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.

The Federal Emergency Management Agency (FEMA) may revise and republish part or all of this Preliminary FIS report at any time. In addition, FEMA may revise part of this FIS report by the Letter of Map Revision (LOMR) process, which does not involve republication or redistribution of the FIS report. Therefore, users should consult community officials and check the Community Map Repository to obtain the most current FIS components. Flood Insurance Rate Map panels for this community contain the most current information that was previously shown separately on the corresponding Flood Boundary and Floodway Map panels (e.g., floodways and cross sections). In addition, former flood hazard zone designations have been changed as follows.

Old Zone(s)	New Zone
A1 through A30	AE
B	X (shaded)
C	X

Initial Countywide FIS Effective Date:

FLOOD INSURANCE STUDY
CUMBERLAND COUNTY, MAINE (ALL JURISDICTIONS)

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study (FIS) revises and updates information on the existence and severity of flood hazards in the geographic area of Cumberland County, including the Cities of Portland, South Portland, Westbrook, and the Towns of Baldwin, Bridgton, Brunswick, Cape Elizabeth, Casco, Chebeague Island, Cumberland, Falmouth, Freeport, Frye Island, Gorham, Gray, Harpswell, Harrison, Long Island, Naples, New Gloucester, North Yarmouth, Pownal, Raymond, Scarborough, Sebago, Standish, Windham, and Yarmouth (referred to collectively herein as Cumberland County), and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood-risk data for various areas of the community that will be used to establish actuarial flood insurance rates and to assist the community in its efforts to promote sound floodplain management. Minimum floodplain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

There were no previously printed FISs for the Towns of Chebeague Island, Frye Island, Long Island and Pownal. Chebeague Island was previously a part of the Town of Cumberland until July 1, 2007, when it became the Town of Chebeague Island. Long Island was previously a part of the City of Portland until July 1, 1993, when it became the Town of Long Island.

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) will be able to explain them.

1.2 Authority and Acknowledgments

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

This FIS was prepared to incorporate all the communities within Cumberland County in a countywide format. Information on the authority and acknowledgements for each jurisdiction included in this countywide FIS, as compiled from their previously printed FIS reports, are shown below:

Baldwin, Town of:	The hydrologic and hydraulic analyses for the January 1980 study were performed by Edward C. Jordan Company for the Federal Insurance Administration (FIA), under Contract No. H-4578. This study was completed in August 1978.
Bridgton, Town of:	The hydrologic and hydraulic analyses for the November 3, 1981 study were prepared by the Soil Conservation Service (SCS) for the Federal

Bridgton, Town of - continued:	Emergency Management Agency (FEMA) under Interagency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in March 1980.
Brunswick, Town of:	The hydrologic and hydraulic analyses for the January 3, 1986 study were prepared by a joint venture including Anderson-Nichols & Company, Inc., Camp Dresser & McKee (CDM), and the New England Coastal Engineers for FEMA under Contract No. H-4771. This work was completed in June 1980. The analysis of wave effects and additional analyses for the Androscoggin River were completed by Anderson-Nichols & Company, Inc. and CDM in November 1983.
Cape Elizabeth, Town of:	The analyses of flooding in the December 19, 1985 report were performed in two phases. The initial hydrologic and hydraulic analyses of riverine and stillwater flooding were performed by a joint venture including Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work was completed in November 1979. A modification to the contract in September 1982 called for the analysis of the impacts of wave heights and wave runup on flooding. The updated work was performed by the joint venture of Anderson-Nichols & Company, Inc. and CDM/Resource Analysis for FEMA. The updated work was completed in September 1983.
Casco, Town of:	The hydrologic and hydraulic analyses for the November 5, 1980 study were prepared by SCS for FIA under Interagency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in November 1979.
Cumberland, Town of:	The initial hydrologic and hydraulic analyses of riverine and open coastal surge flooding for the October 15, 1985 study were performed by a joint venture including Anderson-Nichols & Company, Inc., CDM, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work was completed in March 1980. A subsequent modification to the contract called for the analysis of the impact of a wave runup on flooding. The updated version was

Cumberland, Town of - continued:	prepared by the joint venture of Anderson-Nichols & Company, Inc. and CDM for FEMA. The updated work was completed in September 1983.
Falmouth, Town of:	The hydrologic and hydraulic analyses for the April 16, 1984 study were prepared by a joint venture by Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and the New England Coastal Engineers for FEMA, under Contract No. H-4771. The riverine analyses were completed in May 1980. The wave runup analysis was completed in February 1983.
Freeport, Town of:	The hydrologic and hydraulic analyses for the July 17, 1984, study were prepared by a joint venture including Anderson-Nichols & Company, Inc., CDM and New England Coastal Engineers, for FEMA, under Contract No. H-4771. This work was completed in March 1980. The analysis of wave effects was completed by Anderson-Nichols & Company, Inc. and CDM in July 1983.
Gorham, Town of:	The hydrologic and hydraulic analyses for the April 15, 1981, study were prepared by the U.S. Geological Survey (USGS) for FIA, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 7. This work was completed in December 1979.
Gray, Town of:	The hydrologic and hydraulic analyses in the July 6, 1981 study were prepared by the SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in February 1980.
Harpswell, Town of:	The analyses of flooding in the January 3, 1985 report were performed in two phases. The initial hydrologic and hydraulic analyses of open coastal surge flooding were performed by a joint venture including Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work was completed in January 1980. A modification to the contract in September 1982 called for the analysis of the impacts of wave heights and wave runup on flooding. The updated work was

Harpswell, Town of - continued:	performed by the joint venture of Anderson-Nichols & Company, Inc. and CDM/Resource Analysis for FEMA. The updated work was completed in September 1983.
Harrison, Town of:	The hydrologic and hydraulic analyses for the October 15, 1981 study were prepared by SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78. This work was completed in December 1979.
Naples, Town of:	The hydrologic and hydraulic analyses for the October 1, 1981 study were prepared by SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in November 1979.
New Gloucester, Town of:	The hydrologic and hydraulic analyses for the October 1, 1981 study were prepared by SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in January 1980.
North Yarmouth, Town of:	The hydrologic and hydraulic analyses for the January 16, 1981 study were prepared by SCS for FEMA, under Inter-Agency Agreement No. IAA-H-17-78, Project Order No. 5. This work was completed in January 1980.
Portland, City of:	For the original July 17, 1986 FIS, the hydrologic and hydraulic analyses were prepared in several phases. The initial analyses of riverine and stillwater flooding were performed under a joint venture by Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work was completed in November 1979. A modification to the contract in September 1982 called for the analysis of the impacts of wave heights and wave runup on flooding. The updated work was performed under the joint venture of Anderson-Nichols & Company, Inc. and CDM/Resource Analysis for FEMA. The updated work was completed in September 1983. For the December 8, 1998 FIS, the revised hydrologic and hydraulic analyses for Capisic Brook and new analyses for East Branch Capisic Brook and West Branch Capisic Brook were prepared by the Natural Resource Conservation Service (NRCS) for the City of Portland; this

Portland, City of – continued: work was completed in November 1995. Also, the revised analyses for Fall Brook were prepared by Green International Affiliates, Inc., for FEMA, under Contract No. EMB-96-CO-0403, Task Order No. 2. This work was completed in June 1997. Finally, a revision to the hydrologic and hydraulic analyses for Capisic Brook, from the upstream side of Capisic Pond Dam to Warren Avenue, was prepared by NRCS in response to a request by the City of Portland. The results of the analyses were provided to FEMA in January 1996.

Raymond, Town of: The hydrologic and hydraulic analyses for the November 5, 1980 study were prepared by USGS for FIA, under Inter-Agency Agreement No. IAA-H-14-78, Project Order No. 10. This work was completed in November 1979.

Scarborough, Town of: The analyses of flooding in the December 19, 1984 report were performed in two phases. The initial hydrologic and hydraulic analyses of open coastal surge flooding were performed by a joint venture including Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work was completed in December 1979. A modification to the contract in September 1982 called for the analysis of the impacts of wave heights and wave runup on flooding. The updated work was performed by the joint venture of Anderson-Nichols & Company, Inc. and CDM/Resource Analysis for FEMA. The updated work was completed in September 1983.

Sebago, Town of: The hydrologic and hydraulic analyses for the October 1, 1980 study were prepared by USGS for FIA, under Inter-Agency Agreement No. IAA-H-14-78, Project Order No. 10. This study was completed in September 1979.

South Portland, City of: The analyses of flooding in the October 17, 1984 report were performed in two phases. The initial hydrologic and hydraulic analyses of riverine and open coastal surge flooding were performed by a joint venture including Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The initial work

South Portland, City of - continued:	was completed in January 1980. A modification to the contract in September 1982 called for the analysis of the impacts of wave heights and wave runup on flooding. The updated work was performed by the joint venture of Anderson-Nichols & Company, Inc. and CDM/Resource Analysis for FEMA. The updated work was completed in July 1983.
Standish, Town of:	The hydrologic and hydraulic analyses for the November 19, 1980 study were prepared by USGS for FIA, under Inter-Agency Agreement No. IAA-H-14-78. This work was completed in December 1979.
Westbrook, City of:	The hydrologic and hydraulic analyses for the July 1980 study were performed by the New England Division, US Army Corps of Engineers (USACE), for FIA, under Inter-Agency Agreement No. IAA-H-7-76, Project Order No. 25, and Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 1. Approximate flood boundaries for Beaver Pond Brook, Blanchette Brook, Davis Brook, Dolley Brook, and Meader Brook were determined in April 1974 and 1976 by Michael Baker, Jr., Inc., under the contract to FIA (IAA-H-10-77). This study was completed in May 1978.
Windham, Town of:	The hydrologic and hydraulic analyses for the March 2, 1981 study were prepared by USGS for FIA, under Inter-Agency Agreement No. IAA-H-9-77, Project Order No. 7. This work was completed in January 1980.
Yarmouth, Town of:	The hydrologic and hydraulic analyses for the May 15, 1984 study were prepared as a joint venture by Anderson-Nichols & Company, Inc., CDM/Resource Analysis, and New England Coastal Engineers for FEMA, under Contract No. H-4771. The riverine analyses were completed in March 1980. The wave runup analysis was completed in March 1983.

Base map information shown on the FIRM panels was obtained from the MeGIS. High resolution orthophoto imagery were produced from 3-inch, 6-inch, and 2-foot pixel cells. Photography was captured during spring 2012 and produced at a scale of 1:600 on August 2012. The projection used in the preparation for the orthophoto imagery was Universal Transverse Mercator (UTM) Zone 19. The horizontal datum is North American Datum (NAD) of 1983, GRS80 spheroid (Reference 1).

The coastal wave height analysis for this FIS was prepared by the Strategic Alliance for Risk Reduction (STARR) for FEMA under Contract No. HSFEHQ-09-D-0370, Task Order 8 and completed April 2013. This analysis is divided into three groups according to the type of study performed by the STARR team. The three groups are referred to in this report as "New Transect," "Updated Map Mod Transects," and "Submitted Transects." Below is a description of each group.

New Transects
Contains the 30 transects in the towns of Brunswick, Falmouth, Freeport, Long Island, and Yarmouth. A completely new RiskMap engineering analysis was performed for these transects (Reference 2). This analysis includes transect numbers 59, 62, 65, 66, 68-72, and 100-120.

Updated Map Mod Transects
Contains 87 transects in the City of Portland and the towns of Cape Elizabeth, Chebeague Island, Cumberland, Harpswell, and Scarborough. This study updated the former analysis (performed as part of FEMA's previous Map Modernization Program) by updating input wave conditions from a newer wave model (Reference 3). This analysis includes transect numbers 1-15, 17-20, 22, 23, 26, 28, 30, 32, 41-57, 73-99, 121-123, 125, 129-130, 132-133, 135, 150-155, 158, and 160-161.

Submitted Transects
Contains the 44 transects in the cities of Portland and South Portland and the towns of Cape Elizabeth, Falmouth, and Harpswell. Sebago Technics completed the coastal engineering analysis for this group in 2010. The STARR team utilized the 2010 study results for mapping. The titles of the five studies are "Peer Review of Federal Emergency Management Agency for the Town of Cape Elizabeth, Maine, 2010," "Review of FEMA Provisional Coastal Flood Maps for the Town of Falmouth, Maine, 2010," "Peer Review of Federal Emergency Management Agency (FEMA) Mapping – Harpswell, ME, 2010," "Delineation of the VE-Zone on the Northern Side of Portland Harbor, Maine, 2010," and "Delineation of the VE-Zone in South Portland, Maine, 2010" (References 4, 5, 6, 7, and 8). This analysis includes transect numbers 16, 21, 24-25, 27, 29, 31, 33-40, 58, 60-61, 63-64, 67, 124, 126-128, 131, 134, 136-149, 156-157, 159.

This new analysis resulted in revisions to the Special Flood Hazards Areas (SFHAs) within the cities of Portland, and South Portland; and the towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth.

1.3 Coordination

The purpose of an initial Consultation Coordination Officer's (CCO) meeting is to discuss the scope of the FIS. A final meeting is held to review the results of the study.

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

TABLE 1 - INITIAL, INTERMEDIATE, AND FINAL CCO MEETINGS

Community Name	Initial CCO Date	Intermediate CCO Date(s)	Final CCO Date
Town of Baldwin	June 1977	*	July 18, 1979
Town of Bridgton	January 1978	*	September 30, 1980
Town of Brunswick	April 20, 1978	June 6, 1980 October 19, 1983	December 20, 1984
Town of Cape Elizabeth	April 18, 197	November 20, 1979 April 7, 1983	July 12, 1984
Town of Casco	January 1978	*	June 18, 1980
Town of Cumberland	April 19, 1978	April 20, 1983	November 13, 1984
Town of Falmouth	April 19, 1978	May 27, 1980 January 19, 1983	November 01, 1983
Town of Freeport	April 19, 1978	March 6, 1980/April 20, 1983	January 30, 1984
Town of Gorham	December 15, 1977	*	September 08, 1980
Town of Gray	January 1978	December 1979	October 22, 1980
Town of Harpswell	April 19, 1978	December 27, 1979 April 7, 1983	August 09, 1984
Town of Harrison	January 1978	*	June 24, 1980
Town of Long Island	*	September 5, 1996	*
Town of Naples	January 1978	*	May 20, 1980
Town of New Gloucester	January 1978	*	August 21, 1980
Town of North Yarmouth	January 1978	*	August 04, 1980
City of Portland	*	September 5, 1996	*
Town of Raymond	December 16, 1977	*	June 21, 1980
Town of Scarborough	April 18, 1978	December 18, 1979 March 31, 1983	August 07, 1984
Town of Sebago	September 06, 1979	*	April 30, 1980
City of South Portland	April 19, 1978	February 5, 1980 January 19, 1983	June 12, 1984
Town of Standish	December, 1977	*	July, 7 1980
City of Westbrook	December 2, 1976	May 18, 1978	October 24, 1979
Town of Windham	December 17, 1977	August 28, 1979	August 21, 1980
Town of Yarmouth	April 19, 1978	January 27, 1983	December 20, 1983

*Data not available

For this countywide FIS, the initial CCO meeting was held on November 5, 2005 and was attended by FEMA, the Maine Floodplain Management Program, Watershed Concepts, USGS Maine Water Science Center, and community officials. For the 2013 coastal study, letters were sent to inform the communities of the scope of the FIS, and to solicit pertinent local information. Work map discussion meeting were held with the communities on February 11 and 12, 2013, to discuss the initial results of the new coastal flood hazard analysis. The results of this countywide study were reviewed at the final CCO meetings held on _________________, and attended by representatives of the communities, the______________. All problems raised at that meeting were addressed in this study.

2.0 AREA STUDIED

2.1 Scope of Study

This FIS report covers the geographic area of Cumberland County, Maine, including all jurisdictions listed in Section 1.1. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

All or portions of the flooding sources listed in Table 2, "Flooding Sources Studied by Detailed Methods," were studied by detailed methods in the pre-countywide FIS's. Limits of detailed study are indicated on the Flood Profiles (Exhibit 1) and on the FIRM. The areas studied by detailed methods were selected with priority given to all known flood hazards and areas of projected development or proposed construction.

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS

Flooding Source Name	Description of Study Reaches
Androscoggin River	Tidal flooding including its wave action, and riverine flooding from the Cumberland-Sagadahoc county boundary to approximately 1.38 miles upstream of dam in Town of Brunswick
Atlantic Ocean	Tidal flooding, including its wave action, for its entire coastline in Cape Elizabeth, and areas affecting Saco Bay in Scarborough, and for several areas of shallow flooding in Cape Elizabeth and Scarborough
Back Cove	Tidal flooding including its wave action in the City of Portland and Town of Long Island
Bay of Naples (Brandy Pond)	In the Town of Naples
Bonny Eagle Dam Pond	In the Town of Standish

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Breakneck Brook	From its confluence with Saco River to Douglas Hill Road in the Town of West Baldwin
Capisic Brook	From its confluence with Fore River to Warren Avenue in the City of Portland
Casco Bay	Tidal flooding including its wave action and along the shorelines of Cape Elizabeth, Cumberland, Great Chebeague Island, Sturdivant Island, portions of Hope Island, Little Chebeague Island, Upper Green Islands, Stockman Island, Bangs Island, Stave Island, Ministerial Island, Bates Island, Jewell Island, and Basket Island
	Tidal flooding including its wave action along the mainland coast of Harpswell, Quahog Bay, Middle Bay, Harpswell Sound, the New Meadows River, 61 named islands, and several unnamed islands, the City of Portland, Presumpscot River from its mouth to the Allen Avenue Bridge in the Town of Falmouth, Mackworth Island, Clapboard Island, the Town of Freeport, portions of the Royal River (Downstream) in the Town of Yarmouth, the Cousins River, Pratts Brook, and the coastlines of Cousins Island, Little John Island, Mosier Island, Little Mosier Island, and Lane Island
Clark Brook	From its confluence with Stroudwater River to approximately 1.06 miles upstream from its confluence with Tributary to Clark Brook
Colley Wright Brook	From a point approximately 1,975 feet upstream of its confluence with Unnamed Tributary to a point approximately 3,800 feet upstream of its confluence with Unnamed Tributary
Collins Pond	In the Town of Windham
Collyer Brook	From its confluence with Stevens Brook to approximately 100 feet upstream of Park Street in Town of Bridgton
Corn Shop Brook	From the confluence with Stevens Brook to Park Street in the Town of Bridgton
Crescent Lake	In the Town of Raymond
Crooked River	From its confluence with Songo River to approximately 1.40 miles upstream of Edes Falls Dam in the Town of Naples

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Crooked River (Town of Harrison)	From the Town of Naples and Town of Harrison community boundary to approximately 1,200 feet upstream of State Route 117 in the Town of Harrison
Crystal Lake (Town of Gray)	For its entire shoreline within the Town of Gray
Crystal Lake (Town of Harrison)	For its entire shoreline within the Town of Harrison
Crystal Lake Brook	From its confluence with Long Lake to Crystal Lake Dam in the Town of Harrison
Ditch Brook	From Varney's Mill Dam to Mill Pond Dam in the Town of Windham
Dug Hill Brook	From its confluence with Saco River to approximately 1,350 feet upstream from State Route 113 in the Town of Cornish
East Branch Capisic Brook	From its confluence with Capisic Brook to a point approximately 1,560 feet downstream from the confluence of Capisic Brook.
East Branch Piscataqua River	Backwater affects from the Presumpscot River in Falmouth
Eddy Brook	From its confluence with Collyer Brook to the Town of Gloucester corporate limits
Fall Brook	From confluence with Back Cove to a point just upstream of Allen Street in the Town of Portland
Fogg Brook	From confluence with South Branch Brook and Silver Brook to a point approximately 1,040 feet upstream of Log Bridge
Fore River	Tidal flooding including its wave action
Harraseeket River	Mainland coast of the Town of Freeport and several islands
Highland Lake (Town of Bridgton)	For the entire lake within the Town of Bridgton
Highland Lake (Town of Falmouth)	In the Town of Falmouth

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Hobbs Brook	From corporate limits (a point approximately 1,650 feet downstream of State Route 26 (Gray Road)) to State Route 26 (Gray Road) and from Schuster Road to a point approximately 870 feet upstream
Jackson Brook	From its confluence with Fore River to a point approximately 3,600 feet downstream of the Maine Turnpike
Jones Creek	In the Town of Scarborough
Little Sebago Lake	In the Towns of Gray and Windham
Long Brook	From its confluence with Fore River to the City of Portland corporate limits
Long Lake	In the Towns of Bridgton, Harrison, Naples, and Freeport
Maquoit Bay	In the Town of Freeport
Mill Brook	From its confluence with Presumpscot River to Austin Street in the Town of Westbrook
Mill Pond	In the Town of Windham
Miliken Brook	From a point approximately 3,450 feet upstream of its confluence with Inkhorn Brook to a point approximately 5,525 feet upstream of its confluence with Inkhorn Brook
Minnow Brook	From its confluence with Presumpscot River to approximately 1.36 miles upstream of Brook Road in the Town of Westbrook
Nasons Brook	From its confluence with Capisic Brook to approximately 25 feet upstream of the Portland Railroad Terminal.
New Meadows River	Tidal flooding including its wave action in the Town of Brunswick
Nonesuch River	In the Town of Scarborough
North Branch Little River	From a point approximately 21,240 upstream of mouth (approximately 7,000 feet downstream of its confluence with Westcott Brook) to its confluence with Westcott Brook

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Panther Pond	For the entire pond in the Town of Raymond
Pigeon Brook	From its confluence with Saco River to approximately 50 feet upstream of Chase Siding Road in the Town of West Baldwin
Pigeon Brook Tributary	From its confluence with Pigeon Brook to the upstream side of Chase Siding Road in the Town of Baldwin
Piscataqua River	From its confluence with Presumpscot River to approximately 3,625 feet upstream of State Route 100 in the Town of Falmouth
Pleasant River	From the Town of Gray corporate limits to approximately 1,400 feet upstream of Hunts Hill Road in the Town of Gray
Portland Islands	Along the eastern shores of several of the Islands in the City of Portland
Presumpscot River	For its entire length within Cumberland County
Quaker Brook	From its confluence with Saco River to approximately 455 feet upstream of State Route 113 in the Town of East Baldwin
Red Brook	Within the corporate limits of South Portland from confluence with Jackson Brook to the corporate limits with the Town of Scarborough
Royal River (Downstream)	From its confluence with Casco Bay to approximately 0.83 miles upstream of North Elm Street Railroad
Royal River (Upstream)	From the Town of North Yarmouth corporate limits to the Town of New Gloucester corporate limits
Saco Bay	Tidal flooding including its wave action from the Atlantic Ocean
Saco River	From the York-Cumberland County Boundary to the Cumberland-Oxford County Boundary lines
Saco River Left Channel	From the Cataract Dam to its confluence with the Saco River in the Town of Standish
Scarborough River	In the Town of Scarborough

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Sebago Lake	In the Towns of Casco, Naples, Raymond, Frye Island and Standish
Silver Brook	From its confluence with Fogg Brook and South Branch Brook to approximately 290 feet upstream of Timber Plank Bridge
Songo River	From its confluence with Sebago Lake to its confluence with the Bay of Naples in the Town of Naples
South Branch Brook	From a point approximately 950 feet downstream of its confluence with Fogg Brook and Silver Brook to its confluence with Fogg Brook and Silver Brook
Stevens Brook	From Kansas Road to the Highland Lake Dam in the Town of Bridgton
Stroudwater River	From its confluence with Fore River to approximately 75 feet downstream from the Town of Gorham corporate limits
Thayer Brook	From its confluence with Pleasant River to approximately 2,000 feet upstream of the confluence with Tributary A
Tributary 1 to Presumpscot River	From corporate limits (a point approximately 2,000 feet downstream of its confluence with Tributary 2 to Presumpscot River to a point approximately 2,140 feet upstream of its confluence with Tributary 2 to Presumpscot River
Tributary 2 to Presumpscot River	From its confluence with Tributary 1 to Presumpscot River to a point approximately 2,225 feet upstream
Tributary A	From its confluence with Thayer Brook to approximately 250 feet upstream of Farm Road in the Town of Gray
Tributary to Clark Brook	From its confluence with Clark Brook to approximately 3,500 feet downstream of the confluence with Clark Brook
Trout Brook	From its confluence with Fore River to approximately 13 feet upstream of Spurwick Avenue in the Town of Cape Elizabeth
Unnamed Tributary to Colley Wright Brook	From a point approximately 2,850 feet upstream of its confluence with Colley Wright Brook to a point approximately 520 feet upstream of private drive

TABLE 2 – FLOODING SOURCES STUDIED BY DETAILED METHODS – continued

Flooding Source Name	Description of Study Reaches
Unnamed Tributary to Presumpscot River	From a point approximately 700 feet upstream of its confluence with Presumpscot River to a point approximately 510 feet upstream of dirt road
Unnamed Tributary to Rich Mill Brook	From a point approximately 2,200 feet upstream of its confluence with Rich Mill Brook to a point approximately 2,025 feet upstream of Maine Central Railroad
Unnamed Tributary to Tucker Brook	From a point approximately 5,300 feet upstream of its confluence with Tucker Brook to a point approximately 2,875 feet upstream of Maine Central Railroad
Westcott Brook	From a point approximately 150 feet upstream of its confluence with North Branch of Little River to Plummer Road
West Branch Capisic Brook	From its confluence with Capisic Brook to the Maine Turnpike in the Town of Portland
Willett Brook	From its confluence with Stevens Brook to approximately one foot upstream from Willett Road in the Town of Bridgton

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 individual communities within Cumberland County. For this countywide revision, no new approximate studies were executed. All or portions of the flooding sources listed in Table 3, "Flooding Sources Studied by Approximate Methods," were studied by approximate methods in the pre-countywide FISs.

