Prepared in cooperation with the
Maryland Department of the Environment

Selected Low-Flow Frequency Statistics for Continuous-Record Streamgage Locations in Maryland, 2010

Open-File Report 2010–1310

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

Cover. View of Mattawoman Creek looking upstream at the stream channel and MD-227 State Highway bridge from the center of the stream channel. [Photograph taken on September 29, 2010 by David P. Brower, U.S. Geological Survey, at station 01658000, Mattawoman Creek near Pomonkey, Maryland as part of a maintenence visit to the station.]

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U.S. Department of the Interior
KEN SALAZAR, Secretary

U.S. Geological Survey
Marcia K. McNutt, Director

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Conversion Factors and Datums

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
inch per year (in/yr)	25.4	millimeter per year (mm/yr)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

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

$$°C = (°F - 32) / 1.8$$

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

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

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

Abbreviations

BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
GIS	Geographic Information System
MDE	Maryland Department of the Environment
SWSTAT	Surface-Water Statistics
USGS	U.S. Geological Survey

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Abstract

According to a 2008 report by the Governor's Advisory Committee on the Management and Protection of the State's Water Resources, Maryland's population grew by 35 percent between 1970 and 2000, and is expected to increase by an additional 27 percent between 2000 and 2030. Because domestic water demand generally increases in proportion to population growth, Maryland will be facing increased pressure on water resources over the next 20 years. Water-resources decisions should be based on sound, comprehensive, long-term data and low-flow frequency statistics from all available streamgage locations with unregulated streamflow and adequate record lengths. To provide the Maryland Department of the Environment with tools for making future water-resources decisions, the U.S. Geological Survey initiated a study in October 2009 to compute low-flow frequency statistics for selected streamgage locations in Maryland with 10 or more years of continuous streamflow records.

This report presents low-flow frequency statistics for 114 continuous-record streamgage locations in Maryland. The computed statistics presented for each streamgage location include the mean 7-, 14-, and 30-consecutive day minimum daily low-flow discharges for recurrence intervals of 2, 10, and 20 years, and are based on approved streamflow records that include a minimum of 10 complete climatic years of record as of June 2010. Descriptive information for each of these streamgage locations, including the station number, station name, latitude, longitude, county, physiographic province, and drainage area, also is presented.

The statistics are planned for incorporation into StreamStats, which is a U.S. Geological Survey web application for obtaining stream information, and is being used by water-resource managers and decision makers in Maryland to address water-supply planning and management, water-use appropriation and permitting, wastewater and industrial discharge permitting, and setting minimum required streamflows to protect freshwater biota and ecosystems.

Introduction

Hydrologic data and statistics that define the magnitude and variability of streamflow during periods of low flow are critical to effective management of water resources (Carpenter and Hayes, 1996). Engineers, scientists, natural resource managers, and many others use low-flow frequency statistics for (1) establishment of minimum flow-by requirements for streams and rivers, (2) quantifying **base flows**[1] in streams and rivers, (3) wastewater discharge permitting, (4) water-supply planning and management, (5) protection of stream biota, and (6) evaluation of time of travel and dilution of toxic spills (Ries, 2006; Carpenter and Hayes, 1996).

Low-flow frequency statistics are computed for locations where U.S. Geological Survey (USGS) streamgages have collected continuous **records** of daily streamflow that are computed each year as part of the long-term station record (Ries, 2006). Because the frequency statistics for different streamgage locations are representative of different record lengths and different periods of time, they should be considered estimates when used for predicting long-term and future low-flow conditions (Ries, 2006). Statistics also change over time as longer streamflow records become available for streamgage locations, and as extreme hydrologic conditions influence the computed statistics (Ries, 2006). As a result, low-flow frequency statistics should be updated periodically to reflect the longer record lengths that are available for the streamgage locations (Ries, 2006).

[1] Words in **bold** are defined in the glossary section at the end of the report.

Low-flow frequency statistics were last published for streamgage locations in Maryland on a statewide basis by Carpenter and Hayes (1996). The 1996 investigation made use of streamflow records through March 1987 from 94 continuous-record streamgage locations. Extreme drought conditions that occurred across Maryland in 1999 and 2002 are now included in the long-term record for many streamgage locations that were part of the 1996 investigation. Ries (2006) published selected streamflow statistics for 47 streamgage locations in northeastern Maryland, based on streamflow records through September 2004. This 2006 study produced updated low-flow frequency statistics for 7 streamgage locations that were previously used in the investigation by Carpenter and Hayes (1996).

According to a 2008 report by the Governor's Advisory Committee on the Management and Protection of the State's Water Resources, Maryland's population grew by 35 percent between 1970 and 2000, and is expected to increase by an additional 27 percent between 2000 and 2030 (Wolman, 2008). Because domestic water demand generally increases in proportion to population growth, Maryland will be facing increased pressure on water resources over the next 20 years. Water-resources decisions should be based on sound, comprehensive, long-term data and low-flow frequency statistics from all available streamgage locations with unregulated streamflow and adequate record lengths (Wolman, 2008). To provide the Maryland Department of the Environment (MDE) with tools for making future water-resources decisions, the USGS initiated a study in October 2009 to compute low-flow frequency statistics for selected streamgage locations in Maryland with 10 or more years of continuous streamflow records.

The purpose of this report is to present low-flow frequency statistics for 114 continuous-record streamgage locations in Maryland, based on approved streamflow records that include a minimum of 10 complete **climatic years** of record as of June 2010. The statistics presented in this report include the mean 7-, 14-, and 30-consecutive day low-flow discharges for **recurrence intervals** of 2, 10, and 20 years. These statistics are planned for incorporation into StreamStats, a USGS web application for obtaining stream information, which is being used by water-resource managers and decision makers in Maryland for water-supply planning and management, water-use appropriation and permitting, wastewater and industrial discharge permitting, and setting minimum required streamflows to protect freshwater biota and ecosystems (Ries and others, 2004; Ries and others, 2008).

Description of Study Area

Maryland lies between 37°53′ and 39°43′ north latitude, and 75°04′ and 79°29′ west longitude (fig. 1). Maryland has a total area of about 12,407 mi^2 (square miles), of which about 9,775 mi^2 is land area. About 2,633 mi^2 are covered by water, which includes the Chesapeake Bay and other inland water (Netstate.com, 2010). Brief descriptions of Maryland's physiography and climate follow.

Physiography

Maryland has five major physiographic provinces (Fenneman, 1938). These provinces include the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateaus (fig. 1). The following description of Maryland's physiographic provinces includes excerpts that were most recently presented in studies conducted by Carpenter and Hayes (1996) and Dillow (1996).

Coastal Plain—The Coastal Plain Province in Maryland consists of two distinct divisions that are separated by the Chesapeake Bay: (1) the Eastern Coastal Plain on the east side of the Chesapeake Bay, and (2) the Western Coastal Plain located east of the **Fall Line** and west of the Chesapeake Bay. The Eastern Coastal Plain, commonly called the Eastern Shore, is characterized by relatively flat topography and low relief, with elevations rising from sea level to slightly less than 100 ft (feet) above sea level. The Eastern Shore is drained by small, sluggish streams with very low gradients. The Western Coastal Plain rises to about 200 ft above sea level and has streams with slightly higher gradients that are less sluggish than those of the Eastern Shore. The Western Coastal Plain is a rolling upland with topography that more closely resembles the Piedmont Province than it does the Eastern Shore. Most streams and rivers in both parts of the Coastal Plain are affected by tides for considerable distances above their outlets. The Coastal Plain Province in Maryland includes almost 5,000 mi^2 of land area, which is nearly half of the total land area of the State.

Piedmont—The Piedmont Province in Maryland covers approximately 2,500 mi^2 and is characterized by gently rolling topography, with hills and ridges rising to about 800 ft above sea level. The province is drained by many streams and rivers with moderate to fairly steep gradients in relatively deep, narrow valleys. Streams and rivers in the eastern part of the Piedmont drain into the Chesapeake Bay, whereas those in the western part of the province drain into the Potomac River.

Blue Ridge—The Blue Ridge Province in Maryland covers approximately 600 mi^2 and is characterized by rugged topography, with high relief and fairly steep stream gradients. Elevations rise to more than 1,600 ft above sea level. The region is drained primarily by Catoctin Creek and its tributaries.

Valley and Ridge—The Valley and Ridge Province in Maryland covers almost 800 mi^2 and consists of two distinct divisions: (1) the Great Valley, and (2) the Allegheny Ridges. The Great Valley consists of gently rolling, broad lowlands with elevations averaging about 500 to 600 ft above sea level. The valley is drained primarily by Antietam Creek and Conococheague Creek. Streams and rivers are gently sloped with relatively high sinuosity. Limestone underlies the valley, and caves, sinkholes, and springs are common. Streams in this region tend to have more uniform flows than streams in other areas of Maryland. The Allegheny Ridges are composed of a series of uniform, northeastward-trending hills and ridge lines that are located west of the Conococheague Creek watershed.

