In cooperation with the

University of Maryland, Baltimore County
and the
Institute of Ecosystem Studies

Index of Hydrologic Characteristics and Data Resources for the Gwynns Falls Watershed, Baltimore County and Baltimore City, Maryland

Open-File Report 99-213

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

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Branch of Information Services
Box 25286
Denver, CO 80225-0286

Contents

Figures

Tables

Conversion Factors and Vertical Datum

Multiply	By	To obtain
foot (ft)	0.3048	meter
square foot (ft^2)	0.0929	square meter
foot per second (ft/s)	0.3048	meter per second
cubic foot per second (ft^3/s)	0.02832	cubic meter per second
square mile (mi^2)	2.590	square kilometer
square mile (mi^2)	259.067	hectare
gallon per minute	3.785412	liter per minute

Sea level: In this report, “sea level” refers to the National Geodetic Vertical Datum 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.

Water year*:* In this report, “water year” refers to the 12–month period October 1 through September 30. The water year is designated by the calendar year in which it ends. Thus, the water year ending September 30, 1998, is called the 1998 water year.

Index of Hydrologic Characteristics and Data Resources for the Gwynns Falls Watershed, Baltimore County and Baltimore City, Maryland

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Abstract

The Gwynns Falls watershed has been selected as the primary study area for the Baltimore Ecosystem Study, as part of the National Science Foundation's Long-Term Ecological Research program. Because the Baltimore Ecosystem Study will be investigating long-term hydrologic changes in the Gwynns Falls watershed, a compilation of existing data resources for the watershed is necessary.

This report discusses hydrologic characteristics and presents a compilation of historical data resources for the Gwynns Falls watershed. Tables are presented that list active and discontinued continuous-record streamflow-gaging stations, nontidal crest-stage partial-record stations, low-flow partial-record stations, and water-quality partial-record stations operated by the U.S. Geological Survey, Maryland-Delaware-D. C. District, in the Gwynns Falls watershed. Statistics regarding the number of inventoried ground-water wells in or bordering the Gwynns Falls watershed also are presented. A summary of additional data resources for the Gwynns Falls watershed is provided. This includes (1) an inventory of selected U.S. Geological Survey studies and reports that contain historical data or basin characteristics for streams in the watershed, (2) a listing of indirect flood-discharge measurements that have been made at several monitoring stations in the watershed, (3) a brief discussion of channel-stability and bridge-scour data collected by the U.S. Geological Survey in the watershed during 1990–95, (4) a listing of climatological data stations in the watershed and in the surrounding regional area, and (5) a listing of other selected reports that include data or information on the Gwynns Falls watershed.

Introduction

Urban development often results in significant changes to ecological systems within a watershed. Little is known regarding the function of urban and suburban areas as ecological systems (Baltimore Ecosystem Study, information accessed September 28, 1998, on the World Wide Web at URL *http://baltimore.umbc.edu/lter/welcome/default.htm*). The National Science Foundation (NSF) has recently sponsored a long-term, national, interdisciplinary research program to explore, quantify, and document knowledge of natural and urban ecosystems (S.T.A. Pickett, Institute of Ecosystem Studies, written commun., 1998). This program, entitled Long-Term Ecological Research (LTER), includes the Baltimore metropolitan area as one of two study locations for predominantly urban ecosystems. The Baltimore Ecosystem Study (BES), as part of LTER, was initiated in 1998. BES is initially focusing on the Gwynns Falls watershed because it includes areas with varying degrees of urban development, and is a major source for toxics entering Baltimore Harbor. The Baltimore Harbor region also is a principal region of concern for toxics entering the Chesapeake Bay (J.S. Lizárraga, U.S. Geological Survey, written commun., 1996). Because BES will be working in the Gwynns Falls watershed on a long-term basis, a summary of hydrologic characteristics and a compilation of historical data resources in the Gwynns Falls watershed are required.

This report discusses hydrologic characteristics and historical data resources for the Gwynns Falls watershed. A summary of monitoring stations currently and previously operated by the U.S. Geological Survey (USGS) in the Gwynns Falls watershed is presented. Tables are included that list active and discontinued continuous-record streamflow-gaging stations, nontidal crest-stage partial-record stations, low-flow partial-record stations, and water-quality partial-record stations in the Gwynns Falls watershed. Statistics regarding the number of inventoried ground-water wells in or bordering the Gwynns Falls watershed are presented. The report also summarizes additional data resources for the Gwynns Falls watershed, including (1) an inventory of selected USGS studies and reports that contain historical data or basin characteristics for streams in the watershed, (2) a listing of indirect flood-discharge measurements that have been made at several monitoring stations in the watershed, (3) a brief discussion of channel-stability and bridge-scour data collected by USGS in the watershed during 1990–95, (4) a listing of climatological data stations in the watershed and in the surrounding regional area, and (5) a listing of other selected reports that include data or information on the Gwynns Falls watershed.

Hydrologic Characteristics

Gwynns Falls drains a 66.5-square-mile (mi^2) sub-basin of the larger Patapsco River watershed in Baltimore County and Baltimore City, Md. (fig. 1). The Gwynns Falls watershed includes 17 major subwatersheds that range in size from 1.80 mi^2 to 7.16 mi^2.

The headwaters of Gwynns Falls are located in the town of Glyndon in west-central Baltimore County, Md. The stream drains several residential communities in west-central Baltimore County before entering the south-western corridor of Baltimore City. Flow becomes tidal approximately 1 mile above the mouth. Gwynns Falls discharges into the Middle Branch of the Patapsco River, which comprises the western part of Baltimore Harbor. The Middle Branch of the Patapsco River ultimately drains into the Chesapeake Bay.

