. These measurements show that, on average, the venturi instruments gave larger results, specifically, +3.2 percent for the totalizer and +3.0 percent for the rate-of-flow indicator when compared to the current-meter measurements. Inspections of the channel below the outlet, when valves were closed, revealed only negligible leakage.

A hydroelectric powerplant uses water diverted through the West Delaware Tunnel, but the plant operates only when diversions are less than 300 Mgal/d. When the powerplant is not operating, the valves on the pipelines to the plant are closed, and there is no leakage through the system. The results of the measurements and inspections made during the report year and previous years indicate that the reported record of diversions through the West Delaware Tunnel is substantially correct.

The Neversink Tunnel is used to divert water from Neversink Reservoir to Rondout Reservoir. No current-meter measurements of flow from Neversink Tunnel were made during the report year, although one measurement was made at the end of the 1998 report year. The result from the venturi instruments and totalizer was +4.2 percent, and the result from the instruments and rate-of-flow indicator was +4.5 percent, compared to the flow measured by current meter.

A hydroelectric plant uses water diverted through the Neversink Tunnel. When the powerplant is not operating and the main valve on the diversion tunnel is open, leakage develops that is not recorded on the venturi instruments. On the basis of one measurement made during the report year, the average rate of leakage was 16.2 ft³/s (10.5 Mgal/d). When the powerplant was operating, the leakage was included in the recorded flow. No leakage occurs when the main valve on the tunnel is closed.

During the 1999 report year, the powerplant operated part of the day on most days and was not operated the equivalent of 249 days. Using the average leakage rate and records of powerplant operation, slightly more than 2.6 Bgal of water was diverted but not recorded.

Diversions by New Jersey

The Amended Decree authorizes New Jersey to divert water from the Delaware River or its tributaries in New Jersey, to areas outside the Delaware River Basin, without compensating releases. These diversions may not exceed 100 Mgal/d (154.7 ft³/s) as a monthly average, and the diversion on any day may not exceed 120 Mgal/d (185.6 ft³/s). The U.S. Geological Survey gaging station on Delaware and Raritan Canal at Port Mercer, New Jersey (fig. 1) is used as the official control point for measuring the diversions by New Jersey (table 18).

The following tabulation lists the allowable diversion by New Jersey, the period it was in effect, and the maximum monthly diversion during the report year:

Effective dates	Allowable monthly average diversion (Mgal/d)	Maximum monthly average diversion (Mgal/d)	Month of maximum average diversion
Dec. 1, 1998 to Dec. 14, 1998	100	--	--
Dec. 15, 1998 to Dec. 22, 1998	85	--	--
Dec. 23, 1998 to Feb. 1, 1999	70	66.2	January 1999
Feb. 2, 1999 to Nov. 30, 1999	100	105	July 1999

Symbol -- indicates period less than 1 month

The maximum daily diversion was 111 Mgal on July 13, 1999. The actual June and July 1999 average diversions by New Jersey, measured at Port Mercer, were slightly greater than the limit stipulated by the Decree. During this 2-month period, however, streamflow data collected at the Port Mercer gaging station indicated that the New Jersey diversion was within the legal limits. Subsequent recomputation of the June and July preliminary flow data resulted in a monthly average diversion of 103 Mgal/d for June and 105 Mgal/d for July. Because the flow data were recomputed and revised upward after July 31, the River Master deems that New Jersey complied with the terms of the Decree during June and July 1999, and all other months of the River Master year.

Conformance of Operations as Provided Under Amended Decree of The U.S. Supreme Court Dated June 7, 1954

From December 1, 1998 to February 4, 1999, operations of the Delaware River Master were conducted as prescribed by unanimous agreements of the Parties to the Decree and by the "Interstate Water Management Recommendations of the Parties to the Decree (DRBC Resolution 83-13)," which were designed to alleviate near or actual drought-warning conditions in the basin. From February 5 to November 30, 1999, operations were conducted as stipulated by the Decree.

Diversions from the Delaware River Basin to the New York City water-supply system were less than those authorized by the Decree and the "Interstate Water Management Recommendations of the Parties to the Decree." Under compensating releases of the Montague Formula, New York City released water from its reservoirs at rates designed by the River Master to maintain the applicable flow objectives at Montague. During the report year, New York City complied fully with the directives of the River Master.

Diversions from the Delaware River Basin by New Jersey were deemed in compliance with the terms of the Decree. New Jersey complied fully with the requests of the River Master.

Table 1. Precipitation in the Delaware River Basin above Montague, N.J.

[All values, except percentages, in inches]

Month	December 1940 to November 1998 Monthly Average	December 1998 to November 1999			
		Amount	Percent of average	Excess (+) or deficit (-)	
				Month	Cumulative
December	3.40	1.53	45	-1.87	-1.87
January	2.97	5.65	190	+2.68	+.81
February	2.66	1.67	63	-.99	-.18
March	3.30	4.40	133	+1.10	+.92
April	3.78	2.29	61	-1.49	-.57
May	4.19	3.32	79	-.87	-1.44
June	3.94	2.28	58	-1.66	-3.10
July	4.12	2.34	57	-1.78	-4.88
August	3.87	3.00	78	-.87	-5.75
September	3.74	9.11	244	+5.37	-.38
October	3.40	2.72	80	-.68	-1.06
November	3.87	2.75	71	-1.12	-2.18
12 months	43.24	41.06	95	-2.18	

Table 2. Conservation release rates for New York City reservoirs in the Delaware River Basin

[All values in cubic feet per second]

Reservoir	Effective Dates	Conservation Release Rates		
		Basic	Augmented	Experimental
Pepacton	December 1 to March 31	6	50	45
	April 1-7	6	70	45
	April 8-30	19	70	45
	May 1-31	19	70	70
	June 1 to August 31	19	70	95
	September 1-30	19	70	70
	October 1-31	19	70	45
	November 1-30	6	50	45
Cannonsville	December 1 to March 31	8	33	45
	April 1-15	8	45	45
	April 16 to May 31	23	45	45
	June 1-14	23	45	160
	June 15 to August 15	23	325	160
	August 16 to September 15	23	45	160
	September 16 to October 31	23	45	45
	November 1-30	23	33	45
Neversink	December 1 to March 31	5	25	25
	April 1-7	5	45	25
	April 8-30	15	45	25
	May 1 to September 30	15	45	53
	October 1-31	15	45	25
	November 1-30	5	25	25

Table 3. Summary of releases during administration of the December 1, 1998, agreement among the Parties to the Decree and the Delaware River Basin Commission to modify diversions and releases pursuant to DRBC Resolution 83-13, effective December 2, 1998 to April 15, 1999

[All values in cubic feet per second except cumulative fishery in cubic feet per second-days; Bal. Adj. = Balancing adjustment from design table]

Design Date 1998	Daily Mean Flow at Trenton on Previous Day	Montague Date 1998	Directed Releases				Pepacton			Cannonsville				Neversink			Cumulative Fishery				
			Deficiency	Bal. Adj.	Fishery reduction for bank	Directed	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Bank	Releases	
Dec. 2	3,480	5	593	-100	50	443	51	0	0	0	51	368	0	0	368	25	0	0	25	903	0
3	2,980	6	663	-100	0	563	43	0	0	0	43	495	0	0	495	25	0	0	25	903	0
4	2,940	7	599	-87	0	512	43	0	0	0	43	442	0	0	442	25	0	0	25	903	0
5	2,790	8	674	-71	0	603	43	0	0	0	43	535	0	0	535	25	0	0	25	903	0
6	2,730	9	535	-64	0	471	43	0	0	0	43	401	0	0	401	25	0	0	25	903	0
7	2,790	10	678	-61	0	617	45	0	0	0	45	551	0	0	551	25	0	0	25	903	0
8	2,730	11	737	-48	0	689	45	0	0	0	45	620	0	0	620	25	0	0	25	903	0
9	2,830	12	655	-39	0	616	45	0	0	0	45	548	0	0	548	25	0	0	25	903	0
10	2,790	13	659	-24	0	635	45	0	0	0	45	565	0	0	565	25	0	0	25	903	0
11	2,880	14	657	-29	0	628	45	0	0	0	45	560	0	0	560	25	0	0	25	903	0
12	2,800	15	683	-39	0	644	45	0	0	0	45	574	0	0	574	25	0	0	25	903	0
13	2,830	16	756	-42	0	714	45	0	0	0	45	645	0	0	645	25	0	0	25	903	0
14	2,960	17	771	-37	0	734	45	0	0	0	45	665	0	0	665	25	0	0	25	903	0
15	2,790	18	810	-30	0	780	45	0	0	0	45	710	0	0	710	25	0	0	25	903	0
16	2,720	19	813	-17	0	796	45	0	0	0	45	729	0	0	729	25	0	0	25	903	0
17	2,680	20	831	-8	0	823	45	0	0	0	45	752	0	0	752	25	0	0	25	903	0
18	2,650	21	839	-2	0	837	45	0	0	0	45	767	0	0	767	25	0	0	25	903	0
19	2,650	22	731	-2	0	729	45	0	0	0	45	659	0	0	659	23	0	0	23	903	0
20	2,720	23	682	-1	0	681	45	0	0	0	45	610	0	0	610	23	0	0	23	903	0
21	2,700	24	479	+1	0	480	45	0	0	0	45	412	0	0	412	25	0	0	25	903	0
22	2,750	25	161	+5	0	166	45	0	0	0	45	97	0	0	97	26	0	0	26	903	0
23	2,680	26	251	+12	0	263	43	0	0	0	43	193	0	0	193	25	0	0	25	903	0
24	2,680	27	376	-6	0	370	45	0	0	0	45	302	0	0	302	25	0	0	25	903	0
25	2,640	28	515	-54	0	461	45	0	0	0	45	393	0	0	393	25	0	0	25	903	0
26	2,960	29	668	-71	0	597	45	0	0	0	45	528	0	0	528	25	0	0	25	903	0
27	3,520	30	588	-86	100	402	45	0	0	0	45	333	0	0	333	25	0	0	25	1,053	0
28	2,700	31	553	-86	0	467	45	0	0	0	45	398	0	0	398	25	0	0	25	1,053	0

Table 3. Summary of releases during administration of the December 1, 1998, agreement among the Parties to the Decree and the Delaware River Basin Commission to modify diversions and releases pursuant to DRBC Resolution 83-13, effective December 2, 1998 to April 15, 1999 —Continued
[All values in cubic feet per second except cumulative fishery in cubic feet per second-days; Bal. Adj. = Balancing adjustment from design table]

Design Date 1998/1999	Daily Mean Flow at Trenton on Previous Day	Montague Date 1999	Directed Releases			Pepacton			Cannonsville			Neversink			Cumulative Fishery				
			Deficiency	Bal. Adj.	Fishery reduction for bank	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Bank	Releases
Dec. 29	2,300	Jan. 1	513	-100	0	413	45	0	45	343	0	0	343	25	0	0	25	1,053	0
30	2,550	2	406	-100	0	306	45	0	45	235	0	0	235	25	0	0	25	1,053	0
31	3,050	3	429	-100	0	329	45	0	45	260	0	0	260	25	0	0	25	1,053	0
Jan. 1	3,250	4	300	-100	0	200	45	0	45	131	0	0	131	25	0	0	25	1,053	0
2	2,420	5	300	-100	0	200	45	0	45	131	0	0	131	25	0	0	25	1,053	0
3	2,490	6	300	-100	0	200	43	0	43	131	0	0	131	25	0	0	25	1,053	0
4	5,330	7	218	-86	75	57	19	0	19	25	0	0	25	19	0	0	19	1,128	0
5	8,990	8	460	-71	100	289	45	0	45	220	0	0	220	25	0	0	25	1,228	0
6	5,850	9	549	-66	100	383	45	0	45	314	0	0	314	25	0	0	25	1,328	0
7	4,010	10	471	-71	100	300	45	0	45	231	0	0	231	25	0	0	25	1,428	0
8	3,500	11	464	-64	100	300	45	0	45	232	0	0	232	25	0	0	25	1,528	0
9	3,810	12	111	-54	0	57	19	0	19	26	0	0	26	12	0	0	12	1,528	0
10	3,930	13	0	-49	0	0	0	6	13	19	8	15	23	0	5	10	15	1,490	38
11	8,450	14	0	-59	0	0	0	6	13	19	8	15	23	0	5	10	15	1,452	38
12	7,090	15	0	-84	0	0	0	6	13	19	8	15	23	0	5	10	15	1,414	38
13	5,910	16	0	-90	0	0	0	6	13	19	8	15	23	0	5	9	14	1,377	37
14	5,580	17	36	-93	0	0	0	6	13	19	8	9	17	0	5	0	5	1,355	22
15	6,430	18	0	-97	0	0	0	8	0	8	8	0	8	0	5	0	5	1,355	0
16	6,680	19	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
17	7,620	20	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
18	6,420	21	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
19	9,440	22	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
20	28,500	23	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
21	18,100	24	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
22	19,400	25	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
23	17,700	26	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
24	16,700	27	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
25	23,100	28	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
26	57,300	29	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
27	58,600	30	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0
28	37,900	31	0	-100	0	0	0	6	0	6	8	0	8	0	5	0	5	1,355	0

Table 3. Summary of releases during administration of the December 1, 1998, agreement among the Parties to the Decree and the Delaware River Basin Commission to modify diversions and releases pursuant to DRBC Resolution 83-13, effective December 2, 1998 to April 15, 1999 —Continued
 [All values in cubic feet per second except cumulative fishery in cubic feet per second-days; Bal. Adj. = Balancing adjustment from design table]

Design Date 1999	Daily Mean Flow at Trenton on Previous Day	Montague Date 1999	Directed Releases				Pepacton			Cannonville				Neversink			Cumulative Fishery		
			Deficiency	Bal. Adj.	Fishery reduction for bank	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Directed	Conser- vation	Fishery release	Total	Bank	Releases
Jan. 29	28,400	Feb. 1	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
30	23,000	2	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
31	18,800	3	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
Feb. 1	15,900	4	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
2	13,800	5	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
3	13,800	6	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
4	20,300	7	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
5	22,300	8	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
6	22,100	9	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
7	18,700	10	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
8	16,800	11	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
9	15,600	12	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
10	14,300	13	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
11	12,900	14	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
12	12,300	15	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
13	11,400	16	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
14	12,700	17	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
15	14,300	18	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
16	14,500	19	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
17	12,900	20	0	-100	0	0	6	0	6	0	8	0	8	0	5	0	5	1,355	0
18	12,200	21	0	-100	0	0	6	0	6	0	8	0	8	0	11	0	11	1,355	0
19	14,100	22	0	-100	0	0	14	0	14	0	29	0	29	0	23	0	23	1,355	0

The experimental conservation release rates were restored at 8:00 a.m. on February 20, 1999, when combined storage in the New York City Delaware River Basin reservoirs had been more than 25 billion gallons above the drought-warning zone for 15 consecutive days. Fishery releases were suspended at that time but the potential for reduction in directed releases remained until April 15, 1999, when the agreement expired.

Table 4. Storage in Pepacton Reservoir, N.Y. for year ending November 30, 1999

[Storage in millions of gallons above elevation 1,152.00 ft. Add 7,711 million gallons for total contents above sill of outlet tunnel, elevation 1,126.50 ft. Storage at spillway level is 140,190 million gallons] (River Master daily operation record; gage reading at 0800 hours)

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	85,116	72,368	95,932	104,082	118,647	129,695	130,546	122,584	115,625	100,032	102,258	102,227
2	84,749	71,776	96,567	103,909	119,308	129,642	130,652	122,292	114,978	99,536	102,242	101,945
3	84,299	71,378	97,328	104,082	120,174	129,925	130,440	121,916	114,611	98,967	102,054	102,289
4	83,808	71,390	98,153	105,002	120,889	129,748	130,280	121,711	113,964	98,460	102,101	102,554
5	83,401	70,778	98,629	106,212	121,814	129,748	130,103	122,636	113,584	97,938	101,945	102,429
6	82,886	70,472	99,474	107,156	122,464	129,642	129,925	122,739	113,173	97,419	102,085	102,492
7	82,427	70,053	100,032	107,911	123,084	129,341	129,589	123,187	112,530	96,886	102,007	102,383
8	81,953	69,725	100,668	108,347	123,807	129,148	129,518	123,170	112,333	96,567	102,023	101,976
9	81,498	69,763	101,055	108,749	124,153	128,954	129,218	123,050	111,824	96,114	101,836	102,070
10	80,975	70,256	101,304	108,830	124,742	128,602	129,095	123,239	111,513	95,448	101,758	101,664
11	80,410	70,447	101,586	108,878	125,175	128,567	128,514	123,359	110,908	94,890	101,898	101,538
12	80,042	70,434	102,054	108,813	125,626	128,392	128,251	123,101	110,420	94,471	101,945	101,133
13	79,591	70,409	102,398	108,572	126,289	128,110	128,005	123,084	109,867	93,737	101,554	101,009
14	79,141	70,282	102,775	108,443	126,342	127,882	127,618	122,791	109,283	93,332	101,664	100,699
15	78,559	70,497	103,152	108,056	126,307	127,864	127,320	122,429	109,154	92,813	101,664	100,373
16	78,559	70,943	103,594	108,007	126,324	127,425	126,936	122,121	108,282	92,694	101,773	100,078
17	78,166	71,365	104,034	108,024	126,482	127,460	126,796	122,002	107,702	97,389	101,804	99,831
18	77,735	71,571	104,304	108,040	126,621	127,146	126,307	121,643	107,172	99,336	101,773	99,197
19	77,011	74,150	104,558	108,233	126,778	127,041	126,079	121,163	106,676	100,295	101,711	98,998
20	76,716	75,837	104,811	108,379	126,988	127,320	125,905	120,735	106,148	101,009	101,554	98,614
21	76,064	76,783	104,954	108,395	126,953	127,530	125,644	120,497	105,637	101,414	101,476	98,184
22	75,798	77,789	104,954	109,413	127,407	127,741	125,401	120,123	105,225	101,711	101,586	97,953
23	75,612	78,762	105,098	110,925	127,372	127,952	125,105	119,648	104,638	102,445	101,664	97,603
24	75,188	81,292	105,209	112,004	127,723	127,970	124,707	119,274	104,098	102,539	101,929	97,419
25	75,017	87,023	105,336	112,843	128,022	128,655	124,308	118,731	103,672	102,790	102,101	97,237
26	74,596	89,884	105,018	113,815	128,427	129,183	124,100	118,361	103,152	102,461	102,148	96,795
27	74,215	91,526	104,558	114,694	128,392	129,571	123,773	117,972	102,759	102,585	102,148	97,968
28	73,797	92,709	104,367	115,625	129,130	129,713	123,445	117,417	102,117	102,336	102,305	99,243
29	73,354	93,811	---	116,361	129,448	130,032	123,136	116,897	101,820	102,258	102,195	99,939
30	73,198	94,695	---	117,115	129,695	130,387	123,032	116,578	101,195	102,101	102,274	100,311
31	72,730	95,282	---	117,905	---	130,422	---	116,093	100,636	---	102,336	---
Change	-12,938	+22,552	+9,085	+13,538	+11,790	+727	-7,390	-6,939	-15,457	+1,465	+235	-2,025
Equiv. Mgal/d	-417.4	+727.5	+324.5	+436.7	+393.0	+23.5	-246.3	-223.8	-498.6	+48.8	+7.6	-67.5
Equiv. ft ³ /s	-646	+1,125	+502	+676	+608	+36.3	-381	-346.3	-771	+75.5	+11.7	-104
Change for year +14,643 Mgal												
Equivalent for year +40.1 Mgal/d												
Equivalent for year +62.1 ft ³ /s												

Table 5. Storage in Cannonsville Reservoir, N.Y. for year ending November 30, 1999

[Storage in millions of gallons above elevation 1,040.00 ft. Add 2,584 million gallons for total contents above sill outlet tunnel, elevation 1,020.50 ft. Storage at spillway level is 95,706 million gallons] (River Master daily operation record; gage reading at 0800 hours)

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	22,237	17,059	50,379	59,682	78,540	90,382	88,526	76,246	63,396	38,465	41,207	50,309
2	22,190	17,017	51,068	59,816	79,231	90,032	88,419	76,205	62,275	37,856	41,669	50,472
3	21,982	17,137	52,246	60,341	79,755	90,138	88,206	76,011	61,091	37,212	41,974	50,834
4	21,858	17,249	53,284	60,756	80,488	90,169	88,013	75,818	60,500	36,370	42,352	51,184
5	21,649	17,446	54,054	62,390	81,206	90,153	87,912	75,970	58,925	35,706	42,678	51,464
6	21,448	17,601	54,778	63,230	81,784	90,184	87,883	76,246	57,899	35,291	43,067	51,709
7	21,169	17,650	55,396	63,893	82,232	90,077	87,883	76,233	56,788	34,973	43,298	51,919
8	21,061	17,594	56,092	64,249	82,810	90,108	87,594	76,177	55,689	34,775	43,577	52,129
9	20,736	17,741	56,629	64,530	83,432	90,245	87,060	76,191	54,696	34,409	43,877	52,339
10	20,477	18,128	57,289	64,937	83,778	90,229	86,655	76,177	53,564	33,873	44,233	52,502
11	20,196	18,761	57,753	65,166	84,140	90,169	86,019	76,122	52,584	33,195	44,622	52,735
12	19,837	19,106	57,960	65,357	84,501	90,153	85,586	76,094	51,394	32,490	44,912	52,969
13	19,556	19,465	58,253	65,510	84,820	89,986	84,762	75,859	50,332	31,879	45,278	53,179
14	19,303	19,795	58,595	65,624	85,210	89,910	84,285	75,472	49,387	31,322	45,601	53,389
15	18,895	20,125	58,742	65,714	85,441	89,788	83,909	75,044	48,603	30,914	45,934	53,599
16	18,641	20,484	58,949	65,905	85,687	89,651	83,432	74,561	48,036	30,887	46,212	53,751
17	18,247	21,138	59,169	66,019	85,976	89,423	83,099	73,927	47,547	31,888	46,535	53,937
18	17,910	21,734	59,401	66,414	86,279	89,073	82,593	73,490	46,980	34,022	46,869	54,136
19	17,474	24,241	59,621	66,808	86,684	88,876	81,958	73,066	46,424	34,696	47,091	54,299
20	17,109	27,145	59,804	66,999	86,973	88,830	81,597	72,602	45,746	35,142	47,347	54,474
21	16,738	28,506	59,938	67,279	87,334	88,784	80,778	72,020	45,012	35,499	47,636	54,649
22	16,648	29,728	59,926	67,914	87,609	88,678	80,032	71,464	44,333	36,241	47,925	54,661
23	16,784	31,072	60,036	69,371	87,854	88,465	79,521	70,814	43,755	37,301	48,092	54,591
24	17,066	33,953	60,317	70,457	88,419	88,465	78,871	70,086	43,235	38,074	48,459	54,369
25	17,277	39,800	59,816	71,345	88,906	88,541	78,166	69,358	42,647	38,727	48,703	54,147
26	17,256	43,099	59,804	72,179	89,317	88,769	77,490	68,762	42,121	39,190	49,004	54,066
27	17,263	45,178	59,755	73,212	89,636	88,891	76,854	67,848	41,564	39,589	49,189	54,708
28	17,130	46,624	59,670	74,395	89,910	88,921	76,564	67,076	40,871	39,873	49,457	57,276
29	17,172	47,925	---	75,445	90,032	88,982	76,412	66,439	40,251	40,220	49,667	58,693
30	17,123	48,926	---	76,412	90,199	88,845	76,385	65,510	39,663	40,556	49,889	59,706
31	17,101	49,761	---	77,503	---	88,784	---	64,479	39,127	---	50,099	---
Change	-5,136	+32,660	+9,909	+17,833	+12,696	-1,415	-12,399	-11,906	-25,352	+1,429	+9,543	+9,607
Equiv. Mgal/d	-165.7	+1,054	+353.9	+575.3	+423.2	-45.6	-413.3	-384.1	-817.8	+47.6	+307.8	+320.2
Equiv. ft ³ /s	-256	+1,630	+547	+890	+655	-70.6	-639	-594	-1,265	+73.7	+476	+495
Change for year +37,469 Mgal												
Equivalent for year +102.7 Mgal/d												
Equivalent for year +159 ft ³ /s												

Table 6. Storage in Neversink Reservoir, N.Y. for year ending November 30, 1999

[Storage in millions of gallons above elevation 1,319.00 ft. Add 525 million gallons for total contents above sill of outlet tunnel, elevation 1,314.00 ft. Storage at spillway level is 34,941 million gallons] (River Master daily operation record; gage reading at 0800 hours)

