FLOOD INSURANCE STUDY

VOLUME 1 of 7

MONTGOMERY COUNTY, PENNSYLVANIA (ALL JURISDICTIONS)

Montgomery County

COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER	COMMUNITY NAME	COMMUNITY NUMBER
ABINGTON, TOWNSHIP OF	420695	LOWER MORELAND, TOWNSHIP OF	420702	*TELFORD, BOROUGH OF	422339
AMBLER, BOROUGH OF	420947	LOWER POTTSGROVE, TOWNSHIP OF	421908	TOWAMENCIN, TOWNSHIP OF	422236
BRIDGEPORT, BOROUGH OF	420948	LOWER PROVIDENCE, TOWNSHIP OF	420703	TRAPPE, BOROUGH OF	421907
BRYN ATHYN, BOROUGH OF	421899	LOWER SALFORD, TOWNSHIP OF	421170	UPPER DUBLIN, TOWNSHIP OF	420708
CHELTENHAM, TOWNSHIP OF	420696	MARLBOROUGH, TOWNSHIP OF	421913	UPPER FREDERICK, TOWNSHIP OF	421916
COLLEGEVILLE, BOROUGH OF	421900	MONTGOMERY, TOWNSHIP OF	421226	UPPER GWYNEDD, TOWNSHIP OF	420956
CONSHOHOCKEN, BOROUGH OF	420949	NARBERTH, BOROUGH OF	421903	UPPER HANOVER, TOWNSHIP OF	421917
DOUGLASS, TOWNSHIP OF	421911	NEW HANOVER, TOWNSHIP OF	421914	UPPE R MERION, TOWNSHIP OF	420957
EAST GREENVILLE, BOROUGH OF	421901	NORRISTOWN, BOROUGH OF	425386	UPPER MORELAND, TOWNSHIP OF	421909
EAST NORRITON, TOWNSHIP OF	420950	NORTH WALES, BOROUGH OF	420704	UPPER POTTSGROVE, TOWNSHIP OF	421910
FRANCONIA, TOWNSHIP OF	422494	PENNSBURG, BOROUGH OF	422496	UPPER PROVIDENCE, TOWNSHIP OF	420709
GREEN LANE, BOROUGH OF	421902	PERKIOMEN, TOWNSHIP OF	421915	UPPER SALFORD, TOWNSHIP OF	421918
HATBORO, BOROUGH OF	420697	PLYMOUTH, TOWNSHIP OF	420955	WEST CONSHOHOCKEN, BOROUGH OF	420710
HATFIELD, BOROUGH OF	420698	POTTSTOWN, BOROUGH OF	420705	WEST NORRITON, TOWNSHIP OF	420711
HATFIELD, TOWNSHIP OF	420699	*RED HILL, BOROUGH OF	422718	WEST POTTSGROVE, TOWNSHIP OF	421133
HORSHAM, TOWNSHIP OF	420700	*ROCKLEDGE, BOROUGH OF	420706	WHITEMARSH, TOWNSHIP OF	420712
JENKINTOWN, BOROUGH OF	422717	ROYERSFORD, BOROUGH OF	421904	WHITPAIN, TOWNSHIP OF	420713
LANSDALE, BOROUGH OF	420951	SALFORD, TOWNSHIP OF	422497	WORCESTER, TOWNSHIP OF	421919
LIMERICK, TOWNSHIP OF	421912	SCHWENKSVILLE, BOROUGH OF	421905		
LOWER FREDERICK, TOWNSHIP OF	420952	SKIPPACK, TOWNSHIP OF	421149		
LOWER GWYNEDD, TOWNSHIP OF	420953	SOUDERTON, BOROUGH OF	421906		
LOWER MERION, TOWNSHIP OF	420701	SPRINGFIELD, TOWNSHIP OF	425388	* No Special Flood Hazard Areas Identified	

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
42091CV001B
REVISED: MARCH 2, 2016

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study (FIS) may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

Part or all of this FIS may be revised and republished at any time. In addition, part of this FIS may be revised by the Letter of Map Revision process, which does not involve republication or redistribution of the FIS. It is, therefore, the responsibility of the user to consult with community officials and to check the community repository to obtain the most current FIS components.

ATTENTION: On FIRM panel 0382G, the Cheltenham Levee has not been demonstrated by the community or levee owner(s) to meet the requirements of Section 65.10 of the NFIP regulations in 44 CFR as it relates to the levee's capacity to provide 1% annual chance flood protection. The subject areas are identified on FIRM panels (with notes and bounding lines) and in the FIS report as potential areas of flood hazard data changes based on further review.

FEMA has updated levee analysis and mapping protocols. Until such time as FEMA is able to initiate a new flood risk project to apply the new protocols, the flood hazard information on the aforementioned FIRM panel that is affected by the Cheltenham Levee is being added as a snapshot of the prior effective information presented on the FIRMs and FIS reports dated December 19, 1996. As indicated above, it is expected that affected flood hazard data within the subject area could be significantly revised. This may result in floodplain boundary changes, 1% annual chance flood elevation changes, and/or changes to flood hazard zone designations.

The effective FIRM panels (and the FIS) will again be revised to update the flood hazard information associated with the Cheltenham Levee when FEMA is able to initiate and complete a new flood risk project to apply the new protocols.

Initial Countywide FIS Effective Date: December 19, 1996

Revised Countywide FIS Date:

March 2, 1998 – to change base flood elevations, floodway, and special flood hazard areas.

April 21, 1999 – to correct the elevation of Elevation Reference Mark.

August 9, 1999 – to add base flood elevations, special flood hazard areas, and roads and road names; to change special flood hazard areas and zone designations; to reflect updated topographic information; and to incorporate previously issued Letters of Map Revision.

October 19, 2001 – to change base flood elevations and special flood hazard areas.

March 2, 2016 – to add, change and delete Special Flood Hazard Areas; to reflect updated topographic information; to change, add Base Flood Elevations; and to incorporate previously issued Letters of Map Revision.

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FLOOD INSURANCE STUDY
MONTGOMERY COUNTY, PENNSYLVANIA (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This countywide Flood Insurance Study (FIS) investigates the existence and severity of flood hazards in, or revises and updates previous FIS's / Flood Insurance Rate Maps (FIRMs) in the geographic area of Montgomery County, Pennsylvania, including: the Boroughs of Ambler, Bridgeport, Bryn Athyn, Collegeville, Conshohocken, East Greenville, Green Lane, Hatboro, Hatfield, Jenkintown, Lansdale, Narberth, Norristown, North Wales, Pennsburg, Pottstown, Royersford, Schwenksville, Souderton, Trappe, and West Conshohocken; and the Townships of Abington, Cheltenham, Douglass, East Norriton, Franconia, Hatfield, Horsham, Limerick, Lower Frederick, Lower Gwynedd, Lower Merion, Lower Moreland, Lower Pottsgrove, Lower Providence, Lower Salford, Marlborough, Montgomery, New Hanover, Perkiomen, Plymouth, Salford, Skippack, Springfield, Towamencin, Upper Dublin, Upper Frederick, Upper Gwynedd, Upper Hanover, Upper Merion, Upper Moreland, Upper Pottsgrove, Upper Providence, Upper Salford, West Norriton, West Pottsgrove, Whitemarsh, Whitpain, and Worcester (hereinafter referred to collectively as Montgomery County).

Please note that the Borough of Telford is geographically located in Buck and Montgomery Counties. Only the portions of the Borough of Telford within Montgomery County are included in this FIS report. Also note that on the effective date of this study, the Boroughs of Red Hill, Rockledge, and Telford (areas within Montgomery County) have no mapped Special Flood Hazard Areas (SFHA). This does not preclude future determinations of SFHAs that could be necessitated by changed conditions affecting the community (i.e. annexation of new lands) or the availability of new scientific or technical data about flood hazards.

This FIS aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This FIS has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates. This information will also be used by Montgomery County to update existing floodplain regulations as part of the Regular Phase of the National Flood Insurance Program (NFIP), and will also be used by local and regional planners to further promote sound land use and floodplain development. Minimum floodplain management requirements for participation in the NFIP are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, floodplain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence, and the State (or other jurisdictional agency) shall be able to explain them.

Please also note that FEMA has identified one levee in this jurisdiction that has not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1% annual chance flood protection. As such, there are temporary actions being taken until such time as FEMA is able to initiate a new flood risk project to apply new protocols. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

1.2 Authority and Acknowledgments

The sources of authority for this FIS are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The original countywide FIS dated December 19, 1996, was prepared to include all jurisdictions within Montgomery County into a countywide FIS. Information on the authority and acknowledgments for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, is shown on the following pages.

Abington, Township of: The hydrologic and hydraulic analyses for the FIS report dated September 30, 1977, were prepared by the U.S. Army Corps of Engineers (USACE), Philadelphia District, for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. H-15-72, Project Order No. 7. The hydrologic and hydraulic analyses for Tacony Creek were prepared by Michael Baker, Jr., Inc., during the preparation of the FIS for the Township of Cheltenham. The hydrologic and hydraulic analyses for Pennypack Creek, Meadow Brook, and Baeder Run in the FIS report dated January 2, 1991, were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-87-E-2549. That work was completed in May 1989. The hydrologic and hydraulic analyses for Sandy Run for the FIS report dated March 3, 1992, were prepared by the USACE for FEMA, under Inter-Agency Agreement No. EMW-88-E-2768, Project Order No. 2, Task Letter No. 88-3. That work was completed in August 1990.

Ambler, Borough of: The hydrologic and hydraulic analyses for the FIS report dated November 2, 1977, were prepared by the Delaware River Basin Commission (DRBC) for FEMA, under Contract No. H-3747. That work was completed in January 1977. For the FIS report dated August 18, 1992, the hydrologic and hydraulic analyses for Rose Valley Creek and Tannery Run were prepared by the U.S. Geological Survey (USGS) for FEMA, under Inter-Agency Agreement No. EMW-89-E-2997. That work was completed in August 1990.

Bridgeport, Borough of: The hydrologic and hydraulic analyses for the FIS report dated July 1978 were prepared by the USGS for the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-8-76, Project Order No. 23 (previously IAA-H-17-75, Project Order No. 11). That work was completed in April 1977.

Bryn Athyn, Borough of: The hydrologic and hydraulic analyses for the FIS report dated February 17, 1982, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 22. That work was completed in June 1980. For the FIS report dated May 15, 1991, the hydrologic and hydraulic analyses for Pennypack Creek were prepared by the USACE under agreement with FEMA; the hydrologic and hydraulic analyses for Huntingdon Valley Creek were revised based on information taken from the FIS for the Township of Lower Moreland. That work was completed in May 1988.

Cheltenham, Township of: The hydrologic and hydraulic analyses for the FIS report dated May 1976 were prepared by Michael Baker, Jr., Inc., for the FIA, under Contract No. H-3599.

Collegeville, Borough of: The hydrologic and hydraulic analyses for the FIS report dated August 1979 were prepared by the DRBC for the FIA, under Contract No. H-4521. That work was completed in August 1978. The hydrologic and hydraulic analyses for Perkiomen Creek were adopted from data developed by Gannett, Fleming, Corddry, and Carpenter, Inc.

Conshohocken, Borough of: The hydrologic and hydraulic analyses for the FIS report dated June 1977 were prepared by Gannett. Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA under Contract No. H-3747. That work was completed in November 1976. All survey work was done by, or under the direction of Quinn & Associates, Inc.

Douglass, Township of: The hydrologic and hydraulic analyses for the FIS report dated November 15, 1983, were prepared by the DRBC for FEMA, under Contract No. EMW-C0249. That work was completed in May 1982. For the FIS report dated July 2, 1991, the hydrologic and hydraulic analyses for Swamp Creek were prepared by the USACE, Philadelphia District, for FEMA. That work was completed in March 1990.

East Norriton, Township of: The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in November 1976. All survey work was done by, or under the direction of Quinn & Associates, Inc.

Franconia, Township of: The hydrologic and hydraulic analyses for the FIS report dated September 15, 1981, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 22. That work was completed in March 1980.

Green Lane, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated March 2, 1981, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979.
Hatboro, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated December 15, 1976, were prepared by E. H. Bourquard Associates, Inc., under subcontract with the DRBC, for FEMA, under Contract No. H-3747. The hydrologic and hydraulic analyses for the FIS report dated January 3, 1990, were prepared by the USACE, Philadelphia District, under agreement with FEMA. That work was completed in May 1988.
Hatfield, Borough of	The hydrologic and hydraulic analyses for the FIS report dated February 1978 were prepared by Gannett, Fleming, Corddry, and Carpenter. Inc., for the FIA, under Contract No. H-3813. That work was completed in July 1977. All survey work was done by, or under the direction of Quinn & Associates, Inc.
Hatfield, Township of:	The hydrologic and hydraulic analyses for the FIS report dated May 15, 1979, were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., for FEMA, under Contract No. H-3813. That work was completed in July 1977. The survey work was prepared by Quinn & Associates, Inc. Portions of the hydrologic and hydraulic analyses were prepared by the DRBC during the preparation of the FISs for the Township of New Britain and the Borough of Lansdale; and by Gannett, Fleming, Corddry, and Carpenter, Inc., during the preparation of the FIS for the Borough of Hatfield. The hydrologic and hydraulic analyses for the FIS report dated February 4, 1988, were prepared by the DRBC for FEMA, under Contract No. EMW-85-C-1876. That work was completed in September 1986.

Horsham, Township of:	The hydrologic and hydraulic analyses for the FIS report dated January 16, 1977, were prepared by E. H. Bourquard Associates, Inc., Consulting Engineers, under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in May 1976. The hydrologic and hydraulic analyses for the FIS report dated June 17, 1991, were prepared by the USACE, Philadelphia District, under agreement with FEMA. That work was completed in May 1988.
Lansdale, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated November 1977 were prepared by E. H. Bourquard Associates, Inc., Consulting Engineers, under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in July 1976. The survey and topographic data were compiled by Quinn & Associates, Inc.
Limerick, Township of:	The hydrologic and hydraulic analyses for the FIS report dated September 16, 1980, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in July 1979. Flood profiles and crass sections for the Schuylkill River were previously prepared in 1977 by Gannett, Fleming, Corddry, and Carpenter, Inc.
Lower Frederick, Township of:	The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement Nos. IAA-H-16-75 and IAA-H-7-76, Project Order Nos. 16 and 1, respectively. That work was completed in November 1976.

Lower Gwynedd, Township of:	The hydrologic and hydraulic analyses for the FIS report dated October 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., for the FIA, under Contract No. H-3 747. That work was completed in October 1976. Survey data, including aerial survey, were compiled by Quinn & Associates, Inc., under subcontract with Gannett, Fleming, Corddry, and Carpenter, Inc.
Lower Merion, Township of:	The hydrologic and hydraulic analyses for the FIS report dated August 1977 were prepared by the DRBC for the FIA, under Contract No. H-3747. That work was completed in September 1976. All survey work was done by, or under the direction of Quinn & Associates, Inc.
Lower Moreland, Township of:	The hydrologic and hydraulic analyses for the FIS report dated September 1, 1977, were prepared by E. H. Bourquard Associates, Inc., under subcontract with the DRBC, for the FLA, under Contract No. H-3747. That work was completed in June 1976. The hydrologic and hydraulic analyses for Pennypack Creek and Huntingdon Valley Creek for the FIS report dated February 15, 1991, were prepared by the USACE, Philadelphia District, under Inter-Agency Agreement No. EMW-87-E-2549. That work was completed in July 1989.
Lower Pottsgrove. Township of:	The hydrologic and hydraulic analyses for the FIS report dated July 2, 1980, were prepared by O'Brien and Gere Engineers, Inc., Justin and Courtney, Division, for the FIA, under Contract No. H-4555. That work was completed in June 1979.
Lower Providence, Township of:	The hydrologic and hydraulic analyses for the FIS report dated January 1979 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under the direction of the DRBC, for the FIA, under Contract No. 1-1-3747. That work was completed in September 1976. All survey work was done by, or under the direction of Quinn & Associates, Inc.

Lower Salford, Township of:	The hydrologic and hydraulic analyses for the FIS report dated August 3, 1981, were prepared by the USACE for FEMA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 9. That work was completed in November 1979.
Marlborough, Township of:	The hydrologic and hydraulic analyses for the FIS report dated March 2, 1981, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979. The USACE, Philadelphia District, provided hydrologic information on Perkiomen Creek. The USACE also provided hydrologic and hydraulic data for Unami Creek. The Philadelphia Suburban Water Company provided pertinent data and plans of the Green Lane Dam and Reservoir on Perkiomen Creek.
Montgomery, Township of	The hydrologic and hydraulic analyses for the FIS report dated November 15, 1983, were prepared by the DRBC for FEMA, under Contract No. EMW-C-0249. That work was completed in January 1982.
Narberth, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated July 16, 1980, were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 22. That work was completed in November 1978.
New Hanover, Township of:	The hydrologic and hydraulic analyses for the FIS report dated March 16, 1981, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979.

Norristown, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated July 6, 1981, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979. The updated version was prepared by the USGS for the FIA, under Inter-Agency Agreement No. IAA-H-17-72, Project Order No.4.
North Wales, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 20.
Perkiomen, Township of:	The hydrologic and hydraulic analyses for the FIS report dated August 3, 1981, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H-l0-77, Project Order No. 9. That work was completed in December 1979.
Plymouth, Township of:	The hydrologic and hydraulic analyses for the FIS report dated August 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. All survey work, including aerial surveys, was done by, or under the direction of Quinn & Associates, Inc. That work was completed in October 1976.
Pottstown, Borough of	The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. All survey work, including aerial surveys, was done by, or under the direction of Quinn & Associates, Inc. That work was completed in November 1976.

Royersford, Borough of: The hydrologic and hydraulic analyses for the FIS report dated May 1980 were prepared by Pickering, Cods & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in July 1979. The flood profiles and cross sections for the Schuylkill River were developed by Gannett, Fleming, Corddry, and Carpenter, Inc., in 1977.

Salford, Township of: The hydrologic and hydraulic analyses for the FIS report dated August 3, 1981, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H-l8-78, Project Order No. 22. That work was completed in April 1980.

Schwenksville, Borough of: The hydrologic and hydraulic analyses for the FIS report dated March 30, 1981, were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 9, Amendment No. 2. That work was completed in August 1978.

Skippack, Township of: The hydrologic and hydraulic analyses for the FIS report dated September 1, 1981, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H- 10-77, Project Order No. 9. That work was completed in January 1980.

Springfield, Township of: The hydrologic and hydraulic analyses for the FIRM dated July 7, 1972, were prepared by the Soil Conservation Service (SCS), for the FIA, under Inter-Agency Agreement No. IAA-H-9-71, Project Order No. 17. That work was completed in December 1971. The hydrologic and hydraulic analyses for Sandy Run for the FIS report dated May 17, 1993, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-88-E-2768, Project Order No. 2, Task Letter No. 88-3. That work was completed in August 1990; the hydrologic and hydraulic analyses for

Wissahickon Creek were taken from the FISs for the Township of Whitemarsh and the City of Philadelphia.

Towamencin, Township of: The hydrologic and hydraulic analyses for the FIS report dated January 1980 were prepared by the DRBC for the FIA, under Contract No. H-4521. That work was completed in November 1978. The survey data were developed by F. X. Ball Associates, Inc., Consulting Engineers, under subcontract with the DRBC.

Trappe, Borough of: The hydrologic and hydraulic analyses for the FIS report dated July 20, 1981, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 22. That work was completed in December 1979.

Upper Dublin, Township of: The hydrologic and hydraulic analyses for the FIS report dated July 3, 1978, were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., for the FIA, under Contract No. H-3813. That work was completed in March 1977. The hydrologic and hydraulic analyses for Sandy Run for the FIS report dated January 16, 1992, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-88-E-2768, Project Order No. 2, Task Letter No. 88-3. That work was completed in August 1990. The hydrologic and hydraulic analyses for Pine Run for the FIS report dated February 16, 1995, were prepared for FEMA by the USACE, Philadelphia District, under Inter-Agency Agreement No. EMW92-E-3839. That work was completed in July 1993.

Upper Frederick, Township of: The hydrologic and hydraulic analyses for the FIS report dated February 17, 1981, were prepared by Pickering, Corts, & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979. The USACE, Philadelphia District, provided hydrologic information on Perkiomen Creek, Scioto Creek, Swamp Creek, and

Goshenhoppen Creek. The Philadelphia Suburban Water Company provided pertinent data and plans of the Green Lane Dam and Reservoir on Perkiomen Creek.

Upper Gwynedd, Township of:	The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in October 1976. The approximate flood boundaries for the portion of Haines Run between the railroad and Britt Road, and Tributary No. 5 of Wissahickon Creek, were determined in January 1977 by Dewberry, Nealon & Davis, under contract to the FIA.
Upper Hanover, Township of:	The hydrologic and hydraulic analyses for the FIS report dated July 20, 1981, were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in December 1979.
Upper Merion, Township of:	The hydrologic and hydraulic analyses for the FIS report dated November 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract to the DRBC, for the FIA, under Contract No. H-3747. That work was completed in November 1976. All survey work, including aerial photography, was done by, or under the direction of Quinn & Associates, Inc.
Upper Moreland, Township of	The hydrologic and hydraulic analyses for the FIS report dated September 2, 1982, were prepared by the USACE, for FEMA, under Inter-Agency Agreement No. IAA-H-18-78, Project Order No. 22. That work was completed in May 1980. The hydrologic and hydraulic analyses for Blair Mill Run for the FIS report dated September 28, 1990, were prepared by the USACE, Philadelphia District, under agreement with FEMA. That work was completed in May 1988.