The watershed lies mostly within the Piedmont Physiographic Province and is underlain primarily by crystalline bedrock. A small section near the mouth of the watershed is located in the Coastal Plain Physiographic Province, which is underlain by unconsolidated layers of sand, gravel, silt, and clay. The Piedmont and Coastal Plain are separated by the Fall Line, which is a transition zone where the unconsolidated sand, gravel, silt, and clay of the Coastal Plain begin overlapping the crystalline rocks of the Piedmont (Fenneman, 1938).

Land use in the watershed is predominantly urban, with significantly lesser amounts of forest and agriculture. The percentage of urban land use also has increased by nearly 10 percent since 1970, with associated decreases in the percentage of forest and agriculture. Table 1 shows the percentages of different land-use types in the Gwynns Falls watershed between 1970 and 1990 (Baltimore Ecosystem Study, data accessed September 28, 1998, on the World Wide Web at URL *http://baltimore.umbc.edu/lter/description/working/description.htm*).

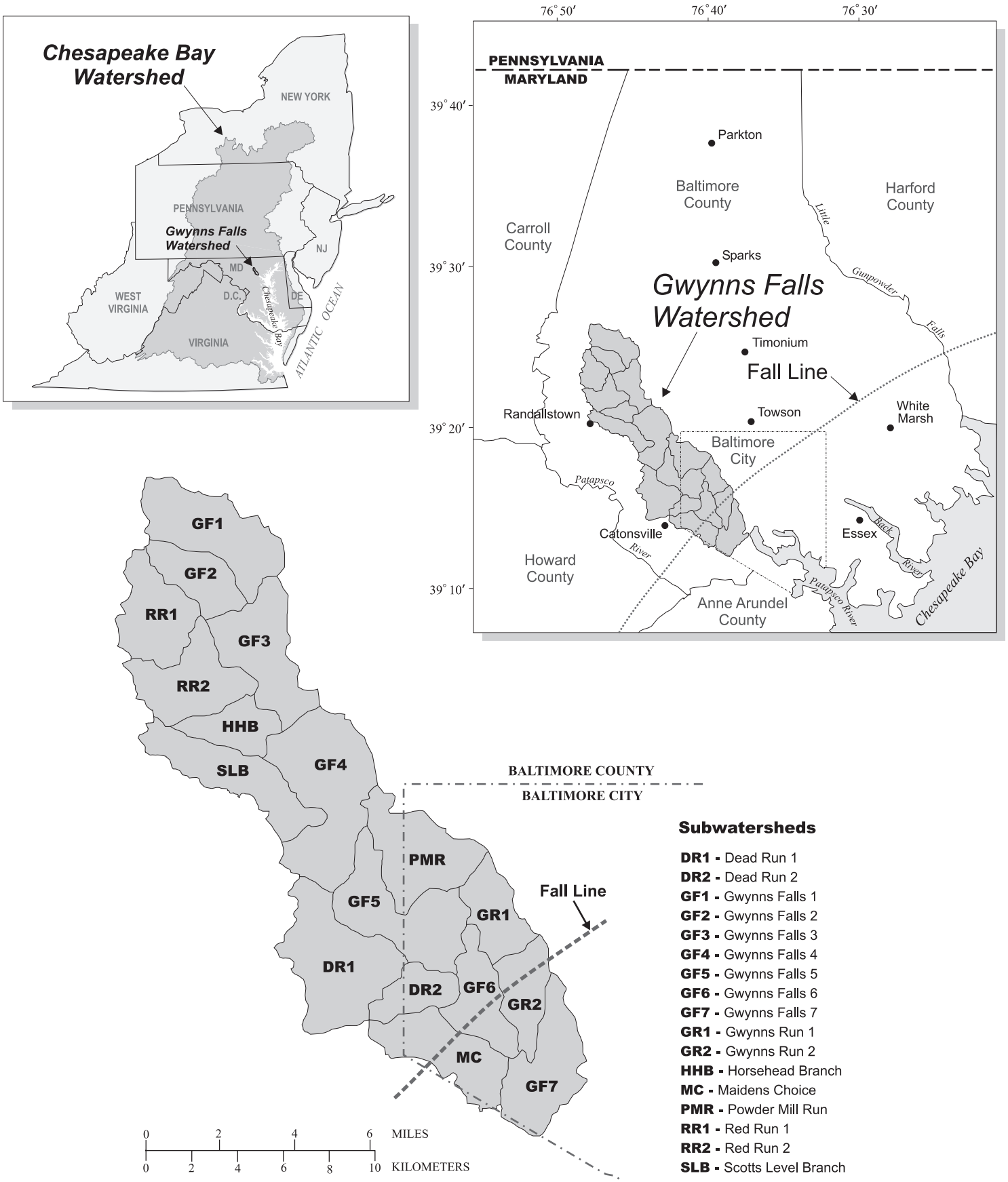

Figure 1. Location of Gwynns Falls watershed and approximate boundaries of seventeen subwatersheds.

Table 1. *Percentages of major land-use types in the Gwynns Falls watershed, 1970–90*

Land-use type	1970	1980	1990
Agriculture	10.5	9.7	6.7
Forest	24.8	23.9	18.9
Urban	64.6	66.3	74.3
Water	0.1	0.1	0.1

Annual-mean precipitation in the Gwynns Falls watershed is about 43 inches, and the annual-mean runoff is about 16 inches (Baltimore Ecosystem Study, data accessed September 28, 1998, on the World Wide Web at URL *http://baltimore.umbc.edu/lter/description/working/description.htm*). Based on the annual-mean discharge for 34 years of continuous record and the drainage area, the annual-mean runoff at the continuous-record streamflow-gaging station on Gwynns Falls at Villa Nova, Md., is 16.5 inches (U.S. Geological Survey, 1999). The difference between annual-mean precipitation and annual-mean runoff is almost entirely due to evapotranspiration losses (James, 1986). Because of variations in seasonal rates of evapotranspiration and seasonal changes in ground-water discharge to streams, monthly mean stream discharges generally decline from highs in March to lows occurring in September and October. This pattern then reverses as evapotranspiration losses decrease after the growing season, resulting in increased ground-water discharge to streams (Simmons, 1986). Figure 2 shows a hydrograph of daily-mean discharge for the 1998 water year at the continuous-record streamflow-gaging station on Gwynns Falls at Villa Nova, Md.