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	12,329	9,498	17,251	18,126	24,748	28,557	31,639	29,333	18,345	12,778	13,212	12,681
2	12,263	9,540	17,227	18,243	24,916	28,623	31,592	29,137	18,091	12,582	13,126	12,758
3	12,181	9,543	17,722	18,317	25,122	28,668	31,551	28,981	17,861	12,272	13,043	12,798
4	12,101	9,653	17,952	18,660	25,304	28,764	31,415	28,743	17,636	12,012	12,906	13,792
5	12,051	9,729	18,088	19,231	25,533	28,791	31,332	28,663	17,422	11,693	12,895	14,034
6	11,974	9,794	18,165	19,467	25,671	28,870	31,350	28,473	17,185	11,389	12,789	14,228
7	11,921	9,796	18,219	19,653	25,758	28,937	31,327	28,228	16,992	11,093	12,675	14,405
8	11,823	9,778	18,197	19,770	25,841	28,990	31,146	28,014	16,961	10,842	12,577	14,523
9	11,784	9,839	18,165	19,891	25,925	29,083	31,044	27,670	16,938	10,554	12,409	14,658
10	11,712	10,009	18,169	20,024	26,097	29,137	31,044	27,275	16,803	10,283	12,335	14,797
11	11,650	10,143	18,112	20,146	26,228	29,186	31,012	26,936	16,782	9,967	12,435	14,917
12	11,562	10,219	18,084	20,275	26,418	29,231	30,827	26,536	16,661	9,666	12,447	15,021
13	11,473	10,309	18,130	20,364	26,583	29,261	30,730	26,148	16,457	9,357	12,383	15,116
14	11,389	10,397	18,137	20,454	26,706	29,311	30,612	25,779	16,281	9,327	12,377	15,190
15	11,306	10,485	18,165	20,570	26,829	29,342	30,520	25,383	16,162	9,301	12,247	15,289
16	11,071	10,627	18,155	20,656	26,923	29,378	30,264	24,973	16,076	9,291	12,073	15,358
17	10,748	10,770	18,144	20,716	27,068	29,410	30,186	24,535	15,847	11,662	11,879	15,454
18	10,447	10,906	18,151	20,833	27,184	29,333	30,191	24,067	15,580	12,366	11,681	15,503
19	10,148	11,634	18,137	20,991	27,288	29,383	29,959	23,617	15,280	12,603	11,444	15,567
20	9,834	12,110	18,109	21,108	27,442	29,616	29,964	23,195	15,006	12,730	11,226	15,654
21	9,525	12,401	18,063	21,177	27,533	29,724	29,928	22,772	14,746	12,863	11,155	15,709
22	9,244	12,629	18,025	21,619	27,615	29,783	29,923	22,361	14,540	13,013	11,276	15,781
23	9,095	12,915	17,917	22,435	27,732	29,856	29,778	21,942	14,314	13,167	11,457	15,657
24	9,175	13,550	17,935	22,776	27,900	30,013	29,679	21,484	14,123	13,286	11,718	15,564
25	9,220	16,172	17,900	23,052	28,032	30,584	29,647	21,063	13,889	13,373	11,877	15,441
26	9,241	16,871	17,879	23,278	28,101	30,887	29,616	20,592	13,668	13,439	12,065	15,428
27	9,279	17,155	17,928	23,481	28,202	31,132	29,566	20,161	13,424	13,481	12,170	15,703
28	9,340	17,521	18,000	23,717	28,298	31,271	29,575	19,733	13,322	13,547	12,277	16,073
29	9,380	17,542	---	23,967	28,403	31,397	29,342	19,293	13,227	13,406	12,404	15,978
30	9,428	17,563	---	24,246	28,442	31,485	29,329	18,846	13,069	13,257	12,499	15,919
31	9,453	17,391	---	24,486	---	31,578	---	18,586	12,938	---	12,588	---
Change	-2,933	+7,938	+609	+6,486	+3,956	+3,136	-2,249	-10,743	-5,648	+319	-669	+3,331
Equiv. Mgal/d	-94.6	+256.1	+21.8	+209.2	+131.9	+101.2	-75.0	-346.5	-182.2	+10.6	-21.6	+111.0
Equiv. ft ³ /s	-146	+396	+33.6	+324	+204	+156	-116	-536	-282	+16.4	-33.4	+172
Change for year +3,533 Mgal												Equivalent for year +15.0 ft ³ /s
Equivalent for year +9.68 Mgal/d												Equivalent for year +15.0 ft ³ /s

Table 7. Design rates for Delaware River at Montague, N.J. gaging station, December 1, 1998 to November 30, 1999
[In cubic feet per second]

Effective dates	Montague Design Rate
December 1 to December 25, 1998	1,655
December 26, 1998 to February 4, 1999	1,550
February 5 to November 30, 1999	1,750

Table 8. Consumption of water by New York City, 1950 to 1999

Data furnished by New York City, Department of Environmental Protection, Bureau of Water Supply

[Mgal/d, million gallons per day; Bgal, billion gallons]

Year	Average daily consumption			Annual Consumption (Bgal)
	City Proper (Mgal/d)	Outside Communities (Mgal/d)	Total (Mgal/d)	
1950	953.3	29.1	982.4	358.576
51	1,041.9	28.1	1,070.0	390.550
52	1,087.0	32.7	1,119.7	409.810
53	1,093.9	44.6	1,138.5	415.552
54	1,063.4	46.3	1,109.7	405.040
1955	1,109.9	45.3	1,155.2	421.648
56	1,111.3	48.9	1,160.2	424.633
57	1,169.0	57.2	1,226.2	447.563
58	1,152.9	49.6	1,202.5	438.912
59	1,204.3	60.3	1,264.6	461.579
1960	1,199.4	58.9	1,258.3	460.529
61	1,221.0	64.0	1,285.0	469.022
62	1,207.6	68.8	1,276.4	465.896
63	1,218.0	76.7	1,294.7	472.582
64	1,189.2	79.4	1,268.6	464.295
1965	1,052.1	71.2	1,123.3	409.995
66	1,044.9	73.2	1,118.1	408.128
67	1,135.3	71.0	1,206.3	440.302
68	1,242.0	78.2	1,320.2	483.175
69	1,328.7	80.1	1,408.8	514.229
1970	1,400.3	90.4	1,490.7	544.116
71	1,423.6	87.9	1,511.5	551.695
72	1,412.4	83.0	1,495.4	547.340
73	1,448.9	95.4	1,544.3	563.681
74	1,441.8	96.3	1,538.1	561.409
1975	1,415.0	92.1	1,507.1	550.093
76	1,435.0	95.8	1,530.8	560.264
77	1,483.0	104.7	1,587.7	579.510
78	1,479.4	103.0	1,582.4	577.566
79	1,513.0	104.6	1,617.6	590.426
1980	1,506.3	110.1	1,616.3	591.582
81	1,309.5	100.0	1,409.5	514.475
82	1,383.0	104.8	1,487.8	543.060
83	1,424.2	112.6	1,536.8	561.010
84	1,465.2	113.9	1,579.1	577.963
1985	1,325.4	106.5	1,431.9	522.656
86	1,351.1	115.2	1,466.3	535.200
87	1,447.1	119.8	1,566.9	571.885
88	1,484.3	125.6	1,609.9	589.090
89	1,402.0	113.4	1,515.4	553.158
1990	1,424.4	122.4	1,546.8	564.577
91	1,469.9	123.6	1,593.5	581.628
92	1,368.7	113.9	1,482.6	542.632
93	1,368.9	118.8	1,487.7	543.011
94	1,357.8	119.2	1,477.0	539.105
1995	1,326.1	123.1	1,449.2	528.958
96	1,283.5	120.2	1,403.7	512.351
97	1,201.3	123.5	1,324.8	483.552
98	1,220.0	124.7	1,344.7	490.816
99	1,237.2	128.6	1,365.8	498.517

Table 9. Summary of daily operations for Delaware River at Montague and Trenton, N.J. during administration of Lower Basin Drought Management Plan
[NYC, New York City; DRBC, Delaware River Basin Commission; All values in cubic feet per second except quantity remaining in excess release bank is in cubic feet per second days]

Design date 1999	Supply exclusive of NYC release	Deficiency	Balancing adjustment	Release directed for Montague flow objective	DRBC request for Trenton flow objective	Total directed release	Montague date 1999	Montague flow	Trenton flow (2 days later)	Excess Release Bank	
										Amount released	Quantity remaining
July 12	983	767	+50	817	0	817	July 15	1,870	2,650	0	5,709
13	908	842	+50	892	200	1,092	16	2,060	2,770	200	5,509
14	877	873	+50	923	200	1,123	17	2,170	2,840	200	5,309
15	664	1,086	+50	1,136	200	1,336	18	1,850	2,610	200	5,109
16	772	978	+50	1,028	200	1,228	19	1,970	2,630	200	4,909
17	991	759	+50	809	200	1,009	20	1,900	2,630	200	4,709
18	870	880	+50	930	200	1,130	21	1,910	2,610	200	4,509
19	1,037	713	+50	763	300	1,063	22	1,940	2,710	300	4,209
20	837	913	+50	963	300	1,263	23	2,180	2,850	300	3,909
21	813	937	+50	987	300	1,287	24	1,970	2,630	300	3,609
22	641	1,109	+50	1,159	300	1,459	25	1,970	2,570	300	3,309
23	500	1,250	+50	1,300	200	1,500	26	1,880	2,480	200	3,109
24	747	1,003	+50	1,053	200	1,253	27	1,920	2,480	200	2,909
25	702	1,048	+50	1,098	200	1,298	28	2,170	2,820	200	2,709
26	701	1,049	+50	1,099	200	1,299	29	2,030	2,730	200	2,509
27	677	1,073	+50	1,123	200	1,323	30	1,950	2,560	200	2,309
28	541	1,209	+50	1,259	200	1,459	31	2,080	2,670	200	2,109
29	313	1,437	+50	1,487	200	1,687	Aug. 1	2,190	2,750	200	1,909
30	352	1,398	+50	1,448	150	1,598	2	2,130	2,700	150	1,759
31	283	1,467	+50	1,517	200	1,717	3	2,050	2,650	200	1,559
Aug. 1	260	1,490	+50	1,540	200	1,740	4	1,980	2,650	200	1,359
2	289	1,461	+32	1,493	200	1,693	5	1,880	2,570	200	1,159
3	264	1,486	+9	1,495	100	1,595	6	1,800	2,540	100	1,059
4	340	1,410	-1	1,409	100	1,509	7	1,810	2,580	100	959
5	264	1,486	-4	1,482	100	1,582	8	1,760	2,570	100	859
6	296	1,454	+3	1,457	100	1,557	9	1,740	2,530	100	759
7	353	1,397	+8	1,405	100	1,505	10	1,800	2,580	100	659
8	289	1,461	+12	1,473	100	1,573	11	1,760	2,570	100	559
9	313	1,437	+21	1,458	100	1,558	12	1,930	4,840	100	459
10	203	1,547	+32	1,579	100	1,679	13	2,070	4,530	100	359
11	202	1,548	+37	1,585	100	1,685	14	2,520	4,330	100	259
12	200	1,550	+46	1,596	100	1,696	15	2,470	3,850	100	159
13	233	1,517	+38	1,555	100	1,655	16	2,250	3,340	100	59
14	603	1,147	+16	1,163	59	1,222	17	2,150	3,070	59	0

Table 10. New York City reservoir release design data (River Master daily operation record)

[ft³/s, cubic feet per second; (ft³/s)-d, cubic feet per second days; Col., Column]

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases										Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s)	Indicated deficiency (ft ³ /s)	Balancing adjustment (ft ³ /s)	Directed release (ft ³ /s)	Adjusted directed release		Actual deficiency		Cumulative difference [(ft ³ /s)-d]	Balancing adjustment [ft ³ /s]
	Lake Wallenpaupack (ft ³ /s)	Rio Reservoir (ft ³ /s)	Current condition (ft ³ /s)	Weather adjustment (ft ³ /s)						Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]	Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]		
	1998	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
MONTAGUE DESIGN RATE = 1,655 ft ³ /s -- DECEMBER 1, 1998 to DECEMBER 25, 1998															
Nov. 28	0	0	1,288	0	Dec. 1	1,288	367	-43	324	322	116,662	377	115,379	1,283	-100
29	0	0	1,304	85	2	1,389	266	-100	166	158	116,820	363	115,742	1,078	-100
30	0	0	1,159	41	3	1,200	455	-100	355	356	117,176	561	116,303	873	-87
Dec. 1	0	0	1,117	0	4	1,117	538	-100	438	436	117,612	601	116,904	708	-71
2	0	0	1,062	0	5	1,062	593	-100	493	444	118,056	509	117,413	643	-64
3	0	0	985	7	6	992	663	-100	563	563	118,619	598	118,011	608	-61
4	0	0	930	126	7	1,056	599	-87	512	510	119,129	635	118,646	483	-48
5	0	0	896	85	8	981	674	-71	603	603	119,732	698	119,344	388	-39
6	0	0	936	184	9	1,120	535	-64	471	469	120,201	614	119,958	243	-24
7	0	0	906	71	10	977	678	-61	617	621	120,822	576	120,534	288	-29
8	0	0	856	62	11	918	737	-48	689	690	121,512	585	121,119	393	-39
9	0	0	1,000	0	12	1,000	655	-39	616	618	122,130	593	121,712	418	-42
10	0	0	992	4	13	996	659	-24	635	635	122,765	680	122,392	373	-37
11	0	0	998	0	14	998	657	-29	628	630	123,395	705	123,097	298	-30
12	0	0	972	0	15	972	683	-39	644	644	124,039	769	123,866	173	-17
13	0	0	899	0	16	899	756	-42	714	715	124,754	810	124,676	78	-8
14	0	0	884	0	17	884	771	-37	734	735	125,489	790	125,466	23	-2
15	0	0	845	0	18	845	810	-30	780	780	126,269	785	126,251	18	-2
16	0	0	842	0	19	842	813	-17	796	799	127,068	804	127,055	13	-1
17	0	0	824	0	20	824	831	-8	823	822	127,890	847	127,902	-12	+1
18	0	0	791	25	21	816	839	-2	837	837	128,727	872	128,774	-47	+5
19	0	0	777	147	22	924	731	-2	729	727	129,454	802	129,576	-122	+12
20	0	0	774	199	23	973	682	-1	681	678	130,132	493	130,069	63	-6
21	0	0	784	392	24	1,176	479	+1	480	482	130,614	0	130,069	545	-54
22	0	0	1,431	63	25	1,494	161	+5	166	168	130,782	0	130,069	713	-71
MONTAGUE DESIGN RATE = 1,550 ft ³ /s -- DECEMBER 26, 1998 to FEBRUARY 4, 1999															
Dec. 23	0	0	1,299	0	Dec. 26	1,299	251	+12	263	261	131,043	111	130,180	863	-86
24	0	0	1,174	0	27	1,174	376	-6	370	372	131,415	372	130,552	863	-86
25	0	0	1,035	0	28	1,035	515	-54	461	463	131,878	213	130,765	1,113	-100
26	0	0	882	0	29	882	668	-71	597	598	132,476	48	130,813	1,663	-100
27	0	0	962	0	30	962	588	-86	502	403	132,879	203	131,016	1,863	-100
28	0	0	997	0	31	997	553	-86	467	468	133,347	418	131,434	1,913	-100

Col. 1 - Furnished by power company.

Col. 2 - Furnished by power company.

Col. 3 - Computed from index stations.

Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.

Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.

Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.

Col. 7 = Col. 14 (4 days earlier).

Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.

Col. 9 = Col. 7 from table 11.

Col. 10 = Summation of Col. 9.

Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.

Col. 12 = Summation of Col. 11.

Col. 13 = Col. 10 - Col. 12.

Col. 14 = Col. 13 divided by minus 10, limited to ±100.

Table 10. New York City reservoir release design data (River Master daily operation record) —Continued

[ft³/s, cubic feet per second; (ft³/s)·d, cubic feet per second days; Col., Column]

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases										Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s)	Indicated deficiency (ft ³ /s)	Balancing adjustment (ft ³ /s)	Directed release (ft ³ /s)	Adjusted directed release		Actual deficiency		Cumulative difference [(ft ³ /s)·d]	Balancing adjustment (ft ³ /s)
	Lake Wallenpaupack (ft ³ /s)	Rio Reservoir (ft ³ /s)	Current condition (ft ³ /s)	Weather adjustment (ft ³ /s)						Daily (ft ³ /s)	Cumulative [(ft ³ /s)·d]	Daily (ft ³ /s)	Cumulative [(ft ³ /s)·d]		
1998/1999	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14
Dec. 29	0	0	1,037	0	Jan. 1	1,037	513	-100	413	413	133,760	663	132,097	1,663	-100
30	0	0	1,144	0	2	1,144	406	-100	306	305	134,065	755	132,852	1,213	-100
31	0	0	1,021	100	3	1,121	429	-100	329	330	134,395	680	133,532	863	-86
Jan. 1	0	0	1,000	250	4	1,250	300	-100	200	201	134,596	351	133,883	713	-71
2	0	0	850	400	5	1,250	300	-100	200	201	134,797	251	134,134	663	-66
3	0	0	972	278	6	1,250	300	-100	200	199	134,996	149	134,283	713	-71
4	0	0	1,332	0	7	1,332	218	-86	132	63	135,059	138	134,421	638	-64
5	0	0	1,090	0	8	1,090	460	-71	389	290	135,349	390	134,811	538	-54
6	0	0	1,001	0	9	1,001	549	-66	483	384	135,733	434	135,245	488	-49
7	0	0	1,025	54	10	1,079	471	-71	400	301	136,034	201	135,446	588	-59
8	0	0	985	101	11	1,086	464	-64	400	302	136,336	52	135,498	838	-84
9	0	0	1,165	274	12	1,439	111	-54	57	57	136,393	0	135,498	895	-90

The estimated discharge at Montague was greater than the Montague design rate from Jan. 13 to Feb. 4, 1999

MONTAGUE DESIGN RATE = 1,750 ft³/s -- FEBRUARY 5, 1999 TO NOVEMBER 30, 1999

The estimated discharge at Montague was greater than the Montague design rate from Feb. 5 to May 15, 1999

May 13	0	0	1,678	0	May 16	1,678	72	--	72	72	72	68	68	4	0
14	0	71	1,510	0	17	1,581	169	--	169	169	241	169	237	4	0
15	0	71	1,406	0	18	1,477	273	--	273	276	517	346	583	-66	+7
16	0	71	1,279	0	19	1,350	400	--	400	397	914	157	740	174	-17
17	0	0	1,211	66	20	1,277	473	0	473	476	1,390	0	740	650	-50
18	0	0	1,145	369	21	1,514	236	0	236	236	1,626	0	740	886	-50

Col. 1 - Furnished by power company.

Col. 2 - Furnished by power company.

Col. 3 - Computed from index stations.

Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.

Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.

Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.

Col. 7 = Col. 14 (4 days earlier).

Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.

Col. 9 = Col. 7 from table 11.

Col. 10 = Summation of Col. 9.

Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.

Col. 12 = Summation of Col. 11.

Col. 13 = Col. 10 - Col. 12.

Col. 14 = Col. 13 divided by minus 10, limited to ±100 through Feb. 4; ± 50 after Feb. 4.

Table 10. New York City reservoir release design data (River Master daily operation record) —Continued
[ft³/s, cubic feet per second; (ft³/s)-d, cubic feet per second days; Col., Column]

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases										Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s) Col. 5	Indicated deficiency (ft ³ /s) Col. 6	Balancing adjustment (ft ³ /s) Col. 7	Directed release (ft ³ /s) Col. 8	Adjusted directed release		Actual deficiency		Cumulative difference [(ft ³ /s)-d] Col. 13	Balancing adjustment (ft ³ /s) Col. 14
	Lake Wallenpaupack (ft ³ /s) Col. 1	Rio Reservoir (ft ³ /s) Col. 2	Current condition (ft ³ /s) Col. 3	Weather adjustment (ft ³ /s) Col. 4						Daily (ft ³ /s) Col. 9	Cumulative [(ft ³ /s)-d] Col. 10	Daily (ft ³ /s) Col. 11	Cumulative [(ft ³ /s)-d] Col. 12		
1999															
June 3	0	0	1,692	10	June 6	1,702	48	-50	0	0	1,626	157	897	729	-50
4	0	57	1,492	0	7	1,549	201	-50	151	151	1,777	304	1,201	576	-50
5	224	57	1,335	0	8	1,616	134	-50	84	84	1,861	0	1,201	660	-50
6	224	57	1,249	43	9	1,573	177	-50	127	127	1,988	0	1,201	787	-50
7	224	0	1,076	0	10	1,300	450	-50	400	400	2,388	319	1,520	868	-50
8	0	0	1,061	0	11	1,061	689	-50	639	639	3,027	666	2,186	841	-50
9	0	0	987	0	12	987	763	-50	713	700	3,727	670	2,856	871	-50
10	0	57	925	0	13	982	768	-50	718	718	4,445	778	3,634	811	-50
11	0	57	871	10	14	938	812	-50	762	764	5,209	844	4,478	731	-50
12	224	0	898	121	15	1,243	507	--	507	506	506	516	516	-10	+1
13	0	57	877	95	16	1,029	721	--	721	719	1,225	779	1,295	-70	+7
14	217	71	872	189	17	1,349	401	--	401	401	1,626	491	1,786	-160	+16
15	470	89	976	17	18	1,552	198	--	198	198	1,824	228	2,014	-190	+19
16	256	0	875	77	19	1,208	542	+1	543	541	2,365	481	2,495	-130	+13
17	0	0	722	111	20	833	917	+7	924	925	3,290	895	3,390	-100	+10
18	0	0	846	0	21	846	904	+16	920	920	4,210	950	4,340	-130	+13
19	320	0	760	8	22	1,088	662	+19	681	681	4,891	441	4,781	+110	-11
20	320	0	730	0	23	1,050	700	+13	713	713	5,604	593	5,374	230	-23
21	320	87	673	0	24	1,080	670	+10	680	681	6,285	821	6,195	90	-9
22	320	50	625	0	25	995	755	+13	768	770	7,055	890	7,085	-30	+3
23	320	0	584	0	26	904	846	-11	835	835	7,890	815	7,900	-10	+1
24	0	57	564	25	27	646	1,104	-23	1,081	1,081	8,971	1,091	8,991	-20	+2
25	0	0	546	14	28	560	1,190	-9	1,181	1,177	10,148	1,187	10,178	-30	+3
26	256	0	582	284	29	1,122	628	+3	631	631	10,779	521	10,699	+80	-8
27	256	0	551	940	30	1,747	3	+1	4	4	10,783	348	11,047	-264	+26

The estimated discharge at Montague was greater than the Montague design rate from May 22 to June 5, 1999

Col. 1 - Furnished by power company.
Col. 2 - Furnished by power company.
Col. 3 - Computed from index stations.
Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.
Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.
Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.
Col. 7 = Col. 14 (4 days earlier).
Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.
Col. 9 = Col. 7 from table 11.
Col. 10 = Summation of Col. 9.
Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.
Col. 12 = Summation of Col. 11.
Col. 13 = Col. 10 - Col. 12.
Col. 14 = Col. 13 divided by minus 10, limited to ±50

Table 10. New York City reservoir release design data (River Master daily operation record) —Continued
[ft³/s, cubic feet per second; (ft³/s)-d, cubic feet per second days; Col., Column]

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases															Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s)	Indicated deficiency (ft ³ /s)	Balancing adjustment (ft ³ /s)	Directed release (ft ³ /s)	Adjusted directed release		Actual deficiency		Cumulative difference [(ft ³ /s)-d]]	Balancing adjustment (ft ³ /s)					
	Lake Wallenpaupack (ft ³ /s)	Rio Reservoir (ft ³ /s)	Current condition (ft ³ /s)	Weather adjustment (ft ³ /s)						Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]	Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]							
1999	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14					
June 28	256	88	612	370	July 1	1,326	424	+2	426	426	11,209	308	11,355	-146	+15					
29	256	24	973	631	2	1,884	0	+3	0	0	11,209	423	11,778	-569	+50					
30	256	88	1,095	62	3	1,501	249	-8	241	241	11,450	601	12,379	-929	+50					
July 1	0	88	849	240	4	1,177	573	+26	599	599	12,049	624	13,003	-954	+50					
2	128	0	778	223	5	1,129	621	+15	636	636	12,685	715	13,718	-1,033	+50					
3	128	0	854	11	6	993	757	+50	807	807	13,492	290	14,008	-516	+50					
4	256	0	708	50	7	1,014	736	+50	786	786	14,278	0	14,008	270	-27					
5	256	0	976	197	8	1,429	321	+50	371	371	14,649	735	14,743	-94	+9					
6	256	0	732	74	9	1,062	688	+50	738	738	15,387	514	15,257	130	-13					
7	256	67	1,358	0	10	1,681	69	+50	119	119	15,506	365	15,622	-116	+12					
8	0	0	882	423	11	1,305	445	-27	418	418	15,924	876	16,498	-574	+50					
9	0	0	697	403	12	1,100	650	+9	659	659	16,583	879	17,377	-794	+50					
10	289	0	931	0	13	1,220	530	-13	517	518	17,101	698	18,075	-974	+50					
11	289	0	789	0	14	1,078	672	+12	689	687	17,788	717	18,792	-1,004	+50					
12	289	0	686	8	15	983	767	+50	817	815	18,603	695	19,487	-884	+50					
13	289	0	619	0	16	908	842	+50	892	892	19,495	782	20,269	-774	+50					
14	289	0	588	0	17	877	873	+50	923	923	20,418	703	20,972	-554	+50					
15	0	103	561	0	18	664	1,086	+50	1,136	1,133	21,551	1,233	22,205	-654	+50					
16	64	103	538	67	19	722	978	+50	1,028	1,028	22,579	1,008	23,213	-634	+50					
17	253	120	513	105	20	991	759	+50	809	810	23,389	860	24,073	-684	+50					
18	253	0	527	90	21	870	880	+50	930	930	24,319	987	25,060	-741	+50					
19	253	0	536	248	22	1,037	713	+50	763	763	25,082	873	25,933	-851	+50					
20	253	0	529	55	23	837	913	+50	963	962	26,044	832	26,765	-721	+50					
21	253	0	497	63	24	813	937	+50	987	987	27,031	1,067	27,832	-801	+50					
22	0	57	489	95	25	641	1,109	+50	1,159	1,159	28,190	1,239	29,071	-881	+50					
23	0	0	479	21	26	500	1,250	+50	1,300	1,300	29,490	1,370	30,441	-951	+50					
24	225	0	456	66	27	747	1,003	+50	1,053	1,052	30,542	1,082	31,523	-981	+50					
25	225	0	467	10	28	702	1,048	+50	1,098	1,098	31,640	878	32,401	-761	+50					
26	225	0	469	7	29	701	1,049	+50	1,099	1,101	32,741	1,025	33,426	-685	+50					
27	225	142	310	0	30	677	1,073	+50	1,123	1,123	33,864	1,130	34,556	-692	+50					
28	225	0	300	16	31	541	1,209	+50	1,259	1,260	35,124	1,130	35,686	-562	+50					

Col. 1 - Furnished by power company.
Col. 2 - Furnished by power company.
Col. 3 - Computed from index stations.
Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.
Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.

Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.
Col. 7 = Col. 14 (4 days earlier).
Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.
Col. 9 = Col. 7 from table 11.
Col. 10 = Summation of Col. 9.

Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.
Col. 12 = Summation of Col. 11.
Col. 13 = Col. 10 - Col. 12.
Col. 14 = Col. 13 divided by minus 10, limited to ±50

Table 10. New York City reservoir release design data (River Master daily operation record) —Continued
[ft³/s, cubic feet per second; (ft³/s)-d, cubic feet per second days; Col., Column]

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases															Computation of balancing adjustment					
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s)	Indicated deficiency (ft ³ /s)	Balancing adjustment (ft ³ /s)	Directed release (ft ³ /s)	Adjusted directed release		Actual deficiency		Cumulative difference [(ft ³ /s)-d]	Balancing adjustment (ft ³ /s)					
	Lake Wallenpaupack (ft ³ /s)	Rio Reservoir (ft ³ /s)	Current condition (ft ³ /s)	Weather adjustment (ft ³ /s)						Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]	Daily (ft ³ /s)	Cumulative [(ft ³ /s)-d]							
	1999	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13	Col. 14					
July 29	0	0	265	48	Aug. 1	313	1,437	+50	1,487	1,480	36,604	1,240	36,926	-322	+32					
30	62	0	241	49	2	352	1,398	+50	1,448	1,448	38,052	1,218	38,144	-92	+9					
31	0	0	254	29	3	283	1,467	+50	1,517	1,516	39,568	1,416	39,560	8	-1					
Aug. 1	0	0	260	0	4	260	1,490	+50	1,540	1,540	41,108	1,510	41,070	38	-4					
2	0	0	276	13	5	289	1,461	+32	1,493	1,494	42,602	1,564	42,634	-32	+3					
3	0	0	261	3	6	264	1,486	+9	1,495	1,495	44,097	1,545	44,179	-82	+8					
4	0	70	263	7	7	340	1,410	-1	1,409	1,410	45,507	1,450	45,629	-122	+12					
5	0	0	260	4	8	264	1,486	-4	1,482	1,481	46,988	1,571	47,200	-212	+21					
6	0	0	256	40	9	296	1,454	+3	1,457	1,452	48,440	1,562	48,762	-322	+32					
7	64	0	256	33	10	353	1,397	+8	1,405	1,405	49,845	1,455	50,217	-372	+37					
8	0	0	261	28	11	289	1,461	+12	1,473	1,473	51,318	1,563	51,780	-462	+46					
9	0	0	304	9	12	313	1,437	+21	1,458	1,459	52,777	1,379	53,159	-382	+38					
10	0	0	192	11	13	203	1,547	+32	1,579	1,579	54,356	1,360	54,519	-163	+16					
11	0	0	189	13	14	202	1,548	+37	1,585	1,585	55,941	915	55,434	507	-50					
12	0	0	169	31	15	200	1,550	+46	1,596	1,594	57,535	974	56,408	1,127	-50					
13	0	0	164	69	16	233	1,517	+38	1,555	1,554	59,089	1,154	57,562	1,527	-50					
14	225	0	189	189	17	603	1,147	+16	1,163	1,162	60,251	821	58,383	1,868	-50					
15	225	0	482	4	18	711	1,039	-50	989	985	61,236	955	59,338	1,898	-50					
16	225	0	358	12	19	595	1,155	-50	1,105	1,105	62,341	1,215	60,553	1,788	-50					
17	225	0	293	0	20	518	1,232	-50	1,182	1,182	63,523	1,132	61,685	1,838	-50					
18	225	0	252	0	21	477	1,273	-50	1,223	1,222	64,745	1,072	62,757	1,988	-50					
19	0	71	238	29	22	338	1,412	-50	1,362	1,360	66,105	1,130	63,887	2,218	-50					
20	0	0	221	171	23	392	1,358	-50	1,308	1,306	67,411	1,286	65,173	2,238	-50					
21	257	0	247	65	24	569	1,181	-50	1,131	1,130	68,541	1,000	66,173	2,368	-50					
22	257	0	387	0	25	644	1,106	-50	1,056	1,056	69,597	1,106	67,279	2,318	-50					
23	257	0	343	0	26	600	1,150	-50	1,100	1,101	70,698	1,061	68,340	2,358	-50					
24	257	0	296	23	27	576	1,174	-50	1,124	1,125	71,823	1,095	69,435	2,388	-50					
25	257	0	277	26	28	560	1,190	-50	1,140	1,138	72,961	918	70,353	2,608	-50					
26	0	0	314	41	29	355	1,395	-50	1,345	1,343	74,304	1,255	71,608	2,696	-50					
27	0	0	390	27	30	417	1,333	-50	1,283	1,283	75,587	1,377	72,985	2,602	-50					
28	257	0	385	0	31	642	1,108	-50	1,058	1,058	76,645	1,108	74,093	2,552	-50					

Col. 1 - Furnished by power company.
Col. 2 - Furnished by power company.
Col. 3 - Computed from index stations.
Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.
Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.
Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.
Col. 7 = Col. 14 (4 days earlier).
Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.
Col. 9 = Col. 7 from table 11.
Col. 10 = Summation of Col. 9.
Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.
Col. 12 = Summation of Col. 11.
Col. 13 = Col. 10 - Col. 12.
Col. 14 = Col. 13 divided by minus 10, limited to ±50.

Table 10. New York City reservoir release design data (River Master daily operation record) —Continued

Advance estimate of discharge of Delaware River at Montague, N.J. exclusive of New York City reservoir releases													
Date of advance estimate	Powerplant release forecasts		Uncontrolled runoff		Montague date	Discharge (ft ³ /s)	Indicated deficiency (ft ³ /s)	Balancing adjustment (ft ³ /s)	Directed release (ft ³ /s)	Computation of balancing adjustment			
	Lake Wallenpaupack (ft ³ /s)	Rio Reservoir (ft ³ /s)	Current condition (ft ³ /s)	Weather adjustment (ft ³ /s)						Adjusted directed release	Actual deficiency		Balancing adjustment (ft ³ /s)
1999	Col. 1	Col. 2	Col. 3	Col. 4		Col. 5	Col. 6	Col. 7	Col. 8	Daily (ft ³ /s)	Cumulative [(ft ³ /s)·d]	Daily (ft ³ /s)	Cumulative [(ft ³ /s)·d]
Aug. 29	257	0	349	0	Sept. 1	606	1,144	-50	1,094	1,094	77,739	1,154	75,247
30	257	0	290	0	2	547	1,203	-50	1,153	1,151	78,890	1,131	76,378
31	257	0	252	0	3	509	1,241	-50	1,191	1,192	80,082	1,222	77,600
Sept. 1	257	71	263	0	4	591	1,159	-50	1,109	1,108	81,190	1,058	78,658
2	0	0	235	0	5	235	1,515	-50	1,465	1,464	82,654	1,454	80,112
3	0	0	225	0	6	225	1,525	-50	1,475	1,475	84,129	1,435	81,547
4	257	0	218	264	7	739	1,011	-50	961	961	85,090	1,181	82,728
5	257	0	210	556	8	1,023	727	-50	677	677	85,767	931	83,659
6	257	0	248	1,311	9	1,816	0	-50	0	0	85,767	815	84,474
7	257	0	337	293	10	887	863	-50	813	813	86,580	1,024	85,498
8	257	0	478	37	11	772	978	-50	928	927	87,507	917	86,415
9	0	0	437	23	12	460	1,290	-50	1,240	1,245	88,752	1,335	87,750
10	0	0	426	15	13	441	1,309	-50	1,259	1,258	90,010	1,308	89,058
11	0	0	437	0	14	437	1,313	-50	1,263	1,263	91,273	1,373	90,431
12	257	0	366	4	15	627	1,123	-50	1,073	1,074	92,347	1,044	91,475
13	257	0	343	71	16	671	1,079	-50	1,029	1,029	93,376	0	91,475
The estimated discharge at Montague was greater than the Montague design rate from Sept. 17 to Nov. 18, 1999													
Nov. 16	0	0			Nov. 19	1,750+	0	-50	0	0	93,376	59	91,534
17	0	0			20	1,750+	0	-50	0	0	93,376	110	91,644
18	0	0			21	1,750+	0	-50	0	0	93,376	60	91,704
19	0	0	1,528	45	22	1,573	177	-50	127	126	93,502	106	91,810
20	0	71	1,467	32	23	1,570	180	-50	130	129	93,631	129	91,939
21	0	0	1,498	0	24	1,498	252	-50	202	203	93,834	213	92,152
22	0	0	1,455	17	25	1,472	278	-50	228	229	94,063	219	92,371
23	0	0	1,411	45	26	1,456	294	-50	244	245	94,308	55	92,426
24	0	0	1,394	102	27	1,496	254	-50	204	205	94,513	0	92,426
The estimated discharge at Montague was greater than the Montague design rate from Nov. 28 to Nov. 30, 1999													

Col. 1 - Furnished by power company.
Col. 2 - Furnished by power company.
Col. 3 - Computed from index stations.
Col. 4 - Computed increase in runoff based on quantitative precipitation forecasts.
Col. 5 = Col. 1 + Col. 2 + Col. 3 + Col. 4.
Col. 6 = Design rate - Col. 5, when positive; otherwise Col. 6 = 0.
Col. 7 = Col. 14 (4 days earlier).
Col. 8 = Design rate - Col. 5 + Col. 7, when positive; otherwise Col. 8 = 0.
Col. 9 = Col. 7 from table 11.
Col. 10 = Summation of Col. 9.
Col. 11 = Design rate - (Col. 9 + Col. 10 from table 11), when positive; otherwise Col. 11 = 0.
Col. 12 = Summation of Col. 11.
Col. 13 = Col. 10 - Col. 12.
Col. 14 = Col. 13 divided by minus 10, limited to ±50.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record)

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)-d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits	
Date	Amount								N.Y.C. reservoirs	Other	Power-plants	Col. 10	Col. 11	Daily	Cumul.
1998	Col. 1	Col. 2	Col. 3	Col. 4	1998	Col. 5	Col. 6	1998	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Nov. 28	324	43	254	25	Nov. 30	0	0	Dec. 1	322	0	0	1,278	1,600		
29	166	46	87	25	Dec. 1	50	0	2	158	0	50	1,242	1,450		
30	355	45	286	25	2	0	0	3	356	0	0	1,094	1,450		
Dec. 1	438	45	359	32	3	0	0	4	436	0	0	1,054	1,490		
2	443	51	368	25	4	0	0	5	444	0	0	1,096	1,540		
3	563	43	495	25	5	0	0	6	563	0	0	1,057	1,620		
4	512	43	442	25	6	0	0	7	510	0	0	1,020	1,530		
5	603	43	535	25	7	0	0	8	603	0	0	957	1,560		
6	471	43	401	25	8	0	0	9	469	0	0	1,041	1,510		
7	617	45	551	25	9	0	0	10	621	0	0	1,079	1,700		
8	689	45	620	25	10	0	0	11	690	0	0	1,070	1,760		
9	616	45	548	25	11	0	0	12	618	0	0	1,062	1,680		
10	635	45	565	25	12	0	0	13	635	0	0	975	1,610		
11	628	45	560	25	13	0	0	14	630	0	0	950	1,580		
12	644	45	574	25	14	0	0	15	644	0	0	886	1,530		
13	714	45	645	25	15	0	0	16	715	0	0	845	1,560		
14	734	45	665	25	16	0	0	17	735	0	0	865	1,600		
15	780	45	710	25	17	0	0	18	780	0	0	870	1,650		
16	796	45	729	25	18	0	0	19	799	0	0	851	1,650		
17	823	45	752	25	19	0	0	20	822	0	0	808	1,630		
18	837	45	767	25	20	0	0	21	837	0	0	783	1,620		
19	729	45	659	23	21	0	0	22	727	0	0	853	1,580		
20	681	45	610	23	22	0	0	23	678	0	0	1,162	1,840		
21	480	45	412	25	23	0	0	24	482	0	0	2,108	2,590		
22	166	45	97	26	24	0	0	25	168	0	0	1,722	1,890		
23	263	43	193	25	25	0	0	26	261	0	0	1,439	1,700		
24	370	45	302	25	26	0	0	27	372	0	0	1,178	1,550		
25	461	45	393	25	27	0	0	28	463	0	0	1,337	1,800		
26	597	45	528	25	28	0	0	29	598	0	0	1,502	2,100		
27	402	45	333	25	29	0	0	30	403	0	0	1,247	1,650		
28	467	45	398	25	30	0	0	31	468	0	0	1,132	1,600		
Total		1,39	14,838	779		50	0		17,007	0	50	34,563	51,620		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed algebraically, but not greater than Col. 7;

except that part of Col. 8 contributing to the excess-release increment of Col. 11.

Col. 13 - Season limit of cumulative credit beginning June 15, 1998 = 11,418 (ft³/s)-d.

Excess-release quantity suspended Oct. 12, 1998.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)/d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs			Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Excess Release Credits	
Date	Amount	Col. 2	Col. 3	Col. 4	1998/1999	Col. 5	Col. 6	1999	N.Y.C. reservoirs	Power-plants	Col. 10	Total	Daily	Cumul.
1998/99	Col. 1								Col. 7	Col. 8	Col. 9	Col. 11	Col. 12	Col. 13
Dec. 29	413	45	343	25	Dec. 31	56	0	Jan. 1	413	0	56	831	1,300	
30	306	45	235	25	Jan. 1	0	0	2	305	0	0	795	1,100	
31	329	45	260	25	2	0	0	3	330	0	0	870	1,200	
Jan. 1	200	45	131	25	3	0	0	4	201	0	0	1,199	1,400	
2	200	45	131	25	4	0	0	5	201	0	0	1,299	1,500	
3	200	43	131	25	5	107	0	6	199	0	107	1,294	1,600	
4	57	19	25	19	6	0	0	7	63	0	0	1,337	1,400	
5	289	45	220	25	7	0	0	8	290	0	0	1,060	1,350	
6	383	45	314	25	8	0	0	9	384	0	0	1,016	1,400	
7	300	45	231	25	9	0	0	10	301	0	0	1,249	1,550	
8	300	45	232	25	10	0	0	11	302	0	0	1,398	1,700	
9	57	19	26	12	11	0	0	12	57	0	0	2,143	2,200	
10	0	19	23	15	12	0	0	13	0	57	0	1,993	2,050	
11	0	19	23	15	13	0	0	14	0	57	0	1,843	1,900	
12	0	19	23	15	14	37	0	15	0	57	37	1,806	1,900	
13	0	19	23	14	15	0	0	16	0	56	0	1,744	1,800	
14	0	19	17	5	16	0	0	17	0	41	0	1,859	1,900	
15	0	8	8	5	17	0	0	18	0	21	0	2,279	2,300	
16	0	6	8	5	18	0	0	19	0	19	0	4,181	4,200	
17	0	6	8	5	19	223	0	20	0	19	223	10,758	11,000	
18	0	6	8	5	20	0	0	21	0	19	0	7,981	8,000	
19	0	6	8	5	21	0	0	22	0	19	0	5,781	5,800	
20	0	6	8	5	22	0	0	23	0	19	0	5,981	6,000	
21	0	6	8	5	23	0	0	24	0	19	0	12,981	13,000	
22	0	6	8	5	24	0	170	25	0	19	170	41,811	42,000	
23	0	6	8	5	25	250	298	26	0	19	548	20,433	21,000	
24	0	6	8	5	26	460	358	27	0	19	818	12,663	13,500	
25	0	6	8	5	27	458	429	28	0	19	887	9,394	10,300	
26	0	6	8	5	28	480	238	29	0	19	718	7,523	8,260	
27	0	6	8	5	29	424	199	30	0	19	623	6,198	6,840	
28	0	6	8	5	30	239	241	31	0	19	480	4,991	5,490	
Total	3,034	667	2,500	415	2,734	1,933	3,046	536	4,667	176,691	184,940			

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed

algebraically, but not greater than Col. 7; except that part of Col. 8 contributing to the excess-release increment of Col. 11.

Col. 13 - Season limit of cumulative credit beginning June 15, 1998 = 11,418 (ft³/s)-d.

Excess-release quantity suspended Oct. 12, 1998.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)·d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs			Segregation of Flow Delaware River at Montague, N.J.							
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits	
Date	Amount								N.Y.C. reservoirs	Other	Power-plants			Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Jan. 29	0	6	8	5	Jan. 31	398	195	Feb. 1	0	19	593	4,288	4,900		
30	0	6	8	5	Feb. 1	401	227	2	0	19	628	4,373	5,020		
31	0	6	8	5	2	404	617	3	0	19	1,021	8,370	9,410		
Feb. 1	0	6	8	5	3	462	340	4	0	19	802	9,479	10,300		
2	0	6	8	5	4	411	287	5	0	19	698	7,923	8,640		
3	0	6	8	5	5	350	748	6	0	19	1,098	6,763	7,880		
4	0	6	8	5	6	344	695	7	0	19	1,039	5,742	6,800		
5	0	6	8	5	7	359	323	8	0	19	682	5,169	5,870		
6	0	6	8	5	8	373	28	9	0	19	401	4,970	5,390		
7	0	6	8	5	9	835	184	10	0	19	1,019	4,232	5,270		
8	0	6	8	5	10	567	0	11	0	19	567	4,174	4,760		
9	0	6	8	5	11	663	238	12	0	19	901	4,160	5,080		
10	0	6	8	5	12	355	301	13	0	19	656	5,755	6,430		
11	0	6	8	5	13	525	206	14	0	19	731	6,210	6,960		
12	0	6	8	5	14	586	238	15	0	19	824	4,807	5,650		
13	0	6	8	5	15	898	287	16	0	19	1,185	4,416	5,620		
14	0	6	8	5	16	857	596	17	0	19	1,453	4,498	5,970		
15	0	6	8	5	17	812	789	18	0	19	1,601	4,440	6,060		
16	0	6	8	5	18	1,105	514	19	0	19	1,619	4,552	6,190		
17	0	6	8	5	19	1,142	167	20	0	19	1,309	4,222	5,550		
18	0	6	8	11	20	870	113	21	0	25	983	3,972	4,980		
19	0	14	29	23	21	934	106	22	0	66	1,040	3,264	4,370		
20	0	46	40	25	22	944	99	23	0	111	1,043	2,706	3,860		
21	0	46	43	25	23	875	117	24	0	114	992	2,564	3,670		
22	0	46	45	25	24	988	312	25	0	116	1,300	2,644	4,060		
23	0	43	45	25	25	866	177	26	0	113	1,043	2,824	3,980		
24	0	46	45	25	26	668	117	27	0	116	785	2,539	3,440		
25	0	43	45	25	27	407	0	28	0	113	407	2,570	3,090		
Total	0	410	460	284		18,399	8,021		0	1,154	26,420	131,626	159,200		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed

algebraically, but not greater than Col. 7; except that part of Col. 8 contributing to the excess-release increment of Col. 11.

Col. 13 - Season limit of cumulative credit beginning June 15, 1998 = 11,418 (ft³/s)·d.

Excess-release quantity suspended Oct. 12, 1998.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)-d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs			Segregation of Flow Delaware River at Montague, N.J.							
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits	
Date	Amount								N.Y.C. reservoirs		Power-plants			Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Feb. 26	0	43	45	25	Feb. 28	517	67	Mar. 1	0	113	584	3,313	4,010		
27	0	43	45	25	Mar. 1	567	28	2	0	113	595	4,542	5,250		
28	0	45	45	25	2	606	326	3	0	115	932	3,953	5,000		
Mar. 1	0	45	45	25	3	496	237	4	0	115	733	8,062	8,910		
2	0	40	43	25	4	586	71	5	0	108	657	13,635	14,400		
3	0	46	45	26	5	443	103	6	0	117	546	9,437	10,100		
4	0	46	45	25	6	409	195	7	0	116	604	7,560	8,280		
5	0	46	45	25	7	540	408	8	0	116	948	5,916	6,980		
6	0	45	45	25	8	582	241	9	0	115	823	5,072	6,010		
7	0	45	45	25	9	573	252	10	0	115	825	4,870	5,810		
8	0	45	45	25	10	543	475	11	0	115	1,018	4,387	5,520		
9	0	45	45	25	11	461	404	12	0	115	865	3,950	4,930		
10	0	45	45	25	12	416	92	13	0	115	508	3,387	4,010		
11	0	45	45	25	13	428	39	14	0	115	467	3,538	4,120		
12	0	45	45	25	14	467	298	15	0	115	765	3,490	4,370		
13	0	45	45	25	15	566	770	16	0	115	1,336	3,279	4,730		
14	0	45	45	25	16	537	330	17	0	115	867	3,328	4,310		
15	0	43	45	25	17	624	206	18	0	113	830	3,997	4,940		
16	0	43	45	25	18	582	210	19	0	113	792	4,715	5,620		
17	0	43	45	25	19	528	74	20	0	113	602	4,635	5,350		
18	0	45	45	25	20	488	0	21	0	115	488	4,257	4,860		
19	0	45	45	26	21	582	667	22	0	116	1,249	10,335	11,700		
20	0	45	39	25	22	524	680	23	0	109	1,204	13,587	14,900		
21	0	46	43	25	23	558	599	24	0	114	1,157	10,729	12,000		
22	0	43	45	25	24	598	560	25	0	113	1,158	9,329	10,600		
23	0	45	45	25	25	585	507	26	0	115	1,092	8,383	9,590		
24	0	45	45	25	26	499	738	27	0	115	1,237	7,218	8,570		
25	0	45	45	25	27	508	149	28	0	115	657	7,128	7,900		
26	0	45	45	25	28	535	216	29	0	115	751	7,504	8,370		
27	0	45	45	25	29	599	465	30	0	115	1,064	7,301	8,480		
28	0	46	45	25	30	583	365	31	0	116	948	7,056	8,120		
Total	0	3	1,385	777		16,530	9,772		0	3,545	26,302	197,893	227,740		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed algebraically, but not greater than Col. 7;

except that part of Col. 8 contributing to the excess-release increment of Col. 11.

Col. 13 - Season limit of cumulative credit beginning June 15, 1998 = 11,418 (ft³/s)-d.

Excess-release quantity suspended Oct. 12, 1998.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)/d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink		Lake Wallen- paupack	Rio Reservoir		Controlled Releases			Computed uncon- trolled		Excess Release Credits	
Date	Amount				Date			Date	N.Y.C. reservoirs		Power- plants		Total	Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Mar. 29	0	46	46	25	Mar. 31	537	99	Apr. 1	0	117	636	6,607	7,360		
30	0	46	46	25	Apr. 1	577	312	2	0	117	889	6,444	7,450		
31	0	46	46	25	2	502	379	3	0	117	881	5,892	6,890		
Apr. 1	0	45	46	25	3	496	0	4	0	116	496	5,978	6,590		
2	0	45	46	25	4	528	142	5	0	116	670	5,464	6,250		
3	0	43	45	25	5	505	284	6	0	113	789	4,988	5,890		
4	0	45	46	25	6	537	323	7	0	116	860	4,354	5,330		
5	0	46	48	25	7	627	500	8	0	119	1,127	3,934	5,180		
6	0	46	43	25	8	580	418	9	0	114	998	3,698	4,810		
7	0	45	43	25	9	515	88	10	0	113	603	4,384	5,100		
8	0	45	43	25	10	462	0	11	0	113	462	4,405	4,980		
9	0	46	43	25	11	573	298	12	0	114	871	4,075	5,060		
10	0	46	43	25	12	571	496	13	0	114	1,067	4,449	5,630		
11	0	46	43	25	13	605	369	14	0	114	974	4,512	5,600		
12	0	45	43	25	14	596	99	15	0	113	695	3,832	4,640		
13	0	45	43	25	15	531	39	16	0	113	570	3,607	4,290		
14	0	45	43	25	16	452	149	17	0	113	601	3,696	4,410		
15	0	45	43	25	17	0	0	18	0	113	0	4,187	4,300		
16	0	45	43	25	18	83	106	19	0	113	189	4,238	4,540		
17	0	50	45	25	19	504	209	20	0	120	713	3,807	4,640		
18	0	51	45	25	20	570	195	21	0	121	765	3,694	4,580		
19	0	46	45	25	21	554	304	22	0	116	858	3,526	4,500		
20	0	46	45	25	22	539	238	23	0	116	777	3,367	4,260		
21	0	46	45	25	23	525	110	24	0	116	635	4,419	5,170		
22	0	45	45	25	24	0	0	25	0	115	0	5,035	5,150		
23	0	43	45	25	25	88	223	26	0	113	311	4,246	4,670		
24	0	42	45	25	26	511	106	27	0	112	617	3,841	4,570		
25	0	43	45	25	27	625	0	28	0	113	625	3,462	4,200		
26	0	45	45	25	28	529	0	29	0	115	529	3,206	3,850		
27	0	45	45	25	29	446	103	30	0	115	549	2,966	3,630		
Total	0	3	1,337	750		14,168	5,589		0	3,450	19,757	130,313	153,520		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed algebraically, but not greater than Col. 7;

except that part of Col. 8 contributing to the excess-release increment of Col. 11.

Col. 13 - Season limit of cumulative credit beginning June 15, 1998 = 11,418 (ft³/s)·d.