Upper Pottsgrove, Township of:	The hydrologic and hydraulic analyses for the FIS report dated March 1980 were prepared by Pickering, Corts & Summerson, Inc., for the FIA, under Contract No. H-4758. That work was completed in July 1979.
Upper Providence, Township of:	The hydrologic and hydraulic analyses for the FIS report dated January 1978 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in September 1976. All survey work was done by, or under the direction of Quinn & Associates, Inc.
Upper Salford, Township of:	The hydrologic and hydraulic analyses for the FIS report dated November 17, 1981, were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H- 10-77, Project Order No. 15, Amendment No. 2. That work was completed in May 1980.
West Conshohocken, Borough of:	The hydrologic and hydraulic analyses for the FIS report dated November 1977 were prepared by the DRBC, for the FIA, under Contract No. H-3747. That work was completed in September 1976. All survey work was done under the direction of Quinn & Associates, Inc.
West Norriton, Township of:	The hydrologic and hydraulic analyses for the FIS report dated September 1977 were prepared by Gannett, Fleming, Corddry, and Carpenter, Inc., under subcontract with the DRBC, for the FIA, under Contract No. H-3747. That work was completed in November 1976. All aerial and field survey work was done by, or under the direction of Quinn & Associates, Inc.
West Pottsgrove, Township of:	The hydrologic and hydraulic analyses for the FIS report dated May 1979 were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 16. That work was completed in November 1977. The

hydrologic and hydraulic analyses for the Schuylkill River were prepared by the DRBC. The hydrologic and hydraulic analyses for Manatawny Creek were prepared by the SCS in November 1977.

Whitemarsh, Township of: The hydrologic and hydraulic analyses for the FIS report dated December 1, 1977, were prepared by the DRBC, for the FIA, under Contract No. H-3747. That work was completed in September 1976. The hydrologic and hydraulic analyses for Sandy Run for the FIS report dated January 2, 1992, were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-88-E-2768, Project Order No. 2, Task Letter No. 88-3. That work was completed in August 1990.

Whitpain, Township of: The hydrologic and hydraulic analyses for the FIS report dated February 4, 1987, were prepared by the DRBC, for the FIA, under Contract No. H-3747. That work was completed in December 1976. All survey work was performed by, or under the direction of Quinn & Associates, Inc.

Worcester, Township of: The hydrologic and hydraulic analyses for the FIS report dated September 16, 1980, were prepared by the USACE, Philadelphia District, for the FIA, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 9, Amendment No. 2. That work was completed in March 1979.

The authority and acknowledgments for the Boroughs of East Greenville, Jenkintown, Pennsburg, and Souderton are not included because there were no previously printed FIS reports for those communities.

For the original December 19, 1996, countywide FIS, the hydrologic and hydraulic analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-92-E-3 842, Project Order No. 2. That work was completed in February 1994. The hydrologic and hydraulic analyses for Valley Creek were taken from the FIS for the Township of Tredyffrin (Reference 1).

For the March 2, 1998, FIS, the hydrologic and hydraulic analyses were prepared by the USACE, Philadelphia District, for FEMA, under Inter-

Agency Agreement No. EMW-93-E-4119, Project Order No. 2, Task Letter No. 93-9. This work was completed in February 1995.

For the August 9, 1999, revision, the hydrologic and hydraulic analyses were prepared by Gannett Fleming, Inc., under contract to Montgomery County, and were subsequently accepted by FEMA for NFIP purposes. This work was completed in July 1993.

For October 19, 2001 revision, the hydrologic and hydraulic analyses for Perkiomen Creek and East Branch Perkiomen Creek were prepared by the USACE, Philadelphia District, for FEMA, under Inter-Agency Agreement No. EMW-96-IA-0294. Project Order No. 19. This work was completed in September 1998.

For this countywide FIS, new hydrologic and hydraulic analyses for Pennypack Creek and Sandy Run watersheds are included. Both analyses were performed by Temple University under contracts with FEMA, and finalized in 2010. Redelineation of the rest of detailed floodplains based on previous effective hydrologic and hydraulic analyses and current topographic data, as well as revised hydrologic and hydraulic analyses for approximate streams were performed by AMEC Earth & Environmental Inc. for FEMA under Contract No. EMP-2001-CO-2411, Task Order 0017. In addition, this countywide FIS incorporates the Letter of Map Revisions (LOMRs):

COMMUNITY NAME	CASE NUMBER	STUDY NAME
Township of Whitpain	02-03-035P	East Tributary Stony Creek
Township of Upper Gwynedd	06-03-B024P	Wissahickon Creek
Township of East Norriton	07-03-0101P	Unnamed tributary to Stony Creek Tributary
Township of Whitpain	08-03-0033P	East Tributary Stony Creek
Township of Upper Hanover	08-03-1024P	Unnamed Tributary of Macoby Creek
Borough of Royersford	10-03-0462P	Schuylkill River
Township of Upper Merion	10-03-0510P	Tributary to Trout Creek
Township of Lower Merion	10-03-0696P	East Branch Indian Creek
Township of Marlborough	12-03-0885P	Unami Creek
Township of Whitpain,	12-03-1849P	Stony Creek
Township of Lower Moreland	13-03-0174X	Pennypack Creek
Borough of Ambler	14-03-0829P	Tannery Run

COMMUNITY NAME	CASE NUMBER	STUDY NAME
Township of Lower Merion	96-03-484P	Mill Creek
Township of Lower Merion	97-03-059P	Gully Run
Township of Lower Merion*	98-03-171P	East Branch Indian Creek

* Partially superseded by 10-03-0696P

For the August 19, 1999 FIS, the digital base map files were provided by the Pennsylvania Department of Transportation, Cartographic Information Division, 912 Transportation and Safety Building, Harrisburg, Pennsylvania 17120. These files were compiled at a scale of 1:24,000 from USGS 7.5-Minute Series Topographic Maps on a stable base. The base map files were modified in and around the floodplains to match detailed data for the Schuylkill River derived from aerial photography flown in March 1991 that was provided by the USACE. Additional base map information was added in and around the other floodplain areas within the county to match previously published FISs. Therefore, the modified files used to create the base map for Montgomery County are not approved by the Pennsylvania Department of Transportation; the master files are retained by the Pennsylvania Department of Transportation.

For the October 19, 2001 revision, planimetric base map files were provided in digital format by the Pennsylvania Department of Transportation (PennDOT). These files were compiled at a scale of 1:24,000 from U.S. Geological Survey (USGS) 7.5-Minute Series Topographic maps. Adjustments were made to specific base map features to align them to 1:12,000 scale USGS Digital Orthophoto Quarter Quadrangles. Therefore, the modified files used to create this base map are not PennDOT approved; PennDOT retains the master files.

For this countywide FIS, base map files were obtained in digital spatial data format from the Delaware Valley Regional Planning Commission (DVRPC) and Pennsylvania Spatial Data Access website. The previous effective political boundaries were adjusted to match the neighboring counties. Streamlines were digitized from the 2003 – 2006 orthophotos obtained from DVRPC.

This revision reflects more detailed and up-to-date stream channel configurations and floodplain delineations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM have been adjusted to conform to these new stream channel configurations.

The coordinate system used for the production of this FIRM is Universal Transverse Mercator (UTM), Zone 18 North, North American Datum of 1983 (NAD 83), GRS 80 spheroid. Corner coordinates shown on the

FIRM are in latitude and longitude referenced to the UTM projection, NAD 83. Differences in the datum and spheroid used in the production of FIRMs for adjacent counties may result in slight positional differences in map features at the county boundaries. These differences do not affect the accuracy of information shown on the FIRM.

1.3 Coordination

An initial CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to explain the nature and purpose of a FIS and to identify the streams to be studied by detailed methods. A final CCO meeting is held typically with representatives of FEMA, the community, and the study contractor to review the results of the study.

The dates of the initial and final CCO meetings held for the incorporated communities within the boundaries of Montgomery County are shown in Table 1, "Initial and Final CCO Meetings."

TABLE 1 – INITIAL AND FINAL CCO MEETINGS

Community Name	Initial CCO Date	Final CCO Date
Abington, Township of	*	*
Ambler, Borough of	April 1975	November 16, 1976
Bridgeport, Borough of	January *1975*	July 6, 1977
Bryn Athyn, Borough of	December *5*, 1977	March 23, 1981
Cheltenham, Township of	*	*
Collegeville, Borough of	March 29, 1977	March 2, 1979
Conshohocken, Borough of	April 1975	November 4, 1976
Douglass, Township of	June *15*, 1979	May 18, 1983
East Norriton, Township of	April 1975	November 4, 1976
Franconia, Township of	December 15, 1977	February 19, 1981
Green Lane, Borough of	May 2, 1978	July 10, 1980
Hatboro,Borough of	May23, 1975	April 8, 1976
Hatfield, Borough of	February 1975	September 8. 1977
Hatfield, Township of	November 19, 1984	March 23, 1987
Horsham, Township of	May 21, 1975	October 8, 1976
Lower Frederick, Township of	June 16, 1975	November 23, 1976
Lower Gwynedd, Township of	April 1975	November 12, 1976
Lower Merion, Township of	April 1975	November 22, 1976
Lower Moreland, Township of	May 22, 1975	December 22, 1976
Lower Pottsgrove, Township of	May 1977	February 14, 1980
Lower Providence, Township of	April 1975	November 24, 1976
Lower Salford, Township of	August 31, 1976	January 22, 1981
Perkiomen, Township of	September 14, 1976	February 19, 1981
Plymouth, Township of	April 1975	November 10, 1976
Pottstown, Borough of	April 1976	November 24, 1976
Royersford, Borough of	May 4, 1978	February 22, 1980

TABLE 1 – INITIAL AND FINAL CCO MEETINGS (continued)

Salford, Township of	December 15, 1977	February 26, 1981
Schwenksville, Borough of	August 31, 1976	October 20, 1980
Skippack, Township of	August 30, 1976	January 21, 1981
Springfield, Township of	*	November 26, 1991
Upper Dublin, Township of	November 1975	May 11, 1977
Upper Frederick, Township of	May 3, 1978	July 10, 1980
Upper Gwynedd, Township of	April 1975	November 12, 1976
Upper Hanover, Township of	May 2, 1978	February 4, 1981
Upper Merion, Township of	April 1975	November 22, 1976
Upper Moreland, Township of	December 5, 1977	August 26, 1981
Upper Pottsgrove, Township of	May 3, 1978	December 6, 1979
Upper Providence, Township of	April 1975	November 3, 1976
Upper Salford, Township of	December 28, 1977	July 6, 1981
West Conshohocken, Borough of	April 1975	November 4, 1976

* Data not available

For the December 19, 1996, FIS, initial CCO meetings were held on May 23, May 24, and May 30, 1991. The Boroughs of East Greenville, Jenkintown, and Pennsburg were notified by FEMA with a June 20, 1994, acknowledgment letter of the preparation of the countywide FIS. Final meetings were held for the Boroughs of Conshohocken; Jenkintown; and Pennsburg; on February 14, 1995; January 18, 1995; and March 17, 1995; respectively; these meetings were attended by representatives of the respective communities, the USACE, and FEMA.

For the August 9, 1999, revision, the Township of Upper Merion was notified by FEMA in a letter dated March 12, 1997, that its FIS would be revised.

For the October 19, 2001, revision, the county was notified by letter on March 13, 1997, that its FIS would be revised using the analyses prepared by the USACE, Philadelphia District.

For this revision, six CCO meetings were held on October 19, 20 and 27, 2014 and were attended by representatives of the communities, AMEC, RAMPP (Risk Assessment, Mapping, and Planning Partners), and FEMA.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS covers the geographic area of Montgomery County, Pennsylvania.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM (Exhibit 2).

TABLE 2- FLOODING SOURCES STUDIED BY DETAILED METHODS

Abrams Creek	Perkiomen Creek
Abrams Run	Pine Run
Baeder Run	Plymouth Creek
Blair Mill Run	Rapp Run
Blair Mill Run Tributary (Tributary 02463)	Rock Creek
Buckwalter Tributary	Rose Valley Creek
Colmar Tributary	Sanatoga Creek
Crow Creek	Sandy Run
Davis Grove Tributary	Sandy Run Tributary No. 1
Deep Creek	Sandy Run Tributary No. 1A
Dodsworth Run	Sawmill Run
Donny Brook Run	Schlegel Run
East Branch Indian Creek	Schuylkill River
East Branch Perkiomen Creek	Scioto Creek
East Tributary Stony Creek	Skippack Creek
Erdenheim Run	Skippack Creek Tributary No. 1
Frog Run	Skippack Creek Tributary No. 2
Goshenhoppen Creek	Southampton Creek
Gulph Mills Creek	Sprogels Run
Gulph Mills Creek Tributary A	St. Josephs Run
Gulph Mills Creek Tributary B	Stony Creek
Hosensack Creek	Stony Creek Tributary
Huntingdon Valley Creek	Stony Run
Indian Creek	Swamp Creek
Jenkintown Creek	Tacony Creek
Lansdale Tributary	Tannery Run
Little Neshaminy Creek	Towamencin Creek No. 1
Little Neshaminy Creek Tributary No. 1	Towamencin Creek No. 2
Little Neshaminy Creek Tributary No. 2	Tributary C to Oak Terrace Tributary
Lodal Creek	Tributary No. 1 to Unionville Tributary
Macoby Creek	Tributary No. 2 to Pine Run
Macoby Creek Branch	Tributary to Oreland Run
Manatawny Creek	Tributary to Trout Creek
Matsunk Creek	Trout Creek
Meadow Brook	Unami Creek

TABLE 2- FLOODING SOURCES STUDIED BY DETAILED METHODS (continued)

Middle Creek	Unionville Tributary
Mill Creek	Unnamed Creek A
Mingo Creek	Unnamed Tributary to Stony Creek Tributary
Mingo Creek Tributary No. 1	Valley Creek
Minister Creek	Vaughn Run
Minister Creek Tributary	War Memorial Creek
North Branch Baeder Run	West Branch Neshaminy Creek
North Branch Zacharias Creek	West Branch Neshaminy Creek Tributary
North Hatfield Tributary	West Branch Neshaminy Creek Tributary 2
Oak Terrace Tributary	West Branch Perkiomen Creek
Oley Creek	West Branch Skippack Creek
Oreland Run	West Branch Swamp Creek
Park Creek	West Branch Towamencin Creek
Pennypack Creek	West Branch Towamencin Creek Tributary No. 3
Pennypack Creek Branch (Tributary B to Pennypack Creek)	Wissahickon Creek
Pennypack Creek Tributary No. 1 (Tributary 02460)	Zacharias Creek

For the December 19, 1996, countywide FIS, the Schuylkill River was restudied by detailed methods, including its backwater effects, for its entire length within the county.

For the March 2, 1998 revision, West Branch Neshaminy Creek Tributary No. 2 (previously named as Neshaminy Creek Branch) was restudied by detailed methods from its confluence with West Branch Neshaminy Creek to a point approximately 0.23 mile upstream of Schwab Road, including its backwater effects on Lansdale Tributary. The Township of Hatfiled and the Borough of Lansdale were affected by that revision.

The Township of Upper Marion was affected by the October 19, 2001 revision.

For October 19, 2001 revision, East Branch Perkiomen Creek was restudied by detailed methods from its confluence with Perkiomen Creek to the upstream county boundary, including its backwater effects on Indian Creek and Vaughn Run. Perkiomen Creek was restudied by detailed methods from its confluence with the Schuylkill River to Green Lake Dam, including its backwater effects on Macoby, Skippack, Swamp, and Unami Creeks. The Townships of Franconia, Lower Salford, Perkiomen, Salford, Skippack, and Upper Salford, are affected by the revision to East Branch Perkiomen Creek. The Boroughs of Collegeville, Green Lane, and Schwenkville, and the Townships of Lower Frederick, Lower Providence, Marlborough, Perkiomen, Salford, Skippack, Upper Frederick, Upper

Providence, and Upper Salford are affected by the revision to Perkiomen Creek.

For this revision, topographic, new detailed hydrologic and hydraulic analyses were performed for streams in the Pennypack and Sandy Run watershed that were previously studied by detailed methods. Floodplains for other detailed streams were redelineated based on updated topographic data. The approximate 1–percent annual chance floodplains were delineated and mapped for reaches of streams that are not studied by detailed method and meet the following criteria: shown in the 1:24,000 National Hydrography Dataset (NHD), having a drainage area of 1 square mile or greater, and the resulting floodplain has a width of 200 feet of greater, with the exception of Pennypack Creek and Sandy Run watersheds. The new analyses for these watersheds delineated approximate 1–percent annual chance floodplains narrower than 200 feet for many streams with smaller drainage area. Most of them are mapped on the DFIRM and attributed as 0.2–percent annual chance floodplain.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction.

All or portions of numerous flooding sources in the county were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the affected communities.

2.2 Community Description

Montgomery County is located in southeastern Pennsylvania. The county is bordered by the Philadelphia County to the southeast, Chester County to the southwest, Berks County to the northwest, Lehigh County to the north, and Bucks County to the northeast. The 2012 estimate of population in Montgomery County is 808,460, a 1.1 percent increase over the U.S. Census for 2010 of 799,874. The county population has grown 6.6% from 2000 to 2010 (Reference 166).

The county is located in the Piedmont Province of the Appalachian Highlands Division. The Piedmont Province is a gently rolling area that, in general, slopes southeastward. As a result of prolonged erosion, much of its former plateau-like appearance has been modified to slopes and gently rounded hills. This particular region of the Piedmont Province is characterized by lower paleozoic and precambrian granites, gneisses, and schists. At the southern part of the basin, a thin veneer of pleistocene and recent river gravels mask this complex metamorphic region. The soil supports vegetation and both soft and hardwood trees (Reference 2).

Generally, the climate in southeastern Pennsylvania is milder than in other portions of the State. This is due primarily to the relatively low elevations and the protection offered by the mountainous areas to the north and west. Temperatures are characteristic of a prevailing temperate climate. Winter temperatures range from 10 degrees Fahrenheit (˚F) to 50˚F, with an average of 30˚F. Summer temperatures vary from 60˚F to 100˚F, with an average temperature of 80˚F. The average annual precipitation of the area is 44.7 inches (Reference 2).

2.3 Principal Flood Problems

Major flooding in Montgomery County may occur during any season of the year. During the spring and summer, floods are usually associated with tropical storms moving up the Atlantic coastline. Spring floods are generally the result of a combination of heavy rains on frozen ground augmented by melting snow. Summer and fall floods are generally the result of widespread heavy rainfall. For the tributaries, heavy rainfalls of short duration, particularly summer thunderstorms, cause most of the flooding problems by inundating several low-lying areas (References 3, 4, and 5).

Major floods on Pennypack Creek result from a storm of longer duration, such as a hurricane, when heavy rains fall on saturated ground. Whenever major rainfall runoff occurs, stages can rise from normal flow to extreme flood peaks in relatively short time periods with high velocities in the main stream channel. Flooding of minor scale may also occur during the winter if snow melts rapidly and flows over frozen ground.

Flooding on Crow Creek in the Borough of Bridgeport is due to the inability of culverts located between the corporate boundary and Ross Road to pass flood flows of a 100-year magnitude or greater.

Flooding on Rose Valley Creek and Tannery Run in the Borough of Ambler results primarily from unusually heavy summer thunderstorms. Structures built at floodplain grade, particularly those in areas where undersized culverts cause backwater, are subject to inundation.

Flood potential in the Township of Cheltenham has been increased by the urban nature of the Tacony Creek watershed, where storm sewers and large paved areas cause heavy and rapid storm runoff, and by the large number of bridges and culverts, many with inadequate waterway openings, which obstruct flood waters.

An examination of the stream channels of West Branch Neshaminy Creek Tributary No. 2 and Wissahickon Creek in the Borough of Lansdale indicates that silting of the channels has occurred and can aggravate flooding in local areas.

The headwaters of East Branch Indian Creek pose minimal flood hazards to residents in surrounding Narbrook Park, as the floodplain is wholly contained within the Borough of Narberth's park land. In the densely settled area between Windsor Avenue and the railroad embankment, inadequate drainage results in severe flooding from local ponding of storm runoff in the area.

Available records do not show any major flooding along Dodsworth Run in the Borough of North Wales. Sheet flow will occur occasionally on the overbanks of Dodsworth Run because of its narrow channel and the topography of the area.

There is little or no information available concerning flood problems on Mine Run. Presently, most of the flooding in the area occurs in open-space and recreational lands.

Localized flooding has occurred in the Borough of Trappe near the intersection of West Third Avenue and Clayhor Road (Reference 6).