Monitoring Stations Operated by the U.S. Geological Survey in the Gwynns Falls Watershed

The USGS has operated several monitoring stations in the Gwynns Falls watershed since the late 1950's. Some stations have been operated as part of long-term-monitoring networks. Others have been operated for shorter periods of time for project-specific data needs. Such stations include continuous-record streamflow-gaging stations, nontidal crest-stage partial-record stations, low-flow partial-record stations, and water-quality partial-record stations. Figure 3 shows the types and locations of monitoring stations operated by USGS in the Gwynns Falls watershed.

Continuous-Record Streamflow-Gaging Stations

Continuous-record streamflow-gaging stations have water-stage recorders that are used to collect continuous time-series stage data. The stage data are related to systematic discharge measurements at the station (Carter and Davidian, 1968). Continuous-record streamflow-gaging stations are often operated as part of a long-term-monitoring network, or for hydrologic investigations.

Three continuous-record streamflow-gaging stations have previously been operated by the USGS in the Gwynns Falls watershed. Two of these stations, Gwynns Falls at Villa Nova, Md. (01589300), and Dead Run at Franklintown, Md.(01589330), were recently re-actived in cooperation with the Baltimore County Department of Environmental Protection and Resource Management (DEPRM). The third station, Gwynns Falls near Owings Mills, Md. (01589200), was destroyed during Tropical Storm Eloise in September 1975. Current site conditions make re-activation impossible at this location. As a result, a new station was activated in 1998 in cooperation with Baltimore County DEPRM

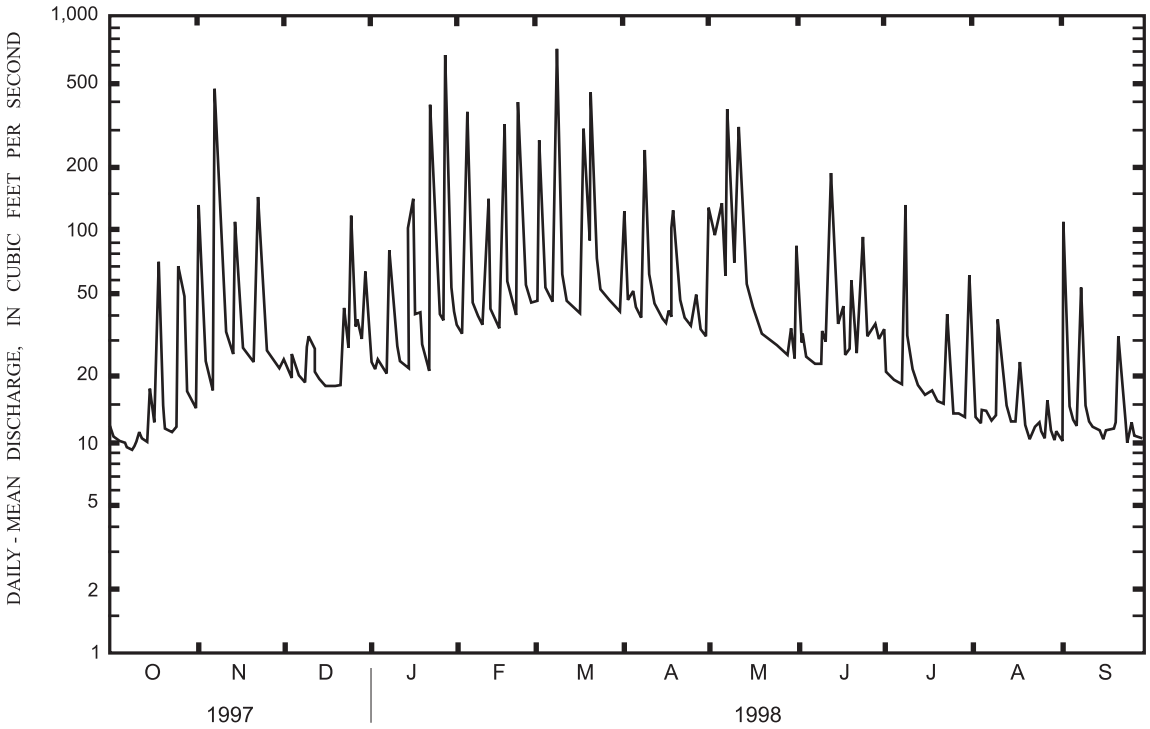

Figure 2. Hydrograph of daily-mean discharge for station 01589300, Gwynns Falls at Villa Nova, MD, water year 1998 (Modified from U. S. Geological Survey, 1999).

just upstream of the discontinued station on Gwynns Falls near Owings Mills, Md. This station, Gwynns Falls near Delight, Md. (01589197), is considered a new station despite its proximity to the discontinued station because the respective drainage areas differ by more than 5 percent (Novak, 1985).

Three new stations were recently activated as part of BES. These include Gwynns Falls at Glyndon, Md.; Gwynns Falls at Washington Boulevard at Baltimore, Md.; and Rognel Heights Storm Sewer Outfall at Baltimore, Md. One additional station will be activated during 1999 as part of BES. Precipitation gages will also be installed at or near selected stations during 1999.

Table 2 lists all active and discontinued continuous-record streamflow-gaging stations operated by USGS in the Gwynns Falls watershed.