Excess-release quantity suspended Oct. 12, 1998.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s); d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Excess Release Credits		
Date	Amount	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	N.Y.C. reservoirs		Power-plants	Col. 10	Total	Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Apr. 28	0	45	45	25	Apr. 30	448	0	May 1	0	115	448	2,777	3,340		
29	0	43	45	32	May 1	0	88	2	0	120	88	2,592	2,800		
30	0	50	45	53	2	18	0	3	0	148	18	2,474	2,640		
May 1	0	70	45	53	3	467	209	4	0	168	676	2,296	3,140		
2	0	70	45	54	4	489	89	5	0	169	578	2,363	3,110		
3	0	70	45	54	5	574	82	6	0	169	656	2,225	3,050		
4	0	70	45	53	6	426	89	7	0	168	515	2,137	2,820		
5	0	70	45	53	7	419	0	8	0	168	419	2,153	2,740		
6	0	70	45	53	8	0	64	9	0	168	64	2,568	2,800		
7	0	70	45	53	9	0	0	10	0	168	0	2,902	3,070		
8	0	71	45	53	10	0	28	11	0	169	28	2,563	2,760		
9	0	71	45	53	11	0	202	12	0	169	202	2,229	2,600		
10	0	70	45	53	12	0	167	13	0	168	167	2,005	2,340		
11	0	70	45	53	13	0	0	14	0	168	0	1,892	2,060		
12	0	70	45	53	14	0	124	15	0	168	124	1,748	2,040		
13	72	70	45	53	15	0	0	16	72	96	0	1,682	1,850		
14	169	70	46	53	16	0	0	17	169	0	0	1,581	1,750		
15	273	70	153	53	17	0	0	18	276	0	0	1,404	1,680		
16	400	70	274	53	18	0	0	19	397	0	0	1,593	1,990		
17	473	70	353	53	19	0	131	20	476	0	131	2,923	3,530		
18	236	70	113	53	20	0	85	21	236	0	85	3,139	3,460		
19	0	70	45	53	21	0	0	22	0	168	0	2,662	2,830		
20	0	70	45	53	22	0	0	23	0	168	0	2,282	2,450		
21	0	70	45	53	23	0	0	24	0	168	0	2,652	2,820		
22	0	70	45	53	24	0	131	25	0	168	131	6,301	6,600		
23	0	70	45	53	25	0	156	26	0	168	156	7,376	7,700		
24	0	70	45	53	26	0	145	27	0	168	145	5,597	5,910		
25	0	70	45	53	27	0	106	28	0	168	106	4,496	4,770		
26	0	70	45	53	28	0	0	29	0	168	0	3,762	3,930		
27	0	70	51	53	29	0	74	30	0	174	74	3,192	3,440		
28	0	70	45	70	30	0	0	31	0	185	0	2,805	2,990		
Total	1,623	2,10	2,115	1,613		2,841	1,970		1,626	4,202	4,811	88,371	99,010		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Col. 11 - Col. 8 - 1,750 ft³/s computed algebraically.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)·d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs			Segregation of Flow Delaware River at Montague, N.J.								
Directed		Pepacton	Cannonsville	Neversink		Lake Wallen-paupack	Rio Reservoir		Controlled Releases			Computed uncontrolled	Total	Excess Release Credits		
Date	Amount	Col. 1	Col. 2	Col. 3	Col. 4	Date	Col. 5	Col. 6	Date	N.Y.C. reservoirs	Power-plants	Col. 9	Col. 10	Col. 11	Daily	Cumul.
1999		Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
May 29	0	70	161	70	70	May 31	0	49	June 1	0	301	49	2,480	2,830		
30	0	70	161	70	70	June 1	222	34	2	0	301	256	2,363	2,920		
31	0	74	196	70	70	2	229	88	3	0	340	317	2,073	2,730		
June 1	0	97	302	67	67	3	139	88	4	0	466	227	1,857	2,550		
2	0	97	223	53	53	4	0	103	5	0	373	103	1,724	2,200		
3	0	93	161	53	53	5	0	0	6	0	307	0	1,593	1,900		
4	151	93	161	70	70	6	0	0	7	151	173	0	1,446	1,770		
5	84	93	254	90	90	7	292	230	8	84	353	522	1,331	2,290		
6	127	93	326	90	90	8	338	241	9	127	382	579	1,252	2,340		
7	400	93	346	70	70	9	199	57	10	400	109	256	1,175	1,940		
8	639	93	495	68	68	10	0	0	11	656	0	0	1,084	1,740		
9	713	93	554	53	53	11	0	67	12	700	0	67	1,013	1,780		
10	718	93	555	70	70	12	0	0	13	718	0	0	972	1,690		
11	762	94	600	70	70	13	0	0	14	764	0	0	906	1,670		
12	507	94	342	70	70	14	224	0	15	506	0	224	1,010	1,740	0	0
13	721	94	572	53	53	15	0	92	16	719	0	92	879	1,690	0	0
14	401	94	254	53	53	16	249	35	17	401	0	284	975	1,660	0	0
15	198	94	161	53	53	17	455	88	18	198	110	543	979	1,830	0	0
16	543	94	394	53	53	18	270	99	19	541	0	369	900	1,810	0	0
17	924	94	778	53	53	19	0	0	20	925	0	0	855	1,780	0	0
18	920	94	756	70	70	20	0	50	21	920	0	50	750	1,720	0	0
19	681	94	517	70	70	21	419	160	22	681	0	579	730	1,990	0	0
20	713	94	549	70	70	22	363	124	23	713	0	487	670	1,870	0	0
21	680	94	517	70	70	23	282	0	24	681	0	282	647	1,610	0	0
22	768	94	603	73	73	24	271	0	25	770	0	271	589	1,630	0	0
23	835	94	651	90	90	25	401	0	26	835	0	401	534	1,770	0	0
24	1,081	94	897	90	90	26	64	88	27	1,081	0	152	507	1,740	0	0
25	1,181	94	993	90	90	27	64	24	28	1,177	0	88	475	1,740	0	0
26	631	94	447	90	90	28	187	273	29	631	0	460	769	1,860	0	0
27	4	94	252	82	82	29	209	184	30	4	424	393	1,009	1,830	0	0
Total	14,382	0	13,178	2,094	2,094		4,877	2,174		14,383	3,639	7,051	33,547	58,620		

Col. 2 - 24 hours beginning 1200 of date shown.
Col. 3 - 24 hours ending 2400 one day later.
Col. 4 - 24 hours beginning 1500 one day later.
Col. 5 - 24 hours beginning 0800 of date shown.
Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).
Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.
Col. 9 = Col. 5 + Col. 6.
Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.
Col. 11 = 24 hours of calendar day shown.

Col. 12 = Directed by DRBC under provisions of Lower Basin Drought Management Plan (LBDMP)
Col. 13 - Season limit of cumulative credit beginning June 15, 1999 = 11,418 (ft³/s)·d. One half of this quantity [5,709 (ft³/s)·d] available for LBDMP.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)-d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs										Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date		Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total		Excess Release Credits				
Date	Amount	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Directed	N.Y.C. reservoirs	Other	Col. 8	Col. 9	Col. 10	Col. 11	Daily	Cumul.	
1999																				
June 28	426	94	311	53	53	June 30	305	0	July 1	426	32	305	1,137	1,900	0	0	0	0	0	0
29	0	94	316	53	53	July 1	295	0	2	0	463	295	1,032	1,790	0	0	0	0	0	0
30	241	94	254	53	53	2	244	103	3	241	160	347	802	1,550	0	0	0	0	0	0
July 1	599	94	450	70	70	3	123	188	4	599	15	311	815	1,740	0	0	0	0	0	0
2	636	94	452	99	99	4	123	106	5	636	9	229	806	1,680	0	0	0	0	0	0
3	807	111	620	139	139	5	388	309	6	807	63	697	763	2,330	0	0	0	0	0	0
4	786	150	569	139	139	6	575	358	7	786	72	933	849	2,640	0	0	0	0	0	0
5	371	149	657	139	139	7	98	142	8	371	574	240	775	1,960	0	0	0	0	0	0
6	738	138	606	70	70	8	255	0	9	738	76	255	981	2,050	0	0	0	0	0	0
7	119	108	353	54	54	9	410	70	10	119	396	480	905	1,900	0	0	0	0	0	0
8	418	93	350	53	53	10	0	0	11	418	78	0	874	1,370	0	0	0	0	0	0
9	659	94	512	53	53	11	0	0	12	659	0	0	871	1,530	0	0	0	0	0	0
10	517	94	371	53	53	12	248	0	13	518	0	248	804	1,570	0	0	0	0	0	0
11	689	94	540	53	53	13	360	103	14	687	0	463	570	1,720	0	0	0	0	0	0
12	817	94	668	53	53	14	344	128	15	815	0	472	583	1,870	0	0	0	0	0	0
13	1,092	94	945	53	53	15	400	0	16	1,092	0	400	568	2,060	200	200	200	200	200	200
14	1,123	94	942	87	87	16	366	117	17	1,123	0	483	564	2,170	200	200	200	200	200	200
15	1,336	94	1,129	110	110	17	32	0	18	1,333	0	32	485	1,850	200	200	200	200	200	200
16	1,228	108	990	130	130	18	60	188	19	1,228	0	248	494	1,970	200	200	200	200	200	200
17	1,009	130	750	130	130	19	210	124	20	1,010	0	334	556	1,900	200	200	200	200	200	200
18	1,130	130	927	90	90	20	264	0	21	1,147	0	264	499	1,910	200	200	200	200	200	200
19	1,063	94	916	53	53	21	263	99	22	1,063	0	362	515	1,940	300	300	300	300	300	300
20	1,263	94	1,115	53	53	22	342	173	23	1,262	0	515	403	2,180	300	300	300	300	300	300
21	1,287	94	1,105	88	88	23	298	0	24	1,287	0	298	385	1,970	300	300	300	300	300	300
22	1,459	94	1,255	110	110	24	61	106	25	1,459	0	167	344	1,970	300	300	300	300	300	300
23	1,500	128	1,262	110	110	25	60	10	26	1,500	0	70	310	1,880	200	200	200	200	200	200
24	1,253	130	1,012	110	110	26	222	96	27	1,252	0	318	350	1,920	200	200	200	200	200	200
25	1,298	130	1,115	53	53	27	452	63	28	1,298	0	515	357	2,170	200	200	200	200	200	200
26	1,299	97	1,151	57	57	28	326	74	29	1,301	4	400	325	2,030	200	200	200	200	200	200
27	1,323	94	1,159	77	77	29	237	32	30	1,323	7	269	351	1,950	200	200	200	200	200	200
28	1,459	94	1,256	110	110	30	215	0	31	1,460	0	215	405	2,080	200	200	200	200	200	200
Total	27,945	3,29	24,058	2,555	2,555		7,576	2,589		27,958		10,165	19,478	59,550						

Col. 2 - 24 hours beginning 1200 of date shown.
Col. 3 - 24 hours ending 2400 one day later.
Col. 4 - 24 hours beginning 1500 one day later.
Col. 5 - 24 hours beginning 0800 of date shown.
Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).
Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.
Col. 9 = Col. 5 + Col. 6.
Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.
Col. 11 = 24 hours of calendar day shown.

Col. 12 = Directed by DRBC under provisions of Lower Basin Drought Management Plan (LBDMP)
Col. 13 - Season limit of cumulative credit beginning June 15, 1999 = 11,418 (ft³/s)-d. One half of this quantity [5,709 (ft³/s)-d] available for LBDMP.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.								
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits			
Date	Amount	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Directed	Other	Col. 8	Power-plants	Col. 9	Col. 10	Col. 11	Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13		
July 29	1,687	94	1,476	110	July 31	158	46	Aug. 1	1,680	0	204	306	2,190	200	3,800		
30	1,598	110	1,378	110	Aug. 1	49	160	2	1,598	0	209	323	2,130	150	3,950		
31	1,717	130	1,496	90	2	0	99	3	1,716	0	99	235	2,050	200	4,150		
Aug. 1	1,740	110	1,576	54	3	0	0	4	1,740	0	0	240	1,980	200	4,350		
2	1,693	94	1,547	53	4	0	0	5	1,694	0	0	186	1,880	200	4,550		
3	1,595	94	1,448	53	5	0	0	6	1,595	0	0	205	1,800	100	4,650		
4	1,509	94	1,363	53	6	0	106	7	1,510	0	106	194	1,810	100	4,750		
5	1,582	94	1,434	53	7	0	0	8	1,581	0	0	179	1,760	100	4,850		
6	1,557	94	1,405	53	8	0	0	9	1,552	0	0	188	1,740	100	4,950		
7	1,505	94	1,358	53	9	84	0	10	1,505	0	84	211	1,800	100	5,050		
8	1,573	94	1,426	53	10	0	0	11	1,573	0	0	187	1,760	100	5,150		
9	1,558	94	1,412	53	11	41	191	12	1,559	0	232	139	1,930	100	5,250		
10	1,679	94	1,530	56	12	0	127	13	1,679	1	127	263	2,070	100	5,350		
11	1,685	94	1,501	90	13	315	14	14	1,685	0	329	506	2,520	100	5,450		
12	1,696	94	1,530	70	14	211	159	15	1,694	0	370	406	2,470	100	5,550		
13	1,655	94	1,490	70	15	0	156	16	1,654	0	156	440	2,250	100	5,650		
14	1,222	94	1,057	70	16	223	340	17	1,221	0	563	366	2,150	59	5,709		
15	989	94	823	68	17	215	167	18	985	0	382	413	1,780				
16	1,105	94	958	53	18	262	0	19	1,105	0	262	273	1,640				
17	1,182	94	1,035	53	19	262	0	20	1,182	0	262	356	1,800				
18	1,223	94	1,075	53	20	246	0	21	1,222	0	246	432	1,900				
19	1,362	93	1,214	53	21	0	70	22	1,360	0	70	550	1,980				
20	1,308	93	1,160	53	22	0	0	23	1,306	0	0	464	1,770				
21	1,131	93	984	53	23	263	0	24	1,130	0	263	487	1,880				
22	1,056	93	910	53	24	217	0	25	1,056	0	217	427	1,700				
23	1,100	94	954	53	25	204	0	26	1,101	0	204	485	1,790				
24	1,124	94	961	70	26	169	0	27	1,125	0	169	486	1,780				
25	1,140	94	954	90	27	257	0	28	1,138	0	257	575	1,970				
26	1,345	94	1,196	53	28	0	0	29	1,343	0	0	497	1,840				
27	1,283	94	1,134	59	29	0	0	30	1,283	4	0	373	1,660				
28	1,058	94	874	90	30	273	0	31	1,058	0	273	369	1,700				
Total		43,657	38,659	1,998	3,449	1,635	43,630	5	5,084	10,761	59,480						

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Col. 12 = Directed by DRBC under provisions of Lower Basin Drought Management Plan (LBDMP)

Col. 13 - Season limit of cumulative credit beginning

June 15, 1999 = 11,418 (ft³/s)d. One half of

this quantity [5,709 (ft³/s)d] available for LBDMP.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallenpaupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits	
Date	Amount								N.Y.C. reservoirs	Other	Power-plants			Daily	Cumul.
1999	Col. 1	Col. 2	Col. 3	Col. 4	1999	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Aug. 29	1,094	94	947	53	Aug. 31	246	0	Sept. 1	1,094	0	246	350	1,690		
30	1,153	94	1,004	53	Sept. 1	284	0	2	1,151	0	284	335	1,770		
31	1,191	90	1,049	53	2	223	0	3	1,192	0	223	305	1,720		
Sept. 1	1,109	70	985	53	3	269	96	4	1,108	0	365	327	1,800		
2	1,465	70	1,324	70	4	0	0	5	1,464	0	0	296	1,760		
3	1,475	90	1,295	90	5	0	0	6	1,475	0	0	315	1,790		
4	961	90	781	90	6	0	0	7	961	0	0	569	1,530		
5	677	90	503	88	7	207	0	8	677	4	207	612	1,500		
6	0	88	364	53	8	226	0	9	0	505	226	709	1,440		
7	813	68	693	53	9	219	0	10	814	0	219	507	1,540		
8	928	70	804	53	10	276	0	11	927	0	276	557	1,760		
9	1,240	70	1,122	53	11	0	0	12	1,245	0	0	415	1,660		
10	1,259	70	1,137	51	12	0	0	13	1,258	0	0	442	1,700		
11	1,263	70	1,140	53	13	0	0	14	1,263	0	0	377	1,640		
12	1,073	70	951	53	14	300	0	15	1,074	0	300	406	1,780		
13	1,029	68	908	53	15	484	7	16	1,029	0	491	3,350	4,870		
14	0	68	162	53	16	709	656	17	0	283	1,365	21,552	23,200		
15	0	70	84	54	17	472	687	18	0	208	1,159	14,033	15,400		
16	0	70	45	53	18	0	88	19	0	168	88	6,784	7,040		
17	0	70	46	53	19	63	0	20	0	169	63	4,398	4,630		
18	0	70	46	51	20	582	117	21	0	167	699	3,274	4,140		
19	0	70	46	51	21	428	0	22	0	167	428	3,215	3,810		
20	0	70	46	53	22	542	0	23	0	169	542	4,469	5,180		
21	0	70	46	53	23	434	35	24	0	169	469	4,262	4,900		
22	0	70	46	53	24	461	0	25	0	169	461	3,190	3,820		
23	0	70	46	53	25	0	0	26	0	169	0	2,631	2,800		
24	0	70	46	53	26	85	0	27	0	169	85	2,166	2,420		
25	0	70	46	51	27	550	60	28	0	167	610	1,943	2,720		
26	0	70	46	51	28	569	149	29	0	167	718	1,735	2,620		
27	0	70	46	53	29	512	223	30	0	169	735	1,866	2,770		
Total		2,24	15,804	1,707		8,141	2,118		16,732	3,019	10,259	85,390	115,400		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s); d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs				Segregation of Flow Delaware River at Montague, N.J.						
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Excess Release Credits		
Date	Amount	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	1999	N.Y.C. reservoirs	Other	Col. 9	Col. 10	Total	Daily	Cumul.
1999		Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	1999	Col. 7	Col. 8	Col. 9	Col. 10	Col. 11	Col. 12	Col. 13
Sept. 28	0	71	45	51	Sept. 30	496	0	Oct. 1	0	167	496	2,607	3,270		
29	0	70	45	43	Oct. 1	448	71	2	0	158	519	3,073	3,750		
30	0	65	45	25	2	0	0	3	0	135	0	2,515	2,650		
Oct. 1	0	46	45	25	3	55	0	4	0	116	55	2,409	2,580		
2	0	46	45	25	4	463	32	5	0	116	495	3,239	3,850		
3	0	46	45	25	5	629	106	6	0	116	735	3,509	4,360		
4	0	50	45	25	6	493	14	7	0	120	507	2,963	3,590		
5	0	50	45	23	7	515	0	8	0	118	515	2,557	3,190		
6	0	46	45	23	8	439	0	9	0	114	439	2,457	3,010		
7	0	46	45	23	9	0	209	10	0	114	209	2,557	2,880		
8	0	46	45	23	10	40	0	11	0	114	40	3,486	3,640		
9	0	46	45	23	11	588	0	12	0	114	588	3,848	4,550		
10	0	46	45	23	12	558	0	13	0	114	558	3,308	3,980		
11	0	46	45	23	13	507	0	14	0	114	507	3,099	3,720		
12	0	46	45	23	14	491	89	15	0	114	580	3,366	4,060		
13	0	46	45	26	15	477	305	16	0	117	782	3,151	4,050		
14	0	46	45	25	16	0	273	17	0	116	273	2,811	3,200		
15	0	48	45	25	17	23	124	18	0	118	147	2,595	2,860		
16	0	48	45	25	18	465	0	19	0	118	465	2,447	3,030		
17	0	46	45	25	19	503	0	20	0	116	503	2,361	2,980		
18	0	46	45	25	20	435	0	21	0	116	435	2,549	3,100		
19	0	46	45	23	21	391	0	22	0	114	391	2,655	3,160		
20	0	46	45	23	22	514	0	23	0	114	514	2,802	3,430		
21	0	46	45	23	23	0	0	24	0	114	0	2,826	2,940		
22	0	45	45	23	24	94	89	25	0	113	183	2,904	3,200		
23	0	45	45	23	25	609	0	26	0	113	609	2,538	3,260		
24	0	45	45	26	26	573	0	27	0	116	573	2,371	3,060		
25	0	45	45	25	27	692	89	28	0	115	781	2,204	3,100		
26	0	45	45	26	28	591	0	29	0	116	591	2,093	2,800		
27	0	45	45	26	29	474	89	30	0	116	563	2,001	2,680		
28	0	43	45	26	30	0	0	31	0	114	0	1,926	2,040		
		1,49													
Total	0	7	1,395	798		11,563	1,490		0	3,690	13,053	85,227	101,970		

Col. 2 - 24 hours beginning 1200 of date shown.

Col. 3 - 24 hours ending 2400 one day later.

Col. 4 - 24 hours beginning 1500 one day later.

Col. 5 - 24 hours beginning 0800 of date shown.

Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).

Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.

Col. 9 = Col. 5 + Col. 6.

Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.

Col. 11 = 24 hours of calendar day shown.

Table 11. Controlled releases from reservoirs in the upper Delaware River Basin and segregation of flow of Delaware River at Montague, N.J. (River Master daily operation record) —Continued

[Mean discharge in cubic feet per second for 24 hours; (ft³/s)/d, cubic feet per second-days; Col., Column]

Controlled Releases from New York City Reservoirs					Controlled Releases from Power Reservoirs			Segregation of Flow Delaware River at Montague, N.J.									
Directed		Pepacton	Cannonsville	Neversink	Date	Lake Wallen-paupack	Rio Reservoir	Date	Controlled Releases			Computed uncontrolled	Total	Excess Release Credits			
Date	Amount	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	1999	Col. 7	Directed	Other	Col. 8	Col. 9	Col. 10	Col. 11	Daily	Cumul.
1999								1999									
Oct. 29	0	45	45	26		66	170	Nov. 1	0			116	236	1,708	2,060		
30	0	46	45	25	Oct. 31	632	273	2	0			116	905	1,749	2,770		
31	0	43	43	25	Nov. 1	660	131	3	0			111	791	2,998	3,900		
Nov. 1	0	43	43	25	2	568	106	4	0			111	674	4,395	5,180		
2	0	45	45	25	3	571	85	5	0			115	656	3,879	4,650		
3	0	45	45	25	4												
4	0	45	45	25	5	522	0	6	0			115	522	3,263	3,900		
5	0	43	45	23	6	46	0	7	0			115	46	2,989	3,150		
6	0	43	45	23	7	0	0	8	0			111	0	2,809	2,920		
7	0	43	45	23	8	0	46	9	0			111	46	2,583	2,740		
8	0	43	45	23	9	0	0	10	0			111	0	2,449	2,560		
9	0	45	45	22	10	0	0	11	0			111	0	2,349	2,460		
10	0	46	45	23	11	0	0	12	0			112	0	2,268	2,380		
11	0	46	42	25	12	0	60	13	0			114	60	2,176	2,350		
12	0	46	40	25	13	0	0	14	0			113	0	2,067	2,180		
13	0	46	40	23	14	0	167	15	0			111	167	1,962	2,240		
14	0	46	40	23	15	0	88	16	0			109	88	1,883	2,080		
15	0	46	40	23	16	0	0	17	0			109	0	1,831	1,940		
16	0	46	40	23	17	0	0	18	0			109	0	1,771	1,880		
17	0	45	40	25	18	0	0	19	0			109	0	1,691	1,800		
18	0	45	40	25	19	0	0	20	0			110	0	1,640	1,750		
19	127	45	40	25	20	0	89	21	0			110	89	1,601	1,800		
20	130	45	56	25	21	0	89	22	126			0	89	1,555	1,770		
21	202	45	59	25	22	0	89	23	129			0	89	1,532	1,750		
22	228	45	133	25	23	0	89	24	203			0	89	1,448	1,740		
23	244	45	159	25	24	0	99	25	229			0	99	1,432	1,760		
24	204	45	175	25	25	0	0	26	245			0	0	1,695	1,940		
25	0	45	135	25	26	0	0	27	205			0	0	6,975	7,180		
26	0	45	42	25	27	0	0	28	0			112	0	12,788	12,900		
27	0	45	40	25	28	0	0	29	0			110	0	8,800	8,910		
Total	1,135	1,346	1,742	730	3,065	1,719	2,681	4,784	92,818	101,420							

Col. 2 - 24 hours beginning 1200 of date shown.
Col. 3 - 24 hours ending 2400 one day later.
Col. 4 - 24 hours beginning 1500 one day later.
Col. 5 - 24 hours beginning 0800 of date shown.
Col. 6 - 24 hours beginning 1600 of date shown.

Col. 7 = Col. 2 + Col. 3 + Col. 4 in response to direction (Col. 1).
Col. 8 = Col. 2 + Col. 3 + Col. 4 - Col. 7.
Col. 9 = Col. 5 + Col. 6.
Col. 10 = Col. 11 - Col. 7 - Col. 8 - Col. 9.
Col. 11 = 24 hours of calendar day shown.