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS

Flooding Source Name	Community
Adams Pond	Standish
Ai Brook	Raymond
Alewife Brook	Cape Elizabeth
Allen Range Brook	Freeport
Anderson Brook	Windham
Bachelder Brook	Sebago
Baker Brook	Windham
Barker Ponds	Sebago
Beaver Pond Brook	City of Westbrook
Biglow Swamp	Harrison

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS - continued

Flooding Source Name	Community
Blachette Brook	City of Westbrook
Black Brook	Windham
Blanchard Pond	Cumberland
Bog Pond	Harrison
Bonny Eagle Pond and inlet brook	Standish
Branch Brook	Gorham, Gray, New Gloucester
Breakneck Brook	Sebago
Browns Pond	Sebago
Bunganuc Brook	Brunswick
Carsley Brook	Harrison
Chaffin Pond	Windham
Chandler River	North Yarmouth
Clark Brook	City of Westbrook
Coffee Pond	Casco
Cold Rain Pond	Naples
Cold Spring Brook	Gorham
Cole Brook	Gray
Colley Wright Brook	Windham
Collins Brook	Brunswick, Freeport
Corn Shop Brook	Bridgton above Park Street
Cousins River	Freeport, Yarmouth
Crescent Lake	Casco
Crooked River	Naples
Crooked River (Town of Harrison)	Harrison
Davis Brook	City of Westbrook
Day Brook	Bridgton
Deer Brook	North Yarmouth
Ditch Brook	Windham
Dolley Brook	Westbrook
Douglas Brook	Gorham
Dumpling Pond	Casco
Dunstan River	Scarborough
East Branch Capisic Brook	City of Portland, Long Island
East Branch Piscataqua River	Cumberland, Falmouth
East Branch Royal River	Freeport
Eel Weir Canal	Standish
Files Brook	Gorham
Forest Lake	Cumberland, Gray, Windham
Fort Hill Brook	Gorham
Foster Brook	New Gloucester
Frost Gully Brook	Freeport
Gay Brook	Raymond
Great Pond	Cape Elizabeth
Gully Brook	Gorham
Hancock Pond	Sebago
Harraseeket River	Freeport

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS - continued

Flooding Source Name	Community
Harvey Brook	Freeport
Hayden Brook	Raymond
Highland Lake, including tributary	Windham
Hill Brook	Sebago
Hobbs Brook	Cumberland, Falmouth
Holt Pond	Bridgton, Naples
Hyde Brook	Windham
Indian Camp Brook	Gorham
Ingalls Pond	Bridgton
Inkhorn Brook	Windham
Island Pond	Harrison
Johnson Brook	Gorham
Josies Brooks	Standish
Kelsey Brook	Freeport
Kimball Brook	City of South Portland
Leavitt Brook	Naples
Libby River	Scarborough
Lincoln Weeks Brook, including tributary	Windham
Little Duck Pond	Windham
Little River	Freeport, Gorham
Little Watchic Pond	Standish
Long Creek	City of Portland, Long Island
Lower portion of Hunt Hill Brook	Gray
Mare Brook	Brunswick
Martin Brook	Gorham
McIntosh Brook	Windham
Meader Brook	Falmouth, Westbrook
Meadow Brook	Casco, New Gloucester, Raymond
Merrill Brook	Freeport
Mile Brook	Casco
Mill Brook	Cumberland, Sebago, City of Westbrook
Mill Creek	Falmouth
Mill Stream	Freeport
Moose Pond	Bridgton
Mosher Brook	Gorham
Mud Pond, including outlet brook	Windham
Muddy River	Naples
Nasons Brook	Gorham, Sebago, City of Portland, Long Island
Nonesuch River	Gorham, Scarborough
North Branch of Little River	Gorham, Standish
Northwest River	Sebago
Notched Pond	Gray
Notched Ponds	Raymond

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS - continued

Flooding Source Name	Community
Numerous Unnamed tributaries	City of Westbrook
Otter Brook	Windham
Otter Pond	Bridgton
Panther Run Brook	Raymond
Parker Pond	Casco
Peabody Pond	Bridgton, Naples, Sebago
Perley Pond	Sebago
Pettengill Pond, including outlet brook	Windham
Pigeon Brook Tributary	Baldwin
Piscataqua River	Cumberland, Falmouth
Pleasant Lake	Casco
Pleasant River	Windham, Gray
Pratts Brook	Freeport, North Yarmouth, Yarmouth
Presumpscot River	Standish section, Windham
Quaker Brook	Baldwin
Raymond Brook	Raymond
Rich Mill Pond	Standish
Rolfe Brook	Casco
Royal River (Downstream)	Yarmouth
Royal River (Upstream)	New Gloucester
Runaround Brook	New Gloucester
Sanborn Brook	Gorham
Sand Brook	Gray
Scarborough River	Scarborough
Shad Gully Brook	Gorham
Shaker Bog	New Gloucester
Skunk Knoll Brook	Gorham
Small Brook	Windham
South Branch Brook	Gorham
Southeast Pond	Sebago
Spurwink River	Cape Elizabeth, Scarborough
Staples Brook	Casco, Raymond
Stevens Brook	Bridgton
Sticky River	Standish
Stroudwater River	Gorham, City of Portland, Long Island
Strout Brook	Gorham, Standish
Sucker Brook	Gray, Raymond
Tannery Brook	Gorham
Tarkhill Pond	Windham
Thayer Brook	Gray
The Heath	Casco
Thoits Brook	North Yarmouth
Thomas Brook	Raymond
Thomas Pond	Casco

TABLE 3 – FLOODING SOURCES STUDIED BY APPROXIMATE METHODS - continued

Flooding Source Name	Community
Thompson Lake	Casco
Toddy Brook	North Yarmouth
Tributaries of the Presumpscot River	City of Westbrook
Tributaries of the Stroudwater River	City of Westbrook
Tributary to Clark Brook	City of Westbrook
Tributary to Mill Brook	Cumberland
Trickey Pond	Naples
Trout Brook	City of South Portland
Tucker Brook	Standish
Unnamed brook at Little Falls south of State Route 237	Naples
Unnamed brook downstream of Newhall Dam	Windham
Unnamed tributaries to Broad Cove	Cumberland
Unnamed tributaries to Collins Brook	Freeport
Unnamed tributary to Crooked River (Town of Harrison)	Harrison
Unnamed tributaries to the West Branch and East Branch Piscataqua	Cumberland Rivers
Unnamed tributaries and streams (several)	All communities
Upstream portions of Minnow Brook	City of Westbrook
West Branch Piscataqua River	Cumberland
Westcott Brook	Gorham, New Gloucester
Wiggins Brook	Gray
Willett Brook	Bridgton above Willett Road
Willow Brook	Cape Elizabeth
Woods Pond	Bridgton

Table 4, "Stream Name Changes," lists streams that have names in the countywide FIS other than those used in the previously printed FISs for the communities in which they are located.

TABLE 4 - STREAM NAME CHANGES

Community	Old Name	New Name(s)
Town of Harrison	Crooked River	Crooked River (Town of Harrison)
Town of Yarmouth	Royal River	Royal River (Downstream)
Town of New Gloucester	Royal River	Royal River (Upstream)
Town of Gorham	South Branch Stroudwater River	South Branch Brook

This FIS also incorporates the determinations of letters issued by FEMA resulting in map changes (Letter of Map Revision [LOMR], Letter of Map Revision - based on Fill [LOMR-F], and Letter of Map Amendment [LOMA]), as shown in Table 5, "Letters of Map Change."

TABLE 5 – LETTERS OF MAP CHANGE

Community	Case Number	Flooding Source	Letter Date
Cumberland, Town of	95-01-033P	Casco Bay	06/20/1995
Falmouth, Town of	05-01-0287P	Piscataqua River	09/28/2006
Falmouth, Town of	06-01-B534P	Hobbs Brook	11/23/2006
Falmouth, Town of	09-01-0247P	Presumpscot River	03/09/2009
Falmouth, Town of	09-01-0124P	Hobbs Brook	06/15/2009
Freeport, Town of	01-01-007P	Casco Bay	02/15/2001
Gorham, Town of	07-01-0160P	Westcott Brook	04/26/2007
Harpswell, Town of	98-01-005P	Atlantic Ocean	12/17/1997
Harpswell, Town of	98-01-053P	Atlantic Ocean	11/25/1998
Harpswell, Town of	05-01-0539P	Casco Bay	09/09/2005
Harpswell, Town of	06-01-B113P	Atlantic Ocean	06/25/2006
Harpswell, Town of	07-01-0567P	Atlantic Ocean	04/02/2007
Portland, City of	500031652R01	Fall Brook	11/20/1997
Portland, City of	98-01-150A	Fall Brook	01/30/1998
Portland, City of	98-01-176A	Fall Brook	02/18/1998
Portland, City of	98-01-780A	Fall Brook	07/17/1998
Portland, City of	98-01-830A	Fall Brook	07/24/1998

TABLE 5 – LETTERS OF MAP CHANGE - continued

Community	Case Number	Flooding Source	Letter Date
Portland, City of	98-01-844A	Kelly Dot Drain	08/07/1998
Portland, City of	98-01-864A	Fall Brook	08/12/1998
Portland, City of	12-01-0271P	Casco Bay	09/14/2012
Portland, City of	12-01-0692P	Atlantic Ocean and Casco Bay	11/09/2012
Scarborough, Town of	1-89-12	Atlantic Ocean	06/21/1989
Scarborough, Town of	1-89-13	Atlantic Ocean	06/21/1989
Scarborough, Town of	93-01-047P	Scarborough River Estuary	11/01/1993
Scarborough, Town of	01-01-045P	Fogg, Silver, & South Branch Brooks	11/19/2001
Scarborough, Town of	04-01-031P	Atlantic Ocean	06/28/2004
Standish, Town of	03-01-001P	Tributary to Presumpscot River	02/25/2003
Standish, Town of	05-01-A566P	Tributary to Presumpscot River	08/17/2006
Standish, Town of	06-01-B168P	Tributary to Tucker Brook	12/07/2006
Standish, Town of	05-01-A329P	Josies Brook	12/20/2006
Westbrook, City of	05-01-0338P	Tributary to Presumpscot River	12/01/2005
Westbrook, City of	08-01-0842P	Mill Brook	10/24/2008
Windham, Town of	03-01-063P	Unnamed Tributary To Hyde Brook	12/01/2003
Windham, Town of	06-01-B562P	Colley Wright Brook	10/30/2006
Windham, Town of	06-01-B270P	Unnamed Tributary To Colley Brook	12/21/2006
Windham, Town of	06-01-B717P	Miliken Brook	01/25/2007

TABLE 5 – LETTERS OF MAP CHANGE - continued

Community	Case Number	Flooding Source	Letter Date
Yarmouth, Town of	04-01-632P	Unnamed Tributary to Royal River	09/19/2004

Detail-studied streams that were not re-studied as part of this revision may include a profile baseline on the FIRM. The profile baselines for these streams were based on the best available data at the time of their study and are depicted as they were on the previous FIRMs. In some cases the transferred profile baseline may deviate significantly from the channel or may be outside of the floodplain.

Revised coastal analyses were performed for the open water flooding sources in the Cities of Portland and South Portland, and the Towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth. Based on the new updated analysis, the results of LOMR cases 01-01-007P and 96-01-069P were superseded

All new or revised modeling and updated topographic data, including existing 2006 LiDAR bare earth data that was processed to create 2 feet contours and breakline data, was used to delineate the coastal floodplain and regulatory floodway boundaries along 205 miles of shoreline within the communities of Scarborough, Cape Elizabeth, South Portland, Portland, Cumberland, and Harpswell (Reference 9).

2006 LiDAR bare earth data (Reference 9) also covered portions of Androscoggin River. Based on this information, the redelineation for the Androscoggin River was performed.

2.2 Community Description

Cumberland County is located in southwestern Maine. In Cumberland County, there are 25 towns and three cities. The Towns of Casco, Harrison, Naples and Raymond are located in northern Cumberland County. The Towns of Bridgton, Frye Island and Sebago are located in the northwestern portion of the county. The Towns of Brunswick, Falmouth, Freeport, are located in the northeastern portion of the county. The Towns of Cumberland and Scarborough are located in the southern portion of the county. The Towns of Gorham and Standish are located in southwestern Cumberland County. The Towns of Cape Elizabeth and Long Island and the Cities of Portland, South Portland and Westbrook are in the southeastern portion of the county. The Towns of Gray, Harpswell, New Gloucester, North Yarmouth, Pownal and Yarmouth are located in eastern Cumberland County. The Town of Baldwin is in the western portion of the county. The Town of Windham is located in the central portion of Cumberland County. Chebeague Island is an island town located in Casco Bay, 10 miles from Portland.

Cumberland County is bordered on the north by Androscoggin County, Maine, on the northwest by Oxford County, on the northeast by Sagadahoc County, Maine, and on the southwest by York County, Maine.

Cumberland County has the deepest and second largest body of water in the state, Sebago Lake, which supplies tap water to most of the county.

According to census records, the population of Cumberland County was 281,674 in 2010, 265,612 in 2000 and 243,135 in 1990. The total area in Cumberland County consists of 1,217 square miles, including 836 square miles of land and 381 square miles of water area (Reference 10).

In Cumberland County, the climate is characterized by four distinct seasons. Average temperatures range from a July high of 79 degrees Fahrenheit (F.) to a January low of 10 degrees F. The mean annual temperature is approximately 42.0 degrees F. Cumberland County gets 44 inches of rain per year, and 71 inches of snowfall. Precipitation is evenly distributed throughout the year; however, snowmelt in the spring accounts for a large part of the runoff. The climate of the County is typified by pleasant summers and falls, cold winters with frequent thaws, and unsettled springs (Reference 11).

The Town of Baldwin, located near the White Mountains, is characteristically hilly. Most of the town is heavily forested with portions cleared for development and agricultural use. Soils located in the Baldwin area belong to two basic soil associations. The soils in the upland areas of West Baldwin and the Great Falls area consist of the Hermon-Peru-Paxton Association, typified as generally to moderately well-drained with sandy to loamy textures. These soils are found on hills and ridges. Located along the Standish corporate limit and the Saco River downstream from Cornish Station are soils of the Windsor-Hinckley-Deerfield Association. These soils are deep coarse-textured, excessively to moderately well-drained, and formed in glacial outwash on outwash plains and terraces.

The river banks in Baldwin are relatively flat. Pigeon Brook flows southward for approximately 4.3 miles to its confluence with the Saco River. It has an average slope of 170 feet per mile and a drainage area of approximately 5.6 square miles. Pigeon Brook Tributary drains an area of approximately 2.9 square miles, has an average slope of 110 feet per mile, and flows a distance of approximately 3.8 miles to its confluence with Pigeon Brook. Dug Hill Brook drains approximately 3.2 square miles, has an average slope of 141 feet per mile, and flows approximately 4.4 miles to its confluence with the Saco River. Breakneck Brook drains an area of approximately 5.5 square miles, has an average slope of 127 feet per mile, and flows about 6.4 miles to its confluence with the Saco River.

Baldwin is mainly farming and residential community, with lumbering and vacation resorts being other economic activities. The major residential development is located in West Baldwin on State Route 113. The remaining development is evenly distributed throughout the town. Floodplains in the community are generally undeveloped (Reference 12).

Stevens Brook, a tributary of Long Lake, flows east from Highland Lake (Town of Bridgton) through downtown Bridgton into Long Lake. It is 2.2 miles long and has a drainage area of 42.5 square miles. Willett Brook is a tributary of Stevens Brook and flows north to its confluence with Stevens Brook in downtown Bridgton. It has length of 6.6 miles and a drainage area of 20.2 square miles. Corn Shop Brook also flows south to its confluence with Stevens Brook in downtown Bridgton. It is 0.2 mile long and has a drainage area of 0.7 square mile.

Highland Lake (Town of Bridgton) is located in northern Bridgton, has a surface area of 1,400 acres, and a drainage area of 20.5 square miles at its outlet. The major portion of Long Lake is located in eastern Bridgton and forms Bridgton's eastern border with the Town of Harrison, outlets into the Bay of Naples in the Town of Naples. It has a surface area of 4,900 acres, 3,100 of which are in Bridgton, and a drainage area of 114 square miles.

The majority of the land area of Bridgton, Casco, Harrison, Naples, New Gloucester, and North Yarmouth is devoted to timber stands.

Within the floodplains studied in Bridgton, development consists of an urban area in downtown Bridgton, which includes businesses, homes, and government buildings. Seasonal and single-family residences, recreational property, and businesses are located in the floodplains of Highland and Long Lakes. The majority of development in Bridgton is centered around the downtown area, with substantial development also in the vicinities of North Bridgton, South Bridgton, U.S. Route 302, Highland Lake (Town of Bridgton), and Long Lake (Reference 13).

Brunswick has a substantial commercial and industrial district in the center of town. Private residences surround this district and extend along the main roads which radiate from the town center. The properties adjacent to the Androscoggin River in the center of the town are commercial and industrial. There are private residences located downstream and upstream along the river. Most of the properties along the Atlantic coast and the new Meadows River are residential (Reference 14).

The land in eastern Brunswick consists of broad, low flat areas along the coast and the downstream portion of the Androscoggin River. West of the town center, the terrain is more rugged, with ridges and hills rising to elevations greater than 300 feet.

Within the studied floodplains of Casco, development consists of single family residences, seasonal homes, roads, bridges, and a state park. Most of the development in Casco is located along U.S. Route 302 and State Routes 121 and 11. There is also substantial recreational development located around and adjacent to the lakes and ponds of Casco, and along the Crooked and Songo Rivers (Reference 15).

Within the studied floodplains of Harrison, development consists of single family and seasonal residences, businesses, recreation facilities, barns and other assorted outbuildings, a National Register Historic Site, roads, and bridges. Most of the development in Harrison is located in the vicinity of Harrison Village, at Bolster's Mills, and along the shores of Long Lake and Crystal Lake (Town of Harrison) (Reference 16).

In Naples, within the studied floodplains, development consists of single-family residences, businesses, seasonal homes, recreational development, a National Register Historic Site, a state park, roads, and bridges. The majority of development in Naples is located along U.S. Route 302, primarily in the Village of Naples. There is also substantial recreational development located around and adjacent to the lakes and ponds of Naples, and along the Crooked and Songo Rivers (Reference 17).

In New Gloucester, in addition to timberland, there is a considerable amount of farmland in the valleys adjacent to the Royal River (Upstream). Within the floodplains studied, development is limited to single-family residences, roads, bridges, and railroads. The majority of development in New Gloucester is located in the vicinities of the Village of New Gloucester, Upper Gloucester, White's Corner, Pineland Hospital, and Sabbathday Pond (Reference 18).

In North Yarmouth, within the floodplains studied, development consists of a brickyard, several single-family residences, roads, and bridges. The majority of development is located in the vicinity of Walnut Hill and along State Routes 115 and 231 (Reference 19).

The terrain of Cape Elizabeth varies from sea level along the coast and the Spurwink River to areas having a maximum elevation of 150 feet. The town harbor has an irregular, rocky, steep coastline with several small inlets and bays. The Spurwink River is a tidal estuary forming the western boundary of the town. The river is influenced by tides for virtually its entire length within the town. The area within several hundred feet of the river is typically very low and is covered by marsh grass and other semi-aquatic vegetation. Much of the marsh area near the river has been bought by the town and is termed a Resource Protection Area.

Cape Elizabeth has little or no manufacturing and industry. Many of the inhabitants work in the Portland area and commute daily. Tourists are apparently not as important to the economy as in some of the neighboring communities such as Scarborough. Much of the land in the town is owned by the government. This land is owned by either federal, state, or municipal. A former military base, Fort Williams, lies in the northeastern corner of the town and occupies approximately 20 acres of land; this land is now owned by the town. In the southeastern portion of Cape Elizabeth, several areas are occupied by state parks, including Crescent Beach (Reference 20).

The Songo River, which flows south along the Town of Casco's southwestern border and the Town of Naples southeastern boarder, is the principal tributary of Sebago Lake. It has a length of 3.7 miles and a drainage area of 275 square miles (Reference 15).

The Crooked River, which flows south-southwest along Casco's western border, Harrison's eastern border, and Naples southern border, is a principal tributary of the Songo River. It has a length of 42 miles (Reference 15) and a drainage area of 152 square miles.

Sebago Lake, the second largest lake in Maine, is about 12 miles long, 8 miles wide, and has a surface area of about 46 square miles. It is located only 16 miles north of Portland, Maine's largest city. Its scenic shores are attractive to prospective homeowners because of its proximity to Portland. The lake was appropriately named Sebago, "big stretch of water," by the Sokokis Indians. Sebago Lake is the southernmost in a string of 32 lakes and ponds that collect water from a drainage area of 446 square miles. Water from the lake is used as part of the greater Portland area public water supply. Conservatively estimated, Sebago Lake could safely produce a yield of approximately 300 million gallons per day, indefinitely.

In the Town of Cumberland, approximately half of the employed residents are employed outside of the town. There are few commercial and industrial businesses in Cumberland. The economic mainstay of Great Chebeague Island is fishing and the vacation industry (Reference 21).

The terrain of Cumberland is rolling and is cut by many small streams. The western half of the town is more irregular, containing several abrupt rocky hillocks rising to 400 feet or more. The soils near State Route 9 in Cumberland Center are mainly well-drained Windsor and Hinckley soils that are formed on glacial outwash material. The soils northwest of State Route 9 are poorly-drained Au Gres, Scarborough, and Swanton soils, which are saturated sands underlain by marine sediments. The area between Cumberland Center and the Maine Turnpike consists mainly of soils formed in marine sediments. These soils have a low permeability due to the presence of silt and clay textures. Southwest of Tuttle Road is a large area of well-drained, till-derived soil. The Cumberland Foreside Area is comprised predominantly of well drained Windsor and Hinckley soils, moderately well-drained Deerfield soil, and Hollis soil. The low-lying areas have poorly-drained soils (Reference 21).

The terrain in Falmouth varies from sea level along the coast and the Presumpscot River to areas of high elevations that reach a maximum of 176 feet. Falmouth is a predominantly suburban community with a population of approximately 10,310 (Reference 22). Areas in the northern parts of the town are relatively undeveloped with some farming and large tracts of open unwooded land. The watersheds of the Presumpscot and Piscataqua Rivers are largely undeveloped; however, there are some residential properties on the Piscataqua. The Highland Lake (Town of Falmouth) watershed is moderately developed with residential properties, while most of the properties along the Atlantic coast, Clapboard Island, and Mackworth Island are also residential.

The land surface in the Town of Freeport rises from 0 feet at tide's edge to just over 300 feet at the northeast corner of the town. The major landforms are aligned approximately northeast-southwest along the trends of the underlying bedrock ridges and valleys.

The geology of Freeport is characterized by a series of topographically-subdued, northeast-trending ridges and valleys underlain by bedrock composed predominantly of crystalline schists and gneisses whose internal layering slopes moderately to the southeast. The bedrock, which commonly crops out in scattered exposures along the shoreline, on the surfaces of the steeper hillsides, and in man-made excavations, was consolidated during regional mountain-building epochs in the Paleozoic era, several hundred million years ago, and has been subjected to wearing down by weathering and erosion since that time.

Throughout the area of Freeport, the bedrock is widely veneered by a relatively thin blanket of unconsolidated glacial sediments which were deposited on the bedrock surface at the time of melting of the last Pleistocene ice sheet which covered the area during the period from 25,000 to 12,000 years ago. The glacial sediments include stony tills, sand and gravel ice-contact deposits, silty marine clay, and outwash sands. Recent sediments derived from erosion and reworking of the glacial deposits include floodplain silts and sands, sandy beaches, and the wind-blown dune sands of the Desert of Maine area. Peat deposits have formed in the tidal marshes along the shoreline and in poorly drained swamps in upland areas.

Although no large rivers flow through Freeport, there is a dense drainage pattern composed of small intermittent and perennial streams. The general trend of the major streams is from northeast to southwest, thus following the trends of bedrock valleys. The lower elevations of Harvey Brook, Merrill Brook, Mill Stream, the Little River, and the

Cousins River are primarily silty clay marine deposits which are relatively impervious and have a high runoff coefficient. Thus, the drainage pattern is particularly dense here, and the common steep gullies feeding the streams are seldom more than 1,000 feet apart and are commonly 500 feet apart (Reference 23).

Freeport is situated on the southeastern edge of the seaboard lowland. Its coastal location, sheltered harbor, and easy access to the inland forests were primary factors in its early development as a town devoted to shipbuilding and other marine endeavors, as well as to farming. Later, its location on coastal routes and railroads favored other trades which required good transportation links, such as shoe manufacturing. The growth of Freeport is also a direct result of its coastal location and good transportation links. Although commercial marine industries are quite limited, the excellent harbor and proximity to many coastal recreation resources have favored an intensive recreational boating use. The interstate highways and other modern roads to Portland, Brunswick, Bath, Lewiston, Auburn, and Augusta have made Freeport a desirable commuter residential area. This is especially true because of the colonial period housing and large rural areas that remain as a result of the early development of Freeport (Reference 23).

Gorham is a part of the Greater Portland Metropolitan Area and is a member of the Greater Portland Council of Governments. The Gorham campus of the University of Southern Maine is located adjacent to the downtown area. U.S. Route 202 and State Routes 4, 114, and 25 are the major highways in Gorham. The town is situated between the ocean beaches of southern Maine and the Sebago Lake Region. It is a very desirable housing area, shown by the recent growth in population. Eighty-six percent of the town, including agricultural and forested land, is classified as undeveloped. Of the 14 percent of the land within the town that is developed, 8 percent of it is used for year-round and seasonal housing (Reference 24).

Most of Gorham is located in the Presumpscot River basin, which is surrounded by watersheds of the Androscoggin River to the north and east, Maine coastal streams to the south, and the Saco River to the west. The Presumpscot River basin extends 55 miles in a northwest-southeast direction and is about 20 miles wide near its downstream end. The drainage area of the basin is 648 square miles.

The Presumpscot River originates at Sebago Lake, which is just west of Windham, and follows a meandering but generally southeast course for about 24 miles to its mouth at Casco Bay. The river is the natural outlet of Sebago Lake, but most of the flow out of the lake is carried by the Eel Weir Canal. This canal has the capacity to carry 6,000 cfs, and joins the original course of the Presumpscot River 1 mile downstream of the outlet dam. The Presumpscot River is very scenic, of excellent quality, and characterized by hydroelectric power plants at every available waterfall.

Nason and Mosher Brooks empty directly into the Presumpscot River. The South Branch Brook and Gully, Strout, and Indian Camp Brooks join to form the Stroudwater River, which drains South Gorham and flows east into the Atlantic Ocean. The Nonesuch River flows along the southern Gorham corporate limits and also empties into the ocean.

Gorham is located on a gently undulating coastal plain. Topographic relief in this area is generally less than 360 feet. The upland areas of the Presumpscot basin bedrock are covered by glacial till composed of silt, sand, gravel, cobbles, and boulders. At the lower elevations and in the stream valleys of Gorham, the till is buried under marine clay deposited during the period of oceanic inundation that occurred following the recession of the glacier. Small streams have cut into the clay deposits, forming shallow gullies with moderate slopes. In the northern section of Gorham, there are several extensive areas of sand and gravel classified as ice-contact deposits (Reference 24).

Collyer Brook, a tributary flowing southeast to the Royal River (Upstream), has a length of 9 miles and a drainage area of 19.6 square miles.

Crystal Brook, also known as Dry Pond, is located in northern Gray at the head of Collyer Brook. It has a surface area of 190 acres and a drainage area of 1.8 miles at its outlet. Eddy Brook is a tributary flowing 3.4 miles south to Collyer Brook. This area has drainage of 4.3 square miles.

The Pleasant River is a tributary of the Presumpscot River, originates at Gray Meadow, and flows southwest through Gray. It has a length of 17 miles and a drainage area of 49 square miles. Thayer Brook flows 4.5 miles south to the Pleasant River, with a drainage area of 5.7 square miles. Thayer Brook's tributary, Tributary A, flows south 0.8 mile and has a drainage area of 1 square mile.

Little Sebago Lake, the major portion of which is located in western Gray, empties into Mill Pond in Windham, Maine. It has surface area of 1,900 acres, 1,300 of it located in Gray, and a drainage area of 18.9 square miles at its outlet.

The majority of the land area in Gray is forest land. Within the floodplains studied, development consists of single-family residences, seasonal homes, recreational development, the Pineland Hospital, water supply facility, farmland, roads, and bridges. The development is located mostly at Gray Center and Dry Mills; however, there is substantial residential development in most areas of Gray and heavy recreational development around its lakes and ponds (Reference 25).