There is no historical information available for streams in the Townships of Upper Frederick and Upper Hanover. Local residents have stated that flooding problems occur along certain streams at road crossings. These locations include Swamp Creek at Colonial Road and Fagleysville Road, and Tributary to Deep Creek at Snyder Road in the Township of Upper Frederick. In the Township of Upper Hanover, these locations include Perkiomen Creek at Conner Road, Palm Hill Road, and along Water Street between State Route 29 and Peevy Road; Macoby Creek at Hendricks Road, James Road, St. Paul's Church Road, Buck Road at Frey Road and Tagart Road; Stony Run at Old School Road; and Macoby Creek Branch at Wasser Road.

Flooding History

Significant floods of recent record on the Schuylkill River (USGS 0147150 Schuylkill River at Reading, PA, Berks County, PA) have occurred in 1972, 1933, 1955, 2006, and 2011. Their estimated discharges and recurrence intervals are shown below (Reference 7).

Year	Estimated Discharge (cfs)*	Recurrence Intervals (years)
1972	100,000	35
1933	76,000	15
1955	64,000	8
2006	55,100	--
2011	42,900	--

* Cubic feet per second

Records of flooding on the Schuylkill River at Reading, Pennsylvania date back to 1757 (Reference 8). According to these records and other available information, the worst flooding along the Schuylkill River since 1757 was caused by Tropical Storm Agnes in June 1972. A flood in September 1850 ranks second. Other major floods occurred in October 1869, February 1902, August 1933, and May 1942. A record of annual flood peaks, beginning in 1928, is available for the USGS gage on the Schuylkill River at Pottstown (USGS 01472000) where the drainage area is approximately four percent less than that at East Pikeland (Reference 9).

Discharges and recurrence intervals for the ten highest floods recorded at the Pottstown gage for essentially unregulated conditions are as follows:

Year	Discharge (cfs)*	Recurrence Interval (years)
1972	95,900	greater than 100
1942	50,800	25
2006	50,300	--
1933	47,800	20
1979	43,000	--
1955	42,300	14
2011	42,100	--
1950	42,000	12
1976	41,800	12
1971	38,100	9

* Cubic feet per second

The recurrence intervals presented above were determined using methods outlined in USGS Water Resources Council Bulletin 17A, "Guidelines for Determining Flood Flow Frequency" (Reference 10).

At the Philadelphia gaging station (with 83 years of record), located 30 miles downstream of East Coventry, the Schuylkill River discharge was 96,200 cubic feet per second for the 1933 flood (Reference 11). For the 1955 flood, the peak discharge for the Philadelphia station was 90,100 cfs. During the flood associated with Tropical Storm Agnes in 1972, the peak discharge was 103,000 cfs at the Philadelphia station. On September 17, 1999, the peak discharge was 92,500 cfs for Hurricane Floyd. The peak discharge associated with Hurricane Irene on August 28, 2011 was 83,900 cfs at the Philadelphia station (Reference 168).

The estimated 1-percent annual chance discharge for East Tributary Stony Creek is 980 cfs in the Township of Whitpain.

Floods on Huntingdon Valley Creek in the Township of Lower Moreland, which occurred in 1931, 1950, 1967, 1971, 1999, and 2011, were of large magnitude; however, no gaging station records are available for Huntingdon Valley Creek. Most of the floods in the Township of Lower Moreland occurred near the confluence of Pennypack Creek and

Huntingdon Valley Creek where industrial development has occurred in the floodplain.

The estimated 1-percent annual chance discharge for Manatawny Creek is 16,100 cfs.

The estimated 1-percent annual chance discharge for Mill Creek in the Township of Lower Merion is 3,770 cfs.

The estimated 1-percent annual chance discharge for Mingo Creek is 3,770 cfs. The estimated 1-percent annual chance discharge for Mingo Creek Tributary No. 1 is 1,480 cfs. For Lodal Creek, the estimated 1-percent annual chance discharge is 3,340 cfs. No high water marks are known to exist within the Township of Limerick for Mingo Creek, Mingo Creek Tributary No. 1, or Lodal Creek.

No serious floods have been observed or recorded on Colmar Tributary, Little Neshaminy Creek, Little Neshaminy Creek Tributary No. 1, Little Neshaminy Creek Tributary No. 2, or West Branch Neshaminy Creek Tributary. The history of flooding on Neshaminy Creek places the most severe flood in 1865 and the highest recorded stage at the Langhorne gage in August 1955 (References 12 and 11). Significant flooding occurred on the Neshaminy Creek on September 17, 1999, from Hurricane Floyd (Reference 168).

Floods in 1933, 1960, and 1971 along West Branch Neshaminy Creek Tributary No. 2 were of large magnitude, and were caused by regional storms. No peak flows or frequencies are available for these floods.

There have been a number of major floods on Pennypack Creek and its tributaries. On July 14, 1931, a severe thunderstorm accompanied by high winds and heavy rainfall lashed the area, and many small creeks overflowed their banks. Many residents were forced to evacuate their homes due to rising flood waters. No record of discharge is available. On November 25, 1950, heavy rains from a fall storm battered the east coast and caused flooding problems in Montgomery County. On August 27, 1967, heavy rainfall from severe thunderstorms fell on ground that had been previously saturated, and caused much flooding in that area. Three USGS stream gages exist along Pennypack Creek in Philadelphia: At Pine Road (No. 01467042), operating from 1964-1970 and from 1974 to present; below Veree Road (No. 01467045), operating from 1964-1980; and at the Lower Rhawn Street bridge (No. 01467048), operating from 1965 to 1970 and from 1974 to present. Estimated peak discharges at the USGS gages on Pennypack Creek at Veree Road, Lower Rhawn Street, and Pine Road were 6,420, 5,160, and 3,540 cfs, respectively, for the 1967 flood (Reference 11). On August 28, 1971, when flooding from Hurricane Doria caused damage within the Pennypack Creek watershed, the estimated peak discharges were 5,200 cfs at Veree Road, 6,630 cfs at Lower Rhawn Street, and 5,160 cfs at Pine Road. On September 14, 1971, heavy rainfall on the Pennypack Creek watershed, which had been saturated the previous month, caused flooding in several locations. On September 16, 1999, Hurricane Floyd caused flooding in the area, with a peak streamflow of 12,400 cfs at Lower Rhawn Street (no data for the other two gages). On August 28, 2011, estimated peak discharges associated with Hurricane Irene were 13,200 and 13,300 cfs at Pine Road and Lower Rhawn Street, respectively (Reference 168).

Major floods (gage height greater than 15 feet at the Graterford stream gaging station) on Perkiomen Creek occurred on October 4, 1869, August 23, 1933, July 9, 1935, August 9, 1942, June 2, 1946, June 22, 1972, January 19, 1996, September 16, 1999, and August 28, 2011. The flood of 1935 was the largest recorded flood on Perkiomen Creek at the USGS gage at Graterford and resulted from a two-hour cloudburst, which climaxed in a night of rain and showers. The Ridge Pike stone bridge on U.S. Route 422 was almost inundated. The computed peak discharge at the Graterford gaging station was 39,900 cfs. This is the largest discharge of record, but is lower than the estimated 1–percent annual chance discharge. The data at Graterford have been collected by the USGS (References 13 and 11).

The estimated 1-percent annual chance Plymouth Creek flood discharge is 2,820 cfs. No high-water marks are known to exist on Plymouth Creek.

There are very few discharge records available for Skippack Creek because the gage near Collegeville, PA has only been in operation since 1966. However, during that time, on September 13, 1971, a peak discharge of 40,400 cfs was computed (Reference 11). This discharge is slightly greater than the 0.2–percent annual chance discharge of 39,180 cfs, which was computed for this stream flow gage by the USGS. The gage has 29 years of record. The computations were accomplished using the Water Resources Council log-Pearson Type III method (Reference 14). In addition, a high-water mark left by the September 13, 1971, flood was recovered from the sewage treatment plant located in the vicinity of the confluence of Towamencin Creek and its West Branch. The flood reached an elevation of 192.5 feet at this location.

There have been a number of major floods on Stony Creek during this century. High-water marks for Stony Creek on the Schmidt Brewery (outside the corporate limits of the Township of East Norriton) document major rises since 1896. The most noteworthy floods occurred in 1971, 1972, 1979, and 1990. The largest known flood on Stony Creek was in 1990. Streamflow data from Stony Creek at Sterigere Street at Norristown, PA (USGS 01473470) has the highest peak measured at 15,800 cfs on June 18, 1990. Records for this gage are from water year 1971 – 1994, with no data for 1972 – 1974.

The estimated 1-percent annual chance Trout Creek flood discharge in the Township of Upper Merion is 3,300 cfs. No recorded highwater marks for Trout Creek within the township are known to exist.

The worst flood of record along West Branch Neshaminy Creek resulted from excessive rainfall in September 1971. No discharge records are available for this flood so a return period could not be determined. The flooding experienced at that time was more severe along West Branch Neshaminy Creek than the flooding associated with Tropical Storm Agnes in June 1972. According to the officials of the Township of Hatfield, other major floods occurred in 1933, 1955, and 1960, with high enough discharges to cause extensive property damage.

There have been a number of major floods on Wissahickon Creek during this century. The most notable flood occurred in August 1955. The elevation of the 1955 flood at Butler Pike Bridge over the Wissahickon Creek was approximately 178.6 feet above sea level (Reference 15). This corresponds to the elevation of the estimated 500-year recurrence interval flood developed for the Borough of Ambler. The base (1–percent annual chance) flood elevation is 177.1 feet above sea level, or approximately 1.5 feet below the 1955 flood. Floods in 1933, 1960, and 1971 were of large magnitude, and were caused by regional storms. No peak flows or frequencies are available for these floods. The highest peak recorded at the USGS gaging station (01473900), Wissahickon Creek at Fort Washington, PA, was on September 16, 1999 (Hurricane Floyd) at 14,300 cfs.

There is little specific flooding information available for the streams in the Township of Lower Frederick, but it is known that floods have occurred as early as 1884 in the general area and again in 1915, 1933, 1942, 1946, 1969, and 1972, with the most severe flood occurring in 1935.

By far, the most severe flooding that has occurred in the Township of Towamencin was the result of the most intense regional storm ever to hit southeastern Pennsylvania. This record breaking flood resulted from heavy intermittent thunderstorms, which occurred on September 11-13, 1971. It produced approximately six inches of rainfall in the area. Saturated ground conditions existed prior to the September storm. This was due to approximately five inches of rain that fell on August 26-28 as Tropical Storm Doria passed the area (Reference 4).

Since 1960, the USGS has maintained a stream gage on Zacharias Creek downstream of Green Hill Road. The flood of record occurred on September 13, 1971, and had a discharge of 10,000 cfs and a flood height of 181.85 (Reference 11). Major floods in the township also occurred in 1970, 1972, and 1973. The corresponding recurrence intervals for the 1971 and 1972 floods were 100 years and 25 years, respectively; the recurrence intervals for the 1970 and 1973 floods were under 10 years. Data is available for USGS 0147310 (Zacharias Creek near Skippack, PA) from 1960 – 1980 only.

Flood Damages

Huntingdon Valley Creek, West Branch Neshaminy Creek Tributary No. 2, Park Creek and its tributaries, Pennypack Creek and its tributaries, and Wissahickon Creek have experienced flood flows that have caused property damage.

Damage has been limited along Dodsworth Run in the Borough of North Wales to minor flooding in basements between 8th and 10th Streets.

Property losses associated with the July 9, 1935, flood on Perkiomen Creek amounted to approximately $300,000 (1935 dollars) (Reference 16). According to records of the Pennsylvania Department of Environmental Resources, the flood along Perkiomen Creek on September 12, 1960, caused $1,821,000 worth of damage, and the flood of June 22, 1972, caused $472,000 dollars worth of damage (1976 dollars). Only one property experienced flood damage during Hurricane Agnes in 1972 (Reference 17).

Damages resulting from the June 1972 flood along the Schuylkill River, as reported by Civil Defense, involved 133 homes, 27 businesses, and affected 298 adults and 209 children (Reference 18). No monetary estimates of damages are available, however.

Minor damages to residential areas in the Township of East Norriton and the stream bed proper on Stony Creek resulted from the floods of 1971 and 1972.

The floods of September 1971 and June 1972 along West Branch Neshaminy Creek resulted in extensive residential damage and first floor flooding in the Borough of Hatfield and the Township of Hatfield.

The estimated costs to the Township of Towamencin resulting from the September 13, 1971, flood on Skippack Creek were $57,114 (Reference 19).

Storms in 1955, 1969, 1972, and 1973 have caused damage in the Township of Upper Dublin. Most of this damage has occurred in the Fort Washington Industrial Park area from flooding of Rapp Run and Pine Run.

On January 19, 1996, the combination of snowmelt from the previous week's two storms, unseasonably warm temperatures and an additional one to two inches of rain caused the flash flooding of almost every small stream and significant roadway flooding the afternoon and early evening hours on the 19th. Major flooding of the larger streams and rivers in Pennsylvania continued through the 21st. The flooding caused three deaths, all in Montgomery County, three injuries and about 50 million dollars in property damage (Reference 169).

On June 27–29, 2006, several days of heavy rain throughout the Schuylkill River Basin culminated with moderate flooding along the Schuylkill River and its tributaries. There was 22 million dollars of Property Damage recorded for this storm (Reference 169).

On September 2, 2006, there was one death in the Township of Schwenksville, attributed to the combination of the remnants of Tropical Storm Ernnesto and a large high pressure system over eastern Canada which produced heavy rain and winds over Montgomery County (Reference 169).

On October 1, 2010, a series of low pressure systems that moved north along a slowly moving cold front brought heavy rain into Eastern Pennsylvania. Event precipitation totals average 5 to 10 inches with the highest amounts in the Philadelphia western suburbs. The Perkiomen Valley was hit the hardest by flooding in Montgomery County. A 55-year-old woman drowned after she drove into flood waters of the Skippack Creek on the morning of October 1st off Stump Hall road just north of Anders Road near Evansburg State Park near Skippack. Total property damage was estimated at $750,000 (Reference 169).

On August 28, 2011, Hurricane Irene produced heavy flooding rain, tropical storm force wind gusts with hundreds of thousands of outages, moderate tidal flooding along the Delaware River and one flooding related death in Eastern Pennsylvania. Property damage was estimated at $100,000 (Reference 169).

2.4 Flood Protection Measures

Within this jurisdiction there is one levee that has not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1% annual chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

Several dams are located along the Schuylkill River in Montgomery County. They include: the Norristown Dam, which has an approximate height of 11 feet, is located 80 feet downstream of the upstream Borough of Bridgeport corporate limits, and has no significant effect on 10-year and higher flood elevations; Flat Rock Dam in the Township of Lower Merion; Plymouth Dam in the Boroughs of Conshohocken and West Conshohocken; Black Rock Dam in the Township of Upper Providence; Vincent Dam in the Township of Limerick; and an unnamed rock dam in the Township of Upper Providence.

Blue Marsh Dam and Reservoir, a multi-purpose reservoir located in Berks County, was constructed by the USACE on Tulpehocken Creek in

1982. The 100-foot high earthfill dam provides flood protection by significantly reducing flood levels in the City of Reading. This reduction in flood waters is subsequently experienced downstream along the Schuylkill River.

Green Lane Reservoir is formed by a concrete gravity spillway and is located on Perkiomen Creek approximately one mile upstream from the Borough of Green Lane. The dam's spillway is ungated, and the reservoir is used primarily for municipal water supply. The dam and reservoir cannot be relied upon to affect flood levels to any measurable degree downstream of the dam; however, because the pool is normally maintained at the spillway elevation, minimum flood peak moderation is accomplished by the reservoir.

Knight Lake Dam located on Perkiomen Creek and Deep Creek Dam located on Deep Creek in the Upper Perkiomen Valley county park were constructed to form recreational use lakes. The spillways of both dams are ungated and, therefore, provide essentially no flood protection. As with Green Lane Dam, neither of these dams will adversely affect flood levels in the feeder streams to the lakes.

For the October 19, 2001 revision, it should be noted that the small dams on both streams were not constructed for flood control purposes and do not alter flood flows.

Crow Creek flows through underground culverts near U.S. Route 202 (L.R. 143), passing under Fourth Street and the railroad tracks, downstream from which is an open channel on the Schuylkill River floodplain. Earth channel improvements have been made on Crow Creek upstream of Ross Road.

A local flood protection project along Pennypack Creek within the Borough of Hatboro has been completed (Reference 20). Flooding in this area is the result of physical constrictions both upstream and downstream of the Old York Road Bridge. The modification consists of channel realignment and bank protection. In addition, a meandering triangular low-flow channel has been provided for fishery. No other flood protection measures exist along Pennypack Creek within the borough.

An effective channel improvement and stream clearing project has been carried out on Sandy Run Creek. Consideration has also been given to further improvement. Land elevations along Pennypack Creek have been raised in an attempt to escape future flood heights. As of January 1991, a study for Baeder Run by the Pennsylvania Department of Environmental Resources was nearing completion, but the recommendations are not expected to have any foreseeable effect on the current flooding situation.

There are some flood retention structures in the Township of Montgomery for development after 1972. These structures do not result in major reductions in peak flows, because they compensate for the new development. A small farm pond at the headwaters of West Branch Neshaminy Creek does not significantly affect flooding on the stream due to its extreme upstream location.

As a result of serious flooding in 1955 and in 1967, the Township of Cheltenham undertook a large number of stream improvements along Tacony Creek and its tributaries. These improvements were based on recommendations in a report prepared by a joint venture of George B. Mebus, Inc., Engineers, Glenside, Pennsylvania, and Metcalf and Eddy Engineers, Boston, Massachusetts. The projects include:

a. Stream alignment changes on Jenkintown Creek upstream of Tacony Creek, on Tacony Creek upstream of Church Road and Springhouse Lane.

b. Construction of rip-rap stream banks on Jenkintown Creek upstream of Tacony Creek and on Rock Creek upstream of Widener Road to Serpentine Lane.

c. Stream clearance of gravel bars and deposits.

d. Construction of concrete, stone, masonry, and concrete block channel sections on Tacony Creek upstream of Church Road and Ashmead Road and on Rock Creek upstream of Widener Road to Serpentine Lane.

e. Replacement and reconstruction of bridges and culverts and underpinning of Mill Road bridge.

f. Storm sewer extension on Cadwalader Avenue, Shoemaker to Marion Roads.

g. Acquisition and demolition of 26 flood-prone homes along Rock Creek.

h. Levee construction along Tacony Creek from Rices Mill Road to Brookdale Avenue.

i. Flood-proofing of private structures by owners.

The Township of Cheltenham is continually rectifying problem areas and maintains previously constructed flood protection projects. The Pennsylvania Department of Environmental Resources was completing a project, as of May 1976, that would alleviate flooding problems in the Glenside area of the township. This project would include a storm water pumping station on Brookdale Avenue to control flooding behind an existing levee on Tacony Creek.

The Norristown Flood Control Program, which is comprised of the Fomance Street Dam on Sawmill Run and channel improvements on Sawmill Run from Fornance Street Dam to the Schuylkill River, was designed and constructed to significantly reduce flood discharges on Sawmill Run as it passes through the residential and commercial areas of downtown Norristown. This program was completed in 1973 by the Pennsylvania Department of Environmental Resources, and is maintained and operated by the Borough of Norristown. As a result of this program, Sawmill Run, from the dam to the backwaters of the Schuylkill River at Airy Street, has been designated as having no special flood hazards because it is protected by a flood control structure. The Norristown Dam offers no flood protection to the Borough of Norristown but is used in conjunction with the borough water supply.

Exclusive of a number of stormwater retention basins, which have been built in conjunction with housing developments, there are no existing flood protection works present of planned in Towamencin (References 21, 22, and 23). Several non-structural flood control measures currently exist within Towamencin. Floodplain regulations are defined in Article XI of the Township of Towamencin Zoning Ordinance (Reference 24). These regulations regulate development within designated Flood Plain Conservation Districts, which are defined on the community's Flood Plain Soils map. These floodplain districts are based on soil information prepared by the SCS.

Additional non-structural floodplain protection was obtained from the National Weather Service, Allentown Office (Reference 25).

Magnitudes of floods on Tannery Run have been significantly reduced by impoundment upstream of the relatively small culverts under the Bethlehem Pike and under Woodland Avenue.

A flood detention structure, PA-625, owned and operated by the NWRA, is located on Unionville Tributary in the Township of Hilltown. This structure reduces flooding on Unionville Tributary and downstream of its confluence with West Branch Neshaminy Creek.

The Vincent Dam on the Schuylkill River and the adjacent levees offer no flood protection for the Township of Limerick and the Borough of Royersford but are used in conjunction with the Schuylkill Canal.

There are small dams in the Boroughs of Collegeville and Norristown and the Townships of Douglass, Lower Frederick, Lower Moreland, Lower Providence, Marlborough, New Hanover, Upper Frederick, and Upper Providence; these dams were not constructed for flood control purposes and do not alter flood flows.