Table 12. Diversions to New York City water supply (River Master daily operation record)
[Million gallons per day for 24 hour period beginning 0800 local time; Horizontal line in average diversion column indicates change in allowable diversion]

Date 1998	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Nov. 21, 1998 or Dec. 23, 1998 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Dec. 23, 1998 to date
Dec. 1	540	0	110	591	Jan. 1	539	0	0	524
2	538	0	111	596	2	539	0	0	525
3	537	0	110	600	3	535	0	0	526
4	539	0	98	603	4	537	0	0	527
5	540	0	112	606	5	537	0	0	527
6	538	0	111	609	6	407	0	0	519
7	539	0	114	611	7	367	0	79	515
8	540	0	83	612	8	134	0	0	492
9	539	0	105	614	9	125	0	0	472
10	538	0	103	615	10	125	0	0	454
11	539	0	109	616	11	305	0	0	446
12	537	0	109	618	12	367	0	0	442
13	536	0	110	619	13	366	0	0	439
14	538	0	104	620	14	148	0	0	426
15	15	0	285	607	15	128	0	0	414
16	514	0	348	617	16	127	0	0	402
17	536	0	332	626	17	126	0	0	392
18	538	0	350	636	18	132	0	0	382
19	538	0	350	644	19	129	0	0	373
20	537	0	350	652	20	129	0	0	365
21	537	0	354	660	21	14	0	0	353
22	539	0	350	667	22	0	0	0	342
23	540	0	0	540	23	0	0	0	331
24	538	0	0	539	24	0	0	0	321
25	540	0	0	539	25	0	0	0	312
26	535	0	0	538	26	0	0	0	303
27	537	0	0	538	27	0	0	0	294
28	536	0	0	538	28	0	0	353	296
29	397	0	0	518	29	0	0	195	293
30	536	0	0	520	30	0	0	319	294
31	537	0	0	522	31	0	0	312	294
Total	15,988	0	4,208			5,816	0	1,258	

Table 12. Diversions to New York City water supply (River Master daily operation record) —Continued
[Million gallons per day for 24 hour period beginning 0800 local time; Horizontal line in average diversion column indicates change in allowable diversion]

Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Dec. 23, 1998 or Feb. 2, 1999 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Feb. 2, 1999 to date
Feb. 1	0	0	253	293	Mar. 1	340	298	0	509
2	255	0	285	540	2	286	298	0	512
3	267	0	305	556	3	286	298	0	514
4	30	0	231	458	4	33	298	0	508
5	0	0	206	395	5	0	299	0	502
6	0	0	205	357	6	0	297	0	496
7	0	0	200	331	7	0	297	0	490
8	124	0	189	328	8	334	298	0	494
9	140	0	201	330	9	377	298	0	499
10	141	0	209	332	10	379	298	0	504
11	141	266	208	360	11	512	298	0	512
12	35	299	153	372	12	530	298	0	520
13	0	299	175	380	13	531	298	0	528
14	0	300	94	381	14	524	298	0	535
15	0	298	155	387	15	391	246	0	537
16	0	298	154	391	16	376	188	0	538
17	0	299	154	395	17	373	185	0	538
18	209	299	153	410	18	200	299	0	537
19	150	299	144	421	19	144	200	0	533
20	144	299	152	430	20	143	300	0	531
21	143	299	142	437	21	144	296	0	529
22	141	299	150	445	22	9	0	0	519
23	141	299	75	448	23	0	0	0	508
24	140	205	107	448	24	0	200	0	502
25	434	299	110	465	25	0	199	0	496
26	530	299	0	479	26	80	0	0	489
27	529	297	0	492	27	19	0	0	480
28	520	297	0	504	28	0	0	0	471
					29	0	0	0	463
					30	0	0	0	455
					31	0	0	0	447
Total	4,214	5,250	4,410			6,011	6,284	0	

Table 12. Diversions to New York City water supply (River Master daily operation record) —Continued
[Million gallons per day for 24 hour period beginning 0800 local time]

Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Feb. 2, 1999 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average Feb. 2, 1999 to date
Apr. 1	0	202	90	444	May 1	184	299	0	439
2	0	199	95	442	2	183	299	0	439
3	0	193	111	439	3	193	299	0	440
4	0	201	95	437	4	383	299	0	442
5	0	201	100	435	5	449	299	0	446
6	0	201	99	433	6	448	299	0	449
7	0	200	100	431	7	448	299	0	452
8	0	200	102	429	8	448	299	0	455
9	0	200	0	425	9	448	299	0	458
10	0	200	0	422	10	299	299	0	459
11	0	200	0	419	11	299	299	0	461
12	0	200	0	416	12	300	299	0	462
13	375	200	0	418	13	298	299	0	464
14	397	200	0	421	14	297	299	0	465
15	398	200	0	423	15	298	299	0	466
16	273	299	0	425	16	298	299	0	467
17	271	300	0	427	17	298	299	0	469
18	271	300	0	429	18	292	299	0	470
19	267	300	0	431	19	0	299	0	468
20	271	300	0	432	20	0	299	0	467
21	240	300	0	434	21	0	299	0	465
22	448	300	0	438	22	0	299	0	464
23	202	298	0	438	23	286	298	0	465
24	180	300	0	439	24	311	298	0	466
25	184	300	0	440	25	296	298	0	467
26	204	300	0	440	26	301	299	0	468
27	0	300	0	439	27	280	299	0	469
28	0	299	0	437	28	195	298	0	469
29	186	299	0	438	29	183	299	0	470
30	186	299	0	438	30	197	299	0	470
					31	194	299	0	470
Total	4,353	7,491	792			8,106	9,265	0	

Table 12. Diversions to New York City water supply (River Master daily operation record) —Continued
[Million gallons per day for 24 hour period beginning 0800 local time]

Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date
June 1	290	245	92	627	July 1	450	0	195	646
2	318	201	99	623	2	449	0	192	645
3	295	201	193	645	3	450	0	194	645
4	288	201	110	633	4	448	0	195	645
5	298	0	0	566	5	450	0	197	645
6	297	0	48	529	6	451	0	230	646
7	292	285	192	564	7	450	0	193	646
8	300	299	101	581	8	450	0	349	650
9	299	299	0	583	9	451	0	394	655
10	296	299	34	587	10	451	0	394	660
11	434	299	210	620	11	449	0	396	665
12	448	299	95	638	12	449	0	397	669
13	448	298	134	657	13	449	0	398	673
14	373	299	121	666	14	449	0	399	677
15	309	300	230	678	15	449	0	400	681
16	297	299	94	679	16	449	0	402	685
17	300	300	0	674	17	412	0	403	687
18	295	299	228	682	18	449	0	404	691
19	288	299	0	677	19	416	0	406	693
20	273	299	0	672	20	451	0	408	697
21	295	299	0	668	21	451	0	408	700
22	295	300	133	671	22	450	0	405	703
23	300	299	90	672	23	407	0	411	705
24	298	298	0	669	24	448	0	413	708
25	299	200	0	662	25	448	0	414	711
26	299	200	0	656	26	423	0	413	713
27	298	200	0	650	27	451	0	412	716
28	452	201	213	657	28	450	0	412	718
29	450	17	44	652	29	450	199	405	724
30	449	0	0	646	30	450	200	200	726
Total	9,873	7,035	2,461		31	450	200	199	728
						13,800	599	10,638	

Table 12. Diversions to New York City water supply (River Master daily operation record) —Continued
[Million gallons per day for 24 hour period beginning 0800 local time]

Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date
Aug. 1	449	200	204	730	Sept. 1	519	0	181	730
2	450	201	202	732	2	519	0	288	730
3	449	201	175	733	3	520	0	241	731
4	449	201	204	735	4	519	0	303	732
5	449	201	204	737	5	519	0	315	733
6	390	197	171	737	6	519	0	318	734
7	434	201	0	736	7	519	0	307	735
8	445	201	0	735	8	520	0	308	736
9	449	200	94	735	9	520	0	317	737
10	449	200	0	733	10	520	0	322	738
11	500	200	76	734	11	519	0	324	739
12	519	200	177	736	12	518	0	325	740
13	520	0	149	735	13	518	0	17	738
14	520	0	135	734	14	519	0	0	736
15	519	0	134	733	15	79	0	0	730
16	519	0	222	733	16	0	0	0	723
17	520	0	243	734	17	0	0	0	716
18	519	0	282	735	18	0	0	0	710
19	519	0	239	735	19	0	0	0	703
20	519	0	255	735	20	0	0	0	697
21	519	0	243	736	21	302	0	0	693
22	519	0	230	736	22	148	0	0	689
23	519	0	207	736	23	333	0	0	686
24	518	0	211	736	24	450	0	0	684
25	519	0	207	736	25	450	0	0	682
26	520	0	212	735	26	450	0	0	680
27	520	0	103	734	27	448	0	0	678
28	520	0	104	733	28	450	0	212	678
29	519	0	106	732	29	450	0	205	677
30	518	0	104	731	30	450	0	228	677
31	519	0	145	730	31	450	0	0	0
Total	15,297	2,403	5,038			11,278	0	4,211	

Table 12. Diversions to New York City water supply (River Master daily operation record) —Continued
[Million gallons per day for 24 hour period beginning 0800 local time]

Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date	Date 1999	East Delaware Tunnel	West Delaware Tunnel	Never- sink Tunnel	Average June 1, 1999 to date
Oct. 1	449	0	185	677	Nov. 1	293	0	0	650
2	448	0	202	677	2	292	0	0	648
3	448	0	220	677	3	533	0	0	647
4	449	106	220	677	4	549	0	0	647
5	449	48	221	678	5	546	0	0	646
6	449	0	220	678	6	543	0	0	645
7	448	0	220	678	7	540	0	0	645
8	449	0	260	678	8	545	0	0	644
9	449	0	192	678	9	543	0	0	644
10	449	0	197	677	10	542	0	0	643
11	450	0	191	677	11	544	0	0	642
12	449	0	199	677	12	542	0	0	642
13	449	0	158	676	13	540	0	0	641
14	449	0	315	677	14	542	0	0	641
15	449	0	339	678	15	540	0	0	640
16	448	0	338	679	16	542	0	0	639
17	449	0	338	679	17	541	0	0	639
18	448	0	339	680	18	544	0	0	638
19	448	0	340	681	19	544	0	0	638
20	448	0	226	681	20	541	0	0	637
21	262	0	0	678	21	544	152	3	637
22	292	0	0	675	22	409	295	199	639
23	291	0	0	673	23	446	295	206	641
24	291	0	0	670	24	447	295	197	642
25	292	0	1	667	25	447	295	45	643
26	292	0	0	665	26	447	295	137	645
27	292	0	0	662	27	447	296	149	646
28	292	0	0	660	28	446	296	370	648
29	292	0	0	657	29	448	297	188	650
30	304	0	0	655	30	431	196	88	650
31	292	0	0	653					
Total	12,166	154	4,921			14,858	2,712	1,582	

Table 13. Daily mean discharge, East Branch Delaware River at Downsview, N.Y. (station number 01417000) for year ending November 30, 1999
(U.S. Geological Survey published record)

[All values except total in cubic feet per second, ft³/s; total in cubic feet per second days, (ft³/s)·d; e, estimated]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	45	43	7.0	44	42	62	86	90	113	71	52	43
2	44	42	7.6	44	42	69	95	90	96	63	45	43
3	53	40	7.3	43	43	69	93	98	87	73	45	43
4	41	31	7.3	43	43	69	92	121	87	82	46	43
5	41	30	7.2	42	43	69	93	144	87	82	45	43
6	41	41	7.3	42	43	69	92	144	87	83	45	43
7	42	41	7.3	43	42	69	92	121	87	73	45	43
8	42	41	7.3	43	42	69	92	98	87	65	45	43
9	42	31	e7.2	42	43	69	90	90	87	65	45	43
10	42	19	7.2	42	44	69	90	90	87	65	45	44
11	42	19	7.3	43	44	71	90	90	87	65	45	43
12	42	19	7.5	42	44	71	90	90	87	65	45	43
13	42	19	7.4	42	44	71	90	90	87	65	45	43
14	42	19	7.3	42	44	71	91	90	87	65	45	44
15	42	15	7.3	42	44	71	92	90	87	65	45	44
16	42	6.8	7.3	42	44	71	92	97	87	68	46	44
17	42	6.9	7.2	42	44	71	91	115	87	66	45	43
18	42	8.8	7.0	42	44	71	90	125	86	67	45	42
19	42	8.0	7.0	42	44	72	90	108	85	67	45	42
20	42	7.7	29	42	44	71	90	89	85	67	45	43
21	42	7.7	42	43	44	71	90	88	85	67	46	42
22	43	7.6	42	43	44	71	90	88	85	67	43	42
23	42	7.2	43	43	44	71	90	105	86	65	43	42
24	43	8.4	44	43	41	71	90	126	87	67	43	42
25	43	8.2	44	43	43	71	90	126	87	67	43	42
26	43	7.8	44	43	45	71	90	110	87	67	43	43
27	43	7.6	44	43	46	71	90	90	87	67	43	43
28	43	7.6	44	43	46	71	90	90	87	67	43	43
29	43	7.4	---	43	47	70	90	90	87	66	43	43
30	43	7.3	---	43	47	71	90	98	87	65	43	43
31	43	7.2	---	43	---	69	---	115	87	---	43	---
Total	1324	572.2	514.0	1322	1314	2172	2721	3196	2722	2047	1385	1287
Mean	42.7	18.5	18.4	42.6	43.8	70.1	90.7	103	87.8	68.2	44.7	42.9

Year total 20,576.2 (ft³/s)·d

Mean 56.4 ft³/s

Table 14. Daily mean discharge, West Branch Delaware River at Stilesville, N.Y. (station number 01425000) for year ending November 30, 1999
(U.S. Geological Survey published record)
[All values except total in cubic feet per second, ft³/s; total in cubic feet per second days, (ft³/s)·d]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	253	205	12	53	58	53	196	266	1410	993	43	44
2	293	147	17	52	59	52	289	422	1500	935	42	47
3	315	107	16	52	59	53	234	427	1480	1240	41	55
4	422	144	15	61	59	53	176	567	1370	1220	43	53
5	367	58	14	56	59	52	175	528	1290	748	42	53
6	448	174	14	55	57	52	248	610	1360	469	40	53
7	350	250	13	55	52	52	313	567	1330	359	39	53
8	459	229	13	53	52	55	334	347	1280	620	39	53
9	543	190	13	53	53	53	451	342	1340	742	40	52
10	445	86	12	53	53	52	503	461	1340	1050	40	51
11	477	30	12	53	53	52	517	364	1460	1070	39	63
12	453	31	14	53	54	52	532	489	1420	1070	38	84
13	490	31	15	53	53	52	337	613	1460	894	40	63
14	535	31	13	53	52	52	503	885	1420	861	42	44
15	574	26	12	53	53	54	267	890	1020	198	43	38
16	596	9.0	13	53	54	110	182	1070	796	142	43	37
17	636	12	13	54	55	233	364	936	903	92	43	36
18	638	14	13	54	55	320	704	709	991	73	43	36
19	677	20	12	54	54	137	689	867	1030	53	43	36
20	544	13	27	53	54	81	485	863	1150	37	44	62
21	522	12	46	51	54	55	518	1050	1100	43	44	83
22	346	13	48	58	54	55	476	1040	946	52	44	158
23	121	15	50	57	56	57	548	1170	868	51	46	203
24	176	33	50	56	55	61	591	1190	911	45	45	246
25	238	25	51	56	54	64	819	963	917	44	45	209
26	324	18	51	56	54	64	939	1060	905	43	45	127
27	418	16	51	57	54	64	435	1080	1130	43	46	63
28	289	16	52	57	54	69	279	1090	1080	41	46	50
29	323	15	---	58	53	68	309	1180	833	41	46	50
30	294	14	---	58	53	137	318	1390	892	46	46	47
31	225	13	---	58	---	173	---	1300	949	---	45	---
Total	12791	1997.0	682	1698	1639	2537	12731	24736	35881	13315	1325	2249
Mean	413	64.4	24.4	54.8	54.6	81.8	424	798	1157	444	42.7	75.0

Year total 111,581 (ft³/s)·d
Mean 306 ft³/s

Table 15. Daily mean discharge, Neversink River at Neversink, N.Y. (station number 01436000) for year ending November 30, 1999
(U.S. Geological Survey published record)

[All values except total in cubic feet per second, ft³/s; total in cubic feet per second days, (ft³/s)·d]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	22	25	4.6	26	26	42	66	54	92	53	30	23
2	29	25	5.1	25	26	52	66	57	72	53	22	23
3	29	25	5.3	26	25	52	59	70	54	57	22	23
4	32	25	5.3	26	25	52	54	105	54	72	22	23
5	28	21	5.2	26	25	53	58	124	54	82	22	23
6	28	20	5.2	25	25	52	72	124	54	82	22	22
7	28	25	5.2	25	24	52	82	102	54	71	22	21
8	27	25	5.2	25	24	53	77	61	54	52	22	21
9	29	25	5.2	25	25	53	65	54	54	51	21	21
10	31	23	5.0	25	25	53	59	53	54	51	21	21
11	28	21	5.0	25	25	53	58	53	54	51	21	21
12	28	23	5.1	25	26	53	64	53	67	52	21	22
13	28	24	5.1	25	26	53	64	52	77	51	23	22
14	28	24	5.0	25	25	53	60	53	66	52	23	22
15	28	20	5.0	26	26	53	53	61	67	52	26	21
16	27	13	5.0	26	26	53	54	88	66	54	25	21
17	27	13	5.0	26	26	52	54	105	61	50	24	21
18	27	14	5.1	26	26	52	53	116	54	50	24	22
19	27	14	5.4	25	26	52	57	103	54	49	24	23
20	27	14	18	25	25	52	64	70	54	49	24	23
21	27	14	26	26	25	52	64	54	54	49	24	23
22	24	10	26	26	25	52	64	62	54	49	24	22
23	26	5.8	26	25	26	53	64	88	54	49	24	22
24	27	7.2	25	25	25	53	72	99	54	49	23	22
25	26	6.1	25	25	25	53	80	99	58	49	25	22
26	27	6.0	25	25	25	53	80	83	72	49	25	22
27	27	5.4	25	25	25	53	80	54	73	48	24	23
28	29	5.2	26	26	25	53	80	61	53	48	24	22
29	28	4.7	---	26	25	58	65	84	69	48	24	22
30	25	4.6	---	26	25	66	54	99	72	47	24	22
31	25	4.6	---	27	---	66	---	99	54	---	23	---
Total	849	492.6	319.0	790	758	1652	1942	2440	1883	1619	725	661
Mean	27.4	15.9	11.4	25.5	25.3	53.3	64.7	78.7	60.7	54.0	23.4	22.0

Year total 14,130.6 (ft³/s)·d

Mean 38.7 ft³/s

Table 16. Daily mean discharge, Wallenpaupack Creek at Wilsonville, Pa. (station number 01432000) for year ending November 30, 1999
(Record furnished by Pennsylvania Power & Light Company)
[All values except total in cubic feet per second, ft³/s; total in cubic feet per second days, (ft³/s)·d]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	50	0	433	562	582	0	222	295	49	284	585	573
2	0	0	365	605	553	0	229	244	0	223	0	714
3	0	0	453	464	521	465	139	123	0	269	0	548
4	0	0	431	591	489	489	0	123	0	0	458	575
5	0	107	391	522	479	586	0	388	0	0	672	615
6	0	0	344	409	556	446	0	575	0	0	434	47
7	0	0	344	494	588	433	292	98	0	207	527	0
8	0	0	371	557	580	0	338	255	0	226	497	0
9	0	0	620	584	566	0	199	410	84	219	0	0
10	0	0	560	514	476	0	0	0	0	276	0	0
11	0	0	601	503	496	0	0	0	41	0	575	0
12	0	0	677	463	609	0	0	248	0	0	551	0
13	0	0	525	428	599	0	0	360	315	0	526	0
14	0	37	491	405	587	0	224	344	211	293	473	0
15	0	0	667	546	554	0	0	400	0	441	536	0
16	0	0	865	561	524	0	249	366	223	500	0	0
17	0	0	849	583	0	0	455	32	215	730	0	0
18	0	0	943	614	0	0	270	60	215	0	424	0
19	0	223	999	556	543	0	0	210	262	0	441	0
20	0	0	1070	497	513	0	0	264	246	561	409	0
21	0	0	864	501	571	0	419	263	0	439	479	0
22	0	0	942	544	540	0	363	342	0	549	571	0
23	0	0	945	586	610	0	282	298	263	487	0	0
24	0	0	903	541	0	0	271	61	217	472	0	0
25	0	250	904	581	0	0	401	60	204	0	640	0
26	0	427	1000	591	543	0	74	222	169	0	544	0
27	0	445	407	501	592	0	69	452	257	568	702	0
28	0	497	472	474	543	0	187	326	0	575	596	0
29	0	459	---	610	418	0	209	237	0	495	551	0
30	0	237	---	584	551	0	305	215	273	437	0	15
31	56	352	---	524	---	0	---	158	246	---	0	---
Total	106	3034	18436	16495	14183	2419	5197	7429	3490	8251	11191	3087
Mean	3.42	97.9	658	532	473	78.0	173	240	113	275	361	103

Year total 93,318 (ft³/s)·d

Mean 256 ft³/s

Table 17. Daily mean discharge, Delaware River at Montague, N.J. (station number 01438500) for year ending November 30, 1999
(U.S. Geological Survey published record)
[All values except total in cubic feet per second, ft³/s; total in cubic feet per second days, (ft³/s)·d; e, estimated]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	1600	e1300	4900	4010	7330	3320	2830	1940	2180	1780	3310	2050
2	1440	e1100	5010	5250	7450	2800	2900	1820	2110	1870	3750	2760
3	1440	e1200	9410	5000	6890	2660	2700	1580	2020	1810	2640	3880
4	1490	e1400	10300	8890	6560	3130	2510	1780	1990	1880	2590	5170
5	1520	e1500	8640	14400	6260	3120	2160	1730	1890	1840	3870	4660
6	1620	e1600	7880	10100	5860	3040	1850	2400	1800	1880	4350	3920
7	1530	e1400	6800	8280	5310	2810	1770	2710	1820	1610	3590	3160
8	1600	e1350	5870	6980	5160	2750	2290	2030	1760	1570	3190	2920
9	1520	e1400	5390	6010	4800	2810	2340	2120	1750	1510	3000	2740
10	1700	e1550	5270	5810	5100	3070	1940	1950	1810	1620	2880	2560
11	1760	e1700	4750	5520	4980	2760	1750	1410	1780	1840	3660	2460
12	1680	e2200	5080	4920	5060	2600	1780	1590	1970	1740	4550	2380
13	1610	e2050	6420	4010	5650	2330	1690	1610	2130	1700	3970	2360
14	1580	e1900	6960	4120	5570	2060	1680	1750	2600	1650	3710	2180
15	1530	e1900	5640	4360	4600	2040	1740	1910	2550	1790	4070	2230
16	1560	e1800	5610	4720	4280	1850	1670	2070	2360	4840	4030	2080
17	1600	e1900	5960	4310	4400	1750	1650	2180	2270	23200	3190	1940
18	1650	e2300	6060	4930	4310	1680	1830	1860	1830	15400	2850	1880
19	1650	e4200	6190	5620	4550	2010	1810	1980	1720	7070	3030	1800
20	1630	e11000	5550	5340	4640	3550	1780	1990	1880	4640	2970	1750
21	1630	e8000	4970	4850	4570	3450	1720	1900	1990	4160	3100	1800
22	1570	e5800	4360	11600	4500	2820	2000	1970	2070	3830	3170	1770
23	1840	e6000	3860	14900	4260	2450	1890	2200	1870	5210	3420	1750
24	2590	e13000	3670	12000	5190	2840	1630	2000	1980	4930	2940	1750
25	1890	e42000	4060	10600	5120	6630	1610	1980	1800	3840	3180	1770
26	e1700	e21000	3980	9600	4700	7690	1760	1880	1880	2830	3270	1940
27	e1550	e13500	3440	8570	4540	5900	1740	1930	1880	2460	3060	7130
28	e1800	e10300	3090	7890	4180	4750	1740	2170	2070	2760	3100	12900
29	e2100	8260	---	8360	3830	3920	1860	2030	1950	2650	2810	8910
30	e1650	6830	---	8490	3620	3440	1850	1940	1760	2790	2690	6780
31	e1600	5490	---	8140	---	2990	---	2080	1800	---	2050	---
Total	51630	184930	159120	227580	153270	99020	58470	60400	61270	116700	101990	101380
Mean	1665	5965	5683	7341	5109	3194	1949	1948	1976	3890	3290	3379

Year total 1,375,760 (ft³/s)·d
Mean 3,769 ft³/s

Table 18. Diversions by New Jersey; daily mean discharge, Delaware and Raritan Canal at Port Mercer, N.J. (station number 01460440) for year ending November 30, 1999 (U.S. Geological Survey published record)

[All data except total in million gallons per day, Mgal/d; total in Million gallons, Mgal; e, estimated; -, reverse flow condition]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	96	74	70	73	91	100	98	106	101	92	92	100
2	96	73	64	79	91	100	95	104	100	91	92	94
3	97	57	60	79	92	101	94	105	100	91	94	89
4	98	60	70	69	92	101	96	107	99	92	91	96
5	98	66	83	78	92	101	96	107	101	94	92	93
6	98	71	85	80	90	99	98	105	99	94	88	100
7	98	70	85	73	93	101	99	105	97	96	90	99
8	98	63	86	79	92	101	98	106	99	95	90	99
9	96	73	84	81	92	100	98	107	99	94	92	100
10	96	70	85	82	87	99	99	107	98	100	93	99
11	97	67	82	82	86	98	105	109	100	92	92	99
12	96	68	79	83	85	100	107	110	99	94	90	95
13	97	69	82	90	88	98	110	111	96	93	92	96
14	96	68	87	92	92	100	103	107	36	e93	96	95
15	89	61	87	90	92	98	103	108	90	e82	94	95
16	88	56	87	83	93	100	102	106	94	e-149	99	96
17	87	72	88	84	92	100	103	107	94	e-181	101	96
18	85	57	74	87	93	100	106	107	95	e52	97	96
19	85	55	76	90	94	100	106	109	96	e56	94	98
20	87	66	83	92	94	98	107	109	95	e82	93	98
21	86	69	84	89	94	98	110	107	92	e80	94	100
22	80	71	87	8.4	96	99	108	107	95	89	93	87
23	77	70	85	76	100	99	106	105	96	89	93	79
24	76	56	87	87	98	81	105	101	96	88	91	84
25	76	61	86	88	99	76	106	101	96	98	89	98
26	76	65	83	91	100	98	107	100	82	96	92	100
27	74	66	83	94	100	100	105	100	78	95	92	85
28	70	66	85	94	100	101	104	101	92	96	91	85
29	70	69	--	91	100	101	104	101	93	94	98	75
30	70	71	--	90	99	101	105	100	92	90	101	78
31	71	73	--	89	--	100	---	100	92	---	101	---
Total	2704	2053	2277	2543.4	2807	3049	3083	3265	2892	2168	2897	2804
Mean	87.2	66.2	81.3	82.0	93.6	98.4	103	105	93.3	72.3	93.5	93.5

Year total 32,542.4 Mgal

Mean 89.2 Mgal/d

QUALITY OF WATER IN THE DELAWARE ESTUARY

Introduction

This section describes the water-quality monitoring program for the Delaware Estuary during the River Master 1999 report year, December 1, 1998, to November 30, 1999. This program is conducted by the U.S. Geological Survey, in cooperation with the Delaware River Basin Commission. Selected data collected for this program are presented and water-quality conditions are summarized. The Delaware River Basin Commission and other entities use these data to assess water-quality conditions and track the movement of the "salt front" in the Delaware Estuary.

Water-Quality Program

As part of a long-term program, the quality of water in the Delaware Estuary between Trenton, N.J. and Reedy Island Jetty, Del. was monitored at various locations (fig. 7). Data on temperature, specific conductance, dissolved oxygen, and pH were collected by electronic instruments at four sites -- Trenton, Benjamin Franklin Bridge, Chester, and Reedy Island Jetty. Data on temperature and specific conductance were collected in the same manner at Fort Mifflin. Water-quality monitors at Fort Mifflin and Chester were not operated during February and March 1999. Monitors at Trenton, Benjamin Franklin Bridge, and Reedy Island Jetty were operated throughout the report year.

From March to November, discrete water-quality data were obtained on a bi-monthly basis at 18 sites between Fieldsboro, N.J. and the mouth of Mahon River (sample sites A-S on fig. 7). These data were collected by the State of Delaware for the Delaware River Basin Commission. At each of these sites, water samples were collected near the center of the channel and analyzed for 28 physical properties and chemical constituents including temperature, chloride, alkalinity, specific conductance, dissolved oxygen, pH, nutrients, and trace metals. These analyses consist of field measurements and laboratory determinations.

During the 1999 report year, water-quality data were obtained on a monthly basis at three additional sites in lower Delaware Bay (sites T-V on fig. 7). Water samples were collected during March, May, July, August, September and November and were analyzed for the same physical properties and chemical constituents as noted for the 18-site network.

Data obtained from the water-quality monitors are processed and stored in the U.S. Geological Survey's National Water Information System data base. These data are published annually by the Geological Survey in water resources data reports for New Jersey and Pennsylvania. Water-quality data for the 18 bimonthly and 3 monthly sampling sites are not presented in this report but are available from the Delaware River Basin Commission. All data collected before 1999 are available from STORET, the U.S. Environmental Protection Agency's electronic storage and retrieval system for water-quality data.