Harpswell encompasses a portion of Casco Bay and includes more than 60 islands of varying size.

The terrain of Harpswell consists of long narrow projections of land interrupted by numerous bays and inlets which are dotted with small islands. Rock ledges are found at the ocean end of many of the large peninsulas. The current topography was shaped by the past glacial activity in this region. The huge masses of ice moving north to south cut long narrow valleys that were later inundated by rising sea level. Glacial activity in this area helped to form the present day soil profiles by mixing clays, shales, limestones, and sandstones with older soils in some areas and removing the soil to bedrock in other areas.

Harpswell has experienced limited growth, enabling the town to retain much of its original character. Most of the residents of this seaside community rely on the tourist and fishing industries for their livelihoods. Others are employed at the Bath Iron Works (Reference 26).

Long Lake, which borders Harrison to the west and has a portion located in Naples, discharges into the Bay of Naples in the Town of Naples. It has a surface area of 4,900 acres and a drainage area of 114 square miles.

Crystal Lake Brook flows south from Crystal Lake into the northern end of Long Lake. It has a length of 0.2 mile and a drainage area of 8.7 square miles.

Crystal Lake (Town of Harrison), located just north of Harrison Village, empties into Crystal Lake Brook. It has a surface area of 460 acres and a drainage area of 8.6 square miles (Reference 16).

The Bay of Naples, otherwise known as Brandy Pond, is located between the outlet of Long Lake and the head of the Songo River in Naples. It has a surface area of 760 acres and a drainage area of 119 square miles (Reference 17).

The Royal River flows through New Gloucester, North Yarmouth and Gray and empties into Casco Bay in the Town of Yarmouth. It has a length of 25 miles and a drainage area of 142 square miles (Reference 18 and 19).

The terrain of the City of Portland varies from sea level along the coast and the Fore River to areas reaching a maximum elevation of 160 feet. Topographical features in the area are the result of glacial deposition in some areas and removal of bedrock in others. The material deposited by the glaciers consists of clay, sand, and silt (Reference 27).

The watersheds of the Stroudwater River, Fall Brook, Capisic Brook, and Nasons Brook are predominantly residential with scattered industrial development. The area along the Presumpscot River is devoted to major public and institutional use. The properties along the Fore River and the Atlantic Coast are predominantly commercial and industrial. Development on the Portland Islands is mainly residential, but Long Island has major industrial development.

Raymond is primarily a residential community, and a large part of the population is employed in the greater Portland area. Raymond's population increases substantially during the summer by visitors who stay at the various boys and girls camps, private campgrounds, lodges, motel, and rental cottages. The shorelines of all the lakes and ponds studied in Raymond have been extensively developed for housing. Most of these residences are seasonal cottages, although Sebago Lake has many year-round homes along its shores. There has been a recent trend in the area to convert seasonal cottages to year-round homes. The few commercial establishments in the town are service oriented and are generally located along U.S. Highway 302 which runs from east to west across town.

The soils and topography of Raymond have been extensively influenced by glaciation. Most of the terrain is hilly, with moderate to steep slopes. Glacial till deposits cover most of these hills, except for outcrops of the granite bedrock. Areas of sand and gravel near Panther Run, Tenny River, and along the east shore of Jordan Bay are classified as ice-contact deposits (Reference 28). The soils in these ice-contact areas vary from loamy sand to silty loam; in the till areas, the soils tend to be stony and well-drained. Land elevations in Raymond range from 868 feet at Tenny Hill to 267 feet at Sebago Lake.

The major lakes and ponds in Raymond are Raymond Pond, Crescent Lake, Panther Pond, Sebago Lake, Thomas Pond, and Notched Pond. Raymond Pond, Crescent Lake, and Panther Pond make up a chain of lakes that empty into Sebago Lake. Thomas Pond also drains into Sebago Lake via its outlet brook which forms part of the town boundary. Notched Pond is located on the east boundary of Raymond, and is the smallest of the ponds studied. These lakes and ponds all have many seasonal and some year-round homes along their shores, many of which are subject to damage during high water.

Raymond Pond covers 346 acres, is fairly deep, has good quality water, and drains into Crescent Lake. Crescent Lake covers 716 acres and flows into Panther Pond through the Tenny River with no significant change in water-surface elevation. Panther Pond covers 1,439 acres. The outlet dam on Panther Pond, which controls the levels of both Panther Pond and Crescent Lake, has a head of about 10 feet. Panther Run starts below this dam and flows into Sebago Lake with an insignificant drop in water-surface elevation.

The terrain of Scarborough varies from sea level along the coastline, the Spurwink River, and the Scarborough River to areas reaching a maximum elevation of 215 feet. Much of the open coastline is beach area, with the exception of the tip of Prouts Neck, which is rocky. The Spurwink River forms the boundary with Cape Elizabeth and is influenced by tides for virtually the entire length. The area within several hundred feet of the river is typically very low and is covered by marsh grass and other semi-aquatic vegetation. The Scarborough River-Nonesuch River system has a very similar configuration. It also is surrounded by low-lying marsh areas, much of which are owned by the State of Maine. Two smaller marsh areas near the Dunstan and Nonesuch Rivers are maintained by the town as Game Management Areas.

Scarborough has very little manufacturing and industry. Many of the permanent residents work in the Portland area and commute daily. Tourism is very important to the local economy (Reference 29).

The Town of Sebago is a small summer resort town. Sebago is primarily a residential community, with a large part of the population employed in the Portland-Westbrook area. Most of the businesses in Sebago are seasonal, based on tourism and recreation. These include marinas, boat rentals and service, hotel, motel, and cottage rentals, stores and restaurants, summer camps for children, snack bars and beach rental. These commercial establishments are mostly located along State Route 114, which runs from south to north across the town and along the west shore of Sebago Lake.

Sebago is located in the Presumpscot River Basin, a region which is characterized by its many lakes, Sebago Lake is the major lake in the town and has many seasonal and year-round dwellings on its shores, many of which are subject to flood damage during periods of high lake elevation (Reference 30).

Areas in the western portions of the City of South Portland are relatively undeveloped with some farming and large tracts of open land. The watersheds of Long Creek and Red Brook are moderately developed with commercial and industrial properties. The properties adjacent to the Fore River are commercial and industrial, while most of the properties along the Atlantic coast are residential. The terrain of South Portland varies from 0 feet along the coast and along the Fore River to areas of high elevations reaching a maximum of 160 feet (Reference 31).

Standish is a rural area, but is considered a suburb of Portland. The parts of Standish bordering on the Saco River, Sebago Lake, and the other lakes in the town are desirable locations for residential use. There is some light industry in the town, much of which is associated with recreation. Many seasonal or year-round dwellings on the shores of the major lakes and ponds in Standish are subject to damage during high water.

Watchic, Little Watchic and Bonny Eagle Ponds also have forested shorelines that are in demand for season and year-round housing. There is a small dam at the outlet of each lake.

In Standish, the Saco River has a flat, fertile floodplain which is considered to be prime agricultural land. Farming has traditionally been its most valuable use. Planners are concerned that increasing population in the town may lead to residential development in this floodplain.

The soils and topography of Standish have been greatly influenced by glaciation. The relatively level areas adjacent to the Saco River and surrounding Sebago Lake are chiefly made up of ice contact and glacial outwash deposits. The higher elevations of the town are underlain by till. Some glacial marine deposits can be found along the small stream valleys. Large swamp deposits can be found along the banks of Tucker and Josies Brooks and Sticky River.

The Saco River Basin is one of the major river basins in Maine, with a drainage area of 1,700 square miles above its mouth. The Saco River flows 125 miles from its origin at the outlet of Saco Lake in New Hampshire to its mouth 5 miles below the head of tidewater at Biddeford, Maine. The river drops a total of 383 feet in Maine. Eleven industrial or utility power dams have been built along its course. At the Standish-Baldwin-Limington town line, the Saco is a wide, meandering, smoothly flowing river. At Steep Falls, it becomes a rapid.

Below Steep Falls, the river alternates between rapids and pools until it flows into Bonny Eagle Dam Pond. The hydropower dam at Bonny Eagle, built in 1910, is a 1,120-foot long concrete cavity dam with a 350-foot long spillway section. The power station has a maximum operating head of 38 feet, but stores very little water. The power plant and spillway section can pass 85,000 cfs, however the 0.2-percent-annual-chance flood discharge of the Saco River at Bonny Eagle is only 60,000 cfs. The normal full pond elevation of Bonny Eagle Pond is 215.1 feet (North American Vertical Datum of 1988 (NAVD88)).

The small streams which drain Standish either flow from north to south into the Saco River, or flow north into Sebago Lake. These include Tucker Brook, Strout Brook, the inlet and outlet brooks of Rich Mill Pond, and Sticky River.

The small streams studied in the southern portion of the town tend to drain hilly terrain. Their stream courses are fairly straight, their floodplains are narrow, and their stream gradients tend to be steeper than those in the north. Josies Brook, the inlet brooks of Watchic and Bonny Eagle Ponds, and the North Branch of Little River all show these characteristics (Reference 32).

Windham is a rural suburb of the City of Portland. The areas near Sebago Lake and the other lakes in the town, along with land bordering the Presumpscot and Pleasant Rivers, are very desirous locations for residential use. Windham has several population centers including Windham Center and North and South Windham. North Windham is close to Little Sebago Lake and its outlet, Ditch Brook, and South Windham is located along the Presumpscot River.

Little Sebago Lake in Windham covers an area of 1,898 acres; however, about half this area is in the Town of Gray. Ditch Brook flows out of Little Sebago Lake, and there is a considerable amount of housing along it. There are three small, shallow ponds along Ditch Brook: Mill Pond, Collins Pond, and Varney Mill Pond.

The major lakes in Windham have many seasonal or year-round dwellings on their shores, some of which are subject to damage during high water, including along Sebago Lake.

There are many small brooks and streams in the approximate study area in Windham, and they generally drain areas of sandy loam soils underlain by marine clay. Hyde Brook drains directly into Sebago Lake, and the outlet of Chaffin Pond drains into the Sebago Lake basin. Otter Brook, an unnamed brook downstream of Newhall Dam, Black Brook, Colley Wright Brook, Anderson Brook, and Inkhorn Brook drain directly into the Presumpscot River. Highland Lake (Town of Bridgton), which is at the northeast boundary of the town, has a surface area of 640 acres, of which only half is in Windham. This lake has three small inlet brooks, two of which are unnamed. The brook on the west shore drains a swamp, and the small brook south of Falmouth Road has a straight channel with a narrow floodplain. However, this brook has several houses on its banks in the lower reaches. The largest tributary of Highland Lake (Town of Bridgton), McIntosh Brook, flows out of Little Duck Pond with a narrow floodplain, after which it enters a flat area with a wide floodplain. Forest Lake, which has a surface area of 198 acres, is located in the northeast section of the town; however, only about half of this area is in Windham.

Windham is located on a gentle, undulating coastal plain. Topographic relief in this area is generally less than 360 feet.

The Presumpscot River basin is covered by glacial till composed of silt, sand, and gravel with cobbles and boulders. At the lower elevations and in the stream valleys of Windham, the till is buried under marine clay deposited during the ocean inundation that occurred following the recession of the glacier. Small streams have cut into these clay deposits and formed shallow gullies with moderate slopes. In the northwest section of Windham, there are several extensive areas of sand and gravel classified as ice-contact deposits (Reference 33).

The terrain in Yarmouth is generally low and cut by many small streams with low ridges between them. The Cousins River and the Royal River (Downstream) are major streams draining the area and are fed by smaller streams. Elevations range from sea level at the coast to over 200 feet on York Hill in the southwest part of town.

The soil types in Yarmouth range from moderate to deep and well drained in the northern part of Yarmouth, with an even mix of deep, moderate and poorly drained soils throughout the remainder of the town. Erosion of the soil is moderate to high throughout most of the town (Reference 34).

2.3 Principle Flood Problems

Past flooding in Cumberland County indicates that most flooding occurs in the winter or early spring months. Flooding is generally the result of northeasters which are more prevalent in the winter months and result from heavy rainfall on snow-covered or frozen ground and thunderstorms and hurricanes which occur in the late summer and early fall months and result in heavy rainfall. However, flooding can occur within the river and coastal areas of the County any time of year and is usually initiated or exacerbated by severe winter and summer storm events and snow melt (Reference 35).

Coastal flooding occurs frequently. Low pressure systems moving up the east coast with strong northeasterly wind gusts in the Gulf of Maine can cause rapidly growing seas and storm surges throughout the area. Low pressure systems that coincide with astronomical high tides and high winds frequently cause tide levels to rise above flood level, submerging docks, moving rocks onto roads, flood, and causing beach erosion (Reference 36).

The flood problems for the communities within Cumberland County have been compiled and are described below:

Flooding is historically the most common hazard affecting Cumberland County. Between 1987 and 2010, there were twenty federally declared disasters in which FEMA funds were utilized, seventeen of which were a type of flooding event. Every municipality in the County has received disaster assistance at least once with the exception of Frye Island (Reference 35).

In Baldwin, the low-lying areas are subject to periodic flooding caused by the overflow of the Saco River. The most severe flooding occurs in the early spring as a result of snowmelt and heavy rain in conjunction with ice jams. Additional floods, generally less severe, also occur in late summer as a result of hurricanes and tropical storms.

The two major floods from the Saco River affecting the Town of Baldwin were in 1936 and 1953. The 1936 event is the flood of record, having a peak discharge of 45,000 cfs and a return period of 200 years, according to records of the USGS gage at Cornish (Reference 12). The 1953 flood had a peak discharge of 42,400 cfs and a 170-year return period. A major flood on Breakneck Brook occurred in 1939 as a result of a localized storm centered over the drainage basin. This storm had a return period of 160 years and a peak discharge of 1,600 cfs. A total of $105,000 in damages to bridges, roads, and private property occurred during this flood (Reference 12).

For Bridgton, figures kept on Long Lake and the Bay of Naples at Songo Lock from 1920 to 1960 show major floods occurred in 1920, 1936, and 1953 (Reference 13). These floods have recurrence intervals of approximately 70, 70, and 20 years, respectively.

Major floods occurred on Stevens and Willett Brooks in 1896, 1936, and 1953. The most destructive flood in recent history is considered to be that of March 1953. Under present conditions, the 1953 flood was estimated to have a recurrence interval of approximately 1-percent-annual-chance.

Flooding on Highland and Long Lakes in Bridgton resulted in damage to single-family residences, numerous seasonal homes, businesses, recreational property, and roads. On Stevens, Willett, and Corn Shop Brooks, flooding resulted in damage to numerous businesses, several residences, public buildings, roads, and bridges.

In Brunswick, Cumberland, Freeport, and Yarmouth, flooding along the Casco Bay coastline is generally the result of northeasters, although hurricanes can also cause flooding in these areas.

Much of the Brunswick, Cumberland, and Freeport coastlines are characterized by steep bluffs. In areas where these bluffs are composed of unconsolidated materials, erosion during major storms is a significant problem. This bluff erosion is caused by the combination of high tides, wave action, and storm runoff.

The storm of January 1978 was the largest on record in the Brunswick area and involved unusually high tides and sustained winds. However, it produced little damage along the Brunswick coastline. The flood of record on the Androscoggin River occurred in March 1936, from a combination of heavy spring rains and melting snow.

Each year, Cape Elizabeth is exposed to northeasters. Hurricanes occur less frequently but can cause extreme high tides and flooding of low-lying areas along the coast and the Spurwink River.

Tide levels along the Cape Elizabeth coast are greatly influenced by the force, duration, and direction of winds as well as the distance across open water, or fetch, over which these winds act. A northeaster produces high tides along the coast of the town. This trend results from strong winds which blow out of the northeast and across the considerable fetch of the Gulf of Maine. The duration of a northeaster can be several days, and the result of all these forces is the stacking of water against the coast. There has been minimal property damage from flooding caused by storm-induced surge. This is partially a result of the fact that most of the coast in the town can be characterized as steep and rocky.

In Casco, Sebago Lake water level records have been kept by the Portland Water district since 1905 (Reference 15). These show the flood of record to have occurred in June 1917. This flood reached an elevation of approximately 266.8 feet and is estimated to have a frequency of 70 years. The second highest flood recorded was in April 1953. It reached an elevation of approximately 266.6 feet and an estimated frequency of 30 years. Floods of lesser magnitude were recorded on Sebago Lake in 1920, 1928, 1936, 1945, 1954, 1960, and 1973.

A substantial number of seasonal homes have been constructed within the floodplains of the Crooked and Songo Rivers. Many of these properties sustain damage from relatively frequent floods. The only known record of a flood discharge on the Crooked River was 8,300 cfs, measured in Norway, Maine in Oxford County, in March 1936 (References 15 and 26), which would have a frequency of approximately 30 years. Records of flood damages and high water marks were kept on the Crooked River (Town of Harrison) at Schribner’s Mill in Harrison, Maine for many years. These show major floods having occurred in 1896, 1936, 1942, and 1953.

The major flood damages in Casco are to single family and seasonal residences, recreational property, roads, and bridges.

The areas of flooding in the Town of Cumberland are minimal. On Great Chebeague Island, there are a few buildings that can be affected by high water in large storms; however, most structures on the mainland and islands are built at protected elevations.

The Town of Falmouth is subject to northeasters and hurricanes as well, which cause extreme high tide levels and flooding of low-lying areas along the coast and the Presumpscot River.

Tidal levels along Falmouth's coastline are also influence by wind force and duration. A northeaster produces high tide levels along the coastline of Falmouth. The winter storm of February 1978 was the storm of record in this area. Storm surge damage occurred along the coast and along the Presumpscot River. Highland Lake (Town of Falmouth) sustained some storm damage during the 1973 storm.

In Freeport, flooding along Marquoit Bay coastline and the Harraseeket River shoreline is generally the result of northeasters, although hurricanes can also cause flooding, especially along non-tidal rivers in the Freeport area.

Most damage along the Freeport coast is the result of wave action. The January 1978 northeaster was the largest storm of record and involved unusually high tides and sustained winds. The 1936 and 1954 hurricanes were the cause of the most extensive inland flooding in Freeport.

In Gorham, flooding commonly occurs in late winter and early spring and is generally caused by melting snow, frozen ground, ice jams, and early spring rains. At least one flood has occurred in the early fall as the result of torrential rains from a coastal hurricane. Because of the comparatively small drainage area and the short reaches between dams, the Presumpscot River can rise from normal flow to flood flow in a relatively short period of time. Once flood discharges are attained, the high flows can persist for several days while the many ponds behind dams in the basin are drained to normal levels.

Since 1987, long-term continuous discharge records and documented flood records have been kept in the City of Westbrook, just downstream of the Towns of Gorham and Windham, at the Cumberland Mills plant. Major floods were recorded in the Presumpscot River basin in March 1896, March 1936, September 1954, and March 1977. The recorded discharges for the four floods were 13,400 cfs at Saccarappa Dam, 11,200 cfs at Cumberland Mills, 12,500 cfs at Cumberland Mills, and 12,500 cfs at the USGS West Falmouth gage, respectively; the corresponding recurrence intervals for the 1896, 1936, and 1954 floods were 1-, 2-, and between 2- and 1-percent-annual-chance. No recurrence interval was available for the 1977 flood (Reference 37).

The 1896 flood was the highest known flood on the Presumpscot River. The apparent causes of this flood were ice, frozen ground, snowmelt, and approximately 6 inches of rainfall in 2 days (Reference 37). The extent of damage is not known due to limited records.

The March 1936 flood was one of the worst flood disasters ever recorded in Maine. It was caused by days of heavy rain, melting snow, ice jams, and several thunderstorms and cloudbursts. Although damage was severe, the Presumpscot River was affected to a lesser degree than others in the state. Peak flow recorded at the Cumberland Mills Dam (drainage area = 570 square miles) was 11,200 cfs. This discharge approaches that of a 2-percent-annual-chance flood. The S.D. Warren Paper Company was forced to cease operation for several days and received damage to equipment and property. Normal erosion and maintenance problems associated with flooding were intensified because of banks being overtopped.

A peak flow of 12,500 cfs on the Presumpscot River at West Falmouth in March 1977 also caused localized flooding in Westbrook, Windham and West Falmouth. The flood was caused by 4 inches of rain falling on frozen ground covered with snow. Because the gage at West Falmouth had only been in operation since 1975, no recurrence interval could be computed at that time. Other USGS gaging stations in the area recorded peak flows with 0.2-percent-annual-chance recurrence intervals for this event.

Because of the comparatively small drainage area and length of reaches, the Presumpscot River, in Westbrook, can rise from normal flow to flood flow in a relatively short period of time. Once flood flows are attained, high flows can persist for several days while the ponds behind dams are drained to normal levels.

USGS stream gage no. 01059800 is located on Collyer Brook in Gray and has records dating from September 1964. The highest recorded discharge at this gage was 1,220 cfs on December 27, 1969. Due to its short period of record, an adequate frequency analysis could not be made for this gage; however, based on the TR-20 watershed model, the December 27, 1969 discharge had a recurrence interval of approximately 30 years.

The major flood damage in Gray is to single-family and seasonal residences and recreational property located around Little Sebago Lake and Crystal Lake (Town of Gray). Damage along the streams of Gray is limited to several single-family residences, the Pineland Hospital water-supply facility, farmland, roads, and bridges.

Tide levels along the coastline of Harpswell are influenced by wind duration and fetch. Northeasters produce high tide levels along the coastline of Harpswell. Most damage in the town is a result of heavy wave action. The winter storm of 1978 was the largest on record and involved unusually high tides and sustained winds, creating powerful waves. The worst damage occurred near Wills Gut between Bailey and Orrs Islands and near The Dock in Lowell Cove at Orrs Island. These areas are some of the most populous in Harpswell near the open ocean.

The only known record of a flood discharge on the Crooked River was 8,830 cfs, measured in Norway, Maine, in March 1936 (References 15 and 26) which would have a frequency of approximately 30 years. Records of flood damages and high water marks were kept for many years at Scribner's Mill. These show major floods having occurred in 1896, 1936, 1942, and 1953. Scribner's Mill in Harrison, a National Register Historic Site, was virtually destroyed by spring runoff in 1977.

Most flooding on Crystal Lake Brook occurs on its lower end and is the result of backwater from Long Lake.

In Naples, Sebago Lake water-level records have been kept by the Portland Water District since 1905. These show the flood of record to have occurred in June 1917. This flood reached an elevation of approximately 267.7 feet and is estimated to have a frequency of approximately 70 years. The second largest flood recorded was in April 1953. It had an elevation of approximately 267.5 feet and has an estimated frequency of 30 years. Floods of lesser magnitude were recorded on Sebago Lake in 1920, 1928, 1936, 1945, 1954, 1960, and 1973.

Flooding on the Bay of Naples, Long Lake, and Sebago Lake resulted in damages to single-family dwellings, numerous seasonal homes, businesses, recreational property roads, and Sebago Lake State Park.

Monthly storage records were kept for Long Lake and the Bay of Naples at Songo Lock from 1920 through 1960 (Reference 17). The records show major floods occurring in 1920, 1936, and 1953 and these floods having recurrence frequencies of approximately 70, 70, and 20 years, respectively.

In New Gloucester, USGS stream gage no. 0106000, with records dating from October 1949, is located on the Royal River (Downstream) in Yarmouth, Maine, approximately 15 miles downstream of New Gloucester (Reference 18). The flood of record at this gage occurred on March 13, 1977, and had a peak discharge of 11,500 cfs and an estimated recurrence interval in excess of 1-percent-annual-chance. The next highest discharge of 7,960 cfs was recorded on September 12, 1974, and had an estimated recurrence interval of approximately 4-percent-annual-chance. A discharge of 6,730 cfs was recorded at Yarmouth in March 1936, with an estimated recurrence interval of approximately 10-percent-annual-chance.

The major flood related damage along the Royal River (Upstream) in North Yarmouth and Gray has been to a brickyard, several homes, farmland, roads, and bridges.

In the past, hurricanes have caused extreme high tides and flooding of low-lying areas along the Portland coast and the Fore River. Tide levels along the coastline of the City of Portland are greatly influenced by the force, duration, and direction of winds as well as fetch, over which these winds act. The storm of record occurred in February 1978, and damage occurred along the coast, the Fore River, and Back Cove.

In Raymond, the shorelines of all the lakes in the town can be subject to significant flooding and erosion caused by high lake levels and by wind-generated waves. The shores can be significantly gouged by ice movement when lake levels are high. Flooding generally occurs in the spring from runoff caused by unusually heavy rains combined with snowmelt. Flooding has also occurred as a result of heavy rainfall associated with hurricanes.

Panther Pond reached a flood elevation of 277.9 feet in November 1953, which has a recurrence interval of 75 years. Before 1953, the highest recorded lake level of Panther Pond was 277.7 feet (recurrence interval of about 2-percent-annual-chance) in 1936.

For Sebago Lake, a peak lake elevation of 266.8 feet was recorded in 1891, 1902, and 1917. This flood height has a recurrent interval of approximately 1-percent-annual-chance. The second highest flood recorded was in April 1953. It reached an elevation of approximately 266.6 feet and an estimated frequency of 30 years. Floods of lesser magnitude were recorded on Sebago Lake in 1920, 1928, 1936, 1945, 1954, 1960, and 1973. The S.D. Warren Company controls water-surface elevations of Sebago Lake by the methods outlined below.

USGS publishes records obtained from the S.D. Warren Company of Warren, Maine, which has been recording the discharge into the Presumpscot River from Sebago Lake continuously since 1887. The gage is located about 1 mile downstream from the Sebago Lake outlet at the hydroelectric plant dam at Eel Weir Falls.

Lake levels are generally affected by three categories of fluctuations: long-term, seasonal, and short-term. Long-term fluctuations are caused principally by an increase of precipitation over the drainage basin. Flooding can occur along the shoreline when rainfall of consecutive years is higher than the mean annual precipitation. The time interval between successive high water periods varies but abrupt increases in the lake level can sometimes occur. This study is primarily concerned with long-term fluctuations, combined with seasonal and short-period variations of the lake levels. Lake levels are normally high in the spring when runoff increases because of snowmelt, and evapotranspiration is low. Short-period fluctuations of lake levels are often caused by wind blowing across the surface of the lake.

In Scarborough, each year the town is exposed to northeasters. Hurricanes occur less frequently but can cause extreme high tides and flooding of low-lying areas along the coast and the Scarborough River-Nonesuch River system.

There are several areas in the town which are regularly flooded during major storms. A 1-mile stretch of U.S. Route 1 crossing the marsh area on either side of the Dunstan River is inundated during most major storms. The flooding extends beyond U.S. Route 1 to Milliken Road. Pine Point is flooded by 6 to 10 inches of water during most major storms but remains passable. Where it crosses the Nonesuch River, Black Point Road is also flooded and becomes impassable.