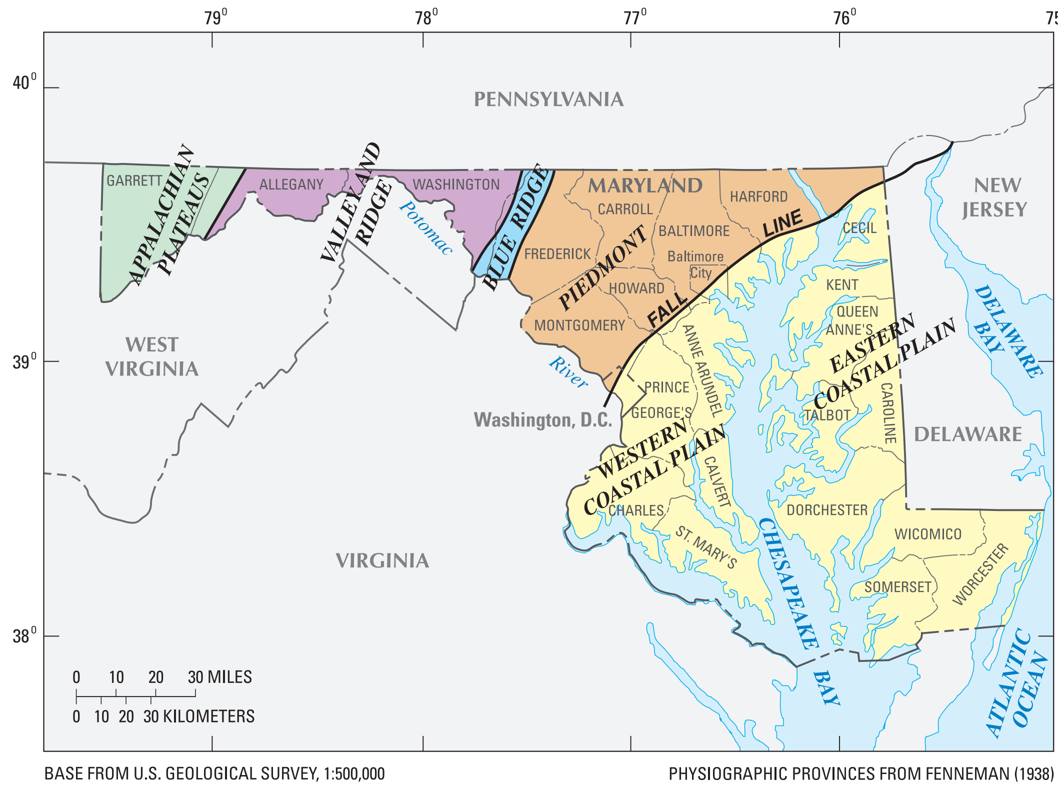


Figure 1. Location of study area and physiographic provinces in Maryland.

Elevations range from about 400 ft above sea level in the valleys to about 1,500 ft above sea level on the ridges. This region is drained by fairly steep, swift streams.

Appalachian Plateaus—The Appalachian Plateaus Province in Maryland covers about 800 mi^2 and is characterized as a broad, dissected upland with pronounced relief and rugged topography. Elevations in the Maryland section of the province range from about 1,500 to 3,000 ft above sea level, with a maximum elevation of 3,360 ft. Streams and rivers draining the Appalachian Plateaus generally have steep gradients, as well as rapids and waterfalls.

Climate

Maryland's climate can be described as generally moderate, with seasons that are well defined (Carpenter and Hayes, 1996). Summers range in temperature from mild to hot, and in winter from moderate in the east and south, to very cold in the western part of the State (Maryland State Archives, 2010). The mean annual temperature for Maryland is about 55°F (degrees Fahrenheit). July is the warmest month with high temperatures averaging in the mid to upper 80s across the State. January is the coldest month with low temperatures averaging in the low to mid 20s (Maryland State Archives, 2010).

Mean annual precipitation for Maryland is about 41 in. (inches) (Maryland State Archives, 2010), and historically has ranged from about 36 to 52 in/yr (inches per year) in different regions of the State (Carpenter and Hayes, 1996). Precipitation is distributed fairly evenly throughout the year, but can vary from month to month depending on the magnitude of spring and summer thunderstorms that occur across the region. Average seasonal snowfall is about 20.6 in., and ranges from about 10 in. on the lower Eastern Shore to about 110 in. in the Appalachian Plateaus region (Maryland State Archives, 2010). Lowest streamflows typically occur between the months of July and September.

Computation of Low-Flow Frequency Statistics

Low-flow frequency statistics for 114 continuous-record streamgage locations in Maryland are presented in this report. Streamgage locations used in the study included both active and discontinued stations with a minimum of 10 complete climatic years of record. Ten years of record was selected as the criteria for inclusion of stations because it is widely considered to be the minimum sufficient record length to warrant statistical analysis (Interagency Advisory Committee on Water Data, 1982). Descriptive information for each streamgage location, including the station number, station name, latitude, longitude, county or city, physiographic province, and drainage area, is shown in table 1. The streamgage locations that were included in the study are shown in figure 2.

Computer programs used to compute the statistics for this study included version 4.0 of the Better Assessment Science Integrating Point and Nonpoint Sources software (BASINS) (U.S. Environmental Protection Agency, 2007) and Surface-Water Statistics (SWSTAT), which is a program developed by the USGS. BASINS is a geographic information system (GIS)-based program that was used for database management. SWSTAT was used for calculating the low-flow frequency statistics. The SWSTAT program incorporates standard USGS methods for computing low-flow frequency statistics that were originally described by Riggs (1972).

The statistics computed for each streamgage location included the mean 7-, 14-, and 30-consecutive day low-flow discharges for recurrence intervals of 2, 10, and 20 years. The statistics were computed from the annual series of minimum 7-, 14-, and 30-consecutive day, daily mean discharges for each streamgage location.

For each streamgage location, the 7-, 14-, and 30-consecutive day period with the lowest daily mean discharge was identified for each climatic year of record. Five streamgage locations had periods of record that were truncated for the analysis so that only the periods where low flows were unaffected by regulation or diversions were included (table 1). Mann-Kendall nonparametric tests for monotonic trends were performed using the **annual 7-day minimum daily mean streamflow** for each streamgage location to determine if increases or decreases in the annual series may be occurring over time at the 95-percent confidence interval (Helsel and Hirsch, 1992). Twenty-five streamgage locations were identified where further investigation would be required to determine the significance of any trends in the annual 7-day minimum daily mean streamflow over time. These streamgage locations are shown in table 2, along with the computed low-flow frequency statistics.

Low-flow frequency statistics were computed by fitting the logarithms of the annual 7-, 14-, and 30-day minimum daily mean discharges for each streamgage location to a log-Pearson, Type III frequency distribution to determine discharges corresponding to recurrence intervals of 2, 10, and 20 years for the 7-, 14-, and 30-day minimum streamflows (Riggs, 1972; Ries, 2006). The discharge equal to or less than that given for a specific recurrence interval can be expected to occur, on average, once during that interval (Ries, 2006). For instance, a streamgage location with a computed 7-day, 10-year low flow of 25 ft^3/s (cubic feet per second) indicates that an average discharge of less than or equal to 25 ft^3/s over the lowest 7 consecutive days in the year should be expected at that streamgage location, on average, once every 10 years. On a percentage basis, these streamflow conditions have a 10-percent [(1 year/10 years) x 100] chance of occurring in any given climatic year. Similarly, a streamgage location with a computed 30-day, 20-year low flow of 10 ft^3/s indicates that a discharge of less than or equal to 10 ft^3/s, which is the average over the lowest 30 consecutive days in the year, should be expected at that streamgage location, on average, once every 20 years. These streamflow conditions would have a 5-percent [(1 year/20 years) x 100] chance of occurring in any given climatic year. The low-flow frequency statistics for the 114 streamgage locations in Maryland are presented in table 2.

The 14-day and 30-day statistics presented for station 01583000, Slade Run near Glyndon, MD, are those that were previously published in Carpenter and Hayes (1996). Although the period of record for this streamgage location did not change since the last low-flow investigation was conducted for Maryland, SWSTAT did not produce comparable results for the 14-day and 30-day statistics. The previously published statistics are still considered valid for Slade Run because they are based on the same period of record that is currently available and because the land use in the watershed has not changed considerably over time (Carpenter and Hayes, 1996; McCandless and Everett, 2002).