Nontidal Crest-Stage Partial-Record Stations

Nontidal crest-stage partial-record stations are locations where peak stages and discharges are determined by use of a crest-stage gage instead of a water-stage recorder. A crest-stage gage is a device that will register the peak stage occurring between inspections of the gage (Buchanan and Somers, 1968). A stage-discharge relation for a station can be developed from discharge measurements made indirectly through field survey shortly after the peak flow has receded, or directly by current meter (Kennedy, 1984). The date of the

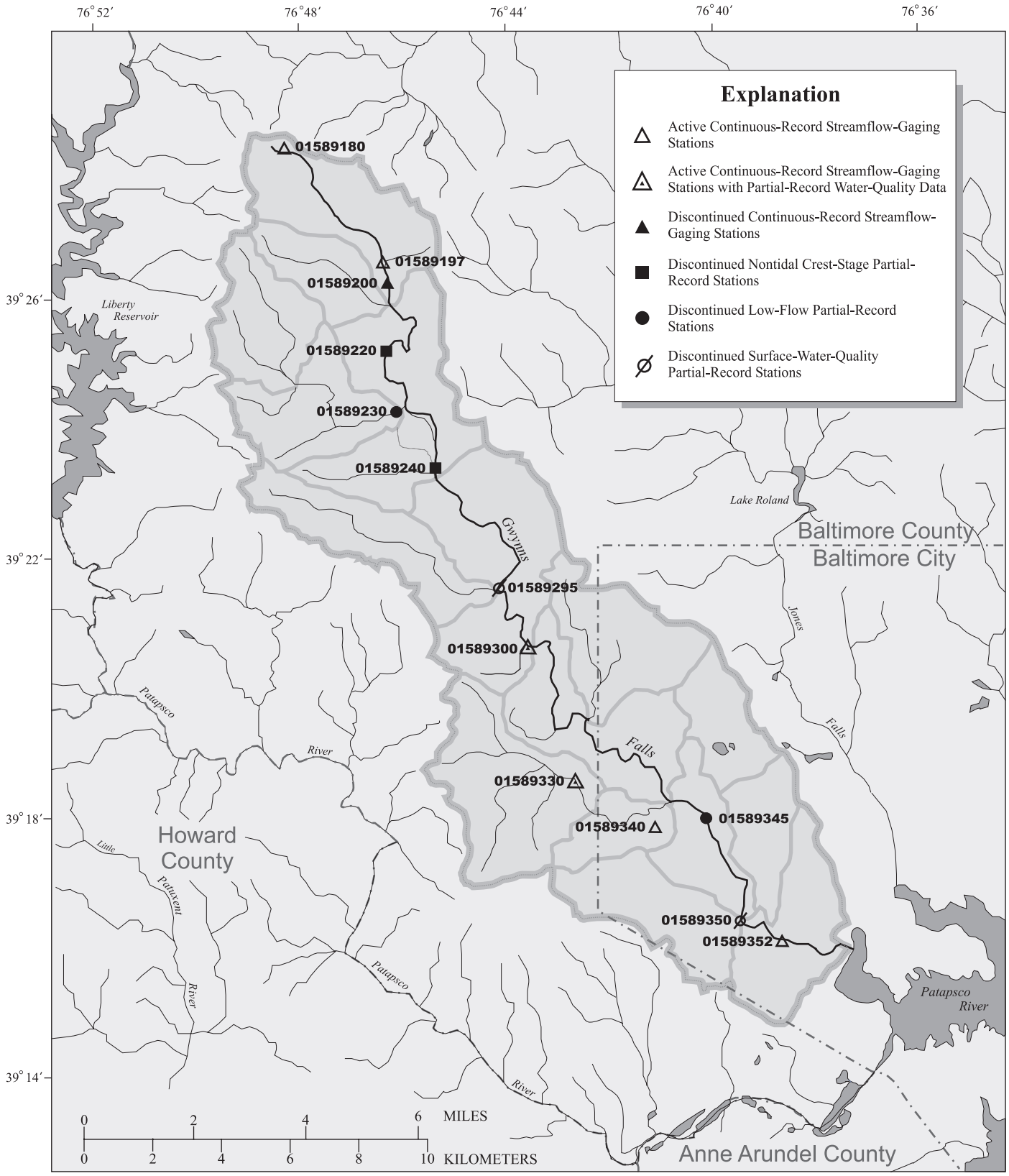

Figure 3. Types and locations of monitoring stations operated by the U. S. Geological Survey in the Gwynns Falls watershed.

Table 2. *Active and discontinued continuous-record streamflow-gaging stations in the Gwynns Falls watershed*

[mi^2, square miles]

Station no.	Station name	Drainage area (mi^2)	Period of record (water years)
01589180	Gwynns Falls at Glyndon, Md.	0.32	1998–present
01589197	Gwynns Falls near Delight, Md.	4.23	1998–present
01589200	Gwynns Falls near Owings Mills, Md.	4.90	1958–1975
01589300	Gwynns Falls at Villa Nova, Md.	32.5	1957–1988, 1997–present
01589330	Dead Run at Franklintown, Md.	5.52	1960–1987, 1998–present
01589340	Rognel Heights Storm Sewer Outfall at Baltimore, Md.	0.03	1999–present
01589352	Gwynns Falls at Washington Boulevard at Baltimore, Md.	65.9	1999–present

Table 3. *Discontinued nontidal crest-stage partial-record stations in the Gwynns Falls watershed*

[mi^2, square miles]

Station no.	Station name	Drainage area (mi^2)	Period of record (water years)
01589220	Gwynns Falls at Owings Mills, Md.	9.12	1958–1965, 1967–1968
01589240	Gwynns Falls at McDonogh, Md.	19.3	1958–1968, 1971–1984

maximum discharge is not always certain, but is usually determined by comparison with nearby continuous-record stations, weather records, or local inquiry. USGS is not currently operating any nontidal crest-stage partial-record stations in the Gwynns Falls watershed. Table 3 lists discontinued nontidal crest-stage partial-record stations in the Gwynns Falls watershed that were previously operated by the USGS.