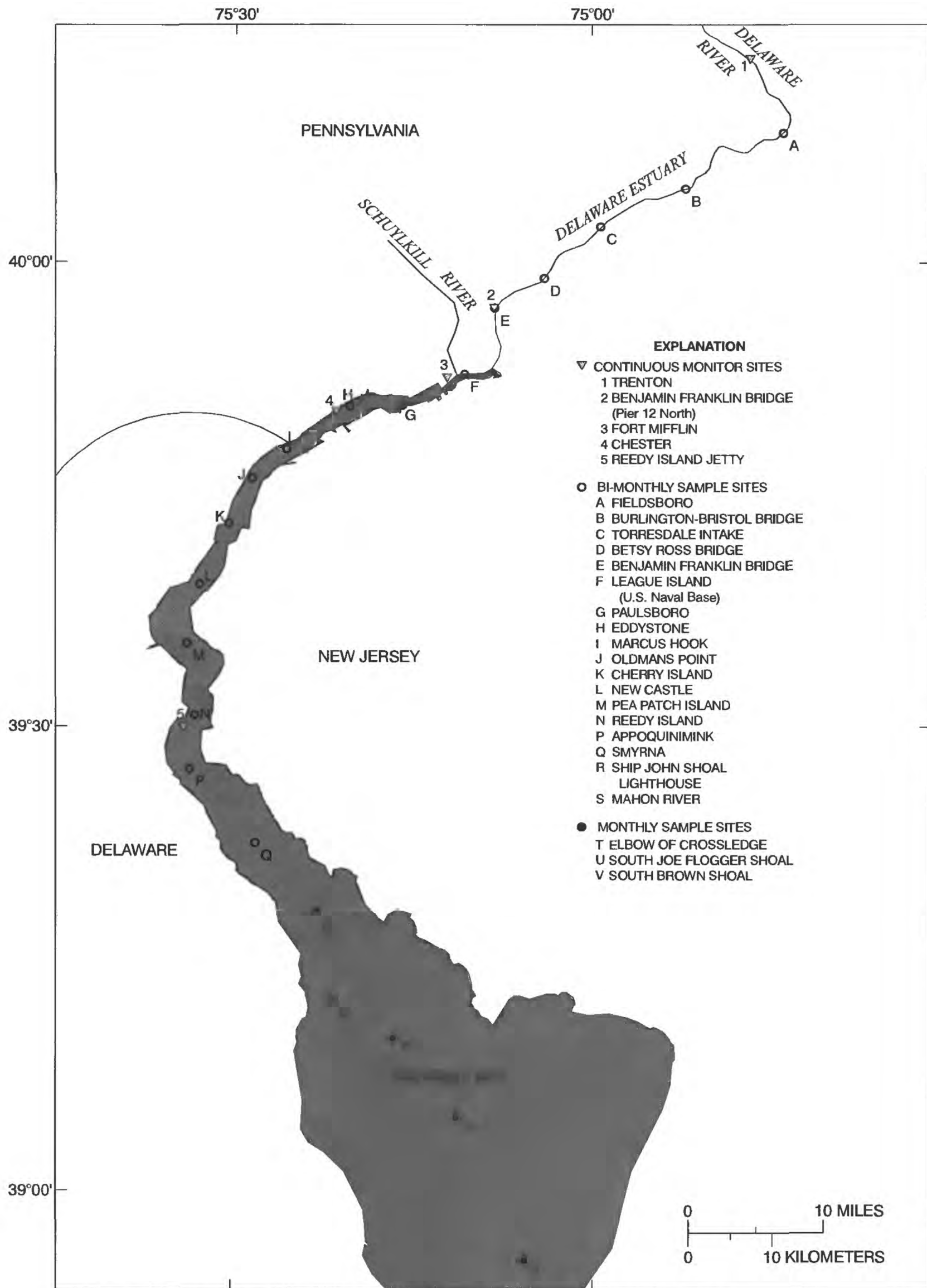


Figure 7. Location of water-quality monitoring sites on the Delaware Estuary.

Water Quality During the 1999 Report Year

Streamflow

Streamflow has a major effect on the quality of water in the Delaware Estuary. Increased streamflow usually results in improved water quality by limiting the upstream movement of seawater and reducing the concentration of dissolved substances. Increased flow also aids in maintaining lower water temperatures during warm weather and in supporting higher concentrations of dissolved oxygen. Under certain conditions, however, high streamflows can transport large quantities of nutrients to the estuary, which may result in noxious algal blooms.

During the report year, monthly mean streamflow measured at the U.S. Geological Survey streamgaging station Delaware River at Trenton, N.J. was lowest during July (2,720 ft³/s) and highest during March (16,240 ft³/s; table 19). Monthly mean streamflows were greater than long-term mean monthly flows in January, February, September, and October, and were substantially less than the long-term flows in the other months. The greatest flow deficiency was in December 1998, when monthly mean streamflow was about 22 percent of the long-term mean monthly flow. Long-term monthly mean streamflow is computed on the basis of data collected from 1913 to 1998. The highest daily mean streamflow during the report year was 75,300 ft³/s, recorded on September 17, 1999. The peak discharge for the year was 112,000 ft³/s on September 16. This peak flow resulted from Tropical Storm Floyd, which delivered as much as 10 inches of rain to parts of the Delaware River Basin.

Water Temperature

Water temperature is an important factor affecting water quality, as it influences various physical, chemical, and biological properties of water. Generally, increases in water temperature have deleterious effects on water quality by decreasing the saturation level of dissolved oxygen and increasing the biological activity of aquatic organisms. Although the primary factors that affect water temperature in the Delaware Estuary are climatic, various kinds of water use, especially powerplant cooling, also can have measurable effects.

Water-temperature records for the monitor site at Benjamin Franklin Bridge (Pier 12 North), Philadelphia, Pa., show that monthly mean temperatures from April to November 1999 were greater than the long-term mean monthly temperatures during April, June to August, and November. Long-term mean water temperatures were computed using data for the period from 1964 to 1998 (fig. 8).

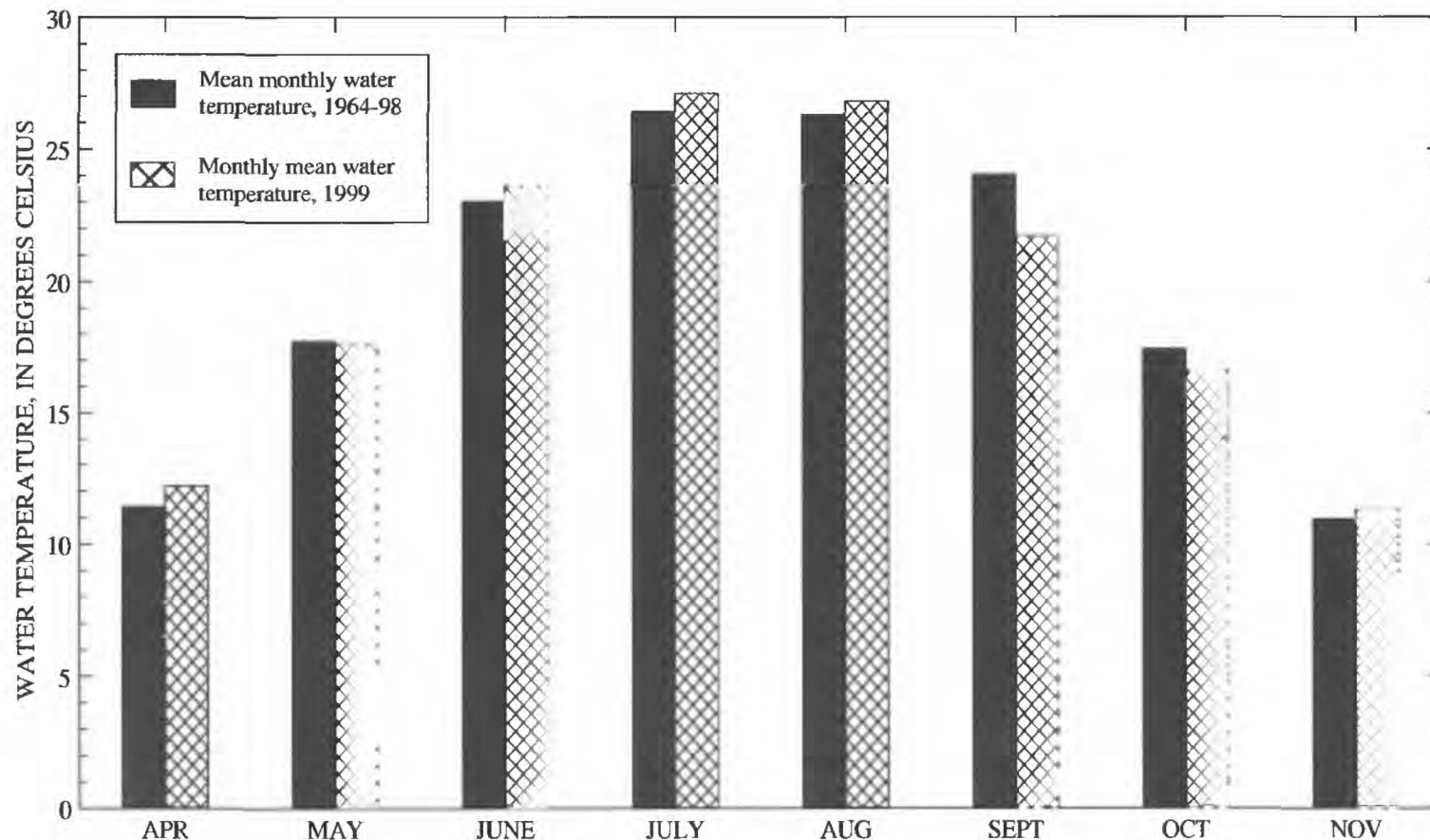


Figure 8. Water temperature in the Delaware Estuary at Benjamin Franklin Bridge at Philadelphia, Pa., April to November.

Specific Conductance and Chloride Concentration

Specific conductance is a measure of the capacity of water to conduct an electrical current and is a function of the types and quantities of dissolved substances in water. As concentrations of dissolved ions increase, specific conductance of the water increases. Specific conductance measurements are a good indicator of dissolved solids content and total ion concentrations. High concentrations of ions in seawater and some contaminants from man-made sources can have substantial effects on specific conductance. Dilution associated with high streamflows results in decreased levels of dissolved solids and specific conductance, whereas low streamflows have the opposite effect.

The upstream movement of seawater, and the accompanying increase in chloride concentrations, is an important concern for water supply in the Delaware Estuary region. Water with chloride concentrations greater than 250 mg/L (milligrams per liter) is considered undesirable for domestic use, and water with concentrations exceeding 50 mg/L is unsatisfactory for some industrial uses. Chloride concentrations in the estuary generally increase in a downstream direction, in proximity to the Atlantic Ocean.

Chloride concentration was not measured directly at the monitor sites at Fort Mifflin, Pa., and Reedy Island Jetty, Del. Instead, mathematical relations between specific conductance and chloride concentration have been developed on the basis of long-term field measurements of specific conductance and laboratory analyses of chloride. These relations can be used to estimate chloride concentrations from specific conductance data (tables 20 and 21). The specific conductance-chloride relations are less reliable when chloride concentrations are less than 30 mg/L, because other dissolved ions may be present in amounts large enough to affect the relations. Therefore, chloride concentrations estimated from specific conductance data are not presented when concentrations of less than 30 mg/L would result from the relations. Chloride concentrations at Chester, Pa., (table 22) were measured directly by Kimberly Clark Chester Operations, and are not derived from specific conductance data.

At Fort Mifflin, the highest daily maximum chloride concentration for the periods December 1, 1998 to January 14, 1999 and March 30 to November 30, 1999 was 310 mg/L on August 11 (table 20). During the same period, daily maximum concentrations exceeded 50 mg/L on 41 percent of the days. The lowest daily minimum chloride concentration was less than 30 mg/L on many days during the report year (table 20). Daily minimum concentrations exceeded 50 mg/L on 32 percent of the days. From April to June, the lowest daily minimum chloride concentration was consistently less than 30 mg/L, and the highest daily maximum concentration was 43 mg/L. From July to November, daily minimum chloride concentrations ranged from less than 30 to 130 mg/L, and daily maximum concentrations ranged from less than 30 to 310 mg/L.

At Chester, the highest daily maximum chloride concentration was 930 mg/L on August 13, 1999 (table 22). During the report year, daily maximum concentrations exceeded 50 mg/L on 64 percent of the days. The lowest daily minimum chloride concentration was 20 mg/L on April 18, 1999 (table 22). Daily minimum concentrations exceeded 50 mg/L on 43 percent of the days. During December 1998 and January 1999, daily maximum chloride concentrations ranged from 55 to 460 mg/L. From July to September 1999, daily maximum concentrations ranged from 42 to 930 mg/L.

At Reedy Island Jetty, the highest daily maximum daily chloride concentration was 9,600 mg/L on August 23, 1999 (table 21). Daily maximum chloride concentrations during the report year exceeded 1,000 mg/L on 98 percent of the days. The lowest daily minimum chloride concentration for the report year was less than 250 mg/L on 12 days in late January and early February 1999 (table 21). Daily minimum chloride concentrations exceeded 1,000 mg/L on 74 percent of the days. During December 1998 and January 1999, daily maximum chloride concentrations at Reedy Island Jetty ranged from 800 to 7,500 mg/L. From July to September, daily maximum chloride concentrations ranged from 2,000 to 9,600 mg/L.

Large volumes of freshwater inflow resulting from the passage of Tropical Storm Floyd on September 16, 1999, had a major diluting effect on chloride concentrations in the Delaware Estuary. At Fort Mifflin, the daily maximum chloride concentration was 120 mg/L on September 15 and less than 30 mg/L on September 17. At Chester, daily maximum chloride concentrations decreased from 600 mg/L on September 15 to 84 mg/L on September 18, whereas at Reedy Island Jetty, concentrations decreased from 9,300 mg/L on September 16 to 2,000 mg/L on September 18.

Dissolved Oxygen

Dissolved oxygen in water is necessary for the respiratory processes of aquatic organisms and in chemical reactions in aquatic environments. Fish and many other clean-water biota require relatively high dissolved oxygen concentrations at all times. The major source of dissolved oxygen in water is diffusion from the atmosphere and, to a lesser extent, photosynthetic activity of aquatic plants. The principal factors that affect dissolved oxygen concentrations in the Delaware Estuary are water temperature, biochemical oxygen demand, freshwater inflow, phytoplankton, turbidity, salinity, and tidal and wind-driven mixing.

Concentrations of dissolved oxygen at various sites on the Delaware Estuary have been measured since 1962 by the U.S. Geological Survey. Two of these sites, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pa., and Delaware River at Chester, Pa., have nearly continuous records and are in the reach of the estuary most affected by effluent discharges. The mean and minimum daily mean dissolved oxygen concentrations from July to September at these stations during the 1965-99 report years is shown in figure 9. An increasing trend in concentration is indicated. Although concentrations have increased considerably over this period, mean concentrations can vary widely from year to year.

Concentrations of dissolved oxygen in the Delaware Estuary generally are greatest near Trenton and decrease in a downstream direction. In an area just below the Benjamin Franklin Bridge, concentrations usually reach minimum levels. During the report year, daily mean concentrations of dissolved oxygen at the Benjamin Franklin Bridge monitor site were lowest in mid-June, and the lowest recorded daily mean concentration was 3.7 mg/L on June 15, 1999 (table 23). The minimum hourly concentration was 3.4 mg/L on June 15 and 16. From December 1998 until early June 1999, and from September to November, daily mean concentrations of dissolved oxygen were greater than 6.0 mg/L. At Chester, daily mean dissolved oxygen concentrations were lowest in mid-September, and the lowest recorded daily mean concentration was 4.8 mg/L on September 12 and 15 (table 24). The minimum hourly concentration was 4.6 mg/L on September 1 and 15. From December 1998 until early June 1999, and from late-September to November, daily mean dissolved oxygen concentrations generally were greater than 6.0 mg/L.

Histograms of hourly dissolved oxygen concentrations at the Benjamin Franklin Bridge and Chester monitor sites during the critical summer period--July to September 1999--are presented in figure 10. Hourly concentrations at the Benjamin Franklin Bridge were 4 mg/L or less during 3 percent of this period. In comparison, in 1998, hourly concentrations decreased to levels less than 4 mg/L during 1 percent of the critical period. In 1997, hourly concentrations did not fall below 4 mg/L although in 1996, hourly concentrations declined below 4 mg/L for 13 percent of the time. At Chester, hourly dissolved oxygen concentrations did not decline below 4 mg/L during the 1997-99 critical summer periods. In 1996, hourly concentrations were less than 4 mg/L during only 0.1 percent of the critical period.

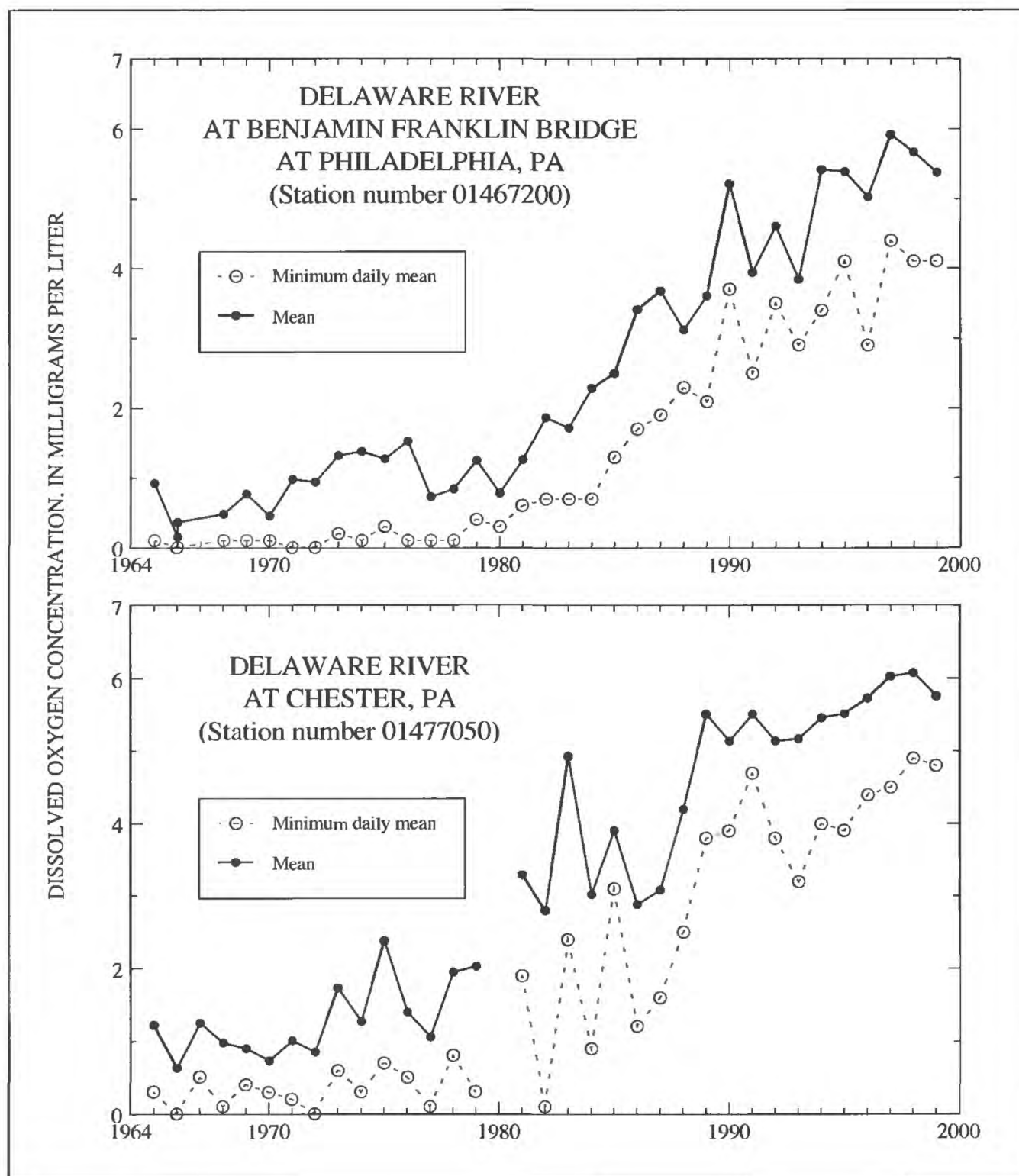


Figure 9. Mean and minimum daily mean dissolved oxygen concentrations from July to September at two monitor sites on the Delaware Estuary, 1965-99.

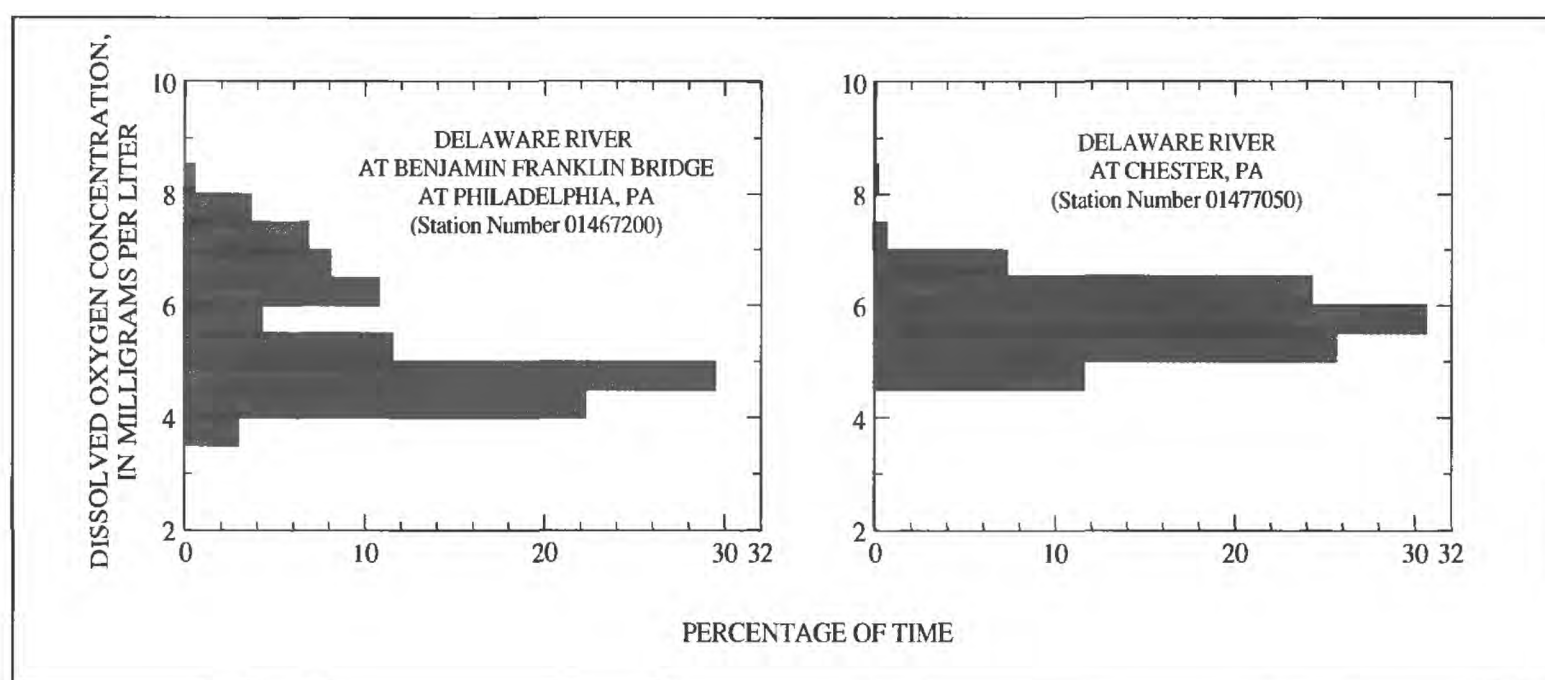


Figure 10. Distribution of hourly dissolved oxygen concentrations at two monitor sites on the Delaware Estuary, July to September 1999.

Hydrogen-Ion Activity (pH)

The pH of a solution is a measure of the effective concentration (activity) of dissolved hydrogen ions. Solutions having a pH less than 7 are characterized as acidic whereas solutions with a pH greater than 7 are considered basic or alkaline. The pH of uncontaminated surface water generally ranges from 6.5 to 8.5. The major factors affecting the pH of surface water usually are the geochemical composition of the drainage basin and human inputs such as effluent discharges. In addition, photosynthetic activity, and dissolved gases including carbon dioxide, hydrogen sulfide, and ammonia can have a considerable effect on pH. During the report year, pH was measured continuously at the Benjamin Franklin Bridge, Chester, and Reedy Island Jetty monitor sites. The pH ranges for each station are as follows: Benjamin Franklin Bridge, 6.6 to 7.5; Chester, 6.8 to 7.7; and Reedy Island Jetty, 7.2 to 8.3. Generally, the pH of water in the Delaware Estuary is lowest near Trenton, N.J. and increases in a downstream direction.

Local Variations in Water Quality

In 1999, the U.S. Geological Survey measured water quality along estuary cross sections at the five continuous monitor sites. Measurements of temperature, specific conductance, dissolved oxygen, and pH were made at various points along the cross sections, and at various depths at each point, to identify any local variations in these parameters. The measurements show that generally, locational differences in water quality along individual cross sections are small, indicating reasonably uniform water quality (table 25). Complete listings of water-quality data collected during the cross-sectional measurements are presented in the U. S. Geological Survey's annual water-data reports for New Jersey and Pennsylvania, water year 1999.