The 10-year statistics for station 01585400, Brien Run at Stemmers Run, MD, were based on a manual verification and update of statistics that were previously published in Carpenter (1983), because SWSTAT produced questionable results for the 10-year statistics that could not be easily explained through analysis of the dataset or input to the program. The published statistics originally presented by Carpenter (1983) were based on 21 years of climatic record. The 7-, 14-, and 30-consecutive day periods with the lowest daily mean discharge were identified for an additional 8 years of climatic record that were available for analysis. The 10-year statistics were then manually updated and verified to account for the additional 8 years of climatic record and used in place of the SWSTAT output.

Low-flow statistics that were produced by SWSTAT for other streamgage locations with periods of record that did not change since the last low-flow investigation for Maryland were checked against previously published values from Carpenter and Hayes (1996). The low-flow statistics for these streamgage locations were found to be comparable to the previously published values.

The 7-day low-flow statistics for station 01493000, Unicorn Branch near Millington, MD, and station 01585200, West Branch Herring Run at Idlewylde, MD are not presented because the computed skews of the logarithms of the annual 7-day minimum daily mean streamflows were -3.61 and -3.65, respectively. The SWSTAT program does not compute reliable low-flow frequencies when skew values exceed an absolute value of 3.3.

Table 1. Continuous-record streamgage locations in Maryland for which low-flow frequency statistics were computed.

[MD, Maryland; PA, Pennsylvania; WV, West Virginia; °, degrees; ′, minutes; ″, seconds; mi², square miles]

Station number	Station name	Latitude (° ′ ″)	Longitude (° ′ ″)	County/City	Physiographic province	Drainage area (mi²)	Remarks
0148471320	Birch Branch at Showell, MD	38 24 33.6	75 12 44.6	Worcester	Coastal Plain	6.38	
01485000	Pocomoke River near Willards, MD	38 23 20.0	75 19 28.0	Worcester	Coastal Plain	60.5	
01485500	Nassawango Creek near Snow Hill, MD	38 13 44.1	75 28 17.2	Worcester	Coastal Plain	44.9	
01486000	Manokin Branch near Princess Anne, MD	38 12 50.0	75 40 17.0	Somerset	Coastal Plain	4.80	
01489000	Faulkner Branch at Federalsburg, MD	38 42 44.0	75 47 34.0	Caroline	Coastal Plain	7.10	
01490000	Chicamacomico River near Salem, MD	38 30 42.0	75 52 47.7	Dorchester	Coastal Plain	15.0	
01491000	Choptank River near Greensboro, MD	38 59 49.9	75 47 08.9	Caroline	Coastal Plain	113	
01491500	Tuckahoe Creek near Ruthsburg, MD	38 58 00.5	75 56 35.0	Queen Anne's	Coastal Plain	85.2	
01492000	Beaverdam Branch at Matthews, MD	38 48 41.0	75 58 15.0	Talbot	Coastal Plain	5.85	
01492500	Sallie Harris Creek near Carmichael, MD	38 57 53.6	76 06 31.8	Queen Anne's	Coastal Plain	8.09	
01493000	Unicorn Branch near Millington, MD	39 14 58.9	75 51 40.7	Queen Anne's	Coastal Plain	19.7	
01493500	Morgan Creek near Kennedyville, MD	39 16 48.1	76 00 52.4	Kent	Coastal Plain	12.7	
01495000	Big Elk Creek at Elk Mills, MD	39 39 25.4	75 49 20.5	Cecil	Piedmont	52.6	
01496000	Northeast Creek at Leslie, MD	39 37 38.0	75 56 40.0	Cecil	Coastal Plain	24.3	
01496200	Principio Creek near Principio Furnace, MD	39 37 34.0	76 02 27.0	Cecil	Piedmont	9.03	
01578500	Octoraro Creek near Rising Sun, MD	39 41 24.0	76 07 43.0	Cecil	Piedmont	193	Truncated record (Use 1933–1949)
01580000	Deer Creek at Rocks, MD	39 37 47.9	76 24 11.9	Harford	Piedmont	94.4	
01580520	Deer Creek near Darlington, MD	39 37 02.8	76 11 30.7	Harford	Piedmont	164	
01581500	Bynum Run at Bel Air, MD	39 32 29.3	76 19 48.4	Harford	Piedmont	8.52	
01581700	Winters Run near Benson, MD	39 31 11.8	76 22 22.7	Harford	Piedmont	34.8	
01581810	Gunpowder Falls at Hoffmanville, MD	39 41 23.3	76 46 53.3	Baltimore	Piedmont	27.0	
01581830	Grave Run near Beckleysville, MD	39 39 17.3	76 46 51.3	Baltimore	Piedmont	7.68	
01581870	Georges Run near Beckleysville, MD	39 37 33.2	76 46 21.1	Baltimore	Piedmont	15.8	
01581960	Beetree Run at Bentley Springs, MD	39 40 23.1	76 40 30.7	Baltimore	Piedmont	9.72	
01582000	Little Falls at Blue Mount, MD	39 36 14.7	76 37 13.7	Baltimore	Piedmont	52.9	
01583000	Slade Run near Glyndon, MD	39 29 43.4	76 47 41.4	Baltimore	Piedmont	2.09	

Table 1. Continuous-record streamgage locations in Maryland for which low-flow frequency statistics were computed.—Continued

[MD, Maryland; PA, Pennsylvania; WV, West Virginia; °, degrees; ′, minutes; ″, seconds; mi², square miles]

Station number	Station name	Latitude (° ′ ″)	Longitude (° ′ ″)	County/City	Physiographic province	Drainage area (mi²)	Remarks
01583100	Piney Run at Dover, MD	39 31 14.2	76 46 00.8	Baltimore	Piedmont	12.3	
01583500	Western Run at Western Run, MD	39 30 38.8	76 40 35.4	Baltimore	Piedmont	59.8	
01583570	Pond Branch at Oregon Ridge, MD	39 28 49.1	76 41 15.0	Baltimore	Piedmont	0.12	
01583580	Baisman Run at Broadmoor, MD	39 28 46.1	76 40 40.9	Baltimore	Piedmont	1.47	
01583600	Beaverdam Run at Cockeysville, MD	39 29 08.1	76 38 44.6	Baltimore	Piedmont	20.9	
01584050	Long Green Creek at Glen Arm, MD	39 27 16.9	76 28 44.0	Baltimore	Piedmont	9.40	
01584500	Little Gunpowder Falls at Laurel Brook, MD	39 30 19.3	76 25 54.4	Baltimore	Piedmont	36.1	
01585090	Whitemarsh Run near Fullerton, MD	39 22 46.5	76 29 44.9	Baltimore	Coastal Plain	2.73	
01585095	North Fork Whitemarsh Run near White Marsh, MD	39 23 09.2	76 28 07.9	Baltimore	Coastal Plain	1.34	
01585100	Whitemarsh Run at Whitemarsh, MD	39 22 13.9	76 26 45.3	Baltimore	Coastal Plain	7.61	
01585104	Honeygo Run near White Marsh, MD	39 22 58.8	76 25 58.7	Baltimore	Coastal Plain	2.50	
01585200	West Branch Herring Run at Idlewylde, MD	39 22 25.1	76 35 03.6	Baltimore	Piedmont	2.13	
01585225	Moores Run Tributary near Todd Avenue at Baltimore, MD	39 20 12.1	76 32 26.2	Baltimore City	Coastal Plain	0.21	
01585230	Moores Run at Radecke Avenue at Baltimore, MD	39 19 48.3	76 32 05.6	Baltimore City	Coastal Plain	3.52	
01585300	Stemmers Run at Rossville, MD	39 20 28.0	76 29 17.0	Baltimore	Coastal Plain	4.46	
01585400	Brien Run at Stemmers Run, MD	39 20 01.0	76 28 23.0	Baltimore	Coastal Plain	1.97	
01586210	Beaver Run near Finksburg, MD	39 29 22.0	76 54 10.6	Carroll	Piedmont	14.0	
01586610	Morgan Run near Louisville, MD	39 27 06.8	76 57 19.1	Carroll	Piedmont	28.0	
01587000	North Branch Patapsco River near Marriottsville, MD	39 21 56.0	76 53 06.0	Howard	Piedmont	165	Truncated record (Use 1930–1951)
01587500	South Branch Patapsco River at Henryton, MD	39 21 05.0	76 54 50.0	Howard	Piedmont	64.4	
01588000	Piney Run near Sykesville, MD	39 22 55.0	76 58 00.0	Carroll	Piedmont	11.4	
01589100	East Branch Herbert Run at Arbutus, MD	39 14 24.0	76 41 31.9	Baltimore	Coastal Plain	2.47	
01589180	Gwynns Falls at Glyndon, MD	39 28 18.1	76 49 00.8	Baltimore	Piedmont	0.32	
01589197	Gwynns Falls near Delight, MD	39 26 34.6	76 47 00.3	Baltimore	Piedmont	4.23	
01589200	Gwynns Falls near Owings Mills, MD	39 26 16.0	76 46 57.0	Baltimore	Piedmont	4.90	