At present, there are no flood protection structures within the Boroughs of Ambler, Conshohocken, Green Lane, Hatfield, Norristown, Pottstown, Royersford, Trappe, or West Conshohocken or the Townships of East Norriton, Hatfield, Horsham, Limerick, Lower Gwynedd, Lower Merion, Lower Moreland, Lower Pottsgrove, Lower Providence, Marlborough, New Hanover, Plymouth, Upper Dublin, Upper Frederick, Upper Gwynedd, Upper Hanover, Upper Merion, Upper Pottsgrove, Upper Providence, West Norriton, Whitemarsh, or Whitpain. Non-structural measures of flood protection are in effect in these communities, however, to aid in the prevention of future flood damage. Land use regulations, adopted from the Code of Federal Regulations, Title 24, Chapter 10, Parts 1910.3 (a) and 1910.3 (b), control building within areas that have a high risk of flooding (Reference 26). The local regulations, set up by Township of Lower Gwynedd officials, are contained within Lower Gwynedd Township zoning ordinances, Article II (Definitions), Sections 200-207.

Presently, there are no flood control measures that would alter the flood flows on any of the streams within the Boroughs of Bryn Athyn, Schwenksville, or Trappe or the Townships of Franconia, Lower Frederick, Lower Salford, Perkiomen, Salford, Skippack, Towamencin, Upper Moreland, Upper Salford, or Worcester. Residents of these communities depend on the usual warnings issued through radio, television, and local newspapers for information concerning possible flood conditions. Flood warnings and predicted flood peaks are issued by the National Oceanic and Atmospheric Administration (NOAA) Flood Forecasting Centers located at Harrisburg, Pennsylvania, and Trenton, New Jersey.

The Borough of Lansdale has no major flood control structures regulating stream flows of the tributaries that begin in the community, nor are there any on the streams that flow through the community. The Borough of Lansdale has no ordinance regulating development in the floodplains. The SCS has proposed a flood control reservoir to be built on Park Creek in the Township of Horsham. Damages to the Borough of Lansdale sewerage treatment plant by the September 13, 1971, flood prompted the construction of the protective levee around the plant, which essentially protects the plant against the 1–percent annual chance flood, but not the 0.2–percent annual chance flood.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the county, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10–, 2–, 1–, and 0.2–percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedance) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

Note: Within this jurisdiction there is one levee that has not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1% annual chance flood protection. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the county.

Pre-countywide Analyses

Each community within Montgomery County, except for the Boroughs of East Greenville, Jenkintown, and Pennsburg has a previously printed FIS report. The hydrologic analyses described in those reports have been compiled and are summarized below.

Flood-flow frequency analyses for Baeder Run, from its confluence with Tacony Creek to a point approximately 265 feet upstream of Abington Avenue, were based on the USACE HEC-1 flood hydrograph computer program (Reference 27). Rainfall amounts for the 10–, 2–, 1–, and 0.2–percent annual chance storms were obtained from Weather Bureau Technical Paper No. 40 and NOAA Technical Memorandum NWS Hydro-35 (References 28 and 29). The 0.2–percent annual chance rainfall amounts were extrapolated from the 10–, 2–, and 1–percent annual chance data.

Hydrologic analyses for the remaining portion of Baeder Run, North Branch Baeder Run, Sandy Run, and Sandy Run Tributary No. 1 were based on small drainage area criteria, including Snyder's unit hydrographs, the Rational Equation, drainage area proportions, and the USGS Water-Supply Paper No. 1672 (Reference 8).

Hydrologic analyses for Meadow Brook, from a point approximately 1,100 feet upstream of Susquehanna Road to the upstream limit of detailed study, were based on statistical analyses of stream-flow records taken from the USGS stream gage on Pennypack Creek at Pine Road. Records from this gaging station have been taken since 1964 and were used in conjunction with regional synthetic analyses from selected points along the main stem. Peak flows were developed by the USACE in cooperation with the NOAA. Much of the data appears in the floodplain information report for Pennypack Creek (Reference 30).

Flood-flow frequency data for the following streams were based on the Pennypack Watershed Expanded Flood Plain Information Report: Blair Mill Run; Blair Mill Run Tributary; Huntingdon Valley Creek; Meadow Brook, from its confluence with Pennypack Creek to a point approximately 1,100 feet upstream of Susquehanna Road; and Pennypack Creek (Reference 31). The Pennypack watershed was subdivided into subbasins to facilitate estimating a consistent set of discharge-frequency values. Gages with rainfall and streamflow records were identified, and data were obtained from the NWS and the USGS. Several methods were used to estimate unit hydrograph (basin runoff) characteristics for each of the sub-basins. Initially, the unit hydrograph and exponential loss theory was evaluated using the unit hydrograph optimization routine of the HEC-l program (Reference 27). Discharge frequencies were statistically estimated for five stream gage locations within the basin on available annual series data. Rainfall intensity-frequency-duration curves were developed from the NWS Technical Paper No. 40 (Reference 28). Hypothetical storm events of selected frequencies were developed and runoff estimates were generated by the HEC-l model. Unit hydrograph and loss rates were adjusted to obtain results reasonably consistent with historical storm events and statistically-derived discharge-frequency data.

For the following streams, flood flows for drainage areas less than 5.0 square miles were developed using the rational method: Davis Grove Tributary, Dodsworth Run, Oak Terrace Tributary, Park Creek, and West Branch Neshaminy Creek Tributary. Flood flows for drainage areas greater than 5.0 square miles were developed and compared using the regional method outlined in the USGS Water-Supply Paper No. 1672 (Reference 8). This method employs regionalization of many stream gaging station records in terms of similar topographic and geologic characteristics and flood frequency characteristics. Curves of mean annual flood versus drainage area size yield mean annual flood values for any location within the northeastern United States; adjustment factors applied to the mean annual flood yield floods of the desired recurrence interval. Discharges for 0.2–percent annual chance floods, when not directly available from analytical data, were determined by extrapolation of a curve of analytically computed flood discharges plotted on log-log graph paper.

The 10–, 2–, and 1–percent annual chance peak discharges of Buckwalter Tributary and Donny Brook Run were calculated using a regional flood frequency method, which consists of regression model methodologies based on statistical analyses of Pennsylvania streamflow records. These methodologies were developed through cooperative agreements between the USGS and the Pennsylvania Department of Environmental Resources

(Reference 32). The 0.2–percent annual chance peak discharges were extrapolated from a straight line graph of these discharges. The results for Donny Brook Run in the Borough of Collegeville were compared with discharges of other FISs and with discharges that were calculated using an SCS method for estimating the volume and rate of runoff in small watersheds (Reference 33).

Hydrologic analyses for the following streams consisted of formulating a rainfall-runoff model using the USACE HEC-l computer program: Pennypack Creek Tributary No. 1, Southampton Creek, and War Memorial Creek (Reference 27). Using the model, hydrographs were developed and peak flows were determined from frequency rainfall distributions for hypothetical storms having recurrence intervals of 10, 50, and 100 years. Model calibration was accomplished by adjusting the rainfall loss rates until the hypothetical storm events produced a peak discharge consistent with frequency discharge data developed at selected USGS recording gages in the vicinity of the Township of Upper Moreland. Discharges for the 0.2–percent annual chance flood were determined by straight-line extrapolation of flood discharges computed for frequencies up to 100 years.

For Jenkintown Creek, Rock Run, and Tacony Creek, hydrologic analyses were taken from the FIS for the Township of Cheltenham (Reference 34). In that study, hydrographic methods were used to determine the flood-flow frequency data. Several storm hydrographs were analyzed by standard methods to produce the unit hydrograph for Tacony Creek. Rainfall intensity-duration curves for Philadelphia were used to obtain rainfall frequencies for a six-hour storm. The rainfall was applied in accordance with the distribution suggested in Civil Works Engineer Bulletin 52-8 by the USACE. Flood flows were established and adjusted for drainage area using regional curves developed in a USGS Open-File report (Reference 35). The calculated flows were compared with flows for similar drainage basins, produced by log-Pearson Type 111 frequency distribution, applying methods outlined in the USGS Open-File report, and/or records of past floods. The above comparisons indicated that the calculated flood-frequency relationships are reasonable for Tacony Creek and its tributaries.

Peak discharges for Pennypack Creek Branch of the 10-, 50-, 100-, and 500-year recurrence intervals were based on data previously developed by the USACE (Reference 31). The discharges were then compared to discharges computed using the regional method outlined in the Design Manual Part 2 Highway Design (Reference 36). The discharges determined by the USACE were used in the study because these discharges were more conservative. These flows were adjusted for changes in upstream areas on the basis of the following drainage area proportionment formula:

$$Q_u/Q_d = (A_u/A_d)^{0.8}$$

where "u" and "d" represent upstream and downstream points, respectively.

The hydrologic analyses of Goshenhoppen Creek, Perkiomen Creek, Scioto Creek, and Swamp Creek in the Township of Lower Frederick and Swamp Creek in the Township of Douglass were developed based on a 1976 hydrologic analysis performed by the USACE for Perkiomen Creek, Scioto Creek, Swamp Creek, and Goshenhoppen Creek (Reference 37). This analysis was for the area located downstream of the Township of Upper Frederick. The USACE hydrologic analyses consisted of analyses of historical storms and development of a rainfall-runoff model for that part of the basin above the USGS stream gage at Graterford, approximately 12 miles downstream of the Township of New Hanover (Reference 37). The Graterford gage has recorded streamflow data from 1914 to the present. The basin model was developed using the USACE HEC-1 flood hydrograph computer program and was used to study the historical events and generate storm hydrographs for floods having recurrence intervals of 10-, 50-, and 100-years (Reference 37). The peak flow of the 0.2–percent annual chance flood was obtained by extrapolating the discharge-frequency curves developed from peak flows of the more frequent flood events. The USACE hydrologic analyses determined peak discharges according to procedures contained in the regional study for the Upper Delaware and Hudson River Basins (References 37 and 38).

For Hosensack Creek and Perkiomen Creek in the Township of Upper Hanover, the hydrologic analyses were performed following the methodology presented in the USACE regional study for the Upper Delaware and Hudson River Basins (Reference 38). The methodology presented in the regional study for the Upper Delaware and Hudson River Basins is based on a statistical analyses of stage-discharge records covering a 32 year period at gaging stations operated by the USGS (References 38, 39, and 11). This method of analyses follows the standard log-Pearson Type III method as outlined by the Water Resources Council (Reference 14). Missing flood peaks were estimated by correlation with nearby long-record stations and the statistics were then recomputed.

The hydrologic analyses for the following streams were performed following the methodology presented in Water Resources Bulletin No. 13 on floods in Pennsylvania: Deep Creek, Goshenhoppen Creek in the Township of Upper Frederick, Lodal Creek, Macoby Creek Branch, Middle Creek, Mingo Creek, Mingo Creek Tributary No. 1, Minister Creek, Minister Creek Tributary, Perkiomen Creek in the Borough of Green Lane and the Townships of Marlborough and Upper Frederick, Sanatoga Creek, Sawmill Run, Schlegel Run, Scioto Creek in the Township of Upper Frederick, Skippack Creek in the Townships of Franconia and Towamencin, Skippack Creek Tributary No. 1, Skippack Creek Tributary No. 2, Sprogels Run, Stony Creek Tributary, Stony Run, Swamp Creek in the Townships of New Hanover and Upper Frederick, Towamencin Creek No. I, West Branch Perkiomen Creek, West Branch Swamp Creek, West Branch Towamencin Creek, and West Branch Towamencin Creek Tributary No. 3 (Reference 32). For some of the streams studied using this method, the results were then adjusted to match the USACE downstream hydrologic analyses for these drainage basins. The discharges computed for Sawmill Run compared favorably with discharges computed for the Sawmill Run Flood Control Projects by the SCS triangular method, using the 1–percent annual chance, 6-hour storm pattern "B" (Reference 40).

Discharges for the 0.2–percent annual chance floods for Skippack Creek in the Township of Franconia, Skippack Creek Tributary No. 1, and the streams in the Townships of Douglass and Towamencin were determined by extrapolation.

The Bulletin No. 13 regression model is based upon 10 gaging stations. All of the methodologies used to calculate the peak discharges relate the magnitude of instantaneous peak stream discharges for selected recurrence intervals to statistically significant drainage basin characteristics. These drainage basin characteristics include the drainage area as determined from topographic maps and the Water Resources Bulletin No. 6, Pennsylvania Gazetteer of Streams, channel slope, storage, and annual precipitation (References 41, 32, and 42).

The hydrologic analyses for Macoby Creek were performed following both the methodology presented in Water Resources Bulletin No. 13 and the methodology presented in the USACE regional study (References 32 and 39). For drainage basins having characteristics similar to the Macoby Creek basin, experience has shown that the USACE regional study provides realistic peak discharges for larger drainage areas and Bulletin No. 13 provides realistic peak discharges for smaller drainage basins. Therefore, the USACE regional study methodology was used to compute Macoby Creek discharges upstream of the confluence of Stony Run. The methods in Bulletin No. 13 were used to compute the discharges of Macoby Creek at the confluence with Perkiomen Creek, while the discharges between Perkiomen Creek and Stony Run are interpolated.

The peak discharge-frequency values for Perkiomen Creek in the Borough of Collegeville and the Townships of Lower Providence and Upper Providence were derived from 60 years of recorded annual peak flow data, which were collected at the Graterford stream gaging station by the USGS (Reference 39). These analyses were based on a log-Pearson Type III method of analysis, as outlined by the Water Resources Council (References 14 and 43). The results were compared for acceptability with frequency data published by the USGS, the USACE, and the DRBC (References 13, 38, 44, 41, and 42).

Peak discharges for East Branch Perkiomen Creek; Indian Creek; Perkiomen Creek in the Townships of Perkiomen, Schwenksville, Skippack, and Upper Salford; and West Branch Skippack Creek were determined using the hydrologic analyses prepared by the USACE for the Perkiomen Creek basin (Reference 45). This analysis consisted of formulating a rainfall-runoff model for the entire Perkiomen Creek watershed using the USACE HEC-1 computer program (Reference 27). The watershed was divided into 20 subbasins. Using the model, hydrographs were computed, and peak flows were determined from frequency rainfall distributions for hypothetical storms having recurrence intervals of 10-, 50-, and 100-years. Model calibration was accomplished by adjusting the rainfall loss rates until the hypothetical storm events produced a peak discharge consistent with the frequency-discharge data developed at the USGS recording gage on Perkiomen Creek at Graterford (Reference 11). Discharges for the 0.2–percent annual chance flood was determined by straight-line extrapolation of a single-log graph of flood discharges computed for frequencies up to 100 years.

Rainfall data for the following streams were calculated using the Pennsylvania State University's Design Procedures for Rainfall-Duration-Frequency in Pennsylvania: Colmar Tributary in the Township of Hatfield, Lansdale Tributary, North Hatfield Tributary, Pine Run, Rapp Run, Towamencin Creek No. 2, Tributary No. 1 to Unionville Tributary, Unionville Tributary, West Branch Neshaminy Creek, and Wissahickon Creek in the Township of Upper Dublin (Reference 46). These data were combined with basin characteristics such as drainage area, stream slope, vegetation, soil cover, and land-use characteristics to estimate the resulting discharge values considering a time lapse to the peak discharge calculated by empirical equations.

For West Branch Neshaminy Creek from the downstream Township of Hatfield corporate limits to Lexington Road and Unionville Tributary, discharges were determined using 12-hour duration hydrographs supplied by the SCS. The following formula, which was able to calculate peak flows upstream and downstream of points given by the SCS, was used:

$$Q_u/Q_d = (A_u/A_d)^{0.8}$$

where Q_u is the discharge upstream and Q_d is the discharge downstream of the point given by the SCS, A_u is the area upstream and A_d is the area downstream of the point given by the SCS, and 0.8 is a transfer coefficient.

The PSU-IV regional method was used to estimate the peak discharges for Little Neshaminy Creek; Little Neshaminy Creek Tributary No. 1; Little Neshaminy Creek Tributary No. 2; North Hatfield Tributary from Bergey Road to Unionville Pike; Oley Creek; Rose Valley Creek; Sandy Run in the Townships of Springfield, Upper Dublin, and Whitemarsh; Swamp Creek in the Township of Douglass; and Tannery Run (Reference 47). Regional equations developed from regression analyses for gaged watersheds in Pennsylvania can generate instantaneous peak flows for an ungaged location. Information regarding the drainage area size, location within the State, and divide elevation at the ungaged site is required to use the PSU-IV method. Extrapolation was used to determine the 0.2–percent annual chance peak flow for North Hatfield Tributary.

The use of drainage area size and location, plus adjustments for drainage areas under 1,000 acres allowed coordination of peak discharge values between the small tributaries and the Little Neshaminy Creek (Reference 47).

The resulting peak flows for Swamp Creek in the Township of Douglass proved to be in good relation to the downstream analysis performed by the USACE, and thus, were used in this study for Swamp Creek.

Attenuation of the 1–percent annual chance flood on Tannery Run by impoundment above Bethlehem Pike and Woodland Avenue was determined by a minute-step analysis of flow. An approximately 1–percent annual chance inflow hydrograph, storage accounting, and culvert-discharge ratings developed from culvert-capacity analyses were used in this attenuation analysis (Reference 48).

The hydrologic analyses for Zacharias Creek in the Township of Skippack were developed by the USACE in a Special Flood Hazard Information report (Reference 49). A USGS stream gaging station has been maintained on Zacharias Creek just downstream of Green Hill Road (Reference 11). At the time of this analysis, the record of this gage spanned only 14 years. Therefore, additional data for this analysis were obtained from gaging stations in the vicinity of the Zacharias Creek watershed. Discharge-frequency relationships for North Branch Zacharias Creek and Zacharias Creek were developed from available gage data by regional frequency computations and distributed throughout the watershed by proportional drainage area relationships (Reference 50). Peak flows for the 0.2–percent annual chance flood were obtained by extrapolation.

Frequency-discharge data for Vaughn Run was developed using the HEC-I computer program, with input data developed using SCS methodology for rainfall, loss rates, and unit hydrographs.

The hydrology for Unami Creek was based on data contained in a USACE Special Flood Hazard Information report for Unami Creek (References 51 and 52). There are no stream gages located on Unami Creek to record historical flood events. The hydrologic analysis consisted of formulating a rainfall-runoff model for the entire Unami Creek Basin using the USACE HEC-1 computer program (Reference 27). Using the model, hydrographs were computed and peak flows determined from frequency rainfall distributions for hypothetical storms having recurrence intervals of 10-, 50-, and 100-years. Peak flows for the 0.2–percent annual chance flood were obtained by extrapolating the discharge-frequency curve computed

for flood events up to the 1–percent annual chance flood and by comparison with USACE standard project flood calculations.
To define discharge-frequency data for East Tributary Stony Creek in the January 5, 1978, FIS report for the Township of Whitpain; Stony Creek in the Township of Whitpain; and Wissahickon Creek in the Borough of Ambler and the Townships of Lower Gwynedd. Upper Gwynedd, Whitemarsh, and Whitpain, several methods of analyses were used. These methods are modifications of the SCS procedure and are designated in this study as "McSparran Tp, Condition III," and "Segment Tc, Condition III" (References 53, 54, 40, and 28). The methods presented in SCS Bulletin No. 55 were used to perform the hydrologic calculations of the upper reaches of the Wissahickon Creek drainage basin (Reference 55). Each of the above methods were used to relate drainage basin characteristics and stream-flow characteristics. Rainfall data is combined with basin characteristics, such as drainage area, stream slope, vegetation, and soil cover, to estimate the resulting discharge values considering a time lapse to the peak discharge calculated by empirical equations.

For the following streams, the discharges were determined using a modification of the SCS procedure designated in this study as "McSparran Tp, Condition III": Colmar Tributary, Lansdale Tributary, Manatawny Creek, Plymouth Creek, Skippack Creek in the Township of Lower Providence, Stony Creek in the Townships of East and West Norriton, West Branch Neshaminy Creek in the Borough of Hatfield and from Lexington Road to a point approximately 2,000 feet upstream of Hollowell Corporate Road, and Wissahickon Creek in the Township of Upper Dublin (Reference 54, 40, and 53).

The hydrologic analyses for Mill Creek and Trout Creek were based on a modification of the SCS procedure designated in this study as "Segment Tc, Condition III" (References 56, 53. and 40).

For North Hatfield Tributary in the Borough of Hatfield and from the downstream Township of Hatfield corporate limits to Bergey Road, Pine Run, Rapp Run, Towamencin Creek No. 2, and Tributary No. 1 to Unionville Tributary, the discharges were determined following the SCS procedure designated in this study as "Kirpich Tp, Condition III," which relates basin characteristics to stream flow characteristics (References 54, 40, and 53).

East Tributary Stony Creek, from Township Line Road to a point approximately 2,100 feet upstream in the vicinity of the Maxi Group project, was based on a Special Flood Hazard report for Stony Creek prepared by the USACE (Reference 57).

For West Branch Neshaminy Creek Tributary No. 2 and Wissahickon Creek in the Borough of Lansdale, values of the 10–, 2–, 1– and 0.2–percent annual chance peak discharges were based on criteria established for small watersheds by the SCS (Reference 55). Discharges obtained in this manner agree closely with those computed using the rational method and regional methods developed by the USGS (Reference 8). A close agreement was not achieved using regional methods applies in highway design by the Pennsylvania Department of Transportation (Reference 36). Discharges obtained using the regional methods of the SCS are felt to be more valid, however, because this procedure fully accounts for land use in small drainage areas. The 0.2–percent annual chance peak discharge was determined by the extrapolation of a log-log plot of flood discharges computed by analytical methods.