Low-Flow Partial-Record Stations

Low-flow partial-record stations are ungaged locations where discharge measurements are made during the periods of lowest flows to determine the contributions of ground-water storage to discharge in the stream. Stages are generally not recorded at these stations. USGS is not currently operating any low-flow partial-record stations in the Gwynns Falls watershed. Table 4 lists discontinued low-flow partial-record stations in the Gwynns Falls watershed that were previously operated by the USGS.

Water-Quality Partial-Record Stations

Surface-water-quality stations are locations where surface-water-quality samples are collected to determine concentrations of selected chemicals in the water. No continuous-record surface-water-quality stations have ever been operated by the USGS in the Gwynns Falls watershed. Periodic sampling was conducted at one active, continuous-record streamflow-gaging station during 1969–72.

Table 4. *Discontinued low-flow partial-record stations in the Gwynns Falls watershed*

[mi^2, square miles]

Station no.	Station name	Drainage area (mi^2)	Period of record (water years)
01589230	Red Run near Owings Mills, Md.	7.39	1975–1979
01589345	Gwynns Falls at Baltimore, Md.	50.7	1980–1982

Table 5. *Discontinued surface-water-quality partial-record stations in the Gwynns Falls watershed*

[mi^2, square miles; –, no data available]

Station no.	Station name	Drainage area (mi^2)	Period of record (water years)
01589295	Scotts Level Branch at Villa Nova, Md.	–	1995–1996
01589300	Gwynns Falls at Villa Nova, Md.	32.5	1969–1972, 1995
01589330	Dead Run at Franklintown, Md.	5.52	1995–1996
01589350	Gwynns Falls at US-1 at Baltimore, Md.	–	1995–1996

Samples have also been collected periodically at ungaged locations and at discontinued streamflow-gaging stations at various times between water years 1969 and 1996. At these ungaged locations and discontinued stations, discharge measurements were made during sampling to relate streamflow to chemical concentrations. Table 5 lists locations in the Gwynns Falls watershed where periodic surface-water-quality samples have been collected by the USGS.

Ground-Water Wells

Water-level measurements are made in ground-water wells to determine the quantity of ground water or the direction of ground-water flow. Certain wells are measured systematically by USGS and the Maryland Geological Survey as part of the Maryland Water-Level Network. Others are measured only for specific lengths of time or sampled as part of hydrologic investigations. At present, no wells in the Maryland Water-Level Network are located in the Gwynns Falls watershed. One well in the network, BA Ec 43, is located just outside the watershed boundary at Druid Ridge Cemetery near Pikesville, Md. Water levels in this well have been measured approximately once a month since March 1956.

In addition to systematic measurement of ground-water levels in wells, the USGS maintains electronic records and hard-copy files on ground-water wells across Maryland. A search of historical records indicates that (1) approximately 250 ground-water wells are located in the Gwynns Falls watershed, and (2) about another 100 ground-water wells are located in the vicinity of the watershed boundary or just outside the watershed. Table 6 shows the distribution of these wells according to specific USGS 7.5-minute topographic maps.

Although many of these ground-water wells may still be in existence, some may have been destroyed or permanently sealed in areas of Baltimore City or in developing areas of Baltimore County. Analysis of individual well records or field visits may be necessary to determine the condition and usefulness of certain

Table 6. *Approximate number of ground-water wells in the Gwynns Falls watershed, on the watershed boundary, or just outside the watershed*

USGS 7.5–minute topographic map	Number of ground-water wells in watershed	Number of ground-water wells on watershed boundary or just outside watershed
Reisterstown, Md.	183	50
Cockeysville, Md.	10	8
Ellicott City, Md.	19	31
Baltimore West, Md.	47	13
Total	259	102

wells for hydrologic investigations.

Additional Information and Data Resources

The USGS Maryland-Delaware-D.C. District office library and data files were reviewed to compile historical information and data resources related to the Gwynns Falls watershed. Resources that are available through USGS include (1) annual water-resources data reports, (2) selected reports and papers that were prepared as part of hydrologic investigations or for data compilation, (3) indirect flood-discharge measurements that have been made at selected monitoring stations, and (4) channel-stability and bridge-scour data collected at selected bridge crossings in the watershed. Various reports that summarize climatological data for Maryland were also inventoried to determine the availability of historical precipitation and air-temperature data for the Gwynns Falls watershed and surrounding areas.

(U.S Department of Agriculture, Weather Bureau, 1909–13;

U.S. Department of Agriculture, Weather Bureau, 1914–23;

U.S Department of Agriculture, Weather Bureau, and Maryland State Weather Service, 1924–40;

U.S. Department of Commerce, Weather Bureau, and Maryland State Weather Service, 1941–48;

U.S. Department of Commerce, Weather Bureau, 1949–66;

U.S. Department of Commerce, Environmental Science Services Administration, Environmental Data Service, 1967–70;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, 1971–76;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, 1977–82; and

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data and Information Service, and National Climatic Data Center, 1983–99).

U.S. Geological Survey Annual Water-Resources Data Reports

The USGS releases an annual water-resources data report for each water year, which runs from October of one year to September of the next. For example, October 1, 1998, to September 30, 1999, is referred to as "Water Year 1999." These reports have been published in Maryland on a yearly basis since water year 1961. Since water year 1997, the report has also been accessible on the USGS Maryland-Delaware-D.C. web page at *http://md.usgs.gov*. The reports summarize flow conditions at all active USGS streamflow-gaging stations in the Maryland-Delaware-D.C. District for the given water year. This includes such information as daily-mean discharges for each day

of the water year, annual-mean discharge, selected low-flow statistics, and the instantaneous-peak gage height and discharge at each streamflow-gaging station for the given water year (U.S. Geological Survey, 1962–99).