Table 1. Continuous-record streamgage locations in Maryland for which low-flow frequency statistics were computed.—Continued

[MD, Maryland; PA, Pennsylvania; WV, West Virginia; °, degrees; ′, minutes; ″, seconds; mi^2, square miles]

Station number	Station name	Latitude (° ′ ″)	Longitude (° ′ ″)	County/City	Physiographic province	Drainage area (mi^2)	Remarks
01589238	Gwynns Falls Tributary at McDonogh, MD	39 24 01.6	76 46 13.6	Baltimore	Piedmont	0.03	
01589300	Gwynns Falls at Villa Nova, MD	39 20 45.2	76 43 59.5	Baltimore	Piedmont	32.5	
01589330	Dead Run at Franklintown, MD	39 18 40.4	76 42 59.9	Baltimore	Piedmont	5.52	
01589352	Gwynns Falls at Washington Boulevard at Baltimore, MD	39 16 17.4	76 38 54.8	Baltimore City	Coastal Plain	65.9	
01589440	Jones Falls at Sorrento, MD	39 23 30.2	76 39 39.4	Baltimore	Piedmont	25.2	
01589795	South Fork Jabez Branch at Millersville, MD	39 04 05.7	76 39 05.5	Anne Arundel	Coastal Plain	1.0	
01590000	North River near Annapolis, MD	38 59 09.0	76 37 21.0	Anne Arundel	Coastal Plain	8.5	
01591000	Patuxent River near Unity, MD	39 14 17.7	77 03 20.6	Montgomery	Piedmont	34.8	
01591400	Cattail Creek near Glenwood, MD	39 15 21.5	77 03 03.8	Howard	Piedmont	22.9	
01591700	Hawlings River near Sandy Spring, MD	39 10 28.8	77 01 17.7	Montgomery	Piedmont	27.0	
01593500	Little Patuxent River at Guilford, MD	39 10 03.9	76 51 04.5	Howard	Piedmont	38.0	
01594000	Little Patuxent River at Savage, MD	39 08 03.9	76 48 58.2	Howard	Coastal Plain	98.4	
01594500	Western Branch near Largo, MD	38 52 24.0	76 47 54.0	Prince George's	Coastal Plain	30.2	
01594526	Western Branch at Upper Marlboro, MD	38 48 51.2	76 44 55.4	Prince George's	Coastal Plain	89.7	
01594600	Cocktown Creek near Huntingtown, MD	38 38 27.0	76 38 07.0	Calvert	Coastal Plain	3.85	
01594710	Killpeck Creek at Huntersville, MD	38 28 37.0	76 44 08.0	St. Mary's	Coastal Plain	3.26	
01594800	St. Leonard Creek near St. Leonard, MD	38 26 56.1	76 29 42.5	Calvert	Coastal Plain	6.73	
01594950	McMillan Fork near Fort Pendleton, MD	39 16 36.1	79 23 25.1	Garrett	Appalachian Plateaus	2.30	
01595000	North Branch Potomac River at Steyer, MD	39 18 06.8	79 18 24.8	Garrett	Appalachian Plateaus	73.1	
01596500	Savage River near Barton, MD	39 34 12.2	79 06 07.0	Garrett	Appalachian Plateaus	49.1	
01597000	Crabtree Creek near Swanton, MD	39 30 00.0	79 09 35.0	Garrett	Appalachian Plateaus	16.7	
01599000	Georges Creek at Franklin, MD	39 29 38.1	79 02 40.9	Allegany	Appalachian Plateaus	72.4	
01601500	Wills Creek near Cumberland, MD	39 40 10.6	78 47 16.9	Allegany	Valley and Ridge	247	
01609000	Town Creek near Oldtown, MD	39 33 11.6	78 33 18.0	Allegany	Valley and Ridge	148	

Table 1. Continuous-record streamgage locations in Maryland for which low-flow frequency statistics were computed.—Continued

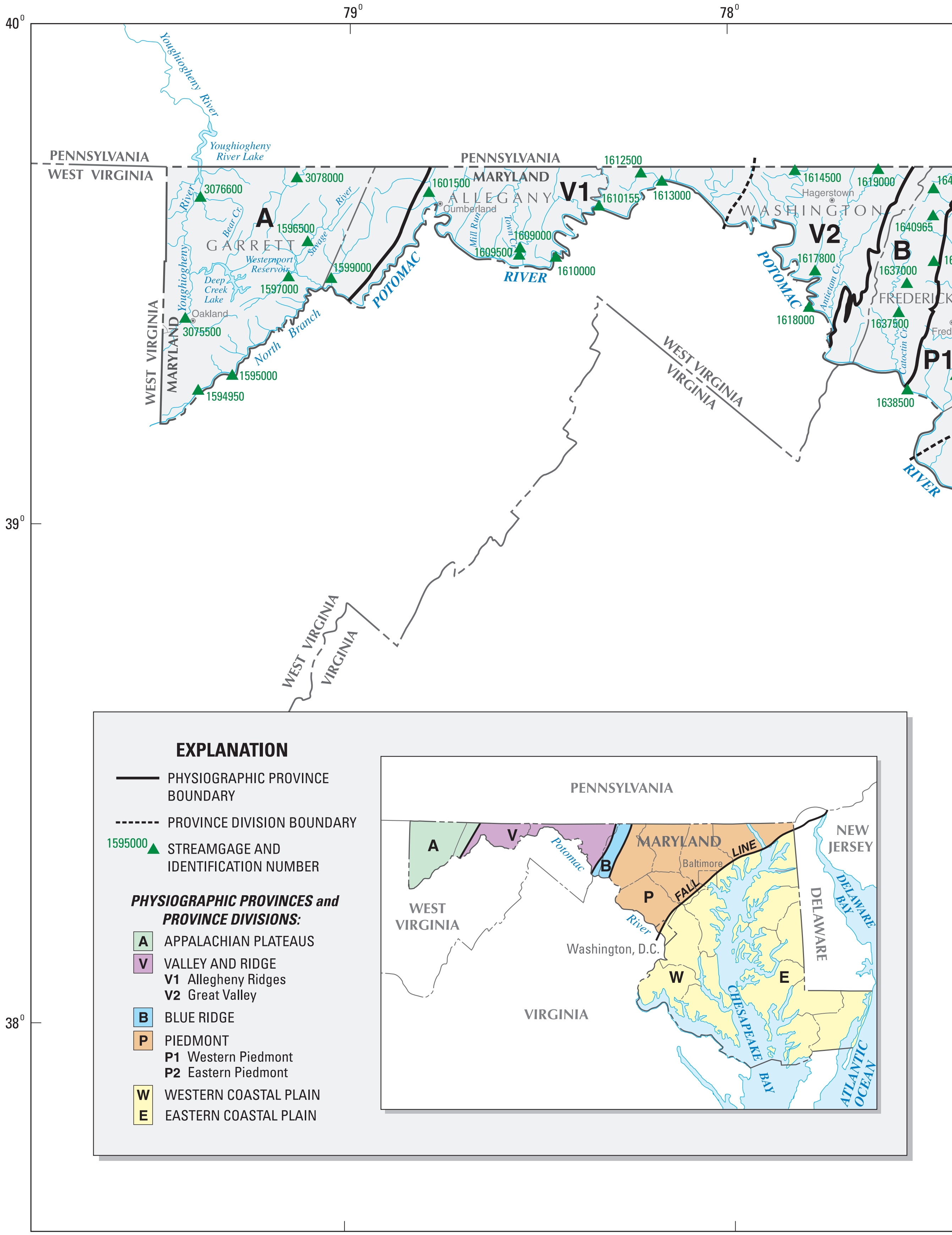
[MD, Maryland; PA, Pennsylvania; WV, West Virginia; °, degrees; ′, minutes; ″, seconds; mi², square miles]