The peak discharge-frequency relationship information for Wissahickon Creek in the Township of Springfield was taken from the FISs for the Township of Whitemarsh and the City of Philadelphia (References 58 and 59).

For Stony Creek in the Borough of Norristown, the hydrologic analyses reflect stream discharges obtained from the FIS for the Township of East Norriton and the 1972 Norristown study (References 60 and 61). The discharges compared favorably with the methodology in a regional study for the Upper Delaware River and the Hudson River basins, and the methodology presented in Water Resources Bulletin No. 13 (References 38 and 32).

The approximate analyses of Corner Tributary were determined using a modification of the "McSparran Tp, Condition III" (References 54, 40, and 53).

Flood discharges for approximately studied streams in the Townships of East Norriton, Lower Gwynedd, Lower Merion, Plymouth, Upper Gwynedd, Upper Merion, West Norriton, Whitemarsh, and Whitpain followed the USGS Open-File Report 76-391, "Floods in Pennsylvania: A Manual for Estimation of Their Magnitude and Frequency," which is a regional method using regression equations relating drainage area, channel slope, percent area of storage, and an index of average annual excess precipitation (Reference 62).

Flood discharges for approximately studied streams in the Township of Lower Providence were based on rainfall data from the National Weather Service (Reference 28). The hydrologic analysis followed the standard SCS Condition III procedure, which relates basin characteristics to stream flow characteristics (References 53 and 40).

Revised Analyses for the December 19, 1996, Countywide FIS

Information on the methods used to determine peak discharge-frequency relationships for the Schuylkill River restudied as part of this countywide FIS is shown below.

Frequency discharge relationships were developed for six streamflow gaging stations on the Schuylkill River, which have periods of record greater than 20 years, using the HECWRC computer program, which utilizes procedures outlined in Bulletin 17B (Reference 63). Input into the program were unregulated and naturalized annual peak flow data, a generalized, regional skew value, and mean squared error of this skew. Peak flow data were obtained from the USGS Flood Peaks and Discharge Summaries in the Delaware River Basin and Water Resource Data. Pennsylvania (References 64 and 11).

The peak flows were adjusted to the historical floods of 1850, 1870, 1902, and 1972 in the lower basin and 1942 and 1972 in the upper basin, which were specified as being major flood events. Where there was no published peak for a major event, the peak flow was estimated by means of linear regression with surrounding gages. Peaks flows recorded since 1978 on the Schuylkill River downstream of the confluence of Tulpehocken Creek are subject to a varying degree of regulation by Blue Marsh Lake. Generalized, regional skew and mean squared error were obtained from Generalized Skew Study for the Delaware River Basin performed by the USACE (Reference 65). Naturalized frequency discharge curves developed for the six gages were transformed to regulated conditions curves using flow reduction curves published in "Special Projects Memo #475, Discharge Reduction Curves, Schuylkill River, Pennsylvania" (Reference 66).

Revised Analyses for the March 2, 1998, Countywide FIS

Discharge-frequency relationships for West Branch Neshaminy Creek Tributary No. 2 in the Borough of Lansdale and the Township of Hatfield were developed using the SCS TR-55 computer model (Reference 55). The effects of the Lansdale Storm Water Management project, which diverts water from the Borough of Lansdale to downstream of the railroad Bridge, were included.

Revised Analyses for the August 9, 1999, Countywide FIS

The initial flow quantities were taken from the report entitled Township-Wide Stormwater Management Plan. Existing Hydrologic Conditions. Draft Report, prepared by Gannett Fleming, Inc., for the Township of Upper Merion (Reference 67). Flow quantities from the draft report were input at identified cross section locations to develop rating tables for each cross section. The hydrologic model was also modified with the insertion of various "micro" drainage areas which were developed from the locations of known obstructions and the detailed mapping, which was not available during development of the draft hydrology report. The updated hydrologic model was run to obtain accurate flow quantity values.

Revised Analyses for the October 19, 2001, Countywide FIS

Available hydrologic data was reviewed for consistency and applicability to conditions present at the time of this revision. The Hydrologic Engineering Center Special Project Memo No. 78-4, the USGS annual peak flow data and the current Flood Insurance Studies were included in the review. For consistency, the U.S. Army Corps of Engineers, Hydrologic Engineering Center Special Project Memo No. 78-4 was selected for both streams. SPM 78-4 was updated to include twenty more years of record at the Graterford gage. A ratio of the old flows and new flows at the gage was computed. The ratios were applied along each stream at the same drainage areas as the current Flood Insurance Study for Montgomery County, Pennsylvania.

This Countywide Revision

Temple University conducted a detailed hydrologic study for the Pennypack Watershed. The Pennypack watershed lies in the lower Delaware River Basin in Pennsylvania and discharges into the Delaware River in the City of Philadelphia. Most of the watershed is located in Montgomery County, and a small part is in Bucks County. The watershed area is 56 square miles, of which approximately 90 % lies upstream of the USGS gauge station at Rhawn Street in Philadelphia. The topography of the Pennypack Watershed is characterized by gently rolling hills in the headwaters, and moderately sloping valley in the central part of the watershed, and tidal flats draining to the Delaware River. Blair Mill Run, Blair Mill Run Tributary, Huntingdon Valley Creek, Meadow Brook, Pennypack Creek, Pennypack Creek Branch, Pennypack Creek Tributary No. 1, Southampton Creek, and War Memorial Creek are the streams studied in detail.

Temple University conducted a separate detailed study for the Sandy Run Watershed. The Sandy Run Watershed lies in the upper Delaware River Basin in Pennsylvania and discharges into the Wissahickon Creek located to the north of City of Philadelphia. The watershed area is 13.84 square miles. The topography of the Sandy Run Watershed is characterized by gently rolling hills in the headwaters, and moderately sloping valley in the central part of the watershed, and tidal flats draining to the Wissahickon Creek. Pine Run, Rapp Run, Sandy Run, Sandy Run Tributary No. 1, Sandy Run Tributary No. 1A, and Tributary No. 2 to Pine Run are the streams studied in detail.

For both studies, the peak flow Q_i in each stream "i" was obtained according to the formula:

$$Q_i = \frac{A_i}{A_b} Q_b + Q_{upstream}$$

Where Q_b is the peak flow from the subbasin in which stream “i” is located, A_i is the area draining into stream i, and A_b is the drainage area of the subbasin. The term $Q_{upstream}$ indicates peak flow rate from an upstream subbasin that is routed through reach “i”. USACE’s software HEC-HMS was used for both studies.

For all streams studied by approximate methods, regression equations from the USGS report titled “Regression Equations for Estimating Flood Flows at Selected Recurrence intervals for Ungaged Streams in Pennsylvania” (Reference 167) were used for the hydrologic analysis. Equations were developed utilizing peak flow data from 322 gaging stations within Pennsylvania and surrounding states. Pennsylvania was divided into four regions, and Montgomery County lies in region 2. The equation for region 2 uses three parameters to estimate discharge: drainage area (as determined from 30 meter digital elevation model), percent carbonate bedrock, and percent urban area. However, the impact of percent urban area on the 1–percent annual chance flood is so small that this parameter was not included in the analysis.

A summary of the drainage area-peak discharge relationships for the streams studied by detailed methods, except for Erdenheim Run, Oreland Run, St. Josephs Run, Tributary C to Oak Terrace Tributary, Tributary to Oreland Run, Valley Creek and West Branch Neshaminy Creek Tributary No. 2, is shown in Table 3, "Summary of Discharges." There is no summary of discharge data available for these streams that have been excluded. The discharges for Dodsworth Run are shown in Figure 1, “Frequency-Discharge, Drainage Area Curves.”

TABLE 3- SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
ABRAMS CREEK					
At Beidler Road	0.26	169	281	329	*
At Brownlee Road	0.19	146	236	275	*
ABRAMS RUN					
Just upstream of confluence with Crow Creek	1.07	448	673	765	*
At Powderhorn Road	0.96	252	411	480	*
At Cemetery Road	0.57	314	447	509	*
At Croton Road	0.39	170	238	248	*
At Falcon Road	0.30	147	278	339	*
BAEDER RUN					
At confluence with Tacony Creek	0.89	680	1,070	1,270	1,690
Upstream of Wanamaker Road	0.78	540	710	770	1,125
Upstream of confluence of North Branch Baeder Run	0.31	340	540	640	860
BLAIR MILL RUN					
Downstream of confluence of Blair Mill Run Tributary	4.3	2,095	3,297	3,920	5,631
Downstream of confluence of Tributary K to Blair Mill Run	2.5	1,301	2,047	2,434	3,496
Downstream of confluence of a unnamed stream, about 300 ft southeast of the Intersection of Marilyn Road and Diane Avenue	1.3	597	940	1,118	1,606

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
BLAIR MILL RUN TRIBUTARY (TRIB 02463)	*	*	*	*	*
BUCKWALTER TRIBUTARY					
At Betcher Road	0.93	440	820	1,050	1,660
Upstream of confluence of Bonnie Brook	0.61	320	580	740	1,140
COLMAR TRIBUTARY					
At Old Bethlehem Pike (State Route 309)	3.5	955	1,350	1,472	1,830
At Cowpath Road	1.4	402	573	644	924

* Data Not Available

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
CROW CREEK					
At a point approximately 850 feet upstream of confluence with Schuylkill River	4.64	1,645	2,883	3,544	*
At Covered Bridge Road	4.11	1,635	2,856	3,269	*
Just downstream of confluence of Abrams Run	3.24	1,505	2,542	2,615	*
Just upstream of confluence of Abrams Run	1.92	775	1,397	1,618	*
At Tannery Drive	1.54	625	1,219	1,462	*
At Kerrwood Drive	0.73	251	524	637	*
At Croton Road	0.53	242	454	553	*
DAVIS GROVE TRIBUTARY					
At confluence with Park Creek	2.0	570	736	814	975
At State Route 463	1.4	402	519	575	688

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
DEEP CREEK					
At Deep Creek Dam	6.6	2,150	4,110	5,270	8,040
At a point approximately 0.49 mile downstream of Henning Road	5.8	1,930	3,700	4,730	7,200
Upstream of Hildebrand Road	1.8	750	1,420	1,800	2,700
DONNY BROOK RUN					
At Stratford Avenue	1.8	740	1,380	1,750	2,850
At a point approximately 195 feet upstream of Eleventh Avenue	1.0	455	850	1,070	1,700
Upstream of Tributary to Donny Brook Run	0.49	260	490	620	970
EAST BRANCH INDIAN CREEK					
At City Avenue / US Route 1	1.40	*	*	2,022	*
Downstream of South Lancaster Avenue	1.17	*	*	1,852	*
EAST BRANCH PERKIOMEN CREEK					
At confluence with Perkiomen Creek	60.9	10,830	15,740	18,470	21,200
Downstream of confluence of Indian Creek	55.8	9,280	13,640	15,360	18,310
Upstream of confluence of Indian Creek	48.8	8,460	12,590	13,870	16,480
Approximately 2,500 feet downstream of Route 476	44.0	7,840	11,540	12,880	15,420
At Bucks County/ Montgomery County line	38.2	7,220	10,490	11,890	13,980

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
EAST TRIBUTARY STONY CREEK					
At confluence with Stony Creek	2.50	2,640	3,550	4,000	5,180
At Pulaski Drive	2.27	740	940	980	990
FROG RUN					
Approximately 1.11 miles above confluence with the Schuylkill River	1.47	551	675	728	*
Upstream of I-276	1.40	653	821	889	*
At Crooked Lane	1.08	646	816	870	*
At Church Road	0.78	682	1,006	1,082	*
Just downstream of Yerkes Road	0.78	682	1,006	1,082	*
Upstream of Yerkes Road	0.42	316	518	602	*
GOSHENHOPPEN CREEK					
At confluence with Swamp Creek	2.6	950	1,425	1,700	2,650
At a point approximately 0.49 mile upstream of Simmons Road	1.3	500	760	900	1,350
GULPH MILLS CREEK					
At South Gulph Road	4.83	1,199	1,694	1,921	*
Just downstream of confluence of Gulph Mills Creek Tributary A	4.83	1,344	2,364	2,934	*
Just upstream of confluence of Gulph Mills Creek Tributary A	1.02	584	1,043	1,254	*
Just downstream of confluence of Gulph Mills Creek Tributary B	1.02	584	1,075	1,300	*
Just upstream of confluence of Gulph Mills Creek Tributary B	0.71	459	828	994	*

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Approximately 0.34 mile upstream of confluence of Gulph Mills Creek Tributary B	0.37	251	444	530	*
GULPH MILLS CREEK TRIBUTARY A					
Upstream of confluence with Gulph Mills Creek	3.71	963	1,726	2,071	*
GULPH MILLS CREEK TRIBUTARY B					
At Lantern Lane	0.31	134	262	321	*
HOSENSACK CREEK					
Upstream of confluence with Perkiomen Creek	18.0	2,330	4,550	5,850	10,000
Downstream of confluence of Huntingdon Valley Creek Tributary No. 2	1.80	560	1,270	1,700	3,100
Upstream of confluence of Huntingdon Valley Creek Tributary No.2	1.35	500	1,000	1,320	2,500
HUNTINGDON VALLEY CREEK					
480 feet upstream of State Highway 232	3.88	1,913	3,111	3,733	5,457
320 feet downstream of Red Lion Road	3.50	1,717	2,792	3,350	4,898
670 feet upstream of Red Lion Road	3.27	1,668	2,712	3,254	4,758
300 feet upstream of confluence of Huntingdon Valley Creek Tributary No. 1	3.15	1,619	2,632	3,159	4,618
Upstream of Philmont Avenue	3.09	1,520	2,473	2,967	4,338

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
1600 feet upstream of confluence of Huntingdon Valley Creek Tributary No. 2	1.30	687	1,117	1,340	1,959
2450 feet downstream of Byberry Road	1.05	540	877	1,053	1,539
2010 feet downstream of Byberry Road	0.93	490	798	957	1,399
190 feet downstream of Edencroft Road	0.66	451	734	881	1,287
150 feet upstream of Buck Road	0.41	216	351	421	616
140 feet upstream of Warfield Drive	0.27	162	263	316	462
INDIAN CREEK					
At confluence with East Branch Perkiomen Creek	7.0	2,200	3,150	3,500	4,400
LANSDALE TRIBUTARY					
At confluence with West Branch Neshaminy Creek	2.5	783	1,127	1,265	1,598
At Koffel Road	0.4	311	475	542	690
LITTLE NESHAMINY CREEK					
At a point approximately 0.90 mile downstream of Kenas Road	3.93	1,258	2,083	2,512	3,731
At State Route 463 (Horsham Road)	1.58	658	1,088	1,313	1,950
LITTLE NESHAMINY CREEK TRIBUTARY NO. 1					
Above confluence with Little Neshaminy Creek	0.26	194	320	386	573

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
LITTLE NESHAMINY CREEK TRIBUTARY NO. 2					
Above confluence with Little Neshaminy Creek	1.29	556	919	1,109	1,647
At Stump Road	0.77	387	640	772	1,146
LODAL CREEK					
At Township Line Road	3.8	1,380	2,620	3,340	5,060
Upstream of Graterford Road	1.1	510	950	1,200	1,790
MACOBY CREEK					
At confluence with Perkiomen Creek	17.4	2,640	5,100	6,500	11,000
MACOBY CREEK (continued)					
At a point approximately 0.24 mile upstream of State Route 29 (Gravel Pike)	16.9	2,640	5,100	6,500	11,000
Upstream of McLeans Station Road	13.6	2,530	4,880	6,230	10,180
Upstream of Hendricks Road	11.6	2,470	4,760	6,090	9,750
Upstream of confluence of Stony Run	7.4	2,350	4,520	5,790	8,840
At Buck Road	5.9	1,960	3,750	4,800	7,320
At Ott Road	5.2	1,770	3,380	4,330	6,580
Upstream of confluence of Macoby Creek Branch	1.7	720	1,350	1,720	2,580
At Taggart Road	1.4	615	1,150	1,470	2,200
At Kraussdale Road	1.0	470	880	1,110	1,660
MACOBY CREEK BRANCH					
Upstream of confluence with Macoby Creek	3.4	1,260	2,390	3,050	4,610

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
MANATAWNY CREEK					
At confluence with with the Schuylkill River	91.6	9,200	13,400	16,100	23,100
At a point approximately 0.19 mile upstream of Glasgow Street	88.7	9,080	13,200	15,900	22,200
MATSUNK CREEK					
At Swedeland Road	0.71	255	386	458	*
At Renaissance Boulevard	0.71	291	524	627	*
At Crooked Lane	0.13	169	276	321	*
At a point approximately 150 feet upstream of School Line Drive	0.08	81	140	166	*
MEADOW BROOK					
Upstream of railroad near Meadowbrook Drive	3.72	2,358	3,843	4,621	6,768
740 feet upstream of railroad	3.63	2,234	3,641	4,377	6,412
80 feet downstream of confluence of Robinhood Brook	3.28	2,172	3,540	4,256	6,234
440 feet downstream of Mill Road	2.59	1,675	2,731	3,283	4,809
180 feet downstream of confluence of Tributary No. 1 to Meadow Brook	2.41	1,644	2,680	3,222	4,720
Upstream of Meadowbrook Road	2.19	1,365	2,225	2,675	3,919
Upstream of Valley Road	1.86	1,241	2,023	2,432	3,562
Upstream of Woodland Road and downstream of Dorel Road	1.63	1,179	1,922	2,310	3,384
470 feet upstream of State Highway 2017	0.58	683	1,113	1,338	1,959
750 feet downstream of State Highway 2017	0.31	211	344	413	606
1000 feet upstream of State Highway 2017	0.12	99	162	195	285

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
MIDDLE CREEK					
At the confluence with Swamp Creek	4.5	1,580	3,000	3,840	5,830
At a point approximately 0.30 mile downstream of Middle Creek Road	4.5	1,510	2,870	3,660	5,780
At confluence of Tributary F	2.7	1,040	1,980	2,520	3,900
MILL CREEK					
At confluence with the Schuylkill River	8.32	2,180	3,240	3,770	5,000
At County Line Road	0.43	340	500	590	780
MINGO CREEK					
At Old Mill Road	4.4	1,550	2,950	3,770	5,720
Upstream of Walnut Street	3.5	1,290	2,440	3,120	4,730
Upstream of Mingo Creek Tributary No. 1	1.6	690	1,290	1,640	2,450
Downstream of Linfield Trappe Road	1.1	510	950	1,200	1,790
MINGO CREEK TRIBUTARY NO.1					
At confluence with Mingo Creek	1.1	600	1,150	1,480	2,280
MINISTER CREEK					
Upstream of Reifsnyder Road	7.7	2,420	4,640	5,940	9,080
Upstream of confluence of Minister Creek Tributary	4.1	1,460	2,780	3,560	5,400
At a point approximately 0.34 mile downstream of confluence of Oley Creek	3.88	1,400	2,660	3,400	5,400

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
At a point approximately 0.27 mile upstream of Sweinhart Road	0.32	185	345	435	680
MINISTER CREEK TRIBUTARY					
At confluence with Minister Creek	1.4	615	1,150	1,470	2,200
NORTH BRANCH BAEDER RUN					
At confluence with Baeder Run	0.40	300	400	450	560
Upstream of confluence with Baeder Run	0.30	220	280	320	400
NORTH BRANCH ZACHARIAS CREEK					
At confluence with Zacharias Creek	0.7	500	900	1,200	1,900
NORTH HATFIELD TRIBUTARY					
At confluence with West Branch Neshaminy Creek	1.6	507	855	1,011	1,343
OAK TERRACE TRIBUTARY					
At State Route 152 (Limekiln Pike)	3.3	925	1,177	1,303	1,550
At State Route 63	0.4	194	252	275	330
OLEY CREEK					
At confluence with Minister Creek	1.61	635	1,110	1,370	2,125
At a point approximately 0.25 mile upstream of Sweinhart Road	0.26	195	345	425	660

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
PARK CREEK					
Near Keith Valley Road	10.3	1,980	3,300	3,850	5,500
At Davis Grove Road	7.9	1,620	2,700	3,150	4,500
Just downstream of confluence of Oak Terrace Tributary	7.1	1,440	2,400	2,800	4,050
At State Route 152	3.6	627	795	909	1,100
PENNYPACK CREEK					
390 feet downstream of Moredon Road	37.66	10,204	16,197	20,055	30,819
300 feet upstream of Moredon Road	36.45	9,608	15,194	18,836	29,001
600 feet upstream of State Highway 232	35.34	9,130	14,391	17,861	27,547
140 feet upstream of railroad	31.46	8,880	13,920	16,750	25,377
800 feet upstream of railroad	24.47	8,652	13,666	16,295	23,697
1,100 feet downstream of Paper Mill Road	24.20	8,433	13,292	15,839	22,943
700 feet downstream of Paper Mill Road	23.46	7,950	12,468	14,835	21,437
460 feet downstream of Davisville Road	15.63	7,658	11,984	14,226	20,386
870 feet upstream of Davisville Road	15.38	7,446	11,655	13,836	19,829
990 feet downstream of railroad	13.62	6,551	10,262	12,186	17,470
Downstream of confluence of Pennypack Creek Tributary No. 1	12.28	5,877	9,214	10,943	15,694
180 feet downstream of Warminster Road	9.81	4,705	7,390	8,782	12,605
60 feet downstream of confluence of Blair Mill Run	8.36	4,378	6,881	8,179	11,744