During the February 1978 storm in Scarborough (designated as the 1-percent-annual-chance storm), flood damage occurred at several points along the Nonesuch River, including Plummer's Island and Nonesuch Cove near Clay Pits Road. Most damage involved basement flooding and the loss of septic systems. Waves damaged retaining structures at Grand Beach and Pine Point and the first row of houses at Higgins Beach. A hotel at Higgins Beach was severely undermined and had to be demolished. The Massacre Pond area became very swampy due to freshwater flooding, but damage was limited merely to septic systems.

South Portland annually experiences northeasters. Hurricanes occur less frequently but can cause extreme high tides and flooding of low-lying areas along the coast of South Portland and the Fore River.

Tide levels along the South Portland coastline are greatly influenced by the force, duration, and direction of winds. A northeaster produces high tides along the coastline of the city. The storm of February 1978 was the storm of record in the area. Damage occurred along the coast and along the Fore River.

In Standish, major floods on the Saco River have occurred in the spring, usually the result of heavy rainfall combined with snowmelt. Although flooding has occurred during other months, ten of the 14 highest floods on record occurred during March, April, or May. Heavy rainfall associated with hurricanes moving up the coast of Maine has caused flooding in the fall.

The greatest flood recorded since 1908 at the hydroelectric plant at West Buxton occurred in March 1936, with peak flow of 58,000 cfs (Reference 32). The March 1953 flood, which was more severe than the 1936 flood in the upper portion of the Saco River basin, produced a peak flow of 50,000 cfs at West Buxton. The flood caused about $1.8 million of damage (Reference 32). The March 1936 and March 1953 floods have recurrence intervals of 400 years and 160 years, respectively.

Small areas of localized flooding have been noted along the small brooks studied by approximate methods in Standish. Road overflow is common along these brooks, especially when the culverts are clogged with ice.

The September 1954 flood caused some of the worst localized flooding that some sections of Westbrook have ever experienced. The major cause of this event was Hurricane Edna, which dropped torrents of water on the area for several days. Calculated flows along the Presumpscot River included: Saccarappa Dam - 12,400 cfs; Cumberland Mills Dam - 12,500 cfs; and Presumpscot Lower Falls Dam in Falmouth - 18,700 cfs. These discharges fit the frequency curve between the 2- and 1-percent-annual-chance intervals.

There are no stream gages within the watershed of the Stroudwater River. The largest flood on the Stroudwater River in recent years occurred in April 1973 and is estimated to have a frequency of 2-percent-annual-chance. Westbrook's Spring Street sewage pumping station, which was inundated by approximately 3 feet of water, was out of service until the waters receded. A flood occurred in March 1977 which was estimated to have a discharge of approximately 3,000 cfs, which would place it at about a 25-year event.

Most damage along the Yarmouth coast is the result of heavy wave action. The January storm of 1978 was the largest on record and involved unusually high tides and sustained winds, which created large powerful waves.

Riverine flooding generally occurs in the winter and early spring as a result of heavy rainfall on snow-covered ground. Recent notable riverine floods occurred in Cumberland County in 1987, 1996, 2006, and 2007. In April 2007, up to 8.5 inches of rain fell and combined with up to an inch of snowmelt, in southern Maine, resulted in high water-surface elevations and river streamflows for parts of southern Maine. Peak streamflows determined by the USGS were calculated up to 2-percent-annual-chance flood event in Cumberland County for the 2007 event (References 38 and 39). The storm also caused coastal flooding as it hit during a period of very high (and very low) astronomical tides. Prolonged northeast winds caused prolonged storm surge and large battering waves produced severe coastal flooding. Damage to marinas, buoys, docks and coastal property was significant (Reference 40).

Minor coastal flooding was reported when Hurricane Sandy merged with a strong upper level trough approaching from the west just off the mid Atlantic coast on October 29, 2012 (Reference 36).

2.4 Flood Protection Measures

Flood protection measures for Cumberland County from previous studies have been compiled and are summarized below:

In Baldwin, the Hiram Falls Dam, located below Hiram Village on the Saco River, reduces flood peaks by providing upstream storage. Steep banks of the Saco River which contain the flood flows protect some parts of the town. The bog areas upstream of Hiram Falls Dam on the Saco River act as a natural flood-retarding basin and reduce the peak discharge in Baldwin. Land use regulations adopted from the Saco River Corridor Commission were established in 1973 and control building within areas that have a high risk of flooding (Reference 12).

There are no known existing or planned flood protection structures within the Town of Bridgton. There are four dams on Stevens Brook in the Town of Bridgton. They are Highland Lake Dam, Bisbee Mill Dam, Tannery Dam, an unnamed dam located approximately 280 feet downstream of Highland Road and a power generation dam downstream from Kansas Road. Highland Lake Dam and the unnamed dam are used for recreational purposes only. Bisbee Dam and Tannery Dam no longer provide any significant function to the community.

The Town of Brunswick zoning ordinance has provisions for building in floodplains. In part, this ordinance states that residential structures must be elevated above, or flood-proofed to, 1 foot above the 1-percent-annual-chance flood elevation, and mobile homes must be securely anchored. Permits are required from the Code Enforcement Officer (Reference 14). Neither of the two dams on the Androscoggin River is used for flood control.

Cape Elizabeth has explicitly included provisions in its zoning ordinance to prevent building in obvious floodprone areas. The ordinance considers both coastal waters and inland waters. Building limits are based on obvious high water marks as indicated by the character of the soil and vegetation. Unfortunately, it cannot accurately account for relatively infrequent floods. The town has also purchased considerable amounts of land in the floodplain and, in particular, in the Spurwink Marsh.

There are no flood protection structures existing or planned in the Town of Falmouth. The Falmouth zoning ordinance has provisions for building in the floodplain. Permits are required, and building is permitted at sites that are reasonably safe from flooding based upon any available base flood data, as determined by the town.

Freeport has no planned or proposed flood control structures. The zoning ordinances, however, restrict the use of the flood hazard areas in the town.

In the Town of Gorham, the Central Maine Power Company has built five power stations, including the South Windham Dam, the North Gorham Dam, the Dundee Dam, the Little Falls Dam, and the Newhall Dam, along the river in Gorham to utilize the drop. Housing is limited along the shore because much of the shoreland is owned by the company.

Within the Town of Gorham, the natural streamflow of the Presumpscot River is altered significantly by dams on the numerous lakes and ponds in the watershed and upstream of Sebago Lake. These bodies of water were not specifically constructed as flood protection reservoirs, but they do have an influence on flood peaks. The dams at the outlets of the lakes and ponds are generally controlled by municipal agencies or private companies. Generally, when high levels of runoff are anticipated, the lake levels are lowered to reduce possible flooding.

The Town of Gorham has adopted a zoning ordinance which covers land use in the 1-percent-annual-chance floodplain as well as the shoreland areas. No building is permitted in the floodplain areas, and land use is limited to woodland, grassland, agriculture, and recreation. Land use of all shorelands within 150 feet of the normal high water mark of all navigable waterbodies in Gorham, as well as all permanent or seasonal wetlands, is also restricted. No buildings may be constructed within 100 feet of the high water mark (Reference 24).

There are no major flood protection structures existing or planned in the Town of Harpswell. The town zoning ordinance has provisions for building in the floodplain. In the event of major flooding, the Harpswell evacuation plan calls for residents to seek safety in specified host towns (Reference 26).

The City of Portland has regulations which apply to construction in areas of flood hazard. The regulations call for modifications "to prevent flotation, collapse, or lateral movement of the structure." Structural flood protection measures along the coast are limited.

There is a non-functioning power dam on the Presumpscot River that provides minimal flood protection. The Presumpscot River is regulated to some degree by dams further upstream in Westbrook. These dams were originally designed to provide power; flood protection is an added benefit. The steep banks of the Presumpscot River and the large storage capacity of Lake Sebago provide natural flood protection along the river.

The natural flows out of Sebago, Panther, and Crescent Lakes are altered significantly by dams at the outlets. Although these lakes do not specifically function as flood control reservoirs, they do significantly dampen flood peaks in areas downstream of the dams.

Raymond has adopted a shoreland zoning ordinance which covers most of the land within 600 feet of normal high water of the major bodies of water in the town. The ordinance helps to reduce potential flood damages by restricting development and land use in the shoreland zones (Reference 28).

Scarborough has explicitly included provisions in its zoning ordinance to regulate building in floodprone areas. The ordinance considers both coastal and inland waters. Large portions of the floodprone region are owned by the state and the town and would not be available for development by private individuals and concerns.

In March 1975, Sebago adopted a shoreline zoning ordinance which covers most of the land within 250 feet, horizontal distance, of normal high water of the major bodies of water in the town. This ordinance helps to reduce potential flood damages by restricting development and land use in the floodplain. The shorelines of Hancock, Peabody, Browns, Southeast, Perley, and Barker Ponds, the Northwest River, and Sebago Lake are protected by this ordinance.

There are no flood protection structures existing or planned in the City of South Portland. The city zoning ordinance has provisions for building in the floodplain. Permits are required, and building is permitted at sites that are reasonably safe from flooding based on any available base flood data, as determined by the city.

In Standish, flood discharges in the Saco River basin are greatly reduced by the natural valley storage afforded by the large floodplain extending from near the Maine-New

Hampshire border to Hiram. It has been estimated that nearly 200,000 acre-feet of water (about 8,700 million cubic feet) was stored in the valley during both the 1936 and 1953 floods (Reference 32).

Although there are several large dams on the Saco River, none significantly alter high streamflow or control flooding.

The Saco River Corridor Commission has zoned all of the shoreland of the Saco and Little Ossipee Rivers. The protected area is known as the "Saco River Corridor" and includes the land areas within 500 feet of the normal high water mark of the Saco River in Standish.

In areas where the floodplain exceeds 500 feet in width, the "Corridor," is extended to include the floodplain area, up to a maximum of 1,000 feet wide. In Standish, the Saco River Corridor is zoned either as Resource Protection or Limited Residential, which severely restricts encroachment and development in the floodplain (Reference 32).

The Town of Standish ordinance restricts development within 250 feet of the Sebago Lake; however, many houses and cottages built before the ordinances went into effect are in this shoreland zone (Reference 32).

In Westbrook, a stone masonry dam is located on the Stroudwater River approximately 100 feet upstream from the Westbrook Street Bridge. It is 16 feet high and creates backwater effects for over 1 mile, although it offers very little in the way of flood protection, due to a small retention capacity. These are the only available flood protections measures for Westbrook as the community has not adopted any zoning ordinances.

There are two dams on the Presumpscot River within the city limits of Westbrook. These are the Cumberland Mills Dam and the Saccarappa Dam. Both dams were constructed to produce power but only the latter, upstream of the former, continues to be used for this purpose. Both structures provide minimal flood control protection as an auxiliary function.

The Town of Windham has adopted a zoning ordinance which covers land use in the 1-percent-annual-chance floodplain as well as the shoreland areas. No building is permitted in the floodplain areas, and land use is limited to woodland, grassland, agriculture, and recreation. Land use of all shorelands within 250 feet of the normal high water mark of all navigable waterbodies in Windham, as well as all permanent or seasonal wetlands, is also restricted. No buildings may be constructed within 100 feet of the high water mark.

Yarmouth has no flood control structures planned or proposed. The subdivision ordinance has been amended to help minimize or eliminate flood damage to all utilities, facilities, and new homes.

Cumberland County participates in the Maine "Mandatory Zoning and Subdivision Control Law" (Chapter 424, Section 4811 thru 4814 of the Maine Statutes, (Reference 41) that requires all municipal units of government to adopt zoning and subdivision control ordinances for shoreland areas. Shoreland areas are defined as land within 250 feet of the normal high water mark of any pond, river, or salt water body. If a municipality fails to adopt zoning and subdivision controls for any reason, the Maine

Department of Environmental Protection and the Maine Land Use Regulation Commission shall adopt suitable ordinances for that municipality. The law was revised by the Maine Legislature in 1973 to give the municipalities until June 30, 1974 to adopt the ordinances. At that time, a moratorium was declared in those communities that had failed to develop ordinances on all shoreland areas as defined above. This law prohibits filling or earth-moving without permit within 250 feet of the shoreland.

There are no existing or planned flood protection structures in the Towns of Casco, Chebeague Island, Cumberland, Frye Island, Gray, Harrison, Long Island, Naples, New Gloucester, North Yarmouth, and Pownal.

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-, 2-, 1-, or 0.2- percent-annual-chance (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 2-, 1-, and 0.2-percent-annual-chance floods, have a 10-, 2-, 1-, and 0.2-percent-annual-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 that equals or exceeds the 1-percent-annual-chance flood in any 2-percent-annual-chance period is approximately 40 percent (4 in 10); 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.

3.1 Riverine Hydrologic Analyses

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

For each community within Cumberland County that has a previously printed FIS report, the hydrologic analyses described in those reports have been compiled and are summarized below.

Pre-countywide Analyses

Flood discharge estimates for Stevens, Willett, and Corn Shop Brooks in Bridgton (Reference 13), Songo River and Crooked River in Casco and Naples (References 15 and 17), Pleasant River, Collyer Brook, Thayer Brook, Little Sebago Lake, Tributary A and Eddy Brook in Gray (Reference 25), Crooked River (Town of Harrison) and Crystal Lake Brook in Harrison (Reference 16), Royal River (Upstream) in New Gloucester, North Yarmouth and Gray (References 18, 19, and 25), Capisic Brook, East Branch Capisic Brook and West Branch Capisic Brook in the City of Portland (Reference 27) were generated from the SCS TR-20 hydrologic evaluation model (Reference 42). This model utilizes such variables as rainfall-frequency data, soil type, antecedent moisture condition, land use, time of concentration, and drainage area.

Those for the Royal River (Downstream) were correlated with statistical analyses of USGS stream gage no. 0106000 at Yarmouth, Maine (Reference 34). The discharges used for the Pleasant River basin and Little Sebago Lake were checked against the USGS regression equation for Maine (Reference 43).

The attenuation of peak discharges on the Crooked River (Town of Harrison) is caused primarily by an increased storage in the overbank and channel areas.

For the Stroudwater River, discharges were obtained from the SCS (now the USDA NRCS) flood hazard analyses for the river (Reference 27). The 10-, 1-, and 0.2-percent-annual-chance discharges were given, and the 2-percent-annual-chance discharge was interpolated.

Discharges for several flooding sources within Cumberland were determined using a regional equation developed by USGS. Peak discharges developed for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods at the USGS gaging stations by a log-Pearson Type III analysis were transposed to other stations by the following formula:

$$Q/Q_g = (A/A_g)^{0.8}$$

where Q and Q_g are the discharges at the station and the gage, respectively, and A and A_g are the drainage areas at these locations (Reference 44).

Below is a compilation of the flooding sources that used the log-Pearson Type III analysis and formula described above:

Discharges for Capisic Brook, from its confluence with the Fore River to Warren Avenue and Nasons Brook were determined using the regional equation developed by USGS (Reference 27). The 10-, 2-, and 1-percent-annual-chance discharges at several stations on the streams were calculated. The 0.2-percent-annual-chance discharge at each station was extrapolated from a log-normal plot of the three calculated flow values.

In Baldwin, a USGS gage (no. 01066000) located at Cornish, Maine, on the Saco River, was used to establish the peak discharge-frequency relationships. These discharges are based on statistical analysis of discharge records covering a 60-year record (References 45 and 46). Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data in accordance with the U.S. Water Resources Council Bulletin No. 17 (Reference 44). Flood discharges for the remaining streams in Baldwin were based on the USGS Open-File Report 75-292, "A Technique for Estimating the Magnitude and Frequency of floods in Maine," which is a regional method based on regression analysis (Reference 47).

In Yarmouth, for the riverine portion of the Royal River (Downstream), peak discharges were developed from a weighted combination of the Maine Regional Equation prepared by USGS and flows obtained from the gaging station (no. 010600000, 30 years of record) (Reference 43). The 10-, 2-, and 1-percent-annual-chance peak flows at several stations on the river were calculated. The 0.2-percent-annual-chance discharge at each station was extrapolated from a log-normal plot of the three calculated flow values. A log-Pearson

Type III distribution of annual peak flow data was used to obtain 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges from the gage (Reference 44). The flows from the gage were transposed to points along the Royal River (Downstream) using the following discharge-drainage area ratio formula:

$$Q_1 / Q_g = (A_1/A_g) * 0.8$$

Where Q_1 is the discharge at a specific location, Q_g is the discharge at the gage, A_1 is the drainage area at a specific location, and A_g is the drainage area at the gage (Reference 48).

Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges at the outlet of Sebago Lake in Windham were obtained from a log-Pearson Type III distribution of annual peak flow data according to the Water Resources Council Bulletin 17A (References 33 and 49). Using the methods outlined in USGS Open-File Report 75-292, the Presumpscot River flows were adjusted for a drainage area increase below the confluence with the Pleasant River and below the confluence of the Little River (Reference 43). The values of the peak flows at the 10-, 2-, 1-, and 0.2-percent-annual-chance recurrence intervals at each point of interest were obtained using equations outlined in Open-File Report 75-292 (Reference 43).

In Brunswick, the stream gaging station on the Androscoggin River at Auburn (no. 01059000, with 49 years of record) was used to aid in defining frequency-discharge relationships for the river (Reference 14).

Peak discharges for Trout Brook, Long Creek, Jackson Brook, Red Brook and Piscataqua River were developed using the regional equation prepared by USGS as well (References 31 and 43). The 10-, 2-, and 1-percent-annual-chance peak flows at several locations on Trout Brook and Piscataqua River were calculated. The 0.2-percent-annual-chance discharge was extrapolated from a log-normal plot of the three calculated flow values.

Discharges for the Presumpscot River in Falmouth and Portland were taken from the FIS for the City of Westbrook and transposed by the drainage area discharge ratio (Reference 37).

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods at the spillway of Highland Lake (Town of Falmouth) were determined by hydrologic routing methods (Reference 22). In the routing, it was assumed that the lake was full to the top of the spillway before the storm runoff began entering the lake. This assumption was made because the lake is not regulated to control floods, and it was desired to start with the worst possible conditions. Calculations were made to determine a lake storage curve, a rating curve for the spillway, and an inflow hydrograph. From these working curves, discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods were developed.

In Gorham, the principal source of data for the Presumpscot River is streamflow records published by USGS (station no. 01064000, January 1887 to 1977). In addition, USGS has operated a gage at West Falmouth since October 1975 (station no. 01064140). This station was operating in March 1977 when other USGS gaging stations in the area recorded peak flows with a 0.2-percent-annual-chance recurrence interval.

Discharges for Fall Brook were computed using the USACE HEC-I computer program (Reference 24).

In Raymond, the principal source of data for Sebago Lake was the record of lake elevations maintained by S.D. Warren Company for 106 years (1872-1977).

Values of the 10-, 2-, l-, and 0.2-percent-annual-chance peak stages for Sebago Lake were obtained by graphical methods. These values of peak stages were plotted using the Weibull formula:

PLOTTING POSITION (exceedence probability) = M/(N+l),

where M is the rank of the event and N is the number of events. The values were plotted against the annual maximum lake elevations and a curve was fitted to the data. The peak stage values at the needed recurrence intervals were selected from this curve. The principal source of data for Sebago Lake was the record of lake elevations from 1872 to 1977.

The source of data for Panther Pond was also records of lake elevations for 38 years (1920-1958). The dam at the outlet of Panther Pond also controls the water-surface elevation of Crescent Lake. Values of peak flows at the outlet of Panther Pond and Crescent Lake were determined by using equations developed by R.A. Morrill (Reference 28). These equations relate flood flows to drainage area, main channel slope, and storage area. This method was also adopted for calculating flow for the 0.2-percent-annual-chance recurrence interval.

The estimated flood flows were then used to compute the head on the Panther Pond outlet dam. The geometric features of the dam were surveyed and all data needed to compute heads were obtained in the field. The formula for computing flow over a broad-crested weir: Q = CLH 3/2 was assumed to be valid for computing flow over the spillway. For flow through the deep control gate, fully opened, the equation used was: Q = CA * 2 gH. In the first formula, Q is discharge in cubic feet per second, C is the coefficient of discharge, L is the length of weir in feet, and H is the head on the dam, in feet (Reference 28). In the second formula, A is the area of the gate-opening, in square feet; g = acceleration of gravity, in feet per second squared; H is the head of water on the gate, in feet; and C is the coefficient of discharge (Reference 50). The peak stage values at the needed recurrence intervals were then computed. The values determined were checked against values determined by formulas given in Bulletin 17A of the Water Resources Council (Reference 49). It should be noted that the values used in this check were taken from data on maximum month-end lake elevations.

In Westbrook, discharges from Sebago Lake to the Presumpscot River have been recorded continuously since 1887 by the S.D. Warren Company and published by USGS. In 1975, USGS installed a stream gage on the Presumpscot River in Falmouth at the Maine Turnpike bridge crossing, just downstream of the study area. The only other flow data available for the lower Presumpscot River are miscellaneous peak discharges computed at the Cumberland Mills Dam in Westbrook. Extensive regulation of Sebago Lake has greatly attenuated peak flows from the upper 436 square miles of the Presumpscot River watershed. Runoff from the lower 154-square mile drainage area is the primary contributor to flood flows in Westbrook. The Royal River (Downstream) at Yarmouth, Maine, located adjacent to the Presumpscot River basin, has a drainage area of

141 square miles and is considered somewhat indicative of the runoff characteristics of the lower Presumpscot River. Analysis of 28 years of USGS flow data for this stream was therefore used as a basis for estimating discharge frequencies for the lower Presumpscot River. A frequency curve was developed for the Royal River (Downstream) using a standard log-Pearson Type III statistical distribution (Reference 44). Discharge frequencies for the Presumpscot River watershed, between Sebago Lake and Cumberland Mills Dam, were developed by multiplying the Royal River (Downstream) curve by the ratio of peak flows experienced at Cumberland Mills Dam and the Royal River (Downstream) during the floods of March 1936, September 1954, and March 1977.

An assumed coincident baseflow contribution of 600 cfs from Sebago Lake was then added to the Presumpscot River discharges, reflecting the desynchronization accomplished through regulation at the Eel Weir Canal by the S.D. Warren Company. Frequency data for the Presumpscot River were then transferred downstream to the Falmouth town line by ratio of net drainage areas taken to the 0.7 exponential power, assuming the same continuous baseflow contribution of 600 cfs from Sebago Lake. The resulting peak discharges exceeded those values of the “Floodplain Information, Presumpscot River Study” (Reference 51), by approximately 20 percent, due mainly to the inclusion of the significant March 1977 event in the discharge-frequency analysis.

It was found that water levels along Mill Brook were nearly equal to those near the mouth and the lower portion of the Scarborough River. Calculated storm levels decreased approximately three-fourths of a foot in the upper portions of the Scarborough, Dunstan, and Nonesuch Rivers. The calculations made above neglected any freshwater inflow at the upstream boundary of the Scarborough and Nonesuch Rivers. However, both these rivers drain a substantial area, and a second set of calculations was made which included freshwater inflow of 2,000 cfs at the upstream boundary of both rivers. This flow value was taken from a study by the SCS and corresponds roughly to the 1-percent-annual-chance flood (Reference 52). The addition of freshwater inflow indicated the flood level in the upper portions of the Scarborough and Nonesuch Rivers to be approximately one-fourth of a foot less than the level at the open coast.

The freshwater inflow quantity of 2,000 cfs is based on calculations which are only approximate. Nevertheless, it can be inferred from the results of the modeling that the flood elevation throughout the estuary portion of the Scarborough River-Nonesuch River system is essentially uniform.

There being no discharge records for either Mill Brook or Minnow Brook in Westbrook, the runoff characteristics of the watersheds were assumed to be equivalent to those for the lower Presumpscot River basin as a whole, and flows were determined on a direct drainage area relationship. In the case of Mill Brook, the additional effect of storage at Highland Lake (Town of Falmouth) in the upper watershed was also considered in the selection of peak flows from the lower 4.5 square mile drainage area. Several significant flood events were recently recorded on the Stroudwater River by USGS, suggesting the need for some modification of the discharge-frequency relationship previously published in the “Flood Hazard Analysis Stroudwater River Study” (Reference 53). The discharges developed by SCS for the 1-percent-annual-chance frequency flood were retained, but values in the more frequent range were increased due to the recent frequency of high flows, particularly the events of April 1975, April 1976, and March 1977. Discharges for the ungaged Clark Brook and Tributary to Clark Brook were established on the basis of the Stroudwater River discharge-frequency curve, making appropriate adjustments for differences in drainage areas.

In Standish, computation of flow past the hydropower plant at West Buxton in York County was the principal source of data for defining discharge-frequency relationships for the Saco River and the Saco River Left Channel (Reference 32). Records of annual maximum dai1y discharge were furnished by the Central Maine Power Company. These discharges were computed from records of flow over dam, through gates, and through wheels of the power plant. The data covers a period of 64 years (1908-1916 and 1920-1977).

Values of the 10-, 2-, 1-, and 0.2-percent-annual-chance peak discharges for Saco River and Saco River Left Channel in Standish were obtained from a log-Pearson Type III distribution of these annual maximum daily flow data (Reference 49). The results from this analysis were increased by 1.7 percent to simulate instantaneous peak discharge. The 1.7 percent factor was determined to be the average amount by which instantaneous peak flows exceeded concomitant daily flows at West Buxton, and was based on a comparison of 59 events. The instantaneous peak discharges were computed from flow through wheels and gates, and flow over spillways. Because of the difference in drainage area from West Buxton (1,571 square miles) to the Buxton-Standish-Limington Town line (1,330 square miles), further adjustments in the peak flows were required to estimate flow at various points along the studied reach.

USGS has kept discharge records of the Saco River at Cornish, Maine (station no. 01066000) since 1916. The drainage area at Cornish is 1,298 square miles. The adjusted flows for the Saco River used in this report were prorated values based on the difference in drainage area between Cornish and West Buxton.

At the southern corporate limits of Standish, the Saco River is divided into two channels, the Saco River and the Saco River Left Channel. The total discharge is divided between the two channels. The Bonny Eagle Hydrologic Dam on the Saco River limits the maximum discharge that will be carried by the Saco River and, through the use of a rating curve, the maximum discharge that the Bonny Eagle Hydrologic Dam can carry was determined to be 4,000 cfs. A maximum discharge of 4,000 cfs was used for all floods for the Saco River and the remaining discharge was routed through the Saco River Left Channel.

The drainage area for the Presumpscot River at Cumberland Mills Dam and at Westbrook-Falmouth Boundary is 436 square miles above Sebago Lake. The drainage area for Mill Brook at its mouth is 7.9 square miles above Highland Lake (Town of Falmouth).

For Windham, the principal source of data for the Presumpscot River was records published by USGS (gage no. 01064000, Presumpscot River at the outlet of Sebago Lake, Maine, January 1887 to 1977). In addition, USGS has operated a gage at West Falmouth since 1975 (gage no. 01064140).

Countywide Analyses

For this countywide revision, no new riverine Hydrologic Analyses were conducted.

Peak discharges for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods of each flooding source studied in detail by the previous FIS in Cumberland County are shown in Table 6, "Summary of Discharges".