Station number	Station name	Latitude (° ′ ″)	Longitude (° ′ ″)	County/City	Physiographic province	Drainage area (mi²)	Remarks
01609500	Sawpit Run near Oldtown, MD	39 32 50.0	78 33 20.0	Allegany	Valley and Ridge	5.08	
01610000	Potomac River at Paw Paw, WV	39 32 20.1	78 27 23.0	Allegany	Valley and Ridge	3,129	
01610155	Sideling Hill Creek near Bellegrove, MD	39 38 58.3	78 20 38.9	Washington	Valley and Ridge	102	
01612500	Little Tonoloway Creek near Hancock, MD	39 42 45.0	78 13 55.0	Washington	Valley and Ridge	16.9	
01613000	Potomac River at Hancock, MD	39 41 51.2	78 10 40.4	Washington	Valley and Ridge	4,064	
01614500	Conococheague Creek at Fairview, MD	39 42 59.0	77 49 29.2	Washington	Valley and Ridge	494	
01617800	Marsh Run at Grimes, MD	39 30 52.4	77 46 38.0	Washington	Valley and Ridge	18.9	
01618000	Potomac River at Shepherdstown, WV	39 26 05.0	77 48 05.0	Jefferson	Valley and Ridge	5,929	
01619000	Antietam Creek near Waynesboro, PA	39 42 58.5	77 36 23.9	Washington	Valley and Ridge	93.5	
01637000	Little Catoctin Creek at Harmony, MD	39 28 55.0	77 32 20.0	Frederick	Blue Ridge	8.83	
01637500	Catoctin Creek near Middletown, MD	39 25 38.1	77 33 22.2	Frederick	Blue Ridge	66.9	
01638500	Potomac River at Point of Rocks, MD	39 16 24.9	77 32 35.2	Frederick	Piedmont	9,651	
01639000	Monocacy River at Bridgeport, MD	39 40 43.8	77 14 04.2	Frederick	Piedmont	173	
01639140	Piney Creek near Taneytown, MD	39 39 38.7	77 13 15.5	Carroll	Piedmont	31.3	
01639500	Big Pipe Creek at Bruceville, MD	39 36 44.5	77 14 14.8	Carroll	Piedmont	102	
01640500	Owens Creek at Lantz, MD	39 40 36.0	77 27 50.0	Frederick	Blue Ridge	5.93	
01640965	Hunting Creek near Foxville, MD	39 37 10.0	77 28 00.0	Frederick	Blue Ridge	2.14	
01641000	Hunting Creek at Jimtown, MD	39 35 40.0	77 23 50.0	Frederick	Piedmont	18.4	Truncated record (Use 1950–1968)
01641500	Fishing Creek near Lewistown, MD	39 31 37.6	77 28 01.3	Frederick	Blue Ridge	7.29	
01642000	Monocacy River near Frederick, MD	39 27 09.0	77 22 16.0	Frederick	Piedmont	665	
01642500	Linganore Creek near Frederick, MD	39 24 55.0	77 20 00.0	Frederick	Piedmont	82.3	Truncated record (Use 1935–1970)
01643000	Monocacy River at Jug Bridge near Frederick, MD	39 24 10.2	77 21 57.9	Frederick	Piedmont	817	
01643500	Bennett Creek at Park Mills, MD	39 17 38.9	77 24 25.5	Frederick	Piedmont	62.8	

Table 1. Continuous-record streamgage locations in Maryland for which low-flow frequency statistics were computed. —Continued

[MD, Maryland; PA, Pennsylvania; WV, West Virginia; °, degrees; ′, minutes; ″, seconds; mi², square miles]

Station number	Station name	Latitude (° ′ ″)	Longitude (° ′ ″)	County/City	Physiographic province	Drainage area (mi²)	Remarks
01645000	Seneca Creek at Dawsonville, MD	39 07 41.1	77 20 08.8	Montgomery	Piedmont	101	
01645200	Watts Branch at Rockville, MD	39 05 03.0	77 10 38.0	Montgomery	Piedmont	3.70	
01646550	Little Falls Branch near Bethesda, MD	38 57 27.0	77 06 31.0	Montgomery	Piedmont	4.10	
01649500	Northeast Branch Anacostia River at Riverdale, MD	38 57 36.9	76 55 33.5	Prince George's	Coastal Plain	72.8	
01650500	Northwest Branch Anacostia River near Colesville, MD	39 03 56.4	77 01 45.6	Montgomery	Piedmont	21.0	
01651000	Northwest Branch Anacostia River near Hyattsville, MD	38 57 08.4	76 57 57.8	Prince George's	Coastal Plain	49.4	Truncated record (Use 1962–2008)
01653500	Henson Creek at Oxon Hill, MD	38 47 16.0	76 58 42.0	Prince George's	Coastal Plain	16.7	
01653600	Piscataway Creek at Piscataway, MD	38 42 20.8	76 57 58.3	Prince George's	Coastal Plain	39.5	
01658000	Mattawoman Creek near Pomonkey, MD	38 35 46.1	77 03 21.7	Charles	Coastal Plain	54.8	
01660920	Zekiah Swamp Run near Newtown, MD	38 29 26.1	76 55 37.5	Charles	Coastal Plain	79.9	
01661000	Chaptico Creek at Chaptico, MD	38 22 45.0	76 46 56.0	St. Mary's	Coastal Plain	10.4	
01661050	St. Clement Creek near Clements, MD	38 19 59.9	76 43 30.0	St. Mary's	Coastal Plain	18.5	
01661500	St. Marys River at Great Mills, MD	38 14 30.3	76 30 13.2	St. Mary's	Coastal Plain	24.0	
03075500	Youghiogheny River near Oakland, MD	39 25 17.7	79 25 25.1	Garrett	Appalachian Plateaus	134	
03076600	Bear Creek at Friendsville, MD	39 39 22.1	79 23 38.8	Garrett	Appalachian Plateaus	48.9	
03078000	Casselman River at Grantsville, MD	39 42 07.9	79 08 11.0	Garrett	Appalachian Plateaus	62.5	



BASE FROM U.S. GEOLOGICAL SURVEY, 1:500,000

Figure 2. Locations of 114 continuous-record streamgages in Maryland for which low-flow frequency statistics were computed.

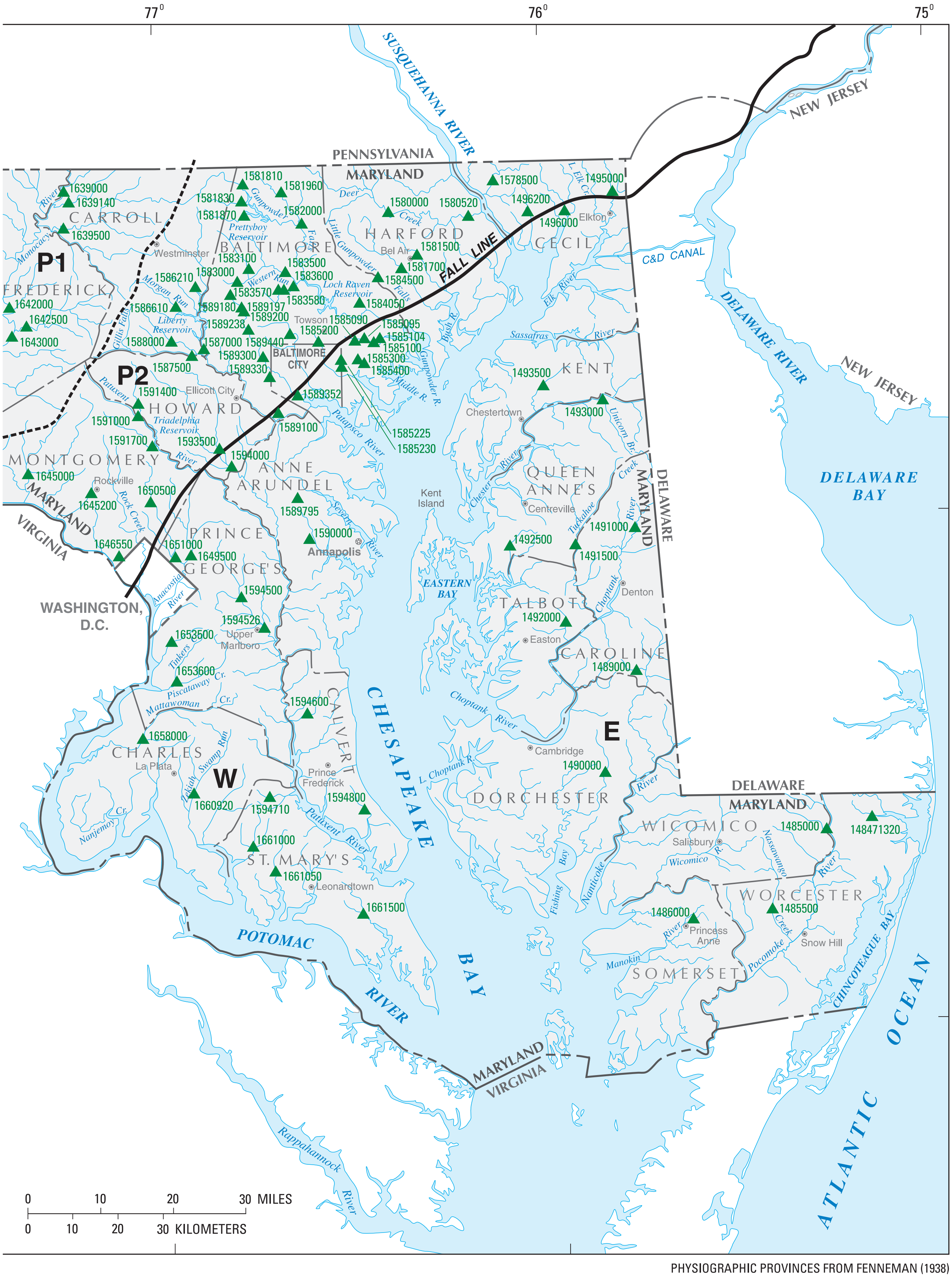


Figure 2. Locations of 114 continuous-record streamgages in Maryland for which low-flow frequency statistics were computed. —Continued