Selected data from all previously listed monitoring stations in the Gwynns Falls watershed can be obtained by accessing the applicable water-data report for the water year of interest, or by requesting copies of the electronic or hard-copy data files maintained by USGS.

Selected U.S. Geological Survey Reports and Papers

The following inventory includes the titles and authors of USGS reports and papers that include basin characteristics, data, or interpretation of data collected in the Gwynns Falls watershed. All reports and papers are listed chronologically according to year of publication.

a. USGS Water-Supply Paper 1722, Compilation of Records of Surface Waters of the United States, October 1950 to September 1960, *Part 1B*, North Atlantic Slope Basins, New York to York River (Hendricks and others, 1964).

b. USGS Open-File Report, Floods of August 1967 in Maryland and Delaware (Carpenter and Simmons, 1969).

c. USGS Open-File Report, A Proposed Streamflow Data Program for Maryland and Delaware (Forrest and Walker, 1970).

d. USGS Water-Supply Paper 1903, Surface-Water Supply of the United States 1961–65, *Part 1*, North Atlantic Slope Basins, vol. 3, Basins from Maryland to York River (Hendricks and others, 1970).

e. USGS Open-File Report, A Summary of Peak Stages and Discharges in Maryland, Delaware, and District of Columbia for Flood of June 1972 (Taylor, 1972).

f. USGS Open-File Report, Floods of August and September 1971 in Maryland and Delaware (Carpenter, 1974).

g. USGS Professional Paper 924, Hurricane Agnes Rainfall and Floods, June-July 1972 (Bailey and others, 1975).

h. USGS Open-File Report 78–171, Exceedance Probability-Depth Relationships of Floods for Maryland Streams West of Chesapeake Bay (Herb, 1978).

i. USGS Water-Supply Paper 2207, Flood Characteristics of Urban Watersheds in the United States (Sauer and others, 1983).

j. USGS Water-Resources Investigations Report 87–4093, Cost Effectiveness of the Stream-Gaging Program in Maryland, Delaware, and the District of Columbia (Carpenter and others, 1987).

k. USGS Water-Resources Investigations Report 94–4020, Low-Flow Characteristics of Streams in Maryland and Delaware (Carpenter and Hayes, 1996).

l. USGS Water-Resources Investigations Report 95–4154, Technique for Estimating Magnitude and Frequency of Peak Flows in Maryland (Dillow, 1996).

m. USGS Open-File Report 95–135, A Technique for Preliminary Appraisal of Potential and Observed Scour as Applied to State-Maintained Highway Bridges in Maryland (Doheny and others, 1996).

n. USGS Water-Resources Investigations Report 97–4279, Technique for Simulating Peak-Flow Hydrographs in Maryland (Dillow, 1997).

A toxics targeting methodology for the Gwynns Falls subwatersheds was also developed by USGS in cooperation with the Baltimore City Water Quality Management Office and Baltimore County DEPRM (J.S. Lizárraga, U.S. Geological Survey, written commun., 1996). The methodology included development and ranking of toxicity potentials for each of the Gwynns Falls subwatersheds. Basin characteristics, including drainage area and percent impervious area, are presented for each subwatershed of Gwynns Falls. A summary of historical water-quality data, most of which were collected by the Baltimore City Water Quality Management Office and Baltimore County DEPRM, are presented for each subwatershed. Also included are the number of samples collected in each subwatershed, the maximum measured discharge, and the maximum concentrations of various chemical constituents.

Indirect Flood-Discharge Measurements

The discharge of streams and rivers is usually measured directly by use of a current meter. During floods, it is sometimes impossible or impractical to measure the discharge directly. Consequently, some peak discharges must be determined after the passage of the flood by indirect methods, such as slope-area, contracted-opening, flow-over-dam, and flow-through-culvert

methods, rather than by direct current-meter measurement (Benson and Dalrymple, 1967).

Indirect methods for determining flood discharge are based on hydraulic equations which relate discharge to the water-surface profile and geometry of the channel. A field survey is made after the flood to determine the location of high-water marks and the physical characteristics of the channel (Benson and Dalrymple, 1967). Hydraulic equations that are most appropriate for the study reach are then solved based on the field data to determine the peak discharge.

Indirect flood-discharge measurements can provide information such as (1) records of high-water marks, (2) cross-section geometry and diagrams, (3) estimates of channel roughness (Manning's *n*), and (4) calculations of water-surface slopes (Doheny, 1997). The data files of the USGS Maryland-Delaware-D.C. District were searched to inventory indirect flood-discharge measurements that have been made in the Gwynns Falls watershed. The results are listed below.

Station 01589200, Gwynns Falls near Owings Mills, Md.—An estimate of peak discharge was obtained using contracted-opening and flow-over-road methods for the flood of June 22, 1972 (Matthai, 1967; Hulsing, 1968). An indirect discharge measurement was made at a location about one-half mile downstream of the gage where the drainage area is approximately 7.38 mi^2. The drainage area at the gaging station is 4.90 mi^2. The results were transferred upstream to the gaging station on the basis of the drainage-area ratio at the two locations raised to the 0.7 power (R.H. Tice and W.B. Solley, U.S. Geological Survey, written commun., 1972). The peak discharge at the indirect measurement location was determined to be 7,300 cubic feet per second (ft^3/s). Based on this determination, the peak discharge at the gaging station was estimated to be 5,500 ft^3/s at a gage height of 5.70 ft.