TABLE 6 – SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
ANDROSCOGGIN RIVER					
At the water quality monitoring station near the State Route 201 bridge in Brunswick	3,410	65,390	93,390	106,960	143,070
BREAKNECK BROOK					
Confluence of Saco River	5.5	615	1,095	1,350	2,075
At 0.9 mile upstream of confluence with Saco River	4.4	550	950	1,225	1,900
At 1.6 miles upstream of confluence with Saco River	3.6	475	850	1,100	1,730
At 3.5 miles upstream of Saco River	1.4	340	630	795	1,320
CAPISIC BROOK					
At its confluence with the Fore River	5.09	620	890	1,020	1,310
At upstream of confluence of Nasons Brook	2.78	539	804	935	1,337
At Essex Road (extended) in Portland	1.92	498	724	835	1,075
CLARK BROOK					
At mouth in Westbrook	1.02	295	350	375	515
COLLEY WRIGHT BROOK					
Downstream of Chute Road	3.8	*	*	5,420	*
COLLYER BROOK					
At the confluence with the Royal River (Upstream)	19.63	1,400	2,250	2,630	3,750

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
COLLYER BROOK - continued					
At Merrill Road in Gray	19.09	1,350	2,180	2,550	3,640
At Megquier Road in Gray	14.49	940	1,610	1,860	2,890
At U. S. Route 202 in Gray	13.75	870	1,480	1,750	2,530
At Mayall Road in Gray	9.31	700	1,100	1,280	1,820
At Weymouth Road in Gray	8.51	630	1,000	1,160	1,640
At the Maine Turnpike in Gray	6.78	490	770	890	1,260
At State Route 26 in Gray	3.18	190	300	340	470
At North Raymond Road in Gray	1.81	80	120	130	170
CORN SHOP BROOK					
At Main Street in Bridgton	0.67	90	190	290	900
CROOKED RIVER					
At 540 feet above confluence with the Songo River	151.5	6,100	9,500	11,000	*
At upstream Casco corporate limits	147.5	6,100	9,500	11,000	14,800
CROOKED RIVER (TOWN OF HARRISON)					
At the upstream of Scribner's Mill in Harrison	107.6	6,200	9,700	11,200	14,500
At the downstream of Norway (Oxford County)/Harrison corporate limits	95.6	6,300	9,700	11,200	14,500
CRYSTAL LAKE BROOK					
At State Routes 35 & 117 bridge over Crystal Lake Brook	8.7	40	95	125	290

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
DITCH BROOK					
At crossing of Varney's Mill Road in Windham	20.3	535	821	988	1,380
At outlet of Little Sebago Lake	18.9	535	821	988	1,380
DUG HILL BROOK					
At the Confluence with Saco River	3.2	315	560	700	1,130
EAST BRANCH CAPISIC BROOK					
At its confluence with Capisic Brook	0.35	191	315	370	521
EDDY BROOK					
At the confluence with Collyer Brook	4.29	190	360	450	710
FALL BROOK					
At near its confluence with Back Cove	1.6	288	433	498	657
Upstream of Washington Avenue in Portland	0.6	114	131	142	171
At Ray Street in Portland	0.27	110	121	128	144
FOGG BROOK					
Approximately 0.3 mile upstream of confluence of Fogg Brook and Silver Brook	16.2	*	*	699	*
JACKSON BROOK					
At upstream of Red Brook	3.5	320	490	580	780
At Gorham Road in South Portland	2.8	230	370	440	610

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
JACKSON BROOK - continued					
At pipeline crossing in South Portland	2.6	170	300	360	530
At Foden Road in South Portland	2.2	150	250	310	470
LITTLE SEBAGO LAKE					
At its outlet	18.9	100	130	140	180
LONG CREEK					
At its confluence with the Fore River	8	500	770	900	1,220
At downstream of Red Brook	6.9	450	700	840	1,150
MILL BROOK					
At mouth	4.5	480	630	700	860
MILIKEN BROOK					
At crossing of Anderson Road	0.5	*	*	350	*
MINNOW BROOK					
At mouth	1.3	340	460	520	660
NORTH BRANCH LITTLE RIVER					
Above confluence with Branch Brook	12.0	1,070	1,650	1,930	2,630
NASONS BROOK					
At Upstream of the confluence of Capisic Brook	1.43	180	270	330	440
At Near Portland Terminal Railroad culvert in Portland	1.15	125	195	225	310

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
PIGEON BROOK					
At the Confluence with Saco River	4.3	570	1,005	1,250	2,000
At the Confluence of Pigeon Brook Tributary	1.4	285	510	640	1,040
PIGEON BROOK TRIBUTARY					
At the Confluence with Pigeon Brook	2.9	325	580	725	1,170
PISCATAQUA RIVER					
At the confluence with the Presumpscot River	41.2	2,020	3,220	3,850	5,380
At upstream of the East Branch Piscataqua River	21	1,170	1,910	2,310	3,290
At upstream of the Tributary which flows through the corner of West Falmouth	19.6	1,120	1,830	2,210	3,150
At State Route 100 in Falmouth	18.6	1,070	1,750	2,210	3,010
PLEASANT RIVER					
At the downstream Gray corporate limits	13.68	1,210	1,990	2,280	3,150
At Lawrence Road in Gray	12.3	1,140	1,900	2,180	3,030
At Windham Center Road in Gray	5	520	860	980	1,360
At Hunts Hill Road in Gray	4.72	500	830	950	1,310
PRESUMPSCOT RIVER					
At Martin Point Bridge in Falmouth	638.1	9,800	13,600	15,300	19,700
At Eel Weir Dam in Gorham	441	2,690	4,840	6,090	10,000
At above mouth of Pleasant River in Gorham	452	2,740	4,940	6,210	10,200

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
PRESUMPSCOT RIVER - continued					
At the Little Falls Dam in Gorham	508	6,000	8,200	10,000	14,000
At the confluence of Little River	516	6,500	9,200	10,800	15,200
At the Gorham-City of Westbrook corporate limits	574	8,500	11,800	13,300	17,000
At downstream of the confluence of the Piscataqua River	632.2	9,800	13,600	15,300	19,700
At upstream of the confluence of the Piscataqua River	590.9	9,300	12,900	14,500	18,600
At Cumberland Mills Dam	134	8,500	11,800	13,300	17,000
At Westbrook-Falmouth Boundary	154	9,300	12,900	14,500	18,600
At the Windham-City of Westbrook boundary	574	8,500	11,800	13,300	17,000
Above mouth of the Little River	516	6,500	9,200	10,800	15,200
At Newhall Dam	502	5,870	8,020	9,780	13,700
At above mouth of the Pleasant River	452	2,740	4,940	6,210	10,200
At the Windham-Standish boundary	437	1,980	4,130	5,380	9,290
QUAKER BROOK					
At the Confluence with Saco River	12.5	830	1,390	1,695	2,880
RED BROOK					
At its confluence with Jackson Brook	3.4	210	350	430	620
At Maine Turnpike exit ramp	3.2	190	320	390	560
At the upstream South Portland corporate limits	2.8	160	280	340	490

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
ROYAL RIVER (UPSTREAM)					
At the Gray downstream corporate limits	72.76	3,390	4,670	5,310	7,170
At Depot Road in Gray	69.12	3,270	4,570	5,220	7,110
At the Main Central Railroad in Gray	48.99	2,650	3,750	4,310	5,940
At the Gray upstream corporate limits	48.35	2,610	3,710	4,270	5,890
At Morse Road in New Gloucester	48.3	2,610	3,710	4,270	5,940
At Penny Road in New Gloucester	45.13	2,450	3,530	4,060	5,890
At State Route 231 in New Gloucester	38.1	2,100	3,110	3,620	5,090
At Canadian National Railroad in New Gloucester	29.15	1,320	2,090	2,460	3,580
At Cobbs Bridge Road in New Gloucester	28.46	1,270	2,020	2,390	3,490
At the New Gloucester upstream corporate limits	26.07	1,110	1,810	2,150	3,190
At the North Yarmouth downstream corporate limits	136.4	6,490	8,930	10,170	13,900
At State Route 9 in North Yarmouth	131.96	6,540	8,850	10,020	13,820
At State Route 231 in North Yarmouth	77.67	3,560	4,800	5,420	7,250
At Mill Road in North Yarmouth	73.84	3,430	4,700	5,330	7,190
At the North Yarmouth upstream corporate Limits	72.76	3,390	4,670	5,310	7,170
ROYAL RIVER (DOWNSTREAM)					
At USGS gage No. 010600000	142	6,085	9,060	10,530	14,540

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
SACO RIVER					
At the Baldwin Corporate Limits	1,340	23,590	34,560	39,835	53,755
At the confluence of Pigeon Brook	1,313	23,065	33,790	38,950	52,560
At the Baldwin-Limington-Standish Corporate Limits	1,330	23,600	34,600	39,800	53,800
At the upstream confluence of Little Ossipee River	1,352	23,600	34,600	39,800	53,800
At the Hollis-Limington-Standish Corporate Limits	1,550	25,200	37,500	43,600	60,200
At Bonny Eagle Dam	1,560	25,300	37,700	43,800	60,600
SACO RIVER AND SACO RIVER LEFT CHANNEL					
At the Buxton-Hollis-Standish corporate limits	1,560	25,400	37,900	40,000	61,000
SILVER BROOK					
Approximately 0.3 mile upstream of confluence of Fogg Brook and Silver Brook	16.2	*	*	699	*
SONGO RIVER					
At 5,000 feet upstream of confluence with Sebago Lake	292	6,300	10,000	11,500	15,200
At downstream of Songo Locks Dam	270.9	6,300	10,000	11,500	15,200
At 5,000 feet above Sebago Lake	292	6,300	10,000	11,500	15,200

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
SOUTH BRANCH BROOK					
Approximately 0.1 mile upstream of confluence of Fogg Brook and Silver Brook	16.2	*	*	1,338	*
STEVENS BROOK					
At Smith Avenue in Bridgton	41.95	1,440	2,590	3,070	4,380
At 1,100 feet upstream of Depot Street in Bridgton	41	1,410	2,520	2,910	3,670
At 75 feet upstream of Beacon Street in Bridgton	20.67	330	620	740	1,320
STROUDWATER RIVER					
At the upstream Portland corporate limits	27.2	1,885	3,100	3,735	5,160
At Spring Street Bridge in Westbrook	25.1	2,760	3,310	3,510	4,860
At Mouth	27.7	2,960	3,540	3,760	5,200
THAYER BROOK					
At Libby Road in Gray	5.58	520	900	1,050	1,500
At U.S. Route 202 in Gray	3.24	300	540	630	920
TRIBUTARY A					
At Farm Road in Gray	0.95	90	160	190	270
TRIBUTARY TO CLARK BROOK					
At mouth	0.45	165	200	210	290
TROUT BROOK					
At the downstream Cape Elizabeth corporate limits	1.3	94	170	200	310

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE MILES)	PEAK DISCHARGES (CUBIC FEET PER SECOND) 10-PERCENT ANNUAL CHANCE	2-PERCENT ANNUAL CHANCE	1-PERCENT ANNUAL CHANCE	0.2-PERCENT ANNUAL CHANCE
TROUT BROOK - continued					
At Spurwink Avenue in Cape Elizabeth	1	85	150	180	270
At its confluence with the Fore River	2.6	290	440	510	690
At upstream of Kimball Brook	2	210	330	390	530
At Fessenden Avenue in South Portland	1.8	170	270	320	450
At Sawyer Street in South Portland	1.7	120	220	270	390
At the upstream South Portland corporate limits	1.3	94	170	200	310
At Spurwink Avenue in South Portland	1	85	150	180	270
UNNAMED TRIBUTARY 1 TO PRESUMPSCOT RIVER					
Approximately 250 feet upstream of community limits	500	*	*	210	*
Just downstream of confluence with Tributary 2 to Presumpscot River	430	*	*	176	*
Approximately 800 feet downstream of Standish Corporate Limes	330	*	*	380	*
370 feet upstream of confluence with Tributary 2 to Presumpscot River	178	*	*	92	*
Approximately 1,600 feet upstream of confluence with Tributary 2 to Presumpscot River	178	*	*	176	*

* Data not available

TABLE 6 – SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (SQUARE 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 TRIBUTARY 2 TO PRESUMPSCOT RIVER					
Just downstream of confluence with Tributary 1 to Presumpscot River	430	*	*	176	*
Approximately 2,200 feet upstream of confluence with Tributary 1 to Presumpscot River	251	*	*	87	*
UNNAMED TRIBUTARY TO TUCKER BROOK					
2,800 feet upstream of Maine Central Railroad	0.37	*	*	43	*
UNNAMED TRIBUTARY TO RICH MILL BROOK					
2,000 feet upstream of Maine Central Railroad	0.32	*	*	51	*
WEST BRANCH CAPISIC BROOK					
At its confluence with Capisic Brook	0.56	340	447	485	601
WESTCOTT BROOK					
At mouth	3.06	359	578	684	956
WILLETT BROOK					
At the confluence with Stevens Brook	20.21	1,350	2,440	2,890	4,130
At Willet Road in Bridgton	19.9	1,330	2,400	2,850	4,070

* Data not available

3.2 Riverine 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 FIRM [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 tables (FDTs) 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 use the flood elevation data presented in this FIS in conjunction with the data shown on the FIRM.

Cross section data for the below-water sections were obtained from field surveys. Cross sections were located at close intervals above and below bridges, culverts, and dams in order to compute the significant backwater effects of these structures. In addition, cross sections were taken between hydraulic controls whenever warranted by topographic changes.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the FIRM.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the Flood Profiles (Exhibit 1) are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

For each community within Cumberland County that has a previously printed FIS report, the hydraulic analyses described in those reports have been compiled and are summarized below.

<u>Pre-countywide Analyses</u>

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each flooding source.

Elevations on Long Lake were obtained through a log-Pearson Type III method of analysis (Reference 49) of 40 years of stage-storage records at the Songo Locks in Naples, Maine (Reference 17). The WSP-2 program was used to compute water-surface profiles from the Songo Locks to the Bay of Naples on which the same elevation as Long Lake is maintained (Reference 54).

Elevations on Crystal Lake (Town of Harrison) were taken directly from the results of the SCS TR-20 hydrologic evaluation (Reference 55) which uses known discharge-elevation relationships to route floods through dams.

In Baldwin, starting water-surface elevations for all streams were calculated using the slope-area method. Water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. The approximate zone on Pigeon Brook Tributary above Chase Siding Road was determined using the 1-percent-annual-chance brook elevation. The flood above Chase Siding Road was assumed to be a level backwater at that elevation.

In Bridgton, water-surface elevations of floods of the selected recurrence intervals were computed using the SCS WSP-2 computer program (References 13 and 54).

Elevations for the streams studied by detailed methods were started from critical depth calculations at the old Central Maine Power Company dam downstream of Kansas Road.

Water-surface elevations on Long Lake and Highland Lake (Town of Bridgetown) were obtained through a log-Pearson Type III method using 40 years of stage-storage records at the Songo Locks in Naples (References 17 and 49). The WSP-2 program was used to compute water-surface profiles from the Songo Locks to the Bay of Naples, which maintains the same elevation as Long Lake.

Water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Androscoggin River were calculated using the mean high tide for Merrymeeting Bay.

In Cape Elizabeth, water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Trout Brook were obtained from the FIS for the City of South Portland (Reference 31).

In Casco, water-surface elevations for the selected recurrence intervals on the Songo River and Crooked River were computed by the SCS WSP-2 computer program (Reference 54), starting from critical depth at Sebago Lake.

In Falmouth water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USACE HEC-2 step-backwater computer program (Reference 56). Starting water-surface elevations for the Presumpscot River were based on the mean tide elevation. Starting water-surface elevations for the Piscataqua River were calculated using the slope/area method.

At various locations along the Presumpscot and Piscataqua Rivers, the analysis indicates that flow would be supercritical flow. Because of the inherent instability of supercritical flow, critical depth was assumed at those locations when establishing the profile elevations for this study.

In Gorham, water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USGS E431 step-backwater computer program (Reference 57). Starting water-surface elevations for the profile determination of the Presumpscot River were taken from the FIS for the City of Westbrook (Reference 37). These elevations were verified by ratings developed for flow over dams. Starting elevations upstream of each of the four dams were determined from the stage-discharge relationships which the USGS computed. USGS made direct readings of the pond elevations upstream from the dams, surveyed the dams, and recorded their physical dimensions. Reference points were set in the forebays of the dams so the head on the dams could be computed for observed and measured flows.

Current meter measurements were made to determine the flow of the Presumpscot River at each of the dams. A relationship between stages and discharges was made for each. These ratings were extended on the basis of the standard flow over dam formula (Francis Formula, Q = CLH 3/2) (Reference 58). The discharge is Q, C is the coefficient of discharge, L is the length of the dam perpendicular to the direction of the flow, and H is the head of the dam.

The coefficient of discharge was determined using the tables and graphs presented in a USGS publication, which lists "C" values for various dam types (Reference 59). The actual "C" value used in the Francis Formula to compute the flood elevation was based on both of these "C" determinations. Ratings were verified by historic flood elevations.

For the streams studied by approximate methods in Gorham, the 1-percent-annual-chance flood elevations were estimated using the regional stage-frequency relationship by USGS hydrologists at the Augusta, Maine, office (Reference 24). This relationship indicates that the 1-percent-annual-chance flood is about 10 feet higher than the stream elevation mapped on USGS topographic maps.

In Gray, water-surface elevations for the selected recurrence intervals were computed by the TR-20 model for Little Sebago Lake and Crystal Lake (Town of Gray), and by the SCS WSP-2 computer program for each of the streams studied in detail (References 54 and 55).

Starting water-surface elevations for the Royal River (Upstream) in Gray were determined using a critical depth elevation at a dam immediately below Elm Street, downstream in the Town of Yarmouth. The Collyer Brook starting water-surface elevations were a continuation of the Royal River (Upstream) water-surface profile. The Pleasant River starting water-surface elevations were determined using critical depth taken downstream in the Town of Windham. The starting water-surface elevations for Eddy Brook are a continuation of the water-surface profile of Collyer Brook. Thayer Brook starting water-surface elevations are a continuation of the water-surface profiles of the Pleasant River; the starting elevations for Tributary A are a continuation of the water-surface profile for Thayer Brook.

In Harrison, water-surface elevations for the selected recurrence intervals were computed by the SCS WSP-2 computer program (Reference 54). The water-surface profiles for the Crooked River (Town of Harrison) were continued from the FIS for Naples (Reference 17). The water-surface elevation of Long Lake was used as the starting water-surface elevation for Crystal Lake Brook.

In Naples, water-surface elevations for the selected recurrence intervals on Sebago Lake were furnished by USGS. USGS determined the water-surface elevations by using 40 years (1920-1960) of gaging station information from the Sebago Lake dam gage. Water-surface elevations for the Bay of Naples, Long Lake, and the Songo River above Songo

Lock were computed through the use of a log-Pearson Type III analysis (Reference 60) on 40 years of records, 1920-1960, from the Songo Lock gaging station.

In Naples, water-surface elevations for the Songo River and Crooked River were computed through the use of the SCS WSP-2 computer program starting from critical depth at Sebago Lake (Reference 54).

In New Gloucester, water-surface elevations of floods of the selected recurrence intervals were computed through the use of the SCS WSP-2 computer program (Reference 54). Critical depth at a dam downstream in the Town of Yarmouth was assumed as starting water-surface elevations for the Royal River (Upstream).

In North Yarmouth, water-surface elevations of floods of the selected recurrence intervals were computed using the SCS WSP-2 computer program (Reference 54). Starting water-surface elevations for the Royal River (Upstream) were started from critical depth at a dam immediately below Elm Street, downstream in the Town of Yarmouth.

In Portland, for the 1986 FIS, water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for the Presumpscot River were obtained from the previous FIS for the Town of Falmouth (Reference 22). Starting water-surface elevations for the Stroudwater River, Fall Brook, Capisic Brook, and Nasons Brook were determined using the mean tide elevation.

For the 1992 Portland revision, water-surface elevations of floods of the selected recurrence intervals were computed for Fall Brook using the USACE HEC-2 step-backwater computer program; and for Capisic Brook. East Branch Capisic Brook, and West Branch Capisic Brook, using the NRCS WSP-2 step-backwater computer program (References 56 and 54).

Delineation of flooding for small portions of Mackworth and Hope Islands was taken from the FlSs for the Towns of Falmouth and Cumberland, respectively (References 22 and 21).

In Sebago, analyses of elevations of Sebago Lake were based on 106 years (1872-1977) of lake stage data furnished by the S.D. Warren Company of Westbrook, Maine.

In South Portland, water-surface elevations of floods of the selected recurrence intervals were computed using the USACE HEC-2 step-backwater computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Flooding from Long Creek was found to be completely controlled by tidal flooding from the Fore River. Starting water-surface elevations for Long Creek, Jackson Brook, and Trout Brook were based on mean high tide elevations. Starting water-surface elevations for Red Brook were taken at its confluence with Jackson Brook assuming coincident peaks.

In Standish, water-surface elevations for the selected recurrence interval floods were computed through use of the USGS E431 step-backwater computer program (Reference 57). The starting water-surface elevations used for the Saco River and the Saco River

Left Channel profile determination were taken from the FIS for the adjacent community of Buxton (Reference 61). The starting elevations upstream of Bonny Eagle Power Station were determined from a spillway discharge rating furnished by Central Maine Power Company. This rating is a stage discharge table that gives flows for peak discharges, including an allowance for water passing the plant while normal power is being generated. Peak discharges obtained were in agreement with flows obtained at the USGS gaging station on the Saco River at Cornish, Maine (station no. 00106600), after an allowance for inflow was made. There is a difference in drainage area of only 262 square miles between the reservoir and gage.

In Westbrook, starting water-surface elevations were determined for the Stroudwater River and the Presumpscot River using previously published elevation discharge relationships (Reference 37). Starting water-surface elevations for Minnow Brook and Mill Brook were determined at their respective mouths at the Presumpscot River. Starting water-surface elevations for Clark Brook were determined at its confluence with the Stroudwater River. Starting water-surface elevations for Tributary to Clark Brook were determined at its confluence with Clark Brook. Flood profiles were computed for all the streams using USACE's HEC-2 computer program (Reference 56). Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

In Windham, water-surface elevations of floods of the selected recurrence intervals were computed through the use of the USGS E431 step-backwater computer program (Reference 57). The starting water-surface elevations used for the profile determination of the Presumpscot River were taken from the FIS for the City of Westbrook (Reference 37). These elevations were verified by ratings developed for flow over dams. Starting water-surface elevations upstream of each of the four dams on the Presumpscot River and upstream of the three dams on Ditch Brook were determined from stage-discharge relationships. For the stage-discharge relationships, USGS personnel made direct readings from the dams, surveyed the dams, and recorded their physical dimensions. Reference points were set in the forebays of the dams so the head on the dams could be computed for observed and measured flows.

Furnished records of discharge measurements or current-meter measurements were made to determine the flow of the streams at each of the dams. These ratings were extended on the basis of the standard flow over dam formula (Francis Formula, Q = CLH3/2) (Reference 58). The discharge being studied is Q, C is the coefficient of discharge, L is the length of the dam perpendicular to the direction of the flow, and H is the head on the dam.

The coefficient of discharge was also determined using the tables and graphs in a USGS publication that lists "C" values for various dam types (Reference 33). The actual "C" value used in the Francis Formula to compute the flood elevations was based on both of these "C" determinations. Ratings were verified by historic flood elevations.

In the area of Elm Street on the Royal River (Downstream) in Yarmouth, there is a diversionary channel bypassing the main dam below the Main Street Bridge. A divided flow analysis was performed between the diversion and the main channel by equalizing head losses over the divided flow region. The diversion carries a small percentage of the total discharge and, therefore, the water-surface elevations on the main channel are only slightly affected by including a divided flow analysis.

At various locations along the Royal River (Downstream), the analysis indicates that flow would be supercritical. Because of the inherent instability of supercritical flow, critical depth was assumed at those locations when establishing the profile elevations for this study.

The overbank portions of the cross section data for the Androscoggin River, Presumpscot River, Piscataqua River, Saco River, Saco River Left Channel, Royal River (Downstream), Songo River, Highland Lake (Town of Falmouth) and Trout Brook were obtained from topographic maps compiled from aerial photographs (References 62, 63, 64, 65, 66, and 67). The below-water sections were obtained by field measurement. Cross sections were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures. In long reaches between structures, appropriate valley cross sections were also surveyed. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Cross sections for the Crooked River and Crooked River (Town of Harrison) were obtained from aerial photographs (Reference 68). The below-water sections, bridges, dams, and culverts were obtained from field surveys.

Cross sections for the backwater analyses in Falmouth were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures. In long reaches between structures, appropriate valley cross sections were also surveyed.

Cross sections on Crystal Lake Brook were obtained from field surveys.

Cross section data in New Gloucester were obtained from field surveys. All bridges and culverts were field surveyed to obtain elevation data and structural geometry.

Overbank portions of cross section data in Portland were obtained from topographic maps (Reference 69); below-water sections were obtained by field survey. Cross sections were located at close intervals above and below bridges in order to compute the significant backwater effects of these structures. In long reaches between structures, appropriate valley cross sections were also surveyed.

Cross sections for the backwater analysis of Ditch Brook were obtained using maps based on aerial photographs at a scale of 1"=800 feet (Reference 67). The below-water sections were obtained by field measurement. All bridges, dams, and culverts were field checked to obtain elevation data and structural geometry.

Roughness factors (Manning's “n”) used in the hydraulic computations were assigned on the basis of field inspection. The channel “n” and overbank “n” values for all streams studied by detailed methods are shown in Table 7, “Manning’s “n” Values” below.

TABLE 7 – MANNING'S "n" VALUES

Flooding Source	Channel "N"	Overbanks
All Stream Channels (At Westbrook)	0.035	0.080
All Streams Studied (At Gray)	0.045 - 0.070	0.070 - 0.095
Capisic Brook (At Portland)	0.035 - 0.060	0.055 - 0.120
Corn Shop Brook (At Bridgton)	0.065	0.050 - 0.075
Crooked River (At Casco)	0.037 - 0.071	0.065 - 0.140
Crooked River (Town of Harrison) (At Harrison)	0.039 - 0.078	0.060 - 0.150
Crooked River (At Naples)	0.037 - 0.071	0.065 - 0.150
Crystal Lake Brook (At Harrison)	0.060 - 0.070	0.065 - 0.095
Ditch Brook (At Windham)	0.035 - 0.055	0.045 - 0.115
East Branch Capisic Brook (At Portland)	0.035 - 0.060	0.055 - 0.120
Fall Brook (At Portland)	0.030 - 0.055	0.030 - 0.140
Jackson Brook (At South Portland)	0.015 - 0.070	0.050 - 0.120
Long Creek (At South Portland)	0.015 - 0.070	0.050 - 0.120
Nasons Brook (At Portland)	0.025 - 0.040	0.040 - 0.080
Piscataqua River (At Falmouth)	0.040 - 0.050	0.065 - 0.080
Presumpscot River (At Falmouth; At Portland)	0.050	0.065 - 0.120
Presumpscot River (At Gorham; At Windham)	0.035 - 0.060	0.045 - 0.125
Red Brook (At South Portland)	0.015 - 0.065	0.040 - 0.100
Royal River (Upstream) (At New Gloucester)	0.055 - 0.070	0.070 - 0.100
Royal River (Upstream) (At North Yarmouth)	0.036 - 0.056	0.060 - 0.170
Royal River (Downstream) (At Yarmouth)	0.032 - 0.045	0.060 - 0.150
Saco River (Baldwin)	0.040 - 0.045	0.080 - 0.10
Saco River (Standish)	0.030 - 0.50	0.035 - 0.120
Saco River Left Channel (Standish)	0.030 - 0.50	0.035 - 0.120
Songo River (Casco)	0.045 - 0.057	0.080 - 0.110
Songo River (Naples)	0.045 - 0.057	0.070 - 0.110
Stevens Brook (Bridgton)	0.022 - 0.075	0.085 - 0.100
Stroudwater River (Portland)	0.030 - 0.040	0.040 - 0.080

TABLE 7 – MANNING'S "n" VALUES - continued

Flooding Source	Flooding Source	Flooding Source
Trout Brook (Cape Elizabeth)	0.065	0.10
Trout Brook (South Portland)	0.015 - 0.070	0.050 - 0.100
West Branch Capisic Brook (Portland)	0.035 - 0.060	0.055 - 0.120
Willett Brook (Bridgton)	0.055 - 0.070	0.070 - 0.090

Countywide Analyses

For this countywide revision, no new riverine Hydraulic Analyses were conducted.