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
0148471320		0.5	2	0.4	0.5	0.5	
	2000–2009	0.1	10	0.2	0.2	0.2	
		0.05	20	0.2	0.2	0.2	
01485000	1950–2003	0.5	2	6.5	7.0	8.1	
	2007–2008	0.1	10	2.7	3.0	3.4	
		0.05	20	2.1	2.3	2.7	
01485500		0.5	2	2.3	2.6	3.5	Trend analysis needed for 7-day statistics
	1950–2008	0.1	10	1.2	1.3	1.5	
		0.05	20	1.1	1.2	1.3	
01486000	1951–1970	0.5	2	0.3	0.3	0.4	Trend analysis needed for 7-day statistics
	1975–2008	0.1	10	0.1	0.1	0.1	
		0.05	20	0.0	0.1	0.1	
01489000		0.5	2	1.1	1.2	1.4	
	1951–1990	0.1	10	0.3	0.5	0.7	
		0.05	20	0.2	0.4	0.6	
01490000	1952–1979	0.5	2	3.7	4.2	4.9	Trend analysis needed for 7-day statistics
	2001–2008	0.1	10	0.9	1.4	1.9	
		0.05	20	0.5	0.9	1.4	
01491000		0.5	2	12.9	14.1	16.1	
	1948–2008	0.1	10	4.0	5.2	6.7	
		0.05	20	2.7	3.9	5.3	
01491500	1951–1955	0.5	2	16.9	19.2	23.1	
	2001–2008	0.1	10	4.7	5.5	7.3	
		0.05	20	2.9	3.4	4.6	
01492000		0.5	2	0.1	0.2	0.3	
	1951–1980	0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.0	
01492500	1952–1955	0.5	2	1.9	2.0	2.3	
	2001–2008	0.1	10	1.4	1.5	1.7	
		0.05	20	1.3	1.4	1.6	
01493000	1948–2004	0.5	2	--	7.6	8.3	
	2007–2008	0.1	10	--	4.4	5.1	
		0.05	20	--	3.7	4.4	
01493500	1952–2004	0.5	2	3.4	3.6	4.0	
	2007–2008	0.1	10	1.6	1.7	2.0	
		0.05	20	1.2	1.3	1.5	
01495000		0.5	2	19.3	21.0	23.1	
	1932–2008	0.1	10	8.7	9.4	11.1	
		0.05	20	6.5	7.0	8.7	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01496000		0.5	2	5.5	6.0	6.8	
	1949–1983	0.1	10	2.7	3.0	3.3	
		0.05	20	2.1	2.3	2.7	
01496200		0.5	2	2.5	2.6	3.0	
	1968–1991	0.1	10	1.3	1.5	1.7	
		0.05	20	1.1	1.2	1.4	
01578500		0.5	2	91.7	96.6	107.1	
	1933–1949	0.1	10	55.1	56.9	64.0	
		0.05	20	45.6	46.9	53.0	
01580000		0.5	2	48.0	49.6	51.7	
	1927–2008	0.1	10	22.8	24.2	28.1	
		0.05	20	17.0	18.6	23.2	
01580520		0.5	2	79.6	82.6	87.6	
	2000–2009	0.1	10	19.5	22.1	29.8	
		0.05	20	10.9	13.0	20.5	
01581500	1945–1950	0.5	2	1.2	1.4	1.7	
	1956–1969	0.1	10	0.3	0.4	0.8	
	2000–2008	0.05	20	0.1	0.2	0.6	
01581700		0.5	2	17.2	17.7	18.0	
	1968–2008	0.1	10	5.4	6.2	8.0	
		0.05	20	3.3	4.0	6.2	
01581810		0.5	2	10.3	10.8	11.8	
	2000–2009	0.1	10	3.7	3.7	4.6	
		0.05	20	2.5	2.6	3.5	
01581830		0.5	2	2.9	3.1	3.4	
	2000–2009	0.1	10	1.0	1.1	1.4	
		0.05	20	0.7	0.8	1.1	
01581870		0.5	2	5.4	5.8	7.0	
	2000–2009	0.1	10	3.8	3.9	4.1	
		0.05	20	3.6	3.6	3.6	
01581960		0.5	2	5.3	5.5	5.9	
	2000–2009	0.1	10	2.3	2.5	3.1	
		0.05	20	1.7	1.9	2.5	
01582000		0.5	2	24.9	26.2	27.9	
	1945-–2008	0.1	10	12.5	13.4	15.6	
		0.05	20	10.0	10.8	13.1	
01583000		0.5	2	0.7	0.8	0.9	
	1948–1980	0.1	10	0.3	0.3	0.4	
		0.05	20	0.2	0.2	0.2	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01583100	1983–1986	0.5	2	5.6	5.8	6.0	Trend analysis needed for 7-day statistics
	1997–2008	0.1	10	2.4	2.6	3.3	
		0.05	20	1.8	1.9	2.7	
01583500		0.5	2	23.9	25.1	26.8	
	1945–2008	0.1	10	10.7	11.4	13.4	
		0.05	20	8.1	8.8	10.8	
01583570	1983–1985	0.5	2	0.0	0.0	0.1	
	1999–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01583580	1965–1968	0.5	2	0.4	0.4	0.4	Trend analysis needed for 7-day statistics
	2000–2008	0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.1	
01583600		0.5	2	9.4	10.0	11.4	
	1983–2008	0.1	10	5.6	6.1	7.3	
		0.05	20	4.9	5.4	6.6	
01584050		0.5	2	3.3	3.4	3.8	
	1976–2009	0.1	10	1.6	1.7	1.9	
		0.05	20	1.3	1.4	1.6	
01584500	1927–1969	0.5	2	16.1	16.8	17.7	Trend analysis needed for 7-day statistics
	1999–2008	0.1	10	6.5	7.0	8.3	
		0.05	20	4.5	5.0	6.3	
01585090		0.5	2	0.2	0.3	0.4	
	1995–2008	0.1	10	0.0	0.0	0.2	
		0.05	20	0.0	0.0	0.1	
01585095		0.5	2	0.1	0.1	0.2	
	1993–2008	0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.0	
01585100	1959–1988	0.5	2	1.0	1.2	1.7	
	1992–2008	0.1	10	0.4	0.6	0.9	
		0.05	20	0.4	0.5	0.8	
01585104		0.5	2	0.1	0.2	0.3	
	2000–2009	0.1	10	0.0	0.0	0.2	
		0.05	20	0.0	0.0	0.2	
01585200	1958–1964	0.5	2	--	0.4	0.6	Trend analysis needed for 7-day statistics
	1966–1986	0.1	10	--	0.2	0.3	
	1997–2008	0.05	20	--	0.2	0.2	
01585225		0.5	2	0.0	0.0	0.0	
	1997–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01585230		0.5	2	0.3	0.4	0.7	
	1997–2008	0.1	10	0.2	0.2	0.4	
		0.05	20	0.2	0.2	0.3	
01585300	1959–1971	0.5	2	0.3	0.4	0.7	
	1974–1988	0.1	10	0.1	0.2	0.3	
		0.05	20	0.1	0.1	0.2	
01585400		0.5	2	0.4	0.5	0.5	
	1959–1986	0.1	10	0.2	0.2	0.3	
		0.05	20	0.0	0.0	0.2	
01586210		0.5	2	4.5	4.7	5.0	
	1983–2008	0.1	10	1.6	1.8	2.5	
		0.05	20	1.0	1.3	2.1	
01586610		0.5	2	8.1	8.6	9.1	
	1983–2008	0.1	10	3.0	3.2	4.2	
		0.05	20	2.1	2.3	3.3	
01587000		0.5	2	50.4	54.5	62.6	Trend analysis needed for 7-day statistics
	1930–1951	0.1	10	27.4	29.6	34.2	
		0.05	20	22.5	24.2	27.9	
01587500		0.5	2	19.8	20.0	20.9	
	1949–1979	0.1	10	5.3	6.7	8.9	
		0.05	20	3.0	4.4	6.7	
01588000		0.5	2	3.5	3.8	4.4	
	1932–1957	0.1	10	1.8	2.0	2.3	
		0.05	20	1.5	1.6	1.9	
01589100	1958–1988	0.5	2	0.6	0.7	0.9	Trend analysis needed for 7-day statistics
	1999–2008	0.1	10	0.3	0.4	0.5	
		0.05	20	0.3	0.3	0.4	
01589180		0.5	2	0.0	0.0	0.0	
	1999–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01589197		0.5	2	1.2	1.3	1.3	
	1999–2008	0.1	10	0.5	0.5	0.7	
		0.05	20	0.3	0.4	0.6	
01589200		0.5	2	1.7	1.7	2.0	
	1959–1974	0.1	10	0.9	1.0	1.2	
		0.05	20	0.7	0.8	1.1	
01589238		0.5	2	0.0	0.0	0.0	
	2000–2009	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft^3/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft^3/s)	14-Day (ft^3/s)	30-Day (ft^3/s)	
01589300	1957–1987	0.5	2	8.0	8.9	10.6	
	1997–2008	0.1	10	3.7	4.2	5.7	
		0.05	20	2.9	3.3	4.7	
01589330	1960–1986	0.5	2	0.6	0.7	1.0	
	1999–2008	0.1	10	0.3	0.3	0.5	
		0.05	20	0.2	0.3	0.4	