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
300 feet downstream of State Highway 611	3.26	1,695	2,668	3,172	4,557
760 feet upstream of Dresher Road	2.64	1,277	2,010	2,390	3,434
740 feet downstream of Sawyers Way	2.06	1,115	1,754	2,086	2,997
1050 feet upstream of Sawyers Way	1.43	701	1,104	1,312	1,885
Downstream of confluence of Pennypack Creek Branch	1.21	562	885	1,052	1,511
70 feet downstream of Witmer Road	0.78	390	614	730	1,049
360 feet upstream of State Highway 63	0.05	177	278	330	474
PENNYPACK CREEK BRANCH (TRIB B TO PENNYPACK)					
120 feet downstream of State Highway 63	0.06	167	263	313	450
PENNYPACK CREEK TRIBUTARY NO. 1 (TRIB 02460)					
680 feet downstream of State Highway 611	1.99	1,142	1,777	2,105	3,009
400 feet downstream of Maryland Road	1.52	906	1,409	1,669	2,386
530 feet downstream of Blair Mill Road	1.40	755	1,174	1,391	1,988
370 feet downstream of State Highway 63	0.05	548	853	1,011	1,445
Downstream of State Highway 63	0.03	25	39	46	66

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
PERKIOMEN CREEK					
At confluence with the Schuylkill River	362.0	28,900	44,000	47,600	61,700
At a point approximately 0.63 mile upstream of confluence of Norma Run	293.9	26,800	39,300	44,600	57,800
At confluence of Tributary A to Perkiomen Creek	291.2	26,800	39,300	44,600	57,800
At USGS gage No. 01473000 at Graterford	279.0	26,300	38,300	43,500	55,900
Downstream of confluence of Swamp Creek	206.0	20,600	31,500	34,200	41,400
Upstream of confluence of Swamp Creek	150.6	17,500	26,200	28,200	34,700
At a point approximately 350 Feet upstream of Kratz Road	142.8	16,500	24,700	27,200	32,800
Upstream of confluence of Unami Creek	95.0	12,900	20,000	20,800	25,500
Upstream of confluence of Deep Creek	89.0	12,400	19,400	20,300	24,600
Upstream of confluence of Macoby Creek	71.0	10,800	15,200	17,800	21,200
Upstream of Church Road	37.8	4,250	8,000	10,150	16,800
Upstream of confluence of Hosensack Creek	17.0	2,220	4,350	5,600	9,500
PINE RUN					
530 feet upstream of confluence of Sandy Run	6.4	2,432	4,833	6,229	10,637
Upstream of confluence of Rapp Run	3.60	1,464	2,875	3,727	6,445

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
190 feet downstream of Susquehanna Road	2.12	990	1,960	2,523	4,364
Upstream of confluence of Tributary No. 2 to Pine Run	1.06	385	796	1,044	1,828
120 feet upstream of Aidenn Lair Road	0.73	272	562	736	1,289
PLYMOUTH CREEK					
At confluence with Schuylkill River	7.10	2,700	3,700	4,293	5,600
At a point approximately 0.30 mile upstream of Elm Street	6.30	1,860	2,480	2,820	3,730
Approximately 650 feet upstream of Plymouth Road	2.86	1,150	1,600	1,900	2,500
RAPP RUN					
Upstream of confluence of Pine Run	2.08	1,088	1,854	2,292	3,646
Upstream of confluence of Tributary No. 1 to Rapp Run	1.23	534	1,039	1,341	2,282
520 feet upstream of Susquehanna Road	0.85	397	781	1,013	1,725
180 feet upstream of Jarrettown Road	0.51	230	467	607	1,049
ROSE VALLEY CREEK					
At a point approximately 70 feet downstream of North Main Street	1.97	*	*	2,360	*
At a point approximately 0.28 mile upstream of Hendricks Street	1.70	*	*	2,200	*

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
SANATOGA CREEK					
At confluence with the Schuylkill River	7.1	2,275	4,360	5,585	8,800
Upstream of Pruss Hill Dam	2.2	870	1,645	2,095	3,320
SANDY RUN					
580 feet downstream of confluence of Pine Run	12.20	4,460	7,709	9,741	16,941
Upstream of confluence of Pine Run	5.85	2,229	3,931	4,945	8,165
1800 feet upstream of State Highway 152	3.74	2,016	3,442	4,317	7,013
450 feet downstream of State Highway 2017	2.60	1,479	2,537	3,146	5,020
280 feet upstream of confluence of Sandy Run Tributary No. 1A	1.11	689	1,169	1,443	2,290
SANDY RUN TRIBUTARY NO. 1					
Upstream of confluence of Sandy Run	0.54	377	622	762	1,191
SANDY RUN TRIBUTARY NO. 1A					
Upstream of confluence of Sandy Run	0.65	310	560	705	1,156
SAWMILL RUN					
At East Johnson Highway	3.0	1,137	2,154	2,748	4,153
SCHLEGEL RUN					
At confluence with Swamp Creek	5.70	1,910	3,650	4,670	7,110
At a point approximately 0.23 mile downstream of Kulps Road	5.80	1,820	3,480	4,450	7,090
At Hoffmansville Road	0.84	408	758	961	1,500

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
SCHUYLKILL RIVER					
Upstream of confluence of Wissahickon Creek (USGS gage No. 01473193)[1]	1,690	62,900	93,700	109,000	146,000
Upstream of confluence of Perkiomen Creek (USGS gage No. 01472162)[1]	1,280	42,300	63,300	73,900	100,000
Upstream of confluence of French Creek (USGS gage No. 01472000)	1,147	36,200	54,200	63,400	86,000
Upstream of confluence of Manatawny Creek (USGS gage No. 01471510)	880	32,300	47,900	55,500	74,300

[1]These are interpolated results

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
SCIOTO CREEK					
At confluence with Swamp Creek	4.5	1,150	1,800	2,200	3,500
At Simmons Road	4.0	1,100	1,650	2,000	3,200
At a point approximately 0.49 mile downstream of Faust Road	3.4	1,100	1,650	2,000	3,200
Upstream of Perkiomenville Road	2.5	900	1,400	1,700	2,700
Upstream of Heimback Road	2.0	750	1,170	1,420	2,250
SKIPPACK CREEK					
At confluence with Perkiomen Creek	55.8	8,480	11,500	13,200	17,700
At Quarry Bridge Road	13.9	4,210	7,540	9,420	15,700
At Rittenhouse Road	12.8	3,880	7,050	8,850	14,600

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
At a point approximately 600 feet upstream of State Route 63 (Sumneytown Pike)	11.3	3,630	6,660	8,390	13,800
At a point approximately 0.54 mile upstream of Cowpath Road	6.2	2,300	3,950	5,000	8,400
SKIPPACK CREEK TRIBUTARY NO. 1					
At confluence with Skippack Creek	2.1	890	1,620	2,040	3,550
Approximately 140 feet upstream of Collegeville Road	1.4	640	1,150	1,450	2,570
SKIPPACK CREEK TRIBUTARY NO. 2					
At Wambold Road	2.59	1,010	1,910	2,430	4,000
At Allentown Road	1.12	513	960	1,220	1,990
SOUTHAMPTON CREEK					
100 feet downstream of Byberry Road	5.54	1,614	2,588	3,095	4,496
Upstream of railroad (about 1,000 feet downstream of I-276)	5.44	1,459	2,339	2,797	4,064
SPROGELS RUN					
At confluence with the Schuylkill River	7.1	2,265	4,345	5,565	8,900
At State Route 663 (Charlotte Road)	2.5	970	1,835	2,340	3,700
Downstream of Mauger's Mill Road	1.8	750	1,420	1,800	2,710
Downstream of Snyders Road	1.0	470	880	1,110	1,660

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
STONY CREEK					
At confluence with the Schuykill River	21.2	3,540	5,550	6,650	9,500
Upstream of confluence of Stony Creek Tributary	15.7	3,300	4,900	5,750	7,800
At a point approximately 1.09 mile downstream of U.S. Route 422 (Germantown Pike)	8.47	2,880	3,920	4,420	5,710
At Township Line Road	6.78	2,640	3,550	4,000	5,180
At North Wales Road	3.59	1,900	2,610	3,020	4,190
STONY CREEK TRIBUTARY					
At the confluence with Stony Creek	3.8	1,380	2,620	3,340	5,060
Approximately 200 feet Downstream of Skippack Pike	1.46	*	*	1,490	*
STONY RUN					
Upstream confluence with Macoby Creek	3.3	1,230	2,330	2,970	4,500
SWAMP CREEK					
At Spring Mount Road	55.4	6,650	10,750	13,150	22,000
At State Route 73	52.8	6,500	10,550	12,800	21,750
At Gerloff Road	51.8	6,500	10,550	12,750	21,500
At a point approximately 0.27 mile upstream of Neiffer Road	44.2	5,800	9,500	11,450	19,000
At a point approximately 0.48 mile downstream of West Branch Swamp Creek	42.9	5,680	9,200	11,200	18,600
Upstream of confluence of West Branch Swamp Creek	39.6	5,400	8,700	10,600	17,600

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
Upstream of Big Road	26.5	4,100	6,600	8,100	13,500
At a point approximately 0.54 mile downstream of Detar Road	14.21	2,110	3,700	4,560	7,090
At County Line Road	11.55	1,820	3,195	3,935	6,115
TACONY CREEK					
At a point approximately 0.16 mile downstream of confluence of Baeder Run	17.0	3,400	4,400	5,100	6,400
Near Jenkintown	6.4	1,700	2,300	2,700	3,300
TANNERY RUN					
At a point approximately 700 feet downstream of North Maple Street	0.69	*	*	700	*
At Lindenwold Avenue	0.63	*	*	630	*
At a point approximately 680 feet upstream of Woodland Avenue	0.55	*	*	600	*
TOWAMENCIN CREEK NO. 1					
At Metz Road	9.96	2,780	5,270	6,720	10,800
Approximately 255 feet upstream of confluence of West Branch Towamencin Creek	5.35	1,810	3,460	4,430	7,200
At Trumbauer Road	5.07	1,740	3,310	4,240	6,840
At Pennsylvania Turnpike (Northeast Extension) Interstate Route 276	3.72	1,350	2,570	3,280	5,350
At Valley Forge Road	2.75	1,060	2,010	2,560	4,120
TOWAMENCIN CREEK NO. 2					
At confluence with West Branch Neshaminy Creek	0.32	155	272	321	435

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
TRIBUTARY NO. 1 TO UNIONVILLE TRIBUTARY					
At confluence with Unionville Tributary	0.6	534	800	907	1,146
TRIBUTARY NO. 2 TO PINE RUN					
Upstream of confluence of Pine Run	0.49	196	414	548	980
TRIBUTARY TO TROUT CREEK					
Downstream of Pennsylvania Turnpike Interstate Route 276	1.2	*	*	922	*
TROUT CREEK					
At confluence with the Schuylkill River	8.8	2,000	2,950	3,300	4,350
UNAMI CREEK					
At confluence with Perkiomen Creek	48.8	8,000	15,800	20,200	35,000
Upstream of Sumneytown Road (State Route 63)	36.7	6,500	13,000	17,000	28,000
UNIONVILLE TRIBUTARY					
At confluence with West Branch Neshaminy Creek	4.7	750	1,200	1,420	2,000
At State Route 309	2.9	510	815	965	1,360

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
UNNAMED CREEK A					
At a point approximately 0.21 mile upstream of confluence with Matsunk Creek	0.42	205	335	387	*
At B Street	0.30	108	201	251	*
UNNAMED TRIBUTARY TO STONY CREEK TRIBUTARY					
At Dekalb Pike	0.31	*	*	484	*
VAUGHN RUN					
At confluence with East Branch Perkiomen Creek	1.3	680	1,140	1,460	2,100
WAR MEMORIAL CREEK (ROUND MEADOW RUN)					
50 feet downstream of confluence of Morgan Mill Creek	1.71	845	1,315	1,558	2,227
1,779 feet downstream of State Highway 263	0.94	614	955	1,132	1,617
60 feet downstream of State Highway 263	0.64	377	587	696	994
* Data Not Available					
WEST BRANCH NESHAMINY CREEK					
At County Line Road	17.8	2,270	3,420	4,010	5,290
At County Line Road of Unionville Tributary	12.2	1,670	2,530	2,960	3,910
At East Vine Street	4.07	1,530	2,080	2,260	2,840
At Township Line Road	0.6	206	284	348	439

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
WEST BRANCH NESHAMINY CREEK TRIBUTARY					
At a point approximately 0.17 mile downstream of Crystal Road	0.96	308	416	468	577
At Richardson Road	0.81	280	374	424	523
At Doylestown Road (U.S. Route 202)	0.21	86	115	128	158
WEST BRANCH PERKIOMEN CREEK					
At West Branch Road	20.57	3,020	4,925	5,910	8,300
At a point approximately 170 feet upstream of Niantic Road	15.50	2,475	4,045	4,855	6,800
WEST BRANCH SKIPPACK CREEK					
At Quarry Road	4.5	1,510	2,180	2,450	3,080
At Old Morris Road	3.0	1,100	1,560	1,770	2,210
At Sumneytown Pike	1.5	630	890	990	1,210
WEST BRANCH STONY CREEK					
At confluence with Stony Creek	1.46	*	*	1,490	*
WEST BRANCH SWAMP CREEK					
At confluence with Swamp Creek	2.6	1,010	1,920	2,440	3,690
Upstream of Swamp Pike	1.8	750	1,420	1,800	2,710

* Data Not Available

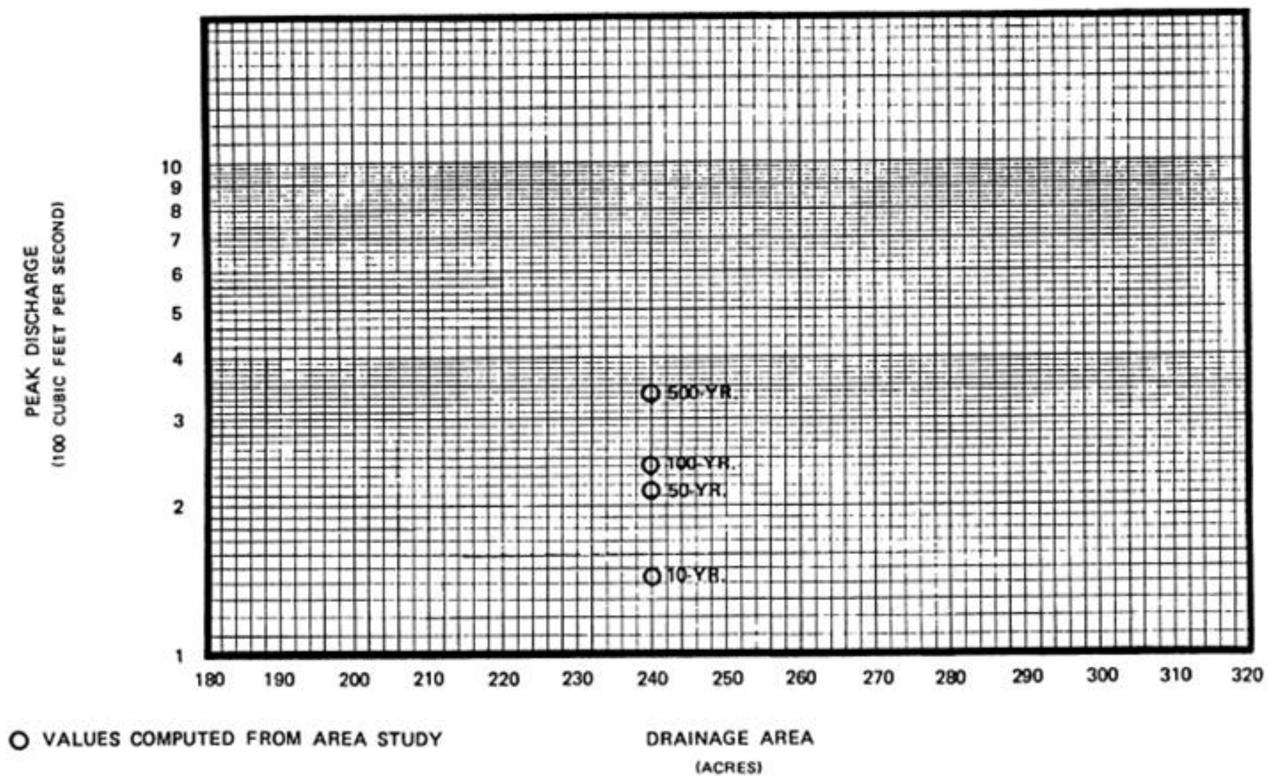
TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
WEST BRANCH TOWAMENCIN CREEK					
At confluence with Towamencin Creek No.1	3.6	1,320	2,500	3,190	5,300
At Pennsylvania Turnpike (Northeast Extension) Interstate Route 276	3.22	1,200	2,280	2,910	4,920
At Keeler Road	1.94	800	1,510	1,920	3,050
At Allentown Road	0.46	251	460	585	990
WEST BRANCH TOWAMENCIN CREEK TRIBUTARY NO. 3					
At confluence of West Branch Towamencin Creek	0.61	315	583	738	1,410
At Weikel Road	0.40	224	413	521	984
At Woodlawn Drive	0.28	168	308	388	720
WISSAHICKON CREEK					
At West Wissahickon Avenue	49.8	8,300	11,200	12,600	15,700
At a point approximately 1,750 feet upstream of West Wissahickon Avenue	27.3	5,400	7,400	8,330	10,800
At a point approximately 600 feet upstream of Morris Road	24.1	4,980	6,830	7,650	9,900
At a point approximately 670 feet upstream of confluence of Tannery Run	20.6	3,840	5,310	6,120	7,700
At a point approximately 0.42 mile upstream of Penllyn Blue Bell Pike	16.44	2,800	3,920	4,450	5,700
At Swedesford Road	8.8	2,360	3,240	3,680	4,660
At Wissahickon Avenue	1.65	1,370	1,900	2,480	2,650
At Knapp Road	1.16	557	783	870	1,040

* Data Not Available

TABLE 3- SUMMARY OF DISCHARGES (continued)

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cubic feet per second) 10-Percent-Annual-Chance	2-Percent-Annual-Chance	1-Percent-Annual-Chance	0.2-Percent-Annual-Chance
ZACHARIAS CREEK					
At confluence with Skippack Creek	8.2	4,500	8,100	10,400	16,200
At USGS crest stage partial record gage	7.3	4,200	7,500	9,600	15,000
Downstream of North Branch Zacharias Creek	2.7	2,100	3,700	4,700	7,400



FEDERAL EMERGENCY MANAGEMENT AGENCY

MONTGOMERY COUNTY, PA
(ALL JURISDICTIONS)

FREQUENCY-DISCHARGE, DRAINAGE AREA CURVES

DODSWORTH RUN

FIGURE 1

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals. Users should be aware that flood elevations shown on the Flood Insurance Rate Map (FIRM) represent rounded whole-foot elevations and may not exactly reflect the elevations shown on the Flood Profiles or in the Floodway Data table in the FIS report. Flood elevations shown on the FIRM are primarily intended for flood insurance rating purposes. For construction and/or floodplain management purposes, users are cautioned to us the flood elevation data presented in this FIS report in conjunction with the data shown on the FIRM.

Cross sections for the flooding sources studied by detailed methods were obtained from field and aerial surveys. Below water cross sections were obtained from field measurements. Cross sections were located at close intervals above and below bridges in order to compute the backwater effects of these structures. Digitized natural ground sections were obtained at points between bridges. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1), and selected cross section locations are also shown on the FIRM (Exhibit 2).

Flood elevations are often raised by debris jams during major floods; the hydraulic analyses for this study, however, were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Pre-countywide Analyses

Each community within Montgomery County, except for the Boroughs of East Greenville, Jenkintown, and Pennsburg has a previously printed FIS report. The hydraulic analyses described in those reports have been compiled and are summarized below.