The Androscoggin River has been redelineated using the LiDAR elevation data obtained for the coastal analyses (Reference 9).

Based on the results of the revised coastal analysis, the backwater elevations are revised where necessary. The flooding sources of Androscoggin River, Capisic Brook, Fall Brook, Long Creek, Presumpscot River, Royal River (Downstream), Stroudwater River, and Trout Brook were revised for backwater elevations.

3.3 Coastal Hydrologic Analyses

In New England, the flooding of low-lying areas is caused primarily by storm surges generated by extratropical coastal storms called northeasters. Hurricanes also occasionally produce significant storm surges in New England, but they do not occur nearly as frequently as northeasters. Due to its geographic location, Cumberland County is susceptible to flooding from both hurricanes and northeasters.

A northeaster is typically a large counterclockwise wind circulation around a low pressure. The storm is often as much as 1,000 miles wide, and the storm speed is approximately 25 mph as it travels up the eastern coast of the United States. Sustained wind speeds of 10-40 mph are common, with short-term wind speeds of up to 70 mph. Such information is available on synoptic weather charts published by the National Weather Service.

Revised coastal analyses were performed for the open water flooding sources along the Atlantic coastline of Cumberland County, including the Cities of Portland, and South Portland; and the Towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth. A description of these revised analyses is presented in the countywide coastal analyses section below.

New Transects

Contains the 30 transects in the towns of Brunswick, Falmouth, Freeport, Long Island, and Yarmouth. A completely new RiskMap engineering analysis was performed for these transects (Reference 2). This analysis includes transect numbers 59, 62, 65, 66, 68-72, and 100-120.

Updated Map Mod Transects

Contains 87 transects in the City of Portland and the towns of Cape Elizabeth, Chebeague Island, Cumberland, Harpswell, and Scarborough. This study updated the former analysis (performed as part of FEMA's previous Map Modernization Program) by updating input wave conditions from a newer wave model (Reference 3). This analysis includes transect numbers 1-15, 17-20, 22, 23, 26, 28, 30, 32, 41-57, 73-99, 121-123, 125, 129-130, 132-133, 135, 150-155, 158, and 160-161.

Submitted Transects

Contains the 44 transects in the cities of Portland and South Portland and the towns of Cape Elizabeth, Falmouth, and Harpswell. Sebago Technics completed the coastal engineering analysis for this group in 2010. The STARR team utilized the 2010 study results for mapping. The titles of the five studies are "Peer Review of Federal Emergency Management Agency for the Town of Cape Elizabeth, Maine, 2010," "Review of FEMA Provisional Coastal Flood Maps for the Town of Falmouth, Maine, 2010," "Peer Review of Federal Emergency Management Agency (FEMA) Mapping – Harpswell, ME, 2010," "Delineation of the VE-Zone on the Northern Side of Portland Harbor, Maine, 2010," and "Delineation of the VE-Zone in South Portland, Maine, 2010" (References 4, 5, 6, 7, and 8). This analysis includes transect numbers 16, 21, 24-25, 27, 29, 31, 33-40, 58, 60-61, 63-64, 67, 124, 126-128, 131, 134, 136-149, 156-157, 159.

This new analysis resulted in revisions to the Special Flood Hazards Areas (SFHAs) within the cities of Portland, and South Portland; and the towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth.

Coastal Stillwater elevations presented in the pre-countywide FISs that have not been superseded by the revised coastal analyses have been compiled and are summarized below.

Pre-countywide Analyses

The pre-countywide stillwater elevations for the 10-, 2-, 1-, and 0.2-percent-annual-chance floods that are not superseded by the coastal study have been determined and are shown in Table 8, "Pre-countywide Summary of Stillwater Elevations." See Section 3.2 Riverine Hydraulic Analyses for information on how these pre-countywide Stillwater elevations were obtained.

TABLE 8 – PRE-COUNTYWIDE SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
BAY OF NAPLES				
Town of Naples	272.6	273.6	273.8	274.5
BONNY EAGLE DAM POND	*	*	268.4	*
COLLINS POND				
At Town of Windham	271.4	271.8	272.0	272.4
CRESENT LAKE				
Along entire shoreline in Raymond	277.7	278.3	278.4	278.6
CRYSTAL LAKE (TOWN OF GRAY)				
Town of Gray	311.6	311.7	311.8	311.9
CRYSTAL LAKE (TOWN OF HARRISON)				
Entire Shoreline in Town of Harrison	298.3	399.3	299.4	300.6
HIGHLAND LAKE (TOWN OF BRIDGETOWN)				
Town of Bridgton	426.8	427.2	427.3	427.7
HIGHLAND LAKE (TOWN OF FALMOUTH)				
Town of Falmouth	192.0	192.5	192.7	193.1
LITTLE SEBAGO LAKE				
For its entire shoreline	286.5	286.9	287.0	287.4
LONG LAKE				
Town of Naples	272.6	267.0	267.1	267.4
For its entire shoreline within Bridgton	272.6	273.4	273.8	274.5
Entire Shoreline within Harrison	272.6	273.4	273.8	274.5

* Data not available
[1]North American Vertical Datum 1988

TABLE 8 – PRE-COUNTYWIDE SUMMARY OF STILLWATER ELEVATIONS - continued

FLOODING SOURCE AND LOCATION	ELEVATION (feet NAVD[1]) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
MILL POND				
Town of Windham	283.5	284.4	284.8	285.8
PANTHER POND				
At Outlet in Raymond	277.7	278.3	278.4	278.6
SEBAGO LAKE				
At outlet	266.7	267.0	267.1	267.4

[1]North American Vertical Datum 1988

Countywide Analyses

Revised coastal analyses were performed for the open water flooding sources along the Atlantic coastline of Cumberland County, including the Cities of Portland, and South Portland; and the Towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth. All revised coastal analyses and redelineation of coastal flood hazards were performed in accordance with Appendix D "Guidance for Coastal Flooding Analyses and Mapping," (Reference 70) of the Guidelines and Specifications, as well as, the "Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update", (Reference 71).

The stillwater elevation (SWEL) is the elevation of the water due to effects of astronomic tides and storm surge on the water surface. Several previous studies were reviewed and it was determined that the 10-percent, 2-percent, 1-percent, and 0.2-percent stillwater elevations for updated Map Mod transects should be taken from the "Technical Support Data Notebook for Coastal Engineering Analysis for Flood Insurance Study Revision" (TSDN) report for Cumberland County (Reference 72).

This report did not update the SWEL values for the new transects; therefore, the 10-percent, 2-percent, 1-percent, and 0.2-percent for the new transects were obtained from the adjacent communities to maintain consistency. The SWEL values were obtained as following:

The SWEL values for the cities of Portland and South Portland and the towns of Harpswell, Chebeague Island, Cumberland, and were determined by Sebago Technics and documented in the TSDN report (Reference 72).

The SWEL values for the towns of Brunswick and Freeport were obtained from the Town of Harpswell.

The SWEL values for the Town of Long Island were obtained from the City of Portland.

The SWEL values for the Town of Yarmouth were obtained from the Town of Cumberland.

The SWEL values for the new transects in the Town of Falmouth were interpolated from the adjacent submitted Falmouth transects.

The 10-, 2-, 1- and 0.2-percent-annual-chance annual-chance stillwater elevations for the revised coastal flooding sources are presented in Table 9, "Summary of Coastal Stillwater Elevations".

TABLE 9 – SUMMARY OF COASTAL STILLWATER ELEVATIONS

	ELEVATION (feet NAVD[1])			
FLOODING SOURCE AND LOCATION	10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
ATLANTIC OCEAN				
Town of Cape Elizabeth	7.9	8.5	8.8	9.5
Town of Scarborough	7.9	8.5	8.8	9.5
CASCO BAY				
Town of Cumberland	8.1	8.7	9.1	9.7
Town of Chebeague Island	8.1	8.7	9.1	9.7
Town of Harpswell	8.1	8.7	9.1	9.7
Town of Cape Elizabeth	7.9	8.5	8.8	9.5
City of Portland	8.0	8.6	8.9	9.5
City of South Portland	8.0	8.6	8.9	9.5
Town of Brunswick	8.1	8.7	9.1	9.7
Town of Freeport	8.1	8.7	9.1	9.7
Town of Long Island	8.0	8.6	8.9	9.5
Town of Yarmouth	8.1	8.7	9.1	9.7
Town of Scarborough	7.9	8.5	8.8	9.5
Town of Falmouth	7.9-8.0	8.5-8.6	8.8-8.9	9.5
Western side of Cushings Island[2]	8.1	8.7	9.0	9.6

[1]North American Vertical Datum 1988
[2]Incorporated from LOMR

3.4 Coastal Hydraulic Analyses

The energy-based significant wave height (Hmo) and peak wave period (Tp) are used as inputs to wave setup and wave runup calculations and were calculated using the Steady-State Spectral Wave Model (STWAVE) . STWAVE is a phased-averaged spectral wave model that simulates depth-induced wave refraction and shoaling, depth-and steepness-induced wave breaking, diffraction, wind-wave growth, and wave-wave interaction and white capping that redistribute and dissipate energy in a growing wave field. The model accepts a spectral form of the wave as an input condition and provides Hmo and Tp results over the gridded model domain.

STARR team developed STWAVE models for the southern coastline of Cumberland County, and the results were obtained from the model for the coastal flooding analysis in the Towns of Brunswick, Chebeague Island, Cumberland, Freeport, Long Island, Scarborough, and Yarmouth.

STWAVE models were developed for the towns of Cape Elizabeth, Falmouth, and Harpswell and the City of Portland by Sebago Technics as part of their study in 2007. STARR team obtained the results from Sebago Technics models for the coastal flooding analysis in these communities (References 4, 5, 6, 7, and 8).

An extremal analysis of historic wind gage records was performed to determine the thresholds for peak wind speeds using three Peaks Over Threshold (POT) statistical methods derived from Goda (Reference 73). The threshold with the highest overall R-squared correlation to the Fisher-Tippett Type I (Gumbel), Fisher-Tippett Type II (Frechet), or Wiebull distribution was chosen to represent the wind speed at 10 meters elevation. The wind speeds for 10-percent, 2-percent, 1-percent, and 0.2-percent-annual-chance events calculated from the extremal analysis for the National Data Buoy Center (NDBC) Wind Buoy 44005 using the POT method were arithmetically averaged, and the resulting wind speed value was used for Cumberland County wave height and wave setup calculations at each coastal transect location. Wind speed data sets used in the extremal analyses were obtained from the National Oceanographic and Atmospheric Administration (NOAA) National Climatic Data Center. The wind data set consists of 1-hour interval data for the period 1979 to 2011 (Reference 74).

Wave height is the distance from the wave trough to the wave crest. The height of a wave is dependent upon wind speed and duration, water depth, and length of fetch. Offshore (deepwater) wave heights, wave setup, and wave runup for each transect were calculated using Mathcad sheets developed by STARR to apply methodologies from the USACE's Coastal Engineering Manual (Reference 75) and FEMA Guidelines and Specifications (Reference 71). Methodologies for each type of calculation are discussed in more detail below. Results from the Mathcad calculations performed for each transect were compiled in a summary spreadsheet.

Overland wave heights were calculated for restricted and unrestricted fetch settings using the Wave Height Analysis for Flood Insurance Studies (WHAFIS), Version 4.0 (Reference 76), within the Coastal Hazard Analysis for Mapping Program (CHAMP) (Reference 77), following the methodology described in the FEMA Guidelines and Specifications for each coastal transect.

The general working procedure for the new transects and submitted transects included eight steps: 1) laying out transects; 2) determining off-shore significant wave heights and corresponding wave periods from STWAVE outputs; 3) performing the off-shore engineering analysis; 4) preparing WHAFIS input data and populating the CHAMP database; 5) performing erosion analysis for erodible transects without a coastal structure; 6) performing WHAFIS modeling runs on eroded transects and transects with both intact and failed structures, as applicable; 7) performing wave runup analysis on intact and failed structures; and 8) identifying primary frontal dunes.

The general working procedure for the updated map mod transects included five steps: 1) determining off-shore significant wave heights and corresponding wave periods from STWAVE output; 2) updating the existing offshore engineering analysis with the updated wave conditions; 3) updating the existing Map Mod CHAMP databases with the updated wave conditions and the updated wave setup; 4) performing WHAFIS modeling runs on eroded transects and transects with both intact and failed structures, as applicable; and 5) updating the existing runup analysis with the updated wave condition and wave setup or performing a new runup analysis if the existing map mod method is not applicable for the intact and the failed transects.

Coastal engineering analysis was performed for each new, submitted, and Map Mod coastal transect using wave condition extracted from the STWAVE model and SWEL data to generate wave setup and wave runup values for open coast transects and transects with vertical structures or revetments, and to generate input used in developing CHAMP and WHAFIS input data. Mathcad sheets were developed and applied by STARR for the calculations to help ensure consistency and accuracy. The input data and results of the analysis were compiled for each transect in a summary spreadsheet. The Mathcad sheets and summary spreadsheet are included in the digital data files compiled for the coastal submittal. This STWAVE model was developed for the entire coastline of Cumberland County, and the results were obtained from the model for the coastal flooding analysis in the City of Portland and the Towns of Cape Elizabeth, Falmouth, and Harpswell (Reference 4, 5, 6, 7, and 8)

CHAMP is a Microsoft (MS) Windows-interfaced Visual Basic language program that allows the user to enter data, perform coastal engineering analyses, view and tabulate results, and chart summary information for each representative transect along a coastline within a user-friendly graphical interface. With CHAMP, the user can import digital elevation data, perform storm-induced erosion treatments, wave height and wave runup analyses, plot summary graphics of the results, and create summary tables and reports in a single environment. CHAMP version 2.0 (Reference 77) was used to perform erosion analysis, run WHAFIS, and apply RUNUP 2.0 to transects without coastal structures. Application of CHAMP followed the instructions in the FEMA Guidelines and Specifications (Reference 71) and the Coastal Hazard Analysis Modeling Program user's guide found in the software documentation (Reference 77).

Wave setup can be a significant contributor to the total water level at the shoreline and was included in the determination of coastal base flood elevations. Wave setup is defined as the increase in total stillwater elevation against a barrier caused by the attenuation of waves in shallow water. Wave setup is based upon wave breaking characteristics and profile slope. Wave setup values were calculated for each coastal transect using the Direct Integration Method (DIM), as described in the FEMA Guidelines and Specifications, Equation D.2.6-1. For those coastal transects where a structure was located, documentation was gathered on the structure, and the wave setup against the coastal structure was also calculated.

The fundamental analysis of overland wave effects for an FIS is provided by FEMA's Wave Height Analysis For Flood Insurance Studies computer program, WHAFIS 4.0, a computer program that uses representative transects to compute wave crest elevations in a given study area. Topographic, vegetative, and cultural features are identified along each specified transect landward of the shoreline. WHAFIS uses this and other input information to calculate wave heights, wave crest elevations, flood insurance risk zone designations, and flood zone boundaries along the transects.

The original basis for the WHAFIS model was the 1977 National Academy of Sciences (NAS) report "Methodology for Calculating Wave Action Effects Associated with Storm Surges" (Reference 79). The NAS methodology accounted for varying fetch lengths, barriers to wave transmission, and the regeneration of waves over flooded land areas. Since the incorporation of the NAS methodology into the initial version of WHAFIS, periodic upgrades have been made to WHAFIS to incorporate improved or additional wave considerations.

WHAFIS 4.0 was applied using CHAMP to calculate overland wave height propagation and establish base flood elevations. For profiles with vertical structures or revetments, a failed structure analysis was performed and a new profile of the failed structure was generated and analyzed.

Wave runup is the uprush of water caused by the interaction of waves with the area of shoreline where the stillwater hits the land or other barrier intercepting the stillwater level. The wave runup elevation is the vertical height above the stillwater level ultimately attained by the extremity of the uprushing water. Wave runup at a shore barrier can provide flood hazards above and beyond those from stillwater inundation. Guidance in the FEMA Guidelines and Specifications (Reference 71) suggests using the 2-percent wave runup value, the value exceeded by 2 percent of the runup events. The 2-percent wave runup value is particularly important for steep slopes and vertical structures.

Wave runup was calculated for each coastal transect using methods described in the FEMA Guidelines and Specifications (Reference 71). Runup estimates were developed for vertical walls using the guidance in Figure D.2.8-3 of the FEMA Guidelines and Specifications (Reference 71), taken from the Shore Protection Manual (Reference 80). Technical Advisory Committee for Water Retaining Structures (TAW) method was applied for sloped structures with a slope steeper than 1:8. For slopes milder than 1:8, the FEMA Wave Runup Model RUNUP 2.0 was used. Both the SPM and RUNUP 2.0 provide mean wave runup. The mean wave runup was multiplied by 2.2 to obtain the 2-percent runup height. Wave runup elevation was added to the stillwater elevation and does not include wave setup.

The LiMWA is determined and defined as the location of the 1.5-foot wave. Typical constructions in areas of wave heights less than 3-feet high have experienced damage, suggesting that construction requirements within some areas of the AE zone should be more like those requirements for the VE zone. Testing and investigations have confirmed that a wave height greater than 1.5 feet can cause structure failure. The LiMWA was determined for all areas subject to significant wave attack in accordance with "Procedure Memorandum No. 50 – Policy and Procedures for Identifying and Mapping Areas Subject to Wave Heights Greater than 1.5 feet as an Informational Layer on Flood Insurance Rate Maps (FIRMs)" (Reference 81). The effects of wave hazards in the Zone AE areas (or shoreline in areas where VE Zones are not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot breaking waves are projected during a 1-percent-annual-chance flooding event.

The effects of wave hazards in the Zone AE areas (or shoreline in areas where VE Zones are not identified) and the limit of the LiMWA boundary are similar to, but less severe than, those in Zone VE where 3-foot breaking waves are projected during a 1-percent-annual-chance flooding event.

In accordance with 44 CFR Section 59.1 of the National Flood Insurance Program (NFIP), the effect of the PFD on coastal high hazard area (V Zone) mapping was evaluated for the communities in Cumberland County. Identification of the PFD was based upon a FEMA-approved numerical approach for analyzing the dune's dimensional characteristics. Using this methodology, the landward toe of the PFD is delineated based on knowledge of local geological processes and remote sensing/GIS technologies utilizing LiDAR data. The PFD defined the landward limit of the V Zone along portions of the shoreline only within the communities of Cape Elizabeth and Scarborough.

Figure 1, "Transect Schematic" represents s sample transect that illustrates the relationship between stillwater elevation, the wave crest elevation, the ground elevation profile and the location of the V/A zone boundary.

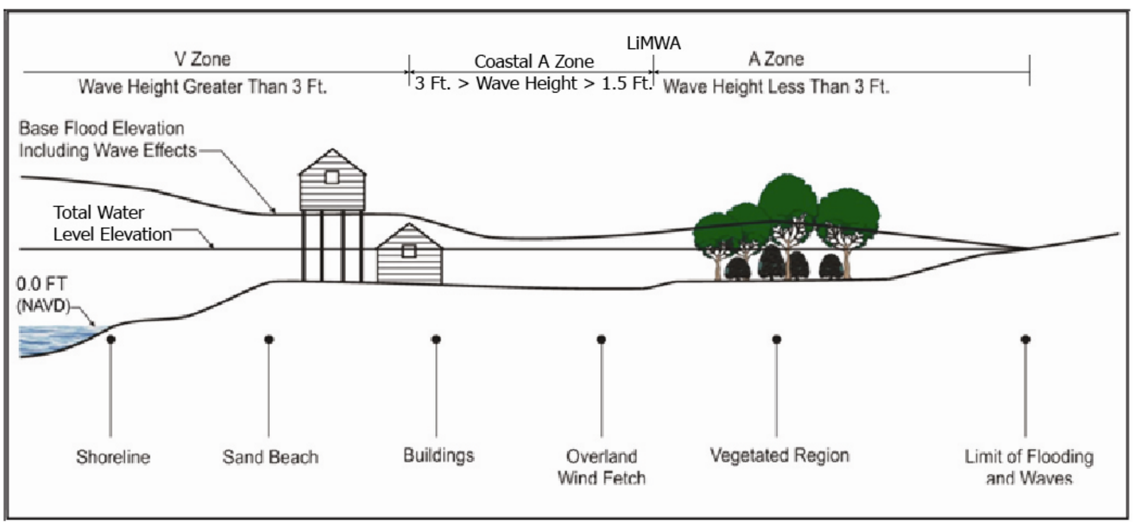

Figure 1. Transect Schematic

Transects (profiles) were located for coastal hydrologic and hydraulic analyses perpendicular to the average shoreline along areas subject to coastal flooding; transects extend off-shore to areas representative of deep water conditions and extend inland to a point where wave action ceases, in accordance with the “User’s Manual for Wave Height Analysis” (Reference 82). Transects were placed with consideration of topographic and structural changes of the land surface, as well as the cultural characteristics of the land, so that they would closely represent local conditions. Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, transects were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Coastal transect topography data was obtained from Light Detection and Ranging (LiDAR) data collected in 2006 by Sanborn Mapping Company, Inc. accurate to 2-foot contours (Reference 9). Bathymetric data was obtained from the NOAA National Ocean Service (NOS) Hydrographic Data Base (NOSHDB) and Hydrographic Survey Meta Data Base (HSMDB) (NOAA, May 27, 2010) (Reference 83). The sounding datum of mean low low water (MLLW) was converted to vertical datum NAVD 88.

Transects were spaced close together in areas of complex topography and dense development. In areas having more uniform characteristics, transects were spaced at larger intervals. It was also necessary to locate transects in areas where unique flooding existed and in areas where computed wave heights varied significantly between adjacent transects.

Table 10, “Transect Descriptions” provides a description of the transect locations, the 1-percent-annual-chance stillwater elevations, and the maximum 1-percent-annual-chance wave crest elevations for the countywide coastal study. Figure 2, "Transect Location Map," illustrates the location of the transects for the entire county.