01589352		0.5	2	15.9	17.8	23.5	
	1999–2008	0.1	10	10.4	11.4	15.2	
		0.05	20	9.5	10.3	13.9	
01589440	1966–1987	0.5	2	8.1	8.6	9.5	Trend analysis needed for 7-day statistics
	1997–2008	0.1	10	3.4	3.6	4.5	
		0.05	20	2.6	2.7	3.6	
01589795		0.5	2	0.2	0.2	0.2	Trend analysis needed for 7-day statistics
	1998–2008	0.1	10	0.1	0.1	0.1	
		0.05	20	0.1	0.1	0.1	
01590000		0.5	2	3.7	3.9	4.5	Trend analysis needed for 7-day statistics
	1932–1973	0.1	10	2.0	2.2	2.6	
		0.05	20	1.7	1.8	2.2	
01591000		0.5	2	8.3	8.8	9.4	
	1945–2008	0.1	10	2.1	2.6	3.6	
		0.05	20	1.2	1.6	2.6	
01591400		0.5	2	5.8	6.1	6.4	
	1979–2008	0.1	10	1.2	1.5	2.2	
		0.05	20	0.7	0.9	1.6	
01591700		0.5	2	4.4	4.8	5.5	
	1979–2008	0.1	10	1.0	1.1	1.6	
		0.05	20	0.5	0.6	1.1	
01593500		0.5	2	8.2	8.8	10.1	
	1932–2008	0.1	10	3.1	3.6	5.1	
		0.05	20	2.2	2.7	4.2	
01594000	1940–1957	0.5	2	20.9	22.5	26.0	
	1976–1979	0.1	10	7.5	8.7	12.1	
	1986–2008	0.05	20	5.4	6.5	9.8	
01594500		0.5	2	2.6	2.9	3.4	
	1950–1974	0.1	10	0.4	0.6	1.0	
		0.05	20	0.2	0.3	0.7	
01594526	1986–1988	0.5	2	7.1	8.1	11.7	
	1992–2008	0.1	10	2.1	2.4	3.9	
		0.05	20	1.4	1.7	2.9	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01594600	1957–1975	0.5	2	0.3	0.4	0.5	
		0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.1	
01594710	1986–1996	0.5	2	0.7	0.8	1.0	
		0.1	10	0.3	0.3	0.4	
		0.05	20	0.2	0.3	0.3	
01594800	1957–1967	0.5	2	1.1	1.4	1.9	Trend analysis needed for 7-day statistics
		0.1	10	0.2	0.4	0.4	
		0.05	20	0.0	0.1	0.2	
01594950	1987–2008	0.5	2	0.1	0.1	0.1	
		0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01595000	1957–2008	0.5	2	14.9	17.6	21.9	Trend analysis needed for 7-day statistics
		0.1	10	6.5	7.8	9.9	
		0.05	20	5.0	6.1	7.9	
01596500	1949–2008	0.5	2	2.4	2.8	3.7	
		0.1	10	1.0	1.1	1.7	
		0.05	20	0.8	0.9	1.4	
01597000	1949–1980	0.5	2	1.7	1.8	2.0	
		0.1	10	1.1	1.1	1.3	
		0.05	20	1.0	1.0	1.2	
01599000	1930–2008	0.5	2	6.2	6.7	7.7	Trend analysis needed for 7-day statistics
		0.1	10	3.3	3.5	4.0	
		0.05	20	2.7	2.9	3.4	
01601500	1930–2008	0.5	2	23.4	25.1	29.0	Trend analysis needed for 7-day statistics
		0.1	10	13.9	14.7	16.6	
		0.05	20	12.2	12.8	14.5	
01609000	1929–1934	0.5	2	6.4	7.6	9.8	
	1968–1980	0.1	10	1.9	2.2	3.1	
	2002–03, 2007–08	0.05	20	1.3	1.5	2.1	
01609500	1948–1957	0.5	2	0.0	0.0	0.0	
		0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01610000	1939–2009	0.5	2	382.2	409.5	459.0	Trend analysis needed for 7-day statistics
		0.1	10	240.9	253.6	280.2	
		0.05	20	215.4	226.4	252.1	
01610155	1968–1976	0.5	2	0.2	0.4	1.0	
	1999–2008	0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.0	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01612500	1948–1962	0.5	2	0.1	0.1	0.2	
		0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01613000	1933–2009	0.5	2	445.7	477.1	533.2	Trend analysis needed for 7-day statistics
		0.1	10	287.9	306.3	337.5	
		0.05	20	258.4	276.2	307.0	
01614500	1929–2008	0.5	2	92.0	96.1	105.4	Trend analysis needed for 7-day statistics
		0.1	10	55.2	57.9	65.6	
		0.05	20	47.7	50.5	58.6	
01617800	1965–2008	0.5	2	3.0	3.2	3.4	
		0.1	10	0.6	0.7	1.0	
		0.05	20	0.3	0.4	0.6	
01618000	1929–1993	0.5	2	707.9	762.9	868.9	
	2001–2003	0.1	10	423.7	453.8	516.1	
		0.05	20	370.0	397.3	455.2	
01619000	1949–1950	0.5	2	37.4	38.8	41.7	
	1966–1980	0.1	10	23.7	24.4	26.2	
	2006–2008	0.05	20	20.2	20.9	22.4	
01637000	1948–1957	0.5	2	1.1	1.2	1.4	Trend analysis needed for 7-day statistics
		0.1	10	0.5	0.6	0.8	
		0.05	20	0.4	0.5	0.6	
01637500	1948–2008	0.5	2	3.2	3.9	5.4	
		0.1	10	0.9	1.2	1.7	
		0.05	20	0.6	0.8	1.2	
01638500	1895–2009	0.5	2	1,387.1	1,473.7	1,623.0	
		0.1	10	903.4	957.5	1,066.5	
		0.05	20	808.9	859.8	972.1	
01639000	1943–2008	0.5	2	4.7	5.8	8.2	
		0.1	10	0.9	1.4	2.9	
		0.05	20	0.4	0.8	2.2	
01639140	1991–2000	0.5	2	0.9	0.9	1.5	
		0.1	10	0.1	0.2	0.3	
		0.05	20	0.0	0.1	0.2	
01639500	1948–2008	0.5	2	23.8	25.8	26.6	
		0.1	10	7.2	7.9	10.4	
		0.05	20	4.1	4.6	7.4	
01640500	1932–1983	0.5	2	0.6	0.7	0.8	
		0.1	10	0.2	0.2	0.3	
		0.05	20	0.1	0.1	0.2	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft³/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft³/s)	14-Day (ft³/s)	30-Day (ft³/s)	
01640965	1982–1993	0.5	2	0.1	0.1	0.1	
		0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.0	
01641000	1950–1968	0.5	2	1.9	2.1	2.5	Trend analysis needed for 7-day statistics
		0.1	10	1.1	1.2	1.5	
		0.05	20	1.0	1.0	1.3	
01641500	1948–1983	0.5	2	1.5	1.6	1.8	
		0.1	10	0.9	1.0	1.1	
		0.05	20	0.8	0.8	1.0	
01642000	1897–1929	0.5	2	84.9	95.5	124.2	
		0.1	10	35.8	41.8	60.4	
		0.05	20	27.0	32.2	47.9	
01642500	1935–1970	0.5	2	15.3	16.5	18.4	
		0.1	10	6.9	7.5	9.0	
		0.05	20	5.2	5.6	7.1	
01643000	1930–2008	0.5	2	103.9	112.2	127.5	Trend analysis needed for 7-day statistics
		0.1	10	49.2	52.8	64.1	
		0.05	20	38.9	42.1	53.7	
01643500	1949–1957	0.5	2	10.8	11.8	13.0	
	1967–2008	0.1	10	3.8	4.3	5.9	
		0.05	20	2.6	3.1	4.8	
01645000	1931–2008	0.5	2	25.8	27.7	30.4	Trend analysis needed for 7-day statistics
		0.1	10	9.5	10.5	13.6	
		0.05	20	6.7	7.5	10.6	
01645200	1958–1986	0.5	2	0.6	0.7	0.9	
		0.1	10	0.2	0.3	0.4	
		0.05	20	0.2	0.2	0.3	
01646550	1945–1958	0.5	2	0.3	0.3	0.5	Trend analysis needed for 7-day statistics
	1962–1977	0.1	10	0.1	0.1	0.2	
		0.05	20	0.0	0.1	0.2	
01649500	1939–2008	0.5	2	11.7	13.3	17.2	
		0.1	10	5.5	6.5	8.7	
		0.05	20	4.2	5.3	7.1	
01650500	1924–1982	0.5	2	3.9	4.9	5.6	Trend analysis needed for 7-day statistics
	1998–2008	0.1	10	0.7	0.7	1.3	
		0.05	20	0.2	0.3	0.8	
01651000	1962–2008	0.5	2	5.9	7.2	10.2	
		0.1	10	2.1	2.8	4.3	
		0.05	20	1.5	2.1	3.4	