Station 01589240, Gwynns Falls at McDonogh, Md.—An indirect measurement of peak discharge was made using contracted-opening methods for the flood of June 22, 1972. The peak discharge was determined to be 14,700 ft^3/s at a gage height of 18.8 ft.

Station 01589300, Gwynns Falls at Villa Nova, Md.—An indirect measurement of peak discharge was made using contracted-opening and flow-over-road methods for the flood of July 21, 1956. The peak discharge was determined to be 5,270 ft^3/s at a gage height of 12.6 ft.

An indirect measurement of peak discharge was also made using contracted-opening methods for the flood of June 22, 1972. The peak discharge was determined to be 16,200 ft^3/s at a gage height of 21.50 ft.

Station 01589330, Dead Run at Franklintown, Md.—An indirect measurement of peak discharge was made using contracted-opening methods for the flood of June 22, 1972. The peak discharge was determined to be 7,400 ft^3/s at a gage height of 12.5 ft.

Channel-Stability and Bridge-Scour Data

During 1990–95, USGS personnel conducted qualitative assessments of channel stability and scour at all interstate, State, and county bridges over waterways in Maryland. The study included all bridges 20 ft in length or greater. Box culverts, pipes, and structures with paved inverts were not included in the study because they do not have footings that can be subjected to scour. While this study focused on bridge crossings, physical data were collected in the stream channels within a two- to three-bridge-width reach upstream and downstream of each bridge. For example, the study reach for a 50-ft bridge opening was about 150 ft upstream of the bridge, and about 150 ft downstream of the bridge. In addition to documenting scour conditions at abutments and piers, data collected in each study reach also included average channel widths, bank heights, bank angles, estimates of woody-vegetative cover on the channel banks, types of bank material, and bank erosion. Channel alignment problems, debris problems, and rip-rap conditions were also documented. All sites were photographed and sketched (Doheny and others, 1996). The study included all applicable bridge crossings in the Gwynns Falls watershed, including bridges over Gwynns Falls, Dead Run, Red Run, and other smaller tributaries. The USGS Maryland-Delaware-D.C. District office maintains hard-copy files with all site reports and photographs, as well as two electronic data bases, where all field data are stored.

Climatological Data

Various reports that summarize climatological data for Maryland were analyzed to determine the availability of historical precipitation and air-temperature data for the Gwynns Falls watershed

and surrounding areas.

(U.S. Department of Agriculture, Weather Bureau, 1909–13;

U.S. Department of Agriculture, Weather Bureau, 1914–23;

U.S. Department of Agriculture, Weather Bureau, and Maryland State Weather Service, 1924–40;

U.S. Department of Commerce, Weather Bureau, and Maryland State Weather Service, 1941–48;

U.S. Department of Commerce, Weather Bureau,1949–66;

U.S Department of Commerce, Environmental Science Services Administration, 1967–70;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1971–76;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, and National Climatic Center, 1977–82;

U.S Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data and Information Service, and National Climatic Center, 1983–99).

These reports are prepared on a monthly basis along with an annual summary at the end of each calendar year. A selected number of the climatological data stations have hourly precipitation data that are published in separate reports. These reports supplement the climatological data reports and have been published monthly along with an annual summary from October 1951 to the present

(U.S. Department of Commerce, Weather Bureau, 1952–64;

U.S. Department of Commerce, Environmental Science Services Administration, Weather Bureau, 1965;

U.S. Department of Commerce, Environmental Science Services Administration, Environmental Data Service, 1966–70;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, and Environmental Data Service, 1971–76;

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service, and National Climatic Center, 1977–80; and

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Environmental Satellite, Data and Information Service, and National Climatic Data Center,1981–99).

Table 7 presents a listing of climatological data stations that are located in the Gwynns Falls watershed and the surrounding regional area.

The USGS maintains a hard-copy file of local climatological data reports from 1909 to the present, and hourly precipitation data reports from 1951 to 1985. More extensive data and station information may be available through the National Oceanic and Atmospheric Administration.

Of the stations presented in table 7, only the inactive station at Pleasant Hill, Md., is located in the Gwynns Falls watershed (fig. 4). The inactive stations at Randallstown, Md., and Pikesville, Md., are located just outside the watershed boundary. Aside from the active and inactive stations in Baltimore City, all other stations are located well outside the watershed, but may be useful in developing estimates of precipitation or temperature based on regional conditions.

Other Selected Reports

The following inventory includes the titles and authors of other selected reports that present data or information on the Gwynns Falls watershed. All reports are listed chronologically according to year of publication. Small local projects conducted by engineering consultants are not included. Respective environmental and public works offices in Baltimore County, Md., and Baltimore City, Md. may have access to additional data and information, as well as reports based on local projects for specific areas of the watershed.

a. Baseline Characterization of the Gwynns Falls Watershed Prior to Non-Point Source Remediation (Kazyak and others, 1988).

b. Final Report, Baltimore Metropolitan Water Resource Feasibility Study (Prepared by AScI Corporation for the U.S. Army Corps of Engineers, Baltimore District, 1995).

Table 7. *Climatological data-collection stations for the Gwynns Falls watershed and surrounding regional area*

[P = precipitation; T = temperature]

Station location	Type of data	Years operated
Baltimore City, Md. (Custom House)	P, T	1871–1991
Baltimore City, Md. (Maryland Science Center)	P, T	1992–present
Baltimore-Washington International Airport	P, T	1934–present
Clarksville, Md.	P, T	1969–present
Cockeysville, Md.	P	1948–50, 1952–53
Eklo, Md.	P, T	1916–19
Freeland, Md.	P, T	1920–24
Lake Montebello, Md.	P, T	1910–16, 1919–21
Lutherville, Md.	P, T	1926–40
Maryland Line, Md.	P, T	1925–48
Parkton, Md.	P, T	1954–92
Pikesville, Md.	P, T	1948–61
Pleasant Hill, Md.	P	1925–43
Prettyboy Dam, Md.	P, T	1931–52
Randallstown, Md.	P, T	1948–60
Riderwood, Md.	P, T	1920–22
Sparks, Md.	P	1951
Towson, Md.	P	1909–47
	P, T	1948–present
Westminster, Md. (State Police Barracks)	P, T	1979–present [a]
Woodstock, Md.	P, T	1870–present

[a.] Data were also collected from 1910–1978, in other locations in Westminster, Md.