Cross sections for the backwater analyses of the following streams were obtained from aerial photographs, and below-water cross sections were obtained by field surveys: Buckwalter Tributary; Colmar Tributary in the Township of Hatfield; Davis Grove Tributary; Deep Creek; Donny Brook in the Borough of Trappe; East Tributary Stony Creek; Goshenhoppen Creek in the Township of Upper Frederick; Hosensack Creek; Lansdale Tributary; Little Neshaminy Creek; Little Neshaminy Creek Tributary No. 1; Little Neshaminy Creek Tributary No. 2; Lodal Creek; Macoby Creek in the Borough of Green Lane and the Townships of Marlborough and

Upper Hanover; Macoby Creek Branch; Manatawny Creek in the Borough of Pottstown; Middle Creek; Mill Creek; Mingo Creek; Mingo Creek Tributary No. 1; Minister Creek; Minister Creek Tributary; West Branch Neshaminy Creek Tributary No. 2 ; North Hatfield Tributary; Oak Terrace Tributary; Oley Creek; Park Creek; Pennypack Creek Branch; Perkiomen Creek in the Borough of Green Lane and the Townships of Lower Providence, Marlborough, Upper Frederick, Upper Hanover, and Upper Providence; Plymouth Creek; Sanatoga Creek; Sandy Run in the Township of Whitemarsh Sawmill Run; Schlegel Run; Scioto Creek in the Township of Upper Frederick; Skippack Creek in the Townships of Lower Providence and Towamencm; Skippack Creek Tributary No. 2; Sprogels Run; Stony Creek; Stony Creek Tributary; Stony Run; Swamp Creek; Towamencin Creek No. 1; Towamencin Creek No. 2; Tributary No. 1 to Unionville Tributary; Trout Creek; Unami Creek in the Township of Marlborough; Unionville Tributary; West Branch Neshaminy Creek; West Branch Neshaminy Creek Tributary; West Branch Perkiomen Creek; West Branch Swamp Creek; West Branch Towamencin Creek; West Branch Towamencin Creek Tributary No. 3; and Wissahickon Creek in the Boroughs of Ambler and Lansdale and the Townships of Lower Gwynedd, Upper Gwynedd, Whiternarsh, and Whitpain (References 68-76).

Data pertaining to waterway permit plans and construction were obtained from the Pennsylvania Department of Environmental Resources.

Construction drawings for the Stony Creek Bridge at Marshall Street were provided by the Borough of Norristown design professional (Reference 77).

Cross sections for Baeder Run in the Township of Abington were taken from topographic maps provided by the Township of Abington.

Cross sections for Sandy Run in the Townships of Springfield, Upper Dublin, and Whitemarsh and Wissahickon Creek in the Township of Springfield were obtained by photogrammetric methods (Reference 78). The ground control for the photogrammetry was acquired using conventional surveying techniques. Bridges and culverts were field surveyed (Reference 79).

Cross sections for all other flooding sources studied by detailed methods were obtained from field surveys (References 80 and 81). In some cases, cross sections and bridge data were field checked to insure validity as well as to verify if bridges have been added, removed, or destroyed. All bridges, dams, and culverts were field surveyed to obtain elevation data and structural geometry.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program. except where otherwise noted (Reference 82).

Water-surface elevations for Macoby Creek in the Borough of Green Lane and Unami Creek in the Township of Marlborough were calculated without consideration of the backwater effects of Perkiomen Creek.

Water-surface elevations for West Branch Swamp Creek were calculated without consideration of the backwater effects of Swamp Creek.

Water-surface elevations of the flood control pool in the Borough of Norristown were obtained from the 1972 FIS for the Borough of Norristown (Reference 83).

The hydraulic analysis for Stony Creek at Marshall Street takes into account physical conditions resulting front the construction of the Marshall Street Bridge (Reference 84).

Water-surface elevations for Rose Valley Creek and Tannery Run were determined by a combination of manual culvert computations, flow-over-dam computations, and the USGS WSPRO step-backwater computer program (References 48 and 85).

Water-surface elevations for Wissahickon Creek in the Township of Springfield were interpolated from the contiguous communities of the Township of Whitemarsh and the City of Philadelphia, which both used the USACE HEC-2 step-backwater computer program (References 58, 59, and 82). No information is available regarding the methods for computing starting water-surface elevations for Erdenheim, Oreland, and St. Josephs Runs and Tributary to Oreland Run.

Data adopted from the FIS for the Township of Lower Providence, were used in the analyses of Perkiomen Creek in the Borough of Collegeville (Reference 86).

The Philadelphia Suburban Water Company supplied design and construction data pertaining to the Green Lane Dam and Reservoir. These data included mapping of the reservoir area, design hydrology, hydraulics, spillway rating curves, and plans of bridges constructed to carry roads across the feeder streams to the reservoir. Water-surface elevations for the Green Lane Reservoir were computed using the Green Lane Dam Spillway Rating Curve provided by the Philadelphia Suburban Water Company.

Footbridges and low height dams that have a negligible effect on flood elevations were not considered in this report.

Due to the topography of the area, there are numerous locations within the Borough of North Wales that are susceptible to sheet flooding. In the lower portion, of Dodsworth Run within the borough, the 1–percent annual chance flood is contained within the Walnut Street culvert; however, the area is susceptible to sheet flooding by the 0.2–percent annual chance flood. In the central and upper portions of Dodsworth Run within North Wales, the borough is susceptible to sheet flooding by all four frequency floods.

In the Boroughs of Ambler, Conshohocken, and Hatfield and the Townships of East Norriton, Lower Gwynedd, Lower Merion, Lower Providence, Plymouth, Pottstown, Upper Gwynedd, Upper Merion, Upper Providence, West Norriton, and Whitpain, the acceptability of all assumed hydraulic factors, cross section, and hydraulic structure data was checked by computations that duplicated available information on previous flooding events.

The slope/area method was used to obtain the starting-water surface elevations for the following streams: Blair Mill Run in the Township of Upper Moreland; Buckwalter Tributary; Donny Brook Run in the Borough of Collegeville; Little Neshaminy Creek; Little Neshaminy Creek Tributary No. 1; Little Neshaminv Creek Tributary No. 2; Lodal Creek; Macoby Creek in the Borough of Green Lane; Mingo Creek; Pennypack Creek Tributary No. 1; Perkiomen Creek in the Borough of Collegeville; Pine Run; Sanatoga Creek; Sandy Run in the Townships of Springfield, Upper Dublin, and Whitemarsh; Sawmill Run; Skippack Creek in the Township of Towamencin; Skippack Creek Tributary No. 2; Southampton Creek in the Township of Upper Moreland; Sprogels Run; Stony Creek; Stony Creek Tributary; Stony Run; Swamp Creek in the Township of New Hanover; Towamencin Creek No. 1; Tributary No. 1 to Unionville Tributary; Unami Creek in the Township of Marlborough; Unionville Tributary; War Memorial Creek; West Branch Perkiomen Creek; West Branch Swamp Creek; West Branch Towamencin Creek; West Branch Towamencin Creek Tributary No. 3; and Wissahickon Creek in the Borough of Ambler and the Townships of Lower Gwynedd, Springfield, Upper Gwynedd, Whitemarsh, and Whitpain.

Backwater elevations shown on the Pine Run profiles were taken from Sandy Run profiles developed for the FIS for the Township of Whitemarsh (Reference 58).

Starting water-surface elevations for the following streams were obtained from normal depth calculations: Baeder Run, Blair Mill Run, Blair Mill Run Tributary, Huntingdon Valley Creek, Meadow Brook, Pennypack Creek in the Township of Lower Moreland, Rose Valley Creek, Skippack Creek in the Township of Franconia, Southampton Creek in the Borough of Bryn Athyn, Tannery Run, and West Branch Skippack Creek.

Starting water-surface elevations for the following streams were calculated based upon coincident conditions with another stream: Blair Mill Run in the Township of Horsham; Hosensack Creek; Macoby Creek Branch; Middle Creek in the Township of New Hanover; Mingo Creek Tributary No. 1; Minister Creek in the Township of New Hanover; Minister Creek Tributary; Oley Creek; Pennypack Creek in the Boroughs of Bryn Athyn and Hatboro and the Townships of Abington. Horsham. and Upper Moreland; Schlegel Run in the Township of New Hanover; Vaughn Run; and Zacharias Creek in the Township of Worcester.

Starting water-surface elevations for the following streams were obtained from backwater computations of their respective main stern: East Branch Perkiomen Creek in the Townships of Perkiomen and Skippack, Goshenhoppen Creek in the Township of Lower Frederick, Indian Creek in the Township of Lower Salford, North Branch Zacharias Creek, Scioto Creek in the Township of Lower Frederick, Skippack Creek Tributary No. 1, Swamp Creek in the Township of Lower Frederick, and Zacharias Creek in the Township of Skippack.

For Colmar Tributary. Lansdale Tributary, North Hatfield Tributary, and Towamencin Creek No. 2, starting water-surface elevations were taken from the profiles for West Branch Neshaminy Creek.

Starting water-surface elevations for Middle Creek in the Township of Douglass, Minister Creek in the Township of Douglass, Schlegel Run in the Township of Douglass, and Swamp Creek in the Township of Douglass were based on the individual stream's flood profile data that were presented in the FIS for the Township of New Hanover (Reference 87). The streams' profiles were calculated as a unit for the Townships of Douglass and New Hanover.

Starting water-surface elevations for Davis Grove Tributary, Oak Terrace Tributary, Park Creek, and Pennypack Creek Branch were taken from uniform flow computations and a previously published study (Reference 31).

Starting water-surface elevations for Goshenhoppen Creek in the Township of Upper Frederick, Perkiomen Creek in the Township of Upper Frederick, and Scioto Creek in the Township of Upper Frederick were obtained from flood profile water-surface elevations published in FJS for the Township of Lower Frederick (Reference 88).

Starting water-surface elevations for Deep Creek in the Township of Upper Frederick were calculated based upon the Deep Creek Dam Spillway Rating Curve. Starting water-surface elevations for Deep Creek in the Township of New Hanover were based upon Deep Creek flood profile data presented in the FIS for the Township of Upper Frederick (Reference 89). The Deep Creek flood profiles were calculated as a unit for the Townships of New Hanover and Upper Frederick.

Starting water-surface elevations for Dodsworth Run and Perkiomen Creek in the Township of Lower Frederick were computed using the critical depth method.

Starting water-surface elevations for Donny Brook in the Borough of Trappe were obtained from the continuation of surface profiles for Donny Brook from the FIS for the Borough of Collegeville (Reference 90).

Starting water-surface elevations for East Branch Perkiomen Creek in the Township of Lower Salford were obtained from the FISs for the Townships of Perkiomen and Skippack (References 91 and 92). Starting water-surface elevations for East Branch Perkiomen Creek in the Township of Salford were obtained from the FIS for the Township of Upper Salford (Reference 93).

For East Branch Perkiomen Creek in the Townships of Franconia and Upper Salford and Indian Creek in the Township of Franconia, starting water-surface elevations were obtained from the FIS for the Township of Lower Salford (Reference 94).

The starting water-surface elevations for East Tributary Stony Creek were taken from the Stony Creek profiles in the FIS for the Township of Whitpain (Reference 95).

Starting water-surface elevations for Manatawny Creek in the Borough of Pottstown. Mill Creek, Perkiomen Creek in the Townships of Lower Providence and Upper Providence, Plymouth Creek, and Trout Creek were taken from the Schuylkill River flood profiles.

Starting water-surface elevations for Manatawny Creek in the Township of West Pottsgrove were taken from the flood profile developed for the Borough of Pottstown FIS by the DRBC (Reference 96).

Starting water-surface elevations for West Branch Neshaminy Creek Tributary No. 2 and Wissahickon Creek in the Borough of Lansdale were derived from uniform flow computations.

For Perkiomen Creek in the Townships of Perkiomen and Skippack, starting water-surface elevations were obtained from the FIS for the Township of Lower Providence (Reference 86). Starting water-surface elevations for Perkiomen Creek in the Borough of Schwenksville and the Township of Upper Salford were obtained from the FIS for the Township of Perkiomen (Reference 91). In the Township of Upper Hanover, starting water-surface elevations for Perkiomen Creek were calculated based on the use of the Green Lane Dam spillway rating curve.

Starting water-surface elevations for Perkiomen Creek in the Borough of Green Lane and the Township of Marlborough were based upon Perkiomen Creek flood profile data presented in the FIS for the Township of Upper Frederick (Reference 89). The Perkiomen Creek flood profiles were calculated as a unit for the Borough of Green Lane and the Townships of Marlborough and Upper Frederick.

Rapp Run starting water-surface elevations were based upon Pine Run flood profile data presented in the FIS for the Township of Upper Dublin (Reference 97).

Skippack Creek starting water-surface elevations were based upon Perkiomen Creek flood profile data presented in the FIS for the Township of Lower Providence (Reference 86).

Starting water-surface elevations for Swamp Creek in Township of Upper Frederick were based upon Swamp Creek flood profile data presented in the FIS for the Township of New Hanover (Reference 87). The Swamp Creek flood profiles were calculated as a unit for the Townships of New Hanover and Upper Frederick.

Starting water-surface elevations of Macoby Creek in the Township of Upper Hanover and Unami Creek in the Township of Upper Salford were obtained from the FIS for the Township of Marlborough (Reference 51).

Starting water-surface elevations of Macoby Creek in the Township of Marlborough were based upon Macoby Creek flood profile data presented in the FIS for the Borough of Green Lane (Reference 98). The Macoby Creek flood profiles were calculated as a unit for the Borough of Green Lane and the Townships of Marlborough and Upper Hanover.

Starting water-surface elevations for West Branch Neshaminv Creek in the Township of Hatfield were obtained from the FIS for the Township of New Britain (Reference 99). Starting water-surface elevations for West Branch Neshaminy Creek in the Borough of Hatfield were taken from the FIS for the Township of Hatfield (Reference 100).

For West Branch Neshaminy Creek Tributary, the starting-water surface elevation was obtained through interpolation of flood elevations, which were computed in the HEC-2 analysis for Colmar Tributary in the FIS for the Township of Hatfield (Reference 100).

Starting water-surface elevations for Wissahickon Creek in the Township of Upper Dublin were obtained from the Wissahickon Creek water-surface profiles developed for the FIS for the Township of Whitemarsh (Reference 58).

Adjustments were made to flood profiles in the Townships of Abington and Lower Moreland to reflect increased water-surface elevations produced by backwater effects from Pennypack Creek and Tacony Creek.

Roughness factors (Manning's "n") for Davis Grove Tributary, West Branch Neshaminy Creek Tributary No. 2, Oak Terrace Tributary, Park Creek, Pennypack Creek Branch, and Wissahickon Creek in the Borough of Lansdale for the hydraulic computations were based on previous studies by the USACE, field inspection, and review of aerial photographs (Reference 31).

For the following streams, roughness coefficients were assigned on The basis of field inspection of floodplain areas and comparisons with data on other nearby streams: Deep Creek; Goshenhoppen Creek in the Township of Upper Frederick; Hosensack Creek; Lodal Creek; Macoby Creek in the Township of Upper Hanover; Macoby Creek in the Borough of Green Lane and the Township of Marlborough; Macoby Creek Branch; Middle Creek in the Township of New Hanover; Mingo Creek; Mingo Creek Tributary No. 1; Minister Creek in the Township of New Hanover; Minister Creek Tributary: Perkiomen Creek in the Borough of Green Lane and the Townships of Marlborough, Upper Frederick, and Upper Hanover; Sawmill Run; Schlegel Run in the Township of New Hanover; Scioto Creek in the Township of Upper Frederick; Sprogels Run in the Township of Upper Pottsgrove; Stony Creek in the Borough of Norristown; Stony Creek Tributary; Stony Run; Swamp Creek in the Townships of New Hanover and Upper Frederick; Unami Creek in the Township of Marlborough; and West Branch Swamp Creek.

Roughness coefficients for East Branch Perkiomen Creek in the Township of Franconia, Indian Creek in the Township of Franconia, and West Branch Skippack Creek in the Township of Franconia were assigned based upon field inspection of the floodplain areas, engineering judgment. and a previously published report.

For all other flooding sources studied by detailed methods, roughness factors (Manning's "n") were chosen by engineering judgment and based on field observations of the stream and floodplain areas (References 79 and 101). The channel and overbank "n" values for the streams studied by detailed methods are shown in Table 4, "Manning's "n" Values," which is located on page 78.

For the streams studied by approximate methods in the Townships of East Norriton, Hatfield, Lower Gwynedd, Lower Merion, Lower Providence, Plymouth, Upper Gwynedd, Upper Merion, Upper Providence, and West Norriton, the boundary of the 1–percent annual chance flood was developed from normal depth calculations, some of which were based on information obtained from field reconnaissance and/or available topographic mapping (Reference 41). The effects of bridges, culverts, and constrictions on the water-surface elevations were considered.

In the Boroughs of Green Lane and Schwenksville and the Townships of Franconia, Lower Frederick, Marlborough, New Hanover, Upper Frederick, Upper Hanover, Upper Pottsgrove, and Worcester, the 1–percent annual chance water-surface elevations for the approximately studied streams were approximated by field inspection of the area, engineering judgment, examination of available topographic mapping, and the use of Flood Hazard Boundary Maps (References 41, 102-110). The effects of bridges, culverts, and other constructions on the flood water-surface were considered. Approximate flood limits were then interpolated between each location.

Approximate flood boundaries for Dodsworth Run in the Borough of North Wales and the tributary to West Branch Neshaminy Creek Tributary No. 2 in the Borough of Lansdale were determined by field inspection and engineering judgment.

The starting water-surface elevations for Skippack Creek in the Township of Skippack were taken from a Special Flood Hazard Information report prepared by the USACE (Reference 49).

For the approximately studied streams in the Township of Whitpain, the 1–percent annual chance water-surface elevations were computed using normal depth calculations at chosen locations along the streams.

For the streams studied by approximate methods in the Township of Lower Moreland, the peak discharges were combined with rough approximations of stream geometry from USGS topographic maps and/or field inspection to calculate the 1–percent annual chance depth of flow and the approximate top width of the estimated 1–percent annual chance flood (Reference 111).

Revised Analyses for December 19, 1996, Countywide FIS

Information on the methods used to determine water-surface elevation data for the Schuylkill River restudied as part of this countywide study is shown below.

Cross sections for the Schuylkill River were obtained from a Digital Terrain Model, which was developed from aerial photography flown in March 1991 and March 1992 (References 112-114). Below-water cross sections of the Schuylkill River were developed from topographic information obtained using CHANNEL, an ARC/INFO software application (Reference 115). When appropriate, bridge and dam measurements were taken from existing HEC-2 models. All bridge and dam information was supplemented with aerial photographs (Reference 116). New or recently renovated or altered structures were modeled using field measurements. Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 82). The HEC-2 hydraulic models for the Schuylkill River were calibrated against available gage information. The final profiles match all gage rating curves within acceptable tolerances. Comparisons were made with high water marks collected during Tropical Storm Agnes in 1972, the flood of record for the Schuylkill River basin. These marks were also modeled within acceptable limits.

Starting water-surface elevations for the Schuylkill River were obtained from the water-surface elevation at the Ben Franklin tide gage near the confluence of the Schuylkill River and the Delaware River.

Roughness factors (Manning's "n") used in the hydraulic computations for the Schuylkill River were chosen by engineering judgment and were based on inspection of aerial photographs and observations of the stream and floodplain areas (References 113 and 114).

Revised Analyses for March 2, 1998, Countywide FIS

Cross sections for West Branch Neshaminy Creek Tributary No. 2 were obtained from topographic data supplied by the Borough of Lansdale and from field surveys (References 75 and 117). Cross sections for Lansdale Tributary in the Township of Hatfield were obtained from the previously printed FIS for the township (Reference 100).

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 82). Starting water-surface elevations were determined by the slope/area method.

Backwater elevations shown on the Lansdale Tributary profiles were taken from West Branch Neshaminy Creek Tributary No. 2 profiles developed for this revision.

Revised Analyses for August 9, 1999, Countywide FIS

The analysis procedure utilized for the hydraulic evaluation involved an iterative procedure of both hydrologic computations as well as hydraulic computations. An initial hydraulic run was made with the USGS computer program WSP-2 (Reference 11 8). For the initial model run, all data were coded and input into the program. Two points of particular concern were the starting water-surface elevation at the first cross section and the quantity of flow for any particular cross section. The initial flow quantities were input from the aforementioned Gannett Fleming, Inc., report for the Township of Upper Merion (Reference 67). Flow quantities from this report were input at identified cross section locations to develop rating tables for each cross section.

Revised Analyses for October 19, 2001, Countywide FIS

Cross sections for East Branch Perkiomen Creek and Perkiomen Creek were obtained from a Digital Terrain Model (DTM), which was developed from aerial photography flown in March 1997 (References 119 and 120).

Water-surface elevations for the selected recurrence intervals were computed using the USACE HEC-RAS standard step-backwater computer program (Reference 121).

Along certain portions of Perkiomen Creek and East Branch Perkiomen Creek, a profile base line is shown on the maps to represent channel distances as indicated on the flood profiles and floodway data tables.

This Countywide Revision

Temple University conducted the detailed Pennypack Creek hydraulic study at the subbasin level. Within each subbasin, the stream reaches were obtained based on a combination of aerial survey and land topography. A Shapefile was created in GIS the stream reaches of each subbasin. Shapefiles for the banks and flowpaths were generated by creating lines at 10 and 30 feet from the stream centerlines, respectively. The Manning's coefficient for the streams was obtained by assigning a value for 24 categories based on the land use data (obtained from DVRPC). The land use shapefile was then overlaid on the stream network, and the corresponding Manning's coefficient was automatically obtained using HEC-GEORAS. Because the land use shapefile was georeferenced with an accuracy of 100 feet at some locations, the Manning's values were not always representing the physics of the problem. This was corrected when observed, but no systematic check on the "n" values was conducted.