TABLE 10 – TRANSECT DESCRIPTIONS

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD 88[2]) MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
1	The transect is located along the Atlantic Ocean shoreline, extending to the north along Sea Rose Lane toward East Grand Avenue.	8.8	19.1
2	The transect is located along the Atlantic Ocean Shoreline, extending north along Avenue One Extension toward Jones Creek Drive.	8.8	18.8
3	The transect is located along the Atlantic Ocean Shoreline at a point approximately 875 feet east of the intersection of Pillsbury Drive and Avenue Five Extension, extending to the north toward King Street.	8.8	18.8
4	The transect extends to the northeast through the mouth of the Scarborough River and portion of Ferry Beach State Park toward Old Neck Road.	8.8	18.2
5	The transect is located along the Atlantic Ocean shoreline at a point approximately 1,500 feet southeast of Ferry Rock, extending to the northeast toward Ferry Road.	8.8	18.7

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
6	The transect is located along the Atlantic Ocean shoreline at a point approximately 500 feet east of Checkly Point, extending to the north toward Winslow Homer Road.	8.8	22.0
7	The transect is located along the Atlantic Ocean shoreline at a point approximately 200 feet east of Lookout Point, extending to the north toward Winslow Homer Road.	8.8	21.9
8	The transect is located along the Atlantic Ocean shoreline at a point approximately 850 feet northwest of East Point, extending to the southwest toward Winslow Homer Road.	8.8	22.6
9	The transect is located along the Atlantic Ocean shoreline, extending to the northwest along Saccarrappa Lane toward Black Point Road.	8.8	19.7
10	The transect is located along the Atlantic Ocean shoreline at a point approximately 2,000 feet northeast of Massacre Lane, extending to the northwest along the state park access road toward Black Point Road.	8.8	20.0

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
11	The transect is located along the Atlantic Ocean shoreline, extending to the northwest along the slough end of Atlantic Drive toward Black Point Road.	8.8	19.9
12	The transect is located along the Atlantic Ocean shoreline at a point approximately 900 feet east of Kirkwood Road, extending to the northwest toward Spurwink Road.	8.8	22.3
13	The transect is located along the Atlantic Ocean shoreline at a point approximately 800 feet southwest of Cliff Street, extending to the northwest toward Greenwood Avenue.	8.8	22.0
14	The transect is located along the Atlantic Ocean shoreline, extending to the northwest along Ocean Avenue toward Greenwood Avenue.	8.8	18.4
15	The transect is located along the Atlantic Ocean shoreline, extending to the northwest along Vesper Street toward Greenwood Avenue.	8.8	20.3
16	The transect is located along the Spurwink River shoreline at a point approximately 1,400 feet north of the intersection of Winter Lane and Lower River Road, extending to the northeast toward Spurwink Farm Airfield.	8.8	15.5

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
17	The transect is located along the Atlantic Ocean shoreline at a point approximately 300 feet northwest of the Cod Rocks, extending to the northeast toward Little Pond Road.	8.8	22.2
18	The transect is located at the south end of Monastery Road, extending to the north.	8.8	18.7
19	The transect is located along the Richmond Island shoreline at a point approximately 800 feet southwest of Watts Point, extending to the northwest.	8.8	21.7
20	The transect is located along the Atlantic Ocean shoreline at a point approximately 2,350 feet southwest of Jordan Point, extending to the northwest toward Breakwater Farm Road.	8.8	18.4
21	The transect is located approximately midway along the Crescent Beach, extending to the north along the park access road toward Bowery Beach Road.	8.8	18.7
22	The transect is located approximately midway along the Maxwell Cove shoreline, extending to the northeast toward Two Lights Road.	8.8	17.6

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD 88[2]) MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
23	The transect is located approximately midway along the Hallicom Cove shoreline, extending to the northwest toward Angell Point Road.	8.8	21.9
24	The transect is located along the Atlantic Ocean shoreline at a point approximately 1,700 feet south of Dyer Point, extending to the northwest toward Beacon Lane.	8.8	22.2
25	The transect is located at the intersection of Hannaford Cove Road and Cunner Lane, extending to the northwest along Hannaford Road.	8.8	21.6
26	The transect is located along the Atlantic Ocean shoreline at a point approximately 650 feet south of Trundy Point, extending to the northwest toward Reef Road.	8.8	20.1
27	The transect is located at the north end of Reef Road, extending to the southeast toward Katahdin Road.	8.8	18.6
28	The transect is located along the Atlantic Ocean shoreline at a point approximately midway between Old Mill Road and Alewife Cove Road, extending to the southwest toward Shore Road.	8.8	20.2

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD 88[2]) MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
29	The transect is located approximately midway along the Zeb Cove shoreline, extending to the southwest toward Ocean House Road.	8.8	20.2
30	The transect is located at the north end of Lawson Road extending to the northwest toward Shore Road.	8.8	19.8
31	The transect is located along the Atlantic Ocean shoreline at a point approximately 200 feet north of Singles Road, extending to the northwest toward Shore Road.	8.8	22.3
32	The transect is located along the Atlantic Ocean shoreline at a point midway between Humphreys Road and Delano Park Entrance 1, extending to the west toward Shore Road.	8.8	22.9
33	The transect is located along the Atlantic Ocean shoreline at a point approximately 750 feet north of Captain Strout Circle, extending to the southwest toward Ocean Road.	8.8	21.7
34	The transect is located at the northeast end of Surf Road extending to the southwest toward Shore Road.	8.8	19.3

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
35	The transect is located at a point along the Danford Cove, extending to the northwest along Ledge Road toward Loveitts Field Road.	8.9	21.3
36	This transect is located along Simonton Cove at a point approximately midway between Willard Street and Dreake Street, extending to the southwest toward Preble Street.	8.9	15.0
37	The transect is located at a point approximately 1,000 feet south of the Spring Point extending to the west toward Fort Hill.	8.9	15.3
38	The transect is located at a point approximately 300 feet west of Spring Point and extending to the southwest toward Fort Hill.	8.9	16.0
39	The transect is located along the eastern shoreline of the City of South Portland at a point approximately 500 feet southeast of Portland Breakwater Light, extending to the southwest toward Preble Street.	8.9	16.0
40	The transect is located along the Fore River shoreline at a point approximately 1,500 feet southwest of Portland Breakwater Light, extending to the south toward Front Street.	8.9	14.8

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
41	The transect is located along the Portland Harbor waterfront at a point approximately 200 feet east of the intersection of Commercial Street and Old Wharf Street, extending to the west toward Fore Street.	8.9	14.9
42	The transect is located along the Portland Harbor waterfront at a point approximately 1,000 feet southwest of Fish Point, extending to the northwest toward the intersection of Eastern Prom and Obrion Street.	8.9	14.4
43	The transect is located along the eastern shoreline of the City of Portland at a point approximately between Cutter Street and Fish Point, extending to the southwest toward Eastern Prom.	8.9	15.0
44	The transect is located along the eastern shoreline of the City of Portland at a point approximately 900 feet northwest of Cutter Street, extending to the southwest toward Eastern Prom.	8.9	13.8
45	The transect is located along the eastern shoreline of the City of Portland at the eastern end of Chester Street, extending to the west toward I-295.	8.9	12.8

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
46	The transect is located along the eastern shoreline of the City of Portland, approximately 1,800 feet south of Martins Point, extending to the northwest along Olympia Street.	8.9	12.9
47	The transect is located along the western shoreline of Great Diamond Island, approximately 850 feet northwest of the intersection of Cleeve Street and Spring Avenue, extending to the east toward Cleeve Street.	8.9	12.4
48	The transect is located along the eastern shoreline of Great Diamond Island at the southern end of Eastside Drive, extending to the northwest along Weymouth Way.	8.9	16.9
49	The transect is located at a point along the northern shoreline of Great Diamond Island, approximately midway along Indian Cove, extending to the southwest toward Seal Cove Lane.	8.9	14.5
50	The transect is located along the western shoreline of Peaks Island extending to the east along Elizabeth Street.	8.9	12.0

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[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
51	The transect is located along the eastern shoreline of Cushing Island at a point approximately 1,000 feet north of Catfish Rock, extending to the northwest.	8.9	18.1
52	The transect is located at the northeastern point of Whitehead, extending to the southwest.	8.9	20.8
53	The transect is located at a point along the western shoreline of Spicers Cove, extending southwest.	8.9	16.3
54	The transect is located at a point along the southern shoreline of Peaks Island, extending to the northwest along Seashore Avenue toward the intersection with Maple Street.	8.9	20.5
55	The transect is located at a point along the eastern shoreline of Peaks Island approximately 200 feet northeast of the intersection of Seashore Avenue and Alder Brook Road, extending to the northwest toward Florida Avenue.	8.9	19.2
56	The transect is located at the intersection of Seashore Avenue and Hussey Road, extending to the southwest toward the intersection of Hussey Road and Reservoir Road.	8.9	18.4

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD 88[2]) MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
57	The transect is located at a point along the eastern shoreline of Peaks Island, approximately midway between Josiahs Cove and Elm Tree Cove, extending to the west toward Reed Avenue.	8.9	19.3
58	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Bayshore Drive and Reg Roc Drive, extending north toward Presumpscot River.	8.8	12.3
59	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Shoreline Drive and McKinley Road, extending northwest paralleling McKinley Road.	8.8	13.0
60	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Brown Street and Carroll Street, extending northwest toward Highway 1.	8.8	12.4
61	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Waters Edge Road and Waites Landing Road, extending northwest toward Landing Woods Lane.	8.8	13.3

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
62	The transect is located at Casco Bay shoreline in the vicinity of the end of Menikoe Point Road, extending northwest to end at a point approximately 150 feet west of the intersection of Waites Landing Road and Elm Drive.	8.8	13.3
63	The transect is located at Casco Bay shoreline crossing the Clapboard Island.	8.8	13.1
64	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Old Mill Road and Edgewater Street, extending Northwest to State Highway 88.	8.9	13.4
65	The transect is located at Casco Bay shoreline at a point approximately 1,900 feet northeast of the mouth of Mill Creek, extending northwest intersecting with Foreside Road.	8.9	13.3
66	The transect is located at Casco Bay shoreline in the vicinity of Old Powerhouse Road, extending northwest, paralleling Old Powerhouse Road to Foreside Road.	8.9	13.4
67	The transect is located at Casco Bay shoreline in the vicinity of Ayers Court, extending northwest along Burgess Street.	8.9	12.5

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[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
68	The transect is located at Casco Bay shoreline at West Point, Long Island, extending east toward the intersection of Island Ave and End Lane.	8.9	19.4
69	The transect is located at Casco Bay shoreline at Wreck Cove, Long Island, extending north-northeast toward the intersection of Ocean Street and Gorham Ave.	8.9	19.4
70	The transect is located at Casco Bay shoreline at a point approximately 450 feet southwest of the intersection of Fern Ave and Harbor Grace Street, Long Island, extending northwest intersecting Fern Ave.	8.9	17.7
71	The transect is located at Casco Bay shoreline in the vicinity of Eastern Ave, Long Island, extending northwest toward the north end of Frances Lane.	8.9	18.0
72	The transect is located at Casco Bay shoreline in the vicinity of a sharp bend in Island Ave, east of Long Cove, Long Island, extending to intersect Island Ave and Stepping Stone Lane.	8.9	13.6
73	The transect is located at the eastern shoreline of the Town of Cumberland mainland along Stornoway Road, extending to the northwest toward Foreside Road.	9.1	14.0

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
74	The transect is located at the eastern shoreline of the Town of Cumberland mainland along Ole Musket Road, extending to the west toward Foreside Road.	9.1	12.9
75	The transect is located at the eastern shoreline of the Town of Cumberland mainland along Wildwood Boulevard, extending to the northwest toward Foreside Road.	9.1	12.3
76	The transect is located at the eastern shoreline of the Spear Hill area, directly south of the pier, extending to the northwest toward Foreside Road.	9.1	12.5
77	The transect is located at the eastern shoreline of the Town of Cumberland mainland, in the vicinity of the intersection of Blue Heron Lane and Ledge Road, extending to the northwest toward Foreside Road.	9.1	12.6
78	The transect is located at a point approximately midway along the eastern shoreline of Sturdivant Island, extending to the northwest.	9.1	13.7
79	The transect is located at the northern end of Island View Road extending to the southwest toward North Road.	9.1	15.1

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
80	The transect is located at the southwest end of Sunset Road, extending to the southeast toward North Road.	9.1	15.6
81	The transect is located at Chandlers Cove, extending to the northeast along Durgin Lane toward South Street.	9.1	14.7
82	The transect is located approximately 300 feet southwest of Ashley Lane, extending to the northeast toward Bennett Cove Road.	9.1	15.3
83	The transect is located approximately 650 feet northeast of the southern end of Deer Point, extending to the north.	9.1	17.8
84	The transect is located at Jenks Landing, extending to the northwest along Sandy Point Road.	9.1	15.7
85	The transect is located at the eastern end of Waldo Point along Roses Point Road northwest toward John Small Road.	9.1	16.0
86	The transect is located at a point approximately midway along the northern shoreline of Waldo Point, extending to the southwest toward Roses Point Road.	9.1	15.4

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

		ELEVATION (feet NAVD 88[2])	
TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
87	The transect is located at a point along the eastern shoreline of Great Chebeague Island at the eastern end of Central Landing Road, extending to the northwest toward South Road.	9.1	17.2
88	The transect is located at a point along the eastern shoreline of Great Chebeague Island approximately midway between Springettes Road and Brookwood Lane, extending to the northwest toward South Road.	9.1	15.8
89	This transect is located at a point along the eastern shoreline of Great Chebeague Island, extending to the west along Capps Road toward South Road.	9.1	17.0
90	The transect is located along the eastern shoreline of Great Chebeague Island, extending to the northwest along Willow Street toward East Shore Drive.	9.1	15.5
91	The transect is located at the southern tip of Hope Island, extending to the northeast.	9.1	16.9
92	The transect is located along the northern shoreline of Stave Island approximately midway along the cove on the north side of the island, extending to the southwest.	9.1	16.3

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[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
93	The transect is located at a point approximately midway along eastern shoreline of Bates Island, extending to the northwest.	9.1	24.9
94	The transect is located at a point along the western shoreline of Cliff Island, approximately 650 feet west of the intersection of Ferry Road and Beach Road, extending to the east toward Island Avenue.	8.9	16.6
95	The transect is located at the southern tip of Cliff Island, extending to the northeast.	8.9	17.9
96	The transect is located along Cliff Street, starting at the southern end of the road and extending to the northeast.	8.9	18.8
97	The transect is located along Cliff Street, starting at the southern end of the road and extending to the northeast.	8.9	15.2
98	The transect is located at a point approximately midway along the eastern most shoreline of Cliff Island extending to the northwest toward Cliff Street.	8.9	20.8
99	The transect is located at the northeast shoreline of Cliff Island, extending to the northwest toward the northern end of Church Road and Sunset Road.	8.9	16.7

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
100	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Battery Point Lane and Princes Point Road, extending to the northwest toward Princes Point Road.	9.1	11.9
101	The transect is located at Casco Bay shoreline in the vicinity of the intersection of Channel Point Road and Seaborne Drive, extending to the northwest paralleling to Gilman Road	9.1	12.2
102	The transect is located at Casco Bay shoreline at a point approximately 700 feet east of Birch Point, Cousins Island, extending to intersect with the eastern most part of Cousins Street.	9.1	12.6
103	The transect is located at Casco Bay shoreline at a point approximately 1,400 feet southwest of the intersection between Spruce Point Road and Wharf Road, extending to intersect Spruce Point Road, on Cousins Island.	9.1	12.3
104	The transect is located at Casco Bay shoreline at a point approximately 150 feet south of the southeast bend of Little John Road, extending to parallel the eastern part of Little John Road, on Little John Island.	9.1	12.2

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	ELEVATION (feet NAVD 88[2]) MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
105	The transect is located at Casco Bay shoreline at a point approximately 1,300 feet from the T intersection of Sea Meadows Lane and Cornfield Road, extending to end at the northeastern end of Groves road on Cousins Island.	9.1	14.8
106	The transect is located at Casco Bay shoreline at the Parker Point on the southern shore of Royal River mouth.	9.1	14.4
107	The transect is located at Casco Bay shoreline at the east part of Moshier Island, extending over the high point of the island.	9.1	15.4
108	The transect is located at Casco Bay shoreline at a point approximately 260 feet south - southeast of the intersection between Staplespoint Road and Starboard, extending in to the north part of inner Staples Cove.	9.1	13.3
109	The transect is located at Casco Bay shoreline at a point approximately 500 feet southeast of the intersection between Winslow Park Way and Black Willow, extending into the southwest part of Harraseeket River near Staples Cove.	9.1	13.2

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
110	The transect is located at Harraseeket River shoreline a point approximately 400 feet south of the intersections between Harraseeket Road and Dixon Road, extending from Casco Bay to Harraseeket Road	9.1	13.6
111	The transect is located at Casco Bay shoreline in the vicinity of Moore Point, extending to a point approximately 50 feet northeast of the intersection between Wolfe's Neck Road and Lmc Lane.	9.1	13.7
112	The transect is located at Casco Bay shoreline in the vicinity of lower Ocean View Road east of the mouth of Little River, extending north toward Ocean View Road.	9.1	13.8
113	The transect is located at Casco Bay shoreline in the vicinity of south Bustins Island Road on Bustins Island at a point approximately 1900 feet west of The Nubble Island, extending north in to the Bustins Island.	9.1	16.0
114	The transect is located at Casco Bay shoreline in the vicinity of east Bustins Island Road on Bustins Island at a point approximately 1,700 feet northeast of The Nubble Island, extending northwest in to the Bustins Island.	9.1	15.5

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
115	The transect is located at Casco Bay shoreline at a point approximately 260 feet southeast of the Y intersection between Lower Flying Point Road and Cunningham Road, extending to intersect with Lower Flying Point Road.	9.1	15.3
116	The transect is located at Maquoit Bay shoreline at a point approximately 1,100 feet southeast of the intersection between Flying Point Road and Fiddlehead Road, extending northwest to parallel Fiddlehead Road.	9.1	13.9
117	The transect is located at Maquoit Bay shoreline at a point approximately 1,000 feet west of Bunganuc Point, extending northeast to intersect with the end of Bunganuc Landing Road.	9.1	13.7
118	The transect is located at Maquoit Bay shoreline at Wharton Point approximately 300 feet southeast of the intersection between Woodside Road and Maquoit Road, extending northeast toward Rossmore Road.	9.1	13.3

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
119	The transect is located at Middle Bay shoreline at a point approximately 1,250 feet south - southwest of the intersection between Marginal Road and Central Ave, extending northwest intersecting E Marginal Road and Central Ave.	9.1	14.2
120	The transect is located at Middle Bay shoreline at a point approximately 800 feet east of Simpsons Point Road, extending northeast toward Ocean Drive.	9.1	12.2
121	The transect is located at the southern tip of Lower Goose Island, extending to the northeast.	9.1	14.5
122	The transect is located at the southeastern tip of Birch Island, extending to the northeast.	9.1	12.2
123	The transect is located along the Middle Bay shoreline at a point approximately 900 feet northeast of Bear Paw Road, extending to the northeast toward Spy Rock Road.	9.1	12.2
124	The transect is located along the Middle Bay shoreline, extending to the northeast along Wood Landing Road.	9.1	12.6

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
125	The transect is located along the Middle Bay shoreline at a point approximately 600 feet north of Sun Liner Drive, extending to the east toward Harpswell Neck Road.	9.1	12.1
126	The transect is located along the Middle Bay shoreline, at a point approximately 500 feet north of the intersection of Basin Point Road and Barrows Lane, extending to the northeast toward Basin Cove.	9.1	13.2
127	The transect is located at Ash Point, extending to the northeast toward Ash Point Road.	9.1	14.2
128	The transect is located at the southern end of Harpswell Neck Road, extending to the northeast toward Hurricane Ridge Road.	9.1	13.9
129	The transect is located at the southern end of Haskell Island, extending to the northeast.	9.1	19.6
130	The transect is located at Graveyard Point, extending to the north toward Harpswell Neck Road.	9.1	21.0
131	The transect is located Along the Harpswell Sound shoreline at a point approximately 300 feet east of Merriconeag Lane, extending to the northwest toward Intervale Road.	9.1	17.5

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

		ELEVATION (feet NAVD 88[2])	
TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
132	The transect is located at the southern end of Shore Acres Road, extending to the north toward Thompson Road.	9.1	11.4
133	The transect is located at a point approximately midway along Clarks Cove, extending to the north toward Morse Shore Road.	9.1	12.7
134	The transect is located at the head of Harpswell Sound, extending to the north along Doughty Point Road.	9.1	11.9
135	The transect is located along the Harpswell Sound shoreline at the western end of Tower Hill Road, extending to the northeast toward Harpswell Islands Road.	9.1	12.9
136	The transect is located along the Merriconeag Sound shoreline at a point approximately 350 feet west of the intersection of Harpswell Islands Road and Garrison Cove Road, extending to the northeast toward Water Cove.	9.1	12.8
137	The transect is located along the Merriconeag Sound shoreline at a point approximately 250 feet southwest of Steamboat Road, extending to the northeast toward Harpswell Islands Road.	9.1	14.8

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[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

		ELEVATION (feet NAVD 88[2])	
TRANSECT	LOCATION	1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
138	The transect is located at the southern end of Abner Point, extending to the north along Abner Point Road.	9.1	17.6
139	The transect is located along the Mackerel Cove shoreline, approximately midway between Harpswell Islands Road and Abner Point Road, extending to the north toward the intersection of Harpswell Islands Road and Abner Point Road.	9.1	11.0
140	The transect is located along the eastern shoreline of Baileys Island at the eastern end of Eastbrook Lane, extending to the northwest along Spruce Ledge Road toward Harpswell Islands Road.	9.1	22.5
141	The transect is located along the eastern shoreline of Baileys Island at a point approximately 750 feet east of the intersection of Harpswell Islands Avenue and Mermaid Lane, extending to the northwest toward Abner Point Road.	9.1	17.5
142	The transect is located along the eastern shoreline of Baileys Island, extending to the northwest along Linnell Drive toward Harpswell Islands Road.	9.1	19.5

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
143	The transect is located along the southeastern shoreline of Orrs Island at a point approximately 400 feet south of the intersection of Harpswell Islands Road and Gleneita Road, extending to the northwest toward Grassy Road.	9.1	18.1
144	The transect is located along the Lowell Cove shoreline at a point approximately 900 feet south of the intersection of Lowells Cove Road and Lane Road, extending to the north along Lane Road.	9.1	13.8
145	The transect is located Along the eastern shoreline of Orrs Island at a point approximately 750 feet west of the intersection of Blueberry Lane and Blueberry Ridge Road.	9.1	18.4
146	The transect is located at the southern end of Totman Point Road, extending to the north toward Harpswell Islands Road.	9.1	10.8
147	The transect is located at the southern tip of Gun Point, extending to the northeast along Gun Point Road.	9.1	16.4
148	The transect is located along the Long Point shoreline at a point approximately 275 feet east of the southern intersection of Tuttle Drive and Long Point Road.	9.1	18.1

[1]Because of map scale limitations, the maximum wave elevation may not be shown on the FIRM.
[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
149	The transect is located along Quahog Bay at a point approximately 300 feet southeast of the intersection of Long Point Road and Spunky Way, extending to the northwest toward Long Point Road.	9.1	17.0
150	The transect is located at the southern tip of Pole Island, extending to the north.	9.1	13.4
151	The transect is located at the southern end of Twin Coves Lane, extending to the northeast toward Brickyard Cove.	9.1	9.6
152	The transect is located at the southwest tip of Ragged Island, extending to the northeast.	9.1	23.3
153	The transect is located at a point approximately midway along the southern shoreline of Yarmouth Island, extending to the north.	9.1	17.5
154	The transect is located at a point approximately 1,000 feet south of Little Ponds Road extending to the northeast.	9.1	12.2
155	The transect is located along Hen Cove shoreline at the intersection of Bethel Point Road and Hen Cove Road, extending to the north along Bethel Point Road.	9.1	10.2

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[2]North American Vertical Datum 1988

TABLE 10 – TRANSECT DESCRIPTIONS - continued

TRANSECT	LOCATION	ELEVATION (feet NAVD 88[2]) 1-PERCENT-ANNUAL-CHANCE STILLWATER[1]	MAXIMUM 1-PERCENT ANNUAL CHANCE WAVE CREST[1]
156	The transect is located at the southern tip of West Cundys Point, extending to the north along W Cundys Point Road.	9.1	18.9
157	The transect is located along Sandy Cove at a point approximately 750 feet southeast of the intersection of Cundys Point Road and West Cundys Point Road, extending to the northwest toward Cundys Point Road.	9.1	15.8
158	The transect is located along the eastern shoreline of the Town of Harpswell at a point approximately 750 feet north of Fort Point, extending to the northwest toward East Cundys Point Road.	9.1	17.3
159	The transect is located at the head of Cundy Harbor at a point approximately 500 feet east of the intersection of Field Road and Cundy Harbor Road, extending to the north toward Holbrook Street.	9.1	14.1
160	The transect is located at the southern end of Starboard Lane, extending to the north along Dingley Island.	9.1	13.4
161	The transect is located at the southern tip of Long Island, extending to the north.	9.1	17.5

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[2]North American Vertical Datum 1988

INSERT FIGURE 2 – Transect Location Map

The results of the coastal analysis using detailed methods are summarized in Table 11, "Transect Data," which provides the flood hazard zone and base flood elevations for each coastal transect, along with the 10-, 2-, 1- and 0.2-percent-annual-chance flood stillwater elevations from the different flooding sources, including effects of wave setup where applicable.

TABLE 11 – TRANSECT DATA

	STILLWATER ELEVATIONS (FEET NAVD88[3])						
TRANSECT	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
1	7.9	8.5	8.8	9.5	12.5	AE	13-14
						VE	16
2	7.9	8.5	8.8	9.5	12.3	AE	12-14
						VE	15
3	7.9	8.5	8.8	9.5	12.3	AE	12-15
						VE	15
4	7.9	8.5	8.8	9.5	11.9	AE	12-14
						VE	14-15
5	7.9	8.5	8.8	9.5	12.2	AE	12-14
						VE	14
6	7.9	8.5	8.8	9.5	14.4	VE	23
7	7.9	8.5	8.8	9.5	14.3	VE	23
8	7.9	8.5	8.8	9.5	14.8	VE	19
9	7.9	8.5	8.8	9.5	12.9	AE	13-15
						VE	15

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

	STILLWATER ELEVATIONS (FEET NAVD88[3])						
TRANSECT	10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
10	7.9	8.5	8.8	9.5	13.1	AE	13-14
						VE	15
11	7.9	8.5	8.8	9.5	13.0	AE	14
						VE	15
12	7.9	8.5	8.8	9.5	14.6	VE	28
13	7.9	8.5	8.8	9.5	14.4	VE	25
14	7.9	8.5	8.8	9.5	13.3	AE	9
						VE	18
15	7.9	8.5	8.8	9.5	13.3	AE	9-15
						VE	15
16	7.9	8.5	8.8	9.5	10.1	VE	18
17	7.9	8.5	8.8	9.5	14.5	VE	20
18	7.9	8.5	8.8	9.5	12.2	AE	12
						VE	14
19	7.9	8.5	8.8	9.5	13.8	VE	21
20	7.9	8.5	8.8	9.5	12.0	AE	22
						VE	22
21	7.9	8.5	8.8	9.5	12.2	AE	12
						VE	13

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
22	7.9	8.5	8.8	9.5	11.5	AE	19
						VE	19
23	7.9	8.5	8.8	9.5	14.3	VE	28
24	7.9	8.5	8.8	9.5	14.5	VE	22
25	7.9	8.5	8.8	9.5	14.1	VE	18
26	7.9	8.5	8.8	9.5	13.1	VE	20
27	7.9	8.5	8.8	9.5	12.1	VE	18
28	7.9	8.5	8.8	9.5	13.2	VE	19
29	7.9	8.5	8.8	9.5	13.2	VE	21
30	7.9	8.5	8.8	9.5	12.9	VE	21
31	7.9	8.5	8.8	9.5	14.6	VE	18
32	7.9	8.5	8.8	9.5	15	VE	40
33	7.9	8.5	8.8	9.5	14.2	VE	26
34	7.9	8.5	8.8	9.5	12.6	VE	20
35	8.0	8.6	8.9	9.5	11.6	VE	25

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
36	8.0	8.6	8.9	9.5	10.1	AE	10-11
						VE	12
37	8.0	8.6	8.9	9.5	10.8	VE	22
38	8.0	8.6	8.9	9.5	10.2	AE	15
						VE	15
39	8.0	8.6	8.9	9.5	10.1	AE	12
						VE	13
40	8.0	8.6	8.9	9.5	9.5	VE	13
41	8.0	8.6	8.9	9.5	10.5	VE	13-14
42	8.0	8.6	8.9	9.5	9.9	VE	14
43	8.0	8.6	8.9	9.5	10.3	VE	14
44	8.0	8.6	8.9	9.5	10.0	VE	15
45	8.0	8.6	8.9	9.5	9.8	VE	19
46	8.0	8.6	8.9	9.5	10.0	VE	15
47	8.0	8.6	8.9	9.5	9.5	VE	12
48	8.0	8.6	8.9	9.5	11.0	VE	21

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
49	8.0	8.6	8.9	9.5	10.7	VE	17
50	8.0	8.6	8.9	9.5	9.7	VE	25
51	8.0	8.6	8.9	9.5	11.8	VE	14
52	8.0	8.6	8.9	9.5	13.6	VE	24
53	8.0	8.6	8.9	9.5	10.9	VE	16-19
54	8.0	8.6	8.9	9.5	13.4	VE	19
55	8.0	8.6	8.9	9.5	12.5	VE	18
56	8.0	8.6	8.9	9.5	12.0	VE	26
57	8.0	8.6	8.9	9.5	12.6	VE	23
58	7.9	8.5	8.8	9.5	9.31	VE	12
59	7.9	8.5	8.8	9.5	10.1	VE	12
60	7.9	8.5	8.8	9.5	9.3	VE	14
61	7.9	8.5	8.8	9.5	9.5	VE	15
62	7.9	8.5	8.8	9.5	9.8	AE VE	10 13

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
63	7.9	8.5	8.8	9.5	9.41	VE	17
64	8.0	8.6	8.9	9.5	9.8	VE	18
65	8.0	8.6	8.9	9.5	9.9	VE	14
66	8.0.	8.6	8.9	9.5	10.2	VE	14
67	8.0	8.6	8.9	9.5	9.4	VE	16
68	8.0	8.6	8.9	9.5	12.7	VE	20
69	8.0	8.6	8.9	9.5	12.7	AE	13
						VE	16
70	8.0	8.6	8.9	9.5	11.6	AE	12
						VE	14
71	8.0	8.6	8.9	9.5	11.8	VE	15
72	8.0	8.6	8.9	9.5	10.6	VE	13
73	8.1	8.7	9.1	9.7	10.2	VE	18
74	8.1	8.7	9.1	9.7	10.3	VE	14
75	8.1	8.7	9.1	9.7	9.7	VE	20
76	8.1	8.7	9.1	9.7	9.9	VE	17