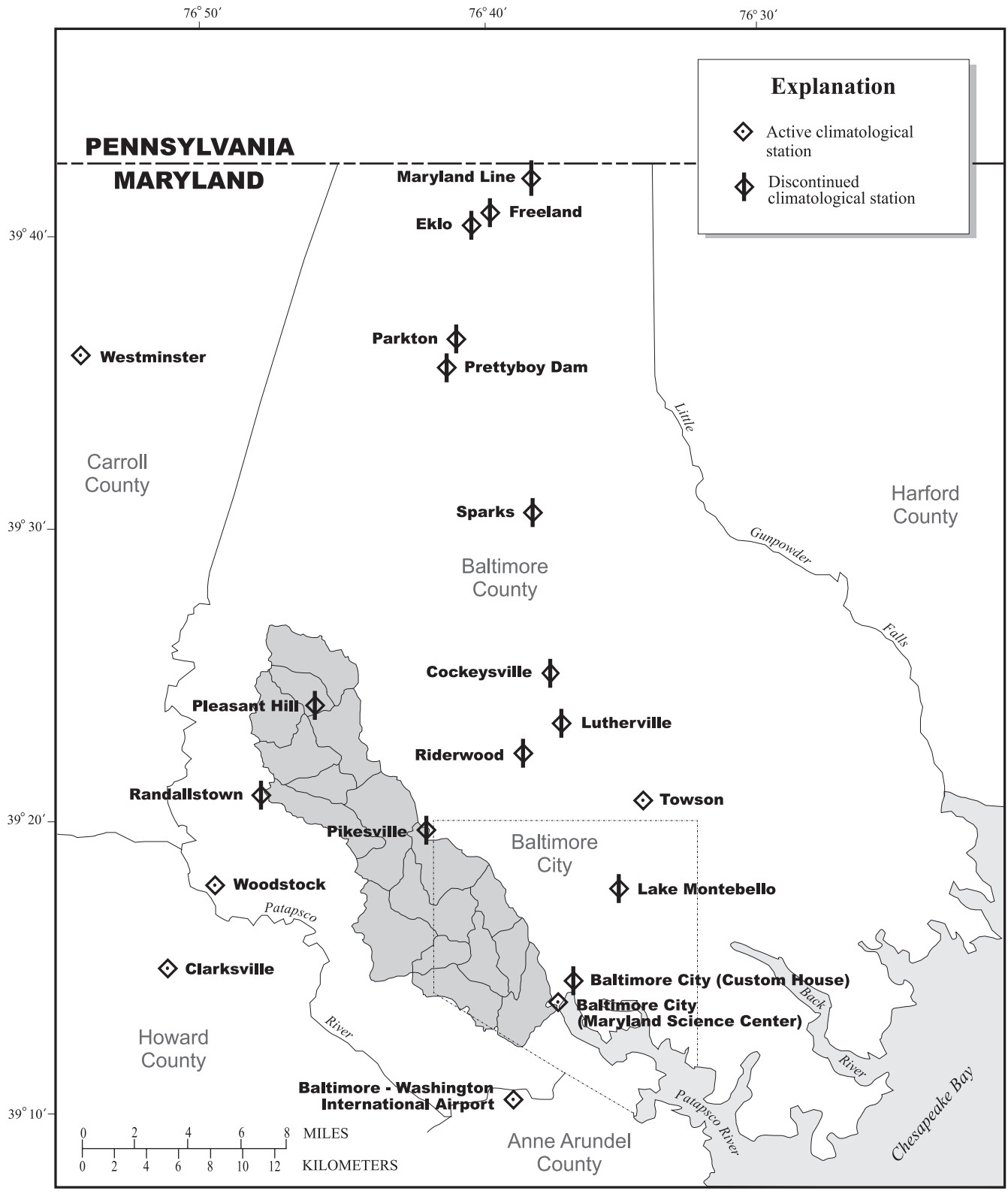

Figure 4. Locations of climatological data-collection stations in the Gwynns Falls watershed and surrounding regional area.

Summary

The Gwynns Falls watershed has been selected as the primary study area for the Baltimore Ecosystem Study, as part of the National Science Foundation's Long-Term Ecological Research program. A compilation of historical data resources is necessary for investigation of long-term hydrologic trends in the watershed. This report discusses hydrologic characteristics and provides a compilation of historical data resources for the Gwynns Falls watershed. Tables are included that list active and discontinued continuous-record streamflow-gaging stations, nontidal crest-stage partial-record stations, low-flow partial-record stations, and water-quality partial-record stations operated by the U.S. Geological Survey in the Gwynns Falls watershed. Statistics regarding the number of inventoried ground-water wells in or bordering the Gwynns Falls watershed also are presented. In addition, the report summarizes some additional data resources for the Gwynns Falls watershed, including (1) an inventory of selected studies and reports that contain historical data or basin characteristics for streams in the Gwynns Falls watershed, (2) a listing of indirect flood-discharge measurements that have been made at several monitoring stations in the watershed, (3) a brief discussion of channel-stability and bridge-scour data collected by the U.S. Geological Survey in the watershed during 1990–95, (4) a listing of climatological data stations in the watershed and in the surrounding regional area, and (5) a listing of other selected reports that include data or information on the Gwynns Falls watershed.

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