Table 19. Daily mean discharge, Delaware River at Trenton, N.J. (station number 01463500) for the year ending November 30, 1999
(U.S. Geological Survey published record)

[All values, except total, in cubic feet per second ft³/s; total in cubic feet per second days, (ft³/s)·d; e, estimated]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	3480	2420	13800	10000	15300	7880	5930	2960	2560	2510	10700	5310
2	2980	2490	13800	11500	14200	7430	5360	3010	2670	2450	9080	4920
3	2940	5330	20300	12200	13800	6730	5290	3040	2750	2420	9420	7750
4	2790	8990	22300	13600	13400	6350	5080	2870	2700	2590	8360	11700
5	2730	5850	22100	19300	12800	6780	4790	2590	2650	2600	9030	11900
6	2790	e4010	18700	24600	12000	6740	4460	2690	2650	2760	9530	11200
7	2730	e3500	16800	20400	11600	6690	3980	2550	2570	3010	9960	9590
8	2830	e3810	15600	16900	10800	6390	3650	3120	2540	3180	8730	8360
9	2790	e3930	14300	14500	10200	6950	3560	3400	2580	3330	7820	7660
10	2880	e8450	12900	12900	11600	6570	3850	2840	2570	3250	8310	6920
11	2800	7090	12300	12200	12100	6520	3790	2900	2530	3450	10100	6520
12	2830	5910	11400	11800	12300	6320	3450	2660	2580	2830	9560	6270
13	2960	5580	12700	10800	11700	5820	3200	2260	2570	2820	10300	5940
14	2790	6430	14300	9790	11300	5390	3420	2300	4840	2610	11100	5830
15	2720	6680	14500	9770	10800	4860	3590	2530	4530	2610	9840	5590
16	2680	7620	12900	10300	10200	4530	3400	2580	4330	33900	8930	5360
17	2650	6420	12200	11100	10800	4460	3340	2650	3850	75300	9170	5320
18	2650	9440	14100	11300	10300	4100	3200	2770	3340	48600	8290	5060
19	2720	28500	15700	11000	9660	4090	3360	2840	3070	28100	7650	4730
20	2700	18100	14400	11500	9590	6080	3400	2610	2780	16300	7490	4590
21	2750	19400	12900	11400	10700	7560	3240	2630	2560	12000	7930	4520
22	2680	17700	11500	29100	10100	7490	3180	2630	2750	10500	7560	4590
23	2680	16700	10500	33100	9940	6780	3130	2610	2790	9490	7630	4570
24	2640	23100	9210	30900	10900	7730	3290	2710	2780	9420	7820	4380
25	2960	57300	8740	25600	11200	8580	3100	2850	2620	9820	7170	4180
26	3520	58600	8790	21900	11000	10700	2800	2630	3300	9000	6730	4350
27	2700	37900	8780	19500	9920	12500	2760	2570	4940	7660	6850	7460
28	2300	28400	8590	17700	9840	10500	3020	2480	3620	6270	6420	17300
29	2550	23000		16700	8990	8970	2940	2480	3050	5950	6140	22500
30	3050	18800		16300	8360	7800	2930	2820	2920	6660	6040	18000
31	3250	15900		15900		6760		2730	2720		5640	
Total	87520	467350	384110	503560	335400	216050	110490	84310	94710	331390	259300	232370
Mean	2823	15080	13720	16240	11180	6969	3683	2720	3055	11050	8365	7746
Max	3520	58600	22300	33100	15300	12500	5930	3400	4940	75300	11100	22500
Min	2300	2420	8590	9770	8360	4090	2760	2260	2530	2420	5640	4180

Year total 3,106,560 (ft³/s)·d

Mean 8,511 ft³/s

Table 20. Daily maximum and minimum chloride concentrations estimated from values of specific conductance, Delaware River at Fort Mifflin, Pa. (station number 01474703) for the year ending November 30, 1999

[Concentrations in milligrams per liter; monitor was not in operation January 15, 1999 to March 29, 1999; --, missing data; *, less than 30 milligrams per liter; Max, maximum value; Min, minimum value; <, less than]

DAY	DEC		JAN		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	93	58	120	81			*	*	*	*	*	*	37	30	160	89	130	54	42	*	---	---
2	90	57	120	80			*	*	*	*	*	*	40	31	150	90	180	56	43	*	---	---
3	91	57	190	90			*	*	*	*	31	*	39	33	170	87	170	57	42	*	---	---
4	110	56	110	59			*	*	*	*	30	*	41	33	200	95	190	59	*	*	---	---
5	100	59	95	50			*	*	*	*	30	*	42	35	180	96	240	57	30	*	42	*
6	120	59	85	55			*	*	*	*	*	*	44	35	160	100	180	61	*	*	33	*
7	120	76	81	52			*	*	*	*	30	*	47	37	200	110	210	56	*	*	38	*
8	120	62	62	49			*	*	*	*	*	*	49	38	200	110	140	52	*	*	34	*
9	110	79	77	50			*	*	34	*	30	*	53	40	---	---	140	52	*	*	*	*
10	110	79	61	47			*	*	30	*	32	*	52	40	230	110	130	58	*	*	*	*
11	98	77	120	46			*	*	*	*	*	*	55	41	310	120	120	60	*	*	30	*
12	110	76	110	47			*	*	30	*	31	*	58	41	280	120	120	58	*	*	*	*
13	97	78	110	54			*	*	32	*	30	*	76	41	270	130	110	56	*	*	*	*
14	110	78	87	54			*	*	33	*	30	*	89	45	240	120	120	57	*	*	32	*
15	110	77					*	*	31	*	31	*	85	46	180	110	120	56	*	*	33	*
16	99	76					*	*	31	*	34	*	90	49	160	99	110	*	*	*	35	*
17	120	76					*	*	30	*	30	*	92	50	160	94	*	*	*	*	35	*
18	110	61					*	*	30	*	30	*	89	50	140	91	*	*	33	*	*	*
19	120	80					*	*	31	*	33	*	89	51	140	88	*	*	*	*	30	*
20	110	76					*	*	32	*	33	*	88	54	150	92	*	*	*	*	32	*
21	130	79					*	*	31	*	35	*	95	55	170	89	*	*	*	*	33	*
22	120	81					*	*	32	*	38	*	110	57	160	89	*	*	*	*	35	*
23	110	59					*	*	31	*	34	*	100	59	160	90	*	*	*	*	35	*
24	120	78					*	*	39	*	34	*	100	60	170	89	*	*	*	*	34	*
25	120	78					*	*	39	*	32	*	110	59	180	90	*	*	50	*	35	*
26	110	80					*	*	31	*	32	*	110	58	180	88	*	*	56	*	33	*
27	120	77					*	*	30	*	35	*	---	---	130	48	*	*	43	*	55	*
28	120	81					*	*	*	*	33	*	---	---	100	49	*	*	---	---	54	*
29	140	81					*	*	30	*	36	*	150	76	100	49	*	*	---	---	31	*
30	150	89					*	*	31	*	43	32	150	79	97	49	35	*	---	---	*	*
31	120	80					*	*	31	*			160	83	120	50			---	---		
Max	150	89	190	90	<30	<30	35	<30	39	<30	43	32	160	83	310	130	240	61	56	<30	55	<30
Min	90	56	61	46			<30		<30		<30	<30	37	30	97	48	<30	<30	<30			

Table 21. Daily maximum and minimum chloride concentrations estimated from values of specific conductance, Delaware River at Reedy Island Jetty, Del. (station number 01482800) for the year ending November 30, 1999

[Concentrations in milligrams per liter; --, missing data; Max, maximum value; Min, minimum value]

DAY	DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	6200	3800	6400	3700	1600	200	4600	1500	740	500	3100	1400	4200	1800	6200	3200	8000	4800	9100	5800	4100	1500	4500	1800
2	6100	3600	5900	3400	1300	220	3000	1200	1900	430	2700	1400	4300	1700	5600	3000	7600	4900	9300	5500	4000	1500	6000	2000
3	6000	3600	7300	4000	1100	230	3800	1200	2800	540	3500	1800	4200	1600	4300	2900	8100	4700	8800	5500	3000	1400	4500	2200
4	6700	3600	5500	3600	840	200	3700	810	2000	560	4100	1700	3800	1600	5300	2900	8300	5200	9100	5700	3000	1200	2600	1400
5	6400	3700	4500	3100	470	160	1300	730	1900	550	3700	1800	4500	1800	5800	3100	8200	5400	9300	6100	4100	1100	2700	1100
6	6600	3800	5400	2700	1800	170	2200	740	2400	590	4200	2200	4400	1900	6100	3200	8400	5300	8400	6100	3600	1200	2600	970
7	6000	4000	4100	2800	1500	220	1700	470	1800	590	3600	2000	3900	1900	6300	3500	8400	5400	8400	6000	3000	980	3100	960
8	6300	4000	4600	2600	1900	230	2800	490	1800	580	3800	2200	4400	1900	6600	3600	8100	5400	8500	6000	3200	950	4400	1300
9	6500	4000	4300	2600	2400	240	3200	690	1900	600	3800	1700	5300	2000	6900	3500	8300	5100	8500	5900	3100	900	4600	1400
10	6400	3900	5100	2800	2400	270	4700	920	3100	860	3400	1500	5000	2200	6600	3400	8500	5400	8400	5600	2900	840	3500	1300
11	5900	4000	5000	2800	3000	370	4900	2000	3400	990	4400	1600	5000	2300	6800	3200	8600	5500	8200	5400	2100	750	4500	1300
12	6600	3900	4000	2300	3400	710	5900	2400	3400	1100	4200	1600	5000	2400	7000	3600	8200	5300	8200	5800	2800	730	5000	1600
13	6500	4200	4200	2300	3200	610	6300	2900	2900	960	4600	1800	5200	2500	6900	3700	8300	5400	8400	5800	2800	740	4000	1700
14	7500	4400	5300	2400	2500	490	7100	3500	3000	860	4800	1800	5000	2500	7900	4100	---	---	8200	5900	2300	610	4500	1800
15	7500	4500	6100	3600	3900	720	7900	4500	3000	850	4600	2000	5300	2500	7000	4000	---	---	8100	5500	2200	580	4900	1700
16	6600	4500	4700	3000	3400	780	7000	3500	2800	980	4400	2000	5100	2600	6800	3900	---	---	9300	4600	3000	570	5600	2000
17	7500	4700	4700	2900	3100	820	5300	3200	2700	1000	4300	2000	5400	2900	6400	3900	---	---	4600	850	3400	770	6600	2400
18	7000	4500	5800	3100	3000	890	5800	3200	2800	850	4600	2000	5800	3100	6200	3800	---	---	2000	350	4800	770	7200	2800
19	7100	4300	5000	2200	2800	740	5500	2800	2500	760	4400	2100	6600	3300	6500	3900	---	---	2700	470	5500	1800	6100	3300
20	6800	4100	3800	1800	2500	700	5600	2800	2400	630	4100	2000	6100	3500	6700	4000	---	---	3600	400	5300	1900	6200	3000
21	7000	4000	3600	1600	2500	640	5700	2600	2100	590	4300	1900	6300	3500	6700	4200	---	---	3800	740	5600	1900	6100	3000
22	6700	3700	3600	1500	3200	600	5100	2200	2400	580	4800	2100	---	---	6600	4100	---	---	4600	860	5700	2100	6200	3100
23	5900	3600	3600	1300	4200	780	2700	1300	2300	650	5200	2600	7100	3400	7000	4000	9600	5800	5000	970	5700	2400	6400	3100
24	6200	3800	3200	1200	3500	890	2100	900	2300	660	5100	2500	---	---	7100	4000	9300	5900	5200	1300	4600	2000	6400	3100
25	6900	3900	1600	860	4500	1000	2500	680	2700	660	4100	2100	6900	3700	7300	3900	9100	5900	4300	1200	5000	1800	6200	3200
26	6700	4200	960	550	4400	1500	2400	490	2600	770	3500	1900	6900	3300	7400	3900	8700	5700	4500	1300	4500	1800	6600	3300
27	6700	4200	800	280	3800	1200	2700	440	3100	810	4000	1700	6000	3300	7500	4100	8500	5300	4300	1500	4200	1600	5700	3100
28	6600	4300	1300	270	4500	1200	3600	630	3100	1000	4100	1800	6300	3400	7700	4300	8200	5000	4000	1600	5200	1800	5000	2800
29	7200	4500	1400	240			3200	540	2800	1100	4500	1800	6000	3200	7700	4600	8100	4900	4500	1700	4600	1900	4600	2500
30	7400	4300	1200	220			2300	480	2500	1200	4400	1700	5800	3100	7900	4500	8100	4700	4300	1700	4500	1800	4800	2200
31	7000	4100	1600	200			950	700			4200	1600			8100	4600	9100	5600			4500	1900		
Mean	6700	4100	4000	2100	2700	600	4000	1600	2500	760	4100	1900	6400	2600	6700	3800	8400	5300	6500	3500	3900	1300	5000	2200
Max	7500	4700	7300	4000	4500	1500	7900	4500	3400	1200	5200	2600	7100	3700	8100	4600	9600	5900	9300	6100	5700	2400	7200	3300
Min	5900	3600	800	200	470	160	950	440	740	430	2700	1400	3800	1600	4300	2900	7600	4700	2000	350	2100	570	2600	960

Table 22. Daily maximum and minimum chloride concentrations, Delaware River at Chester, Pa. (station number 01477050) for the year ending November 30, 1999 (Record furnished by Kimberly Clark Chester Operations)

[Concentrations in milligrams per liter; --, missing data; Max, maximum value; Min, minimum value; >, greater than]

DAY	DEC		JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1	280	238	310	280	42	39	46	38	36	32	45	41	45	40	180	118	672	520	656	540	45	39	48	40
2	250	230	280	214	40	36	42	40	41	34	44	33	42	40	181	104	680	460	720	580	44	35	65	56
3	420	236	320	242	50	40	44	40	44	38	47	40	42	38	186	91	>300	300	600	361	56	37	61	46
4	460	310	330	215	48	40	44	38	41	38	38	35	57	42	146	120	>300	>300	617	367	62	40	80	45
5	375	280	233	165	82	35	46	40	42	38	40	35	48	43	208	115	>300	>300	768	445	62	38	54	40
6	320	260	224	150	56	32	46	37	42	38	40	37	46	42	210	178	595	244	520	250	70	38	50	42
7	354	282	206	184	56	38	55	49	42	38	40	28	52	39	220	158	662	440	585	325	62	36	56	46
8	380	286	216	155	48	35	44	68	42	40	48	35	48	45	144	130	701	480	768	417	48	38	56	42
9	360	280	201	160	40	32	48	40	37	32	41	37	49	45	360	144	570	480	685	448	43	38	50	43
10	360	276	215	160	43	32	48	44	38	31	38	35	50	44	280	154	535	490	560	425	48	42	54	45
11	301	240	190	144	33	30	50	44	34	32	44	38	52	46	222	130	660	496	535	375	56	48	57	42
12	326	250	160	125	54	51	44	40	35	30	44	37	51	44	220	182	710	546	546	340	59	44	64	53
13	311	240	132	105	63	45	42	36	37	31	54	35	54	48	245	178	930	690	570	315	43	37	85	42
14	360	260	150	120	72	40	44	38	43	30	38	36	56	47	329	170	910	640	650	396	45	36	70	43
15	340	240	205	121	40	36	75	36	42	30	40	36	58	50	359	190	760	440	600	369	83	48	75	48
16	310	236	191	130	58	38	90	43	40	36	40	35	80	52	470	260	800	425	573	280	70	55	56	45
17	360	238	134	115	57	36	57	30	--	--	40	34	86	54	420	300	680	530	132	55	65	45	49	40
18	366	280	125	95	60	37	52	40	32	20	51	34	54	35	420	330	690	460	84	50	68	50	50	40
19	326	300	122	95	51	41	48	40	38	32	44	38	44	32	396	260	880	430	66	40	56	46	61	46
20	326	260	124	90	42	37	45	40	43	33	48	40	44	30	420	285	520	470	60	29	48	42	61	45
21	390	305	121	80	45	39	45	43	45	31	44	40	90	70	200	100	450	395	50	40	48	40	82	59
22	352	225	90	72	42	38	48	42	34	32	44	40	90	70	460	325	540	405	48	40	66	58	50	41
23	340	252	81	62	45	38	48	38	34	32	44	40	104	80	410	290	560	408	43	35	80	40	62	45
24	370	261	86	74	46	35	50	36	34	30	45	35	104	84	310	286	440	415	70	34	63	44	60	46
25	368	226	130	75	45	37	44	37	45	32	42	38	105	80	430	312	810	420	65	37	55	38	71	41
26	380	240	84	51	52	40	42	37	41	31	45	40	90	75	370	350	630	320	71	34	87	40	70	47
27	400	285	94	47	54	45	42	39	34	32	42	38	110	80	420	250	450	267	42	28	87	65	74	50
28	410	285	108	53	52	38	42	38	36	32	50	43	175	96	380	250	487	274	70	30	84	80	62	46
29	450	410	55	45			42	32	35	32	46	40	168	100	>300	300	415	288	58	30	52	36	60	45
30	410	300	56	48			34	32	40	38	44	40	160	100	520	330	530	290	42	30	55	42	46	44
31	425	280	56	28			34	31			44	42			586	530	654	320			52	42		
Mean	361	267	162	119	51	38	48	40	39	33	44	37	75	56	323	223	607	418	362	225	60	44	61	45
Max	460	410	330	280	82	51	90	68	45	40	54	43	175	100	586	530	930	690	768	580	87	80	85	59
Min	250	225	55	28	33	30	34	30	32	20	38	28	42	30	144	91		244	42	28	43	35	46	40

Table 23. Daily mean dissolved oxygen concentration, Delaware River at Benjamin Franklin Bridge at Philadelphia, Pa. (station number 01467200) for the year ending November 30, 1999 (U.S. Geological Survey published record)
[Concentrations in milligrams per liter; --, missing data]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	9.5	9.0	12.2	13.0	11.6	10.5	8.2	4.4	5.2	4.6	5.8	7.6
2	9.5	--	12.1	13.2	11.4	10.4	8.8	4.5	5.2	4.7	5.8	7.6
3	9.4	9.3	12.0	13.3	11.2	10.0	9.2	4.4	5.1	4.7	5.8	7.5
4	9.1	9.7	12.0	13.2	11.1	9.4	9.3	4.3	5.0	4.7	5.7	8.3
5	8.9	10.2	12.3	13.2	10.9	9.3	9.0	4.3	--	4.9	5.7	8.5
6	8.5	--	12.3	12.9	10.7	9.2	8.6	4.5	--	5.0	5.6	8.7
7	8.2	10.4	12.2	12.8	10.5	9.0	8.1	4.7	--	5.0	5.7	8.8
8	8.3	10.6	12.2	12.9	10.3	8.7	7.3	4.6	--	4.9	6.0	8.9
9	8.2	10.5	12.2	13.0	10.2	8.4	6.8	4.6	--	4.7	6.0	8.8
10	8.3	--	12.2	13.1	9.9	8.3	6.5	4.6	--	4.3	6.0	8.7
11	8.4	10.9	12.3	13.1	9.7	8.4	5.8	4.6	--	4.1	6.2	8.6
12	8.5	--	12.3	13.3	9.3	8.6	5.2	4.7	--	4.2	6.4	8.6
13	8.6	--	12.4	13.4	9.4	8.7	4.7	4.8	--	4.2	6.7	8.4
14	8.7	--	12.6	13.4	9.3	8.9	4.2	4.8	--	4.2	7.2	8.2
15	8.8	--	12.6	13.3	9.1	9.3	3.7	4.8	--	4.1	7.4	8.3
16	8.8	--	12.7	13.3	9.0	9.4	3.8	5.0	--	4.7	7.5	8.3
17	8.7	10.6	12.7	13.4	8.8	9.3	4.0	5.1	5.8	6.6	7.3	8.9
18	8.8	--	12.6	13.2	8.8	9.0	--	5.2	6.4	7.2	7.4	9.2
19	9.0	--	12.8	13.1	9.1	8.3	4.3	5.3	7.1	7.1	7.5	9.0
20	9.0	--	13.2	12.8	9.2	7.3	4.3	4.8	7.7	7.0	7.3	8.8
21	8.9	--	13.3	12.6	9.4	6.8	4.5	4.3	7.7	6.8	7.2	8.8
22	9.0	--	13.5	11.6	9.4	6.5	4.5	--	7.3	6.6	7.0	8.9
23	9.3	--	13.4	11.3	9.5	6.3	4.7	4.2	6.9	6.4	6.7	8.7
24	9.2	--	13.4	11.1	9.5	5.9	4.9	4.2	7.1	6.4	6.9	8.9
25	9.1	--	13.3	11.0	9.8	5.9	5.2	4.3	7.5	6.3	6.9	8.8
26	9.0	--	13.2	11.4	10.0	6.2	5.2	4.5	7.4	6.3	7.1	8.8
27	8.9	--	13.3	11.5	10.2	6.3	5.2	4.8	6.7	6.1	7.3	8.9
28	8.7	--	13.2	11.5	10.4	6.7	5.1	5.0	6.8	6.0	7.6	9.2
29	8.5	--		11.7	10.5	7.0	4.8	4.9	--	5.8	7.7	9.9
30	8.4	--		11.8	10.6	7.3	4.5	4.9	--	5.9	7.7	10.1
31	8.7	--		11.7		7.7		5.1	--		7.6	
Mean	8.8	10.1	12.7	12.6	10.0	8.2	5.9	4.7	6.6	5.4	6.7	8.7
Max	9.5	10.9	13.5	13.4	11.6	10.5	9.3	5.3	7.7	7.2	7.7	10.1
Min	8.2	9.0	12.0	11.0	8.8	5.9	3.7	4.2	5.0	4.1	5.6	7.5

Table 24. Daily mean dissolved oxygen concentration, Delaware River at Chester, Pa. (station number 01477050) for the year ending November 30, 1999
(U.S. Geological Survey published record)
[Concentrations in milligrams per liter; --, missing data]

DAY	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
1	9.0	10.3	--	--	10.6	8.7	6.9	5.7	--	6.4	6.5	6.5
2	9.1	10.7	--	--	10.6	8.9	6.9	5.9	--	6.4	6.7	6.2
3	9.1	11.2	--	--	10.6	8.8	6.9	5.6	--	6.3	6.7	5.8
4	9.0	10.8	--	--	10.5	8.7	6.9	5.5	--	6.2	6.7	5.8
5	8.8	10.9	--	--	10.5	8.6	6.9	5.5	6.1	6.3	7.2	6.1
6	8.7	11.0	--	--	10.6	8.6	6.8	5.6	6.1	6.3	7.8	6.3
7	8.4	11.1	--	--	10.4	8.5	6.2	5.5	6.2	6.1	7.8	6.5
8	8.1	11.1	--	--	10.3	8.4	5.6	5.4	6.0	5.7	8.1	6.8
9	8.1	11.0	--	--	10.1	8.4	5.2	5.4	5.9	5.4	8.4	7.2
10	8.1	11.3	--	--	10.2	8.6	5.3	5.2	5.9	5.1	8.5	7.5
11	8.1	11.2	--	--	10.1	8.9	5.3	--	5.8	4.9	8.5	7.6
12	8.3	11.1	--	--	10.0	9.2	5.1	--	--	4.8	8.4	7.7
13	8.3	11.1	--	--	9.9	9.1	5.1	--	--	4.9	8.0	7.5
14	8.5	11.4	--	--	9.9	9.5	5.2	--	5.1	4.9	8.4	7.0
15	8.6	12.0	--	--	9.7	9.6	5.0	--	5.2	4.8	8.5	6.8
16	8.6	12.2	--	--	9.4	9.3	5.0	--	5.5	5.8	8.6	6.9
17	8.7	12.0	--	--	--	--	5.1	--	5.6	6.1	8.5	7.2
18	8.8	12.0	--	--	--	8.0	5.0	--	5.5	6.1	8.6	7.4
19	9.1	12.0	--	10.9	9.3	7.2	5.0	--	5.5	6.2	8.9	7.5
20	9.0	12.0	--	10.6	9.1	6.6	4.9	--	5.5	6.0	9.1	7.6
21	9.1	11.9	--	10.4	8.9	6.3	4.9	5.9	5.4	6.0	8.9	7.7
22	9.3	11.9	--	10.3	8.8	5.8	5.0	5.6	5.3	6.2	8.8	7.8
23	9.4	11.8	--	10.5	8.6	--	5.1	--	5.0	6.5	8.8	7.8
24	9.4	11.6	--	10.4	8.6	--	5.4	--	--	6.7	--	7.8
25	9.5	11.3	--	10.3	8.6	--	5.8	--	--	6.6	--	7.8
26	9.6	11.3	--	10.4	8.6	--	6.0	--	--	6.7	--	8.0
27	9.7	11.5	--	10.6	8.6	6.2	6.0	--	5.4	6.6	--	8.1
28	9.7	--	--	10.8	8.6	6.3	6.1	5.7	5.0	6.3	7.0	8.1
29	9.7	--	--	10.8	8.5	6.5	6.0	5.8	5.0	6.3	7.1	8.2
30	9.8	--	--	--	8.6	6.6	5.9	--	5.5	6.7	7.0	8.4
31	10.0	--	--	--	--	6.7	--	--	6.1	--	6.8	--
Mean	9.0	11.4	--	10.6	9.6	8.0	5.7	5.6	5.6	6.0	7.0	7.3
Max	10.0	12.2	--	10.9	10.6	9.6	6.9	5.9	6.2	6.7	9.1	8.4
Min	8.1	10.3	--	10.3	8.5	5.8	4.9	5.2	5.0	4.8	6.5	5.8

Table 25. Summary water-quality data for five cross sections in the Delaware Estuary (see figure 7 for location of monitor sites)

USGS Monitor Site	Date	Cross-section width, in feet	Temperature, in degrees Celsius	Specific conductance, in microsiemens per centimeter at 25°C	Dissolved oxygen concentration, in milligrams per liter	pH, in standard units
Trenton, N.J.	03-16-99	900 ^a	5.1 ^a	185 ^a	14.7 ^b	8.4 ^b
	09-15-99		23.4 ^a	227 ^a	8.4 ^b	8.0 ^b
Benjamin Franklin Bridge at Philadelphia, Pa.	05-12-99	3,340	16.7-17.4	218-233	7.0-9.7	7.2-7.4
Fort Mifflin, Philadelphia, Pa.	05-12-99	5,270	16.8-18.1	254-289	8.0-11.3	7.2-8.0
Chester, Pa.	05-12-99	6,100	16.9-17.5	264-278	7.7-10.0	7.2-7.6
Reedy Island Jetty, Del.	05-11-99	9,000	16.2-17.7	--	8.0-9.6	7.5-7.7

Location of monitor sites shown on figure 7

Notes: a, Mean for cross section

b, Median for cross section

--, not determined

AGREEMENT

The Parties to the U.S. Supreme Court Decree and the Delaware River Basin Commission agreed on November 20, 1998 during two conference calls, pursuant to the Delaware River Basin Commission Resolution No. 83-13, to consider modifications of current diversions to New York City and target flows at the Montague and Trenton gaging stations. This was prompted by a review of current hydrologic conditions and a projection that the New York City Delaware reservoir system would enter drought warning around December 10, 1998 unless there is significant precipitation and runoff. The intent of this emergency program is to delay or avert entry into drought warning conditions.