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
77	8.1	8.7	9.1	9.7	10	VE	19
78	8.1	8.7	9.1	9.7	9.9	VE	18
79	8.1	8.7	9.1	9.7	10.1	VE	15
80	8.1	8.7	9.1	9.7	10.4	VE	20
81	8.1	8.7	9.1	9.7	9.9	VE	12
82	8.1	8.7	9.1	9.7	10.5	VE	18
83	8.1	8.7	9.1	9.7	11.7	VE	19
84	8.1	8.7	9.1	9.7	10.3	VE	12
85	8.1	8.7	9.1	9.7	10.5	VE	19
86	8.1	8.7	9.1	9.7	10.1	VE	12
87	8.1	8.7	9.1	9.7	11.3	VE	17
88	8.1	8.7	9.1	9.7	10.4	AE VE	10 13
89	8.1	8.7	9.1	9.7	11.2	VE	21
90	8.1	8.7	9.1	9.7	10.2	VE	13

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
91	8.1	8.7	9.1	9.7	11.1	VE	26
92	8.1	8.7	9.1	9.7	10.7	VE	14
93	8.1	8.7	9.1	9.7	16.3	VE	18
94	8.0	8.6	8.9	9.5	11.1	VE	13
95	8.0	8.6	8.9	9.5	11.7	VE	19
96	8.0	8.6	8.9	9.5	12.3	VE	15
97	8.0	8.6	8.9	9.5	10.4	VE	13
98	8.0	8.6	8.9	9.5	13.6	AE	12
						VE	25
99	8.0	8.6	8.9	9.5	10.9	VE	17
100	8.1	8.7	9.1	9.7	9.7	VE	12
101	8.1	8.7	9.1	9.7	10.0	VE	12
102	8.1	8.7	9.1	9.7	10.2	VE	12
103	8.1	8.7	9.1	9.7	9.9	VE	12
104	8.1	8.7	9.1	9.7	10.0	VE	16

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
105	8.1	8.7	9.1	9.7	10.0	VE	13
106	8.1	8.7	9.1	9.7	10.1	VE	14
107	8.1	8.7	9.1	9.7	10.3	VE	16
108	8.1	8.7	9.1	9.7	9.9	AE VE	9-10 15
109	8.1	8.7	9.1	9.7	9.8	AE VE	10 23
110	8.1	8.7	9.1	9.7	10.2	VE	14
111	8.1	8.7	9.1	9.7	10.3	VE	14
112	8.1	8.7	9.1	9.7	10.4	VE	14
113	8.1	8.7	9.1	9.7	10.8	VE	14
114	8.1	8.7	9.1	9.7	10.3	VE	17
115	8.1	8.7	9.1	9.7	10.1	VE	16
116	8.1	8.7	9.1	9.7	10.2	VE	14
117	8.1	8.7	9.1	9.7	10.0	AE VE	10 19

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
118	8.1	8.7	9.1	9.7	9.6	AE	10
						VE	12
119	8.1	8.7	9.1	9.7	10.5	VE	14
120	8.1	8.7	9.1	9.7	9.9	VE	12
121	8.1	8.7	9.1	9.7	10.2	VE	18
122	8.1	8.7	9.1	9.7	9.3	VE	17
123	8.1	8.7	9.1	9.7	9.7	VE	15
124	8.1	8.7	9.1	9.7	9.6	VE	16
125	8.1	8.7	9.1	9.7	9.6	VE	16
126	8.1	8.7	9.1	9.7	10.1	VE	16
127	8.1	8.7	9.1	9.7	10.6	VE	18
128	8.1	8.7	9.1	9.7	10.4	VE	14-17
129	8.1	8.7	9.1	9.7	12.8	VE	22
130	8.1	8.7	9.1	9.7	11.1	VE	22
131	8.1	8.7	9.1	9.7	11.4	VE	24
132	8.1	8.7	9.1	9.7	9.9	VE	13

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
133	8.1	8.7	9.1	9.7	10.1	VE	16
134	8.1	8.7	9.1	9.7	9.6	VE	16
135	8.1	8.7	9.1	9.7	10	VE	19
136	8.1	8.7	9.1	9.7	9.8	VE	14
137	8.1	8.7	9.1	9.7	10.3	VE	22
138	8.1	8.7	9.1	9.7	11.5	VE	25
139	8.1	8.7	9.1	9.7	9.5	VE	12
140	8.1	8.7	9.1	9.7	14.7	VE	26
141	8.1	8.7	9.1	9.7	11.4	VE	27
142	8.1	8.7	9.1	9.7	12.7	VE	23
143	8.1	8.7	9.1	9.7	11.8	VE	22
144	8.1	8.7	9.1	9.7	10.3	VE	14
145	8.1	8.7	9.1	9.7	12.0	VE	30
146	8.1	8.7	9.1	9.7	9.5	VE	12
147	8.1	8.7	9.1	9.7	10.7	VE	15

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

TABLE 11 – TRANSECT DATA - continued

TRANSECT	STILLWATER ELEVATIONS (FEET NAVD88[3]) 10-PERCENT-ANNUAL-CHANCE	2-PERCENT-ANNUAL-CHANCE	1-PERCENT-ANNUAL-CHANCE	0.2-PERCENT-ANNUAL-CHANCE	TOTAL WATER LEVEL[1] 1-PERCENT-ANNUAL-CHANCE	ZONE	BASE FLOOD ELEVATION (FEET NAVD 88[2,3])
148	8.1	8.7	9.1	9.7	11.8	VE	23
149	8.1	8.7	9.1	9.7	11.4	VE	23
150	8.1	8.7	9.1	9.7	10.2	VE	14
151	8.1	8.7	9.1	9.7	9.9	VE	12
152	8.1	8.7	9.1	9.7	15.1	AE VE	15 24
153	8.1	8.7	9.1	9.7	11.4	VE	35
154	8.1	8.7	9.1	9.7	9.9	AE VE	12 12-14
155	8.1	8.7	9.1	9.7	9.3	VE	11-14
156	8.1	8.7	9.1	9.7	12.3	VE	19
157	8.1	8.7	9.1	9.7	10.3	VE	13
158	8.1	8.7	9.1	9.7	11.3	VE	24
159	8.1	8.7	9.1	9.7	10.6	VE	20
160	8.1	8.7	9.1	9.7	10.3	VE	12
161	8.1	8.7	9.1	9.7	11.4	VE	23

[1]Including stillwater elevation and effects of wave setup.
[2]Due to map scale limitations, base flood elevations shown on the FIRM represent average elevations for the zones depicted.
[3]North American Vertical Datum 1988

3.5 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). With the completion of the North American Vertical Datum of 1988 (NAVD), 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 referenced to the NAVD 88. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. Ground, structure, and flood elevations may be compared and/or referenced to NGVD 29 by applying a standard conversion factor. **The conversion factor from NGVD 29 to NAVD 88 is -0.6, and from NAVD 88 to NGVD 29 is +0.6.**

For information regarding conversion between the NGVD and NAVD, visit the National Geodetic Survey website at www.ngs.noaa.gov, or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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 county. Interested individuals may contact FEMA to access these data.

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 NGVD 29 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.

For the communities with revised coastal analyses, the elevations presented in the Tidal Flood Survey are referenced to the National Tidal Datum Epoch (NTDE) of 1960-1978. The current tidal datum is based on the NTDE of 1983-2001. The NTDE is a specific 19 year period that includes the longest periodic tidal variations caused by the astronomic tide-producing forces. The value averages out long term seasonal meteorological, hydrologic, and oceanographic fluctuations and provides a nationally consistent tidal datum network (bench marks) by accounting for seasonal and apparent environmental trends in sea level rise that affect the accuracy of tidal datums. For use in this coastal analysis revision, the stillwater elevations presented in the Tidal Flood Survey were converted to the current tidal datum. A datum conversion factor of +0.05 feet was applied to the data in the Tidal Flood Survey for the coastal communities in Cumberland County.

For the communities with redelineation of coastal flood hazard data, the elevations presented in the previous Flood Insurance Studies were referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29). These elevations were converted to the North American Vertical Datum of 1988 (NAVD 88). The vertical datum shift between NGVD29 and NAVD88 was determined in accordance with Appendix B "Guidance for Converting to the North American Vertical Datum of 1988," (Reference 84) of the Guidelines and Specifications, as well as, the “Atlantic Ocean and Gulf of Mexico Coastal Guidelines Update”, (Reference 71).

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

4.0 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- 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 Flood Boundaries

In order to provide a national standard without regional discrimination, the 1-percent-annual-chance flood has been adopted by FEMA as the base flood for floodplain management purposes. The 0.2-percent-annual-chance flood is employed to indicate additional areas of flood risk in the community.

The 1- 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, AE, AO, V, and VE), and the 0.2-percent-annual-chance floodplain boundary corresponds to the boundary of areas of moderate flood hazards. In cases where the 1- 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.

For unrevised streams in Cumberland County, data was taken from previously printed FISs for each individual community and are compiled below.

In Baldwin, for each stream studied in detail, the boundaries of the 1-percent-annual-chance and the 0.2-percent-annual-chance floods have been delineated using the elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric maps at a scale of 1:4,800, with a contour interval of 5 feet (Reference 85). The flood boundaries of the approximate areas were delineated on topographic maps at a scale of 1:24,000, with a contour interval of 20 feet (Reference 86). The flood boundaries for Quaker Brook were obtained from the Baldwin Flood Hazard Boundary Map (Reference 87). These areas were checked by information gathered from the detail study areas and information from the town; no normal depth calculations were made.

In Bridgton, for each stream studied in detail, the boundaries of the 1-year and 0.2-percent-annual-chance floodplains have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated by stereoscoping aerial photographs, and by using topographic maps at scales of 1:62,500 and 1:24,000 with contour intervals of 20 feet (References 89, 90, and

91). The 1- and 0.2-percent-annual-chance flood boundaries for Highland Lake (Town of Bridgton) and Long Lake were delineated using the topographic maps referenced above. For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using the FHBM for the Town of Bridgton (Reference 92). Topographic maps and aerial photographs referenced above and field checks were utilized to verify the approximate flood boundaries.

In Brunswick, for the flooding sources studied in detail, the 1- and 0.2-percent-annual-chance floodplain boundaries, except for the Androscoggin River which has been redelineated as part of this study, have been delineated using topographic maps (Reference 64). For the areas studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps and the Flood Hazard Boundary Map for Brunswick (References 93 and 88).

For Trout Brook in Cape Elizabeth, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 64). For the areas studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps and the Flood Hazard Boundary Map for Cape Elizabeth (References 88 and 94).

In Casco, for the Songo and Crooked Rivers, the boundaries of the 1- and 0.2-percent-annual-chance floodplain have been delineated using the flood elevations determined at each cross section; between cross sections and on Sebago Lake the boundaries were interpolated from stereoplotted floodplain maps with a contour interval of 4 feet (Reference 68). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was taken from the Flood Hazard Boundary Map for Casco (Reference 95). Aerial photographs and topographic maps (References 68 and 96), and field checks were utilized to verify the approximate flood boundaries.

For the streams studied by approximate methods in Cumberland, the boundary of the 1-percent-annual-chance flood was delineated using aerial photographs, USGS topographic maps, the Flood Hazard Boundary Map for the Town of Cumberland, and on-site inspections (References 88, 85, and 97).

In Falmouth, for each stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 98). For the areas studied by approximate methods, the boundary of the 1-percent-annual-chance floodplain was delineated using USGS topographic maps and the Flood Hazard Boundary Map for the Town of Falmouth (References 100 and 99).

In Freeport, for the flooding sources studied in detail, the 1- and 0.2-percent-annual-chance floodplain boundaries have been delineated using topographic maps (Reference 65). For the flooding sources studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps, the Flood Hazard Boundary Map for Freeport, and on-site field inspections (References 88 and 100).

For Gorham, for the stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of l"=400' with a contour interval of 5 feet (Reference 66). The approximate 1-percent-annual-chance flood boundaries were delineated using USGS topographic maps (Reference 101). The 1-percent-annual-chance flood boundaries were then correlated with the Flood Hazard Boundary Map for Gorham (Reference 102).

In Gray, for each stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated by stereoscoping aerial photographs and the use of topographic maps at a scale of 1:62,500 and 1:24,000 with a contour interval of 20 feet (References 89, 90, and 91) Little Sebago Lake flood boundaries were determined from stereoplotted maps furnished by the USGS at a scale of 1"=400' with a contour interval of 4 feet (Reference 103). For the flooding sources studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using the Flood Hazard Boundary Map for the Town of Gray (Reference 104). The topographic maps and aerial photographs referenced above and field checks were used to verify the approximate flood boundaries.

In Harrison, for each stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-annual floodplain have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated from stereoplotted floodplain maps at a scale of 1:4,800, with a contour interval of 4 feet (Reference 68) and by the use of topographic maps at a scale of 1:62,500, with a contour interval of 20 feet (Reference 91). For streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was taken from the Flood Hazard Boundary Map (Reference 105). The topographic maps and aerial photographs referenced above as well as field checks were utilized to verify the approximate flood boundaries.

In Naples, for the streams studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections and on Sebago Lake, the boundaries were interpolated from stereoplotted floodplain maps with a contour interval of 4 feet (Reference 68). The boundaries on the Bay of Naples and Long Lake were delineated by field surveys, stereoscoping aerial photographs (Reference 68), the use of topographic maps (Reference 91), and the Flood Hazard Boundary Map (Reference 106). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was taken from the Flood Hazard Boundary Map. Both the topographic maps and aerial photographs referenced above and field checks were utilized to verify the approximate flood boundaries.

In New Gloucester, for the stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated by stereoscoping aerial photographs and using topographic maps at a scale of 1:62,500, with a contour interval of 20 feet (References 91 and 68). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using the Flood Hazard Boundary Map for the Town of New Gloucester (Reference 107).

The topographic maps and aerial photographs referenced above and field checks were used to verify the approximate flood boundaries.

In North Yarmouth, for the stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated by through the use of aerial photographs and topographic maps at scales of 1:62,500, with a contour interval of 20 feet (References 91 and 68). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using the Flood Hazard Boundary Map for the Town of North Yarmouth (Reference 108). Topographic maps and aerial photographs referenced above and field checks were used to verify the boundaries.

In Portland, for the streams studied in detail, the 1- and 0.2-percent-annual-chance floodplains have been delineated using the flood elevations determined at each cross section. For the 1986 FIS, the boundaries were interpolated between cross sections using topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 69). For the 1998 revision, the boundaries were interpolated between cross sections using topographic maps at a scale of 1:1,200 with a contour interval of 2 feet (Reference 109). For the flooding sources studied by approximate methods, the 1-percent-annual-chance floodplain boundaries were delineated using USGS topographic maps and the Flood Hazard Boundary Map for the city (Reference 86).

In Raymond, on Sebago Lake and Panther Pond, the elevations of the 1- and 0.2-percent-annual-chance floods were delineated using topographic maps of the study area at a scale of 1:4,800 with a contour interval of 5 feet (Reference 110). On Crescent Lake, the elevations of the 1- and 0.2-percent-annual-chance floods were delineated using topographic maps of the study area at a scale of 1:24,000, with a contour interval of 10 feet (Reference 101). The approximate 1-percent-annual-chance flood boundaries for a portion of Thomas Pond were delineated on a topographic map with a scale of 1:62,500 and a contour interval of 20 feet (Reference 91). The rest of the boundaries for the streams and ponds studied by approximate methods were delineated on topographic maps with a scale of 1:24,000 and a contour interval of 10 feet (Reference 86).

In Scarborough, for the areas studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps and the Flood Hazard Boundary Map for Scarborough (References 88 and 111).

In Sebago, the 1- and 0.2-percent-annual-chance boundaries were delineated using planimetric maps of the study area at a scale of 1:4,800 (Reference 84). For the streams studied by approximate methods, the 1-percent-annual-chance flood boundaries were plotted using a method developed by USGS hydrologists at the Augusta, Maine, office. They have determined a regional stage-frequency relationship and estimate a 10-foot rise over the mapped stream elevation to be the inundation limit of the 1-percent-annual-chance year flood (Reference 112). The 1-percent-annual-chance flood boundaries for the streams and ponds in Sebago studied by approximate methods were delineated on topographic maps enlarged to a scale of 1:12,000 with 20-foot contour intervals (References 88 and 91).

In South Portland, for each stream studied in detail, the 1-percent-annual-chance and 0.2-percent-annual-chance floodplain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 113). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps and the original FIRM for South Portland (References 91 and 114).

In Standish, for each stream studied in detail, the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 4 feet (Reference 85). The approximate 1-percent-annual-chance flood boundaries were determined by a regional analysis method developed by the USGS office in Augusta, Maine (Reference 112). The boundaries were delineated on topographic maps at a scale of 1:1,200 and a contour interval of 20 feet (Reference 91).

In Westbrook, for each stream studied in detail, the boundaries of the 1- and the 0.2-percent-annual-chance floods have been delineated using the elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric maps at a scale of 1:4,800, with a contour interval of 5 feet (Reference 115). For the streams studied by approximate methods, the boundary of the 1-percent-annual-chance flood was determined taking into account the previously published Flood Hazard Boundary Map for Westbrook (Reference 116) and photogrammetric maps (Reference 115).

In Windham, for each stream studied in detail, the boundaries of the 1- and the 0.2-percent-annual-chance floods have been delineated using the elevations determined at each cross section; between cross sections, the boundaries were interpolated using photogrammetric maps at a scale of 1"=400' with a contour interval of 5 feet (Reference 115). The approximate 1-percent-annual-chance flood boundaries were delineated using USGS topographic maps (Reference 91). The 1-percent-annual-chance flood boundaries were then correlated with the Flood Hazard Boundary Map for the Town of Windham (Reference 117).

In Yarmouth, for the riverine portion of the Royal River (Downstream), the boundaries of the 1- and 0.2-percent-annual-chance floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:4,800 with a contour interval of 5 feet (Reference 115). For the flooding sources studied by approximate methods, the boundary of the 1-percent-annual-chance flood was delineated using USGS topographic maps, the Flood Hazard Boundary Map for the Town of Yarmouth, and on-site inspections (References 86 and 118).

For the Androscoggin River, the boundaries of the 10-, 2-, 1-, and 0.2-percent-annual-chance floodplains have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using LiDAR data with a contour interval of 2 feet (Reference 9).

For the coastal areas and riverine backwater effects in the Cities of Portland and South Portland, and the Towns of Brunswick, Cape Elizabeth, Chebeague Island, Cumberland, Falmouth, Freeport, Harpswell, Long Island, Scarborough and Yarmouth the flood boundaries were delineated using the elevations determined at each transect (References

4, 5, 6, 7, and 8); between transects, the boundaries were interpolated using engineering judgment, land-cover data, and the topographic maps referenced above. The l-annual-percent-chance floodplain was divided into whole-foot elevation zones based on the average wave envelope elevation in that zone. Where the map scale did not permit these zones to be delineated at one foot intervals, larger increments were used.

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 base flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1 foot, provided that hazardous velocities are not produced. The floodways in this study 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 (see Table 12, "Floodway Data"). In cases where the floodway and 1-percent-annual-chance floodplain boundaries are either close together or collinear, only the floodway boundary is shown.

The coastal study impacted the limit of backwater effects on some of the Floodway Data Tables and Flood Profiles by revising the annual 10-, 2-, 1-, and 0.2-percent-annual-chance flood elevations at the confluence of rivers and the coastal flooding sources. Affected Floodway Data Tables and Flood Profiles were updated for Androscoggin River (FDT only), Capisic Brook, Fall Brook, Long Creek, Presumpscot River, Royal River (Downstream), Stroudwater River, and Trout Brook.

In Casco, portions of the floodway on the Songo and Crooked Rivers extend beyond the corporate limits of Casco.

For the Songo River in Naples, the floodway was computed up until Songo Lock Road at which point all water-surface elevations remain static. For this reason, it was determined that a floodway was unnecessary upstream of this point.

A floodway was calculated for just the main channel of the Royal River (Upstream) in Windham using the total discharge in the main channel. This reflects the possibility of filling the diversion and sending all discharge down the main channel.

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 (WSEL) of the base flood more than 1 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to floodplain development are shown in Figure 2, "Floodway Schematic".

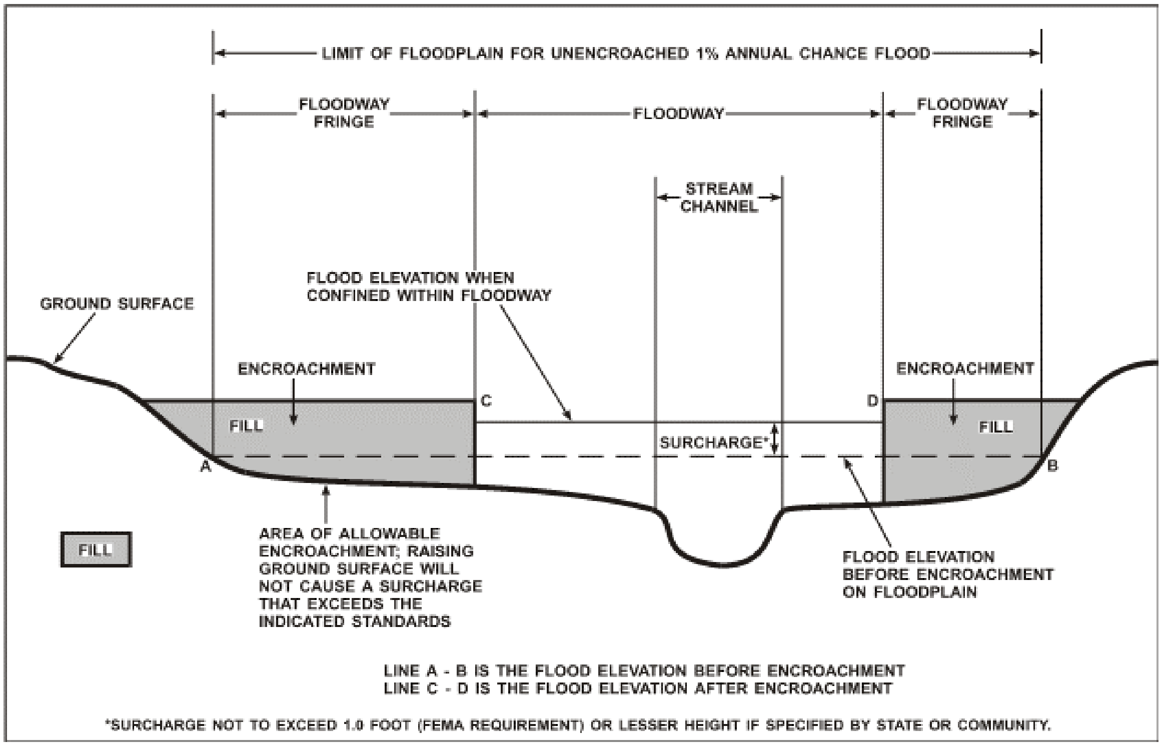

Figure 2. Floodway Schematic

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 12, "Floodway Data," for certain downstream cross sections of the Androscoggin, Presumpscot, Piscataqua, Royal, and Stroudwater Rivers; the Collyer, Eddy, Crystal Lake, Fall, Capisic, Nasons, Trout and Thayer Brooks; and Long Creek 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.

One aspect of floodway and floodplain encroachment is sometimes overlooked and more often neglected: the cumulative effect of encroachment on flood discharge magnitude. Generally, as encroachment occurs, temporary storage areas are lost, velocities increase, and the magnitude of the discharge increases. As floodwaters move downstream, that increase can become more significant. The combined effect of a narrower floodplain and greater discharge can, due to hydraulic effects alone, produce a flood stage that exceeds the anticipated 1-percent-annual-chance flood.

FEMA does not encourage the filling-in of the floodway fringe area. Local officials should be aware that even a 1-foot rise in the water-surface elevation can cause flooding in areas which would have received little or no flooding if such filling had not taken place. Careful consideration of the economic and human dislocation which will be caused by a rise in flood heights should be made before filling is allowed. Large quantities of fill in the fringe area could also disrupt the floodplain ecosystem, causing a major impact on local environmental resources.

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5.0 INSURANCE APPLICATION

For flood insurance rating purposes, flood insurance zone designations are assigned to a community based on the results of the engineering analyses. These zones are as follows:

Zone A

Zone A is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base (1-percent-annual-chance) flood elevations (BFEs) or depths are shown within this zone.

Zone AE

Zone AE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance floodplains that are determined in the FIS report by detailed methods. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone AH

Zone AH is the flood insurance rate zone that corresponds to the areas of 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between 1 and 3 feet. Whole-foot base flood elevations derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone D

Zone D is the flood insurance rate zone that corresponds to unstudied areas where flood hazards are undetermined, but possible.

Zone VE

Zone VE is the flood insurance rate zone that corresponds to the 1-percent-annual-chance coastal floodplains that have additional hazards associated with storm waves. Whole-foot BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone.

Zone X

Zone X is the flood insurance rate zone that corresponds to areas outside the 0.2-percent-annual-chance floodplain, areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile (sq. mi.), and areas protected from the base flood by levees. No BFEs or depths are shown within this zone.

6.0 FLOOD INSURANCE RATE MAP

The FIRM is designed for flood insurance and floodplain management applications.

For flood insurance applications, the map designates flood insurance rate zones as described in Section 5.0 and, in the 1-percent-annual-chance floodplains that were studied by detailed methods, shows selected whole-foot BFEs or average depths. Insurance agents use zones and BFEs in conjunction with information on structures and their contents to assign premium rates for flood insurance policies.

For floodplain management applications, the map shows by tints, screens, and symbols, the 1- and 0.2-percent-annual-chance floodplains, floodways, and the locations of selected cross sections used in the hydraulic analyses and floodway computations.

The countywide FIRM presents flooding information for the entire geographic area of Cumberland County. Previously, FIRMs were prepared for each incorporated community and the unincorporated areas of the County identified as floodprone. This countywide FIRM also includes flood-hazard information that was presented separately on Flood Boundary and Floodway Maps (FBFMs), where applicable. Historical data relating to the maps prepared for each community are presented in Table 13, "Community Map History."

Community Map History Table

7.0 OTHER STUDIES

Information pertaining to revised and unrevised flood hazards for each jurisdiction within Cumberland County has been compiled in this FIS. Therefore, this FIS supersedes all previously printed FIS reports, FIRMs, and/or FHBMs for all of the incorporated jurisdictions within Cumberland County.

Cumberland County is bordered by the Maine Counties of Sagadahoc, Androscoggin, Oxford and York. At the time of this revision, Sagadahoc and York counties were undergoing floodplain mapping revisions and will be in agreement with this countywide FIS.

This FIS report either supersedes or is compatible with all previous studies published on flooding sources studied in this report and should be considered authoritative for the purposes of the NFIP.

8.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting FEMA Region I, 99 High Street, 6th Floor, Boston, MA 02110.

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