Table 2. Low-flow frequency statistics for continuous-record streamgage locations in Maryland.—Continued

[ft^3/s, cubic feet per second; -- not included]

Station number	Period of record (climatic years)	Probability	Recurrence interval (years)	Minimum daily mean streamflow over given number of days			Remarks
				7-Day (ft^3/s)	14-Day (ft^3/s)	30-Day (ft^3/s)	
01653500		0.5	2	1.1	1.5	2.3	
	1949–1977	0.1	10	0.1	0.3	0.5	
		0.05	20	0.0	0.1	0.3	
01653600	1966–2004	0.5	2	0.1	0.5	1.5	
	2007–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01658000	1950–1971	0.5	2	0.0	0.0	0.0	
	2001–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01660920	1984–2004	0.5	2	0.1	0.4	1.7	
	2007–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01661000		0.5	2	0.4	0.7	1.1	
	1948–1971	0.1	10	0.0	0.0	0.1	
		0.05	20	0.0	0.0	0.0	
01661050	1969–2004	0.5	2	0.5	0.7	1.4	
	2007–2008	0.1	10	0.0	0.0	0.0	
		0.05	20	0.0	0.0	0.0	
01661500	1947–2004	0.5	2	2.5	2.9	3.6	
	2007–2008	0.1	10	0.9	1.0	1.4	
		0.05	20	0.6	0.7	1.1	
03075500		0.5	2	16.1	18.6	24.9	
	1942–2008	0.1	10	6.3	7.1	9.9	
		0.05	20	4.7	5.4	7.7	
03076600		0.5	2	6.2	6.9	8.3	
	1965–2008	0.1	10	3.0	3.5	4.1	
		0.05	20	2.5	2.9	3.4	
03078000		0.5	2	5.0	6.0	8.4	
	1948–2008	0.1	10	1.7	2.0	2.8	
		0.05	20	1.2	1.4	2.0	

Data Limitations

The streamgage locations included in this analysis were selected because they were minimally affected by regulation and diversions. Streamgage locations with flows that are significantly or completely regulated were eliminated from use in this investigation, or the period of record used for analysis was truncated to include only the periods with minimal or no regulation. Some streamgage locations used in this analysis may include data with occasional periods of minor diversions for irrigation, occasional low-flow regulation, or slight diurnal fluctuations caused by upstream mills, dams, or coal mining.

In this report, physiographic provinces were reported for each streamgage location based on the actual physical location of the streamgage, rather than the predominant physiographic province. Although some streamgages are physically located in the Western Coastal Plain, the upstream watershed may be hydrologically influenced predominantly by the Piedmont. Streamgage locations that fall into this category include: (1) station 01496000, Northeast Creek at Leslie, MD; (2) station 01585090, Whitemarsh Run near Fullerton, MD; (3) station 01589352, Gwynns Falls at Washington Boulevard at Baltimore, MD; (4) station 01594000, Little Patuxent River at Savage, MD; and (5) station 01651000, Northwest Branch Anacostia River near Hyattsville, MD.

Streamgage locations in watersheds with percentages of suburban or urban land use that would affect streamflow were not excluded from the dataset solely on that basis. No attempt was made to adjust streamflow records for watershed development patterns or percentages, or to limit the periods of record for analyses based on development condition, or other changes in land use.

Low-flow frequency statistics that were computed for each streamgage location in this study were based on the period of continuous streamflow record that was approved as of June 2010. Provisional data were not included in the analysis. Streamgage locations with breaks in the continuous record were included in the analysis, provided that the total period of continuous record was at least 10 complete climatic years. No attempt was made to adjust any low-flow frequency statistics based on any historical data or periods outside the continuous record.

No attempts were made to adjust streamflow records or statistical analyses based on trends in the annual 7-day minimum daily-mean streamflow over time. Further investigation would be required to determine the significance and sources of possible trends for 25 of the 114 streamgage locations that were included in this study.

There is potential that low-flow frequency statistics could be estimated for additional streamgage locations that were not included in this study because of continuous-record lengths that are less than 10 years. Correlations developed between daily-mean discharges at short-record streamgage locations, and those for nearby long-term streamgage locations that were used in the analysis, could be used as a basis for augmenting or extending the record lengths of the short-term streamgage locations with synthesized data, which would allow for computation of low-flow frequency statistics that represent a longer period of time (Ries, 2006; Carpenter and Hayes, 1996).

Summary

Because of continued population growth and increasing domestic water demand, Maryland will be facing increased pressure on water resources over the next 20 years. Water-resources decisions should be based on sound, comprehensive, long-term data and low-flow frequency statistics from all available streamgage locations with unregulated streamflow and adequate record lengths. To provide the Maryland Department of the Environment with tools for making future water-resources decisions, the U.S. Geological Survey conducted a study to compute low-flow frequency statistics for selected streamgage locations in Maryland with 10 or more years of continuous streamflow records.

This report presents low-flow frequency statistics for 114 continuous-record streamgage locations in Maryland. Streamgage locations used in the study included both active and discontinued stations with approved streamflow records with a minimum of 10 complete climatic years of record as of June 2010. Descriptive information for each of these streamgage locations, including the station number, station name, latitude, longitude, county or city, physiographic province, and drainage area, is presented, along with the computed low-flow statistics for the mean 7-, 14-, and 30-consecutive day low-flow discharges with recurrence intervals of 2, 10, and 20 years. These statistics are planned for incorporation into StreamStats, a U.S. Geological Survey web application for obtaining stream information, which is being used by water-resource managers and decision makers in Maryland for water-supply planning and management, water-use appropriation and permitting, wastewater and industrial discharge permitting, and setting minimum required streamflows in streams and rivers for protection of freshwater biota and ecosystems.

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Glossary

Annual 7-day minimum daily mean streamflow The lowest daily mean streamflow for any 7-consecutive-day period in a year. For low-flow frequency analyses, a year is defined as the climatic year.

Base flow The contribution of flow in a stream or river from groundwater or spring effluent.

Climatic year The climatic year is the 12-month period from April 1 through March 31. The climatic year is designated by the calendar year in which it begins. For example, the 12-month period starting on April 1, 2008 and ending March 31, 2009 is the 2008 climatic year.

Fall Line The line marking the point on each stream where the flow descends from the eastern section of the Piedmont Physiographic Province to the Western Coastal Plain in Maryland. The Fall Line is characterized by an abrupt decrease in channel slope in transition between the Piedmont and Coastal Plain Physiographic Provinces.

Records Unit value or daily mean discharge data that are collected continuously from streamgage locations, electronically stored, published, and archived according to U.S. Geological Survey protocols.

Recurrence interval As applied to low-flow statistics, the recurrence interval is the average number of years within which the streamflow will be equal to or less than the given statistic on one occasion.

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