The modified agreement is as follows:

1. New York City diversion from the New York City Delaware River Basin reservoir system would be reduced to 680 million gallons per day (mgd).
2. The Montague flow target would be reduced to 1655 cfs and the Trenton flow target would be reduced to 2700 cfs.
3. Remainder of the excess release bank of 903 cfs-days would be placed in a fishery protection bank for enhancing the winter basic conservation releases during drought warning to the summer basic conservation level as established in Docket No. D-77-20 (Revision No. 3; 15 cfs at Neversink, 19 cfs at Pepacton and 23 cfs at Cannonsville). The operation of this emergency program will be designed by NYSDEC and will be coordinated with the Delaware River Master and NYCDEP.
4. The term of this emergency program begins on November 20, 1998 and continues until December 4, 1998.
5. The parties to this agreement will reconvene via another conference call on November 30 / December 1 to review hydrologic conditions and consider additional steps.

/S/ Harry W. Otto	11/25/98		
/S/ John H. Talley	11/25/98	/S/ Robert Tudor	
State of Delaware	Date	State of New Jersey	Date

/S/ John L Middelkoop, P.E.	11/24/98	/S/ Irene B. Brooks	
State of New York	Date	Commonwealth of Pennsylvania	Date

/S/ William N. Stasiuk, Jr.	
City of New York	Date

Note: Original signatures are on file at the Delaware River Master Office.

AGREEMENT

In accordance with the Delaware River Basin Commission (DRBC) Resolution No. 83-13, the parties to the U. S. Supreme Court Decree and the Delaware River Basin Commission agreed on December 1, 1998 during a conference call (which was agreed to on November 20, 1998) to consider modifications of diversions to New York City and target flows at the Montague and Trenton gaging stations. This was prompted by a review of current hydrologic conditions and a projection that the New York City Delaware Reservoir System would enter drought warning on or about December 10, 1998 unless there is significant precipitation and runoff. Terms of this agreement begin on December 2, 1998 or as soon as possible.

The modified agreement is as follows:

1. New York City allowable diversion from the NYC Delaware River reservoirs will continue to be reduced to 680 million gallons per day (mgd) until storage in the reservoirs enters into the lower half of drought warning.
2. The Montague flow target will continue to be reduced to 1655 cfs and the Trenton flow target will continue to be reduced to 2700 cfs until storage in the NYC Delaware reservoirs enters into the lower half of drought warning.
3. Diversion to New Jersey would continue to be 100 mgd until storage in the NYC Delaware reservoirs enters into the upper half of drought warning and remains there for five consecutive days when it shall be reduced to 85 mgd in accordance with the DRBC Resolution No. 83-13.
4. Remainder of the excess release bank of 903 cfs-days was placed in a fishery protection bank effective November 20, 1998 for enhancing the winter basic conservation releases during drought warning to the summer basic conservation level as established in Docket No. D-77-20 (Revision No. 3). (15 cfs at Neversink, 19 cfs at Pepacton and 23 cfs at Cannonsville). The operation of this program will be designed by NYSDEC and will be coordinated with the Delaware River Master and NYCDEP. The fishery protection bank will be used during drought warning and will expire when storage in the NYC Delaware reservoirs enters into the drought condition or when one of the Delaware reservoirs spills.
5. Effective immediately, when the average daily flow at Trenton is at or above 3500 cfs, the Montague flow objective shall be decreased by 100 cfs; when the flow at Trenton is at or above 3300 cfs but below 3500 cfs, the Montague flow objective shall be decreased by 50 cfs. Water saved by these reductions shall be added to the fishery protection bank and shall be available for use as in 4 above.
6. In order to conserve water, the Delaware River Master is requested to continue the balancing adjustment when calculating the releases to be directed to meet the Montague target. Additionally, the amount of conservation releases from the NYC Delaware reservoirs, that are

above the basic conservation release rates, should be considered as directed releases for the purpose of calculating the balancing adjustment.

7. When storage in the NYC Delaware reservoirs enters into the lower half of drought warning, diversions and flow targets at Montague and Trenton shall be determined according to the DRBC Resolution No. 83-13.

8. This agreement may be revised during any meeting of the interstate parties that is convened according to the DRBC Resolution No. 83-13 as a result of continuing below-normal hydrologic conditions. Normal diversions and releases would resume if the storage in the NYC Delaware Reservoirs returns to normal conditions according to the DRBC Resolution 83-13.

9. This agreement shall terminate on April 15, 1999.

/S/ Harry W. Otto	12/3/98
/S/ Robert R. Jordan	12/3/98
State of Delaware	Date

/S/ Robert Tudor	12/4/98
State of New Jersey	Date

/S/ John L Middelkoop, P.E.	12/2/98
State of New York	Date

/S/ Irene B. Brooks	12/4/98
Commonwealth of Pennsylvania	Date

/S/ William N. Stasiuk, Jr.	12/1/98
City of New York	Date

Note: Original signatures are on file at the Delaware River Master Office.

DOCKET NO. D-77-20 CP (Revision No. 4)

DELAWARE RIVER BASIN COMMISSION

**Modifications to the Schedule of Release Rates from
Cannonsville, Pepacton and Neversink Reservoirs
Delaware and Sullivan Counties, New York**

PROCEEDINGS

This is an application submitted by the New York State Department of Environmental Conservation (NYSDEC) for approval of an amendment to the revised schedule of augmented conservation releases. The proposed amendment is designed to reserve additional water storage that can be subsequently released for improving fisheries during times when the augmented releases are presently curtailed.

The current schedule of experimental revised augmented conservation release rates from Pepacton and Neversink Reservoirs was added to the Comprehensive Plan and approved by the Delaware River Basin Commission (DRBC) pursuant to Section 3.8 of the *Compact* on June 23, 1993 by Docket No. D-77-20 CP (Revision No. 2). At that time, the release schedule proposed for Cannonsville Reservoir could not be implemented since its release valves did not have the operational flexibility necessary. Afterwards, however, new valves were installed and a new experimental release schedule was approved; the current schedule of experimental augmented conservation release rates from Cannonsville Reservoir was added to the Comprehensive Plan and approved pursuant to Section 3.8 of the *Compact* on February 27, 1997 by Docket No. D-77-20 CP (Revision No. 3).

This application provides for the automatic banking of 50 percent of the yearly excess release quantity and the extension of the current experimental releases to coincide with the expiration of the amended releases program on April 30, 2001. This application was reviewed for inclusion of the project in the Comprehensive Plan and approval under Section 3.8 of the Delaware River Basin *Compact*. A public hearing on this project was held by the DRBC on April 28, 1999.

RESERVOIR RELEASE PROGRAMS

A. Current Augmented Conservation Releases.

Whenever the storage in the New York City Delaware River Basin Reservoirs is “Normal” as defined in DRBC Resolution No. 83-13, the experimental augmented conservation releases shall continue as described in DRBC Docket No. D-77-20 CP (Revision No. 3). (See Table 1A)

TABLE 1A

	Column 1	Column 2	Column 3
Reservoir and Operative Dates	Basic Conservation Release	Current Augmented Conservation Release	Augmented Experimental Conservation Release
Pepacton			
1/1 - 3/31	6 cfs	50 cfs	45 cfs
4/1 - 4/7	6	70	45
4/8 - 4/30	19	70	45
5/1 - 5/31	19	70	70
6/1 - 8/31	19	70	95
9/1 - 9/30	19	70	70
10/1 - 10/31	19	70	45
11/1 - 12/31	6	50	45
Neversink			
1/1 - 3/31	5 cfs	25 cfs	25 cfs
4/1 - 4/7	5	45	25
4/8 - 4/30	15	45	25
5/1 - 9/30	15	45	53
10/1 - 10/31	15	45	25
11/1 - 12/31	5	25	25
Cannonsville			
4/1 - 4/15	8 cfs	45 cfs	4/1 - 5/31: 45 cfs
4/16 - 6/14	23	45	
6/15 - 8/15	23	325	6/1 - 9/15: 160 cfs
8/16 - 10/31	23	45	
11/1 - 11/30	23	33	
12/1 - 3/31	8	33	9/16 - 3/31: 45 cfs

B. Proposed Excess Release Banking.

As a means to further increase the amount of water storage available for release for fisheries enhancement during this experimental augmented conservation release program, 50 percent of the annual excess release quantity shall be automatically held and placed into a “fisheries protection bank”. This fisheries protection bank shall be available to augment releases during drought warnings (see “D” below). The remainder of the excess release quantity shall be utilized to provide a proportionally-reduced increase in the Montague flow objective according to the current procedures, or may be banked in accordance with the procedures outlined in the Lower Basin Drought Management Plan.

C. Proposed Drought Watch.

The seasonally segmented line (shown as dashes) splitting the current “Drought Warning” in *Figure 1* of DRBC Resolution No. 83-13 and DRBC Docket No. D-77-20 CP (Revised) is temporarily raised by four (4) billion gallons during the entire year. In addition, the upper half of the drought warning, previously referred to as DWI, is temporarily renamed Drought Watch. Operations during the renamed Drought Watch shall continue to limit the diversion by New York City to 680 million gallons per day (mgd) and reduce the Montague and Trenton flow targets to 1,655 cubic feet per second (cfs) and 2,700 cfs, respectively. Conservation releases will decrease to 85 percent of the augmented experimental level, the remaining thermal stress bank will be reduced by 15 percent, and the New Jersey diversion will remain at 100 mgd.

D. Drought Warning.

The lower half of the drought warning (DW2), based upon the rule curves included in DRBC Resolution No. 83-13 and as temporarily modified by “C” above, is designated Drought Warning, with diversions and flow targets conforming to DRBC Resolution No. 83-13 for the former DW2. The fisheries protection bank shall be used to provide conservation releases at the current summer baseline levels and additional emergency releases, as needed.

E. Drought Emergency.

The Drought Emergency provision shall remain at the levels designated in DRBC Resolution No. 83-13.

F. Balancing Adjustment.

In order to conserve water, the Delaware River Master is requested to utilize a balancing adjustment when calculating the releases to be directed to meet the Montague target. Additionally, during drought warning, the amount of the conservation releases from the New York City Delaware River Basin Reservoirs that is above the basic conservation release rates shall be considered as directed releases for the purpose of calculating the balancing adjustment.

FINDINGS

The experimental augmented conservation release rates program has significantly improved NYSDEC's ability to control the minimum flow and the maximum temperatures downstream of the Cannonsville, Pepacton and Neversink Reservoirs. However, the current experimental augmented release rates program may not provide adequate flows to protect the fisheries during drought warning and drought emergency. The proposed revisions should significantly increase New York State's ability to manage trout habitat conditions during many drought conditions.

DECISION

I. The "Modification to the Schedule of Release Rates from Cannonsville, Pepacton and Neversink Reservoirs", Docket No. D-77-20 CP (Revision No. 3), including the modifications herein, are hereby extended until April 30, 2001.

II. The Comprehensive Plan is hereby amended to include the revisions described above with the modifications specified hereinafter.

III. The amended project, as described above, is approved pursuant to Section 3.8 of the *Compact*, subject to the following conditions:

a. Monthly summaries of reservoir operations submitted by NYCDEP to NYSDEC shall also be submitted to the DRBC.

b. Detailed operational records of each reservoir, maintained by both the City and State Reservoir Release Managers, shall be available to the DRBC upon request.

c. The provisions of the reservoir release program approved herein shall not be applicable to any action taken by NYCDEP or NYSDEC with regard to the operation of the Cannonsville, Pepacton, or Neversink Reservoirs in any emergency situation where there is a threat to the continued existence or safe operation of the dams or tunnels or to any appurtenant structures or to the public health or safety. Any emergency action shall continue only for such time as is necessary to avert the threat and is subject to the approval of the Executive Director of the DRBC.

d. Increases in the augmented conservation release levels may not be made except in accordance with the allowances provided for in the Stipulation of Discontinuance in *The City of New York vs. The State of New York Department of Environmental Conservation*, Index No. 5840-80, and shall be subject to approval by the DRBC.

e. Releases under emergency conditions. The Commission retains its power under Section 3.3(a) and Article 10 of the *Compact* to declare a drought emergency after consultation with the River Master, in order to conserve the waters in the Delaware River and its tributaries and in the reservoirs of the Upper Delaware River Basin, in order to protect water supply, health, and safety of the residents of the Delaware River Basin and its service area. The River Master retains all of his powers under the Decree including the powers under Article VII, B.1 of the 1954 Decree to conserve the waters in the river, its tributaries, and in reservoirs owned by the City of New York, or in reservoirs developed by other parties to the Decree after 1954.

f. Prior to application for an extension or modification of the experimental release program, a report describing the results of the project shall be submitted.

g. This experimental augmented conservation release rates plan may be revisited during any meeting of the parties to the 1954 Supreme Court Decree that is convened pursuant to DRBC Resolution No. 83-13 as a result of below-normal hydrologic conditions.

h. This revised experimental augmented conservation release rates program will automatically terminate on April 30, 2001 unless extended by agreement of all parties to the Decree.

i. The redesignation of the upper portion of drought warning (DWI) to drought watch will not change the compensation release requirements from Merrill Creek Reservoir. For the duration of this fisheries protection plan, the Delaware River Master, in cooperation with the DRBC, will track the operation of Merrill Creek Reservoir and compare the number of days of compensation releases and the volume of compensation releases from the Reservoir to those which would have occurred under the current plan as set forth in DRBC Resolutions Nos. 83-13 and 88-2 (Revised). If the difference in the number of days of compensation releases for any period June 15 to the following March 14 exceeds three days, the Commission shall determine the means by which the additional impact on Merrill Creek Reservoir shall be mitigated.

j. The operation of any project or facility previously approved by DRBC, with a reference to Drought Warning, is not altered or revised by the change in name from Drought Warning to Drought Watch.

BY THE COMMISSION

DATED: April 28, 1999

Consent to Action by
Delaware River Basin Commission

Consent of the parties to the U.S. Supreme Court Decree in New Jersey vs. New York, 347 U.S. 995 (1954) to the action of the Delaware River Basin Commission in adopting Docket No. D-77-20 CP (Revision No. 4) amending the Comprehensive Plan with respect to experimental modifications to the schedule of release rates from Cannonsville, Pepacton and Neversink Reservoirs.

State of New Jersey

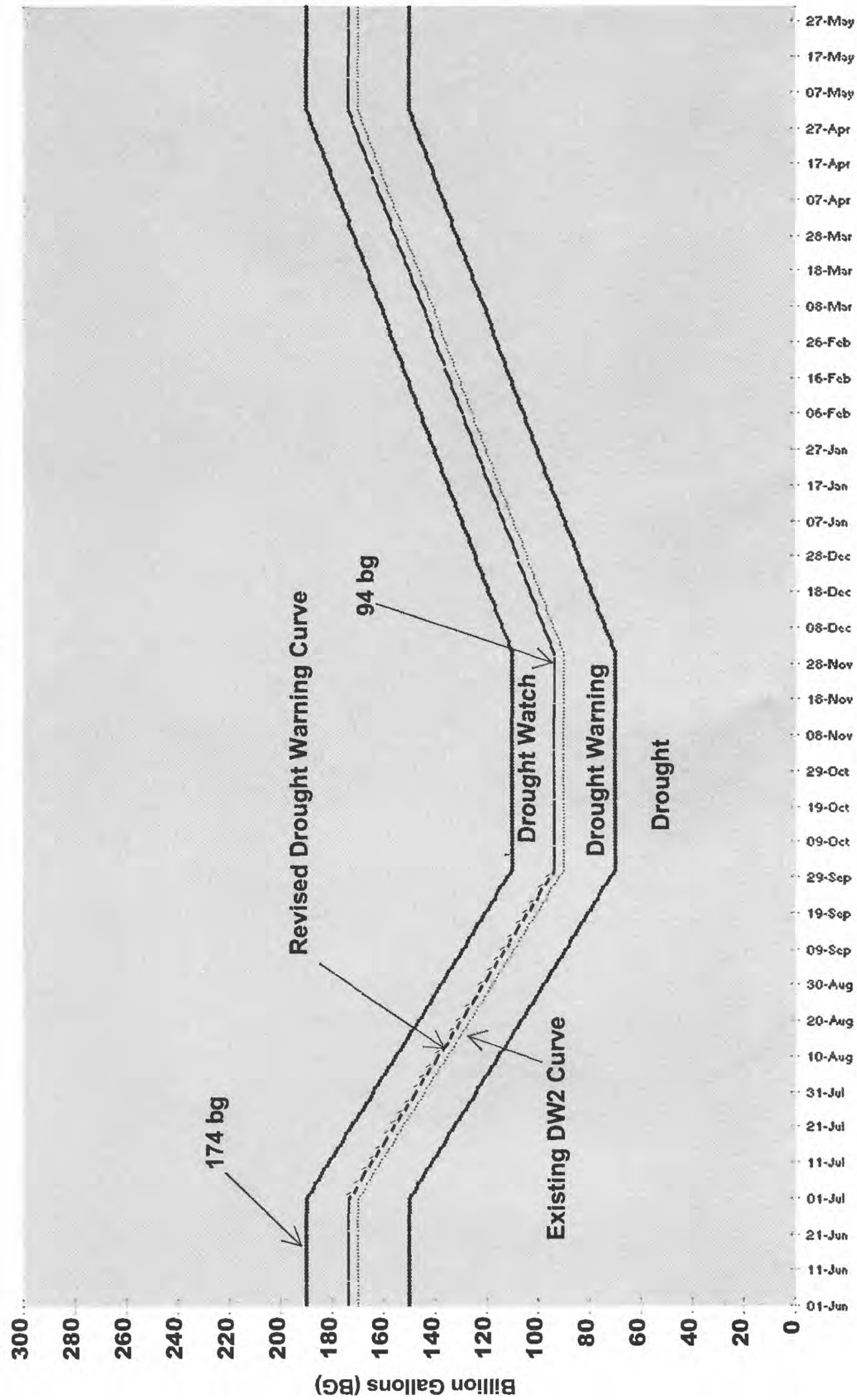
State of New York

State of Delaware

Commonwealth of Pennsylvania

City of New York

New York City Delaware Basin Reservoir Experimental Rule Curve



**AGREEMENT TO SUSPEND THE EXCESS-RELEASE
QUANTITY DURING THE 1999-2000 SEASONAL PERIOD**

As a result of the precipitation shortfall in the upper Delaware River Basin during the past several months, streamflow has been below average and storage in the New York City reservoirs is below average for this time of year. In addition, the Delaware River Master's directed releases during 1999 are expected to be above average. Current storage in the New York City Delaware River Basin reservoirs is about 61 billion gallons above the drought-warning level and is about 19 billion gallons below the median storage for this time of year.

In order to conserve the waters of the Delaware River Basin, the excess-release quantity for the 1999-2000 seasonal period will be suspended. This action was agreed upon by the Parties to the Decree at the May 19, 1999 meeting of the Delaware River Master Advisory Committee. The Delaware River Master will continue to use a +/- 50 cfs balancing adjustment while designing the releases to meet the 1,750 cfs Montague flow objective. Suspension of the excess-release quantity will take effect on June 15, 1999 and will continue until March 15, 2000 unless modified by unanimous agreement by the Parties to the Decree.

/S/ John H. Talley 6/12/99
State of Delaware Date

/S/ Robert C. Shinn, Jr. 6/9/99
State of New Jersey Date

/S/ N.G. Kaul 6/7/99
State of New York Date

/S/ Irene B. Brooks 6/7/99
Commonwealth of Pennsylvania Date

/S/ Joel A. Miele, Sr. 6/21/99
City of New York Date

Note: Original signatures are on file at the Delaware River Master Office.

TEMPORARY MODIFICATION OF TRENTON FLOW OBJECTIVE

WHEREAS, DRBC staff has recommended the reduction in the Trenton flow objective from 3000 cfs to 2700 cfs to conserve storage in the lower basin reservoirs, to preserve such storage for later use if dry weather continues; and

WHEREAS, the conditions for modifying the Trenton flow objective during a lower basin drought warning and drought as set forth in DRBC Resolution 88-22 (Revised) have not yet been satisfied and may not be triggered for approximately 13 days in the absence of rain; and

WHEREAS, the DRBC Commissioners and the Parties to the U. S. Supreme Court Decree have reviewed and discussed this matter by telephone conversation on July 21, 1999; and

WHEREAS, the DRBC Commissioners and the Parties to the Decree have decided it is in the public interest to preserve storage in the lower basin reservoirs to the maximum possible extent; and

WHEREAS, it is the intention of the DRBC Commissioners to formally approve and ratify the action set forth herein at the next Commission meeting to insure full compliance with all applicable DRBC resolutions; now therefore

BE IT RESOLVED by the undersigned Commissioners and Parties to the Decree:

1. Effective as of July 21, 1999, the flow objective at Trenton shall be reduced from 3000 cfs to 2700 cfs until the DRBC otherwise determines.
2. The Executive Director shall coordinate with the River Master to insure that releases are made consistent with the revised flow objective.

/S/ John L. Middelkoop, P.E.
State of New York

/S/ Irene B. Brooks
Commonwealth of Pennsylvania

/S/ John H. Talley
 /S/ Harry W. Otto
State of Delaware

/S/ Robert C. Shinn, Jr.
State of New Jersey

/S/ George C. Clark COL, U.S. Army
United States

/S/ Mark D. Hoffer, General Counsel, NYCDEP
The consent of the City of New York to the
 above action is hereby granted.

Note: Original Signatures are on file at the Delaware River Basin Commission Office.

NO. 99-18

A RESOLUTION pursuant to Article 10.4 of the Delaware River Basin Compact to preserve and protect water supplies in the Delaware River Basin.

WHEREAS, on July 20, 1999, the Commonwealth of Pennsylvania declared a drought emergency for 55 of its 67 counties, including all of those in the Delaware River Basin; and

WHEREAS, on August 5, 1999, the State of Delaware declared a drought emergency for northern New Castle County (north of the Chesapeake and Delaware Canal); and

WHEREAS, on August 5, 1999, the State of New Jersey declared a drought emergency for the entire state; and

WHEREAS, on August 10, 1999, the State of New York declared a drought warning for several counties, including those counties located within the Delaware River Basin; and

WHEREAS, on August 2, 1999, the Commission requested the U. S. Army Corps of Engineers to temporarily store approximately 11 billion gallons of water in F. E. Walter Reservoir above the conservation pool to provide additional water for flow augmentation and salinity control; and

WHEREAS, the Corps has agreed to this request and has begun storing this additional water at the Walter Reservoir; and

WHEREAS, while the Commission's drought warning and emergency indicators set forth in Resolution Nos. 83-13 and 88-22 have not been triggered, unprecedented drought conditions at this time indicate that full drought emergency action by the Commission may be required in the near future pursuant to those resolutions; and

WHEREAS, the Commission deems it in the public interest to support the drought warning and emergency programs of the four basin states and to take certain emergency action to preserve and protect water supplies in the Basin; now therefore,

BE IT RESOLVED by the Delaware River Basin Commission:

1. The July 21, 1999 agreement between the Delaware River Basin Commissioners and parties to the decree is hereby ratified and confirmed and the Trenton flow objective is hereby reduced from 3,000 cubic feet per second (cfs) to 2,700 cfs.
2. As set forth in their drought emergency declarations, the signatory states shall continue to restrict nonessential uses of fresh water in the New Jersey and Pennsylvania portions of the Basin and the area in Delaware north of the Chesapeake and Delaware Canal. The State of New York shall continue to restrict nonessential uses of fresh water on a voluntary basis in the New York portion of the Basin.

3. Water storage presently impounded by the Wallenpaupack dam of the Pennsylvania Power and Light Company and by the Mongaup reservoir system of the former Orange and Rockland Utilities Company in New York will be called upon to provide releases from storage to assist in meeting flow objectives at Montague or Trenton, New Jersey.
4. The Army Corps of Engineers shall continue to store water at F. E. Walter Reservoir and provide releases of water upon the request of the Commission to assist in maintaining the Trenton flow objective.
5. The Commonwealth of Pennsylvania is hereby requested to assist in relieving the water supply emergency by providing releases of water from Nockamixon Reservoir upon the request of the Commission to assist in maintaining the Trenton flow objective.
6. Upon request of the signatory state, the Commission shall require self-supplied users of ground and surface waters in that state whose use for any purpose exceeds an average of 1 mgd during any 30-day period to prepare contingency plans for water curtailment or reduction in the event that it is necessary and submit those plans to the Commission.
7. All residents of the Basin are urged to conserve water to the maximum extent possible to preserve and protect the Basin's water supplies.
8. This resolution shall take effect immediately and shall remain in effect until terminated by action of the Commission.

/s/ Warren T. Lavery
Warren T. Lavery, Chairman pro tem

/s/ Anne M. Zamonski
Anne M. Zamonski, Acting Secretary

ADOPTED: August 18, 1999

NO. 99-22

A Resolution concerning Resolution No. 99-18 and providing for its termination.

WHEREAS, the Commission on August 18, 1999 adopted Resolution No. 99-18 (“the resolution”) to support the drought warning and emergency programs of the four basin states and to take certain emergency actions to preserve and protect water supplies in the basin; and

WHEREAS, hydrologic conditions in the basin have improved since the adoption of the resolution; and

WHEREAS, the Commission deems it in the public interest to terminate the resolution as provided therein; now therefore,

BE IT RESOLVED by the Delaware River Basin Commission:

1. Except as hereinafter provided, Resolution No. 99-18 is terminated.
2. All residents of the basin, consistent with the drought and emergency programs of the basin states, are urged to continue to conserve water to the extent possible to preserve and protect the basin’s water supplies.

/s/ Warren T. Lavery
Warren T. Lavery, Chairman pro tem

/s/ Pamela M. Bush
Pamela M. Bush, Secretary

ADOPTED: September 30, 1999