The Sandy Run detailed study was conducted for the whole watershed. Within the watershed, the stream reaches were obtained based on a combination of aerial survey and land topography. A Shapefile was created in GIS for the stream reaches. Shapefiles for the banks and flowpaths were generated by creating lines at 10 and 20 feet from the stream centerlines, respectively. The Manning's coefficient for the streams was obtained by assigning a value for 23 categories based on the land use data (obtained from DVRPC). The land use shapefile was then overlaid on the stream network, and the corresponding Manning's coefficient was automatically obtained using HEC-GEORAS. Because the land use shapefile was georeferenced with an accuracy of 100 feet at some locations, the Manning's values were not always representing the physics of the problem. This was systematically checked and correction on the "n" values was conducted.

The channel and overbank "n" values for all of the streams studied by detailed methods are shown in Table 4, "Manning's "n" Values."

For streams studied by approximate method, HEC-RAS hydraulic models were generated in an automated environment. The water-surface elevations determined by the HEC-RAS models were then utilized to plot the 1–percent annual chance floodplain boundaries. The aforementioned HEC-RAS models do not include hydraulic structure data. Water surface profiles were computed using HEC-RAS steady state simulation. HEC-RAS applies a peak discharge at each cross section to determine a maximum water surface elevation. The elevations are calculated using the standard step method and the energy, continuity, and Manning equations. A subcritical flow regime was assumed for all reaches. Conservative Manning’s n-values were applied in the HEC-RAS model.

TABLE 4 – MANNING’S “N” VALUES

Stream	Channel "n"	Overbank "n"
Abrams Creek	0.035-0.040	0.030-0.070
Abrams Run	0.013-0.035	0.035-0.050
Baeder Run	0.018-0.070	0.040-0.110
Blair Mill Run	0.020-0.100	0.020-0.100
Blair Mill Run Tributary	0.020-0.100	0.020-0.100
Buckwalter Tributary	0.040-0.045	0.050-0.120
Colmar Tributary	0.025-0.035	0.070
Crow Creek	0.035	0.030-0.050
Davis Grove Tributary	0.040-0.050	0.050-0.130
Deep Creek	0.035-0.045	0.050-0.080
Dodsworth Run	0.012-0.032	0.050
Donny Brook Run	0.012-0.050	0.030-0.125
East Branch Indian Run	*	*
East Branch Perkiomen Creek	0.040-0.050	0.045-0.130
East Tributary Stony Creek	0.045-0.050	0.055-0.085
Erdenheim Run	*	*
Frog Run	0.035-0.040	0.020-0.050
Goshenhoppen Creek	0.035-0.040	0.060-0.080
Gulph Mills Creek	0.035-0.040	0.040-0.050
Gulph Mills Creek Tributary A	0.035	0.050
Gulph Mills Creek Tributary B	0.040	0.050
Goshenhoppen Creek	0.035-0.040	0.060-0.080
Hosensack Creek	0.035-0.040	0.035-0.080
Huntingdon Valley Creek	0.020-0.100	0.020-0.100
Indian Creek	0.030-0.040	0.050-0.125
Jenkintown Creek	0.050	0.130
Lansdale Tributary	0.020-0.035	0.060-0.075
Little Neshaminy Creek	0.030-0.050	0.050-0.110
Little Neshaminy Creek Tributary No. 1	0.045-0.060	0.075-0.120
Little Neshaminy Creek Tributary No. 2	0.025-0.050	0.060-0.120
Lodal Creek	0.040	0.055-0.080

* Data Not Available

TABLE 4 – MANNING'S "N" VALUES (continued)

Stream	Channel "n"	Overbank "n"
Macobv Creek	0.030-0.045	0.030-0.090
Macobv Creek Branch	0.040	0.050-0.080
Manatawny Creek	0.035-0.040	0.050-0.090
Matsunk Creek	0.035-0.040	0.020-0.050
Meadow Brook	0.020-0.100	0.020-0.100
Middle Creek	0.032-0.055	0.030-0.120
Mill Creek	0.020-0.043	0.015-0.090
Mingo Creek	0.040	0.055-0.080
Mingo Creek Tributary No. 1	0.035-0.040	0.050-0.060
Minister Creek	0.032-0.065	0.030-0.120
Minister Creek Tributary	0.040	0.050-0.070
West Branch Neshaminy Creek Tributary No. 2	0.035-0.050	0.050-0.150
North Branch Baeder Run	*	*
North Branch Zacharias Creek	0.035	0.050-0.100
North Hatfield Tributary	0.025-0.040	0.060-0.085
Oak Terrace Tributary	0.040-0.050	0.050-0.130
Oley Creek	0.030-0.055	0.028-0.100
Oreland Run	*	*
Park Creek	0.040-0.050	0.050-0.130
Pennypack Creek	0.030-0.100	0.001-0.500
Pennypack Creek Branch (Trib B to Pennypack)	0.020-0.100	0.020-0.100
Pennypack Creek Tributary No. 1 (Trib 02460)	0.020-0.050	0.020-0.100
Perkiomen Creek	0.020-0.045	0.055-0.100
Pine Run	0.020-0.100	0.020-0.100
Plymouth Creek	0.022-0.050	0.065-0.100
Rapp Run	0.020-0.050	0.020-0.100
Rock Creek	0.015-0.050	0.130
Rose Valley Creek	0.014-0.050	0.020-0.160
Sanatoga Creek	0.030-0.050	0.070-0.120
Sandy Run	0.020-0.100	0.010-0.100
Sandy Run Tributary No. 1	0.030	0.030-0.050
Sandy Run Tributary No. 1A	0.030-0.100	0.030-0.100
Sawmill Run	0.045	0.060-0.080
Schlegel Creek	0.030-0.050	0.028-0.100
Schuylkill River	0.025-0.035	0.030-0.230
Scioto Creek	0.035-0.040	0.060-0.070
Skippack Creek	0.030-0.055	0.040-0.120
Skippack Creek Tributary No. 1	0.030-0.050	0.050-0.125

* Data Not Available

TABLE 4 – MANNING'S "N" VALUES (continued)

Stream	Channel "n"	Overbank "n"
Skippack Creek Tributary No. 2	0.045-0.060	0.035-0.100
Southampton Creek	0.020-0.100	0.020-0.100
Sprogels Run	0.020-0.040	0.070-0.120
St. Josephs Run	*	*
Stony Creek	0.028-0.050	0.040-0.100
Stony Creek Tributary	0.045	0.100
Stony Run	0.040	0.060-0.080
Swamp Creek	0.030-0.050	0.028-0.120
Tacony Creek	*	*
Tannery Run	0.014-0.050	0.020-0.160
Towamencin Creek No. 1	0.040-0.055	0.040-0.120
Towamencin Creek No. 2	0.045-0.080	0.075-0.180
Tributary No. 2 to Pine Run	0.030-0.100	0.020-0.100
Tributary to Oreland Run	*	*
Tributary to Trout Creek	*	*
Trout Creek	0.020-0.040	0.045-0.065
Unami Creek	0.035-0.075	0.040-0.120
Unionville Tributary	0.025-0.038	0.080-0.135
Unnamed Creek A	0.015-0.040	0.015-0.060
Unnamed Tributary to Stony Creek Tributary	*	*
Valley Creek	0.035-0.050	0.070-0.100
Vaughn Run	0.035	0.035-0.060
War Memorial Creek (Round Meadow Run)	0.020-0.100	0.020-0.100
West Branch Neshaminy Creek	0.022-0.055	0.050-0.120
West Branch Neshaminy Creek Tributary	0.030-0.045	0.040-0.100
West Branch Neshaminy Creek Tributary 2	*	*
West Branch Perkiomen Creek	0.032-0.050	0.035-0.120
West Branch Skippack Creek	0.030-0.045	0.060-0.100
West Branch Swamp Creek	0.040	0.050-0.080
West Branch Towamencin Creek	0.024-0.055	0.040-0.100
West Branch Towamencin Creek Tributary No. 3	0.013-0.055	0.040-0.120
Wissahickon Creek	0.025-0.060	0.048-0.150
Zacharias Creek	0.035-0.050	0.040-0.125

* Data Not Available

This entire study was updated to the North American Vertical Datum of 1988 (NAVD 88).

All qualifying benchmarks within a given jurisdiction that are catalogued by the National Geodetic Survey (NGS) and entered into the National Spatial Reference System (NSRS) as First or Second Order Vertical and have a vertical stability classification of A, B or C are shown and labeled on the FIRM with their 6-character NSRS Permanent Identifier.

Benchmarks catalogued by the NGS and entered into the NSRS vary widely in vertical stability classification. NSRS vertical stability classifications are as follows:

- Stability A: Monuments of the most reliable nature, expected to hold position/elevation (e.g., mounted in bedrock)
- Stability B: Monuments which generally hold their position/elevation (e.g., concrete bridge abutment)
- Stability C: Monuments which may be affected by surface ground movements (e.g., concrete monument below frost line)
- Stability D: Mark of questionable or unknown vertical stability (e.g., concrete monument above frost line, or steel witness post)

In addition to NSRS benchmarks, the FIRM may also show vertical control monuments established by a local jurisdiction; these monuments will be shown on the FIRM with the appropriate designations. Local monuments will only be placed on the FIRM if the community has requested that they be included, and if the monuments meet the aforementioned NSRS inclusion criteria.

To obtain current elevation, description, and/or location information for benchmarks shown on the FIRM for this jurisdiction, please contact the Information Services Branch of the NGS at (301) 713-3242, or visit their Web site at www.ngs.noaa.gov.

It is important to note that temporary vertical monuments are often established during the preparation of a flood hazard analysis for the purpose of establishing local vertical control. Although these monuments are not shown on the FIRM, they may be found in the Technical Support Data Notebook associated with the FIS report and FIRM for this community. Interested individuals may contact FEMA to access these data.

3.3 Vertical Datum

All FIS reports and FIRMs are referenced to a specific vertical datum. The vertical datum provides a starting point against which flood, ground, and structure elevations can be referenced and compared. Until recently, the standard vertical datum used for newly created or revised FIS reports and FIRMs was the National Geodetic Vertical Datum of 1929 (NGVD 29). With the completion of the North American Vertical Datum of 1988 (NAVD 88), many FIS reports and FIRMs are now prepared using NAVD 88 as the referenced vertical datum.

All flood elevations shown in this FIS report and on the FIRM are now referenced to NAVD 88. In order to perform this conversion, effective NGVD 29 elevation values were adjusted downward by 0.96 foot. Structure and ground elevations in the community must, therefore, be referenced to NAVD 88. It is important to note that adjacent communities may be referenced to NGVD 29. This may result in differences in base flood elevations across the corporate limits between the communities.
The BFEs shown on the FIRM represent whole-foot rounded values. For example, a BFE of 102.4 will appear as 102 on the FIRM and 102.6 will appear as 103. Therefore, users that wish to convert the elevations in this FIS to NGVD29 should apply the stated conversion factor to elevations shown on the Flood Profiles and supporting data tables in the FIS report, which are shown at a minimum to the nearest 0.1 foot.

NADV88 = NGVD29 – 0.96

For more information on NAVD 88, see Converting the National Flood Insurance Program to the North American Vertical Datum of 1988, FEMA Publication FIA-20/June 1992, or contact the National Geodetic Survey at the following address:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3242
http://www.ngs.noaa.gov/

4. FLOODPLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound floodplain management programs. To assist in this endeavor, each FIS report provides 1–percent annual chance floodplain data, which may include a combination of the following: 10–, 2–, 1–, and 0.2–percent annual chance flood elevations; delineations of the 1–percent and 0.2–percent annual chance floodplains; and a 1–percent annual chance floodway. This information is presented on the FIRM and in many components of the FIS report, including Flood Profiles, Floodway Data tables, and Summary of Stillwater Elevation tables. Users should reference the data presented in the FIS report as well as additional information that may be available at the local community map repository before making flood elevation and/or floodplain boundary determinations.

4.1 Floodplain Boundaries

To provide a national standard without regional discrimination, the 1–percent annual chance (100-year) flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2–percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the county. For the streams studied in detail, the 1– and 0.2–percent annual chance floodplain boundaries have been determined at each cross section. The delineations are based on the best available topographic information.

For the December 19, 1996, FIS, the boundaries of the Schuylkill River were interpolated between cross sections using DFIRM, an ARC/INFO software application (Reference 127).

For the August 9, 1999, revision, the boundaries were interpolated between cross sections using aerial photographs taken in 1991 (Reference 128).

For the October 19, 2001, FIS revision, the boundaries were interpolated between cross sections using Digital Terrain Model (DTM) and DFMAP, an ARC/INFO software application (References 119 and 129).

For this revision, most streams studied by detailed method have been redelineated, where the effective elevations are maintained, but the floodplain boundaries are delineated based on updated topographic data. For Tributary to Oreland Run, the profiles provide insufficient river station reference to be used as the basis for re-delineation. Therefore the 1–percent annual chance water surface was built from the converted BFE. The water surface then was intercepted with the ground surface to produce a delineation of the 1–percent annual chance floodplain. However, due to the fact that the BFEs are rounded numbers, the produced water surface has a potential elevation bias of +- 0.5ft. The 0.2–percent annual chance effective floodplain is maintained as is. New detailed hydrologic and hydraulic analyses for Pennypack Creek and Sandy Run watersheds were performed by Temple University. The 1 percent and 0.2 percent annual chance floodplain boundaries for streams in those watersheds have been updated accordingly. New approximate hydrologic and hydraulic analyses were performed for all streams studied by approximate method. The floodplain boundaries were delineated to water-surface elevations on the 5-ft contour dataset obtained from DVRPC.

The 1 percent and 0.2 percent annual chance floodplain boundaries are shown on the FIRM (Exhibit 2). On this map, the 1 percent annual chance floodplain boundary corresponds to the boundary of the areas of special flood hazards (Zones A and AE), and the 0.2 percent annual chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1 percent and 0.2 percent annual chance floodplain boundaries are close together, only the 1 percent annual chance floodplain boundary has been shown. Small areas within the floodplain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 1 percent annual chance floodplain boundary is shown on the FIRM.

Within this jurisdiction there is one levee that has not been demonstrated by the community or levee owner(s) to meet the requirements of 44 CFR Part 65.10 of the NFIP regulations as it relates to the levee's capacity to provide 1% annual chance flood protection. As such, the floodplain boundaries in this area are subject to change. Please refer to the Notice to Flood Insurance Study Users page at the front of this FIS report for more information on how this may affect the floodplain boundaries shown on this FIRM.

4.2 Floodways

Encroachment on floodplains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from floodplain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the area of the 1 percent annual chance floodplain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 1 percent annual chance flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this FIS are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this FIS were computed for certain stream segments on the basis of equal conveyance reduction from each side of the floodplain. Floodway widths were computed at cross sections. Between cross sections, the floodway boundaries were interpolated. The results of the floodway computations are tabulated for selected cross sections (Table 5, "Floodway Data"). The computed floodways are shown on the FIRM. In cases where the floodway and 1 percent annual chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

Portions of the floodways for the Schuylkill River, Valley Creek, and West Branch Perkiomen Creek extend beyond the county boundary.

The design concept of the Norristown Flood Protection Project-Fornance Street Dam included the acquisition of a perpetual flowage easement upstream of the dam, extending to an elevation of 150 feet (Reference 153). The elevation of 150 feet on Sawmill Run extends to the upstream corporate limits at Johnson Highway. The downstream portion of Sawmill Run below the Fornance Street Dam is already partially protected from development by a perpetual flowage easement. Thus, it was decided that no floodway would be determined for this portion of Sawmill Run.

Floodways were not computed for Abrams Creek, Abrams Run, Crow Creek, Dodsworth Run, Erdenheim Run, Frog Run, Gulph Mills Creek, Gulph Mills Tributary A, Gulph Mills Tributary B, Matsunk Creek, North Branch Baeder Run, Oreland Run, Rose Valley Creek, Sandy Run Tributary No. 1, Tannery Run, Tributary to Oreland Run, Tributary to Trout Creek, and Unnamed Creek A. A floodway was not determined for Green Lane Reservoir.

For most surveyed cross sections on streams in the Township of Abington, the encroachment limits become the natural stream embankments. The reason for this phenomenon is that the overbank flooding was not of great depth. Encroachment calculations were not made for the following reaches of Sandy Run: upstream of Easton Road and downstream of the railroad bridge, because the stream channel is not readily located in the marshy area; and near Hamilton Avenue, because the stream is underground.

Due to the narrowed width of the 1–percent annual chance natural floodplain for Goshenhoppen and Scioto Creeks in the Township of Lower Frederick, encroachment on these floodplains generally produced minimum increases in flood elevations. Also, although there is no allowable encroachment on the 1–percent annual chance floodplain at Cross Section A on Scioto Creek or on Cross Section E on Perkiomen Creek, surcharges shown in Table 5, “Floodway Data” are due to downstream encroachments.

It is recommended that the need for riprap or other forms of bank or channel stabilization within the 1–percent annual chance floodplain in the Township of West Pottsgrove be determined before allowing encroachment in the floodway fringe area. Actual stream velocities in this area may exceed mean velocities shown in Table 5, “Floodway Data”.

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "Without Floodway" elevations presented in Table 5, “Floodway Data” for certain downstream cross sections are lower than the regulatory flood elevations in that area, which must take into account the 1 percent annual chance flooding due to backwater from other sources: Abrams Creek, Baeder Run, Blair Mill Run Tributary, Davis Grove Tributary, East

Branch Perkiomen Creek, Goshenhoppen Creek, Huntingdon Valley Creek, Macoby Creek, Manatawny Creek, Meadow Brook, North Branch Baeder Run, Oak Terrace Tributary, Pennypack Creek Branch, Pennypack Creek Tributary No. 1, Perkiomen Creek, Pine Run, Plymouth Creek, Rapp Run, Sanatoga Creek, Sandy Run, Scioto Creek, Skippack Creek, Skippack Creek Tributary No. 1, Southampton Creek, Sprogels Run, Stony Creek, Stony Creek Tributary, Stony Run, Swamp Creek, Tannery Run, Towamencin Creek No. 2, Trout Creek, Unami Creek, Unionville Tributary, Vaughn Run, War Memorial Creek, West Branch Swamp Creek, West Branch Towamencin Creek, West Branch Towamencin Creek Tributary No. 3, and Zacharias Creek.

Encroachment into areas subject to inundation by floodwaters having hazardous velocities aggravates the risk of flood damage, and heightens potential flood hazards by further increasing velocities. A listing of stream velocities at selected cross sections is provided in Table 5, "Floodway Data." In order to reduce the risk of property damage in areas where the stream velocities are high, the community may wish to restrict development in areas outside the floodway.

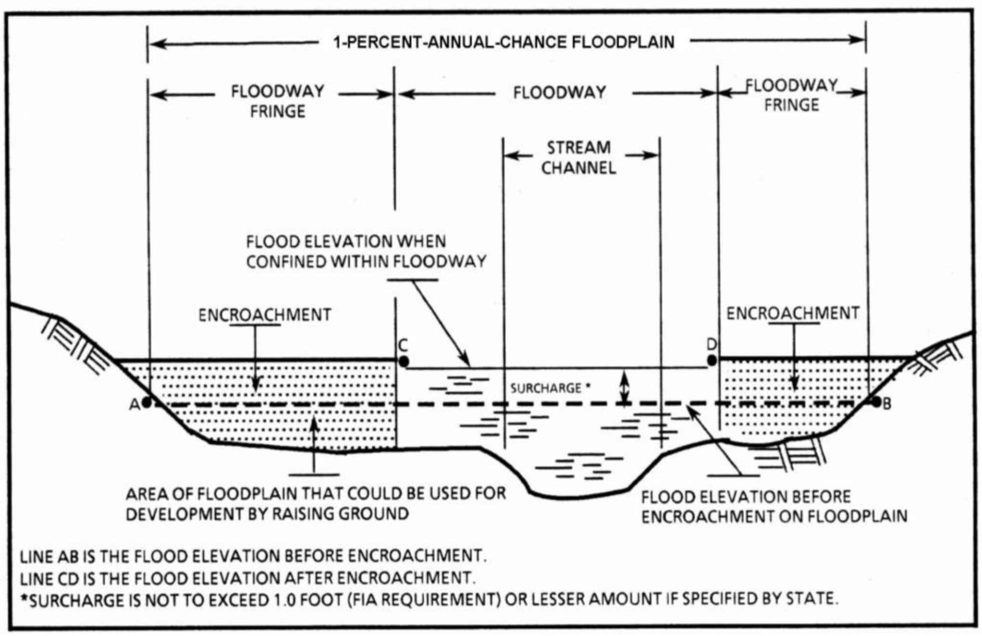


FIGURE 2 – FLOODWAY SCHEMATIC

The area between the floodway and 1 percent annual chance floodplain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the floodplain that could be completely obstructed without increasing the water-surface elevation of the 1 percent annual chance flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2.